Cell - The Unit of Life

Introduction

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

What is A Cell

- Unicellular organisms are capable of (i) independent existence and (ii) performing the essential functions of life. Anything less than a complete structure of a cell does not ensure independent living. Hence, cell is the fundamental structural and functional unit of all living organisms.
- First cell discovered by - Robert Hooke in Cork
- Anton Von Leeuwenhoek first saw and described a live cell. Robert Brown later discovered the nucleus. The invention of the microscope and its improvement leading to the electron microscope revealed all the structural details of the cell.

Cell Theory

- In 1838, Matthias Schleiden, a German botanist, examined a large number of plants and observed that all plants are composed of different kinds of cells which form the tissues of the plant. At about the same time, Theodore Schwann (1839), 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.
- Schwann proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells.
- Schleiden and Schwann together formulated the cell theory. This theory however, did not explain as to how new cells were formed. Rudolf Virchow (1855) first explained that cells divided and new cells are formed from pre-existing cells (*Omnis cellula-e cellula*). He modified the hypothesis of Schleiden and Schwann to give the cell theory a final shape. Cell theory as understood today is:
  (i) All living organisms are composed of cells and products of cells.
  (ii) All cells arise from pre-existing cells.

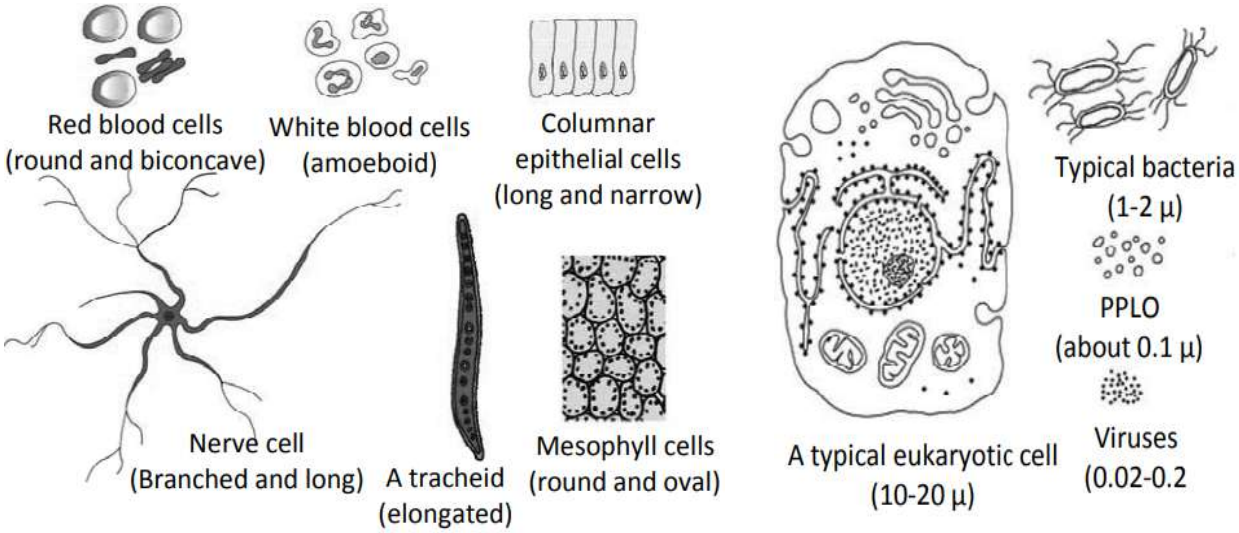
An Overview of Cell

- The onion cell which is a typical plant cell, has a distinct cell wall as its outer boundary and just within it is the cell membrane.
- The cells of the human cheek have an outer membrane as the delimiting structure of the cell. Inside each cell is a dense membrane bound structure called nucleus. This nucleus contains the chromosomes which in turn contain the genetic material, DNA.
- Cells that have membrane bound nuclei are called eukaryotic whereas cells that lack a membrane bound nucleus are prokaryotic.
- In both prokaryotic and eukaryotic cells, a semi-fluid matrix called cytoplasm occupies the volume of the cell.
- The cytoplasm is the main arena (zone) 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, microbodies. The prokaryotic cells lack such membrane bound organelles.
- Ribosomes are non-membrane bound organelles found in all cells both eukaryotic as well as prokaryotic cell. Within the cell, ribosomes are found not only in the cytoplasm but also within the two organelles – chloroplasts (in plants) and mitochondria and on rough ER.
- Animal cells contain another non-membrane bound organelle called centriole which helps in cell division.

1. **Size:**
   - Cell differ greatly in size, shape and activities.
   - Mycoplasma (Smallest cells) : Only 0.3 μm in length
   - Bacteria = 3 to 5 μm
   - Largest isolated single cell = egg of an ostrich.
   - Human red blood cell ≈ 7.0 μm in diameter
   - Nerve cell = longest cell

2. **Shape:**
   - The shape of the cell may vary with the function they perform.
   - They may be disc-like, polygonal, columnar, cuboid, thread like or even irregular.



Prokaryotic Cells

- The prokaryotic cells are represented by bacteria, blue-green algae, mycoplasma or PPLO (Pleuro Pneumonia Like Organisms). They are generally smaller and multiply more rapidly than the eukaryotic cells. They may vary greatly in shape and size. The four basic shapes of bacteria are bacillus (rod like), coccus (spherical), vibrio (comma shaped) and spirillum (spiral).
- The organisation of the prokaryotic cell is fundamentally similar even though prokaryotes exhibit a wide variety of shapes and functions.

Eukaryotic Cells

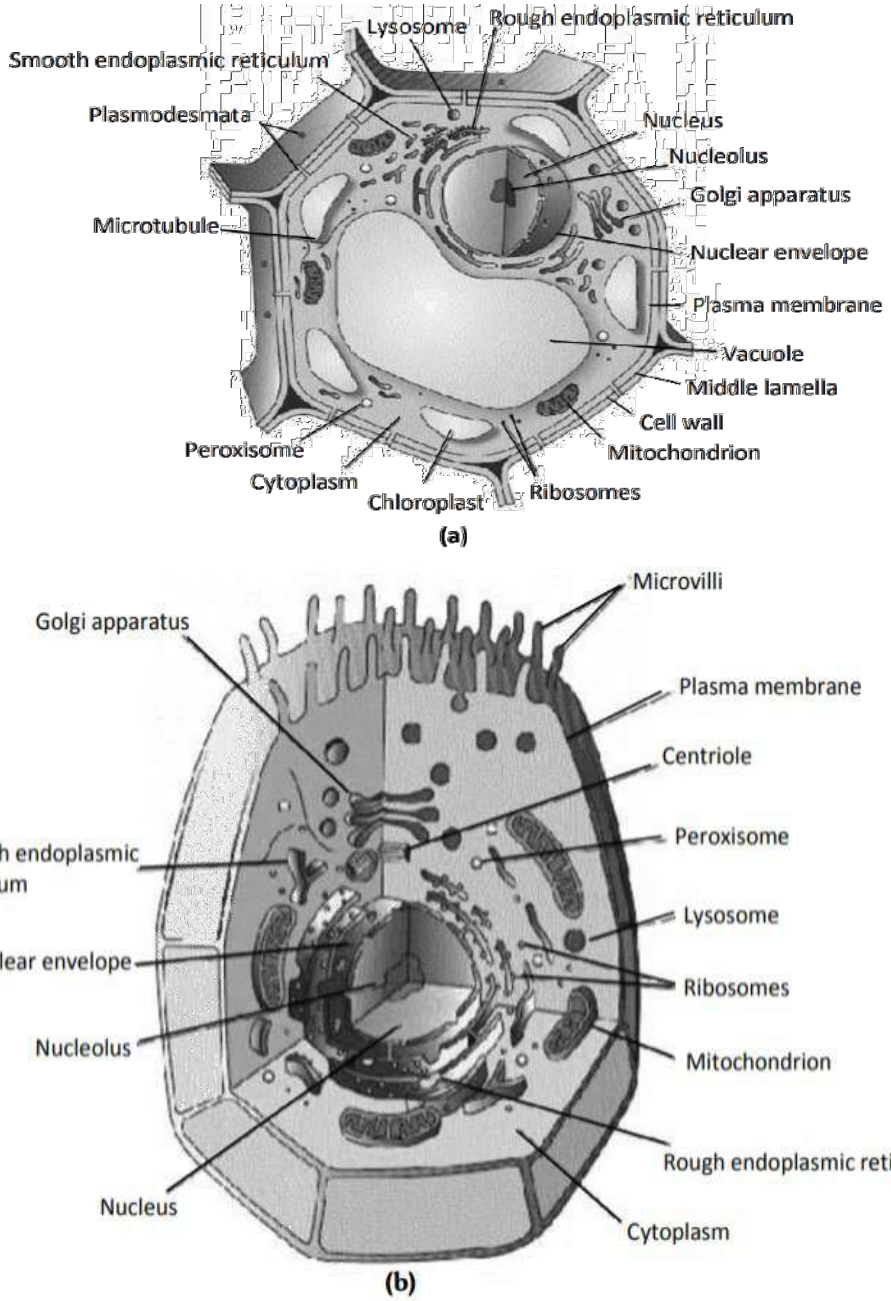


Diagram showing : (a) Plant cell (b) Animal cell

- The eukaryotes include all the protists, plants, animals and fungi. In eukaryotic cells there is an extensive compartmentalisation of cytoplasm through the presence of membrane bound organelles.
- Eukaryotic cells possess an organised nucleus with a nuclear envelope. In addition, eukaryotic cells have a variety of complex locomotory and cytoskeletal structures. Their genetic material is organised into chromosomes.
- All eukaryotic cells are not identical. Plant and animal cells are different as the former possess cell walls, plastids and a large central vacuole which are absent in animal cells. On the other hand, animal cells have centrioles which are absent in almost all plant cells.

Cell-Membrane (Plasma–Membrane)

- The detailed structure of the membrane was studied only after the advent of the electron microscope in the 1950s. Meanwhile, chemical studies on the cell membrane, especially in human red blood cells (RBCs), enabled the scientists to deduce the possible structure of plasma membrane.
- Biochemical investigation clearly revealed that the cell membranes possess lipid, protein and carbohydrate. The ratio of protein and lipid varies considerably in different cell types. In human beings, the membrane of the erythrocyte has approximately 52 per cent protein and 40 per cent lipids. In addition to phospholipids membrane also contains cholesterol.
- It is a universal structure and structurally cell membrane of prokaryotes is similar to the eukaryotes.

➢ **Structure of Biomembranes :**

Fluid Mosaic Model : Proposed by Singer & Nicolson (1972)

- This is latest & most widely accepted model for the structure of cell membrane
- According to fluid mosaic model proteins are arranged in phospholipid layer as mosaic pattern. Thus membrane is termed as "protein iceberg in a sea of phospholipid" or "Gulab Jamun (protein) in a concentrated solution (phospholipid) of sugar".

(a) Lipids :

- Phospholipid is the main component of cell membrane because it forms continuous structural frame of cell membrane.
- These studies showed that the cell membrane is mainly composed of lipids and proteins. The major lipids are phospholipids that are arranged in a bilayer. Also, the lipids are arranged within the membrane with the polar hydrophilic head towards the outer sides and the non-polar 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 (phospholipids).
- Phospholipid layer provides fluidity to plasma membrane because phospholipids are rich in unsaturated fatty acids.
- The Quasifluid nature of lipid enable lateral movement of protein with in the overall bilayer. This ability to move within the membrane is measured as its, fluidity.
- The fluid nature of the membrane is also important in various function like cell growth, formation of intercellular junction, endocytosis, secretion, cell division etc.

> Cholesterol is also present in plasma membrane. Cholesterol are more rigid than phospholipid. So it helps in stability of membrane structure.

(b) Proteins :

- Two types of protein are present in plasma membrane. (On the basis of ease of extraction)

Integral or Intrinsic Protein :-

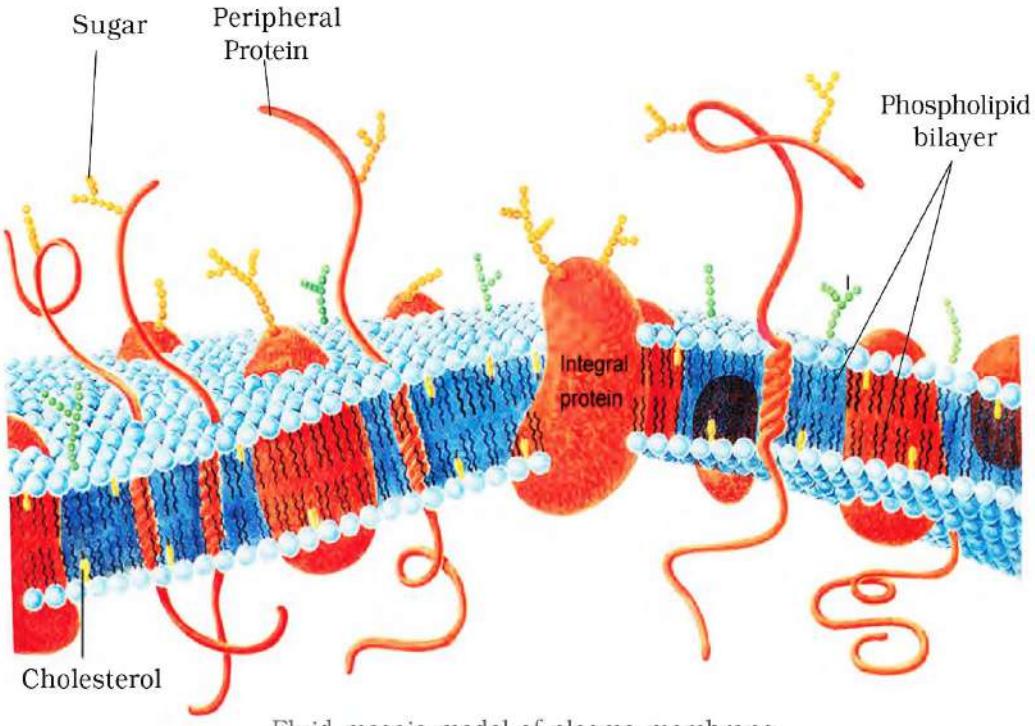
- These protein tightly binds with phospholipid. Thus, they can not be easily removed from membrane.
- Integral proteins are of 2 types : Partially buried and Totally buried.
- Some integral proteins are totally buried through the complete thickness of membrane, these type of proteins are called as tunnel (channel) protein which provide a passage for movement of water soluble material across the membrane.

Peripheral or Extrinsic Protein :-

- These are superficially arranged on the surface of lipid layer and can be separated easily. These protein have enzymatic activity.

(c) Carbohydrates:

- Oligosaccharides (sugar) of the glycolipids & glycoproteins on the outer surface of plasma membranes are involved in cell to cell recognition mechanism. Best examples of cell recognition are fertilisation, (where sperm & egg recognize each other) and blood - Antigens.



Fluid mosaic model of plasma membrane

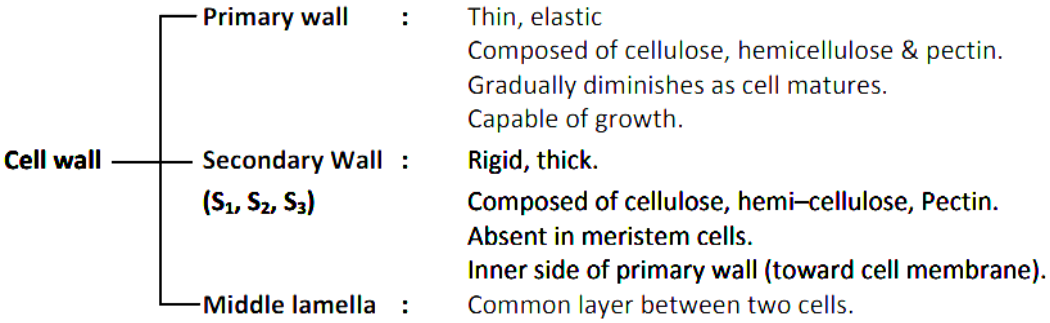
Transport Through Plasma Membrane :

- One of the most important functions of the plasma membrane is the transport of the molecules across it. The membrane is selectively permeable to some molecules present on either side of it. Many molecules can move briefly across the membrane without any requirement of energy and this is called the passive transport.
- Neutral solutes may move across the membrane by the process of simple diffusion along the concentration gradient, i.e., from higher concentration to the lower. Water may also move across this membrane from higher to lower concentration. Movement of water by diffusion is called osmosis.
- As the polar molecules cannot pass through the nonpolar lipid bilayer, they require a carrier protein of the membrane to facilitate their transport across the membrane.
- A few ions or molecules are transported across the membrane against their concentration gradient, i.e., from lower to the higher concentration. Such a transport is an energy dependent process, in which ATP is utilised and is called active transport, e.g., Na^+/K^+ Pump.

Cell Wall

- A non-living rigid structure called the cell wall forms an outer covering for the plasma membrane of Bacteria, Some protistan, Fungi, Algae and Plants.
- Algae have cell wall, made of cellulose, galactans, mannans and minerals like calcium carbonate.
- In other plants cell wall consists of cellulose, hemicellulose, pectins and proteins.

Layers of Cell Wall :



- Cellulose is a main constituent of cell wall but in addition to cellulose, hemicellulose, cutin, pectin, suberin are also present in cell wall.
- Cell wall worked as frame or protective layer of cell.
- Cellulose microfibrils are arranged in layers to form skeleton of cell wall. In between these layers other substances like pectin, hemicellulose may be present. These form matrix of cell wall.
- Middle lamella is a layer mainly of calcium pectate which holds or glues the different neighbouring cells together.

Plasmodesmata:-These are cytoplasmic connections between two adjacent plant cells. Plasmodesmata are characteristic of multi-cellular plants. E.R. tubules (Desmotubules) help to maintain continuity of cytoplasm. The cell wall and middle lamella may be traversed by plasmodesmata which connect the cytoplasm of neighbouring cells.

Functions of Cell Wall :-

- Cell wall gives shape to the cell
- It protects the cell from mechanical damage and infection
- It also helps in cell-to-cell interaction
- It provides barrier to undesirable macromolecules.

Golden Key Points

- The lipid component of the membrane mainly consists of phosphoglycerides (Phospholipid).
- One of the most important functions of the plasma membrane is the transport of the molecules across it.
- In the cell membrane, nonpolar tail of saturated and unsaturated hydrocarbons is protected from the aqueous environment.

Concept Builder

1. Which element mainly occurs in middle lamella ?

(1) Ca (2) Mg (3) Na (4) K

2. Plasma membrane is fluid structure due to presence of :–

(1) Carbohydrate (2) Lipid (3) Glycoprotein (4) Poly saccharide

3. Which of the following features is common to prokaryotes and many eukaryotes?

(1) Chromosomes present (2) Cell wall present

(3) Nuclear membrane present (4) Membrane bound organelles present

4. Lipids are arranged within the membrane with :-

(1) polar heads towards inner side and the hydrophobic tails towards outerside

(2) both heads and tails towards outerside.

(3) heads towards outerside and tail towards inside.

(4) both heads and tails towards inner side.

5. Who proposed a modification in the cell theory ?

(1) Schleiden and Schwann (2) Rudolf Virchow

(3) Robert Brown (4) Robert Hooke

6. "Omnis cellula e cellula" i.e. new cells arise from pre-existing cells; this statement was given by :-

(1) Schleiden and Schwann (2) Rudolf Virchow

(3) Robert Brown (4) Robert Hooke

Concept Builder (Answer-Key)						
Que.	1	2	3	4	5	6
Ans.	1	2	2	3	2	2

Endomembrane System

- While each of the membranous organelles is distinct in terms of its structure and function, many of these are considered together as an endomembrane system because their functions are coordinated.
- The endomembrane system include endoplasmic reticulum (ER), golgi complex, lysosomes and vacuoles. Since the functions of the mitochondria, chloroplast and peroxisomes are not coordinated they do not come under endomembrane system

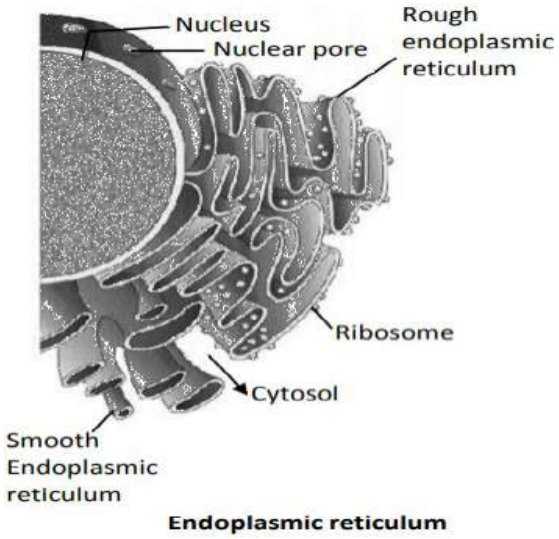
The Endoplasmic Reticulum (E.R.) :

- Electron microscopic studies of eukaryotic cells reveal the presence of a network of reticulum of tiny tubular structures scattered in the cytoplasm that is called the endoplasmic reticulum (ER).
- ER divide the intracellular space into two distinct compartment i.e. Luminal (inside ER) and extra luminal (cytoplasm) compartments

➢ **Components of E.R. :–**

- Cisternae - These are long flattened and unbranched units arranged in stacks.
- Vesicles - These are oval membrane bound structures.
- Tubules - These are irregular, often branched tubes bounded by membrane. Tubules may free or associated with cisternae.

Rough E.R. (Granular)		**Smooth E.R. (Agranular)**	
(1)	80s ribosomes binds by their larger subunit, with the help of two glycoproteins (Ribophorin on the surface of Rough E.R.)	(1)	Ribosomes and Ribophorins absent
(2)	Mainly composed of cisternae.	(2)	Mainly composed of tubules.
(3)	Abundantly occurs in cells which are actively engaged in protein synthesis and secretion. They are extensive and continuous with the outer membrane of the nucleus.	(3)	Abundantly occurs in cells concerned with glycogen and lipid metabolism. → In animal cell lipid like steroidal hormones are synthesised in SER.



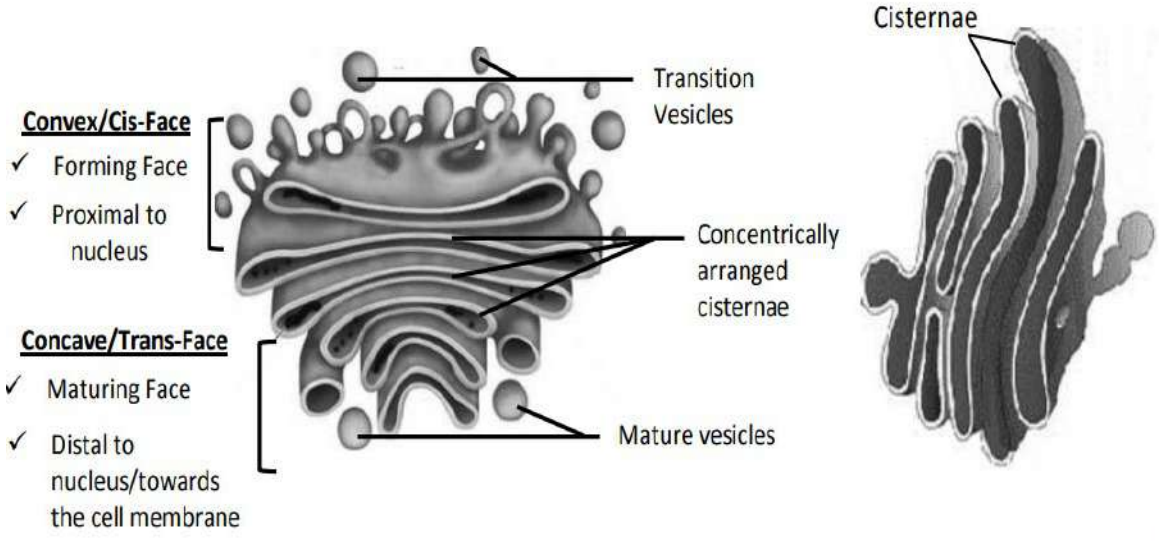
Endoplasmic reticulum

➢ **Functions of E.R. :–**

- Mechanical support :– E.R. provide support to cell from inner side.
- Intracellular transport :– E.R. forms intracellular conducting system. Transport of materials in cytoplasm from one place to another may occurs through the E.R.
- At some places E.R. is also connected to plasma membrane, so E.R. can secrete the materials outside the cell.
- Rough E.R. :– Provides site for the protein synthesis, because rough E.R., has ribosomes on its surface.
- Lipid Synthesis:– Lipids (cholesterol & phospholipids) synthesized by the Smooth E.R.
- E.R. also helps in the synthesis of lipoproteins and glycogen.

Golgi Apparatus or Golgi Complex :

- Camillo Golgi (1898) first observed densely stained reticular structure near the nucleus. These were later named Golgi bodies after him.
  - **Structure :**
    - Golgi complex is made up of three parts –
      - **(a) Cisternae :–** These are flat disc shaped sac like structures with diameter of 0.5 μm to 1.0 μm. Many cistenae are arranged in a stack parallel to each other.
        - Varied number of cisternae are present in Golgi complex.
        - The Golgi cisternae are concentrically arranged near the nucleus.
        - Convex surface of cisternae which is towards the nucleus is called cis-face or forming face.
        - Concave surface of cisternae which is towards the membrane is called Transface or maturing face.
        - The cis and trans faces of the organelle are entirely different but inter connected.
      - **(b) Tubules :–** These are branched and irregular tube like structures associated with cisternae.
      - **(c) Vesicles :–** Transition vesicle and Mature vesicle.

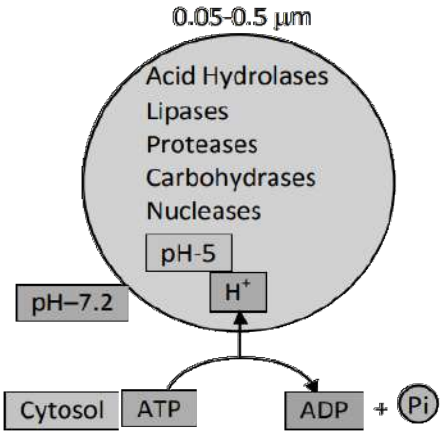


Golgi apparatus

  - **Function of Golgi Complex :**
    - The golgi apparatus principally performs the function of packaging materials, to be delivered either to the intra-cellular targets or secreted outside the cell. Materials to be packaged in the form of vesicles from the ER fuse with the cis face of the golgi apparatus and move towards the maturing face. This explains, why the golgi apparatus remains in close association with the endoplasmic reticulum. A number of proteins synthesised by ribosomes on the endoplasmic reticulum are modified in the cisternae of the golgi apparatus before they are released from its trans face. Golgi apparatus is the important site of formation of glycoproteins and glycolipids.

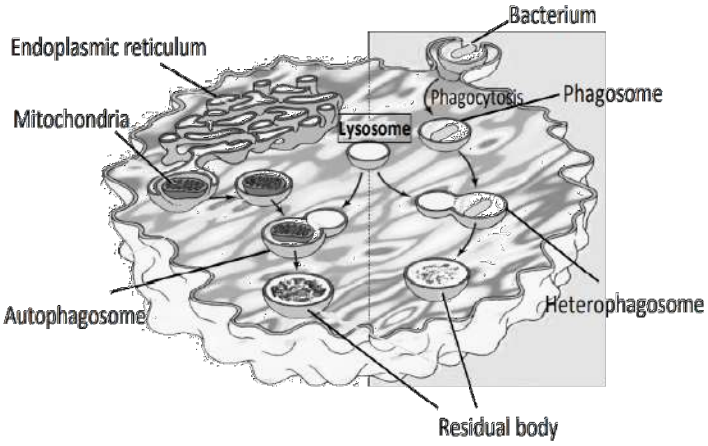
Lysosome :

- **Structure :**
  - These are membrane bound vesicular structures formed by the process of packaging in the golgi apparatus. The isolated lysosomal vesicles have been found to be very rich in almost all types of hydrolytic enzymes (hydrolases – lipases, proteases, carbohydrases) optimally active at the acidic pH (pH = 5). These enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids.



A lysosome containing a number of acid hydrolases that are active under acidic condition, which is maintained by an H^+ ATPase in the membrane

  - Lysosomes are filled with 50 different type of digestive enzymes termed as Acid hydrolases for digestion of all type of macromolecules. These acid hydrolases function in acidic medium (pH=5). Membrane of lysosome has an active H^+ pump mechanism which produce acidic pH in lumen of lysosome.
  - Lysosomes are abundantly found in phagocytic cells.
  - Lysosomes are highly polymorphic cell organelle. Because, lysosomes have different physiological states.



- **Types/Forms of Lysosomes**

  (a) Primary Lysosomes or Storage Granules - These lysosomes store enzyme Acid Hydrolases in the inactive form. These are newly formed lysosome.

  (b) Secondary Lysosome (Heterophagosome\Autophagosome) – Heterophagosomes are formed by the fusion of primary lysosomes and phagosomes. Whereas **Autophagosomes** are lysosomes containing cell organelles to be digested.

  (c) Tertiary Lysosome (Residual Bodies) – Lysosomes containing undigested material are called residual bodies. These may be eliminated by **exocytosis.**

- **Functions :**

  (a) Intracellular Digestion :-
  - **Heterophagy :–** This is digestion of foreign materials received in cell by phagocytosis and pinocytosis.
  - **Autophagy :–** Digestion of old or dead cell organelles. Autophagy also takes place during starvation of cell.

  (b) Extracellular Digestion :– During osteogenesis, lysosomes of osteoclast (bone eating cells) dissolve unwanted part of bones. (Extracellular digestion also occurs by fungal lysosomes.)

  (c) Cellular Digestion/Autolysis/Autodis Solution :– Sometimes all lysosomes of a cell burst to dissolve the cell completely, it is Autolysis. That's why lysosome called as **suicidal bags** of cell.
  - Old cells, unwanted organs of embryo etc. are destroyed by autolysis.
    eg.:-Cathepsin enzyme of lysosome digests the tail of tadpole of frog during metamorphosis.

Vacuoles :

- The vacuole is the membrane-bound space found in the cytoplasm. It contains water, sap, excretory product and other materials not useful for the cell.
- The vacuole is bound by a single membrane called tonoplast.
- In plant cells the vacuoles can occupy up to 90 per cent of the volume of the cell.
- In plants, the tonoplast facilitates the transport of a number of ions and other materials against concentration gradients into the vacuole, hence their concentration is significantly higher in the vacuole than in the cytoplasm.
- In *Amoeba* the contractile vacuole is important for excretion and osmoregulation. In many cells, as in protists, food vacuoles are formed by engulfing the food particles.

Endomembrane System

Endoplasmic reticulum (ER)	Golgi apparatus	Lysosome	Vacuole
Reticulum of tiny tubular structures scattered in the cytoplasm	These were named Golgi bodies after discoverer name Camillo Golgi.	These are membrane bound vesicular structures formed by the process of packaging in the Golgi apparatus.	The vacuole is the membrane bound space found in the cytoplasm, membrane is called tonoplast.
The ER which has ribosomes on surface are called RER, in absence of ribosomes they appear smooth called SER.	They consist of cisternae, which are concentrically arranged near the nucleus with distinct convex cis or the forming face and concave trans or the maturing face.	They are rich in hydrolytic enzymes (lipases, proteases arbohydrases), optimally active at acidic pH.	Contain water, sap, excretory product and other materials not useful for the cell. In *Amoeba*, contractile vacuole is important for excretion.
RER is involved in protein synthesis whereas SER is involved in synthesis.	Principally performs the function of packaging of materials. It is the important site for formation of glycoproteins and glycolipids.	These enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids.	In many cells, as in protists, food vacuoles are formed by engulfing the food particles.

Golden Key Points

- ER, Golgibody, Lysosome and vacuoles are considered together as an endomembrane system because their function are co-ordinated.
- RER, frequently observed in the cells actively involved in protein synthesis and secretion. Where as SER is observed in the cells actively involved in lipid and steroidal hormone synthesis.
- Golgi body recieve the materials from E.R. through it's cis face and these material are modified by golgibody for e.g. Formation of glycolipid and glycoproteins i.e. glycosylation/glycosidation.
- Golgi body is also known as dictyosome in plant cells.
- The isolated lysosomal vesicles have been found to be very rich in almost all types of hydrolytic enzymes (hydrolases-lipases, proteases, carbohydrases) optimally active at the acidic pH. (pH = 5)
- In plant cell the vacuoles can occupy upto 90 percent of the volume of the cell. It contains water, sap, excretory product and other materials not useful for the cell.

Concept Builder

1. Rough E.R. mainly responsible for:-
(1) Protein synthesis (2) Cell wall formation (3) Lipid synthesis (4) Cholesterol synthesis

2. Hydrolytic enzymes are abundantly found in which cell organelle?
(1) Ribosome (2) Lysosome (3) Oxysome (4) Endoplasmic reticulum

3. Chemical modification of substance like glycosylation of protein and lipid occur in :–
(1) Endoplasmic reticulum (2) Golgi body (3) Lysosome (4) Ribosome

4. At which pH lysosomal enzymes remain active :–
(1) pH – 5 (2) pH – 7 (3) pH – 8 (4) pH – 10

5. Polymorphic cell organelle is :–
(1) Ribosome (2) Lysosome (3) Chloroplast (4) Nucleus

6. A major site for synthesis of lipids is :
(1) Nucleoplasm (2) RER (3) SER (4) Lysosome

7. Which group of organelles is involved in synthesis of substances needed by cell?
(1) Lysosome, vacuole, ribosome (2) Vacuole, RER, SER
(3) Ribosome, RER, SER (4) RER, lysosome, vacuole

8. Which of the following is correct for the origin of lysosome?

(1) ER → Golgi bodies → Lysosome (2) Golgi bodies → ER → Lysosome

(3) Nucleus → Golgi bodies → Lysosome (4) Mitochondria → ER → Golgi bodies → Lysosome

9. A cell, which is very active in the synthesis and secretion of proteins, would be expected to have:-

(1) Equal amount of RER and SER (2) More SER than RER

(3) More RER than SER (4) More Golgi bodies and no ER

10. As they release hydrolases that digest old and damaged cells, the term suicidal bags is used by cell biologists for :-

(1) Golgi bodies (2) Lysosomes (3) Glyoxysomes (4) Peroxisomes

Concept Builder (Answer-Key)										
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	2	2	1	2	3	3	1	3	2

Mitochondria :

➢ **Number, Size and Shape :**

- Number of mitochondria depends upon physiological activity of cell.
- Mitochondria differ in size and shape and can make its shape sausage or cylindrical.
- Diameter 0.2–1.0 μm (average 0.5 μm), length 1.0 – 4.1 μm.

Mitochondria is Also Named as –

- Power house of cell or ATP-mill in cell
- Cell within cell
- Most busy and active organelle in cell
- Semi autonomous cell organelle
- Endo-symbionts of cell

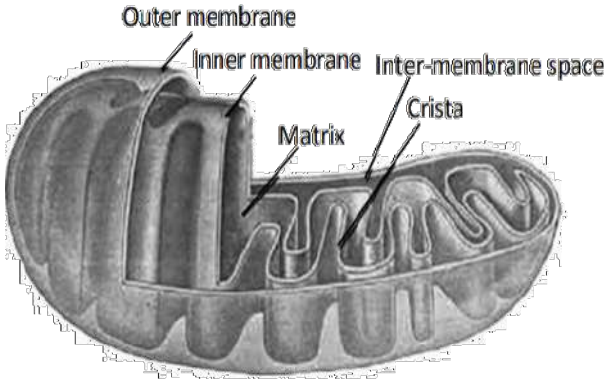
➢ **Structure :**

- Mitochondria (sing.: mitochondrion) unless specifically stained are not easily visible under the microscope. Mitochondria are stained by Janus green B.
- Mitochondria is covered by double unit membrane, 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 filled with a dense homogenous substance is called the matrix. The outer membrane forms the continuous limiting boundary of the organelle. The two membranes have their own specific enzymes associated with the mitochondrial function.
- Both membrane are separated by a space called **perimitochondrial** (Intermembrane) space.
- Inner membrane is folded into a number of finger like cristae.

- In metabolically active mitochondria, cristae are higher in number and bigger in size.
- Many electron carrier cytochromes are arranged in a definite sequence in Inner membrane of mitochondria, which forms **Electron transport system (ETS).**
- Inner membrane is studded with pin head particles called **oxysomes** or **elementary particles** or **F_0 – F_1 particles** or **ATP Synthase.** These particles were first described by **Fernandez Moran.**
- Head of Oxysomes or F_1 is concerned with **Oxidative phosphorylation (formation of ATP by energy of oxidation)**
- Mitochondrial matrix have enzyme for **Kreb's cycle (Aerobic respiration).** Beside these enzymes matrix have a complete protein synthesis apparatus **(Ribosome-** (70-s), **DNA,** few **RNA's & enzymes)** so mitochondria called as **semi autonomous cell organelles.**
- Single, **double stranded** and circular **naked** DNA present in mitochondria matrix.

➢ **Function of Mitochondria :**

- Mitochondria are the site of aerobic respiration, They produce energy in form of ATP, hence they are called “power houses” of cell.



Structure of mitochondrion (Longitudinal section)

Biogenesis of Mitochondria –

- New mitochondria arise from division of pre-existing mitochondria (Mitochondria divide by binary fission)
- **Endosymbiotic Origin** from prokaryotic cells :-
  (i) Type of DNA (DNA sequences, double stranded, circular, G-C rich).

Plastids :

- Plastids are found in all plant cells and in euglenoides. 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 presence or absence and type of pigments plastids can be classified into chloroplasts, chromoplasts and leucoplasts.

(A) Chromoplasts :– In chromoplasts fat soluble carotenoid pigments like carotene, xanthophylls and others are present. This gives yellow, orange or red colour to the part of the plant. Chlorophylls either absent or occur in very less amount. Chromoplasts occurs mainly in **pericarp** and **petals.** Red colour of tomatoes is due to the red pigment **"Lycopene"** of chromoplasts.

(B) Chloroplasts :– The chloroplasts contain chlorophyll and carotenoid pigments which are responsible for trapping light energy essential for photosynthesis.

(C) Leucoplasts :– 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. **Pigments and lamellar structure absents in Leucoplasts. Generally occurs in non green and underground plant cells.**

➢ **Chloroplast :**

Number, Shape & Size of Chloroplasts :

- Majority of the chloroplasts of the green plants are found in the mesophyll cells of the leaves.
- Number varies from 1 per cell (*Chlamydomonas* a green alga) to 20-40 per cell (mesophyll cell).
- These are lens-shaped, oval, spherical, discoid, or even ribbon shaped.
- Length and width are also variable.

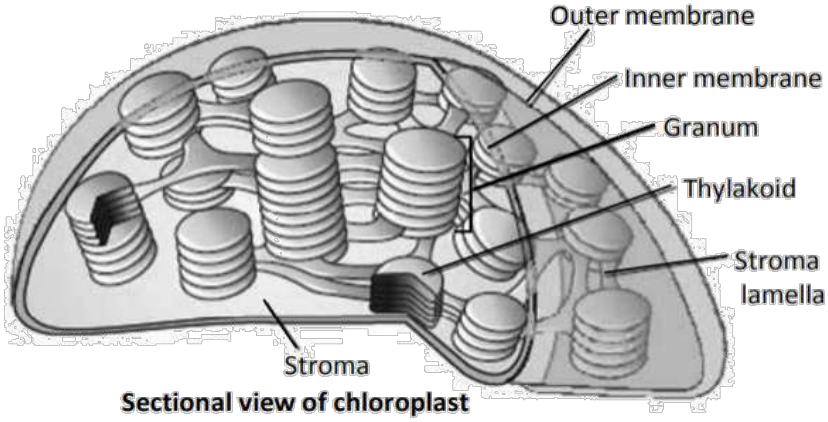
  Length = 5-10 μm Width = 2-4 μm

Structure of Chloroplast :

(a) Membrane : Like mitochondria the chloroplast are also double membrane bound.

Out of the two, the inner membrane is relative less permeble. (Outer membane contain porins)

- The space limited by the inner membrane is called the stroma.



Sectional view of chloroplast

(b) Thylakoids :

- In the stroma a number of organised flatted membranous sacs are present called thylakoids.
- Thylakoids are arranged in stacks like the piles of coins called grana (singular : granum) or the intragranal thylakoids.

- Each chloroplast contains about 40-60 granum.
- Stroma lamellae or Frets channel or Stroma thylakoids are flat membranous tubules connecting the thylakoids of the different granum.
- The membrane of the thylokoids enclose a space called lumen.
- Chlorophyll (photosynthtic pigments) are present in the thylakoid membranes.
- A photosynthetic functional unit (Located in thylakoids membrane) Consist of about 250 to 400 molecules of various pigments (Chl-a, Chl-b, Carotenes, Xanthophylls etc.) is called as Quantasome.

(c) Enzymes :

- The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrate. (i.e. enzymes of Calvin cycle or Dark reaction) and protein synthesis.

(d) DNA :

- Stroma contain small double-stranded circular DNA molecule.

(e) Ribosome :

- The Ribosomes of the chloroplast are smaller (70s) than the cytoplasmic ribosomes(80s).
- Chloroplasts have their own genetic system & complete protein synthesis Machinery (ds-DNA, RNA, Ribosome, Enzymes, Amino acids etc.) but enzymes for photosynthesis are synthesised by both genes of nucleus and chloroplast thus chloroplasts are also called as semi autonomous cell organelle.

Function of Chloroplast :

Photosynthesis : The chloroplasts trap the light energy of sun and transform it into the chemical energy in the form glucose.

Biogenesis –

(1) From Proplastid

(2) From fission of pre-existing plastids.

Origin : Endosymbiotic origin by a cyanobacterium.

Golden Key Points

- Mitochondria supply most of the necessery biological energy through oxidising substrates of TCA cycle (Krebs cycle).
- Mitochondria are the site of aerobic respiration.
- Mitochondria produce cellular energy in the form of ATP, hence they are called 'power houses' of the cell.
- Based on the type of pigments plastids can be classified into chloroplasts, chromoplasts and leucoplasts.
- Chloroplast and mitochondria both are semiautonomous organelles of the cell.

Concept Builder

1. Power house of cell is :-

(1) Nucleus (2) DNA (3) Mitochondria (4) ATP

2. Which of the following sets of cell organelles contain DNA ?

(1) Mitochondria, peroxisome (2) Plasma membrane, ribosome

(3) Mitochondria, chloroplast (4) Chloroplast, Golgi apparatus

3. Semiautonomous cell organelle is :–

(1) Mitochondria (2) Ribosome (3) Plasma membrane (4) Peroxisome

4. Aerobic respiration is performed by :-

(1) Mitochondria (2) Chloroplast (3) Ribosome (4) Golgibody

5. Double layered organelles are -

(1) Ribosomes (2) Mitochondria (3) Lysosomes (4) Centriole

6. Plastids which store fats and oils are called:-

(1) Aleuroplast (2) Amyloplast (3) Chromoplast (4) Elaioplast

7. Various colours of pericarp and petals are due to :-

(1) Chloroplast (2) Chromoplast (3) Elaioplast (4) Aleuroplast

8. All plastids (Choose the correct one) :-

(1) perform the same function (2) are localised in the aerial parts of plants

(3) are membrane bound organelles (4) store starch, lipids and proteins.

9. Match the Column-I with Column-II and select the correct option from the codes given below.

Column-I	**Column-II**
A. Chloroplasts	(i) Colourless plastids
B. Chromoplasts	(ii) Yellow, orange or red coloured plastids
C. Leucoplasts	(iii) Green plastids

(1) A-(iii), B-(i), C-(ii) (2) A-(iii), B-(ii), C-(i)

(3) A-(i), B-(iii), C-(ii) (4) A-(i), B-(ii), C-(iii)

10. Study the following statements regarding mitochondria and select the correct ones.

(i) These are the sites of aerobic respiration.

(ii) Matrix contains single circular ds DNA molecule, a few RNA molecules, 70S ribosomes.

(iii) Mitochondria divide by fission.

(iv) Mitochondria are fully-autonomous.

(1) (i) and (ii) only (2) (iii) and (iv) only (3) (i), (ii) and (iii) (4) (i), (ii), (iii) and (iv)

Concept Builder (Answer-Key)										
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	3	3	1	1	2	4	2	3	2	3

Ribosomes :

- Ribosomes are the granular structures first observed under the electron microscope as dense particles by George Palade (1953). They are composed of ribonucleic acid (RNA) and proteins and are not surrounded by any membrane.
- Except mammalian RBC all living cells have ribosomes. (Both prokaryotes & Eukaryotes)
- Ribosomes are smallest cell organelles
- Ribosomes are also called as "Organelle within organelle", "Protein factory of cell" and "engine of cell"

➢ **Types of Ribosomes :**

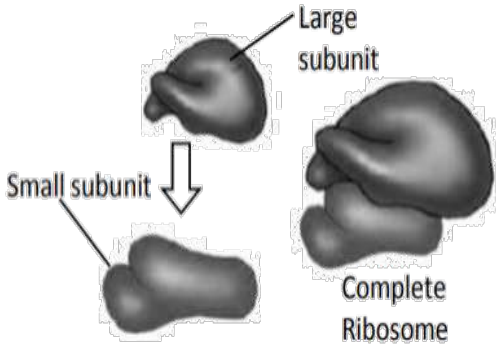
(i) Eukaryotic Ribosomes :– 80 S-Occur in cytoplasm of eukaryotic cells.

(ii) Prokaryotic Ribosomes :– 70 S-Occur in cytoplasm and associated with plasma membrane of prokaryotic cell. Their size is 15 to 20 nanometre.

- 70 S ribosome also present in mitochondria and chloroplast of eukaryotes.
- S=Svedberg unit or Sedimentation rate. It indirectly is a measure of density and size.
- Each ribosome composed of two subunits i.e. larger and smaller subunits.

80 S = 60 S + 40 S

70 S = 50 S + 30 S



- Magnesium ion is essential for the binding the ribosome sub units. Mg^{+2} form ionic bond with phosphate groups of r- RNA of two subunits. Minimum 0.001 M Mg^{+2} concentration is required for structural formation of ribosomes.
- Several 70s ribosomes may attach to a single mRNA and form a chain called polyribosome or polysome.

Cytoskeleton :

- An elaborate network of filamentous proteinaceous structures consisting of microtubules, microfilaments and intermediate filaments present in the cytoplasm is collectively referred to as the cytoskeleton. The cytoskeleton in a cell are involved in many functions such as mechanical support, motility, maintenance of the shape of the cell.

(A) Microtubules :

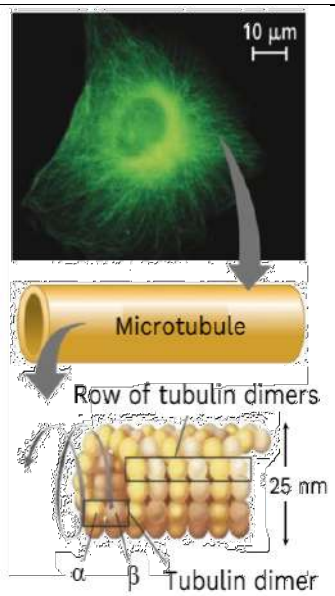
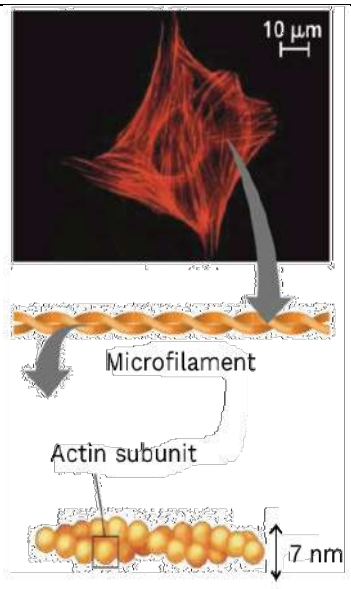
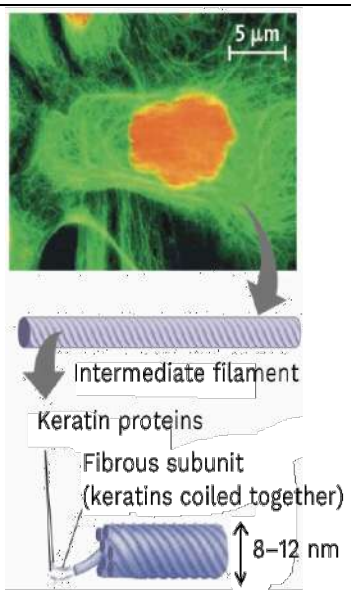
- Microtubules are composed of protien, **Tubulin [Diameter 25 nm.]**
- In plants microtubules often found associated with cell wall. Probably these transport cell wall material from Golgi body to outside of cell. During cell division these microtubules form **spindle fibers.**

(B) Microfilaments :

- They are composed of contractile protein, **Actin** which concern with **muscle contraction,** Along with microtubules, microfilaments are part of cytoskeleton base of cell. **[Diameter 6-7 nm]**

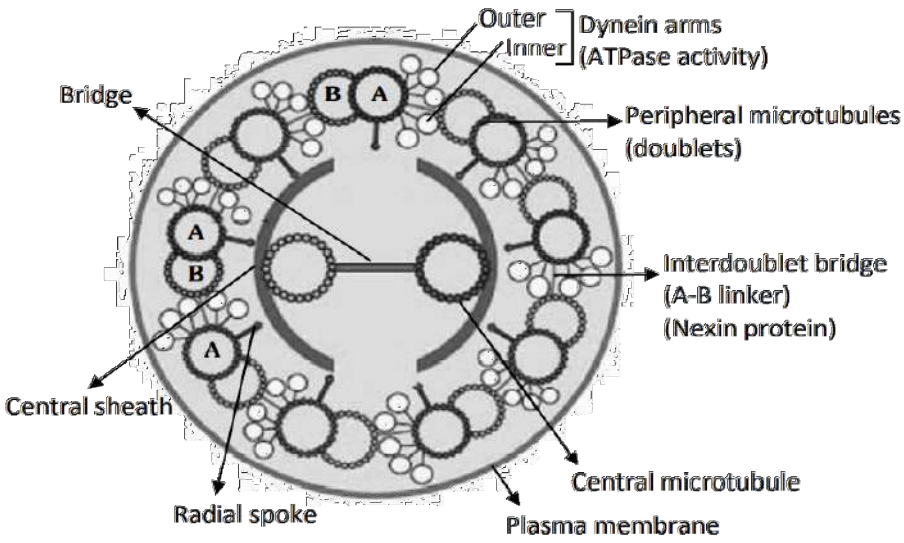
(C) Intermediate Filaments :

- **Intermediate filaments** has diameter in between microfilaments and microtubules. These filaments form basket like structure around the nucleus. **[Diameter 8-12 nm]**

The Structure and Function of the Cytoskeleton		
Microtubules (Tubulin Polymers)	**Microfilaments (Actin Filaments)**	**Intermediate Filaments**
Hollow tubes	Two intertwined strands of actin	Fibrous proteins coiled into cables
25 nm	7 nm	8–12 nm
Tubulin, a dimer consisting of an α-tubulin and a β-tubulin	Actin	One of several different proteins (including keratins)
Maintenance of cell shape; cell motility; chromosome movements in cell division; organelle movements	Maintenance of cells shape; changes in cell shape; muscle contraction; cytoplasmic streaming (plant cells); cell motility; cell division (animal cells)	Maintenance of cell shape; anchorage of nucleus and certain other organelles; formation of nuclear lamina
		

Cilia and Flagella :

- Cilia (sing.: cilium) and flagella (sing.: flagellum) are hair-like outgrowths of the cell membrane. Cilia are small structures which work like oars, causing the movement of either the cell or the surrounding fluid. Flagella are comparatively longer and responsible for cell movement. The bacteria (prokaryotic cell) also possess flagella but these are structurally different from that of the eukaryotic flagella.
- The electron microscopic study of a cilium or the flagellum show that they are covered with plasma membrane. Their core called the axoneme, possesses a number of microtubules running parallel to the long axis. The axoneme usually has nine doublets of radially arranged peripheral microtubules, and a pair of centrally located microtubules. Such an arrangement of axonemal microtubules is referred to as the 9+2 array. (9 doublet + 2 singlet)
- The central tubules are connected by bridges and also enclosed by a central sheath, which is connected to one of the tubules of each peripheral doublets by radial spoke. Thus there are nine radial spokes. The peripheral doublets are also interconnected by linkers. Both the cilium & flgellum emerge from centriole like structure called the basal body or blepheroplast.

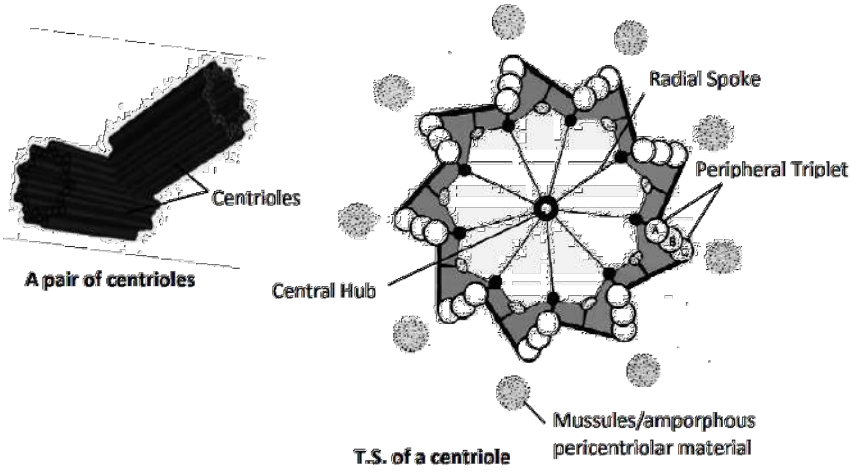


Diagrammatic representation of internal structure of Cilia or Flagella

	Cilia		Flagella
1.	The cilia are small in size (5–10μm)	**1.**	Flagella are long (up to 150 μm)
2.	Number of cilia per cell is very large.	**2.**	Few in number
3.	Cilia beat in a coordinated manner (Pendular movement) / oar like movement	**3.**	Flagella beats independently (Undulating movement)
4.	They take part in locomotion, attachment, feeding and sensation.	**4.**	Flagella involved only in locomotion

Centrosome and Centrioles :

- **Structure :**
  - Centrosome is absent in higher plants.
  - Centrosome containing two centrioles located just outside the nucleus and lie at right angle (90°) to each other. Each centriole is surrounded by amorphous pericentriolar materials.
  - Centrioles are membrane less cylindrical structure which exhibit cart wheel structure in transverse section.
  - Centriole consist of 9 evenly spaced peripheral triplet fibrils of tubulin. These triplets are linked with the help of A-C linker.
  - The central part of the centriole is proteinaceous and called the hub, which is connected with peripheral triplets by radial spokes made of protein. (9 + 0 arrangement)
  - Centrioles are self-duplicating units.



- **Function :**
  - In animal cells, centrioles play important role in cell division by arranging spindle fibres between two poles of cell. The location of centrioles during cell division decides the plane of division. The plane of division is always at right angle to the spindle.
  - Centrioles form the basal body of cilia or flagella.

Microbodies

- Many membrane bound minute vesicles called microbodies that contain various enzymes are present in both plant and animal cells.

Golden Key Points

- Cilia and flagella both have 9 + 2 arrangement of microtubules.
- Arrangement of microtubules in centriole is 9 + 0.
- Ribosomes are composed of ribonucleic acid (RNA) and proteins and are not surrounded by any membrane.
- Ribosomes are composed of two sub units and magnesium ion is essential for the binding of ribosomal sub units.
- Several ribosomes attached to a single mRNA, form polysome.

Concept Builder

1. Which of the following is correct regarding the structure of a section of cilia / flagella?

	Peripheral microtubules (doublets)	Central microtubules (singlets)	Radial spokes
(1)	9	2	8
(2)	2	9	9
(3)	9	2	9
(4)	3	6	9

2. Which of the following statements is incorrect for centrioles?

(1) Both the centrioles in a centrosome lie perpendicular to each other.

(2) Central proteinaceous hub is missing in a centriole.

(3) Each centriole has an organization like that of a cartwheel.

(4) Centrosome usually contains 2 cylindrical centrioles.

3. Which of the following options is correct about structures visible in the cross section of a centriole?

	Peripheral microtubules (triplets)	Central microtubules (singlets)	Hub	Spoke	Inter triplet bridge
(1)	9	2	1	9	9
(2)	9	2	9	9	9
(3)	9	2	1	2	2
(4)	9	0	1	9	9

4. Arrangement of microtubules in a flagellum and a centriole is respectively :-

(1) 9 + 2 and 9 + 1 (2) 9 + 1 and 9 + 0

(3) 9 + 0 and 9 + 2 (4) 9 + 2 and 9 + 0

5. Find out the incorrect statement with respect to glyoxysomes.

(1) It is reported from the endosperm of germinating seeds.

(2) They usually occur in fat rich plant cells.

(3) They are associated with glyoxylate cycle.

(4) They develop from mitochondria.

6. A component of cyto skeleton is :-

(1) Microtubule (2) Bone

(3) Chitin (4) Cartilage

7. Which enzyme performs detoxification of hydrogen peroxide in peroxisome :-

(1) Urate acid oxidase (2) Succinate dehydrogenase

(3) Catalase (4) Ascorbic acid synthetase

8. 70s type of ribosomes are found in :-

(1) Prokaryotic cells only (2) Prokaryotic cells, chloroplasts and mitochondria

(3) Mitochondria only (4) Nucleus, mitochondria

9. The two sub-units of ribosome remain united at a critical ion level of :-

(1) Magnesium (2) Calcium (3) Copper (4) Manganese

Concept Builder (Answer-Key)									
Que.	1	2	3	4	5	6	7	8	9
Ans.	3	2	4	4	4	1	3	2	1

Nucleus :

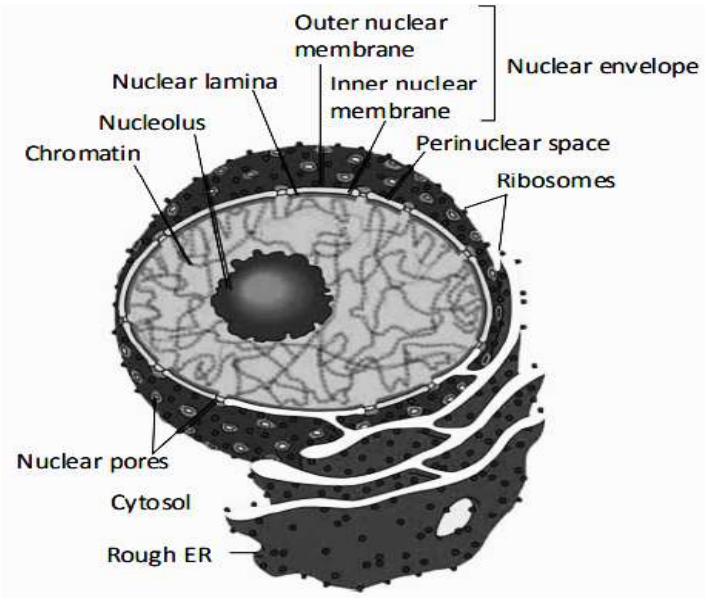
- Nucleus as a cell organelle was first described by Robert Brown as early as 1831. Later the material of the nucleus stained by the basic dyes (Acetocarmine) was given the name chromatin by Flemming.
- "Nucleus is double membrane bound dense protoplasmic body, which controls all cellular metabolism and encloses the genetic information of cell".
- Generally eukaryotic cell contain at least one nucleus but nucleus is absent in mature sieve tube cells of vascular plants and mature erythrocytes of many mammals.
- Dikaryotic *(Paramoecium)* and multikaryotic cells (Phycomycetes fungus) are also known.

➢ **Structure of Interphase Nucleus :**

- Interphase Nucleus : Nucleus of cell when it is not dividing.

(i) Nuclear envelope.

(ii) Nucleoplasm/Nuclear matrix/Karyolymph/Karyoplasm.



(i) Nuclear Envelope :-

- Electron microscopy has revealed that the nuclear envelope, which consists of two parallel membranes with a space between (10 to 50 nm) called the perinuclear space. This envelope forms a barrier between the materials present inside the nucleus and that of the cytoplasm.
- The outer membrane usually remains continuous with the endoplasmic reticulum and also bears ribosomes on it.
- At a number of places the nuclear envelope is interrupted by minute pores, which are formed by the fusion of its two membranes. These nuclear pores are the passages through which movement of RNA and protein molecules takes place in both directions between the nucleus and the cytoplasm.
- The nuclear pore, is guarded by a octagonal discoid structure of nucleoplasmin protein.
- The inner side of inner nuclear membrane is lined by nuclear lamina. This structure is formed by filaments of lamin protein.

(ii) Nucleoplasm :-

- Nucleoplasm is a ground substance of nucleus, which is a complex colloidal formed of a number of chemicals like nucleotides, nucleosides, ATPs, proteins & enzymes.
- Nucleoplasm contains Chromatin net and nucleolus.

  (a) Chromatin Net :- (Term given by Flemming)

  - Interphase nucleus has a loose and indistinct network of nucleoprotein fibers called chromatin, which embeded in nucleoplasm. Chromatin is mainly formed of DNA and histone protein complexes.
  - Chromatin fibres contain genetic information and condense to form chromosomes during cell division.
  - During different stages of cell division cells show structured chromosomes in place of nucleus.
  - Chemically chromatin consists of DNA, RNA, Histone protein (basic proteins, rich in arginine and lysin) and non histone proteins.
  - Chromatin net has two type of chromatins :-

    (i) Euchromatin :- This is lightly stained and diffused part of chromatin. Which is transcriptionally or genetically more active.

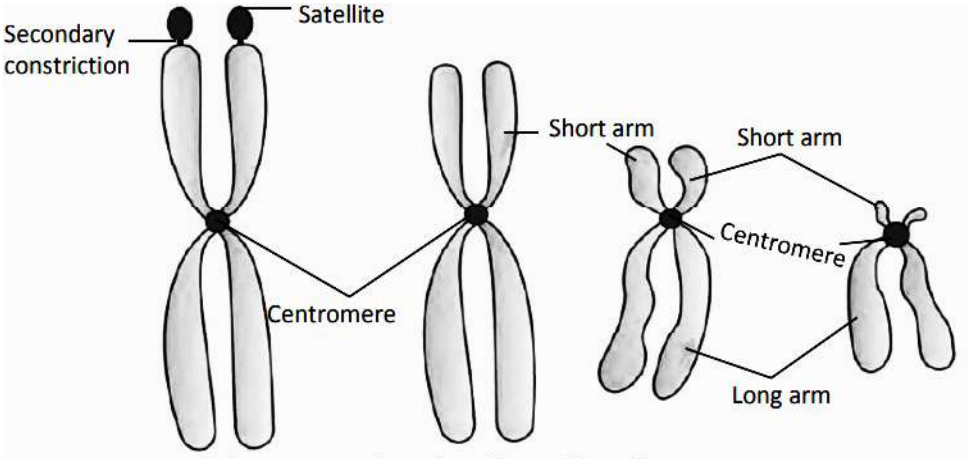
    (ii) Heterochromatin :- This is dark stained, thick and condensed part of chromatin. Heterochromatin is genetically less active or inactive chromatin.

(b) Nucleolus :-

- The nucleolus is spherical and membrane less structure so that the content of nucleolus is continuous with the rest of the nucleoplasm.
- It is a site for active ribosomal RNA (r-RNA) synthesis.
- Nucleolus usually attached to chromatin or chromosomes at specific site called Nucleolar organiser region/NOR.
- Nucleolus is called Ribosome factory of cell.
- Larger and more numerous nucleoli are present in cells actively carrying out protein synthesis.

Chromosomes :

- At the time of cell division the chromatin material get condensed to form chromosomes, thus chromosome is highly condensed form of the chromatin. Chromosomes are not visible during interphase stage but during different stages of cell division, cells show structured chromosomes in place of the nucleus.
- Chromosomes can be best studied at metaphase stage because due to high condensation of chromatin, chromosomes become more clear during this phase.
- The number of chromosomes in a gamete is called "Genome" or ‘‘A complete set (n) of chromosomes inherited as a unit from one parent is known as genome.
- A single human cell has approximately two metre long thread of DNA distributed among its 46 (23 pairs) chromosomes.
  - **Types of Chromosomes (On The Basis of Position of Centromere) :**
    - **(i) Telocentric :-** When centromere is terminal or located at the tip of chromosome.
    - **(ii) Acrocentric :-** When the centromere is sub-terminal or close to chromosome's end
    - **(iii) Metacentric :-** When the centromere is located at mid of the chromosome.
    - **(iv) Sub Metacentric :-** When the centromere located slightly away from the middle of the chromosome.
- The ratio of length of the long arm(q) to the short arm(p) of a chromosome is called arm ratio. Arm ratio is maximum in acrocentric chromosome.

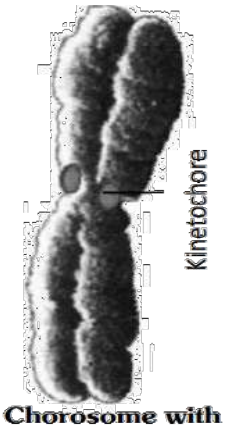


Types of chromosomes based on the position of centromere

- **Structure of Chromosome :**

(i) Chromatid :– At metaphase stage each chromosome is consist of two cylindrical structures called chromatids. Both sister chromatids are joined together by a common centromere. A chromosome, may have single chromatid (in Anaphase or Telophase) or two chromatids (as in prophase and metaphase)

- Each chromatid is consist of DNA associated with histone. Non histone proteins and RNA are also present.



Chorosome with kinetochore

(ii) Centromere :-

- Each chromosome (in prophase or metaphase) is consist of two chromatids. Both the chromatids of a chromosome are joined or connected by a structure called Centromere. At centromere two protein discs are present which are called Kinetochores.
- Kinetochores constitute the actual site of attachment of spindles to chromosomes during cell division.
- At the region of centromere the chromosome is comparatively narrower than remaining part of chromosome thus it is termed as Primary constriction.

(iii) Secondary Constriction : Besides primary constrictions, other constrictions may also occur on some chromosomes, which are known as secondary constrictions. These constrictions are non staining and found at a constant location.

- Secondary constriction is also known as NOR (Nucleolar organizer region). In humans NOR is found in chromosome number 13,14,15,21,22.

(iv) Satellite : Part of chromosome remains after the NOR is known as satellite.

(v) Telomere : Chromosomes have polarity and polar ends of chromosomes are known as Telomeres.

- Telomere prevents fusion or sticking of one chromosome to other chromosome. Telomeres are rich in Guanine base. (5' -TTAGGG-3')

Golden Key Points

- Chromatin fibre represents de-condensed chromosomes, which become condensed at the time of cell division to form chromosome.
- SAT chromosomes have a secondary constriction and the part of chromosome beyond that is known as satellite.
- Larger and more numerous nucleoli are present in cells actively carrying out protein synthesis.

Concept Builder

1. Nucleolar organizer is a :-

(1) Primary constriction (2) Secondary constriction

(3) Tertiary constriction (4) Centriole

2. Nucleus is :-

(1) Single layered structure (2) Three layered structure

(3) Four layered structure (4) Two layered structure

3. Part of chromosome after secondary constriction is called :–

(1) Centriole (2) Telomere (3) Satellite (4) Nucleolar organizer

4. Who is the controller of cell ?

(1) Mitochondria (2) Nucleus (3) Golgi bodies (4) Endoplasmic reticulum

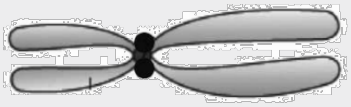
5. Chromosome with centromere at one End :-

(1) Metacentric (2) Submetacentric (3) Telocentric (4) Acrocentric

6. Part of Chromosome which joins with spindle fibres is -

(1) Chromatid (2) Telomere (3) Satellite (4) Centromere

7. Which of the following is correct regarding the given figure?



	Number of centromere	Number of kinetochore	Number of arms
(1)	2	1	4
(2)	1	2	4
(3)	2	4	2
(4)	1	2	2

Concept Builder (Answer-Key)							
Que.	1	2	3	4	5	6	7
Ans.	2	4	3	2	3	4	2

Exercise - I

Cell Wall, Cell Membrane

1. The model given by Singer and Nicolson in _____ was _____ for plasma membrane.
(1) 1982, fluid mosaic model
(2) 1992, bilayer model
(3) 1972, fluid mosaic model
(4) 1952, bilayer model

2. Plasma membrane is:
(1) Semipermeable and symmetric
(2) Selectively permeable, elastic and asymmetric
(3) Permeable and asymmetric
(4) Selective permeable with monolayer phospholipids

3. Select the correct combination of the statements regarding the characteristics of middle lamella:
a. It holds the different neighbouring cells together.
b. It is composed of Mg pectate only.
c. It gets dissolved during ripening of fruits.
(1) a and c (2) b and c
(3) Only a (4) a, b and c

4. Muramic acid (Petidoglycans) is present in cell walls of:
(1) Bacteria (2) Algae
(3) *Yeast* (4) Plants

5. Cell membrane is composed of:
(1) Proteins and cellulose
(2) Proteins and phospholipids
(3) Proteins and carbohydrates
(4) Proteins, phospholipids and some carbohydrates (Oligosaccharides)

6. Which of the following statements is incorrect about the plasma membrane ?
(1) The ratio of proteins and lipids varies considerably in different cell types
(2) 52% proteins are present in the membrane of humans RBCs
(3) The arrangement of protein (P) and lipids (L) is L-P-P-L.
(4) The head of lipid (fatty acid) is hydrophilic (Polar)

7. Carbohydrates are present in the plasmalemma in the form of:
(1) Hemicellulose
(2) Cellulose
(3) Starch
(4) Glycoprotein or Glycolipids

8. Synthesis of cell wall material takes place in:
(1) Dictyosome (GB) (2) Mitochondria
(3) Lysosome (4) E.R.

9. According to fluid mosaic model (proposed by Singer & Nicolson) plasma membrane is composed of:
(1) Cellulose, hemicellulose
(2) Phospholipids and integrated proteins
(3) Phospholipids, extrinsic proteins, intrinsic proteins
(4) Phospholipids and hemicellulose

10. Carbohydrates which present in the cell membrane take part in:
(1) Transport of substance
(2) Cell recognition
(3) Attachment to microfilament
(4) Attachment to microtubules

11. Plasma membrane is fluid structure due to presence of:

(1) Carbohydrates (2) Lipids

(3) Glycoproteins (4) Polysaccharides

12 The most abundant lipid in cell membrane is:

(1) Cutin

(2) Cholesterol

(3) Steroid

(4) Phospholipids (Phosphoglycerides)

13. The chemical substance abundantly present in middle lamella is:

(1) Cutin (2) Chitin

(3) Lignin (4) Ca-pectate

14. Which of following boundary is capable of growth, which gradually diminishes as the cell matures ?

(1) Primary cell wall

(2) Secondary cell wall

(3) Middle lamella

(4) Cell membrane

15. The fluid nature of the membrane indicates function of:

(1) Cell growth (2) Cell division

(3) Endocytosis (4) All the above

16. Amphipathic molecule in plasma membrane is:

(1) Protein (2) Carbohydrates

(3) Phospholipids (4) All the above

17. Unit membrane model of plasmamembrane was proposed by:

(1) Robertson (2) Singer

(3) Danielli (4) Robert Hook

18. Ingestion of solid food by plasma membranes is called:

(1) Endosmosis (2) Pinocytosis

(3) Cytokinesis (4) Phagocytosis

19. Ingestion of large molecules by animal cell is called:

(1) Diffusion (2) Osmosis

(3) Exocytosis (4) Endocytosis

20. Plasma membrane exhibits for external substances:

(1) Impermeability

(2) Semi permeability

(3) Permeability

(4) Selective permeability

21. In fluid mosaic model of plasma membrane:

(1) Upper layer is non-polar and hydrophilic

(2) Polar layer is hydrophobic

(3) Phospholipids form a bimolecular layer in middle part

(4) Proteins form a middle layer

22. According to widely accepted "fluid mosaic model" cell membranes are semi–fluid, where lipids and integral proteins can diffuse randomly. In recent years, this model has been modified in several respects. In this regard, which of the following statements is incorrect:

(1) Proteins can also undergo flip–flop movements in the lipid bilayer.

(2) Many proteins remain completely embeded within the lipid bilayer.

(3) Proteins in cell membranes can travel within the lipid bilayer.

(4) Proteins can remain confined within certain domains of the membranes.

Cytoplasm - Mitochondria, Golgi Complex, Lysosome, E.R.

23. Which type of vacuoles provide buoyancy to bacteria ?
(1) Sap vacuoles
(2) Contractile vacuoles
(3) Gas vacuoles
(4) Food vacuoles

24. A cell organelle 'X' is divided into two types on the basis of a cell organelle 'Y', that helps in the protein synthesis. Identify 'X' and 'Y' respectively:
(1) Golgi complex and ribosome
(2) ER and mitochondria
(3) ER and ribosomes
(4) Lysosome and ER

25. A number of proteins synthesised by ribosomes present on the ER are transferred to:
(1) Vacuoles (2) Lysosome
(3) Plastids (4) Golgi apparatus

26. Which of the following cell organelles is involved in the synthesis of the cell organelle that contains hydrolytic enzymes ?
(1) Mitochondrian
(2) Golgi apparatus
(3) Plastids
(4) Nucleus

27. Which of the following stain is used to observe mitochondria ?
(1) Methylene blue (2) Safranin
(3) Janus green-B (4) Gram stain

28. In plants, the tonoplast facilitates the transport of a number of ions and other materials:
(1) Against concentration gradient into sap vacuole
(2) Along concentration gradient into vacuole
(3) Along concentration gradient into gas vacuoles
(4) Against concentration gradient in contractile vacuole

29. Maximum enzymes are found in:
(1) Lysosomes (2) Mitochondria
(3) Nucleus (4) E.R.

30. Rough E.R. mainly responsible for:
(1) Protein synthesis
(2) Cell wall formation
(3) Steroid hormones synthesis
(4) Cholesterol synthesis

31. Besides producing secretory vesicles, the function of golgibody is:
(1) Lysosome formation
(2) Formation of spindle fibers
(3) Formation of E.R.
(4) ATP synthesis

32. Enzymes for ETS occur in (mitochondria):
(1) Matrix
(2) Outer wall
(3) Inner membrane
(4) Between inner & outer Membrane

33. Which cell organelle secretes zymogen granules ?
(1) Lysosomes (2) Golgibody
(3) Smooth E. R. (4) Sphaerosomes

34. Golgibody originates from:
(1) E. R. (2) Mitochondria
(3) Nucleus (4) Proplastid

35. Digestion of hormonal vesicle by lysosome is called:
(1) Crinophagy (2) Heterophagy
(3) Autophagy (4) Autolysis

36. Which of the following provides mechanical support and shape to the cell ?
(1) Golgi complex (2) Centrioles
(3) Lomasomes (4) E.R.

37. What would happen if lysosomes get ruptured inside the cells, in which they are present ?
(1) Cells will swell (2) Cells will die
(3) Cells will shrink (4) Nothing would

38. Power house of cell is:
(1) Nucleus (2) DNA
(3) Mitochondria (4) ATP

39. $F_0 - F_1$ particles of mitochondria are:
(1) Oxysomes (2) Ribosomes
(3) Desmotubules (4) Lysosomes

40. Where does TCA cycle (Kreb`s cycle) takes place ?
(1) Cytoplasm
(2) Inner membrane of mitochondria
(3) Outer membrane of mitochondria
(4) Mitochondrial matrix

41. Hydrolytic enzymes are abundantly found in which cell organelles:
(1) Ribosome
(2) Lysosome
(3) Oxysome
(4) Endoplasmic reticulum

42. Which of the following sets of cell organelles contain DNA ?
(1) Mitochondria, cell membrane
(2) Plasma membrane, ribosome
(3) Mitochondria, chloroplast
(4) Chloroplast, dictyosome

43. Golgibody is absent in:
(1) Prokaryotes
(2) Mature mammalian R.B.C.
(3) Viruses
(4) All the above

44. Which cell organelles release oxygen ?
(1) Mitochondria (2) Golgi–body
(3) Chloroplast (4) Ribosome

45. Most abundant lysosomes are found in
(1) Bacteria (2) RBCs
(3) Phagocytic cell (4) *Amoeba*

46. Cells which are involved in bone resorption, are
(1) Osteoblasts (2) Fibroblasts
(3) Osteoclasts (4) Condrioblasts

47. Chemical modification of substance like glycosidation of lipid and glycosylation of protein mainly occur in:
(1) Endoplasmic reticulum
(2) Golgi apparatus
(3) Lysosome
(4) Ribosome

48. Most of the cell–organelles are derived from which structure of cell:
(1) Nucleus
(2) Endoplasmic reticulum
(3) Mitochondria
(4) Chloroplast

49. Which of the following is known as ***"System of membrane"*** ?

(1) Lysosome (2) E.R.

(3) Mitochondria (4) Chloroplast

50. Oxysome of mitochondria are concerned with:

(1) Photophosphorylation

(2) Oxidative phosphorylation

(3) Photorespiration

(4) Photolysis

51. Ribophorin–I and II occur on the surface of:

(1) Rough E.R. (2) Smooth E.R.

(3) Golgi body (4) None

52. The golgi components are bound by:

(1) Single unit membrane

(2) Double unit membrane

(3) Cisternae by single, tubules and vesicles by double unit membranes

(4) Cisternae and tubules by single and vacuole by double unit membranes

53. During spermatogenesis golgi is thought to be responsible for the formation of:

(1) Tail (2) Middle piece

(3) Head (4) Acrosome

54. At which pH lysosomal enzymes remain active:

(1) pH – 5 (2) pH – 7

(3) pH – 8 (4) pH – 10

55. Synthesis of hemicellulose takes place in:

(1) Micro bodies (2) Smooth E.R.

(3) Golgi complex (4) Lysosome

56. The cell organelles having abundance of oxidizing enzymes is:

(1) Golgi body

(2) Endoplasmic reticulum

(3) Centrioles

(4) Mitochondria

57. In which part of mitochondria the enzyme succinic dehydrogenase is present:

(1) Outer membrane

(2) Inner membrane

(3) Matrix

(4) Perimitochondrial space

58. ATP ase activity occur in:

(1) Head of F_1–particle

(2) Stalk of F_1–particle

(3) Base of F1–particle

(4) F_0 Part of oxysome

59. The nuclear membrane originate from:

(1) E.R. (2) Golgi cisternae

(3) Golgi vesicle (4) Lysosome

60. T - tubules of muscles are modification of:

(1) E. R. (2) Golgibody

(3) Microtubules (4) Microfilaments

61. RER is well developed in cell engaged in the synthesis of:

(1) Steroids (2) Fats

(3) Vitamin (4) Proteins

62. The endomembrane system does not include:

(1) Mitochondria (2) ER

(3) Lysosomes (4) Vacuoles

63. Fat metabolism takes place in:
(1) Nucleus
(2) Chloroplast
(3) Mitochondria
(4) Glogi bodies

64. Which cell organelles takes part in the formation of lysosomes ?
(1) Endoplasmic reticulum
(2) Golgi bodies
(3) Both 1and 2
(4) Nucleus

65. Mitochondrial matrix possesses:
(1) Enzymes of Krebs cycle and protein synthesis
(2) Formation of Leucocytes
(3) Enzyme of Calvin cycle
(4) None of these

66. Suicide bags of cells are:
(1) Endoplasmic reticulum
(2) Lysosome
(3) Golgi bodies
(4) Vacuoles

67. Cellular furnaces of cells are:
(1) Chloroplast
(2) Mitochondria
(3) Ribosome
(4) Nucleus

68. Cristae are found in:
(1) ER (2) GB
(3) Mitochondria (4) Chloroplast

69. A single unit membrane organelle is:
(1) Ribosomes (2) Mitochondria
(3) Chloroplast (4) Lysosomes

70. Cisterne is found in:
(1) Only mitochondria
(2) Only Endoplasmic Reticulum
(3) Endoplasmic Reticulum and Golgi body
(4) Only Golgi body

71. True Statement about Mitochondria is:
(1) Change in shape and size possible and division also occurs
(2) Do not change shape but division occurs
(3) Do not change shape and size and division not occurs
(4) Change shape but division does not occur

72. The main organelle involved in modification and routing of newly synthesized proteins to their destinations is:
(1) Endoplasmic Reticulum
(2) Lysosome
(3) Mitochondria
(4) Chloroplast

73. Chlorophyll in chloroplasts is located in:
(1) Grana
(2) Pyrenoid
(3) Stroma
(4) Both grana and stroma

74. Detoxification of lipid soluble drugs and other harmful compounds, in endoplasmic reticulum is carried out by:
(1) Cytochrome P450
(2) Cytochrome b_f
(3) Cytochrome c
(4) Cytochrome a-a_3

Plastids, Cilia, Flagella, Centrioles [Centrosome], Ribosome, Microbodies, Microtubules and Microfilaments

75. Which is **correct** option amongst the following statements ?

a. Nuclear membrane, chloroplast, mitochondria, microtubules are absent in prokaryotic cells.

b. Nuclear membrane, chloroplast, mitochondria, microtubules and pili are present in eukaryotic cells.

c. Ribosomes are 70S in prokaryotic cells chloroplast and mitochondria. They are 80S in animal cells.

(1) a and b are wrong, c is correct

(2) a is correct, b and c are wrong

(3) a and b are correct, c is wrong

(4) a and c are correct, b is wrong

76. Which of the following cell organelles is non-membrane bound and found in both prokaryotes and eukaryotes?

(1) Lysosomes (2) Ribosomes

(3) Centrioles (4) Mitochondria

77. Thylakoids are present in:

(1) Aleuroplast (2) Elaioplast

(3) Chloroplast (4) Amyloplast

78. Which of the following statement is incorrect w.r.t. ribosomes ?

(1) Type of ribosomes of prokaryotes is 70S

(2) Discovered by George Palade

(3) Made up of RNA only

(4) Also known as protein factories

79. Microbodies are:

(1) Membrane bound minute vesicles

(2) Non-membrane bound organelles

(3) Present only in animals

(4) Present only in plants

80. Mark the **mis-matched** pair:

(1) Peroxisome - Catalase

(2) Ribosome - Palade particles

(3) Microbodies - Bacteria

(4) Massule – Centrioles

81. Organelle lacking DNA, but capable of duplication is:

(1) Mitochondrion (2) Centriole

(3) Chloroplast (4) Nucleus

82. Larger subunit of ribosome is dome shaped and attached to ER by:

(1) Ribophorins (SRP)

(2) Amino acid

(3) Ca^{+2}

(4) Hydrogen bonds

83. Mitochondria and chloroplast are considered to be endosymbionts of cell because they:

(1) Possess their own nucleic acid

(2) Have capacity of ATP synthesis

(3) Do not reproduce

(4) All the above

84. Which one of the following statements is not correct ?

(1) Magnesium associates Ribosome units

(2) Cytochrome P-450 is found in Golgi complex

(3) Chloroplasts are semi autonomous organelle

(4) Nuclear envelope reappear in telophase stage

85. Factory for synthesis of sugars in autotrophic eukaryotes is:
(1) Mitochondria
(2) Ribosome
(3) Chloroplast
(4) Endoplasmic reticulum

86. Plastids which store fats and oils are called:
(1) Aleuroplast (2) Amyloplast
(3) Etioplast (4) Elaioplast

87. "Palade particles" are:
(1) Ribosomes (2) Golgi vesicles
(3) Lysosomes (4) Sphaerosomes

88. Ribosomes are centre of:
(1) Lipid synthesis
(2) Carbohydrate synthesis
(3) Protein synthesis
(4) All the above

89. Red colour of tomato and chilly is due to:
(1) Lycopene in chloroplast
(2) Xanthophylls in chromoplast
(3) Lycopene in chromoplast
(4) Anthocyanin in leucoplast

90. Polysome structure is related to:
(1) GB (2) Phagosomes
(3) ER (4) Ribosomes

91. Which of the cilia protein is analogous to myosin of muscles?
(1) Tubulin
(2) Dynein
(3) Flagellin
(4) None of the above

92. Function of centrosome is:
(1) Initiation of cell division
(2) Inhibition of cell division
(3) Termination of cell division
(4) Cytokinesis

93. Rhizoplasts or rootlets are part of:
(1) Centriole (2) Root hairs
(3) Ciliary apparatus (4) Spindle

94. Arrangement of microtubules in centriole is:
(1) 9 + 2 (2) 2 + 9
(3) 11 + 0 (4) 9 + 0

95. How many longitudinal peripheral triplets found in a centriole:
(1) 2 (2) 9
(3) 5 (4) 7

96. Non pigmented part of chloroplast is called:
(1) Thylakoids (2) Grana
(3) Stroma (4) Lamellae

97. Which of following is not common in chloroplasts & mitochondria?
(1) Both are present in animal cells
(2) Both contain their own genetic material
(3) Both are present in eukaryotic cells
(4) Both are present in plant cells

98. 70s type of ribosomes found in:
(1) Prokaryotic cells
(2) Prokaryotic cells, chloroplasts and mitochondria
(3) Mitochondria
(4) Nucleus, mitochondria

99. Cilia and flagella arise from:

(1) Basal bodies

(2) Basal granule

(3) Blepharoplast

(4) All of the above

100. Mitoplast is:

(1) Outer membrane less chloroplast

(2) Outer membrane less mitochondria

(3) Granum less chloroplast

(4) Well developed nucleus

101. Cell organelle which called cell engine is:

(1) Ribosome

(2) Lysosome

(3) Vacuoles

(4) Endoplasmic reticulum

102. Functional unit of Chloroplast is:

(1) Stroma

(2) Quantasome

(3) Oxysomes

(4) Peroxysomes

103. Cilia and flagella both have:

(1) 9 + 2 arrangement of microtubules

(2) Protective structure of cells

(3) Only present in protozoans

(4) Only outgrowth structure of cytoplasm

104. Which of the following lacks the unit membrane?

(1) Nucleus & E.R.

(2) Mitochondria & chloroplast

(3) Ribosome & nucleolus

(4) Golgi body & lysosome

105. Three of the following statements regarding cell organelles are correct while one is wrong. Which one is wrong?

(1) Lysosmes are double membraned vesicles budded off form golgi apparatus and contain digestive enzymes.

(2) Endoplasmic reticulum consists of a network of membranous tubules and helps in transport, synthesis and secretion.

(3) Leucoplasts are bound by two membranes lack pigment but contain their own DNA and protein synthesizing machinery.

(4) Spharosomes are single membrane bound and are associated with synthesis and storage of lipids.

106. In photorespiration, the cell organelles involved are:

(1) Chloroplast and mitochondrion

(2) Chloroplast only

(3) Chloroplast, mitochondrion and ribosome

(4) Chloroplast, mitochondrion and peroxisome

107. Which of the following is NOT a membrane bound organalle?

(1) Lysosome

(2) Ribosome

(3) Chloroplast

(4) Mitochondrion

Nucleus and Chromosome

108. Diagrammatic representation of karyotyes of a species is called:

(1) Cladogram

(2) Dendogram

(3) Idiogram

(4) Electrocardiogram

109. Nucleolus is formed in:

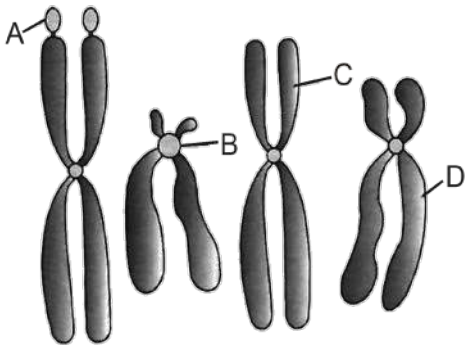
(1) Primary constriction

(2) Nucleolar organiser region

(3) Endoplasmic reticulum

(4) Ribosomes

110. Find out the correct option on the basis of following diagrams:



(1) A – Satellite, B – Secondary constriction, C – Short arm, D – Long arm

(2) A – Satellite, B – Centromere, C – Short arm, D – Long arm

(3) A – Secondary constriction, B – Satellite, C – Long arm, D – Short arm

(4) A – NOR, B – Secondary constriction, C – Short arm, D – Long arm

111. Nucleolar organizer is a:

(1) Primary constriction

(2) Secondary constriction

(3) Tertiary constriction

(4) Centriole

112. Nucleolus in Eukaryotic cell is:

(1) Absent

(2) Visible at Metaphase

(3) Bounded by a membrane

(4) The site of packaging of r-RNA with proteins

113. Which part of chromosome is concern with ageing of organism and cancer?

(1) Centromere (2) Telomere

(3) Kinetochore (4) Satellite

114. The non–sticky chromosomal ends are known as:

(1) Chromatids (2) Centromere

(3) Chromomere (4) Telomere

115. Highest arm ratio occur in which chromosome:

(1) Telocentric (2) Metacentric

(3) Submetacentric (4) Acrocentric

116. Which chromosome does not provide attachment site for spindle fibers ?

(1) Acrocentric (2) Metacentric

(3) Submeta centric (4) Acentric

117. Lampbrush chromosomes of vertebrate animals are found in:

(1) Only somatic cells

(2) Only oocytes

(3) All the cells

(4) Only spermatocytes

118. The chromatin material which takes darker stain in interphase is called:

(1) Euchromatin

(2) Heterochromatin

(3) Primary constriction

(4) Satellite body

119. Part of chromosome after secondary constriction is called:
(1) Chromomere
(2) Telomere
(3) Satellite
(4) Nucleolar organiser

120. If the centromere is sub–median, the two arms are unequal then the chromosome is called as:
(1) Metacentric
(2) Submetacentric
(3) Acrocentric
(4) Telocentric

121. Which of the following occurs more than one and less than five in a chromosome:
(1) Chromatid (2) Chromomere
(3) Centromere (4) Telomere

122. Histones are synthesized in:
(1) Cytoplasm
(2) Nucleoplasm
(3) Nuclear membrane
(4) Nucleolus

123. The telomeres of eukaryotic chromosomes consist of short sequences of:
(1) Cytosine rich repeats (TC-rich)
(2) Adenine rich repeats (AT-rich)
(3) Guanine rich repeats (GC-rich)
(4) Thymine rich repeats (TG-rich)

124. Protein synthesis in an animal cell occurs:
(1) On ribosomes present in cytoplasm as well as in mitochondria
(2) On ribosomes present in the nucleolus as well as in cytoplasm
(3) Only on ribosomes attached to the nuclear envelope and endoplasmic reticulum
(4) Only on the ribosomes present in cytosol

125. Telomerase is an enzyme which is a:
(1) RNA
(2) Ribonucleoprotein
(3) Repetitive DNA
(4) Simple protein

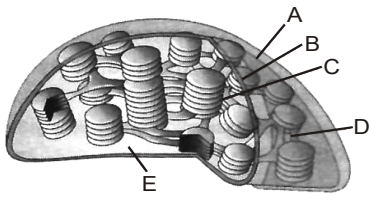
126. If you fractionate all the organelles from the cytoplasm of a plant cell, in which one the following sets of fractions will find nucleic acids?
(1) Nucleus, Mitochondria, Chloroplast, Cytoplasm
(2) Nucleus, Mitochondria, Chloroplast, Glyoxysome
(3) Nucleus, Chloroplast, Cytoplasm, Peroxisome
(4) Nucleus, Mitochondria, Chloroplast, Golgi bodi

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	3	2	1	1	4	3	4	1	3	2	2	4	4	1	4	3	1	4	4	4	3	1	3	3	4
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Ans.	2	3	1	2	1	1	3	2	1	1	4	2	3	1	4	2	3	4	3	3	3	2	2	2	2
Que.	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	1	1	4	1	3	4	2	1	1	1	4	1	3	3	1	2	2	3	4	3	1	1	1	1	4
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	2	3	3	1	3	2	1	1	2	3	4	1	3	3	4	2	1	3	4	2	3	1	2	4	2
Que.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Ans.	1	2	1	3	1	4	2	3	2	2	2	4	2	4	4	4	2	2	3	2	4	1	3	1	2
Que.	126																								
Ans.	1																								

Exercise - II

1. Consider the following five statements (A to E) w.r.t. chloroplast shown below. Select the correct option stating which ones are True (T) and which ones are False (F).



A. It is impermeable and lacks porins.
B. It is selectively permeable, having carrier proteins for transport.
C. Stacked thylakoids one over other, which is the site of production of assimilatory power.
D. Present between two grana and contains enzymes of dark reaction.
E. It contains enzymes for the synthesis of sugar and proteins.

	A	**B**	**C**	**D**	**E**
(1)	F	T	T	T	T
(2)	F	T	T	F	T
(3)	T	F	T	T	T
(4)	T	F	F	T	T

2. Consider the following statements and choose the **incorrect** option:

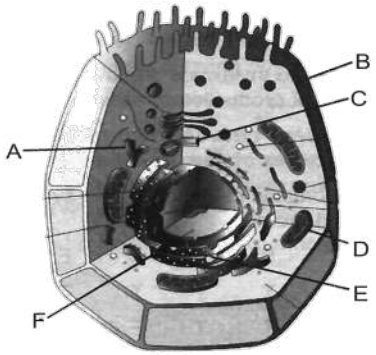
a. Large and more numerous nucleoli are present in cells actively carrying out protein synthesis.
b. Nuclear pores allow bidirectional movement of molecules
c. Cytoskleton is a glycolipid structure for mechanical support, motility and maintenance of the shape of the cell
d. Steroidal hormones are synthesized by Cell membrane

(1) a and b (2) b and c
(3) c and d (4) a and d

3. Which of the following statement is **incorrect** about golgi apparatus ?

(1) It helps in recycling of the plasma membrane pinched off by pinocytosis and phagocytosis
(2) Packaging and secretion is the main function of the golgi complex
(3) It helps in glycosidation and glycosylation of lipids and proteins
(4) Golgi body helps in animal cytokinesis

4. Identify the correct statements w.r.t. the given cell:



A. Concerned with lipid and steroid hormone synthesis.
B. Outer non-living rigid structure which gives shape to the cell and protects from mechanical damage and infection.
C. Both lie perpendicular to each other and each has an organisation like the cart wheel.
D. Responsible for trapping light energy for the synthesis of sugar.
E. Present in cells actively involved in protein synthesis of sugar.
F. Spherical structures, rich in hydrolytic enzymes.

(1) A, D and E (2) B, C and D
(3) A, C and E (4) A, B, C and E

5. .....Was a German scientist, who observed that all plant tissues are made up of cells. At the same time....., British scientist studied different type of animal cells. Though he was able to observe the nuclei, but he could not locate the cell wall, he examined and realised that cell wall forms a unique character of plants.

(1) Rudolf Virchow and Nageli respectively

(2) Mathias Schleiden and Theodore Schwann respectively

(3) Theodore Schwann and Mathias Schleiden respectively

(4) Robert Hooke and Purkinje respectively

6. Who proposed "cell lineage theory" by stating that *"Omnis cellula e cellula"* ?

(1) Karl Nageli

(2) Rudolf Virchow

(3) Schwann

(4) Anton Von Leeuwenhoek

7. Depending upon the....., membrane proteins can be classified as integral or peripheral:

(1) Size

(2) Sedimentation rate

(3) Ease of extraction

(4) Molecular weight

8. .....can not pass through the lipid bilayer, they require a carrier protein of the membrane to facilitate their transport across the membrane:

(1) Nonpolar molecules

(2) Polar molecules

(3) Hydrophobic molecules

(4) Both (2) and (3)

9. The fluid nature of the membrane is also important from the point of view of functions like:

(i) Cell growth

(ii) Formation of intercellular junctions

(iii) Secretions

(iv) Endocytosis

(v) Cell division

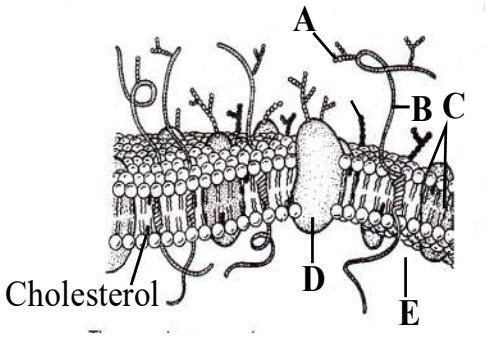
(1) i, iii, iv

(2) ii, iii, v

(3) i, iii, iv, v

(4) i, ii, iii, iv, v

10. Identify the components labelled A, B, C, D and E in the diagram (cell membrane) below from the list (i) to (vii) given along with:



Components:

(i) Sugar (ii) Protein

(iii) Lipid bilayer (iv) Integral protein

(v) Cytoplasm (vi) Cell wall

(vii) External protein

The correct components are:

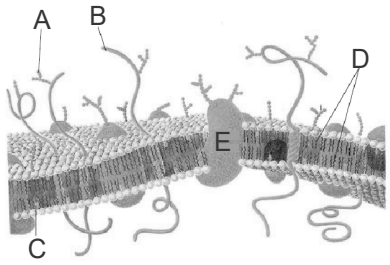
(1) A-(i), B-(ii), C-(iii), D-(iv), E-(v)

(2) A-(ii), B-(i), C-(iii), D-(iv), E-(v)

(3) A-(i), B-(ii), C-(iii), D-(iv), E-(vi)

(4) A-(i), B-(ii), C-(iii), D-(vii), E-(v)

11. The figure given below show the structure of plasma membrane, with its parts labelled from A to E, Identify the correct:



(1) A $\rightarrow$ 52 percent of erythrocyte membrane

(2) B $\rightarrow$ Movement of this measured fluidity of membrane

(3) C $\rightarrow$ Help in facilitated transport of polar molecules

(4) D $\rightarrow$ Its polar tail contain saturated hydrocarbon

12. Which is the function of cell wall ?

I. Provides shape to the cell

II. Protects the cell from mechanical damage and infection

III. Helps in cell to cell interaction

IV. Provides barrier to undesirable macromolecules

V. Imbibition of water

(1) Only III

(2) Only IV

(3) Only II, III and IV

(4) All of the above

13. The endomembrane system includes:

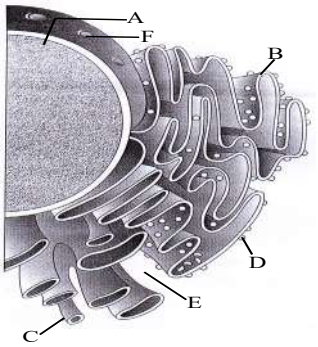
(1) ER, Lysosomes and Golgi body

(2) ER, and Golgi body

(3) ER and Lysosomes

(4) ER, Lysosomes, Golgi body and vacuoles

14. Identify the components labelled A, B, C, D, E and F in the diagram below from the list (i) to (vi) given along with:



Components

(i) SER (ii) Ribosome

(iii) Nucleus (iv) Cytoplasm

(v) Nuclear pore (vi) RER

The correct components are:

	A	B	C	D	E	F
(1)	v	i	vi	iv	ii	iii
(2)	i	iii	ii	vi	v	iv
(3)	iii	vi	i	ii	iv	v
(4)	iii	i	ii	vi	v	iv

15. Which cell organelle divides the intracellular space into two distinct compartments, i.e. luminal (inside) and extra luminal (cytoplasm) compartments?

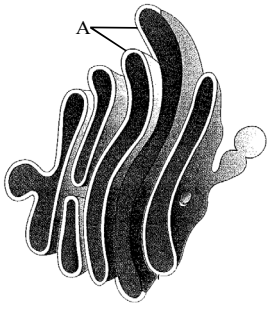
(1) Golgibody

(2) Mitochondria

(3) Endoplasmic reticulum

(4) Lysosome

16. Label-A:-



(1) Cristae (2) Saccule

(3) Cisternae (4) Columns

17. Membrane bound vesicular structures formed by the process of packaging in the Golgi apparatus and filled with hydrolytic enzymes, are called:

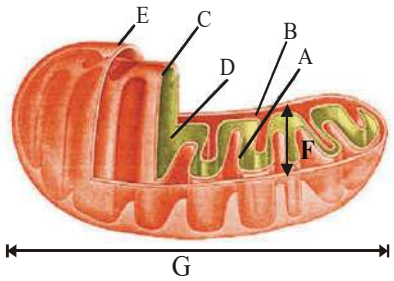
(1) Mitochondria

(2) Transitional vesicles

(3) Lysosomes

(4) Centrosome

For Q. No. 18 to 23 are based on same diagram



18. Which represents aqueous compartments?

(1) A, B (2) D, C

(3) A, D (4) B, D

19. What is the average value of labelled F ?

(1) 0.2 µm (2) 0.5 µm

(3) 1.0 µm (4) 4.1 µm

20. Which component allow movement of ?

(1) A (2) B

(3) D (4) E

21. Cristae are infoldings of ..... , present toward the .....

(1) E and B (2) B and C

(3) C and D (4) F and D

22. Single circular DNA molecule is found in:

(1) B (2) D

(3) E (4) C

23. Labelled-D contains:

(A) A few RNA molecules

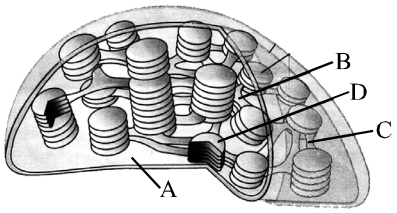
(B) 70s ribosome

(C) Enzymes (D) Circular DNA

(1) B, D (2) A, B, D

(3) B, C, D (4) A, B, C, D

24.



The given diagram shows the sectional view of a chloroplast. In which of the following all the four parts labelled as A, B, C, D are correctly identified ?

	A	B	C	D
(1)	Cytoplasm	Thylakoid	Stroma	Granum
(2)	Stroma	Granum	Stroma lamella	Thylakoid
(3)	Stroma	Thylakoid	Stroma lamella	Granum
(4)	Cytoplasm	Granum	Thylakoid	Stroma lamella

25. (a) granular structure

(b) first observed under the electron microscope as dense particles by George Palade

(c) composed of RNA and proteins

(d) not surrounded by any membrane

Above given statements are true for which cell organelle ?

(1) Nucleolus (2) Ribosomes

(3) Cristae (4) Chloroplast

26. An elaborate network of filamentous proteinaceous structures present in the cytoplasm which helps in the maintenance of cell shape is called:

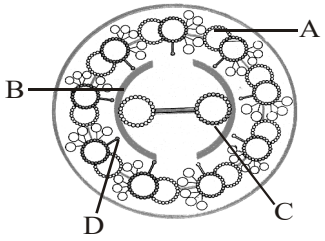
(1) Endoplasmic reticulum

(2) Plasmalemma

(3) Thylakoid

(4) Cytoskeleton

27. Given diagram showingss flagellum's internal structure. In which of the following all the four parts labelled as A, B, C and D are correctly identified ?



	A	B	C	D
(1)	Peripheral microtubules	Central tubule	Central microtubules	Bridge
(2)	Central microtubules	Radial spoke	Peripheral microtubules	Bridge
(3)	Peripheral microtubules	Central sheath	Central microtubules	Radial spoke
(4)	Radial spoke	Central sheath	Central microtubules	Peripheral microtubules

28. Find incorrect statement with regard to centrosome and centrioles:

(a) Centrosomes are surrounded by amorphous pericentriolar material

(b) In centrosome, both centrioles lie parallel to each other in which each has an organisation like the cartwheel

(c) Centrioles are made up of nine evenly spaced peripheral fibrils of tubulin

(d) Hub is the central proteinaceous part of centriole

(e) Proteinaceous radial spokes connect hub to peripheral triplets

(1) a,b, e (2) only b

(3) b, c (4) All are correct

29. Interphase nucleus has a loose and indistinct network of nucleoprotein fibres called chromatin, but during different stages of cell division, cells show "*structured chromosomes*" in place of the:

(1) Nucleus

(2) Nucleosome

(3) Solenoid

(4) Plasmosome

30. Which one of the following is correct ?

(a) Nuclear matrix or nucleoplasm contains nucleolus and chromatin.

(b) Ectokaryotheca usually remains continuous with the ER and also bears ribosomes on it.

(c) Small and less number of nucleoli are present in cells actively carrying out protein synthesis

(1) a and b (2) only a

(3) a, and c (4) b and c

31. Match the following:

Column-I		Column-II	
(a)	Cristae	(i)	Flat membranous sacs in stroma
(b)	Cisternae	(ii)	Infolding in mitochondria
(c)	Thylakoids	(iii)	Disc-shaped sacs in Golgi
(d)	Kinetochores	(iv)	Disc-shaped structure

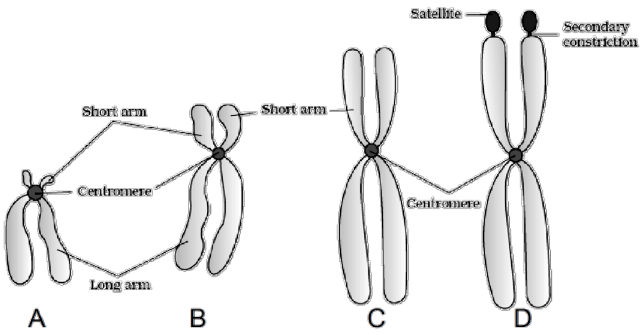
(1) a-ii, b-iii, c-i, d-iv

(2) a-ii, b-i, c-iii, d-iv

(3) a-iii, b-i, c-ii, d-iv

(4) a-i, b-iii, c-ii, d-iv

32. Which one is correct?



	A	B	C	D
1	Acrocentric chromosome	Subcentric chromosome	submeacentric chromosome	Metacentric chromosome
2	Acrocentric chromosome	Telocentric chromosome	Metacentric chromosome	Submetacentric chromosome
3	Submetacentric chromosome	Metacentric chromosome	Telocentrci chromosome	Acrocentric chromosome
4	Metacentric chromosome	Submetacentric chromosome	Acrocentric chromosome	Telocentric chromosome

33. (a) Minute vesicles

(b) Membrane bound

(c) Contained enzymes

(d) Present in plant and animals

Above statements are correct for:

(1) Plastids (2) Microbodies

(3) Nucleoli (4) Satellite bodies

34. Which of the following is/are function(s) of lipochondria (Golgi Apparatus) ?

(I) Chemical modification of lipids and proteins

(II) Detoxification

(III) Formation of acrosome

(IV) Glycogen synthesis & breakdown

Choose the correct option:

(1) I and II are incorrect

(2) I and III are correct

(3) II is incorrect and remaining are correct

(4) II and III are incorrect

35. Cilia are different from flagella:

(A) In having small size

(B) In having non coordinated movement

(C) In taking part in attachment, feeding and sensation

(D) In number of microtubules

(E) In working like oars

Choose the correct option:

(1) A, C and E (2) A, C, D and E

(3) A, B, C, D and E (4) B and D

36. If living cells, similar to those found on earth, were found on another planet, where there was no oxygen, which cell organelle would most probably be absent?

(1) Ribosomes

(2) Golgi apparatus

(3) Mitochondria

(4) Endoplasmic Reticulum

37. Plant and prokaryotic cells are similar with each other but differ from animal cells:

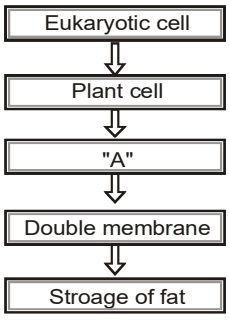
(1) In possessing 70S ribosomes

(2) In possessing cell wall

(3) In possessing Glycocalyx

(4) In possessing inclusion bodies

38. Identify the cell organelle 'A':



(1) Mitochondria (2) Leucoplast

(3) Chloroplast (4) SER

39. How many of the following is observed in the interphase nucleus ?

Chromatid, Nucleosome, Centriole, Nucleolus, Centromere, Kinetochore

(1) Three (2) One

(3) Four (4) Two

40. Which statement is true for both prokaryotic and eukaryotic cells ?

(1) Prokaryotic cells are genetically much larger than eukaryotic cells

(2) Eukaryotic cells have ribosomes and prokaryotic cells do not.

(3) Both have DNA as their of genetic material

(4) Eukaryotic cells have plasma membranes and prokaryotic cells do not

41. Which of the following is essential for living cells?

(1) Flagella

(2) Chloroplast

(3) Cell wall

(4) Cell membrane

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	2	3	4	3	2	2	3	2	4	1	2	4	4	3	3	3	3	4	2	4	3	2	4	2	2
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41									
Ans.	4	3	2	1	1	1	1	2	2	1	3	2	2	4	3	4									

Exercise - III (Previous Year Questions)

[AIPMT-2006]

1. Which of the following statements regarding mitochondrial membrane is not correct ?

(1) The outer membrane resembles a sieve

(2) The outer membrane is permeable to all kinds of molecules.

(3) The enzymes of the electron transfer chain are embedded in the outer membrane.

(4) The inner membrane is highly convoluted forming a series of infoldings.

[AIPMT-2007]

2. Which one of the following is not a constituent of cell membrane ?

(1) Phospholipids

(2) Cholesterol

(3) Glycolipids

(4) Proline

3. Select the wrong statement from the following :

(1) The chloroplasts are generally much larger than mitochondria

(2) Both chloroplasts and mitochondria contain an inner and an outer membrane

(3) Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by the thylakoid membrane

(4) Both chloroplasts and mitochondria contain DNA

[AIPMT-2008]

4. Polysome is formed by :-

(1) A ribosome with several subunits

(2) Ribosomes attached to each other in a linear arrangement

(3) Several ribosomes attached to a single mRNA

(4) Many ribosomes attached to a strand of endoplasmic reticulum

5. Vacuole in a plant cell :-

(1) Lacks membrane and contains air

(2) Lacks membrane and contains water and excretory substances

(3) Is membrane-bound and contains storage proteins and lipids

(4) is membrane-bound and contains water and excretory substances

6. In germinating seeds fatty acids are degraded exclusively in the:-

(1) Peroxisomes (2) Mitochondria

(3) Proplastids (4) Glyoxysomes

[AIPMT-2009]

7. Plasmodesmata are :-

(1) Connections between adjacent cells

(2) Lignified cemented layers between cells

(3) Locomotary structures

(4) Membranes connecting the nucleus with plasmalemma

8. Cytoskeleton is made up of :-

(1) Proteinaceous filaments

(2) Calcium carbonate granules

(3) Callose deposits

(4) Cellulosic microfibrils

[AIPMT-PRE-2010]

9. The plasma membrane consists mainly of :

(1) proteins embedded in a carbohydrate bilayer

(2) phospholipids embedded in a protein bilayer

(3) proteins embedded in a phospholipid bilayer

(4) proteins embedded in a polymer of glucose molecules

10. Which one of the following structures between two adjacent cells is an effective transport pathway ?

(1) Plasmalemma

(2) Plasmodesmata

(3) Plastoquinones

(4) Endoplasmic reticulum

11. Which one of the following has its own DNA?

(1) Peroxisome (2) Mitochondria.

(3) Dictyosome (4) Lysosome

12. The main arena of various types of activities of a cell is:

(1) Nucleus

(2) Plasma membrane

(3) Mitochondrian

(4) Cytoplasm

13. Algae have cell wall made up of:

(1) Cellulose, hemicellulose and pectins

(2) Cellulose, galactans and mannans

(3) Hemicellulose, pectins and proteins

(4) Pectins, cellulose and proteins

[AIPMT-MAINS-2010]

14. An elaborate network of filamentous proteinaceous structures present in the cytoplasm which helps in the maintenance of cell shape is called :

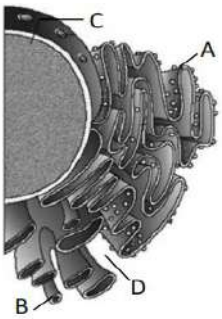
(1) Endosplasmic Reticulum

(2) Plasmalemma

(3) Cytoskeleton

(4) Thylakoid

15. Identify the components labelled A, B,C and D in the diagram below from the list (i) to (viii) given with



Components :

(i) Cristae of mitochondria

(ii) Inner membrane of mitochondria

(iii) Cytoplasm

(iv) Smooth endoplasmic reticulum

(v) Rough endoplasmic reticulum

(vi) Mitochondrial matrix

(vii) Cell vacuole

(viii) Nucleus

The correct component are :

	A	B	C	D
(1)	(i)	(iv)	(viii)	(vi)
(2)	(vi)	(v)	(iv)	(vii)
(3)	(v)	(i)	(iii)	(ii)
(4)	(v)	(iv)	(viii)	(iii)

[AIPMT PRE-2011]

16. Important site for formation of glycoproteins and glycolipids is :-

(1) Vacuole (2) Golgi apparatus

(3) Plastid (4) Lysosome

17. Peptide synthesis inside a cell takes place in:-

(1) Chloroplast (2) Mitochondria

(3) Chromoplast (4) Ribosomes

18. In eubacteria, a cellular component that resembles eukaryotic cell is :-

(1) Plasma membrane (2) Nucleus

(3) Ribosomes (4) Cell wall

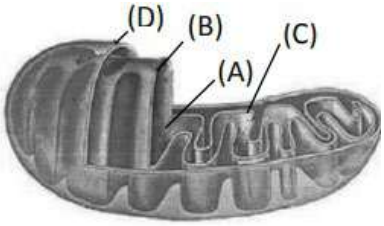
[AIPMT-MAINS-2011]

19. Which one of the following is not considered as a part of the endomembrane system ?

(1) Lysosome (2) Golgi complex

(3) Peroxisome (4) Vacuole

20. The figure below shows the structure of a mitochondrion with its four parts labelled (A), (B), (C) and (D). Select the part correctly matched with its function.



(1) Part (A) : Matrix - major site for respiratory chain enzymes

(2) Part (D) : Outer membrane - gives rise to inner membrane by splitting

(3) Part (B) : Inner membrane - forms infoldings called cristae

(4) Part (C) : Cristae - possess single circular DNA molecule and ribosomes

[AIPMT-PRE-2012]

21. Select the correct statement from the following regarding cell membrane :-

(1) Lipids are arranged in a bilayer with polar heads towards the inner part

(2) Fluid mosaic model of cell membrane was proposed by Singer and Nicolson

(3) Na^+ and K^+ ions move across cell membrane by passive transport

(4) Proteins make up 60 to 70% of the cell membrane

22. Ribosomal RNA is actively synthesized in :-

(1) Nucleoplasm

(2) Ribosomes

(3) Lysosomes

(4) Nucleolus

[AIPMT-MAINS-2012]

23. Which one of the following cellular parts is correctly described?

(1) Ribosomes - those on chloroplasts are larger (80s) while those in the cytoplasm are smaller (70s)

(2) Lysosomes-optimally active at a pH of about 8.5

(3) Thylakoids-flattened membranous sacs forming the grana of chloroplasts

(4) Centrioles - sites for active RNA synthesis

24. Which one of the following structures is an organelle within an organelle?

(1) ER

(2) Mesosome

(3) Ribosome

(4) Peroxisome

[NEET-UG-2013]

25. The Golgi complex plays a major role :

(1) In post translational modification of proteins and glycosidation of lipids

(2) In trapping the light and transforming it into chemical energy

(3) In digesting proteins and carbohydrates

(4) As energy transferring organelles

26. A major site for synthesis of lipids is :

(1) Nucleoplasm (2) RER

(3) SER (4) Symplast

27. Which one of the following organelle in the figure correctly matches with its function?

(1) Rough endoplasmic reticulum, protein synthesis

(2) Rough endoplasmic reticulum, formation of glycoproteins

(3) Golgi apparatus, protein synthesis

(4) Golgi apparatus, formation of glycolipids

[AIPMT-2014]

28. The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as :

(1) Microtubules

(2) Microfilaments

(3) Intermediate filaments

(4) Lamins

29. Match the following and select the correct answer :

(a) Centriole	(i) Infoldings in mitochondria
(b) Chlorophyll	(ii) Thylakoids
(c) Cristae	(iii) Nucleic acids
(d) Ribozymes	(iv) Basal body cilia or flagella

	(a)	(b)	(c)	(d)
(1)	(iv)	(ii)	(i)	(iii)
(2)	(i)	(ii)	(iv)	(iii)
(3)	(i)	(iii)	(ii)	(iv)
(4)	(iv)	(iii)	(i)	(ii)

[AIPMT-2015]

30. DNA is not present in :-

(1) Ribosomes (2) Nucleus

(3) Mitochondria (4) Chloroplast

31. Nuclear envelope is a derivative of :-

(1) Membrane of Golgi complex

(2) Microtubules

(3) Rough endoplasmic reticulum

(4) Smooth endoplasmic reticulum

32. The structures that are formed by stacking of organized flattened membranous sacs in the chloroplasts are :

(1) Grana (2) Stroma lamellae

(3) Stroma (4) Cristae

33. The chromosomes in which centromere is situated close to one end are:

(1) Acrocentric (2) Telocentric

(3) Sub-metacentric (4) Metacentric

34. Select the correct matching in the following pairs:

(1) Smooth ER – Synthesis of lipids

(2) Rough ER– Synthesis of glycogen

(3) Rough ER – Oxidation of fatty acids

(4) Smooth ER – Oxidation of phospholipids

[RE-AIPMT-2015]

35. Which of the following structures is not found in prokaryotic cells?

(1) Plasma membrane

(2) Nuclear envelope

(3) Ribosome

(4) Mesosome

36. Which of the following are not membrane bound?

(1) Mesosomes (2) Vacuoles

(3) Ribosomes (4) Lysosomes

37. Cellular organelles with membranes are :

(1) Lysosomes, Golgi apparatus and mitochondria

(2) Nuclei, ribosomes and mitochondria

(3) Chromosomes, ribosomes and endoplasmic reticulum

(4) Endoplasmic reticulum, ribosomes and nuclei

38. Match the columns and identify the correct option:

Column-I		**Column-I**	
(a)	Thylakoids	(i)	Disc-shaped sacs in Golgi apparatus
(b)	Cristae	(ii)	Condensed structure of DNA
(c)	Cisternae	(iii)	Flat membranous sacs in stroma
(d)	Chromatin	(iv)	Infoldings in mitochondria

	(a)	(b)	(c)	(d)
(1)	(iii)	(iv)	(ii)	(i)
(2)	(iv)	(iii)	(i)	(ii)
(3)	(iii)	(iv)	(i)	(ii)
(4)	(iii)	(i)	(iv)	(ii)

[NEET-I-2016]

39. Mitochondria and chloroplast are :-

(a) semi-autonomous organelles

(b) formed by division of pre-existing organelles and they contain DNA but lack protein synthesizing machinery

Which one of the following options is correct ?

(1) Both (a) and (b) are correct

(2) (b) is true but (a) is false

(3) (a) is true but (b) is false

(4) Both (a) and (b) are false

40. Microtubules are the constituents of :-

(1) Cilia, Flagella and Peroxisomes

(2) Spindle fibres, Centrioles and Cilia

(3) Centrioles, Spindle fibres and Chromatin

(4) Centrosome, Nucleosome and Centrioles

41. Which one of the following cell organelles is enclosed by a single membrane ?

(1) Mitochondria

(2) Chloroplasts

(3) Lysosomes

(4) Nuclei

[NEET(UG)-2017]

42. Which of the following cell organelles is responsible for extracting energy from carbohydrates to form ATP ?

(1) Ribosome

(2) Chloroplast

(3) Mitochondrion

(4) Lysosome

[NEET(UG)-2018]

43. Which of the following is true for nucleolus?

(1) Larger nucleoli are present in dividing cells.

(2) It is a membrane-bound structure.

(3) It takes part in spindle formation.

(4) It is a site for active ribosomal RNA synthesis.

44. The Golgi complex participates in :-

(1) Fatty acid breakdown

(2) Formation of secretory vesicles

(3) Respiration in bacteria

(4) Activation of amino acid

[NEET(UG)-2019]

45. The shorter and longer arms of a submetacentric chromosome are referred to as :-

(1) s-arm and l-arm respectively

(2) p-arm and q-arm respectively

(3) q-arm and p-arm respectively

(4) m-arm and n-arm respectively

46. Which of the following pair of organelles does not contain DNA ?

(1) Mitochondria and Lysosomes

(2) Chloroplast and Vacuoles

(3) Lysosomes and Vacuoles

(4) Nuclear envelope and Mitochondria

47. Which of the following statements is not correct?

(1) Lysosomes have numerous hydrolytic enzymes.

(2) The hydrolytic enzymes of lysosomes are active under acidic pH.

(3) Lysosomes are membrane bound structures.

(4) Lysosomes are formed by the process of packaging in the endoplasmic reticulum.

48. The concept of "Omnis cellula-e cellula" regarding cell division was first proposed by:

(1) Rudolf Virchow

(2) Theodore Schwann

(3) Schleiden

(4) Aristotle

49. Which of the following statements regarding mitochondria is incorrect?

(1) Outer membrane is permeable to monomers of carbohydrates fats and proteins.

(2) Enzymes of electron transport are embedded in outer membrane.

(3) Inner membrane is convoluted with infoldings.

(4) Mitochondrial matrix contains single circular DNA molecule and ribosomes.

[NEET(UG)-2019-(ODISHA)]

50. Which of the following cell organelles is present in the highest number in secretory cells ?

(1) Mitochondria

(2) Golgi complex

(3) Endoplasmic reticulum

(4) Lysosomes

51. Non-membranous nucleoplasmic structures in nucleus are the site for active synthesis of :

(1) Protein synthesis

(2) mRNA

(3) rRNA

(4) tRNA

52. Match the column-I with column-II :-

Column-I	Column-II
(a) Golgi apparatus	(i) Synthesis of protein
(b) Lysosomes	(ii) Trap waste and excretory products
(c) Vacuoles	(iii) Formation of glycoproteins and glycolipids
(d) Ribosomes	(iv) Digesting biomolecules

Choose the right match from options given below :-

(1) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

(2) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

(3) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

(4) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)

[NEET(UG) 2020]

53. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells ?

(1) Polysomes

(2) Endoplasmic reticulum

(3) Peroxisomes

(4) Golgi bodies

[NEET(UG) 2020 (COVID-19)]

54. The biosynthesis of ribosomal RNA occurs in :

(1) Ribosomes

(2) Golgi apparatus

(3) Microbodies

(4) Nucleolus

55. The size of Pleuropneumonia - like Organism (PPLO) is :

(1) 0.02 μm

(2) 1-2 μm

(3) 10-20 μm

(4) 0.1 μm

56. Match the following columns and select the correct option :

Column - I	Column - II
(a) Smooth endoplasmic	(i) Protein synthesis reticulum
(b) Rough endoplasmic	(ii) Lipid synthesis reticulum
(c) Golgi complex	(iii) Glycosylation
(d) Centriole	(iv) Spindle formation

(1) (a)-(ii), (b)-(i), (c)-(iii). (d)-(iv)

(2) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

(3) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

(4) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

[NEET-(UG)-2021]

57. When the centromere is situated in the middle of two equal arms of chromosomes, the chromosome is referred as :

(1) Metacentric

(2) Telocentric

(3) Sub-metacentric

(4) Acrocentric

58. Match List -I with List - II.

List -I		List -II	
(a)	Cristae	(i)	Primary constriction In chromosome
(b)	Thylakoids	(ii)	Disc-shaped sacs in Golgi apparatus
(c)	Centromere	(iii)	Infoldings in mitochondria
(d)	Cisternae	(iv)	Flattened membranous sacs in stroma of plastids

Choose the correct answer from the options given below.

	(a)	(b)	(c)	(d)
(1)	(iv)	(iii)	(ii)	(i)
(2)	(i)	(iv)	(iii)	(ii)
(3)	(iii)	(iv)	(i)	(ii)
(4)	(ii)	(iii)	(iv)	(i)

59. Which of the following is an incorrect statement?

(1) Mature sieve tube elements possess a conspicuous nucleus and usual cytoplasmic organelles.

(2) Microbodies are present both in plant and animal cells.

(3) The perinuclear space forms a barrier between the materials present inside the nucleus and that of the cytoplasm.

(4) Nuclear pores act as passages for proteins and RNA molecules in both directions between nucleus and cytoplasm.

60. The organelles that are included in the endomembrane system are:

(1) Endoplasmic reticulum, Mitochondria, Ribosomes and Lysosomes

(2) Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles

(3) Golgi complex, Mitochondria, Ribosomes and Lysosomes

(4) Golgi complex, Endoplasmic reticulum, Mitochondria and Lysosomes

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61. Match **List–I** with **List–II**.

	List–I		**List–II**
(a))	Metacentric chromosome	(i)	Centromere situated close to the end forming one extremely short and one very long arms
(b)	Acrocentric chromosome	(ii)	Centromere at the terminal end
(c)	Sub-metacentric	(iii)	Centromere in the middle forming two equal arms of chromosomes
(d)	Telocentric chromosome	(iv)	Centromere slightly away from the middle forming one shorter arm and one longer arm

Choose the **correct answer** from the option given below:

(1) (a)–(iii), (b)–(i), (c)–(iv), (d)–(ii)

(2) (a)–(i), (b)–(iii), (c)–(ii), (d)–(iv)

(3) (a)–(ii), (b)–(iii), (c)–(iv), (d)–(i)

(4) (a)–(i), (b)–(ii), (c)–(iii), (d)–(iv)

62. Which of the following statements with respect to Endoplasmic Reticulum is **incorrect**?

(1) RER has ribosomes attached to ER

(2) SER is devoid of ribosomes

(3) In prokaryotes only RER are present

(4) SER are the sites for lipid synthesis

[RE–NEET 2022]

63. If the pH in lysosomes is increased to alkaline, what will be the outcome?

(1) Hydrolytic enzymes will function more efficiently

(2) Hydrolytic enzymes will become inactive

(3) Lysosomal enzymes will be released into the cytoplasm

(4) Lysosomal enzymes will be more active

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	3	4	3	3	4	4	1	1	3	2	2	4	2	3	4	2	4	1	3	3	2	4	3	3	1
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Ans.	3	1	2	1	1	3	1	1	1	2	3	1	3	3	2	3	3	4	2	2	3	4	1	2	2
Que.	51	52	53	54	55	56	57	58	59	60	61	62	63												
Ans.	3	1	4	4	4	1	1	3	1	2	1	3	2												