

Unit-III : CELL : STRUCTURE AND FUNCTIONS
Chapter 8 : Cell : The Unit of Life

.SYNOPSIS

What is Cell?

- All organisms are composed of cells.
- Some organisms are made up of a single cell and these are called **Unicellular organisms**.
- Some organisms composed by many cells are called **Multicellular organisms**.
- Unicellular organisms are capable of
 - i) independent existence
 - ii) performing the essential functions of life
- Cell is the fundamental structural and functional unit of all living organisms.

CELL THEORY

- **Cell theory** was put forward by **Schleiden** and **Schwann** which states that “the bodies of all living beings are formed of cells and their products and that the cells are structural and functional units of living being”.
- **M.J.Schleiden** was a German Botanist published his findings in 1838.
 - i) All types of plant tissues are made of one or other type of cells.
 - ii) Cells are structural units of all plant tissues.
 - iii) Each cell has a boundary namely cell wall and nuclear core surrounding by jelly.
- **Theodore Schwann** was a German Zoologist who found that animal tissues were made of cells and that animal cells differ from plant cells in lacking cell wall. He therefore defined cell as membrane enclosed, nucleus containing structure.
- This theory however didnot explain as to how new cells were formed.
- **Rudolf Virchow** first explained that cells divide 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.
- Two basic aspects of cell theory are
 - i) Body of all living organisms made of cells and their products.
 - ii) Cells develop from pre-existing cells.

AN OVERVIEW OF CELL

- The Onion cell which is a typical plant cell has a distinct cell wall.
- The cells of the human cheek have an outer membrane as the delimiting structure of the cell.
- Cells that have membrane bound nuclei are called **Eukaryotes**, where as cells that lack a membrane bound nucleus are called **Prokaryotes**.
- In both the cells cytoplasm occupies the volume of the cell. It is a semifluid matrix.
- In plants and animal cells cytoplasm is the main site of cellular activities.
- Various chemical reactions occur in cytoplasm and keep the cell in the ‘living state’.
- Eukaryotic cells have membrane bound organelles like **endoplasmic reticulum, golgi complex, lysosomes, mitochondria, plastids(in plants), microbodies and vacuoles**.
- In Prokaryotic cells membrane bound organelles are absent.
- Ribosomes are non-membrane bound organelles found in both eukaryotic as well as prokaryotic.
- These ribosomes not only present in cytoplasm but also found in **chloroplast(in plants), mitochondria** and on **rough ER**.
- Prokaryotes contain 70s types of ribosome, where as in eukaryotes 80s (in cytoplasm, ER) 70s(in chloroplast and mitochondria).
- Animal cells contain another non-membrane bound organelle called **centriole** which help in cell division.

PROKARYOTIC CELLS

- These are represented by bacteria, blue-green algae, mycoplasma(PPLO).
- They are generally smaller and multiply more rapidly than the eukaryotic cells.
- They may vary greatly in shape and size.

Cell Size:

- Cells are generally small. They cannot be observed with the naked eye. Microscopes are used to observe them.

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<i>Organism</i>	<i>Size</i>	Cell wall.
Mycoplasma (or) PPLO	0.3µm in length	<ul style="list-style-type: none"> ➤ The fluid matrix filling the cell is cytoplasm. ➤ Well defined nucleus is absent. Genetic material is naked, circular called nucleoid. ➤ Many bacteria have small circular DNA outside the genomic DNA. These are called plasmids. They create resistance to antibiotics. ➤ Plasmid DNA is used to monitor bacterial transformation with foreign DNA.
Bacteria	3 to 5µm	
Human RBC	7.0µm in diameter	
Unicellular eukaryotes	10 to 20µm	
Nerve cells are longest	90cm in human	
Egg of Ostrich (largest isolated single cell)	17.5x15.0cm	

Cell envelope and its modifications:

- Bacterial cells, have a chemically complex cell envelope.
- Cell envelope consists of a tightly bound three layered structure.
- The outermost glycocalyx followed by the cell wall and then plasma membrane.
- Each layer of the envelope performs distinct function, they act together as a single protective unit.
- Staining procedure developed by **Gram**.
- Based on this he classified bacteria into two groups. Those are **Gram positive** and **Gram negative**.
- Glycocalyx differs in composition and thickness among different bacteria.
- Loose sheath of glycocalyx is called **slime layer**.
- Thick and tough nature of glycocalyx is called **capsule**.
- Cell wall determines the shape of the cell and provides support to prevent the bacterium from bursting or collapsing.
- Plasma membrane is semi-permeable in nature. It is structurally similar to that of the eukaryotes.
- Extensions of plasma membrane into cytoplasm are called **mesosomes**. These extensions are in the form of vesicles, tubules and lamellae.

Functions of mesosomes:

- (i) They help in cell wall formation.
- (ii) Help in DNA replication and its distribution to daughter cells.
- (iii) They help in respiration, secretion processes, to increase the surface area of the plasma membrane.
- (iv) Help in absorption of nutrients and enzymatic content.

Shapes of Cells

Shape	Examples
Round and biconcave	Red blood cells
Amoeboid	White blood cells
Long and narrow	Epithelial cells
Branched and long	Nerve cell
Elongated	Tracheid of xylem
Round and Oval	Mesophyll cells

Bacteria appear in the following shapes

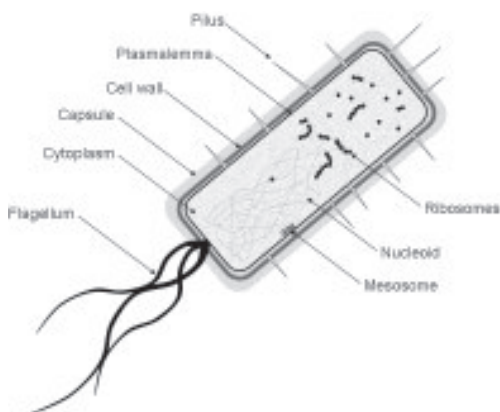
Cocci : They are spherical shaped. They appear is monococcus (single) , diplococcus (two), streptococcus (long chain) , tetra coccus (four) sarcina (eight arranged like a cube) and staphylococcus (Many in irregular shape)

Bacilli : They are rod shaped and appear as mono, diplo and streptobacillus

Vibrios : They are comma shaped bacteria

Spirilla : They are spiral shaped bacteria

- All prokaryotes have a cell wall surrounding the cell membrane.



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- In Cyanobacteria **chromatophores** are present.
- Flagella may be present or absent.
- Flagella composed by 3 parts -
(i) filament (ii) hook (iii) basal body
- Flagella made up of a protein called **flagellin**. They help in movement
- Pili & Fimbriae are help to attach the bacteria to rocks in streams and also to the host tissues.

RIBOSOMES AND INCLUSION BODIES

- These are submicroscopic, naked ribonucleoprotein granular organelles.
- They are about 15nm by 20nm in size.
- Type of ribosome is 70s, subunits are 50s and 30s. Both these subunits are attached by Mg^{2+} ion.
- Ribosomes are the sites of protein synthesis. Those are called **protein factories**.
- Several ribosomes may attach to a single mRNA and form a chain called **polysomes** or **polyribosome**.
- **Palade** studied ribosomes in animal cells.
- Ribosomes are also called **palade particles**.
- In prokaryotes ribosomes are synthesised in the **cytoplasm**.
- Ribosome proteins are formed over ribosomes with the help of mRNAs which are **polycistronic**.

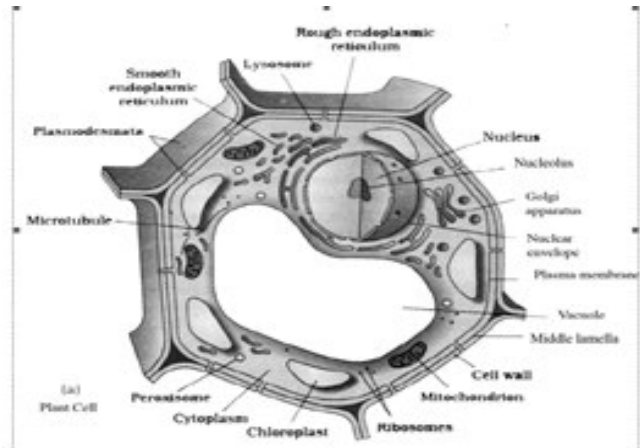
INCLUSION BODIES:

- Reserve materials are stored in the cytoplasm in the form of **inclusion bodies**.
- These are not bounded by any membrane system and lie free in the cytoplasm.
Eg: Phosphate granules, cyanophycean granules and glycogen granules.
- Gas vacuoles are found in blue green, purple and green photosynthetic bacteria.

EUKARYOTIC CELLS

- **Protists, Plants, Animals** and **Fungi** are includes under eukaryotes.
- Membrane bound organelles, nucleus with nuclear envelop, variety of complex locomotory and cytoskeletal structures are present in cytoplasm.
- Genetic material is organised into chromosomes.
- All eukaryotic cells are not identical.

	<i>Plant cell</i>	<i>Animal cell</i>
Cell wall	present	absent
Plastids	present	absent
Vacuole	present	absent
Centriole	absent	present



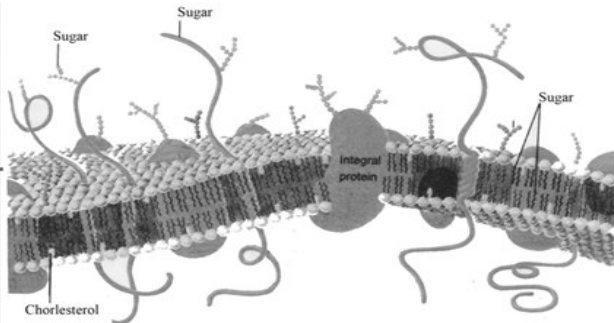
Cell Membrane:

- Detailed structure of the membrane was studied by using **electron microscope**.
- Intracellular biomembranes are found in eukaryotic cells around most cell organelles as well as inside some cell organelles.
Eg: Tonoplast around vacuole.
- Double membrane covering is present around nucleus, mitochondria and plastids.
- Single membrane covering is present around **ER, GC, Lysosomes, Peroxisomes & Glyoxysomes**.
- Cell membrane is composed of lipids that are arranged in a bilayer.
- Lipids are arranged within the membrane with the polar(hydrophilic) head towards the outer sides and the hydrophobic tails towards the inner part.
- Lipid component of the membrane mainly consists of phosphoglycerides.
- Cell membrane also possess protein and carbohydrates.
- The ratio of protein and lipid varies considerably in different cell types.
- In human beings, the membrane of the erythrocyte has approximately **52%** of protein and **40%** lipids.
- Membrane proteins can be classified as integral and peripheral.

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- Peripheral proteins lie on the surface of membrane while the integral proteins are partially or totally buried in the membrane.



- Different models of molecular structure of plasma membrane have been proposed by different scientists.
- Highly acceptable model of cell membrane was proposed by **Singer & Nicolson** widely accepted as **fluid mosaic model**.
- According to this quasi-fluid nature of lipid enables lateral movement of proteins with the overall bilayer.
- Fluid nature of the membrane is also important for cellular functions like
 - * Cell growth
 - * Formation of intercellular junctions
 - * Secretion
 - * Endocytosis
 - * Cell division
- Important function of the plasma membrane is the transport of the molecules into and out of the cells.
- The membrane is **selectively permeable** to some molecules present on either side of it.
- Many molecules can move briefly across the membrane without any utilization of energy is called the **passive transport**.
Eg: 1) Solutes may move across the membrane by simple diffusion along the concentration gradient (from higher concentration to the lower).
2) Movement of water by diffusion across the membrane is called **osmosis**.
- Few ions or molecules are transported across the membrane through its carrier proteins against their concentration gradient (from lower to the higher concentration).

- Such transport is an energy dependent process, in which ATP is utilised and is called **active transport**.

Eg: Na^+/K^+ pump.

FUNCTIONS OF PLASMA MEMBRANE

1. The cell membrane maintains the individuality and form of the cell and its organelles
2. A cell remains dynamic as long as the plasma membrane is able to determine which material should enter or leave the cell. Cell membrane helps in regulating the flow of materials and energy into and out of the cell through the processes of diffusion, osmosis (passive) and active transport. ($\text{Na}^+ - \text{K}^+$ pump).

CELL WALL:

- It is a rigid, semi-elastic, semi-transparent supportive and protective covering of cell in **Plants, Fungi, Prokaryotes** and some **Protists**.
- It was first observed by **Robert Hooke** in cork tissue of oak tree.
- In Mature cell, cell wall contain three layers.
 - 1) Middle lamellum
 - 2) Primary wall
 - 3) Secondary wall
- Algae have cell wall made of cellulose, galactans, mannans and minerals like calcium carbonate
- Cell wall of most of the plants consists of cellulose, hemicellulose, pectins and proteins
- Fungal cell wall made up of chitin

MIDDLE LAMELLUM:

- It is thin amorphous intercellular matrix between two adjacent plant cells that functions as a cement between them.
- It is the **first structure** that is formed from cell plate between the newly formed daughter cells at the time of cytokinesis.
- It is made up of **pectins, (calcium pectate, and magnesium pectate)**.

PRIMARY WALL:

- It is laid inner to the middle lamellum.
- It is thin & elastic and capable of growth.

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- Growth occurs due to incorporation of materials into inside of primary wall such growth is called **intussusception**.
- Primary wall consists of **microfibrils and gel-like matrix**.
- It is the only wall in meristematic and soft parenchymatous tissue like mesophyll, cortex, pith, fruit etc
- The cell wall and middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighbouring cells
- Plasmodesmata helps in inter cellular transport between cells

SECONDARY WALL:

- It is found in mature plant cells
- It is laid inner to the primary wall.
- It is formed by external deposition of new materials over the existing structure. Such growth is called **accretion**. (Apposition)
- New wall materials like **lignin, suberin, pectin** and **cutin** deposited into cellulose interfibrillar spaces.
- Secondary wall is laid in layers. Usually 3 layers, namely S₁, S₂, and S₃.
- The thickening is of purely cellulose in Collenchyma cells, Cotton Fibres and flax fibres.
- **Suberin** is deposited in the walls of **cork cells**.
- The impregnation is of lignin in the wood(xylem) elements like vessels, tracheids and sclerenchyma, fibres.
- In Xylem, the secondary wall exhibits unthickened areas called **pits** to support intercellular transport.
- **Function of cell Wall** : The Cell wall performs the following important functions :
 - i) It provides a definite shape, protection and mechanical support to the cell.
 - ii) It functions as apoplast.
 - iii) It forms a skeletal framework of plants and provide mechanical support
 - iv) Its depositions like cutin, and suberin reduce transpiration
 - v) It is involved in the movements of metabolites in and out of the cell through plasmodesmata

- vi) It counteracts the turgor pressure.

ENDOMEMBRANE SYSTEM:

- The functioning of certain membrane bound cytoplasmic organelles is well coordinated.
- They exchange materials among themselves by means of vesicles.
- The Endomembrane system includes
 - Endoplasmic reticulum
 - Golgi complex
 - Lysosomes and
 - Vacuoles
- Functioning of Mitochondria, Chloroplast and Peroxisomes are not coordinated. These are not considered as part of the endomembrane system.

ENDOPLASMIC RETICULUM (ER):

- The term ER is coined by **K.R.Porter**.
- It is found in all eukaryotic cells except mature erythrocytes.
- It is a complex membrane lined network of flattened sacs, tubules and vesicles that runs throughout the cytoplasm of eukaryotic cells from plasma membrane to nuclear envelope.
- Prokaryotic cells do not possess E.R.
- Endoplasmic reticulum constitutes 30-60% of the total endomembrane system.
- It divides the intercellular space into compartments, **luminal** and **extra luminal**

Types of ER:

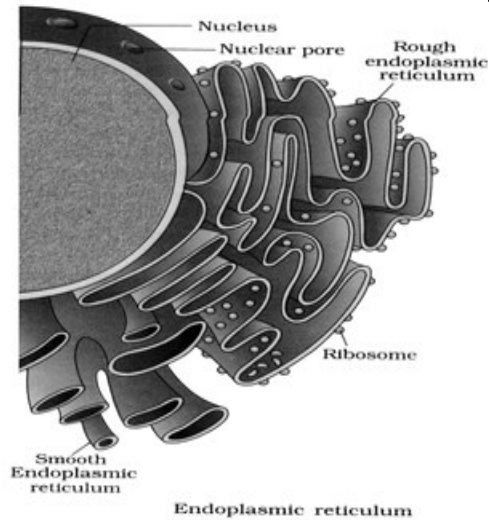
- It is of two main types
 - 1) Smooth ER/Agranular ER
 - 2) Rough ER/Granular ER

1) Smooth Endoplasmic Reticulum(SER):

- Its membranes are smooth. They are devoid of ribosomes.
- It is more abundant near the plasmalemma with which it may be attached.
- SER is believed to be formed from RER.
- It contains few cisternae, concentration of tubules and vesicles is higher.
- **SER is the major site for synthesis of lipid.**
- In animal cells, **lipid** like **steroidal hormones** are synthesized in SER.

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2) Rough Endoplasmic Reticulum(RER):

- Their surface contain large number of ribosomes.
- RER has more of cisternae and fewer number of tubules and vesicles.
- It is more abundant near the nucleus where it is connected with its outer membrane.
- It is specialised to synthesise and transport proteins. Therefore it occurs in cells engaged in active metabolism, secretion of proteins and enzymes.

GOLGI APPARATUS:

- **Camillo Golgi** first observed densely stained reticular structures near the nucleus.
- These are later named as **Golgi bodies**.
- They consists of many flat, disc-shaped sacs or cisternae of $0.5\mu\text{m}$ to $1.0\mu\text{m}$ diameter.
- These are stacked (6-8) parallel to each other.
- Independent subunits are called **dictyosomes**.
- Curvature gives a polarity to cisternae.
- Cisternae are generally arranged concentrically near the nucleus. There is a proximal convex formative **cisface** and a distal concave maturation **trans-face**.
- The concave maturation face is towards the plasmalemma.
- The number of cisternae is counted from the **forming face**.
- Membrane of the cisternae thickness increases from forming face to **maturation face**.

FUNCTIONS OF GOLGI APPARATUS

- The main function of Golgi apparatus is to process, package, transport and release of secretory proteins
- Golgi apparatus is in close association with E.R
- Materials to be packaged in the form of vesicles from the E.R, fuse with the cis face of golgi apparatus and moves towards the maturing face.
- They cause glycosidation of lipids and glycosidation of proteins to form glycolipids and glycoproteins
- Most of the proteins synthesised at ER are modified in Golgi bodies

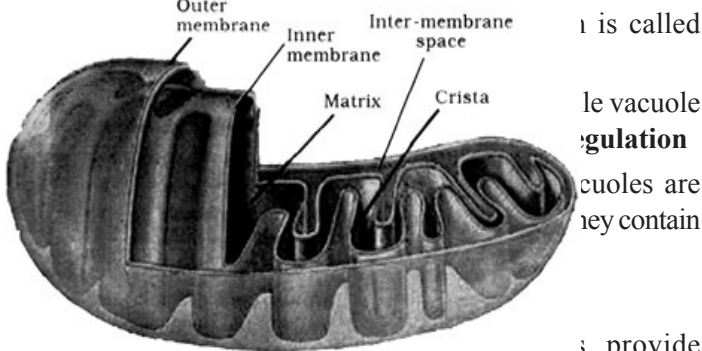
LYSOSOMES

- These are **single membrane bound** vesicular structures formed by the process of packaging in the golgi apparatus.
- The isolated lysosomal vesicles are rich in **hydrolytic enzymes**.
- **Christian De Duve** named lysosomes.
- They are cytoplasmic organelles of eukaryotic cells.
- They have also been reported in **fungi, seeds, root tips, etc.**
- Lysosomes are very rich in hydrolytic enzymes (hydrolases) capable of digesting carbohydrates (carbohydrases), proteins(proteases), lipids (lipases) and nucleic acids(nucleases)
- Digestive enzymes present in lysosomes are called **acid hydrolases** as they function at **acidic p^H**.
- Under starvation conditions, lysosomes digest cellular contents by realeasing hydrolyzing enzymes and cause death of cell. This is called **autolysis**.

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VACUOLE:

- It is the membrane-bound space found in the cytoplasm.
- It contains sap tonoplasm mainly composed of water, metabolic bye products, excretions and other waste materials.
- In some plant cells, vacuolar sap also contains some pigments like **anthocyanin** which impart colour to the plant part.
- The vacuole is bound by a single membrane called **tonoplast**.
- In plant cells the vacuoles can occupy upto 90% of the volume of the cell and play important role in **osmoregulation**.
- 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 Meristematic cells **many small vacuoles** are present.
- In Mature cells a single large vacuole with



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 the intensity of harmful radiations.

MITOCHONDRIA:

- In Greek language **Mitos - thread, Chondrion - grain**.
- The number of mitochondria per cell is variable depending on the physiological activity of the cells.
- Dormant and inactive cells possess fewer mitochondria.
- In animal cells, mitochondria are the second largest cell organelles.

- In plant cells they have the third largest size.
- Commonly mitochondria are 0.2-1.0µm in diameter(average 0.5µm) and length 1.0-4.1µm.
- Typically it is sausage - shaped or cylindrical.
- It is spherical in **yeast**.
- Each mitochondrion is covered by a double membrane envelope which encloses a highly involuted inner core or inner chamber.
- There is an outer and an inner membrane in the envelope.
- Inner membrane dividing its lumen distinctly into two aqueous compartments, i.e. the outer compartment (cytosol or C-face) the inner compartment (matrix or M-face).
- The outer membrane forms the continuous limiting boundary of the organelle.
- The inner membrane forms a number of infoldings called the **crisatæ** towards the matrix.
- The crisatæ increase the surface area of inner membrane.
- On crisatæ stalked particles called **oxysomes, Racker's particles, F₀-F₁ particles or elementary particles** are present.
- The matrix also possesses single circular DNA molecule,(with high G ≡ C ratio) a few RNA molecules,(all 3 forms of RNA) 70s-ribosomes and the components required for the synthesis of proteins.
- During aerobic respiration they produce cellular energy in the form of ATP, hence they are called **Power houses of the cell**.
- The mitochondria divide by **fission**

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PLASTIDS:

- **E. Haeckel** (1865) gave the term plastid. Plastids are largest cell organelles.
- Plastids are double membrane covered cytoplasmic organelles that possess their own genetic machinery.
- They take part in storing or synthesising organic compounds.
- They occur in plants and euglenoids.
- Plastid precursors are called **Proplastids**.

➤ Leucoplasts \rightleftharpoons Chloroplasts

Proplastids Chloroplasts Chromoplasts

Chromoplasts \rightleftharpoons Chloroplasts

PROPLASTIDS:

- They are colourless, rounded but amoeboid plastid precursors found in meristematic and newly formed plant cells.
- It has a double membrane envelope that surrounds a colourless matrix.
- The matrix contains **DNA, Ribosomes** and **reserve food**.
- A few vesicles and lamellae also occur in the matrix.
- They develop from inner membrane.
- Based on the type of pigments plastids can be classified into **leucoplast, chromoplast** and **chloroplasts**.

LEUCOPLASTS:

- Leucoplasts are colourless plastids that occur in non green plant cells, commonly near the nucleus.
- They contain lamellae, some of which are found to be connected with inner membrane.
- Lamellae are not organised to form grana.
- **Photosynthetic pigments are absent**.
- Many leucoplasts become specialised to store food materials.
- These are of 3 types.

(i) Amyloplasts:

Starch storing leucoplast is called **amyloplast**.

Eg: tuber of potato, grain of rice and wheat.

(ii) Elaioplasts:

-They store oils and fat.

Eg: Endosperm of castor seed

(iii) Aleuroplast:

-They are protein storing leucoplasts.

Eg: Aleurone layer of Maize grain, cotyledons of Pulses

CHROMOPLAST:

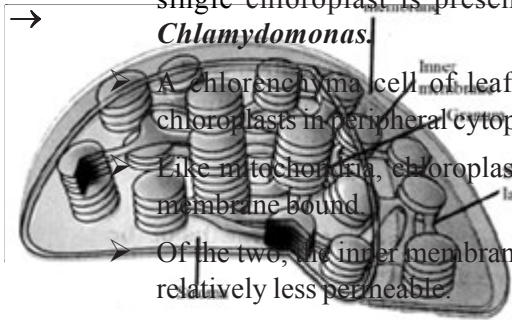
- They are non-photosynthetic coloured plastids which synthesise and store carotenoid pigments.
- They contain fat soluble carotenoid pigments like **carotene, xanthophylls**.
- They, therefore appear orange red or yellow in colours.
- They develop from **proplastids, leucoplasts and chloroplasts**.
- Transformation from chloroplasts is observed during ripening of fruits due to loss of chlorophyll. Eg: Tomato, Chilly
- The most common carotenoid of these fruits is **lycopene**.
- Tuberos roots of carrot contain **carotene**.
- Coloured flowers contain chromoplast. And such flowers attract pollinating insects.
- The coloured fruits attract birds for dispersal.
- Certain carotenoids form Abscisic acid and later they close stomata and induce dormancy.

CHLOROPLAST:

- They are green or chlorophyll containing plastids of plant cells and some protists (Euglena) which are specialised to perform photosynthesis or synthesis of organic food from inorganic raw materials with the help of energy obtained from solar radiations.
- Majority of the chloroplasts of the green plants are found in the **mesophyll cells** of the leaves.
- Chloroplasts of green plants are generally **disc-shaped** with **circular (or) oval-elliptical outline**.

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SECTIONAL VIEW OF CHLOROPLAST

- Chloroplasts are the second largest cell organelles of plant cells with a length of 5-10µm and width 2-4µm.
 - Their number varies from plant to plant. Eg: -A single chloroplast is present in the cells of *Chlamydomonas*.
- 
- A chlorenchyma cell of leaf possesses 20-40 chloroplasts in peripheral cytoplasm.
 - Like mitochondria, chloroplasts are also double membrane bound.
 - Of the two, the inner membrane of chloroplast is relatively less permeable.
 - The space limited by the inner membrane of the chloroplast is called **stroma**.
 - A number of organised flattened membranous sacs called **thylakoids**, are present in the stroma.
 - Thylakoids are arranged in stacks like the piles of coins called **grana** or the intergranal thylakoids.
 - In addition, there are flat membranous tubules called the stroma lamellae connecting the thylakoids of different grana.
 - The membrane of the thylakoids enclosed a space called a **lumen**.
 - The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins. It also contains a small, double-stranded, circular DNA molecules, mRNA, rRNA, tRNA

and 70s ribosomes.

- Photosynthetic pigments are present in the thylakoids.
- Thylakoid membranes possess chlorophylls (a and b in plant chloroplast), Carotenoids (carotenes and xanthophylls).
- The ribosomes of the chloroplasts are smaller (prokaryotic, 70s) than the cytoplasmic ribosomes (Eukaryotic, 80s).
- **Functions :** The chloroplasts perform various functions like;
 - i) Photosynthesis - light reaction (in thylakoids), Dark reaction (in stroma)

The main function of chloroplast is photosynthesis, in which radiant energy of sun is converted into chemical form of energy, which is utilized by all living organisms to perform their life activities. Further, **chloroplasts** help in maintaining **balance of O₂ and CO₂** in the atmosphere

2) Storage of Starch

- These different types of plastids are interchangeable e.g., In tomato

Young ovary (colourless)	Leucoplasts
Young fruits (green)	Chloroplasts
Mature fruits (red)	Chromoplasts
- In carrot root :** Leucoplast Chromoplast
- In chilly :** Chloroplast Chromoplast

SIMILARITIES BETWEEN MITOCHONDRIA & CHLOROPLASTS

1. **Origin.** Both are formed by division of pre-existing organelles.
2. **Envelope.** They are covered by a double membrane envelope.
3. **Outer Membrane.** It is smooth and permeable to many solutes as well as metabolites.
4. **Inner Membrane.** The membrane is selectively permeable in both.
5. **Infoldings.** Inner membrane develops involutions, cristae in mitochondria and lamellae in chloroplasts.
6. **Autonomy.** Both the organelles are semi-autonomous.
7. **Genetic Systems.** They possess their own DNA, RNA and ribosomes.
8. **DNA.** DNA is circular and naked. **chloroplast DNA** is, however, bigger than **mitochondrial**

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DNA.

9. **Ribosomes.** Ribosomes present in these organelles are 70s.
10. **Phosphorylation.** Both possess electron transport chains and take part in synthesis of ATP. (photo phosphorylation and oxidative phosphorylation)

RIBOSOMES:

- Ribosomes are composed of **ribonucleic acid** (RNA) and **proteins**, so they called **ribonucleoprotein granules**.
- They are not surrounded by any membrane. These are **smallest organelle**.
- These are found in both prokaryotic and eukaryotic cells and are, therefore, considered to be **universal cell organelle**.
- Eukaryotic cells have two types of ribosomes, cytoplasmic (80s) and organelle (70s).
- Cytoplasmic ribosomes (80s) or cytoribosomes may occur free in the cytosol or bound to endoplasmic reticulum and outer surface of nuclear envelope.
- Organelle ribosomes (70s) occur in two types of semi-autonomous organelles mitoribosomes in the matrix of mitochondria and stroma of plastids (leucoplast, chloroplast).
- Here 'S' stands for the **sedimentation coefficient**. It is indirectly a measure of density and size.
- Both types of ribosomes are composed of larger and smaller subunits.
- 70s ribosome contains 50s and 30s subunits while 80s contains 60s and 40s subunits.
- The two subunits in both types of ribosomes associate with each other by Magnesium ions.
- Ribosomes provide space as well as enzymes for the synthesis of proteins.
- During protein synthesis, many ribosomes form a chain on a common m - RNA and form the polysomes or ergosome

CYTOSKELETON:

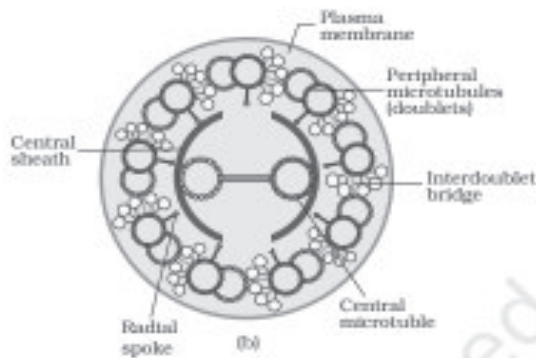
- An elaborate network of filamentous proteinaceous structures present in the cytoplasm is collectively referred to as **cytoskeleton**.

- Eukaryotic cells contain three major components of cytoskeleton:
 - (a) Microtubules
 - (b) Microfilaments
 - (c) Intermediate filaments
- Cytoskeleton in a cell is involved in many functions such as
 - i) Mechanical support
 - ii) Maintenance of cell shape
 - iii) Cell motility
 - iv) Intracellular transport
 - v) Signaling across the cell and karyokinesis

CILIA AND FLAGELLA:

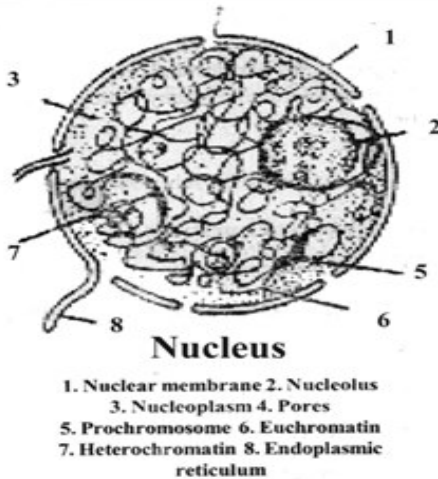
- Cilia and flagella are hair like outgrowths of the cell membrane.
- Cilia are small structures which work like oars, causing the movement of either the cell or the surrounding fluid.
- Flagella are comparatively longer and responsible for cell movement.
- Prokaryotic bacteria also possess flagella but these are structurally different from that of the eukaryotic flagella.
- Both (cilia & flagella) 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 pairs of 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.
- The central tubules are connected by bridges and are also enclosed by a **central sheath**, which is connected to one of the tubules of each peripheral doublet by a **radial spoke**.
- Thus, there are nine radial spokes.
- The peripheral doublets are also interconnected by linkers.
- Both the **cilium** and flagellum emerge from centriole-like structures called the **basal bodies**.

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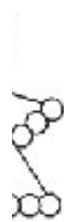


CENTROSOME AND CENTRIOLES:

- These occur in all eukaryotic animal cells and motile lower plant cells
- Centrosome is an organelle usually containing two cylindrical structures called **Centrioles**.
- They are surrounded by amorphous pericentriolar materials. Both the centrioles in a centrosome lie at right angles to each other.
- They are made up of **nine evenly spaced peripheral fibrils of tubulin**.
- Each of the peripheral fibril is a triplet. The adjacent triplets are also linked.



Centriole is also a **hub**; which is made up of nine peripheral triplets of microtubules.



Centriole

FUNCTIONS:

- They polymerize microtubules for formation of spindle fibres and astral rays during mitosis and meiosis.
- Centrioles help in the organisation and development of cilia and flagella
- When centrioles move to periphery of the cell, these function as kinetosomes or basal bodies
- They determine the poles during cell division.

NUCLEUS:

- Nucleus as a cell organelle was first described by **Robert Brown** as early as 1831.
- The material of the nucleus stained by the basic dyes was given the name **chromatin by Flemming**.
- The interphase nucleus (nucleus of a cell when it is not dividing) has highly extended and elaborate nucleoprotein fibres called chromatin, nuclear matrix and one or more spherical bodies called nucleoli (sing:nucleolus).
- Nuclear envelope, consists of two parallel membranes with a space between (10 to 50 nm) called the perinuclear space, 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 called **nuclear 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. Normally, there is only one nucleus per cell, variations in the number of nuclei are also frequently observed.
- Some mature cells even **lack nucleus**, e.g., **Erythrocytes of many mammals** and **sieve tube cells** of vascular plants.
- The nuclear matrix or the nucleoplasm contains **nucleolus** and **chromatin**. The nucleoli are

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spherical structures present in the nucleoplasm.

- The interphase nucleus has a loose and indistinct network of nucleoprotein fibres called **chromatin**. It is differentiated into two regions
- **Heterochromatin and Euchromatin** : It was observed that when chromosomes are stained with basic dyes like **acetocarmine** or **fulgen stain**, then two types of regions can be observed:
 - a) **Heterochromatic region** : This region gets dark stain during interphase. This is genetically inactive and highly condensed region with tightly packed DNA
 - b) **Euchromatin region** : This region gets light stain during interphase. This portion is genetically active and rich in loosely packed DNA. Transcription occurs here.

But during different stages of cell division, cells show structured chromosomes in place of the nucleus.

- Chromatin contains DNA and some basic proteins called **histones**, some **non-histone** proteins and also **RNA**. single human cell has approximately two metre long thread of DNA distributed among its forty six (twenty three pairs) chromosomes.
- Chromosomes were discovered by **Hofmeister** and named by **waldeyer**
- **Structure of Chromosome**: Structurally, a chromosome is composed of following parts :
 1. **Chromatid** : Each metaphase chromosome consists of two symmetrical strands called chromatids.
 2. **Chromonema** : During prophase each chromatid appears to be made of very thin and highly coiled filaments called chromonemata (as subunits of chromatids)
 3. **Chromomeres** : These are bead - like structures formed due to condensation of chromatin material. These are believed to be location of genes.
 4. **Centromere** : The two chromatids are attached to each other by a narrow area, also called primary constriction. This decides the

ratio of arm length called **centromeric index**. Two arms may be equal (Isobrachial) or unequal (Heterobrachial).

5. **Kinetochores** : This is a disc-shaped protein structure attached to the centromeric portion
 6. **Telomere** : This term is applied to the cytologically distinct tips of the chromosomes , these are specific for a chromosome and are rich in G and T bases.
 7. **Nucleolar Organising Region (NOR)** : These areas are certain secondary constrictions containing the genes which code for ribosomal RNA that induce the formation of nucleoli. The chromosomes with these regions are called nucleolar organising chromosomes
 8. **Satellites** : This is a rounded body separated from the rest of the chromosome by a secondary constriction, a chromosome having satellite is called SAT-chromosome and these are considered marker chromosome (SAT-Sine Acid Thymonuclenico)
- Based on the position of the centromere, the chromosomes can be classified into four types.
 - i) The **metacentric chromosome** has middle centromere forming two equal arms of the chromosome. These chromosomes appear 'v'-shaped
 - ii) **The sub-metacentric chromosome has centromere is slightly away from the centre** resulting into one shorter arm and one longer arm. Appear 'L'-shaped
 - iii) In case of **acrocentric chromosome** the centromere is situated close to its end forming one extremely short and one very long arm. These appear 'J'-shaped
 - iv) Whereas the **telocentric chromosome** has a terminal centromere. These appear 'i'-shaped

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numerical) will lead to change in the characters of an organism

MICROBODIES:

➤ These are single membrane bound organelles associated with oxidation reactions other than those of respiration. These include

- A. Peroxisomes
- B. Glyoxysomes

A) Peroxisomes : Peroxisomes are spherical, sac-like structures, bounded by a single membrane. Initially these were reported in animals only, but later also discovered in plants. Christian De Duve discovered them for the first time. These were called **peroxisomes**, because these contain 'peroxide-producing enzymes (oxidases) and 'peroxide'-destroying enzymes (catalases)

➤ Peroxisomes are involved in the catabolism of long chain fatty acids and play important role in the synthesis of phospholipids.

➤ Peroxisomes are involved in photorespiration and protection of cells from toxic effects of hydrogen peroxide.

b) Glyoxysomes : Glyoxysomes are bounded by a single membrane. These contain enzymes for the glyoxylate cycle through which fats are converted into carbohydrates (gluconeogenesis). These are found in germinating seeds, especially in germinating fatty seeds such as castor seeds.

➤ Sometimes a few chromosomes have non-staining secondary constrictions at a constant location. This gives the appearance of small fragment called the **satellite**.

➤ When viewed under electron microscope, chromatin appears as "beads-on-string". The beads are now known as "**nucleosomes**".

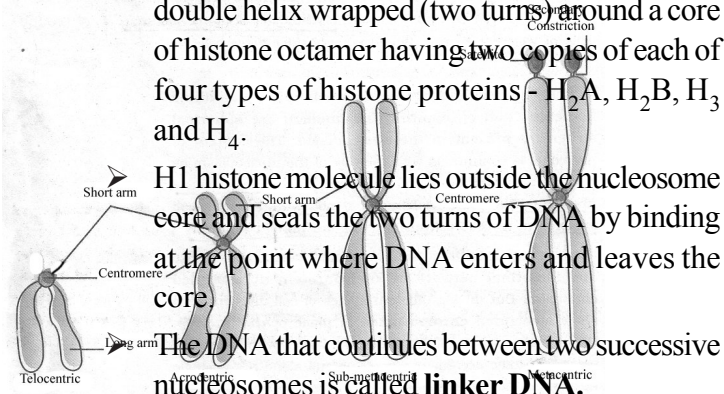
➤ A typical nucleosome contains **200bp** of DNA double helix wrapped (two turns) around a core of histone octamer having two copies of each of four types of histone proteins - H₂A, H₂B, H₃ and H₄.

➤ H1 histone molecule lies outside the nucleosome core and seals the two turns of DNA by binding at the point where DNA enters and leaves the core.

➤ The DNA that continues between two successive nucleosomes is called **linker DNA**.

➤ The association between negatively charged DNA and positively charged histones allows for meaningful DNA packaging inside the nucleus.

➤ The beads-on-string structure in chromatin is packaged to form chromatin fibres that are further coiled and condensed to form the chromosomes.



FUNCTIONS OF CHROMOSOMES:

- 1) Chromosomes are responsible for carrying the genetic information from one generation to another, as genes are located on them
- 2) Any variation in chromosome (Structural or

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DIFFERENCE BETWEEN PROKARYOTIC AND EUKARYOTIC MITOCHONDRIA

S.No.	OUTER PROKARYOTIC MITOCHONDRIA RIBOSOMES	INNER EUKARYOTIC MITOCHONDRIA RIBOSOMES
1.	The cristae are absent in prokaryotes, mitochondria and plastids of eukaryotes.	The cristae are present in eukaryotes.
2.	Sedimentation coefficient is 70S. large solutes.	Sedimentation coefficient is 80S. small number of solutes & metabolites.
3.	The ribosomes are free.	They are both free and membrane bound.
4.	The size is 20-29nm in length & 17-21nm in breadth.	The size is 30-4nm x 20-24nm.
5.	Weight of lipid & cholesterol contents are high.	The lipid & cholesterol contents are 1/3-1/6 of the outer membrane.
6.	The smaller and larger subunits are respectively 30S and 50S.	The two subunits are 40S and 60S.
7.	The Antigenic content is 60-65.	RNA to protein ratio is 4-15.
8.	Number of protein molecules is 21 in smaller subunit and 34 in larger subunit.	Elementary particles are present. 30 in smaller subunit and 40 in larger subunit.
9.	RNAase present in smaller subunit and 23S + 16S in larger subunit.	RNAase present in smaller subunit and 23S + 16S + 5S in larger subunit.
10.	All the rRNA are transcribed nearby.	18S, 5.8S, 28S rRNAs are transcribed in the region of nucleolus while 5S rRNA is synthesized away from it.
11.	Ribosomes synthesis occurs in cytoplasm of prokaryotes and matrix of mitochondria as well as plastids.	Ribosome synthesis occurs in the nucleolus.
12.	Protein synthesis is inhibited by chloramphenicol but not by cycloheximide.	Protein synthesis is inhibited by cycloheximide but not chloramphenicol.

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DIFFERENCES BETWEEN CILIA AND FLAGELLA

S.No.	<i>CILIA</i>	<i>FLAGELLA</i>
1.	A cell bears many cilia, 300-14000.	A cell bears few flagella, 1-4.
2.	The length is 2-10 μ m.	The length is 100-150 μ m.
3.	Cilia occur throughout or on major part of the cell surface.	Flagella develop from one end of the cell.
4.	There is coordination in beating of different cilia of the same cell.	Flagella show independent beating.
5.	Ciliary beating is asymmetrical.	Flagellar beating is symmetrical.
6.	Cilia perform sweeping or rowing action.	Flagella perform undulatory action.
7.	Besides locomotion, cilia can perform function of circulation, aeration, protection, feeding, etc.	Flagella take part in locomotion only.
8.	They may form cirri and undulating membrane.	Such groupings and fusions are unknown in flagella.

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MODEL TEST - I

- Who observed few living cells capable of moving, such as bacteria, protozoa, spermatozoa and red blood corpuscles under his own designed microscope?
1) Aristotle 2) Robert Hooke
3) Leeuwenhoek 4) Dutrochet
- Cells that have membrane bound nucleus are found in
1) Rhizobium 2) Meristem
3) Sieve tube 4) Nostoc
- Endomembrane system of cell includes
1) Golgi complex
2) Lysosome and vacuoles
3) ER 4) All of these
- Intercellular matrix or common layer between the primary walls of adjacent cells is
1) Middle lamella 2) Primary wall
3) Secondary wall 4) Periplasmic space
- Which structure determines the shape of the cell and provides a strong structural support to prevent the bacterium from bursting?
1) Slime layer 2) Capsule
3) Cell membrane 4) Cell wall
- The semifluid nature of the biomembrane
1) Helps in quick repair
2) Provides dynamic nature
3) Gives semipermeable nature
4) More than one option is correct
- Which face of golgi complex rise to the secretory vesicles?
1) Trans face 2) Proximal face
3) Convex face 4) Cis face
- A forming face and maturing face are seen in this cell organelle
1) Golgi complex 2) Endoplasmic reticulum
3) Chloroplast 4) Mitochondria
- RER is found abundantly in those cells which are actively involved in

- 1) Protein synthesis 2) Lipid synthesis
3) Steroidal hormones synthesis
4) Glycogen metabolism
- This is not a function of the cell organelle which was named by Porter
1) Protein synthesis
2) Synthesis of cell wall materials
3) Lipid synthesis
4) Synthesis of steroidal hormones

KEY

- 1) 3 2) 2 3) 4 4) 1 5) 4
6) 4 7) 1 8) 1 9) 1 10) 2

MODEL TEST - II

- Which of the following is not true of a eukaryotic cell?
1) It has 80S type of ribosome present in the mitochondria
2) It has 80S type of ribosome present in the cytoplasm
3) Mitochondria contain circular DNA
4) Membrane bound organelles are present
- Plastid differs from mitochondria on the basis of one of the following features. Mark the right answer
1) Presence of two layers of membrane
2) Presence of ribosome
3) Presence of chlorophyll
4) Presence of DNA
- Many ribosomes may associate with one mRNA to form
1) Polyhedral bodies 2) Polysome
3) Nucleosome 4) Plastidome
- The power house of the cells has
1) DNA 2) RNA
3) Ribosomes 4) All the above
- Which one of the following plastid is involved in storage of proteins in maize?
1) Chromoplast 2) Chloroplast
3) Amyloplast 4) Aleuroplast
- Which one of the following function is not associated with microtubules?

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- 1) Help in anaphasic movement of chromosomes
2) Form the cytoskeleton of cilia and flagella
3) Help in pseudopodia formation
4) Spindle and astral ray formation
17. Centrioles have
1) 9+2 arrangement of microtubules
2) 9 peripheral doublet microtubules
3) 2 centrally located microtubules
4) An organisation like the cart wheel
18. One centrosome contains ____ centrioles
1) one 2) two
3) three 4) many
19. Which of the following cell organelles is concerned with photophosphorylation?
1) Mitochondria 2) Plastochondria
3) Chloroplast
4) More than one option is correct
20. The interdoublet links in eukaryotic flagellum are made up of a protein called.
1) Nexin 2) Dynein 3) Flagellin 4) Actin

KEY

- 11) 1 12) 3 13) 2 14) 4 15) 3
16) 3 17) 4 18) 2 19) 3 20) 1

MODEL TEST - III

21. Cell organelle with both oxidase and catalase enzymes is
1) Lysosome 2) Peroxisome
3) Mitochondria 4) Sphaerosome
22. Karyotheca or nuclear membrane is absent in
1) Nostoc 2) Rhizobium
3) Drosophila 4) Both (1) & (2)
23. This part of nucleolus is in contact with endoplasmic reticulum
1) Pore 2) Inner membrane
3) Outer membrane 4) Chromatin
24. Single human cell is with ____ number of chromosomes
1) 23 pairs 2) 46 pairs
3) 23 4) 22 pairs

25. Chromosome with two arms can be seen in chromosome
1) Metacentric 2) Sub-metacentric
3) Acrocentric 4) All the above
26. Lightly stained region of chromatin during interphase is
1) Genetically inactive
2) Highly condensed region
3) Rich in loosely packed DNA
4) Rich in tightly packed DNA
27. Kinetochore is associated with
1) Primary constriction
2) Secondary constriction
3) Satellite
4) More than one option is correct
28. Centromere is also known as
1) Satellite
2) Primary constriction
3) Kinetochore
4) Secondary constriction
29. The position of Secondary constriction is
1) near centromere 2) at tip
3) constant 4) variable
30. Type of histone proteins present in chromatin are
1) 4 2) 5 3) 8 4) 9

KEY

- 21) 2 22) 1 23) 3 24) 1 25) 4
26) 3 27) 1 28) 2 29) 3 30) 2

MULTIPLE CHOICE QUESTIONS

TYPE - I

31. The middle lamella is composed of
1) Pectates 2) Cellulose
3) Lignin 4) Proteins
32. Cell wall is present in
1) Plant cells 2) Prokaryotic cell
3) Algal cell 4) All the above
33. Plasma membrane is
1) Selectively permeable 2) Permeable
3) Impermeable 4) Partial permeable

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34. Selective permeability occurs in
1) Cell wall 2) Plasma membrane
3) Cytoplasm 4) None of these
35. C.Schleiden a German botanist examined a large number of plants and observed
1) All plants are composed by cells similar in structure and function
2) All plants contain dissimilar cells of different function
3) All plants are formed by both similar and dissimilar cells.
4) All plants are formed by different kinds of cells which form the tissue of the plant.
36. In fluid mosaic model of plasma membrane
1) Upper layer is non-polar & hydrophilic
2) Polar layer is hydrophobic
3) Phospholipids form a bimolecular layer in middle part
4) Proteins form a middle layer
37. Plasmodesmata connections help in
1) Cytoplasmic streaming
2) Synchronous mitotic divisions
3) Locomotion of unicellular organisms
4) Movement of substances between cells
38. Which one of the following is not a constituent of cell membrane?
1) Cholesterol 2) Glycolipids
3) Proline 4) Phospholipids
39. Cell theory as proposed by Schleiden and Schwann explains
1) All living organisms are composed of cells and products of cell
2) All cells arise from pre-existing cells
3) Cell is the structural and functional unit of all organisms
4) Both 1 and 3
40. Three morphological forms of Golgi complex are
1) Lamellae, tubules & vesicles
2) Cisternae, tubules & vesicles
3) Cisternae, tubules & lamellae
4) Granum, thylakoids & vesicles
41. Semi autonomous cell organelles of cell are
1) Nucleus & chloroplast
2) Chloroplast & mitochondria
3) Vacuoles & Golgi complex
4) Ribosome & lysosome
42. Cristae are found in
1) Surface of grana
2) Surface of plasma membrane
3) Wall of Mitochondria
4) Nuclear membrane
43. A single unit membrane organelle is
1) Ribosomes 2) Mitochondria
3) Chloroplast 4) Lysosomes
44. Which of the following plastids are helpful in starch formation and storage?
1) Chromoplast 2) Leucoplasts
3) Chloroplast 4) Lycopene
45. Lamellae of chloroplast are known as
1) Granum 2) Frets
3) Thylakoids 4) Stroma lamellae
46. 70S type of ribosomes is found in
1) Prokaryotic cells
2) Prokaryotic cells, chloroplasts & mitochondria
3) Mitochondria
4) Nucleus, mitochondria
47. Grana & stroma lamellae are the parts of
1) Mitochondria
2) Chloroplast
3) Endoplasmic reticulum
4) Vacuoles
48. The main area of cellular activities in plant and animal cell is
1) Cytoplasm 2) Nucleus
3) Nucleolus 4) Chromosomes
49. Which of the following substances are stored in Aleuroplast
1) Starch 2) Oil & Lipids
3) Proteins 4) Water & Oil
50. Smallest cell organelle which is called protein factory is
1) Ribosome 2) Lysosome
3) Vacuoles 4) Endoplasmic reticulum
51. The Ribosomes are made up of
1) DNA+Protein 2) RNA+Protein
3) DNA+RNA 4) None of these

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52. Cilia and flagella both have
1) 9+2 arrangement of microtubule
2) Protective structure of cells
3) Only present in protozoa animals
4) Only outgrowth structure of cytoplasm
53. Centrioles & centrosomes are present in cells of
1) Animals 2) Bacteria
3) Green cells 4) Cyanobacteria
54. Double membrane bound bodies in eukaryotic cell are
1) Mitochondria, plastids, nucleus
2) Peroxisomes, Glyoxysomes
3) E.R, Golgi complex
4) Lysosomes and vacuoles
55. Eukaryotic cell differ from Prokaryotic cell in having
1) membrane bound organelles
2) membrane bound Nucleus
3) Both 1 and 2
4) dense matrix of cytoplasm
56. Which of the following pair lack the unit membrane?
1) Nucleus & E.R.
2) Mitochondria & chloroplast
3) Ribosome & nucleolus
4) Golgi body & lysosome
57. Golgi body is concerned with
1) Respiration 2) Secretion
3) Excretion 4) Degradation
58. The cell organelles commonly present in both prokaryotes and eukaryotes
1) Peroxisomes 2) Lysosomes
3) Ribosomes 4) Nucleolus
59. Within the cells ribosomes are found in
1) Chloroplast, Mitochondria, Rough E.R
2) Rough E.R microbodies
3) Chloroplast, golgi complex
4) Mitochondria, and Lysosomes
60. Chromosome with centromere at one end
1) Metacentric 2) Sub-metacentric
3) Telocentric 4) Acrocentric
61. The cell organelle in animal cell that helps in cell division
1) Ribosomes 2) Centrioles
- 3) Nucleus 4) Lysosomes
62. One genome is which type of set of chromosomes
1) Haploid 2) Diploid
3) Triploid 4) Polyploid
63. Which structure is present in chromosomes
1) Nucleus 2) Centromere
3) Centrosome 4) Golgi body
64. Part of chromosome which joins with spindle fibres is
1) Chromatid 2) Chromonema
3) Chromomere 4) Centromere
65. Choose the correct statement
1) All cells are structurally similar and functionally dissimilar
2) All cells are Functionally similar through they differ in size and shape
3) All cells are structurally similar and functionally similar
4) All cells differ gradually in size, shape and activities
66. Plant with minimum number of chromosomes is
1) *Haplopappus gracilis*
2) *Salix tetrasperma*
3) *Poa* 4) *Cynodon*
67. Number of base pairs present in DNA wrapped around a core of histone proteins
1) 146 2) 154 3) 200 4) 54
68. In group like bacteria, blue green algae, mycoplasma and PPLO (pleuro pneumonia like organisms) the cell representation explains as they are
1) Eukaryotic cell 2) Prokaryotic cell
3) Eukaryotic cell without membrane bound cell organelles
4) Eukaryotic cells that lack macro bodies
69. Cilia and flagella arise from
1) Basal bodies 2) Basal granules
3) Blepharoplasts 4) All of the above
70. Choose the correct statement
1) All prokaryotes have cell wall surrounding cell membrane
2) All prokaryotes lacks membrane bound cell organelles

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- 3) Prokaryotes are identified by membrane bound nucleus
- 4) Chromatin material with histone proteins seen in prokaryotes
71. What is the site of enzyme synthesis in cells
- 1) Golgi body 2) Ribosome
3) Lysosomes 4) Smooth endoplasmic reticulum
72. In prokaryotes in addition to the genomic DNA small circular DNA are present outside these structures are called as
- 1) Plasmids 2) Nucleoid
3) Chromosomes 4) Mesosomes
73. Glycosidation of lipids and proteins occurs in the cell organelle called
- 1) Golgi complex 2) Mitochondria
3) Ribosomes 4) Peroxisomes
74. Which of the following cell organelles is juxtaposed to nucleus and contains cisternae
- 1) Lysosomes 2) Mitochondria
3) Peroxisomes 4) Golgi apparatus
75. Oxidation of $\text{NADH} + \text{H}^+$ to NAD^+ occurs in
- 1) F_1 particles of mitochondria
2) Mitochondrial matrix
3) Outer membrane of mitochondria
4) shuttle mechanism of mitochondria
76. The term 'suicide bag' is applicable to cell organelle
- 1) Golgi apparatus 2) Lysosome
3) Microsome 4) Peroxisome
77. Certain unique phenotypic characters to bacteria are indicated by
- 1) Nucleoid 2) Chromosomes
3) Genomic DNA 4) Plasmid DNA
78. In bacteria this structure confers resistance to antibiotics
- 1) Circular DNA 2) Plasmid DNA
3) Genomic DNA 4) Both 2 and 3
79. Identify the example of plant in which chloroplast transform into chromoplast
- 1) Fruits of Tomato and Chillies
2) Lady finger 3) Cucurbita
4) Cotton
80. Bacteria can be classified into two groups on the basis of
- 1) Differences in the chemical composition of cell wall
2) Staining reaction 3) Mode of nutrition
4) Both 1 and 2
81. Smooth endoplasmic reticulum is well-developed in the cells, which synthesize
- 1) Steroids 2) Proteins
3) Carbohydrates 4) All of these
82. A piece of chromatin with 40 H_4 proteins means it contains ___ number of nucleosomes
- 1) 5 2) 10 3) 40 4) 20
83. More ribosomes would be found in
- 1) Parenchymatous cells 2) Dead cells
3) Meristematic cells 4) Lignified cells
84. The Golgi complex plays major role
- 1) As energy transducing organelles
2) In digesting proteins and carbohydrates
3) In trapping light quanta and transforming them into chemical energy
4) In glycosidation of lipids and proteins to produce glycolipids and glycoproteins
85. When will green tomatoes turn red
- 1) New chloroplasts are made
2) Chloroplasts are disintegrated and converted into chromoplasts
3) Carbon assimilation will not occur
4) Respiration will not take place
86. If the ribosomes of a cell are destroyed then
- 1) Fats will not stored
2) Proteins will not be formed
3) Carbon assimilation will not occur
4) Respiration will not take place
87. A feature common to nucleus, chloroplast and mitochondria is at the presence of
- 1) Lamellae 2) Cristae
3) Nucleic acids 4) All the above
88. In the plasmalemma, the hydrophobic tails of the lipid molecules are present towards the inner part to protect them from
- 1) Toxins 2) Aqueous environment

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106. Cell organelle extract from endosperm of germinating castor beans are
1) Glyoxysomes 2) Peroxisomes
3) Transposons 4) None of these
107. The pigment, which is not found in chloroplast is
1) Carotene 2) Chlorophyll
3) Xanthophyll 4) Anthocyanin
108. The enzymes present in lysosomes belong to class namely
1) 1 2) 2 3) 3 4) 4
109. As they release hydrolase that digest old and damaged cells, the term suicide bags is aptly used by cell biologists for the
1) Golgi bodies 2) Lysosomes
3) Glyoxysomes 4) Glyoxysomes
110. Which of the following statements is correct
1) Ribosomes do not contain DNA
2) Eukaryotic 80S ribosomes break into 50S and 30S
3) Plasmodesmata are found as intercellular junction between animal cells
4) Ribosomes were discovered by Beadle and Tatum
111. Which cell structure, substructure acts as the site of oxidation reduction reaction
1) Glyoxysomes 2) Mitochondrial cristae
3) Lysosomes
4) Coated vesicles in Golgi complex
112. Membrane bound space with cell sap most common to plant cells is
1) Chloroplast 2) Lysosome
3) Vacuole 4) Chromoplast
113. A cell biologist used ultrasonic method to disrupt the cell and found fragments in cell organelle, which served as site of ATP synthesis. These fragments actually are the parts of
1) Mitochondria 2) Lysosomes
3) Liposomes 4) Ribosomes
114. One of these is an important function of vacuole
1) Osmoregulation 2) Starch synthesis
3) Energy production 4) Digestion
115. Mitochondria are called as the power houses of the cell because
1) They produce ATP
2) They release
3) They use
4) They synthesis proteins
116. Select the false statement
1) Ribosomes and centriole are non-membrane bound organelles of a cell
2) Ribosomes are enveloped by a double membrane
3) Plasmodesmata are the cytoplasmic connections between cells
4) Cell membrane is semipermeable or selectively permeable
117. The cell organelle which has DNA is
1) Endoplasmic reticulum
2) Golgi complex 3) Lysosome
4) Mitochondria
118. Identify the correct pair
1) 70% of cellular proteins –Mitochondrial enzymes
2) Lysosomes –Oxidoreductases
3) Peroxisomes–Hydrolases
4) Ribosomes–Transferases
119. Most living cells acquire unwanted compounds either by absorption from their surroundings or as by products of chemical activities. Cell would die if such compounds accumulated in cytoplasm & nucleus. Hence, mechanisms have evolved to effect their removal. In palnt cells, this is accomplished by developing a system of
1) Membranes such as the endoplasmic reticulum
2) Pores in nuclear wall
3) Vacuoles
4) Semipermeable cell membranes surroundin the cytoplasm
120. Under what conditions do lysosomes cause autolysis
1) Starvation 2) Excess food
3) Injection 4) All the above
121. One of these is a cell organelle common in both monera and protista
1) Ribosome 2) Lysosome
3) Mitochondria 4) Chloroplast

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| <p>122. The process in the cell that is the source of energy for cellular activities is
 1) Photosynthesis 2) Respiration
 3) Fermentation 4) All of these</p> <p>123. Ribosomes present in mitochondria are of this type
 1) 70S 2) 80S 3) 30S 4) 60S</p> <p>124. The cell organelle that is continuous with the outer membrane of the cell is
 1) Mitochondria 2) Endoplasmic reticulum
 3) Golgi complex 4) Lysosome</p> <p>125. Which of the following is not the function of the golgi apparatus
 1) Proteins synthesized by the ribosomes on the endoplasmic reticulum are transferred to the Golgi, where it is accumulated in sacs. These sacs may migrate to the surface of the cell and discharge their contents to the outside
 2) The protein filled sacs may be retained within the cells as ribosomes
 3) It is the site, where the synthesis of polysaccharides takes place
 4) It is the site, where synthesis of lipids takes place</p> <p>126. Plastids are seen in all plant cells and also in
 1) Animals 2) Bacteria
 3) Euglenoids 4) All the above</p> <p>127. Classification of plastids is based on their
 1) Size 2) Pigments
 3) Motility 4) Nuclei acid</p> <p>128. The types of plastids present in a genus <i>Solanum tuberosum</i> are
 1) Chloroplasts 2) Chromoplasts
 3) Leucoplasts 4) All the above</p> <p>129. The fine network of membranes distributed throughout the cytoplasm in a cell is
 1) Golgi body 2) Mitochondria
 3) ER 4) Lysosomes</p> <p>130. Autonomic genome system is present in
 1) Mitochondria and ribosomes
 2) Mitochondria and chloroplast
 3) Ribosomes and chloroplast
 4) Golgi body and mitochondria</p> <p>131. The pigment molecules of a chloroplast are</p> | <p>located within
 1) Its thylakoid membranes
 2) The space between the inner and outer membranes
 3) The inner membrane 4) Intrathylakoid spaces</p> <p>132. Number of chloroplasts in a cell of <i>Chlamydomonas</i> are
 1) 20-40 2) One
 3) Numerous 4) 5 or 6</p> <p>133. Double membrane bound cell organelles of cytoplasm are
 1) Chloroplast 2) Mitochondrion
 3) Chloroplast, Mitochondrion and Nucleus</p> <p>134. Double membrane bound organelles of protoplasm are
 1) Chloroplast 2) Mitochondrion
 3) Both 1 and 2
 4) Chloroplast, Mitochondrion and Nucleus</p> <p>135. After packing materials golgi apparatus secretes them to the
 1) Inside of the cell 2) Outside of the cell
 3) Both 1 and 2
 4) Secretion is not a function of golgi</p> <p>136. The space limited by inner membrane of chloroplast is
 1) Stroma 2) Lumen
 3) Periplastidial 4) Cavity</p> <p>137. Choose the correct match
 1) Cell organelles–Inactive hydrolytic enzyme
 2) Centrosome–Smallest cell
 3) Cell drinking–Cilium or flagellum
 4) Nucleoid – Prokaryotes</p> <p>138. Intergranal thylakoid are known as
 1) Grana lamella 2) Stroma lamellae
 3) Lumen 4) Stroma</p> <p>139. Continuity of cytoplasm from cell to cell is maintained through cytoplasmic connections in plants called
 1) ER 2) Tight junction
 3) Gap junction 4) Plasmodesmata</p> <p>140. Amembranous cell organelles inside chloroplast are
 1) Pigments 2) Circular DNA</p> |
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- 3) Granum 4) Ribosome
141. The main difference between active and passive transport across cell membrane is that the
- 1) Passive transport is non-selective
 - 2) Active transport occurs more rapidly than passive transport
 - 3) Passive transport is gradient based, while active transport is energy based against concentration gradient
 - 4) Passive transport is confined to anions, while active transport is for cations only
142. Pigments required for light reaction of photosynthesis are present in
- 1) Stroma 2) Lumen
 - 3) Ribosome 4) Thylakoids
143. Trans membranes are
- 1) Glycocalyx 2) Intrinsic proteins
 - 3) Extrinsic protein 4) Tunnel protein
144. Enzymes required for protein synthesis are present in
- 1) Stroma 2) Lumen
 - 3) Circular DNA 4) Granum
145. ions play an important role in
- 1) Association of ribosomal sub units
 - 2) Formation of middle lamella
 - 3) Both 1 and 2
 - 4) Production golgi complex
146. According to fluid mosaic model, plasma membrane consists of
- 1) Cellulose, hemicellulose
 - 2) Phospholipid, intrinsic protein, extrinsic protein
 - 3) Phospholipid, intrinsic protein
 - 4) Phospholipidm hemicellulose
147. Network of proteinaceous filaments present in cytoplasm is known as
- 1) Endoplasmic reticulum
 - 2) Cytoplasm 3) Cytoskeleton
 - 4) Cell-organelles
148. What is the difference between DNA of chloroplast and nuclear DNA
- 1) Single DNA in chloroplast
 - 2) Less number of basis in DNA of chloroplast
- 3) Absence of histone proteins 4) All of the above
149. Nucleoid is a
- 1) Single inactive nucleus with double stranded DNA and protein
 - 2) A nucleus without karyotheca with proteins
 - 3) Chromosome associated with proteins
 - 4) Group of chromosomes associated with proteins
150. One of the following is not a part of cytoskeleton
- 1) Microfilaments 2) Microsomes
 - 3) Microtubules 4) Intermediate filaments
151. Nucleus was discovered by
- 1) Robert Hooke 2) Robert Brown
 - 3) Robert Dixen 4) Robet Koch
152. One of the most abundant constituent of a cell that has a unique structure is
- 1) Amino acid 2) Carbohydrate
 - 3) Water 4) Nucleic acid
153. During cell division, movement of chromosomes is cooperated by
- 1) Cilia 2) Flagella
 - 3) Cytoskeleton 4) Ribosomes
154. Chromosomes with terminal centromeres are known as
- 1) Telocentric 2) Metacentric
 - 3) Sub metacentric 4) Acrocentric
155. The organelle of plant cell that does not contain functional DNA, is
- 1) Nucleus 2) Chloroplast
 - 3) Mitochondrion 4) Peroxisome
156. Which one of the following pairs is not correctly matched?
- 1) Nucleus – Genetic information
 - 2) Cell membrane– Selectively Permeable
 - 3) Golgi complex– Secretion
 - 4) Microtubular organelles – Glycolysis
157. The central core of cilium (or) flagellum is known as
- 1) Axoneme 2) Microtubule
 - 3) Doublet 4) Triplet
158. Centriole like structure causing the emergence of cilium or flagellum is known as
- 1) Basal body 2) Hub
 - 3) Axoneme 4) Centrosome

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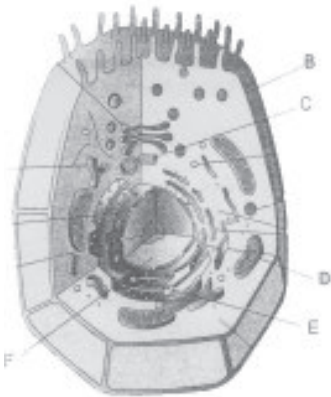
159. Thread like coloured material of eukaryotic nucleus is known as

- 1) Karyon 2) Nucleolous
 3) Chromatin 4) Spoke

160. Tick the wrong statement

- 1) Mammalian erythrocytes are without nucleus
 2) All dead cells are without nucleus
 3) Mature sieve tube cells of cryptogams are without nucleus
 4) All eukaryotic cells are with nuclear membrane

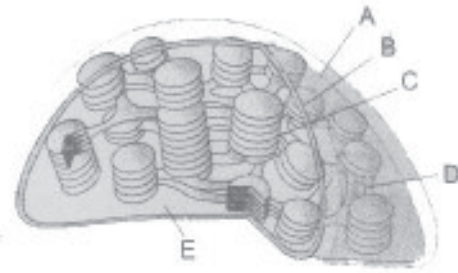
161. Identify the correct statements in the given cell



- A. Concerned with lipid and steroidal 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 and secretion
 F. Spherical structures, rich in hydrolytic enzymes

- 1) A, D & E 2) B, C, D
 3) A, C & E 4) A, B, C, F

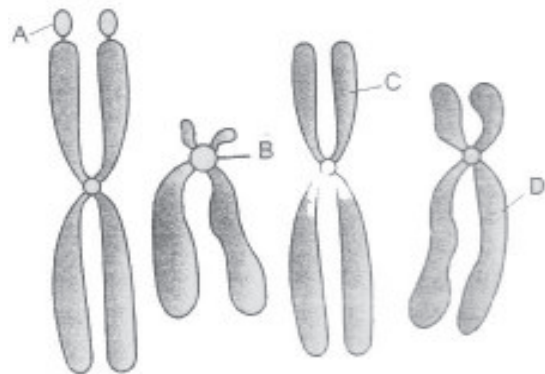
162. Consider the following five statements (A to E) w.r.t chloroplast shown below. select the correct option stating which ones are True (T) and which ones are False (F)



- A. It is impermeable and lack porins
 B. It is selectively permeable having carrier proteins for transport
 C. Stalked 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	T
2) F	T	T	F	T	T
3) T	F	T	T	T	T
4) T	F	F	T	T	T

163. 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 - 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

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TYPE - II

164. Prokaryotic cell differs from eukaryotic cell in lacking
I) Nuclear envelope
II) Membrane bound cell organells
III) Nucleolus IV) Histone proteins
1) I, II, III and IV 2) I and II only
3) I, II and III 4) I and III only
165. Regarding prokaryotic cells
I) Absence of nucleus
II) Absence of membrane-bound protoplasm.
III) Compartmentalized nuclear material and cytoplasm
IV) Absence of nucleolus
1) I only correct 2) I and II correct
3) II and III only incorrect
4) IV only correct
166. Middle lamellum is
I) The intercellular cement-like substance binding adjacent cells together
II) Made up mainly of calcium pectate and little amount of magnesium pectate
III) Cell plate formed during cytokinesis transforms into middle lamellum
IV) Found in the middle of primary wall and secondary wall
1) I and II are only correct
2) II and III are only correct
3) I, II, III and IV are correct
4) IV alone is incorrect
167. Structures responsible for intracellular transport of materials
I) E.R II) Golgi complex
III) Peroxisomes IV) Cytoskeleton
1) I and II are correct 2) II and III are correct
3) III and I are correct 4) I and IV are correct
168. Study the following statements. The correct statements are
I) The diameter of ribosomes is 230 \AA
II) Eukaryotes and Prokaryotes have both 80 S and 70 S ribosomes
III) 80S ribosomes are formed by association between 50 S and 30 S sub units
IV) Polyribosomes translate and produce different polypeptides
1) I only 2) I and III only
3) I, II, and III only 4) II and IV
169. Cell organelles concerned with the formation of cell plate are
I) Golgi complex II) Lysosomes
III) Ribosomes IV) Mitochondria
1) I and II are correct
2) I and III are correct
3) III and IV correct 4) I only
170. Amembranous structures of the animal cell are
A) Ribosome B) Nucleolus
C) Centrosome
1) A only 2) ABC
3) AB only
4) A and C only
171. Conversion of leucoplasts to chloroplasts is found in
I) Tubers of Radish II) Potato tubers
III) Fruit of Tomato IV) Maize kernels
1) I and II only 2) II and III are correct
3) III and IV are correct
4) IV and II are correct
172. Find out the correct match with regard to stored food
I) Aleuroplasts-Proteins
II) Elaioplasts-Fats and Oils
III) RER - Glycogen
IV) Amyloplasts-Starch
1) I & II only 2) I, II, III & IV
3) I, II, & IV 4) I, III and IV
173. Common character found in chloroplasts and mitochondria is
I) Both involve in metabolism
II) Photophosphorylation
III) Both are semi autonomous organelles
IV) Both contain oxysomes
1) I & II 2) II & IV
3) I & III 4) III & IV
174. Carotenoids are found in
I) Chloroplasts II) Leucoplasts
III) Vacuole IV) Chromoplasts

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- 1) I only 2) I and II
3) II and III 4) I and IV
175. Chloroplast does not contain
I) Double membraned envelope
II) Grana and Stroma
III) Matrix and Cristae
IV) Circular DNA and 70 S ribosomes
1) I and IV 2) I and III
3) III only 4) II and IV
176. Correct statement regarding Mitochondria and Chloroplast
I) ATP synthesis is seen in both
II) Outer membrane has more surface in both
III) Circular naked DNA, RNA and 70S ribosomes are seen in both
IV) Oxidative phosphorylation occurs in both
1) I and II 2) II and III
3) I and III 4) I and IV
177. Single membrane bound organelles are
I) Lysosomes II) Peroxisomes
III) Ribosomes IV) Glyoxysomes
1) I and II 2) I, II and III
3) I, II and IV 4) I, II, III and IV
178. Double membraned envelope is found around
I) Nucleus II) Plastids
III) Mitochondria IV) ER
1) I and II 2) II and III
3) III and IV 4) I, II and III

TYPE - III

SIMPLE MATCHING TYPE

212. Some cellular structures bounded by single or double membranes, while some other without a membrane. Match the organelle in List I with the nature of membrane in List II and select the correct answer using the codes given below the lists

List -I

List -II

- | | |
|-----------------|---------------------------------|
| A) Mitochondria | 1) Without membrane |
| B) Lysosomes | 2) Single membrane |
| C) Ribosomes | 3) Double membrane |
| D) Nucleus | 4) Double membrane with prosoed |

	A	B	C	D
1)	1	2	3	2
2)	3	1	1	1
3)	3	2	1	3
4)	2	3	1	3

213. Match List I with II and select the correct answer using the codes given below the lists

List -I

List -II

- | | |
|-----------------|-------------------|
| A) Dictyosomes | 1) Storage |
| B) Mitochondria | 2) Photosynthesis |
| C) Vacuoles | 3) Transport |
| D) Grana | 4) Secretion |
| | 5) Respiration |

	A	B	C	D
--	---	---	---	---

1)	4	5	1	2
2)	3	4	2	1
3)	4	5	3	2
4)	4	3	1	2

214. Match list I with List II and select the correct answer

List -I

List -II

- | | |
|------------------|--------------------------------|
| A) Nucleolus | 1) Lipid storage |
| B) Sphaerosomes | 2) Glycolate metabolism |
| C) Peroxisomes | 3) Transport of macromolecules |
| D) Plasmodesmata | 4) RNA synthesis |

	A	B	C	D
--	---	---	---	---

1)	4	1	3	2
2)	1	2	4	3
3)	4	1	2	3
4)	1	2	3	4

215. Match the following

List -I

List -II

- | | |
|---------------------------------|------------------------|
| A) Lysosomes | 1) Protein synthesis |
| B) Ribosomes | 2) Hydrolytic activity |
| C) Smooth endoplasmic reticulum | 3) Steroidogenesis |
| D) Centriole | 4) Glycolytic activity |

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E) Chromosomes

5) Repository of genetic information

6) Formation of spindle apparatus

	A	B	C	D	E
1)	2	1	3	6	5
2)	6	3	4	5	1
3)	1	4	3	6	1
4)	4	3	1	2	5

216. Match the following

List -I

- A) Karyolymph
- B) Ribonucleoprotein
- C) Spindle fibre
- D) Genes
- E) Rough endoplasmic reticulum

List -II

- 1) Nucleolus
- 2) Nucleus
- 3) DNA
- 4) Centrioles
- 5) Protein synthesis

	A	B	C	D	E
1)	1	3	2	4	5
2)	4	2	3	5	1
3)	2	1	4	3	5
4)	1	2	3	4	5

217. Match the following

List - I

- A) Suicidal bags
- B) Power house of the cell
- C) Cell Brain
- D) Plasmosome

List - II

- I) Mitochondria
- II) Lysosomes
- III) Nucleus
- IV) Chloroplast
- V) Nucleus

	A	B	C	D
1)	II	IV	V	III
2)	I	IV	V	III
3)	II	I	V	III
4)	II	IV	V	I

218. Match the following

List - I

- A) Lysosome
- B) Nucleolus
- C) Nucleus
- D) Golgi complex

List - II

- I) Riosome synthesis
- II) Heredity
- III) Secretion
- IV) Digestion

	A	B	C	D
1)	I	II	III	IV

- 2) IV I II III
- 3) III I II IV
- 4) II I IV III

219. Match the following

List - I

- A) Mitochondria
- B) Peroxisomes
- C) Nucleus
- D) E R

List - II

- I) Photorespiration
- II) Aerobic respiration
- III) Intracellular transport
- IV) Protein synthesis
- V) Heredity

	A	B	C	D
1)	II	I	IV	III
2)	IV	I	V	II
3)	I	IV	V	III
4)	II	I	V	III

220. Match the following

List - I

- A) Glyoxysomes
- B) Leucoplasts
- C) Plasma membrane
- D) Nucleolus

List - II

- I) Storage of food
- II) Osmoregulation
- III) Digestion
- IV) Ribosome synthesis
- V) Conversion of fat to carbohydrate

	A	B	C	D
1)	V	I	II	IV
2)	I	II	I	IV
3)	IV	II	III	I
4)	V	IV	III	I

221. Match the following

List - I

- A) Mitochondrion
- B) Chloroplast
- C) Lysosome
- D) Vacuole

List - II

- I) Cell with in a cell (Autotrophic endosymbiont)
- II) Suicide bag
- III) Cell furnace
- IV) Power house of cell
- V) Repository of cell

	A	B	C	D
1)	III	II	II	IV
2)	IV	I	II	III
3)	III	I	II	V
4)	IV	V	III	II

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TYPE - IV
MULTIPLE MATCHING TYPE

222. Study the following Table

Cell organelle	Discoverer	Function
I. Ribosomes	Palade	Protein synthesis
II. Golgi complex	Golgi	DNA synthesis
III. Glyoxysomes	Bridenbach	Fat metabolism
IV. Nucleus	Robert brown	Cell plate

Which two show the correct combination ?

- 1) I and II 2) II and III 3) III and IV 4) I and III

223. Study the following table

Structure	Chlorophylls	Carotenes	Xanthophylls
I. Chloroplast	Present	Present	Present
II. Chromoplasts	Absent	Present	Present
III. Vacuoles	Absent	Present	Present
IV. Leucoplasts	Absent	Absent	Present

Which two are correct combinations ?

- 1) I and II 2) II and III 3) III and IV 4) I and IV

224. Study the following Table

Cell organelle	Scientist	Function
I. E.R	K.R porter	Production of Golgi complex
II. Lysosomes	Christian de Duve	Autolysis of cell
III. Peroxisomes	Rhodin	Photophosphorylation
IV. Glyoxysomes	Bridenbach	Calvin cycle

Which two are correct combinations ?

- 1) I and II 2) II and III 3) III and IV 4) I and IV

225. Study the following table

Cell structure	Common Name	Function
I) Lysosome	Repository of cell	Digestion of food materials
II) Mitochondria	Power house of the cell	Conversion of potential energy into kinetic energy
III) Nucleus	Cell Brain	Regulates the function of macrocellorganelles only
IV) Vacuole	Suicide bags of cell	Osmoregulatory process

Correct combination is

- 1) I and IV 2) II alone 3) III and IV 4) II and III

226. Cell organelle Discovered by Formed from Enveloped by Functions

I) Plasmosome	Fontana	Nucleolar	No unit	Synthesis of ribosomes
II) Idiosome	Golgi	E.R	One unit membrane	Cell wall material synthesis
III) Lysosome	de Duve	Golgi complex	Single unit /ER	Autolysis membrane
IV) Ergosome	Palade	Plasmosome	No unit membrane	Protein synthesis

Correct combinations are

- 1) All are correct 2) II & III 3) I, III & IV 4) I, II, & III

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227. Study the following table

Cell organelle	discovered by	function
I) Lysosome	Christian Gram	Autolysis of cell contents
II) Plasmosomes	Fontana	Production of ribosomes
III) Idiosomes	Camello Golgi	Secretion of hormones
IV) Peroxisomes	Rhodin	Oxidation of Amino acids

The correct combination is

- 1) I & II 2) II & III 3) III & IV 4) II & IV

228. Study the following table and select the wrong combination

Structure	Plastid	Pigments
I) Petals	Chromoplasts	Carotenoids
II) Brown algae	Chromoplasts	Fucoxanthin
III) Red algae	Chromoplast	Phycoerythrin
IV) Blue green algae	Chloroplasts	Phycocyanin

- 1) I and II 2) II and III 3) III and IV 4) IV only

229. Study the following table

Cell organelle	Scientist	Function
I) Golgicomplex	Golgi	Biological oxidation
II) Ergosome	Palade	Protein synthesis
III) Glyoxysomes	Bridenbach	H ₂ O ₂ degradation
IV) Lysosomes	de Duve	Autolysis of cell contents

Which two show the correct combination

- 1) II & IV 2) I & III 3) II & III 4) I & IV

230. **Structure** **Formed from** **Involved in**

A) Plasmosome M) ER) Polypeptide sythesis

B) Ribosome N) Dictyosome) Digestion of food

C) Idiosome O) Secondary constiction) Cellulose synthesis

D) Lysosome P) Nucleoulus) Production of ergosomes

Identify the correct combination of A,B,C and D with those given in the second and third columns

- | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| A | B | C | D | A | B | C | D |
| 1) | | | | 2) | | | |
| 3) | | | | 4) | | | |

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TYPE - V

QUESTIONS FROM PREVIOUS MEDICAL ENTRANCE EXAMS

- | | |
|--|---|
| <p>231. Stroma in the chloroplasts of higher plants contain (CBSE-AIPMT 2009)
 1) Light-independent reaction enzymes
 2) Light-dependent reaction enzymes
 3) Ribosomes 4) Chlorophyll</p> <p>232. Middle lamella is mainly composed of (CBSE-AIPMT 2009)
 1) Hemicellulose 2) Muramic acid
 3) Calcium pectate
 4) Phosphoglycerides</p> <p>233. Plasmodesmata are (CBSE-AIPMT 2009)
 1) Lignified cemented layers between cells
 2) Locomotory structures
 3) Membranes connecting the nucleus with plasmalemma
 4) Connections between adjacent cells</p> <p>234. Cytoskeleton is made up of (CBSE-AIPMT 2009)
 1) Calcium phosphate granules
 2) Callose deposits
 3) Cellulosic microfibrils
 4) Proteinaceous filaments</p> <p>235. Semiconservative replication of DNA was first demonstrated in (CBSE-AIPMT 2009)
 1) <i>Drosophila melanogaster</i>
 2) <i>Escherichia coli</i>
 3) <i>Streptococcus pneumoniae</i>
 4) <i>Salmonella typhimurium</i></p> <p>236. Keeping in view, the Fluid mosaic model for the structure of cell membrane, which respect to the movement of lipids and proteins from one lipid monolayer to the other (described as flip-flop movement) (CBSE-AIPMT 2008)
 1) Both lipids and proteins can flip-flop
 2) While lipids can rarely flip-flop, proteins cannot
 3) While proteins can flip-flop, lipids cannot
 4) Neither lipids, nor proteins can flip-flop</p> <p>237. Polysome is formed by (CBSE-AIPMT 2008)
 1) Several ribosomes attached to a single mRNA</p> | <p>2) Many ribosomes attached to a strand of endoplasmic reticulum
 3) A ribosome with several subunits
 4) Ribosomes attached to each other in a linear arrangement</p> <p>238. The two subunits of ribosome remain united at a critical ion level of (CBSE-AIPMT 2008)
 1) Copper 2) Manganese
 3) Magnesium 4) Calcium</p> <p>239. Vacuole in a plant cell (CBSE-AIPMT 2008)
 1) Is membrane bound and contains storage proteins
 2) Is membrane bound and contains water and excretory substances
 3) Lacks membrane and contains air
 4) Lacks membrane and contains water and excretory substances</p> <p>240. In germinating seeds, fatty acids are degraded exclusively in the (CBSE-AIPMT 2008)
 1) Proplastids 2) Glyoxisomes
 3) Peroxisomes 4) Mitochondria</p> <p>241. Which one the following is not a constituent of cell membrane (CBSE-AIPMT 2007)
 1) Cholesterol 2) Glycolipids
 3) Proline 4) Phospholipids</p> <p>242. Select the wrong statement from the following (CBSE-AIPMT 2008)
 1) Both chloroplasts and mitochondria contain an inner and an outer membrane
 2) Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by the thylakoid membrane
 3) Both chloroplasts and mitochondria contain DNA
 4) The chloroplasts are generally much larger than mitochondria</p> <p>243. Chlorophyll in chloroplasts is located in (AFMC-2009)
 1) Grana 2) Oxyenoid
 3) Stroma 4) Both (1) and (3)</p> <p>244. Lysosomes are the reservoirs (store houses) of (AFMC-2007)
 1) Hydrolytic enzymes
 2) Secretory glycoproteins
 3) RNA and protein</p> |
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|---|---|
| <p>4) Fats (or sugars or ATP)</p> <p>245. Which of the following cell structures is correctly matched with the accompanying description (AIIMS 2009)</p> <p>1) Plasmamembrane – Outer layer of cel lulose of chitin on absent</p> <p>2) Mitochondria – Bacteria like elements with inner membrane forming sacs containing chlorophyll found in plant cells and algae</p> <p>3) Chloroplasts – Bacteria like elements with inner membrane highly folded</p> <p>4) Golgi apparatus–Sacks of flattened vesicles</p> <p>246. What is common between chloroplasts, chromoplasts and leucoplasts (AIIMS 2008)</p> <p>1) Presence of pigments</p> <p>2) Possession of thylakoids and grana</p> <p>3) Storage of starch, proteins and lipids</p> <p>4) Ability to multiply by a fission-like process</p> <p>247. Assertion (A) : A cell membrane shows fluid behaviour
Reason (R) : A membrane is a mosaic or composite of diverse lipids and proteins (AIIMS 2008)</p> <p>248. Golgi apparatus is absent in (BHU-2008)</p> <p>1) Higher plant 2) Yeast</p> <p>3) Bacteria and blue-green algae</p> <p>4) Liver cells</p> <p>249. Protein synthesis takes place in (BHU-2008)</p> <p>1) Ribosomes 2) Chloroplasts</p> <p>3) Mitochondria 4) Golgibodies</p> <p>250. A genophore is made up of (BHU-2007)</p> <p>1) A single double-stranded DNA</p> <p>2) A single-stranded DNA</p> <p>3) RNA and histones</p> <p>4) Histones and non-histones</p> <p>251. Membrane that covers the vacuole in a plant cell is called (CPMT-2009)</p> <p>1) Tonoplast 2) Tonoplasm</p> <p>3) Jacket 4) Cell membrane</p> <p>252. Nuclear membrane is continuous with (CPMT-2009)</p> <p>1) Rough endoplasmic reticulum</p> <p>2) Smooth endoplasmic reticulum</p> <p>3) Cell membrane 4) Golgi bodies</p> <p>253. Cristae are associated with which of the following (CPMT-2007)</p> | <p>1) Mitochondrion 2) Cytoplasm</p> <p>3) Protoplasm 4) Endoplasmic reticulum</p> <p>254. Centrosome is not present in cell of (CPMT-2007)</p> <p>1) Of higher plants 2) Of lower plants</p> <p>3) Of higher animals 4) Of lower animals</p> <p>255. Subunits of 80S ribosome are (DUMET-2008)</p> <p>1) 40S 2) 60S</p> <p>3) Both (1) and (2) 4) None of these</p> <p>256. Which one of the following is not a plastid (DUMET-2008)</p> <p>1) Mitoplast 2) Chromoplast</p> <p>3) Chloroplast 4) Leucoplast</p> <p>257. Fat storing granules are (DUMET-2007)</p> <p>1) Elaioplast 2) Amyloplast</p> <p>3) Aleuroplast 4) None of these</p> <p>258. Subunits in prokaryotic ribosomes are (DUMET-2007)</p> <p>1) 60S–40S 2) 50S–30S</p> <p>3) 40S–30S 4) 50S–20S</p> <p>259. Extension of plasma membrane in prokaryotic cell is (DUMET-2007)</p> <p>1) Mesosome 2) Hapnoid</p> <p>3) Ribosome 4) None of these</p> <p>260. A cell organelle that is exceptionally rich in hydrolytic enzymes is (Haryan PMT-2009)</p> <p>1) Ribosome 2) Endoplasmic reticulum</p> <p>3) Lysosome 4) Mitochondria</p> <p>261. RNA is not found in (Haryan PMT-2009)</p> <p>1) Chromosome 2) Plasmalemma</p> <p>3) Nucleolus 4) Ribosome</p> <p>262. Highest number of enzymes are found in (Haryan PMT-2008)</p> <p>1) Lysosome 2) Chloroplast</p> <p>3) Mitochondria 4) Peroxisome</p> <p>263. Which organelle is present in higher number in secretory cells (Haryan PMT-2008)</p> <p>1) Dictyosome 2) ER</p> <p>3) Lysosome 4) Vacuole</p> <p>264. F_1 -particles are present in</p> <p>1) Chloroplast 2) Mitochondria</p> <p>3) Ribosome 4) Rough ER</p> <p>265. Plastids of an etiolated plant possess</p> <p>1) Phycobilins (AMU-2008)</p> <p>2) Carotenoids and xanthophyll</p> <p>3) Chlorophylloid and carotenoids</p> |
|---|---|

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- 4) Chlorophyll and carotenes
266. The nucleolus is the site of formation of
 1) Spindle fibres 2) Chromosomes
 3) Ribosomes 4) Peroxisomes
267. The RER in the cell synthesised a protein which would be later used in building the plasma membrane. But it is observed that the protein in the membrane is slightly different from the protein made in the another cell organelle. Identify that organelle in the given diagram **(KCET -2009)**



- 1) D 2) A 3) B 4) C
268. Surrounding membrane of vacuole is called **(Pb PMT-2008)**
 1) Tonoplast 2) Symplast
 3) Apoplast 4) Phragmoplast
269. Fluid mosaic model of plasma membrane was given by **(Pb PMT-2008)**
 1) Robertson 2) Robert Hooke
 2) Singer and Nicholson
 4) Pantin and Mast
270. Prokaryotic ribosome has sedimentation coefficient of **(Pb PMT-2007)**
 1) 80S 2) 70S
 3) 40S 4) 60S
271. Which of the following cell organelles is rich in catabolic enzymes **(Pb PMT-2007)**
 1) Chloroplast 2) Mitochondria
 3) Golgi complex 4) Ribosomes
272. A conspicuous rounded body present in nucleoplasm and attached to a particular chromosome at a definite place is **(Pb PMT-2007)**
 1) Plasmid 2) Karyolymph
 3) Nucleolus 4) Nuclear reticulum
273. Nucleolus is **(Pb PMT-2007)**
 1) Rounded structure found in cytoplasm near nucleus
 2) Rounded structure inside nucleus and having rRNA
 3) Rod-shaped structure in cytoplasm near the nucleus

- 4) None of the above
274. Which of the following organelles is associated with photorespiration **(MP PMT-2009)**
 1) Mitochondrion 2) Peroxisome
 3) Chloroplast 4) All of these
275. Which of the following does not contain DNA **(MP PMT-2009)**
 1) Mitochondrion 2) Chloroplast
 3) Peroxisome 4) Nucleus
276. Which of the following is responsible for the origin of lysosome **(MP PMT-2009)**
 1) Chloroplast 2) Mitochondrion
 3) Golgi body 4) Ribosome
277. Highest number of enzymes is found in **(MP PMT-2007)**
 1) Lysosome 2) Chloroplast
 3) Mitochondria 4) Peroxisome
278. Match the following

(KERALA PMT - 2008)

List –I

List –II

- | | |
|--------------------------|------------------------------------|
| A) Endoplasmic reticulum | 1) Stack of cisternae |
| B) Sphaerosome | 2) Store oils or fats |
| C) Dictyosome | 3) Synthesis and storage of lipids |
| D) Peroxisome | 4) Photorespiration |
| E) Elaioplasts | 5) Detoxification of drugs |

	A	B	C	D	E
1)	5	3	1	4	2
2)	5	3	2	4	1
3)	2	3	1	4	5
4)	4	3	1	5	2
5)	3	5	1	4	2

279. Read the following statements and identify the correct options given

(KERALA PMT - 2008)

- I) Sap vacuoles – Contain digestive enzymes with the help of which nutrients are digested
- II) Contractile vacuoles – Take part in osmoregulation and excretion
- III) Food vacuoles – Store and concentrate mineal salts as well as

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- nutrients
- IV) Air vacuoles – Store metabolic gases and help in buoyancy of cells
- 1) I and II are correct 2) I and III are correct
3) I and IV are correct 4) II and IV are correct
5) II and III are correct
280. Which of these is mis-matched
(KERALA PMT - 2007)
- 1) Amyloplasts – Store protein granules
2) Elaioplasts – Store oils or fats
3) Chloroplasts – Contain chlorophyll pigments
4) Chromoplasts – Contain coloured pigments other than chlorophyll
5) Leucoplasts – contain colourless pigment.
281. Which of the following organelle in the figure correctly match with its function [NEET 2013]
- (1) Golgi apparatus, protein synthesis
(2) Golgi apparatus, formation of glycolipids
(3) Rough endoplasmic reticulum, protein synthesis
(4) Rough endoplasmic reticulum, formation of glycoproteins
282. The Golgi complex plays a major role [NEET - 2013]
- (1) in digesting proteins and carbohydrates
(2) as energy transferring organelles
(3) in post translational modification of proteins and glycosidation of lipids
(4) in trapping the light and transforming it into chemical energy

283. Match the following and select the correct answer

(NEET 2014)

- | | |
|----------------|----------------------------------|
| 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

284. The osmotic expansion of a cell kept in water is chiefly regulated by

(NEET 2014)

1. Mitochondria 2. Vacuoles
3. Plastids 4. Ribosomes

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

(NEET 2014)

1. Microtubules 2. Microfilaments
3. Intermediate filaments 4. Lamins

286. Which structures perform the function of mitochondria in bacteria? (NEET 2014)

1. Nucleoid 2. Ribosomes
3. Cell wall 4. Mesosomes

287. Select the correct matching in the following pairs (NEET 2015)

1. Rough ER-Oxidation of fatty acids
2. Smooth ER-Oxidation of phospholipids
3. Smooth ER-Synthesis of lipids
4. Rough ER- Synthesis of glycogen

288. Which one of the following is not an inclusion body found in prokaryotes?

(NEET 2015)

1. Polysome 2. Phosphate granule
3. Cyanophycan granule 4. Glycogen granule

289. Nuclear envelope is a derivative of (NEET 2015)

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1. Rough endoplasmic reticulum	C	Cisternae	iii	Flat membranous
2. Smooth endoplasmic reticulum				scas in stroma
3. Membrane of Golgi complex	d	Chromatin	iv	Infoldings in
4. Microtubules				mitochondria
290. DNA is not present in (NEET 2015)		a	b	c
1. Mitochondria		iii	iv	i
2. Chloroplast		iv	iii	i
3. Ribosomes		iii	iv	i
4. Nucleus		iii	i	iv
291. Which of the following structures is not found in prokaryotic cells? (NEET 2015 Re)	297. Balbiani rings are sites of (NEET 2015 Re)			
1. Plasma membrane	1. RNA and protein synthesis			
2. Nuclear envelope	2. Lipid synthesis			
3. Ribosome	3. Nucleotide synthesis			
4. Mesosome	4. Polysaccharide synthesis			
292. Which of the following is not membrane bound? (NEET 2015 Re)	298. Mitochondria and chloroplast are : (2016 NEET PHASE I)			
1. Mesosomes	1) Semi-autonomous organelles.			
2. Vacuoles	2) Formed by division of pre-existing organelles and they contain DNA but lack protein synthesizing machinery			
3. Ribosomes	Which one of the following options is correct ?			
4. Lysosomes	1) Both (1) and (2) are correct			
293. Cellular organelles with membranes are (NEET 2015 Re)	2) (2) is true but (1) is false			
1. Lysosomes, Golgi apparatus and mitochondria	3) (1) is true but (2) is false			
2. Nuclei, ribosomes and mitochondria	4) Both (1) and (2) are false			
3. Chromosomes, ribosomes and endoplasmic reticulum	299. Microtubules are the constituents of (2016 NEET PHASE I)			
4. Endoplasmic reticulum, ribosomes and nuclei	1) Cilia, flagella and peroxysomes			
294. Cell wall is absent in (NEET 2015 Re)	2) Spindle fibres, centrioles and cilia			
1. Nostoc	3) Centrioles, spindle fibres and chromatin			
2. Aspergillus	4) Centrosome, nucleosome and centrioles			
3. Funaria	300. One of the major components of cell wall of most fungi is (2016 NEET PHASE I)			
4. Mycoplasma	1) Chitin			2) Peptidoglycan
295. A protoplast is a cell (NEET 2015 Re)	3) Cellulose			4) Hemicellulose
1. Without cell wall	301. Which one of the following cell organelles is enclosed by a single membrane ? (2016 PHASE-I)			
2. without plasma membrane	1) Mitochondria			2) Chloroplasts
3. without nucleus	3) Lysosomes			4) Nuclei
4. undergoing division				
296. Match the columns and identify the correct option (NEET 2015 Re)				
Column-I	Column-II			
a Thylakoids	i Disc-shaped sacs in Golgi apparatus			
b Cristae	ii Condensed structure of DNA			

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- 302. A cell organelle containing hydrolytic enzyme is (2016 NEET PHASE-II)**
 1. Ribosome 2. Mesosome
 3. Lysosome 4. Microsome
- 303. Which of the following components provides sticky character to the bacterial cell ? (NEET 2017)**
 1) Cell wall 2) Nuclear membrane
 3) Plasma membrane 4) Glycocalyx
- 304. Which of the following cell organelles is responsible for extracting energy from carbohydrates to form ATP? (NEET 2017)**
 1) Lysosome 2) Ribosome 3) Chloroplast
 4) Mitochondrion
- 305. The Golgi complex participates in (NEET 2018)**
 1) respiration in bacteria
 2) formation of secretory vesicles
 3) fatty acid breakdown
 4) activation of amino acid
- 306. Which of the following is true for nucleolus ? (NEET 2018)**
 1) It takes part in spindle formation
 2) It is a membrane – bound structure
 3) Larger nucleoli are present in dividing cells
 4) It is a site for active ribosomal RNA synthesis
- 307. The shorter and longer arms of a submetacentric chromosome are referred to as (NEET 2019)**
 1) p-arm and q-arm, respectively
 2) q-arm and p-arm, respectively
 3) m-arm and n-arm, respectively
 4) s-arm and i-arm, respectively
- 308. Which of the following pairs of organelles does not contain DNA ? (NEET 2019)**
 1) Chloroplast and Vacuoles
 2) Lysosomes and Vacuoles
 3) Nuclear envelope and Mitochondria
 4) Mitochondria and Lysosomes

- 309. The concept of ‘Omnis cellula –e-cellula’ regarding cell division was first proposed by (NEET 2019)**
 1) Theodor Schwann 2) Schleiden
 3) Aristotle 4) Rudolf Virchow
- 310. Which of the following cell organelles is present in the highest number in secretory cells ? (NEET 2019 - Odisha)**
 1) Mitochondria 2) Golgi complex
 3) Endoplasmic reticulum 4) Lysosomes
- 311. Non-membranous nucleoplasmic structures in nucleus are the site for active synthesis of (NEET 2019 - Odisha)**
 1) protein synthesis 2) mRNA
 3) rRNA 4) tRNA

**KEY
TYPE - I**

- | | | | | |
|--------|--------|--------|--------|--------|
| 31) 1 | 32) 4 | 33) 1 | 34) 2 | 35) 4 |
| 36) 3 | 37) 4 | 38) 3 | 39) 4 | 40) 2 |
| 41) 2 | 42) 3 | 43) 4 | 44) 2 | 45) 3 |
| 46) 2 | 47) 2 | 48) 1 | 49) 3 | 50) 1 |
| 51) 2 | 52) 1 | 53) 1 | 54) 1 | 55) 3 |
| 56) 3 | 57) 2 | 58) 3 | 59) 1 | 60) 3 |
| 61) 2 | 62) 1 | 63) 2 | 64) 4 | 65) 4 |
| 66) 1 | 67) 1 | 68) 2 | 69) 4 | 70) 2 |
| 71) 2 | 72) 1 | 73) 1 | 74) 4 | 75) 4 |
| 76) 2 | 77) 4 | 78) 2 | 79) 1 | 80) 4 |
| 81) 1 | 82) 4 | 83) 3 | 84) 4 | 85) 2 |
| 86) 2 | 87) 3 | 88) 2 | 89) 1 | 90) 4 |
| 91) 4 | 92) 2 | 93) 3 | 94) 2 | 95) 2 |
| 96) 4 | 97) 3 | 98) 3 | 99) 4 | 100) 1 |
| 101) 2 | 102) 3 | 103) 3 | 104) 1 | 105) 3 |
| 106) 1 | 107) 4 | 108) 3 | 109) 2 | 110) 1 |
| 111) 2 | 112) 3 | 113) 1 | 114) 1 | 115) 1 |
| 116) 2 | 117) 4 | 118) 1 | 119) 3 | 120) 1 |
| 121) 1 | 122) 4 | 123) 1 | 124) 2 | 125) 4 |
| 126) 3 | 127) 2 | 128) 3 | 129) 3 | 130) 2 |
| 131) 1 | 132) 2 | 133) 3 | 134) 4 | 135) 3 |
| 136) 1 | 137) 4 | 138) 2 | 139) 4 | 140) 4 |
| 141) 3 | 142) 4 | 143) 2 | 144) 1 | 145) 3 |
| 146) 2 | 147) 3 | 148) 4 | 149) 2 | 150) 2 |
| 151) 2 | 152) 3 | 153) 3 | 154) 1 | 155) 4 |

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156) 4 157) 1 158) 1 159) 3 160) 3
161) 4 162) 3 163) 2

TYPE - II

164) 1 165) 3 166) 4 167) 4 168) 1
169) 4 170) 2 171) 2 172) 3 173) 3
174) 4 175) 3 176) 3 177) 3 178) 4

TYPE - III

212) 3 213) 1 214) 3 215) 1 216) 3
217) 3 218) 2 219) 4 220) 1 221) 3

TYPE - IV

222) 4 223) 1 224) 1 225) 2 226) 1
227) 2 228) 4 229) 1 230) 1

TYPE - V

**QUESTIONS FROM PREVIOUS
MEDICAL ENTRANCE EXAMS**

231) 1 232) 3 233) 4 234) 4 235) 2
236) 2 237) 1 238) 3 239) 2 240) 2
241) 3 242) 2 243) 1 244) 1 245) 4
246) 4 247) 1 248) 3 249) 1 250) 1
251) 1 252) 1 253) 1 254) 1 255) 3
256) 1 257) 1 258) 2 259) 1 260) 3
261) 2 262) 3 263) 1 264) 2 265) 3
266) 3 267) 1 268) 1 269) 2 270) 2
271) 2 272) 3 273) 2 274) 4 275) 3
276) 3 277) 3 278) 1 279) 5 280) 1
281) 3 282) 3 283) 1 284) 2 285) 2
286) 4 287) 2 288) 1 289) 1 290) 3
291) 2 292) 3 293) 1 294) 4 295) 1
296) 3 297) 1 298) 2 299) 3 300) 1
301) 3 302) 3 303) 4 304) 4 305) 2
306) 4 307) 1 308) 2 309) 4 310) 2
311) 3