9 Organization of Cell

9.0 : Introduction :

Q.1. Define cell.

Ans: Cell is the structural and functional unit of life, (escept viruses).

Q.2. Who coined word cell ?

Ans: Robert Hooke coined the word cell.

Q.3. Who was the first to decribe a live cell?

Ans: Anton van Leenwenboek, a Duth businessman, first described a live cell.

Q.4. Explain why cell is considered as the basic unit of life.

OR

Cell is the basic unit of life, discuss in brief.

Ans: i. All living organisms are made up of cells.
ii. It is the basic stuctural an functional unit of an organism.
iii. Cells contain genetic information which is passes on from cell to cell during cell division.
iv. Cell are similar in their chemical composition and in their metabolic activity.
v. Cell is the simplest organization in living beings, capable of independent existence.
vi. Hence, cell is considered as the basic unit of life.

Q.5. What was the contribution of Robert Hooke in cell biology?

Ans: i. Robert Hooke introduced the work cell in 1665.
ii. He studed cork slices under a microscope.
iii. He found that cork was composed of honey comb like many polygonal compartments.
iv. he actually observed the celll walls within the cork structures.
v. Thus, Robert Hooke was the first person for applying the word cell to describe the basic unit of life.

Q.6. Define cytology.

Ans: The biological science which deals with the study of structure, function, molecular organiztation, growth, reproduction and genetics of the cell is called cell biology or cytology (Gr. Kytos = hollow vessel or cell, logous = discourse)

9.1: Cell theory :

Q.7. Who postulated cell theory ?

Ans: The German botanist M.J. Schleiden (1838) and zoologist T.S. Schwann (1839) postulated the cell theory.

Q.8. Explain about Schleiden and Schwann cell theory.

Ans: Schleiden and Schwann cell theory:

i. Two German botanist Schieiden (in 1838) and Schwann (in 1839) studied a wide veriety of plant and animal tissue and postulated the cell theory in definite form.
ii. Schlieiden unsed a microscope to observe plants and conchided that all plants are composed of cells.
iii. Schwann made similar observations about animal cells.
iv. Their combined views led to the formalation of the cell theory.
v. According to Schleiden and Shwann cell theory.
   a. In both plant and animals, living matter exists in the form of essentially similar unit masses or cell.
   b. The cell is the basic sturctural and functionl unit in all living organism.

c. this simple, basic and formal biological genraalization is kmown as cell theory of cell dotrine.
d. the cell theory given by them form and important lade mark in the history of biology. Schwann's work with connective tissue such as bone and cariliage led him to modify the evolving cell theory to include the fact that living thing are composed of both cells and products or secretions of the cells.

Q.9. give the modern version of cell theory.

Ans: Modern verion of the cell theory :

i. All living organisms are made up of cells.
ii. Cell is the basic sturctural and functional unit of life.
iii. All cells arise from per-existing cells.
iv. Cells possess genetic information which is passed on form cell to cell during cell division.
v. Cells are similar in their chemical composition and in their metabollc activey.
vi. Cells are self-duplicating and self-contained units.
vii. some cells show totipotency, i.e. capacity of dividing and regenerating an entire organism from them.

Q.10. Who coined the word protoplasm ?

Ans: J.E. Purkinje coined the term 'protoplasm' in the year 1939.

Q.11. Write a note on protoplasm.

Ans: Protoplasm.

i. Two German botanist Schieiden (in 1838) and Schwann (in 1839) studied a wide veriety of plant and animal tissue and postulated the cell theory in definite form.
ii. Schlieiden unsed a microscope to observe plants and conchided that all plants are composed of cells.
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Additional Information :

Q.12. Explain the term totipotency.

OR

Define totipolency.

OR

Totipotency has great potential in medical applications– explain.

Ans: Totipotency :

i. Totipotency (totus– entire, potential–power) is the capacity or the potential of living nucleated cell, to differentiate into any other type of cell and thus, can form a complete new organism.
ii. A cell is totipotent as it has the entire genetic information of the organism stored in its nucleus.
iii. Embryonic animal cells are totipotent and are termed as stem cells.
iv. Stem cell are used in curing many diseases. Therefore, they have great potetial for medical applications.

Q.13. Explain how organisms arise from a single cell.

OR

Single cell can given rise to a whole organism–explain.

Ans: i. An organism grows from a single cell.
ii. During cell division, the nucleoulus divides into two nuclei.
iii. The chromosomes (bearing the genes) spit lengthwise and each gene is thus duplicated.
iv. As a result, exact replicas of the original nulceus is produced.
v. After nuclear division, extre-nuclear protoplasm, called cytoplasm divides into two parts forming two calls.

vi. In unicellular organism, body consists of single cell.
vii. in multicellular organisms, single celled zygote undergoes several mitotic cell divisions to product large number of cells giving rise to tissues. Tissues, in turn, combine to form organs.
viii. Various organs combine to form organ systems, while all system make up a multicellular organism. Cell → Tissue → Organ → Organ system → organism.

Q.14. What are the exceptions to cell theory?
Ans: Exceptions to cell theory:
i. Viruses do not have cellular organizations.
ii. Bacteria and blue-green algae are prokaryotes and they do not possess true cellular structures.
iii. Fungi like Mucor, Rhizopus and alga like Vaucheria are tubular and multinucleated.
iv. These organisms contain undivided mass of protoplasm.
v. They do not fit into the preview of the cell theory.

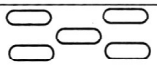
Q.15. Which organisms do not have cellular organization?
Ans: Viruses do not have cellular organization.

Q.16. Justify - "The basic composition of protoplasm of different cells remain same in all organisms."
Ans: All cells have certain common characteristics such as:
i. Each cell is enclosed by a plasma membrane made up of lipo-proteins.
ii. All cells have protoplasm made up of water and various organic and inorganic substances.
iii. Each living cell possesses genetic material which directs and controls the cellular functions.
iv. The proteiri produced within a cell determines the form and structure of a cell.
v. A cell is an independent unit by itself and has capacity to duplicate.
vi. Pre-existing cells, divide to form new cells.
vii. Genetic information is passed on from one generation to the next by the cells through genes.
viii. Hence, the basic composition of protoplasm of different cells remains same in all organisms.

9.2 : Prokaryotic cell and its ultra-structure :

Q.17. State the general characteristics of prokaryotic cell. OR
What are the characteristics of prokaryotic cells?
Ans: General characteristics of prokaryotic cell:
i. Prokaryotic cells are primitive type of cells.
ii. It is small and simple and lacks nuclear membrane.
iii. Due to this, in prokaryotes, nuclear material is mixed up with cytoplasmic material.
iv. Cell envelope having glycocalyx, cell wall and plasma membrane.
v. Genetic material is in the form of nucleoid.
vi. It does not contain membrane bound organelles like endoplasmic reticulum, Golgi complex, mitochondria, etc
vii. Cell cytoplasm contains dense particles called ribosomes. Ribosomes are 70S type.

Q.18. Give the various forms of bacteria.
Ans: There are four different forms of bacteria:

	Form	Shape	Examples	Diagram
i.	Cocci	Spherical or ovoid	*Streptococcus* *Staphylococcus*	
ii.	Bacilli	Rods	*Lactobacillus* *Streptobacillus*	
iii.	Vibrios	Comma	*Vibrio cholerae*	
iv.	Spirilla	Twisted	*Rhodospirillum fulvum*	

Additional Information :

Q.19. What are pili and fimbriae?

Ans: Pili and fimbriae are the external hair-like cell appendages found over. prokaryotic cells. Pili help in the process of conjugation whereas fimbriae help in clinging to a support.

They are mostly seen in Gram negative bacteria. Pili help in the process of sex conjugation, whereas fimbriae functions as organ of attachment by which bacteria attach themselves to plant and animal cells.

Q.20. What are Cyanobacteria? How are they useful to man?

Ans: i. Cyanobacteria or blue-green algae are photosynthetic prokaryotes.

ii. They may be filamentous or non-filamentous.

iii. They are found in symbiotic (e.g. Anabaena) as well as in non-symbiotic (e.g. Nostoc) forms.

iv. **Use:** Many Cyanobacteria fix atmospheric nitrogen, thus, increasing the fertility of the soil. Hence, they are very useful to man for crop cultivation. They are important in adding organic matter to the soil and in preventing erosion.

Q.21. Describe the ultrastructure of a prokaryotic cell.

Ans: The prokaryotic cell shows the following structural components:

i. Cell envelope:

Most of the prokaryotic cells have a chemically complex cell envelope. It consists of three basic layers, namely glycocalyx, cell wall and cell membrane (plasma membrane).

a. Glycocalyx:

It is the outermost layer made up of macromolecules. These help in adhesion of bacteria. In some bacteria, glycocalyx occurs in the form of a slime layer. Other bacteria may have a thick and tough covering called capsule. Both slime layer and capsule are made up of polysaccharides and proteins.

b. Cell wall:

It lies just below the glycocalyx. It gives definite shape and strong structural support to the bacterial cell. Cell wall is made up of peptidoglycan and murein in eubacteria. In archae bacteria, it is made up of pseudopeptidoglycan. The walls of different bacteria show different types' of reactions to Gram's stain. Gram positive bacteria takes up the stain while gram negative bacteria do not take up the stain.

c. Plasma membrane:

It is the innermost covering of the cell envelope, chemically composed of lipids and proteins. The plasma membrane, act as a barrier and helps in intercellular communication. Various metabolic processes such as respiration, photosynthesis, synthesis of lipids and cell wall takes place in plasma membrane. Plasma membrane possesess receptor molecules which help bacteria to detect and respond to chemicals in their surroundings.

ii. Cytoplasm:

Cytoplasm is a semi-fluid ground substance or matrix present inner to the cell membrane of a prokaryotic cell. It consists of variety of inorganic and organic compounds which provides a suitable chemical environment for cellular activities.

The cytoplasm lacks membrane-bound organelles such as mitochondria, endoplasmic reticulum, Golgi bodies, lysosomes.

Certain membranous structures like mesosomes and chromatophores are observed besides inclusion bodies.

a. Mesosomes: These are invaginations of plasma membrane into the cell in the form of vesicles, tubules and lamellae. The exact function of mesosomes is still not known. It is believed that meso somes are involved in cell wall formation, DNA replication and distribution of chromosomes to the daughter cells.

b. Chromatophores: These are seen in photosynthetic bacteria and cyanobacteria. They have

different type of pigments such as bacteriochlorophylls, bacteriophaeophytin and carotenoids.

c. **Inclusion bodies:** These are kind of storage granules lying freely in the cytoplasm and are of two types, as:
   1. Organic inclusions: These include cyanophycean starch granules and glycogen granules.
   2. Inorganic inclusions: These include phosphates and sulphur granules.

iii. Ribosomes:

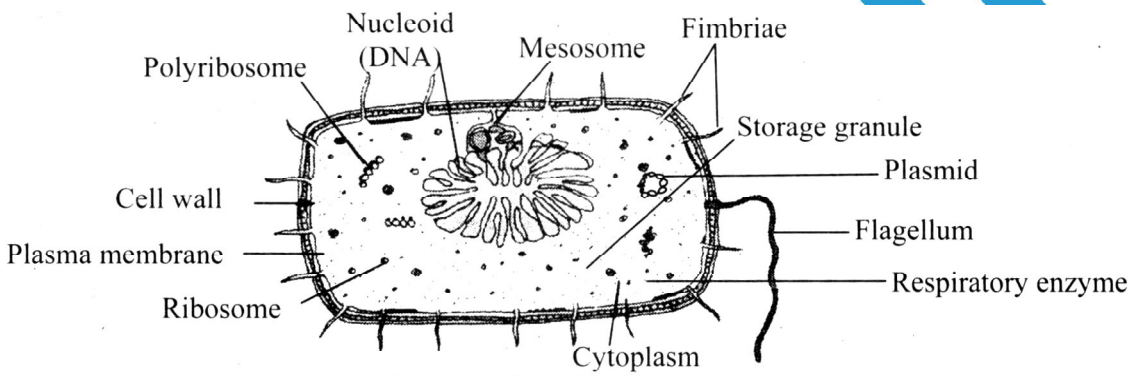
Ribosomes are dense particles present in cytoplasm of prokaryotic cell.
They are made up of RNA and protein.
The prokaryotic ribosomes are of 70S type.
Each 70S is composed of two sub-unit: 50S and 30S.
Function: They help in protein synthesis.

iv. Genetic Material (Nucleoid):

The prokaryotic cell do not have membrane-bound nucleus.
The genetic material consists of a long, double-stranded, circular DNA molecule known as prokaryotic chromosome. The circular DNA lies in association with plasma membrane with the help of mesosomes.

v. Plasmids:

Plasmids are self-replicating, extra-chromosomal, circular DNA molecule. They are also called as mini chromosomes. Plasmids can carry out additional functions such as antibiotic resistance and fertility. A prokaryotic bacterial cell may contain one to two plasmids.



Prokaryotic cell

Q.22. What is ceU envelope? ame the three layers that form the cell envelope in prokaryotes.

Ans: i. Cell envelope is the outer covering of protoplasm of bacterial cell.
ii. It consists of a tightly bound three layered structure as, the outermost glycocalyx followed by the cell wall and plasma membrane.

Q.23. What is glycocalyx?

Ans: Glycocalyx is the outermost layer of cell envelope of prokaryotic cell.

Q.24. Write a note on glycocalyx.

Ans: i. Glycocalyx is the outermost layer of cell envelope found in prokaryotic cells.
ii. This layer is made up of macromolecules which help in adhesion of bacteria.
iii. Some bacteria have a loose sheath called slime layer, while others may have a thick and tough covering called capsule.
iv. Both slime layer and capsule are made up of polysaccharides and may contain proteins.
v. **Function:** The presence of a glycocalyx increases the effective diameter of a bacterium and also covers up internal components of the bacterium.

Q.25. Justify - "Without cell wall, the bacterial cell would not have definite shape."

Ans: The cell wall is a component of cell envelope in bacterial cells.
Cell wall is concerned with providing strong structural support as well as definite shape to the cell.
Hence, in the absence of cell wall, the bacterial cell would not have a definite shape.

Q.26. What is mesosome in prokaryotic cell? Mention the functions that it performs.

Ans: Mesosomes are invaginations of plasma membrane into the cell in the form of vesicles, tubules and lamellae

Function: Although exact function of mesosome is not known, it is believed that mesosomes are involved in cell wall formation, DNA replication, distribution of chromosome to the daughter cells.

Additional Information :

Q.27. What does the letter'S' in 70S ribosomes, stands for?

Ans: The letter'S' stands for Svedberg unit, which is a measure of particle size that depends upon the speed at which the particle sediments in the ultracentrifuge.

Q.28. Give one use of:

i. Ribosomes:

Ans: Ribosomes help in protein synthesis.

ii. DNA:

Ans: DNA acts as the genetic material in living organisms.

iii. Plasmids:

Ans: Plasmids are the circular DNA or mini chromosomes in prokaryotic cells which serve as an agent for gene transfer.

Additional Information :

Q.29. Write a note on Gram staining.

Ans: Gram staining:

i. The Gram staining method was developed by Dr. Christian Gram, a Danish physician in 1884. It is the most useful staining procedure used in bacteriology.

ii. Bacteria differ from one another chemically and physically and thus reacts differently to given staining procedure. This is the basic principle upon which this staining method depends.

iii. Gram's staining is also called as differential staining as it distinguishes between types of bacteria depending upon the stain which they take up.

iv. The Gram's staining procedure involves staining the bacterial cell with a primary stain (eg. Crystal violet). The second step involves application of a mordant. A cell is more strongly stained under its action. The next step involves use of decolourizing agent (alcohol) which removes the dyes from a stained cell. The final step involves applying a counter stain (eg. Saffranin or Basic Fuschin).

v. Gram positive bacteria retain the crystal violet colour and appear purple in colour.

vi. Gram negative bacteria do not retain the crystal violet stain and are readily decolourized by alcohol. They take up the counter stain and appear pink or red in colour.

vii. The difference in staining responses to the Gram stain can be related to physical and chemical differences in their cell walls.
Gram + ve bacteria: Bacillus subtilis, Streptococcus pyogenes
Gram –ve bacteria: Escherichia coli, Salmonella typhi

Q.30. Name the term for extranuclear ring ofD A molecules.

Ans: Plasmids.

Q.31. What are plasmids?

Ans: Plasmids are the circular, extrachromosomal DNA, present in prokaryotic cells and are capable of self replication.

Q.32. Justify the statement- "Plasmids are the pillars of genetic engineering."

OR

"Plasmids are called mini-chromosomes" - Why?

Ans: i. Prokaryotic cells may possess one or more additional molecules of circular DNA or minichromosomes,

known as plasmids.

ii. They are called mini-chromosomes because they are extra-chromosomal DNA, which bears unique properties of self-replication and are autonomous in nature.

iii. These plasmids are with few genes and provide extra-survival advantage.

iv. Besides, they can carry out additional functions such as antibiotic resistance and fertility.

v. In genetic engineering, they serve as an agent for gene transfer.

vi. Hence, they are known as the pillars of genetic engineering.

9.3 : Eukaryotic cell and its ultra-structure :

Q.33. What are eukaryotic cells?

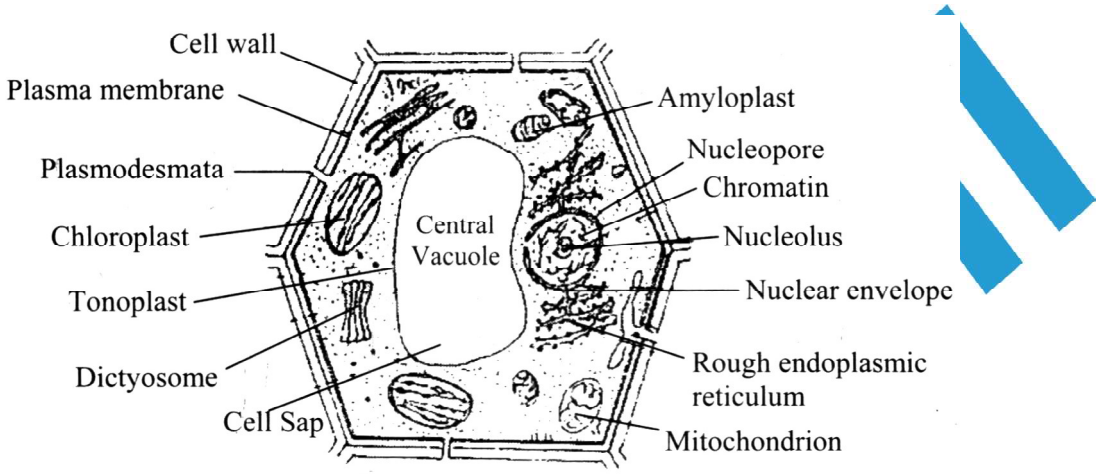
Ans: i. Eukaryotic cells are the modern cells possessing well-defined nucleus and membrane bound organelles.

ii. These organelles are specialized for performing specific functions like respiration, digestion" absorption, etc.

iii. Eukaryotic cells generally have dimension ten times greater than those of prokaryotes.

Q.34. Draw a well laballed diagram of plant cell.

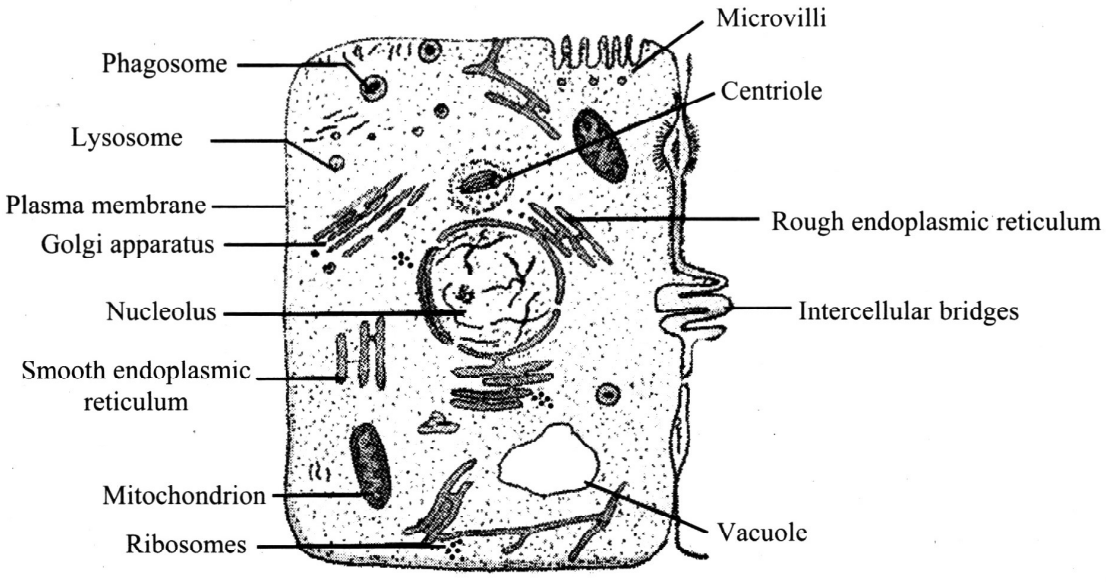
Ans:



Plant cell

Q.35. Sketch and label 'animal cell'.

Ans:



Animal cell

Q.36.Distinguish between Plant cell and Animal cell.

Ans:

No.	Plant cell	Animal cell
i.	Cell wall is present.	Cell wall is absent.
ii.	Plastids present.	Plastids absent.
iii.	Chloroplast present.	Chloroplast absent.
iv.	Centrioles are present only in lower plant forms.	Centrioles are present in all animal cells.
v.	Lysosomes absent.	Lysosomes present in all animal cells.
vi.	One large central vacuole is present.	One or more small vacuoles are present.
vii.	Carbohydrates stored as starch.	Carbohydrates stored as glycogen.

Q.37. Write a note on cell wall inEukaryotic cells.

Ans: i. The protective, semi-transparent covering, outside the cell membrane is called cell wall.

ii. It is thick, strong, rigid and measures 0.1 nrn to several nm in thickness.

iii. Cell wall is present in plant cells, not in eukaryotic animal cells.

iv. The chemical composition of the cell wall differs according to the cell type and function.

v. In higher plants, it is made up of polysaccharides such as cellulose, pectin, lignin, hemicellulose, cutin and suberin.

vi. Function:

Provides support, rigidity and shape to the cell.

Protects the protoplasm against mechanical injury.

Helps in transport of material.

Q.38. Give an account of eukaryotic plasma membrane.

Ans: i. Eukaryotic cell is surrounded by a cell membrane or plasma membrane or plasmalemma.

ii. Plasma membrane constitutes the outermost boundary of the animal cell.

iii. It is about 70 - 100 Å in thickness.

iv. In plant cells, it is covered by cell wall.

v. It is composed of almost equal parts of lipid and protein.

vi. **Function:** Plasma membrane acts as a semi-permeable membrane or selectively permeable membrane helping in transport of material in and out of the cell.

Q.39. Explain the structure of Plasma membrane on the basis of Fluid mosaic model.

OR

Explain the fluid mosaic model of cell membrane.

Ans: Fluid mosaic model:

i. Fluid mosaic model was proposed by Singer and Nicholson (1972).

ii. This model states that plasma membrane is lipoproteineous and trilaminar.

iii. Phospholipid bilayer is fluid in nature.

iv. Each phospholipid molecule consists of a head, which is hydrophilic and two tails, which are hydrophobic.

v. The lipid bilayer is about 4sA thick with the tail directed inwards and at right angle to the surface of the membrane.

vi. The hydrophobic tails from two lipid layers face each other.

vii. The external surface of lipid bilayer has hydrophobic region which provides maximum resistance to the entry of hydrophilic and polar solutes.

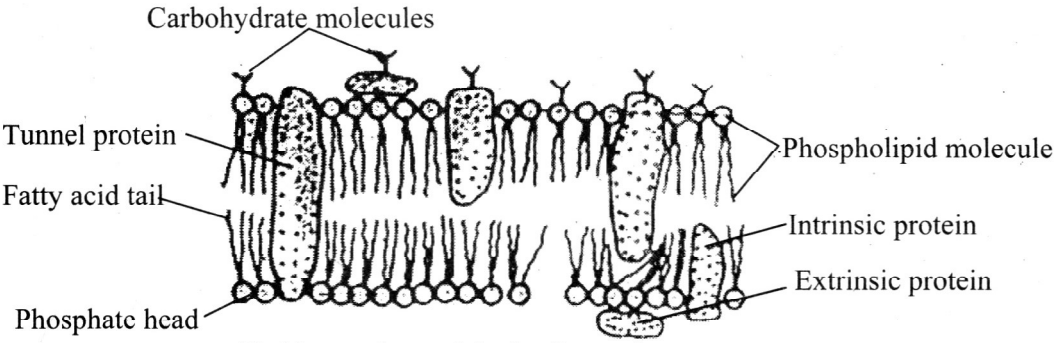
viii. Proteins of cell membrane are globular.

ix. Based on their organization, the membrane proteins are of two types, as:

a. The extrinsic or peripheral proteins are loosely held to the phospholipid layer and can be easily removed. These proteins may not cover the entire surface of the membrane.

b. The intrinsic proteins are tightly bound to the phospholipid bilayer and are embedded in it. Thus, intrinsic proteins form an integral part of the membrane.

x. No protein molecule is entirely embedded in the viscous phospholipid matrix.
xi. Tunnel proteins are larger protein molecules that run across the entire thickness of the phospholipid matrix.



Fluid mosaic model of cell membrane

Q.40. Who proposed the fluid-mosaic model?

Ans: Singer and Nicholson proposed the fluid-mosaic model.

Q.41. Give the functions of plasma membrane.

Ans: i. Plasma membrane imparts shape to the cell.
ii. Plasma membrane protects the cell from injury.
iii. Plasma membrane regulates the cellular semi-permeability, reabsorption, excretion and secretion.
iv. Various cell organelles can be formed within the cell, with the help of plasma membrane.
v. It regulates cellular interactions inthe formation of tissues and the defence against foreign bodies.
vi. The plasmalemma protects a cell from its surrounding environment.
vii. Many membrane proteins serve as enzymes.
viii. The cell membrane separates protoplasm from the external environment to maintain the individuality of the cell.
ix. It also acts as a selectively permeable membrane to allow only specific substances in and out of the cell.
x. It helps in intake of molecules by active or passive absorption.
xi. It acts as a receptor for various chemical stimuli such as amino acids, hormones and sugars.
xii. In unicellular organisms like Amoeba, pseudopodia are formed by projection of plasma membrane.
xiii. Ingestion of food and water by endocytosis or pinocytosis takes place with the help of plasma membrane.

Q.42. Plasma membrane is semi-permeable. Why?

Ans: i. Plasma membrane has an important function of regulation of material in and out of the cell.
ii. It allows only specific substances in and out of the cell.
iii. It helps in intake of molecules by active or passive absorption.
iv. Thus, it acts as a semi-permeable membrane.

Q.43.Enlist different cell organelles present in eukaryotic cell.

Ans: There are several types of organelles present within eukaryotic cell such as nucleus, golgi apparatus, mitochondria, peroxisomes, lysosomes, plastids, endoplasmic reticulum, ribosomes, centrioles, etc.

Q.44. Write a note on cytoplasm in Eukaryotic cell.

Ans: i. Cytosol or cytoplasm consists of jelly-like colloidal, ground substance called cytoplasmic matrix.
ii. It is differentiated into outer ectoplasm and inner endoplasm.
iii. Cytoplasmic matrix shows streaming movement called cyclosis.
iv. The cytoplasmic matrix is composed of minerals, sugars, amino acids, t-RNA, nucleotides, vitamins, proteins and enzymes.
v. Cells have a set of "little organs" called organelles which remains embedded within the cytoplasm.

These organelles are nucleus, golgi apparatus, mitochondria, peroxisomes, lysosomes, plastids, endoplasmic reticulum, ribosome, centriole, etc.

Q.45. Describe the structure of cell organelle known as "power house of the cell".

Ans: i. Mitochondria (Mitos - thread and Chondros - granule) are double membrane bound organelles found in nearly all the eukaryotic cells.

ii. Under the light microscope, mitochondria appears as rod shaped, filamentous, small spherical or granular structures in majority of the cells.

iii. Generally, its size varies from 0.2 to 2.0 urn in diameter.

iv. The outer membrane is smooth about 60A thick and it is freely permeable.

v. The inner membrane is thrown into a series of infoldings in the cavity of the mitochondrion. These infoldings are known as cristae.

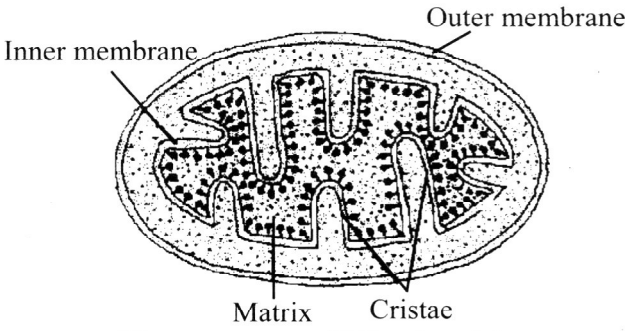
vi. The size of cristae is variable.

vii. Oxysomes or F, particles are attached to the cristae.

viii. In a single mitochondrion, there may be as many as 1 lac to 10 lac oxysomes and these consists of ATPase enzymes (coupling factor F_1) responsible for catalysing the terminal step of AtTP synthesis.

ix. Each oxysome consists of three parts; head piece, stalk and base piece.

x. The cavity of the mitochondrion is filled with dense fluid known as the mitochondrial matrix.



Ultrastructure of Mitochondrion

xi. Matrix shows the presence of proteins, lipids, few ribosomes (70S), one or two DNA molecules, RNA and certain other granules. A larger portion of the mitochondrial proteins represent enzymes.

xii. Electron carrier molecules or coenzymes of the electron transport chain namely cytochromes, dehydrogenases and flavoproteins are present on the rest of the inner mitochondrial membrane.

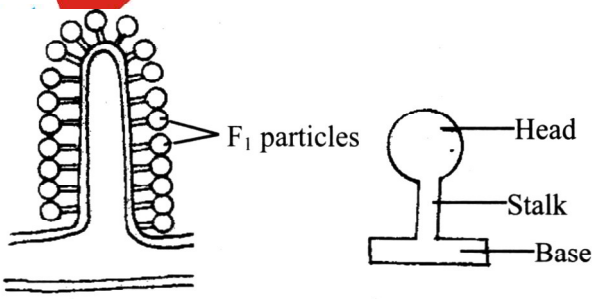
Additional Information :

Q.46. Write a note on oxysomes / F_1 Particles.

Ans: i. In one mitochondrion, there may be 1 lac to 10 lac oxysomes.

ii. Each oxysome is the molecule of ATPase enzyme, responsible for catalysing the terminal step of ATP synthesis.

iii. Each oxysome is 85 A in diameter. It has three parts; head piece of 100 A diameter, stalk of 32 A thickness and basal piece about 45 A in thickness.



Ultrastructure of F_1 particle

Q.47. Name the stalked particles present on the inner surface of inner mitochondrial membrane.

Ans: Oxysomes

Q.48. Mitochondria are called "Power house of the cell" - justify.

Ans: i. Mitochondria possess oxysomes on its inner membrane. These oxysomes take active part in synthesis of ATP molecules.

ii. During cellular respiration, ATP molecules are produced and get accumulated in the mitochondria. They play an important role in cellular activities.

iii. Only mitochondria can convert pyruvic acid to carbon dioxide and water during cell respiration.

iv. Therefore, mitochondria are called 'power house of the cell'.

Q.49. Name the three elements of endoplasmic reticulum.

Ans: Cisternae, vesicles and tubules.

Q.50.Describe the structure and functions of Endoplasmic Reticulum.

OR

Write a note on Endoplasmic reticulum.

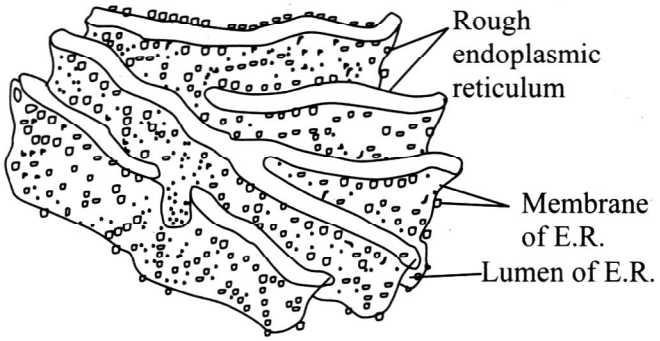
Ans: Endoplasmic reticulum is found in all the eukaryotic cells. It is absent in prokaryotes, in ova and mature red blood corpuscles.

Ultrastructure:

i. Endoplasmic reticulum is membrane-bound organelle found in all eukaryotic cells.

ii. It consist of three types of elements viz., stacks of flattened parallel sacs called the cisternae, irregular branching tubules and oval vesicles. Vesicles may be found in the form of chains connected to one another.

iii. Endoplasmic reticulum is in continuation with the plasma membrane at one end and with the nuclear membrane at the other end. Thus, it provides mechanical support to the cytoplasmic matrix.



Endoplasmic reticulum

iv. Endoplasmic reticulum is filled with an endoplasmic matrix which is different from the matrix present outside of it.

v. Each membrane of the cisternae, tubules and vesicles of the endoplasmic reticulum is about 50-60 A thick.

vi. Depending upon the presence or absence of ribosomes, endoplasmic reticulum is called rough endoplasmic reticulum (RER) or smooth endoplasmic reticulum (SER) respectively.

Functions of ER:

i. The canalicular network of endoplasmic reticulum helps in maintaining the position of various cell organelles.

ii. It serves as an intracellular supporting framework.

iii. It also serves to circulate various materials from one part of the cell to the other.

iv. Smooth endoplasmic reticulum (SER) plays a role in detoxification in the liver. This involves biochemical reactions by which harmful substances are converted to harmless substances suitable for excretion by the cell.

v. SER plays a role in the synthesis and secretion of lipids and steroid hormones by mammalian gonads and the adrenal cortex of the adrenals.

vi. It also provides precursors for different secretory substances to Golgi apparatus.

vii. Rough endoplasmic reticulum (RER) is primarily involved in protein synthesis owing to the presence of ribosomes on them which are the 'protein factories' ofthe cell.

viii. RER gives rise to smooth endoplasmic reticulum.

Q.51. Who discovered Goigi body?

Ans: Camillo Golgi.

Q.52.Explain Goigi complex.

Ans: i. Golgi complex was first described in 1898 by Camillo Golgi, in the nervous tissue.

ii. The ultrastructure of Golgi complex was first described by Dalton and Felix (1954).

iii. Golgi complex is an aggregation of few to several hundred membrane-bound bodies forming either an arched assembly or a simply flattened group.

iv. Golgi apparatus chemically modifies the material within it, and release it to transport vesicles.

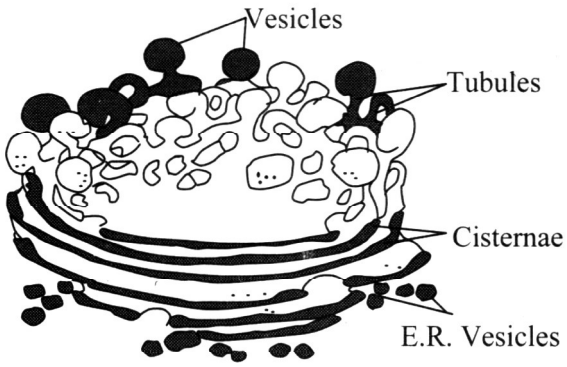
v. Golgi apparatus is concerned with the secretion and storage of proteins, carbohydrates and lipids.

Q.53. Describe the ultra-structure of Golgi complex.

Ans: i. Dalton and Felix (1954) were the first to describe the ultrastructure of Golgi apparatus with the help of electron micrographs.

ii. Golgi complex consists of aggregation of few to several hundred membrane-bound bodies forming either an arched assembly or a simple flattened group.

iii. Electron microscopy has revealed the presence of lamellae composed of flattened saccules or cisternae or they may be like. small tubules or vesicles.



Golgi complex

iv. In addition to this, there are large vacuoles filled with amorphous or granular substance are also present.

v. These lamellae are closely stacked in parallel manner.

vi. Depending upon cell type and its physiological state, the number of associated cisternae in the stack vary.

vii. Two to eight lamellae are common, but much greater numbers are seen especially in invertebrates. Around 50 are present in liver cells.

Q.54. What are the functions of Golgi apparatus or Golgi complex?

Ans: i. Golgi complex modifies the materials present within it and release it to transport vesicles.

ii. Golgi bodies/complex is concerned with secretion and storage of proteins, carbohydrates and lipids.

iii. They synthesize complex carbohydrates from simple sugars.

iv. They are also responsible for the formation of primary lysosomes

Q.55. Write a note on plastids.

OR

What are plastids? State its types.

Ans: i. Plastids are found only in algae, plant cells and certain protists.

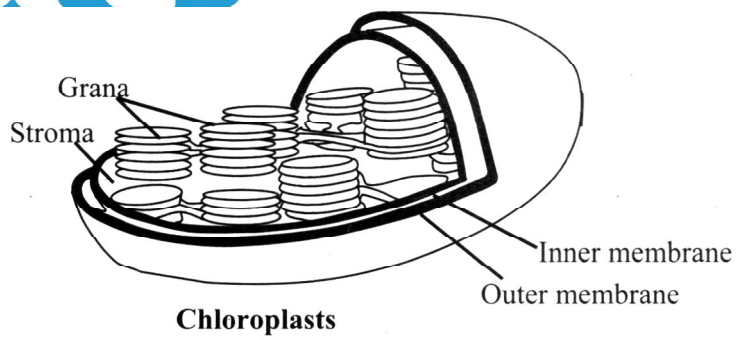
ii. They are semi-autonomous organelles containing DNA and double membrane envelope.

iii. Three main types of plastids are present - leucoplasts, chromoplasts and chloroplasts.

iv. Leucoplasts are colourless and store food material in the form of starch.

v. Chromoplasts are coloured plastids containing pigments other than chlorophyll.

vi. They are yellow, orange or red in colour.



Chloroplasts

vii. These plastids are found in the coloured parts of flowers and fruits.

viii. Chloroplasts are green plastids containing green pigment chlorophyll. They are present in green leaves. They carry out photosynthesis.

ix. Chloroplasts are double membrane bound organelles enclosing colourless matrix called stroma. There are many green coloured 'grana' embedded in the stroma.

x. Grana is the site of light reaction in photosynthesis.
Stroma is the site of dark reaction in photosynthesis.

Q.56.What are lysosomes?

Ans: i. Lysosomes are the single membrane bound bodies; round, elliptical or highly irregular in shape. It consists of a battery of multiple hydrolytic enzymes.

ii. The term 'lysosome' is derived from Greek words, Lyso = digestive and soma = body and was given by Christian de Duve in 1955.

Q.57. Which cell organelles are commonly called as suicide bags?

Ans: Lysosomes are commonly called as "suicide bags".

Q.58. Which organelle shows polymorphism?

Ans: Lysosomes.

Q.59. Write a note on origin, morphology and chemical composition of lysosomes.

Ans: Origin:

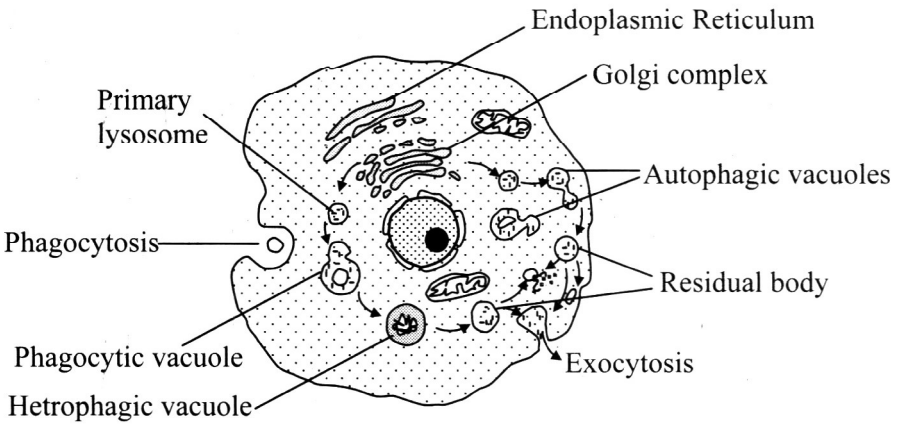
Lysosomes originate from Golgi apparatus. Lysosomes are present in all animal cells (except in mammalian red blood cells). Their number varies in different types of cells.

Morphology and chemical composition:

Lysosomes are dense bodies made up of single unit membrane.

The membrane iscomposed of lipoproteins which encloses various hydrolytic enzymes.

Lysosomes are polymorphic in nature.



Lysosomes in heterophagy, autophagy

Additional Information :

Q.60. Explain the classification of lysosomes in detail.

OR

What are the types of lysosomes? Give their functions.

Ans: Lysosomes, being polymorphic in nature, are of four types, as:

i. Primary Lysosomes ii. Secondary Lysosomes
iii. Residual bodies iv. Autophagic vacuoles

i. Primary Lysosomes:

These have small granules and are homogeneous in nature. They are inactive storage forms or ready reserves of hydrolytic enzymes, not yet involved in digestive enzymes.

ii. Secondary Lysosomes:

Secondary lysosomes are larger types with heterogeneous contents. They are also known as heterophagic vacuoles formed by fusion of primary lysosomes with endocytosis vacuoles.

iii. **Residual bodies:**
After digestion by lysosomal enzymes in heterophagic vacuoles, the products of digestion pass out into cytoplasm and only indigestible residual matter remains in the heterophagic vacuoles which get reduced in size. Such bodies are called residual bodies. These are of varying size and density.

iv. **Autophagic vacuoles:**
Sometimes cell may digest its own organelles and the process accomplishing this is called autophagy and autolysis. Primary lysosomes fuse to unwanted organelles or other materials and form large saclike structure known as autophagic vacuole or autophagosome and digest unwanted organelles like mitochondria, ER etc.

Q.61. Define autophagy.

Ans: Autophagy is the process of intracellular digestion in which enzymes produced by the cell breakdown molecules and pieces of the cytoplasm from the cell itself.

Q.62. "Lysosomes are called suicide bags of the cells" - justify the statement.

Ans: When any cell becomes functionless and cell organelles are unwanted, then lysosomes release hydrolytic enzymes and bring about the digestion of the cell. This digestion is accomplished by autophagic vacuoles, formed by lysosomes. Thus, Iysosornes are capable of destructing all kinds of material in the cell. Therefore, can digest its own cell organelles due to presence of lysosome. Hence, lysosomes are also called as suicide bags.

Q.63. Lysosomes are very important cell organelles in human - why?

Ans: i. Lysosomesperform various important functions such as cellular digestion, autophagy, removal of carcinogens, etc. .

ii. When cell organelles show diminished physiological activity or when they are worn out, internal remodelling is required, which is done by lysosomes.

iii. Sometime, lysosomes of cell liberate their enzyme outside the cell. It occurs in the mechanism where sperm releases hyaluronidase enzyme which dissolve the protective coating of ovum. This helps sperm to penetrate ovum to ensure fertilization.

iv. Lysosomes contain different hydrolytic enzymes.

Additional Information :

Q.64. Define Autophagosome.

Ans: Primary lysosomes fuse to unwanted organelles or other material and form large sac-like structure known as autophagic vacuole or autophagosome. Various cell organelles like mitochondria, endoplasmic reticulum, etc. may be found in the autophagic vacuole.

Q.65. What are Sphaerosomes? .

Ans: Sphaerosomes are small membrane-bound organelles present in the cytoplasm and are seen mostly in plant cells. These are helpful in the storage and synthesis of fats.

Q.66. What are microbodies? Which are the two types of microbodies?

Ans: Microbodies are roughly spherical in shape, bound by a single membrane and usually 0.5 to 1 micro meter in diameter. Two types of microbodies are peroxisomes and glyoxysomes.

Q.67. Write a short note on peroxisomes.

Ans: i. Peroxisomes are microbodies which contain enzymes for the synthesis of peroxide.

ii. Name Peroxisomes was derived from hydrogen peroxide which is a reactive intermediate found in peroxisomes.

iii. Peroxisomes are found in both plant and animal cells and are associated with endoplasmic reticulum.

iv. Peroxisomes contain enzymes like oxidases and catalases.

v. Oxidases catalyse the oxidation of amino acid and uric acid and produce hydrogen peroxide.
vi. Hydrogen peroxide is harmful to living cells, thus catalase degrades hydrogen peroxide to water and oxygen.

Q.68. Write note on Glyoxysomes.

Ans: i. Glyoxysomes are microbodies containing enzymes for oxidation of fatty acids.
ii. They occur in plant cells and are found in large numbers in germinating seeds which store fat as reserve food material.
iii. Their crystalloid core consists of dense rods of 6.0 urn in diameter.
iv. Glyoxysomes perform various biochemical functions of plant cells including fatty acid metabolism, oxidation and Glyoxylate cycle.

Q.69.Write a short note on ribosomes.

Ans: i. Ribosomes are granular organelles without having any enclosed membrane.
ii. Chemically, they are made up of ribonucleoproteins and are the active sites for protein synthesis.
iii. Palade (1955) observed some dense, granule-like cellular particles under electron microscope, which are now called ribosomes.
iv. In eukaryotic cells, ribosomes are found attached to the membranes of endoplasmic reticulum.
v. Sometimes they are found scattered in the cytoplasm, mitochondrial matrix and chloroplasts.
vi. Ribosomes are the sites of protein synthesis. Thus, ribosomes are known as the protein factories. 80S type of ribosomes occur in groups which 'are collectively called as polysomes or polyribosomes.
vii. They have a linear arrangement or they may form a rosette - shaped cluster.
viii. Ribosomal RNA molecules possibly serve as a skeletal framework in the ribosomes.
ix. Ribosomes are also protective in function, as they act against the action of protein digesting enzymes.

Prokaryotic ribosome **Eukaryotic ribosome**

Q.70. What are polyribosomes?

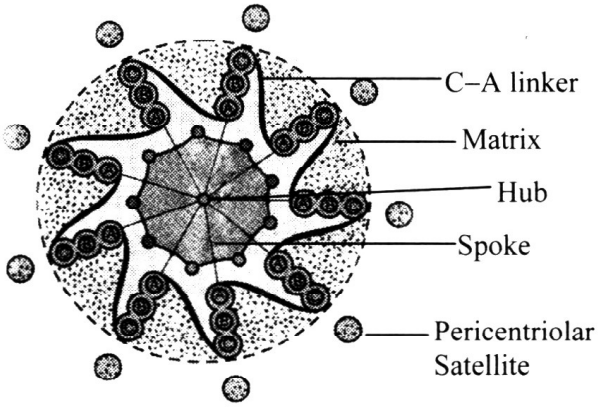
Ans: Polyribosomes or polysomes are 80S ribosomes that are aggregated due to common m-RNA during protein synthesis.

Q.71. Define centrioles.

Ans: Centrioles are non-membranous cylindrical or rod-shaped, micro-tubular structures, normally found In animal cells and in some flagellated plant cells.

Q.72. Write a note on centrioles.

Ans: i. Centrioles are cylindrical or rod shaped cell organelles present only in animal cells. They appear as a dense area of cytoplasmic material with radiating microtubules.
ii. They lack membranous coverings. Centrioles are found in the form of paired cylindrical structures inside the centro somes.
iii. Mature centrioles vary in diameter from 1500A to 2500A.
iv. Each centriole is composed of nine clusters of three microtubules arranged in a circular pattern.
v. The long axis of one centriole is at a right angle to the long axis of the other.
vi. Centrioles playa role in the formation and regeneration of cilia and flagella. Centrioles are required for mitotic division hv nroducino microtnhnles



Centriole

Q.73. Which are the long fibres of cytoskeleton?

Ans: Long fibres of cytoskeleton are microfilaments, microtubules and intermediate filaments.

Q.74. What are microfilaments? State its function.

Ans: Microfilaments are fine, thread-like protein fibres, predominantly of contractile protein called actin. Actin is the most abundant cellular protein.

Function: Microfilaments can carry out cellular movements including gliding, contraction and cytokinesis.

Q.75. Write a short note on microtubules.

Ans: i. Microtubules are cylindrical tubes, 20 - 25 nm in diameter.
ii. Microtubules are composed of subunits of protein tubulin.
iii. These subunits are called as a and - tubulins.
iv. Microtubules determine the shape of cell and also form the spindle fibres during mitosis.
v. When microtubules are arranged inside flagella and cilia, they are used for locomotion.

Q.76. Write a note on vacuoles.

Ans: i. Vacuoles (L. vaccus = empty) are the membrane bound, fluid filled spaces present in the cytoplasm of a eukaryotic cell.
ii. Plant cells show two or three large and permanent vacuoles, whereas in animal cells, there are small sized and temporary vacuoles.
iii. Vacuole is bound by single unit membrane called tonoplast.
iv. Inside the vacuole there is a fluid called cell sap which contains mineral salts, sugars, amino acids, proteins, esters, alkaloids, tannin, waste products and water soluble pigments such as anthocyanin.

Functions of vacuoles:

i. The contractile vacuoles maintain homeostasis.
ii. It maintains the turgidity of the cell.
iii. It helps in maintaining a proper internal balance of cellular contents.
iv. It helps in osmoregulation and excretion.
v. Vacuoles in plants help in the storage of secretions.

Q.77. Both lysosomes and vacuoles are endomembrane structures, yet they differ in terms oftheir functions. Comment.

Ans: Lysosomes are the centres of intracellular digestion, while vacuoles are the centres of storage of water, nutrients, minerals, etc.

Q.78. What are cilia and flagella? From where do they arise?

Ans: i. Cilia and flagella 'are fine hairlike, movable protoplasmic processes of some cells.
ii. Cilia and flagella produce current in the fluid medium for locomotion and passage of substances.

iii. Cilia are short and numerous, while flagella are long and one or few in number.
iv. Cilia and flagella arise from basal body, similar to centriole. It lies in the outer part of cytoplasm below the plasma membrane.

Q.79. Describe the structure of cilia and flagella.

Ans: i. A sheath covers the shaft or hair-like projecting part from outer side.
ii. It is the extension of plasma membrane and contains semifluid matrix having a supporting axoneme.
iii. Axoneme consists of nine pairs of peripheral micro tubules and two single central micro tubules (9 + 2 arrangement).
iv. Two central tubules are covered by a central sheath.
v. Nine filaments made up of complete microtubules extending upto the tip of cilium or flagellum and partial microtubules which do not extend upto the tip.
vi. Cross bridges extend from complete microtubule of one filament to partial microtubule of adjacent filament.
vii. These are made up of motor protein called dynein.

Q.80. What are cell inclusions?

Ans: Cell inclusions are non - living substances present in vacuoles, cytoplasm or cell wall. They may be organic or inorganic in nature.

Q.81. Differentiate between Prokaryotic cell and Eukaryotic cell.

Ans:

No.	Prokaryotic cell	Eukaryotic cell
i.	Nucleus is not well organized.	Nucleus is well organized.
ii.	Nuclear membrane is absent.	Nuclear membrane is present.
iii.	Nucleoid is equivalent to a single chromosome.	Nucleoid absent.
iv.	Genetic material is in the form of circular coil of DNA without histone proteins.	Genetic material is in the form of a double helix DNA with histone proteins.
v.	Membrane bound cell organelles are absent.	Membrane bound cell organelles are present.
vi.	Plasmids are many in number.	Plasmids are absent.
vii.	True vacuoles are absent. Cytoplasm does not show streaming movement.	True vacuoles are present. Cytoplasm shows streaming movement.
viii.	Ribosomes are smaller and of 70S type.	Ribosomes are larger and of 80S type.
ix.	Respiratory enzymes are present on the infoldings of the plasma membrane called mesosomes.	Respiratory enzymes are present within mitochondria.
x.	Cells are capable of Nitrogen fixation.	Cells are not capable of Nitrogen fixation.
xi.	Cell division is amitotic (fission).	Cell division is by mitosis and meiosis.
xii.	Cell cycle is very short. It lasts for about 20-60 minutes.	Cell cycle is very long. It lasts for about 12-24 hours.
xiii.	e.g. Cyanobacteria (Blue green algae) and Bacteria.	e.g. Algae, fungi, plants and animals.
xiv.	Size: Mostly 1-10 µm	Size: Mostly 10-100 µm

9.4 : Nuclear Organization :

Q.82. Who discovered and named the nucleus in the cell?

Ans: Robert Brown discovered and named the nucleus in the cell.

Q.83. Write a note on nucleus in Eukaryotic cell.

Ans: i. Nucleus was discovered by Robert Brown in 1831.

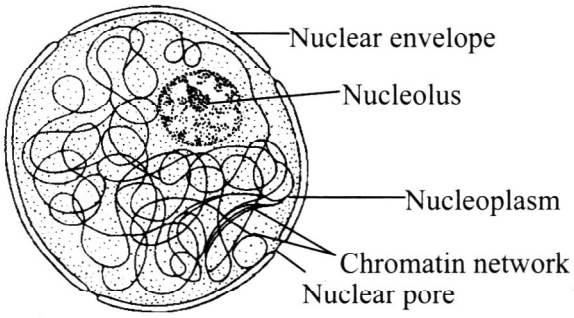
ii. It is the controlling centre of a cell.
iii. It contains genetic material in the form of chromosomes.
iv. Eukaryotic cells contain distinct nucleus which is separated from the surrounding cytoplasm by nuclear membrane.
v. However, some eukaryotic cells such as the mature sieve tubes of higher plants and mature mammalian erythrocytes are without nucleus.
vi. The nucleus is clearly visible during interphase.
vii. **Number:** Generally, single nucleus is present in each cell. However, according to the number of nuclei, the cells have been recognized as:
   a. Mononucleate cells (e.g. Most of the plant and animal cells).
   b. Binucleate cells (e.g. Paramoeciumy.
   c. Multinucleate cells (e.g. Striated muscle fibers).
   The polynucleate cells of the animals are termed as syncytial cells, while the polynucleate cells of the plants are known as coenocytes.
viii. **Position:** Generally, nucleus remains located at the centre. However, its position may change according to the metabolic state of the cell. _
ix. **Shape:** Usually, the shape of nucleus is dependent upon the shape of the cell. The shape of nucleus is spherical (cuboidal cells), disc shaped (squamous epithelial cells), bilobed or multilobed (WBCs), C-shaped (Vorticella) etc.
x. **Size:** The size of the nucleus depends on the volume of the cell, amount of the DNA and proteins and metabolic phase of the cell.
xi. **Structure:** A nucleus at interphase consists of nuclear envelope, nucleoplasm, nucleolus and chromatin network.

Q.84. Classify cells on the basis of the number of nucleus.
Ans: According to the number of nuclei, the cells have been classified as:

No.	Cells	Description	Example
i.	Mononucleate	Possess single nucleus	Most of the plant and animal cells
ii.	Binucleate	Possess two nuclei	*Paramoecium* and cells of the cartilage and liver
iii.	Multinucleate	Possess many nuclei	Striated muscle fibers

Q.85. Describe the structure of the controlling centre of the cell.
OR
Describe in detail the structure of nucleus.
Ans: A typical interphase nucleus consists of nuclear envelope, nucleoplasm, nucleolus; chromatin network.

i. **Nuclear envelope (Karyotheca):**
Nuclear envelope separates nuclear content from the cytoplasm.
It consists of two membranes, the outer and the inner nuclear membranes, separated by perinuclear space.
Nuclear envelope is made up of nuclear membranes, perinuclear space, nuclear pores, annuli, central granule and fibrous lamina.



Structure of nucleus

   a. **Nuclear membranes:**
   There are two nuclear membranes surrounding a nucleus.
   Each membrane has a trilaminar unit membrane structure and about 7-8 nm in thickness.
   Outer nuclear membrane is in contact with the endoplasmic reticulum at several points.

Whereas, the inner nuclear membrane is associated with the dense material termed as fibrous lamina, attached to its inner surface.

b. Perinuclear space:

The space between outer and inner nuclear membranes is called perinuclear space.
It is about 10 - 70 nm (usually 20 nm).
It is filled with fluid of ER.

c. Nuclear pores:

Callan and Tomlin (1950) first observed the nuclear pores in the nuclei of amphibian oocytes.
Perforation on nuclear envelope by many apertures is called nuclear pores.

d. Annuli:

The nuclear pores are enclosed by an electron dense ring or cylinders called annuli.
The nuclear pore together with annulus is known as pore complex.
The annuli may function as a kind of diaphragm, whereas pore complex works as structure for selective permeability.

e. Central granule:

A central granule is present in the pore complex. However, all the nuclei may not show the presence of central granule.

f. Fibrous lamina:

Harris and James (1952) first described the presence of fibrous material on the inner surface of inner nuclear membrane of Amoeba proteus:
This material often represents a honey comb pattern called fibrous lamina.
The fibrous lamina is composed mainly of acid protein.

ii. Nucleoplasm:

The transparent, semi-solid, granular and slightly acidophilic ground substance or matrix present within the nuclear membrane is known as the nuclear sap or nucleoplasm or karyolymph.
Chromatin threads and the nucleolus remain suspended in the nucleoplasm.
It contains nucleic acids, proteins, enzymes and minerals.

iii. Nucleolus:

The nucleolus was first discovered by Fontana.
It is a spherical, acidophilic body present within the nucleus, either in a central or peripheral position.
The cells, which are concerned with the protein synthesis contain large-sized nucleoli. e.g. Oocytes, neurons and secretory cells.
The cells with little or no synthetic activities like sperm cells, blastomeres, muscle cells, etc. contain smaller or no nucleoli.
Nucleolus contains the following parts: The matrix, which is homogenous, nucleolar associated chromatin, fibrils and granules.

iv. Chromatin network:

The nucleoplasm contains many thread-like coiled and much elongated structures known as the chromatin (Gr. chrome = colour) fibres or chromatin network or nuclear reticulum.
Chromatin material is the genetic material consisting of deoxyribonucleic acid (DNA) associated with nuclear proteins (histones and non-histones) and RNA.

Q.86. What are nuclear pores? State their function.

Ans: The nuclear envelope is perforated by many apertures called nuclear pores.

Function: Through nuclear pore, movement of RNA and protein molecules occur between nucleus and cytoplasm.

Q.87. What are the functions of nuclear envelope?

Ans: i. Nuclear envelope separates the nuclear material from cytoplasm.
ii. It carries out nucleo-cytoplasmic exchange of the necessary materials.
iii. It provides surface area for the attachment of cell organelles such as ER.

iv. It also provides surface for the attachment of chromatin material.
v. It is concerned with synthesis of certain proteins.
vi. It acts as a source membrane flow to other cell membrane.
vii. The outer nuclear membrane gives off vesicles which fuse and eventually forms the ER.

Q.88. What is a chromatin material? What are its types?

Ans: The nucleoplasm contains many thread-like coiled and much elongated structures known as the chromatin (Gr. Chrome = colour). Chromatin fibres form the genetic material consisting of deoxyribonucleic acid (DNA) associated with nuclear proteins and RNA.

Two types of chromatin material are; heterochromatin and euchromatin.

i. Heterochromatin:
It is the darkly stained, condensed region of chromatin. It is metabolically and genetically inert as it contains small amount of DNA and large amount of RNA.

ii. Euchromatin:
It is lightly stained and diffused region of chromatin. It contains comparatively large amount of DNA. This region is the genetically active part.

Q.89. ame two types of chromatin.

Ans: Heterochromatin and Euchromatin.

Q.90. What is nucleosomes?

Ans: The chromatin is made up of small repeating units called nucleosomes.

Q.91. Who coined the term 'chromosomes'?

Ans: Waldeyer coined the term 'chromosomes'.

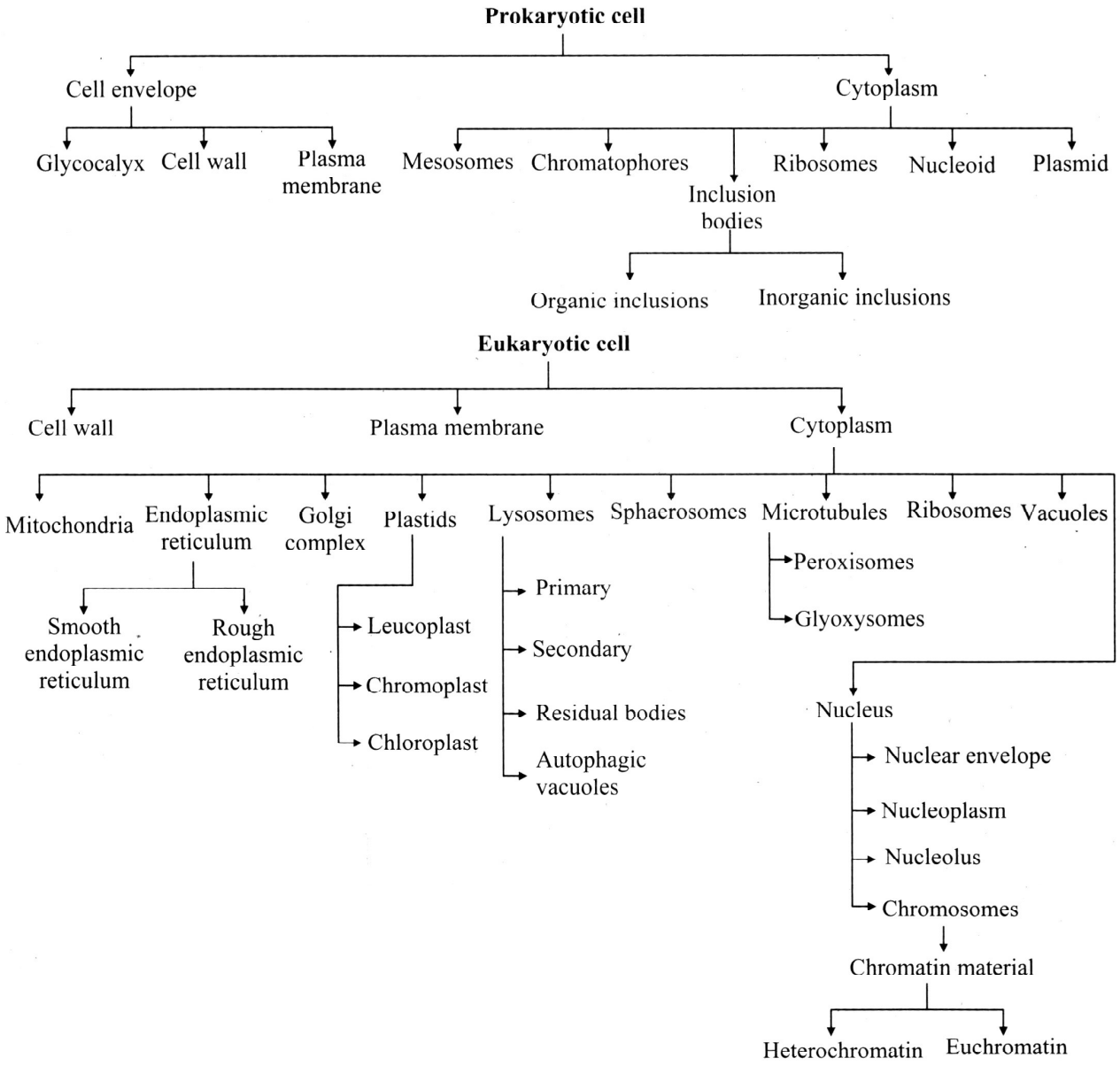
Q.92. Write a note on chromosomes.

Ans: i. Chromosomes were first observed by Hofmeister (1848). The term 'chromosomes' was given by Waldeyer (1888).
ii. During cell division, the chromatin material gets condensed to form distinct structures termed as chromosomes.
iii. The chromosomes are not visible in the active nucleus due to their high water content, but are clearly seen during cell division (metaphase).
iv. Eukaryotic cell shows typical chromosomes (chroma = colour, soma = body) and prokaryotic cell shows irregularly folded mass of genetic material called nucleoid.
v. The chromosomes are the nuclear components of special organization, individuality and function.
vi. Chromosomes have an ability of self-replication and they play an important role in heredity, variation, mutation and evolution of species.
vii. The number of chromosomes is constant for a particular species.
viii. Therefore, these have great importance in the determination of the phylogeny and taxonomy of the species.

Additional Theory Questions :

Q.1. What are mesosomes? Refer Q.26.
Q.2. Draw a neat labelled diagram of ultrastructure of Prokaryotic cell. Refer Q.21.
Q.3. With the help of neat labelled diagram differentiate 'Plant' cell from 'Animal' cell. Refer Q.34, Q.35 and Q.36.
Q.4. Sketch and label the fluid mosaic model of cell membrane. Refer Q.39.
Q.5. State the function of Endoplasmic reticulum. Refer Q.50.
Q.6. Name two cell- organelles that are double membrane bOUI1d.What are the characteristics of these two organelles? State their functions and draw labelled diagrams of both. Refer Q.45. and Q.55.
Q.7. Write short note on lysosomes. Refer Q.56,57,59.

Quick Review :



- **Scientists and their contribution :**

No.	Scientists	Contribution	Year
i.	Robert Hooke	Introduced the word 'cell'.	1665
ii.	Anton Van Leeuwenhoek	Reported the existence of sperm cells, bacteria, RBC, etc.	-
iii.	Robert Brown	Discovered and named the nucleus.	1831
iv.	Schleiden and Schwann	Established cell theory.	1839
v.	J.E Purkinje	Coined the term 'protoplasm'.	1839
vi.	Waldeyer	Concept: Nucleus contains chromosome.	1888
vii.	Rudolf Virchow	All cells arise from pre-existing cells.	1858
viii.	Christian Gram	Developed Gram's staining technique.	1884
ix.	Singer and Nicholson	Proposed fluid mosaic model of Cell membrane.	1972

x.	Camillo Golgi	Discovered Golgi complex.	1898
xi.	Dalton and Felix	Described the ultrastructure of Golgi apparatus with the help of electron micrographs.	1954
xii.	Palade	First cytologist to observe Ribosome in electron microscope.	1955
xiii.	Callan and Tomlin	First to observe nuclear pores in the nuclei of amphibian oocytes.	1950
xiv.	Harris and James	First to describe the presence of fibrous material on the inner surface of the inner nuclear membrane of *Amoeba*.	1952
xv.	Hofmeister	First person to see a chromosome.	1848
xvi.	Waldeyer	Coined the term 'chromosome'.	1888

Multipal Choice Question's

1. _____ do not have a cellular organization.
a) Bacteria b) Algae
c) Protozoa d) Viruses

2. In 1665, Robert Hook first detected cells in
a) Ieaf b) cork
c) intestine d) liver

3. The word 'cell' was coined.by
a) Anton van Leeuwenhoek
b) Mendel
c) Robert Hooke
d) M. J. Schleiden

4. The simple, basic and formal biological generalization is known as
a) Cell theory b) Cell division
c) Cell doctrine d) Both a)and c)

5. Embryonic animal cells are totipotent and termed as
a) Genes b) Bacilli
c) Amyloplast d) Stem cells

6. Prokaryotic cells are the characteristic of
a) animals b) plants
c) fungi d) bacteria

7. The cyanobacteria or blue green algae are photosynthetic
a) prokaryotes b) viruses
c) eukaryotes d) fungi

8. The prokaryotic cell shows absence of
a) cytoplasm b) DNA
c) ribosomes d) mitochondria

9. Mesosome is produced by the infoldings of
a) mitochondria
b) chloroplast
c) golgi complex
d) plasma membrane

10. _____ provides support and rigidity to the cell.
a) Cell membrane b) Cell envelope
c) Cell wall d) Mitochondria

11. The ribosomes present in prokaryotic cells is of type.
a) 30S b) 80S
c) 70S d) 50S

12. The fluid-mosaic model of cell membrane postulates that
a) a lipid bilayer has some embedded proteins and some surface proteins.
b) a lipid bilayer is coated by a layer of proteins on each face.
c) a lipid bilayer has proteins embedded in itself and none on the surface.
d) a lipid bilayer is coated by a layer of proteins on the outer face only.

13. The cytoplasmic connections from cell to cell are known as
a) middle lamella
b) plasmodesmata
c) cell membrane system
d) endoplasmic reticulum

14. Mitochondria present in the eukaryotic cell carry out the function of _____
a) respiration b) photosynthesis
c) digestion d) transpiration

15. Which organelle is surrounded by two membranes?
a) Ribosomes b) Peroxisomes
c) Vacuoles d) Mitochondria

16. _____ are called powerhouse of cell.
a) Endoplasmic reticulum
b) Vacuole
c) Mitochondria
d) DNA

17. An organelle shows a highly folded inner wall. Ultrasonic disruption of the organelle yields fragments, which can synthesize ATP. The organelle is a
a) mitochondria b) ribosomes
c) chloroplast d) centrosome

18. F_1 particles are present in
a) plasmids b) mitochondria
c) chloroplast d) ribosomes

19. Due to presence of , endoplasmic reticulum is termed as rough endoplasmic reticulum.
a) cisternae b) RNA
c) ribosomes d) tubules

20. Proteins that are to be used outside the cell are synthesized
a) in the mitochondria
b) on the rough endoplasmic reticulum
c) on the smooth endoplasmic reticulum
d) on free ribosomes

21. Which of the following pair is mismatched?
a) Nucleus; chromosome
b) Nucleus; DNA replication
c) SER; protein synthesis
d) Cytoskeleton; microtubules

22. The secretory organ of the cell is
a) Golgi complex
b) endoplasmic reticulum
c) chromosomes
d) mitochondria

23. Which one of the following organelles is located near the nucleus and contains a collection of flattened membrane bound cisternae?
a) Nucleolus b) Centriole
c) Golgi apparatus d) Cristae

24. The pancreatic cells that secrete the digestive enzymes show predominance of
a) mitochondria b) Golgi bodies
c) lysosomes d) peroxisomes

25. Which of the following structure IS the functional unit in a Golgi complex?
a) Cisternae b) Thylakoid
c) Archoplasm d) Cristae

26. _____ are green plastids containing green pigment chlorophyll.
a) Chloroplasts b) Leucoplast
c) Chromoplasts d) Xanthophyll

27. The membranous bag of hydrolytic enzymes used for control of intracellular digestion of macromolecules is named as
a) lysosome
b) phagosome
c) nucleosome
d) endoplasmic reticulum

28. _____ are microbodies which contain enzymes for the synthesis of peroxide.
a) Sphaerosomes b) Peroxisomes
c) Centrioles d) Ribosomes

29. Which of the following cell organelle is commonly called as "Suicide bags"?
a) Lysosomes b) Ribosomes
c) Mitochondria d) Chloroplast

30. _____ are known as protein factories.
a) Chloroplasts b) Lysosomes
c) Ribosomes d) Glycoxysomes

31. Nucleic acid and proteins are present in .
a) ribosomes b) starch
c) insulin d) glycogen

32. The number of ribosomes in a polyribosome depends upon the _____
a) diameter of m-RNA
b) length of m-RNA
c) length of t-RNA
d) length of DNA

33. The plant cells do not possess
a) ribosomes
b) mitochondria
c) endoplasmic reticulum
d) centrioles

34. _____ is present in animal cells.
a) Plastid b) Chloroplast
c) Cell wall d) Centriole

35. Microtubules are made up of protein.
a) tubulin b) fibrion
c) collagen d) myosm

36. Tonoplast is a differentially permeable membrane surrounding the
a) cytoplasm b) vacuole
c) nucleus d) mitochondria

37. Nucleus was discovered by .
a) Robert Hook b) Robert Brown
c) de Dove d) Schwann

38. In eukaryotic cells, the chromosomes are located in
a) nucleus b) nucleolus
c) golgi complex d) lysosomes

39. Polynucleate cells of the plants are known as
a) Coenocytes b) Syncytial
c) Karyotheca d) Polysomes

40. _____ is known as karyotheca.
a) Nuclear membrane
b) Nucleoplasm
c) Nucleolus
d) Nuclear envelope

41. The space between the two nuclear membranes is known as
a) peritonial space
b) periplasmic space
c) perinuclear space
d) none of the above

42. Chromatin is made up of small repeating units called
a) peroxisomes b) mesosomes
c) nucleosomes d) polysomes

43. _____ contains the genetic material in the form of chromosomes.
a) Cytoplasm b) Nucleus
c) Ribosomes d) Vacuoles

44. Eukaryotic cells which lack nucleus is/are
a) WBC
b) Mature Sieve tubes
c) mammalian RBC
d) both b) and c)

45. Chromosomes were first observed by
a) Camillo Golgi b) Hofmeister
c) Felix d) Dalton

46. _____ have great importance in determination of phylogeny and taxonomy of species.
a) Chromosomes b) Cell membranes
c) Glyoxysomes d) Lysosomes

Answer Keys

1. d)	2. b)	3. c)	4. d)	5. d)	6. d)	7. a)	8. d)	9. d)	10. c)
11. c)	12. a)	13. b)	14. a)	15. d)	16. c)	17. a)	18. b)	19. c)	20. b)
21. c)	22. a)	23. c)	24. c)	25. a)	26. a)	27. a)	28. b)	29. a)	30. c)
31. a)	32. b)	33. d)	34. d)	35. a)	36. b)	37. b)	38. a)	39. a)	40. d)
41. c)	42. c)	43. b)	44. d)	45. b)	46. a)				