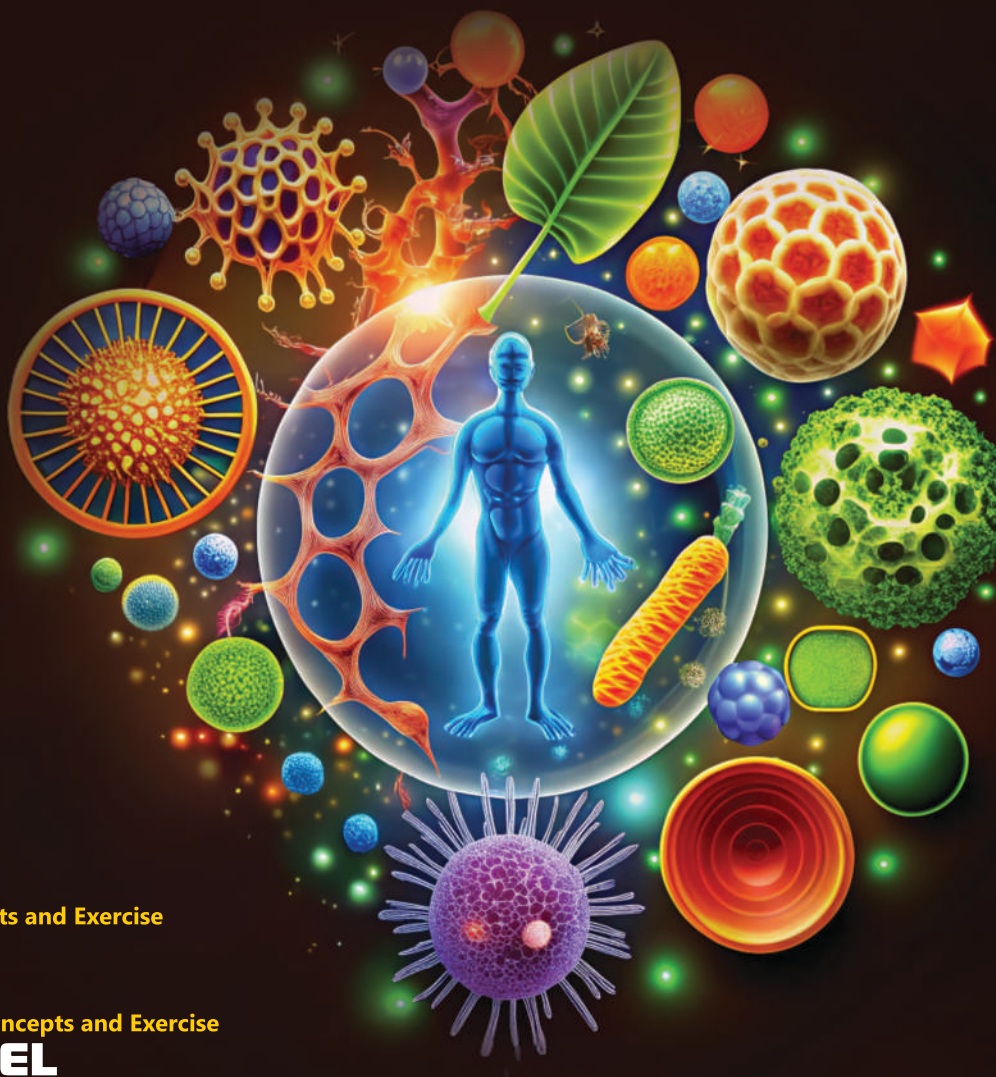
PHYSICS WALLAH

NEEV

From School to Competitive Level

BIOLOGY

Class 9



With Theory and Solved Examples
SELF STUDY

Detailed Solutions
NCERT EXERCISE

Separate Sections For School Level Concepts and Exercise
CBSE LEVEL

Separate Sections for Competitive level Concepts and Exercise
COMPETITIVE LEVEL

Contents

1 CHAPTER

The Fundamental Unit of Life

School Level

Scan me for the Activity Videos

Introduction

As you observe the world around you, you might ponder the distinction between living and non-living entities.

You may have questioned what sets living organisms apart from inanimate objects. They key to this distinction lies in the presence of the basic building block of life: **the cell which is present in all living organism.**

Cell is the **structural** and **functional** unit of life. Each living cell has the capacity to perform certain basic functions that are characteristic of all living forms. Since all living organisms are formed of cells and their physiological, biochemical, genetic and metabolic activities take place inside the cell, therefore, it is called the basic unit of life.

Discovery of Cell

The invention of the microscope helped in the discovery of the cell. First cell was discovered by **Robert Hooke** in **1665** in a cork slice with the help of a self-designed microscope. Robert Hooke saw that the cork resembled the structure of a honeycomb, consisting of many little compartments. Robert Hooke called these boxes or compartments as cells. **Anton Van Leeuwenhoek** was the first scientist to see and describe a **living cell** in pond water in **1674**. **Robert Brown** later in **1831** discovered the nucleus of the cell. In **1839**, **Purkinje** gave the term 'protoplasm' for the fluid substance of the cell.

Microscopes

The small size of cells was the greatest obstacle in determining their nature and study. Cells were discovered after the invention of the microscope because a microscope with high magnifying power was required to see the smallest cell of human body. Cells are microscopic and can be studied using a light microscope (LM), scanning electron microscope (SEM), and transmission electron microscope (TEM). The invention of microscopes revealed all the structural details of the cell.

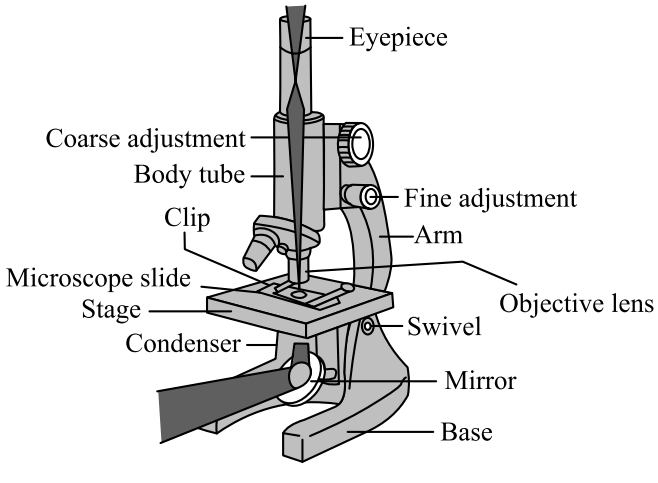


Fig. 1: Compound Microscope

Activity-1

Aim: To prepare temporary mount of onion peel and observe the cell wall.

Method: Take a small piece from bulb of an onion and peel off the skin (epidermis) from the concave side. Take a clean glass slide and add a drop of water on it. Then transfer a small piece of the peel from watch glass to slide and add few drops of iodine solution on the piece of peel to stain. Cover the stained peel with coverslip. Make sure that there are no air bubbles under the coverslip. Now observe the temporary mount of onion peel under low power and then under high power of light microscope.

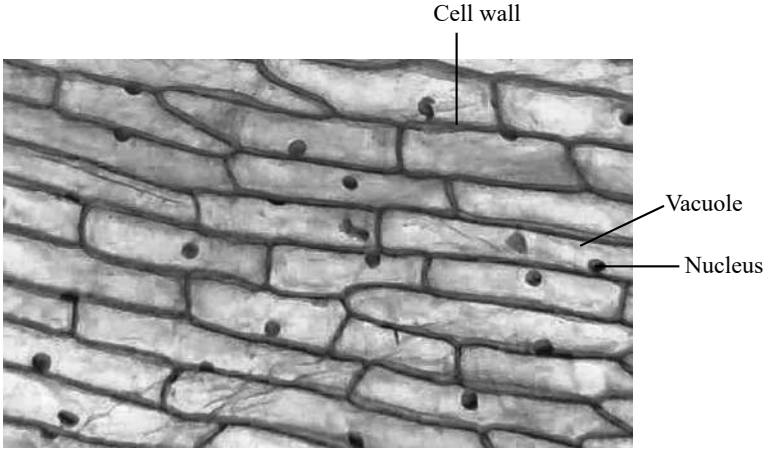


Fig. 2: Temporary Mount of Onion Peel

Observations: Large number of cells are present lying one after the other under low power of microscope while under high power, each cell has a cell wall, a distinct nucleus and vacuoles in the cytoplasm.

Conclusion: As cell walls and large vacuoles are clearly observed in all the cells, the cells on the slide are plant cells.

Activity-2

Aim: To prepare temporary mount of human cheek cells.

Method: Take clean glass slide and add a drop of water on it. Then, scrap from the inner wall of cheek with the help of tooth pick and transfer this material with the help of needle on the glass slide and spread it evenly. Stain this by putting a drop of methylene blue and place coverslip on the stained material and observe this mount under high power of microscope.

Observation: Coloured spherical or oval structure is present near the centre of each cheek cell. It is called **nucleus**. No prominent vacuoles are observed in cells.

Conclusion: As the cells observed lack cell wall as well as prominent vacuole, the cells on the slide are animal cells.

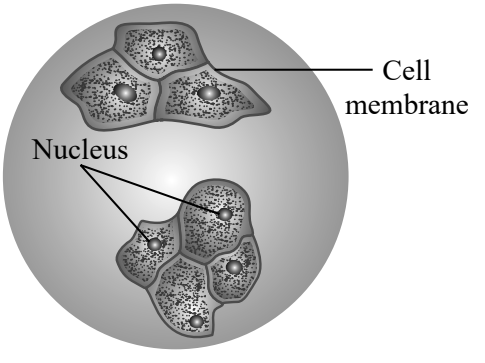


Fig. 3: Microscopic View of Human Cheek Cell

Cell Theory

The scientist who formulated and laid the cell theory are -

1. M. J. Schleiden (1838) - German Botanist
2. T. Schwann (1839) - British Zoologist

Animal Cell

Common Features and General Functions

The cytoplasm is the main arena of cellular activities in all cells. In the cytoplasm, various types of metabolic reactions (catabolic and anabolic) occur to keep the cell in a living state. Animal cells have irregular shape due to the absence of a cell wall. Besides the nucleus, animal cell has other membrane-bound structures called organelles like the endoplasmic reticulum (ER), Golgi complex, lysosomes, mitochondria, and microbodies. These organelles carry out specific functions that are needed for the normal functioning of the cell.

Ribosomes are the non-membrane bound organelles found in animal cells. They are the sites of protein synthesis.

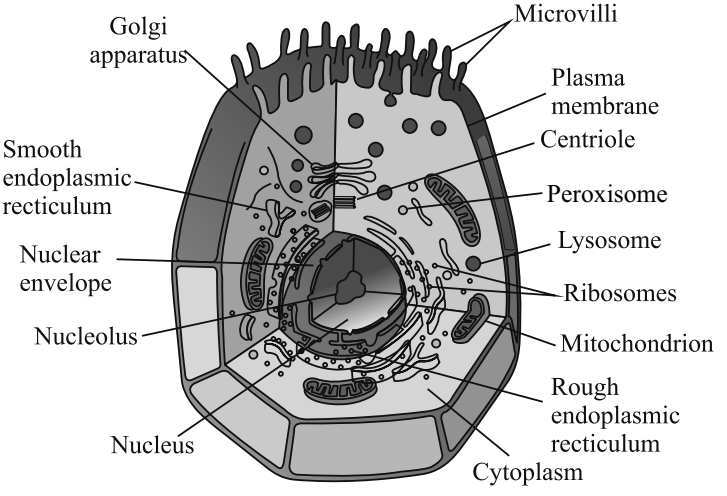


Fig. 6: Structure of an Animal Cell

Plant Cell

Common Features and General Functions

Plant cells are also eukaryotic cells with true nucleus and membrane bound organelles. It has larger size than the animal cell. Both the cells share some organelles but plant cell are bit different. There is presence of rigid cell wall which is made up of cellulose, glycoproteins, lignin, pectin and hemicellulose.

It has plastids which contains different types of pigments that carry out photosynthesis.

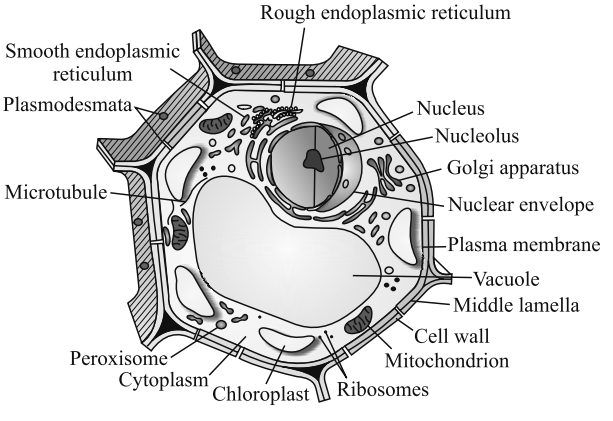


Fig. 7: Structure of a Plant Cell

Functions of Cell Wall

- It provides and maintains a definite shape of the cell.
- It protects the cells from mechanical injury & prevents their desiccation.
- It provides mechanical support against gravity. It is due to rigid cell walls that the aerial part of plants is able to stand erect & expose their leaves to sunlight.
- Cell wall prevents over expansion of cell membrane when water enters the cell and inhibits plant cell from excessive endosmosis.

Knowledge Hub

- ❖ The presence of the cell wall enables the cells of plants, fungi and bacteria to exist in hypotonic media without bursting.
- ❖ A cell without the cell wall is called a protoplast.
- ❖ The space between the cell wall and cell membrane in a bacterial cell is called periplasmic space.

Try it Yourself

Q. Name the cellular structure which is responsible for the formation of boundary of a cell and maintaining its integrity.

Q. Why does the skin of your finger shrinks when you wash clothes for a long time?

Q. If you are provided with some vegetables to cook. You generally add salt into the vegetables during cooking process. After adding salt, vegetables release water. What mechanism is responsible for this?

Cell Membrane

The cell membrane or plasma membrane is the outermost membranous covering of the cell which is present inside the cell wall. This thin membrane forms the barrier between the cell's inner contents and the interstitial fluid (the fluid that surrounds the cell). It is the universal structure that is structurally similar in both prokaryotes and eukaryotes. Cilia, flagella, and microvilli are examples of modified plasma membrane extensions. The plasma membrane is a selectively permeable membrane, which allows some substances to pass through them more readily than others. It also prevents the movement of some other materials.

Chemical Structure of the Plasma Membrane: The plasma membrane is a fluid matrix made up of about **equal amounts** of lipids and proteins by weight. However, the ratio of protein and lipid varies considerably in different cell types. The plasma membrane contains several types of lipids, including phospholipids, cholesterol, and glycolipids. Most of the plasma membrane lipids are phospholipids.

The lipid molecules are amphipathic, i.e., they contain both polar hydrophilic (water loving) and non-polar hydrophobic (water repelling) ends. The hydrophilic region is in the form of a head occurring at outer surface whereas the hydrophobic part contains two tails of fatty acids. The lipids are arranged within the membrane with the polar head of hydrophilic region towards the outer sides (refers to the surfaces of the membrane that face the external environment and the internal cytoplasm of the cell) and the hydrophobic tails towards the inner part (refers to the space within the membrane itself). This ensures that the non-polar tail of saturated hydrocarbons is protected from the aqueous environment. It results in the formation of a lipid bilayer.

Functions of Cell Membrane

- **Cell communication:** Contains receptor proteins that recognize and respond to molecular signals.
- **Exchange of materials:** The main function of the plasma membrane is to regulate the movement of molecules, ions, gases, nutrients, and waste molecules through the plasma membrane. Diffusion allows water and gaseous exchange in and out of the cell. The cell also obtains nutrition from its environment through transport processes. Unicellular freshwater organisms and most plant cells tend to gain water through osmosis. By osmosis, plant roots also absorb water.
- **Electrochemical gradients:** Establishes and maintains an electrical charge difference across the plasma membrane.
- **Physical barrier:** Establishes a flexible boundary, protects cellular contents, and supports cell structure. The flexibility of cell membrane also enables the cell to engulf in food, and other material from its external environment.

Test Prep

- Permeability refers to the ability of a substance to pass through the membrane. Depending upon the permeability, membrane is classified as following:
  - **(a) Impermeable:** When a membrane does not allow both solvent and solute to pass through it. Cuticle layer and rubber membrane are the examples of impermeable membranes.
  - **(b) Permeable:** When a membrane allows both solvent and solute molecules to pass through it. Primary cell wall and filter paper are the examples of permeable membranes.
  - **(c) Semi-permeable:** When a membrane allows only of solvent molecules to pass, but not to the solute particles. Cellophane and parchment paper are examples of this membrane.
  - **(d) Selective permeable membrane:** Such membrane allows the passage of some selective solute particles along with the solvent molecules. E.g. cell membrane and tonoplast.
- **Cilia and flagella:** They 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. Bacteria also possess flagella but are structurally different from the eukaryotic flagella.

Transport of Substances

Transport of substances across the plasma membrane can vary depending upon the requirement of cellular energy. Types of transport are given below:

(a) Diffusion:

- **Simple diffusion:** It is the spontaneous movement of the particle from the area of higher concentration to the area of lower concentration without the involvement of energy, therefore it is called passive transport. For instance, exchange of gases through stomata. Some substances like carbon dioxide or oxygen can move across the cell membrane by diffusion.
- **Facilitated diffusion:** It is a type of diffusion in which material moves across a membrane along a concentration gradient with the help of a specific carrier protein molecule.

(b) Osmosis: Osmosis is defined as the spontaneous movement of solvent or water molecules from the area of higher water potential to an area of lower water potential through a selectively permeable membrane. The movement of water molecules by osmosis is a special case of diffusion. It could be endosmosis or exosmosis.

- **Endosmosis:** Endosmosis is the movement of solvent into the cell.
- **Exosmosis:** Exosmosis is the movement of solvent out of the cell.

Types of Endoplasmic Reticulum

(i) Rough Endoplasmic reticulum (RER):- These appear rough under a microscope because of the presence of large number of ribosomes over their cytoplasmic surface. The ribosomes are the sites of protein synthesis. Thus, RER is engaged in the synthesis and transport of proteins. Generally, RER is more abundant in the deeper part of cytoplasm near the nucleus where it is connected with the outer membrane of the nuclear envelope. RER is well developed in the cells that synthesize and secrete proteins.

(ii) Smooth Endoplasmic Reticulum (SER):- It consists of tubules and vesicles. It is free of ribosomes and is more abundant near the peripheral part of the cytoplasm where it may be attached to the plasma membrane. The SER helps in the synthesis of fat or lipid molecules. It is also the site of synthesis of steroidal hormones in animal cells. It is, therefore, well developed in the cells that secrete lipids.

Functions of Endoplasmic Reticulum

- **Mechanical support:** The ER acts as a supporting material to maintain the skeletal framework of the cell.
- **Transport of materials:** The ER facilitates transport of materials (especially proteins) from one part of the cell to another.
- **Exchange of materials:** It helps in the exchange of materials between the cytoplasm and the nucleus.
- ER functions as a cytoplasmic framework providing a surface for some biochemical activities of the cell. The SER provides a surface for the synthesis of lipids including phospholipids, cholesterol and steroid hormones. In the same manner rough endoplasmic reticulum provides site for the synthesis of protein molecules.
- **Detoxification:** The SER brings about detoxification in the liver, i.e., it converts harmful materials (drugs, insecticides, pollutants and poisons) into harmless substances for excretion by the cell.
- **Formation of nuclear membrane:** The ER elements are arranged around the chromosomes to form a new nuclear membrane.

Knowledge Hub

Sarcoplasmic reticulum in muscles: It is a modified form of smooth E.R. It stores Ca^{+2} ions, which is essential for the contraction of muscles.

Golgi Apparatus

Golgi apparatus is found in all eukaryotic cells except RBCs. Golgi bodies are absent in prokaryotic cells. **Camillo Golgi** (1898), a zoologist, observed Golgi bodies in the form of a network in nerve cells of the owl. These organelles are also known as dictyosomes (plant Golgi body). It is made up of **four parts** which includes cisternae, tubules, vacuoles and vesicles.

Components of Golgi Apparatus

(i) Cisternae: These are flat disk shaped, sac-like structures, that forms cis or forming face and trans or maturing face of the golgi body.

(ii) Tubules: These are branched and irregular tube-like structures attached with the cisternae.

(iii) Vacuoles: These are large spherical structure associated with the tubules.

(iv) Vesicles: Spherical structure that arises by budding from tubules.

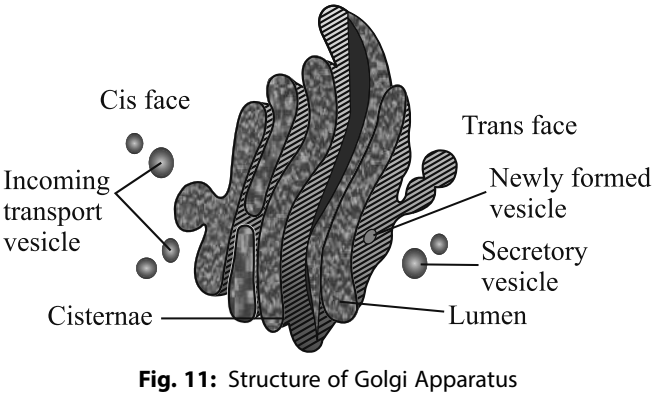


Fig. 11: Structure of Golgi Apparatus

Functions of Golgi Apparatus

- Its functions include the storage, modification and packaging of secretory products in the vesicles.
- In some cases, it helps in the synthesis of complex sugars from simple sugars.
- It produces vacuoles or secretory vesicles which contain cellular secretions like enzymes, proteins, cellulose etc.
- Golgi apparatus is also involved in the synthesis of cell wall, plasma membrane and formation of lysosomes.
- Golgi apparatus is the important site of formation of glycoprotein and glycolipids.

Knowledge Hub

Golgi apparatus is often found in close proximity to the ER in cells. Protein cargo moves from the ER to the Golgi, is modified within the Golgi, and is then sent to various destinations in the cell, including the lysosomes and the cell surface.

Scientist's Corner

In 1843, Camillo Golgi was born at Corteno near Brescia. He studied medicine at the University of Pavia. He is more famously known for his work on the nervous system. However, the work of greatest importance, which Golgi carried out, was a revolutionary method of staining individual nerve and cell structures. This method is referred to as the 'black reaction'. This method uses a weak solution of **silver nitrate** and is particularly valuable in tracing the processes and most delicate ramifications of cells. Golgi received the highest honours and awards in recognition of his work. He shared the Nobel prize in 1906 with Santiago R.Y. Cajal for their work on the structure of the nervous system.

Plastids

Plastids are found in almost all plant cells and in euglenoids. It is a double membranous discoidal structure. Besides being discoidal or rhombic in plant cells they occur in variable shapes like 'U' shaped, spiral, coiled, ribbon shaped, etc. They bear some specific pigments, thus imparting specific colors to the plants.

Types of Plastids

Based on the presence and absence of pigments, plastid can be classified into:

(i) Chloroplast: These are green coloured plastid, which mainly takes part in photosynthesis. The chloroplast has chlorophyll and carotenoids pigments, for trapping sunlight.

(ii) Chromoplast (coloured plastids): These are yellow and red coloured, fat soluble plastid which includes carotenoids pigments such as carotene, xanthophylls, and others. These plastids are mainly present in the coloured part of plants like fruits and flowers.

(iii) Leucoplast: These are colorless plastids of various shapes and sizes with stored nutrients.

Leucoplasts are of three types:

(a) Amyloplasts: Store sugars, e.g., potato.
(b) Elaioplasts: Store oils and fats.
(c) Aleuroplasts: Store proteins.

Structural Parts of Chloroplast

(i) Stroma: It is a granular transparent substance also called as matrix. Grana are embedded in it. Besides grana they also contain enzymes which helps in protein synthesis and carbohydrates synthesis. **Stroma is the site of dark reaction of photosynthesis**. It also houses small, double-stranded circular DNA molecules and ribosomes. The ribosomes in chloroplasts are smaller (70S) compared to the larger cytoplasmic ribosomes (80S).

(ii) Thylakoid: They are flattened sac-like structures present in the stroma of chloroplast. Chlorophyll pigments are present in the thylakoid membrane.

(iii) Grana: Thylakoids are arranged in stacks like the piles of coins. These stacks are called as grana. They are the **sites for light reaction of photosynthesis** as they contain photosynthetic pigment called chlorophyll.

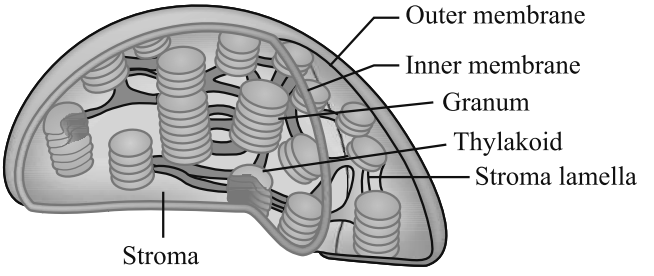


Fig. 12: Structure of Chloroplast

Functions of Plastids

- Photosynthetic pigments of chloroplast traps light energy of the sun and converts it into the chemical energy in the form of glucose.
- Balance the CO_2 and O_2 concentration in the atmosphere.
- Chromoplasts impart odour and colour to fruits and flowers thus help in pollination.

Try it Yourself

Q. Why are chloroplasts commonly called 'kitchen of the cell'?

Mitochondria

It is a sausage shaped structure found in the cytoplasm of all eukaryotic cells except human RBCs. These are also absent in prokaryotes. Maximum mitochondria are found in metabolically active cells. It is also called the **"Power House of the Cell"** or the **"Storage Battery"** as it is the main site of aerobic respiration and extracts energy from food and stores it in the form of ATP (energy currency of the cell).

Structure of Mitochondria

It is a double membranous structure, i.e., has two membranes called outer and inner membrane dividing the lumen (inside) into two aqueous compartments, the outer compartment and the inner compartment. The inner compartment is filled with homogenous substance called as matrix. The outer membrane has specific proteins while the inner membrane is folded to form chambers called cristae. **"Cristae"** are the infoldings of inner mitochondrial membranes that possess enzymes for respiratory cycles like Krebs Cycle. The inner mitochondrial membrane consists of oxysomes also called as F_0-F_1 Particle/ ATP synthase. Space between inner and outer mitochondrial membranes is called peri-mitochondrial space.

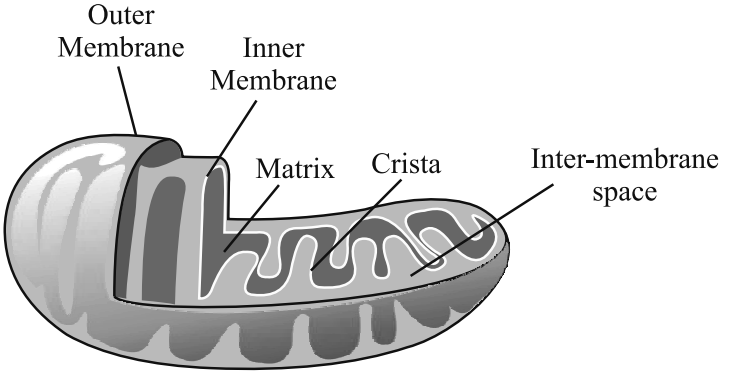


Fig. 13: Structure of Mitochondria

Functions of Mitochondria

- Mitochondria are the site of aerobic respiration. Most of the oxidative metabolism and ATP production occurs in mitochondria.
- Matrix contains enzymes for the Krebs cycle. It is the site of the Krebs cycle in respiration.
- Oxysomes contains enzymes for ATP production.

They provide important intermediates for the synthesis of several biochemicals like chlorophyll, cytochromes, steroids, etc.

Summary

All living organisms present on the earth are made up of cells and their products. They are microscopic and cannot be seen through naked eyes. Thus, different types of microscopes are available which help in studying the structure of cells such as a compound microscope, electron microscope, etc. The cell was discovered by Robert Hooke in a cork slice. Leeuwenhoek discovered the first free-living cell. Some theories were also put forward called the cell theory. Schleiden and Schwann were the first to propose this theory. They said that all living organisms are made up of cell and cell is the basic unit of life. Later, Rudolf Virchow came up with modifications in this theory stating that the cells arise from pre-existing cells.

The cells are categorized based on various aspects like shape, size, number, etc. They can be polygonal, discoid, cubical, etc. The smallest known cell is *Mycoplasma*. The egg of the ostrich is the largest cell in the animal kingdom while the ovule of *Cycas* is the largest cell in the plant kingdom. Based on the number they are classified as unicellular (*Amoeba*, *Chlamydomonas*, etc.) and multicellular (Fungi, plants, etc). Prokaryotic and eukaryotic are the two types of cells categorized on the basis of origin and organization. Animal and plant cells come under the category of the eukaryotic cell. Prokaryotes are the primitive cells that do not possess membrane-bound organelles and well-defined nucleus, and has 70S ribosome while eukaryotic cells have membrane-bound organelles, nucleus, and 80S ribosomes.

There are different components of cells such as plasma membrane, cell wall, nucleus, cytoplasm, organelles like endoplasmic reticulum, Golgi body, mitochondria, etc. The cell wall is the outermost covering that provides support to the plant cell. The plasma membrane helps in communication with the other cells present in the surrounding. The cell membrane helps different modes of transport such as passive (diffusion, osmosis) and active transport. Nucleus acts as the brain of the cell as it helps in transmitting hereditary information from one generation to another. The chromatin material present inside the nucleus condenses to form chromosomes and based on the position of the centromere they are of different types such as Telocentric, Acrocentric, Metacentric, and Sub-metacentric. The cytoplasm is the arena of all chemical reactions taking place in the cell.

The endoplasmic reticulum helps in providing mechanical support, transportation, exchange of materials, detoxification, formation of the nuclear membrane, etc. It is of two types rough and smooth endoplasmic reticulum. Golgi body's main function is storage, modification and packaging of substances manufactured in the cell. Vacuoles are mainly involved in storage. Lysosomes are also called suicidal bags and help in digesting foreign materials. The endoplasmic reticulum, lysosomes, vacuoles, and Golgi body constitute the endomembrane system. Plastids are classified into the chloroplast, chromoplast, and leucoplast. Chloroplast helps in the process of photosynthesis, maintains balance in the concentration of O_2 and CO_2, etc. Ribosomes help in the synthesis of cellular proteins.

Mitochondria is known as the powerhouse of the cell as it helps in aerobic respiration, has oxysomes that contain the enzymes for the production of ATP, etc. Centrosome helps in initiating the process of cell division. Microbodies like peroxisomes help in the metabolism of lipids, glyoxysomes are involved in the glyoxylate cycle.

The process through which the cell grows by involving both nuclear and cytoplasmic division is called cell division. It is of two types namely mitosis and meiosis. Mitosis takes place in somatic cells and daughter cells formed are the exact copies of their parents whereas in meiosis there is an exchange of chromosomes takes place which thus leads to variation and evolution.

NCERT Corner

1. Who discovered cells, and how?

Ans. Robert Hooke in the year 1665 discovered the cell for the first time. He examined a thin slice of cork through a primitive microscope and observed cells as small compartments.

2. Why is the cell called the structural and functional unit of life?

Ans. All living organisms on the earth are made up of cells. They are essential for performing various functions required for sustaining life. They also provide structure, process nutrients and change it into energy. Multicellular organisms have specialized cells which perform specific functions. For example, the blood has RBCs and these cells are primarily involved with transportation of oxygen and carbon dioxide. This is the reason why cell is considered as the structural and functional unit of life.

3. Fill in the gaps in the following table illustrating differences between prokaryotic and eukaryotic cells.

Prokaryotic cell	Eukaryotic cell
1. Size: generally small (1-10 μm) 1 μm = 10^{-6} m	1. Size: generally large (5-100 μm)
2. Nuclear region: _____ and known as ____.	2. Nuclear region: well-defined and surrounded by a nuclear membrane
3. Chromosome: single	3. More than one chromosome
4. Membrane-bound cell organelles are absent.	4. _____ _____

Ans. 2. Poorly defined due to the absence of a nuclear membrane and known as nucleoid.
4. Membrane-bound cell organelles are present.

4. How do substances like CO_2 and water move in and out of the cell? Discuss.

Ans. Diffusion is a process through which oxygen and carbon dioxide move across the cell and this transport does not require energy. It is driven by differences in concentration on either side of the cell membrane. The molecules naturally move from areas of higher concentration to lower concentration.

5. Why is the plasma membrane called a selectively permeable membrane?

Ans. A thin layer of protein and lipid forms the cell membrane which permits only selective materials to pass through itself. It also prevents movement of some other materials. Therefore, plasma membrane is known as selectively permeable membrane.

6. Can you name the two organelles we have studied that contain their own genetic material?

Ans. Mitochondria and Chloroplasts are the two cell organelles which have their own genetic material. Thus, they are called as semi-autonomous organelles.

7. If the organization of a cell is destroyed due to some physical or chemical influence, what will happen?

Ans. If some kind of physical or chemical influence destroys the organization of the cell then in that case cell will not be able to perform its basic functions such as digestion, excretion, circulation, etc. This will also stop all the life activities and therefore the life of an individual will come to an end.

8. Why are lysosomes known as suicide bags?

Ans. In lysosomes, digestive enzymes are present which has the capability to break down different types of biomolecules. Lysosomes tends to burst when the cell is damaged and release all the content outside. The enzyme released then digest its own cell, causing the cell to die. Hence, it is called suicide bags.

9. Where are proteins synthesised inside the cell?

Ans. In ribosomes, the synthesis of proteins takes place. So, they are referred to as protein factories. Ribosomes are the particles that are found attached to the endoplasmic reticulum giving it a name rough endoplasmic reticulum.

NCERT Exercise

1. Make a comparison and write down ways in which plant cells are different from animal cells.

Ans.

Animal cell	Plant cell
They lack cell wall.	They have a cell wall made up of cellulose.
They have centrosome.	They do not have centrosomes.
They do not have chloroplast.	They contain chloroplast.
Vacuoles are smaller in size.	Vacuoles are larger in size.
Prominent Golgi bodies are present.	Subunits of Golgi bodies known as dictyosomes are present.
Lysosomes are larger in number.	Lysosomes are absent or very few in number

2. How is a prokaryotic cell different from a eukaryotic cell?

Ans. Differences between a prokaryotic cell and eukaryotic cell are as follows:

Prokaryotic cell	Eukaryotic cell
The size of the cell is generally small (0.5 – 5 μm).	The size of the cell is generally large (50 – 100 μm).
All prokaryotes are unicellular.	Eukaryotes can be unicellular or multicellular.
The nuclear region is poorly defined due to the absence of a nuclear membrane or the cell lacks a true nucleus.	The nuclear region is well defined and is surrounded by a nuclear membrane, or the true nucleus bound by a nuclear membrane is present in the cell.
It contains a single chromosome.	It contains more than one chromosome.
Membrane-bound cell organelles such as plastids, mitochondria, endoplasmic reticulum, Golgi apparatus, etc. are absent.	Cell organelles such as mitochondria, plastids, endoplasmic reticulum, Golgi apparatus, lysosomes, etc. are present.
Prokaryotic cells are found in bacteria and blue-green algae.	Eukaryotic cells are found in members of kingdom protista, fungi, plantae and animalia.
The nucleolus is absent.	The nucleolus is present.

3. What would happen if the plasma membrane ruptures or breaks down?

Ans. The cell will be unable to exchange material with its surroundings via diffusion or osmosis if the plasma membrane ruptures or breaks. Following that, the protoplasmic substance will vanish and finally the cell will die.

4. What would happen to the life of a cell if there was no Golgi apparatus?

Ans. The Golgi apparatus is used for the storage, modification, and packing of proteins and lipids. If the Golgi apparatus is absent, components produced by the cell will not be packaged or transported.

5. Which organelle is known as the powerhouse of the cell? Why?

Ans. Mitochondria is described as the powerhouse of cell because they release energy in the form of ATP (adenosine triphosphate) molecules, which are required for different metabolic reactions that occur in the protoplasm.

6. Where do the lipids and proteins constituting the cell membrane get synthesized?

Ans. The smooth endoplasmic reticulum (SER) manufactures lipids, while the rough endoplasmic reticulum (RER) manufactures proteins.

7. How does an *Amoeba* obtain its food?

Ans. *Amoeba* takes in food by the process of endocytosis. It engulfs by producing a food-vacuole with transient finger-like extensions of the cell surface (pseudopodia) that fuse over the food particle. Complex chemicals are broken down inside the food vacuole into simpler ones by digestive enzymes, which subsequently diffuse into the cytoplasm. The remaining undigested material is pushed to the cell's surface and discarded.

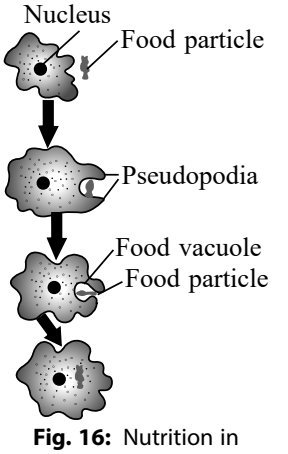


Fig. 16: Nutrition in *Amoeba*

8. What is osmosis?

Ans. Osmosis is the process by which water molecules moves from an area of high concentration to a region of low concentration across a semipermeable membrane.

9. Carry out the following osmosis experiment:

Take four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato. Put each potato cup in a trough containing water. Now,

(*a*) Keep cup A empty

(*b*) Put one teaspoon sugar in cup B

(*c*) Put one teaspoon salt in cup C

(*d*) Put one teaspoon sugar in the boiled potato in cup D.

Keep these for two hours. Then observe the four potato cups and answer the following:

(i) Explain why water gathers in the hollowed portion of B and C.

(ii) Why is potato A necessary for this experiment?

(iii) Explain why water does not gather in the hollowed out portions of A and D.

Ans. (i) Water accumulates in the hollowed portions of B and C because water enters the hollowed portions of potato as a result of osmosis. Because the environment around the cell has a higher concentration of water than the cell, the water moves inside by osmosis. Consequently, the water gathers in the hollowed out parts of the potato cup.

(ii) Potato A in the experiment acts as a control setup therefore it is necessary for carrying out the experiment. There is no water in the empty parts of potato A and it helps us to check what changes occurred during the experiment.

(iii) Water does not gather in the hollow parts of potato A because potato cup A is empty. Water does not gather in potato D because the potato used here has been boiled. Boiling denatures the proteins in the cell membrane, causing the cell membrane to rupture. A semi-permeable membrane is required for osmosis, which is disrupted in this situation. As a result, there will be no osmosis. Hence, no water enters the boiled potato cup.

10. Which type of cell division is required for growth and repair of body and which type is involved in formation of gametes?

Ans. Mitosis is required for growth and repair of body. Meiosis is involved in formation of gametes.

Quick Recall

Fill in the Blanks

1. _____ is the basic structural and functional unit of all life forms.

2. Cell was discovered by _____.

3. First living cell was discovered by _____.

4. _____ is the smallest cell known cell so far.

5. Size of the eukaryotic cell is generally _____.

6. *Amoeba* is a _____ organism.

7. Plasma membrane is mainly made up of _____ and _____.

8. _____ in 1831 discovered the nucleus in the cell.

9. Movement of solvent into the cell takes place through _____.

10. Plastids having coloured pigments are called _____

11. The cell wall lies _____ the plasma membrane.

12. The plant cell wall is mainly composed of _____.

13. Organisms with cells having a nuclear membrane are called _____.

14. Prokaryotic cells lack _____ organelles.

15. Lysosomes are membrane-bound sacs filled with _____.

16. Mitochondria is known as the _____ of the cell.

17. The central vacuole of some plant cells may occupy _____ of the cell volume.

18. Specific cells of reproductive organs or tissues in animals and plants are divided by _____ division.

True and False Statements

1. Oxidation of food takes place in the mitochondria.

2. All plastids have pigments.

3. Cellulose is a protein.

4. Blue green algae are prokaryotes.

5. The cell wall is freely permeable.

6. Bacteria contain mitochondria.

7. DNA is the chemical basis of life.

8. Cell wall of fungi is made up of cellulose.

9. Ribosomes are membrane bound organelles.

10. Both chloroplast and mitochondria contain DNA.

11. Lysosomes are filled with oxidising enzymes.

12. Endoplasmic reticulum consists of a network of membranous tubules and helps in the transport, synthesis and secretion.

13. Plant cells have centrioles which are absent in almost all animal cells.

14. Ribosomes are present on the surface of smooth endoplasmic reticulum.

15. Rough endoplasmic reticulum is associated with the production and secretion of lipids.

Match the Following

1. Match the Column-I with Column-II.

Column-I		Column-II	
P.	Cell theory	(i)	Camillo Golgi
Q.	Discovery of cell	(ii)	Schleiden and Schwann
R.	Discovery of nucleus	(iii)	Robert Brown
S.	Golgi body	(iv)	Robert Hooke

(*a*) P-(i), Q-(iii), R-(ii), S-(iv)
(*b*) P-(iv), Q-(i), R-(iii), S-(ii)
(*c*) P-(iii), Q-(ii), R-(iv), S-(i)
(*d*) P-(ii), Q-(iv), R-(iii), S-(i)

2. Match the Column-I with Column-II.

Column-I		Column-II	
P.	Nucleus	(i)	Absence of membrane
Q.	Ribosomes	(ii)	Single membrane
R.	Lysosomes	(iii)	Double membrane

(*a*) P-(iii), Q-(i), R-(ii)
(*b*) P-(i), Q-(iii), R-(ii)
(*c*) P-(iii), Q-(ii), R-(i)
(*d*) P-(ii), Q-(i), R-(iii)

3. Match the processes given in Column-I with their function given in Column-II.

Column-I		Column-II	
P.	Lysosomes	(i)	Glycosylation of protein
Q.	Endoplasmic reticulum	(ii)	Production of protein
R.	Ribosomes	(iii)	Detoxification
S.	Golgi body	(iv)	Suicidal sacs

(*a*) P-(ii), Q-(iv), R-(i), S-(iii)
(*b*) P-(i), Q-(iii), R-(ii), S-(iv)
(*c*) P-(iv), Q-(iii), R-(ii), S-(i)
(*d*) P-(iii), Q-(ii), R-(iv), S-(i)

4. Match the processes given in Column-I with their definition given in Column-II.

Column-I		Column-II	
P.	Nucleolus	(i)	Site of energy formation
Q.	Middle lamella	(ii)	Site of rRNA synthesis
R.	Mitochondria	(iii)	Layer between the adjacent cell wall in the plant.
S.	Thylakoid	(iv)	Flattened sacs in grana

(*a*) P-(ii), Q-(iii), R-(i), S-(iv)
(*b*) P-(i), Q-(iii), R-(ii), S-(iv)
(*c*) P-(iv), Q-(i), R-(iii), S-(ii)
(*d*) P-(iii), Q-(ii), R-(iv), S-(i)

Multiple Choice Questions

1. Which element mainly occurs in middle lamella?
(*a*) Calcium (*b*) Magnesium
(*c*) Sodium (*d*) Potassium

2. Cell membrane is composed of
(*a*) proteins and cellulose.
(*b*) proteins and phospholipids.
(*c*) carbohydrates only.
(*d*) proteins, phospholipids and some carbohydrates.

3. Cell wall was discovered by:
(*a*) Robert Brown (*b*) Malpighi
(*c*) Robert Hooke (*d*) Nageli

4. Cell wall is
(*a*) dead and impermeable.
(*b*) dead and permeable.
(*c*) living and impermeable.
(*d*) living and selective.

5. The most abundant lipid in cell membrane is:-
(*a*) cutin. (*b*) Cholesterol.
(*c*) Steroid. (*d*) Phospholipid.

6. Lysosomes are filled with
(*a*) hydrolytic enzymes.
(*b*) glycolytic enzymes.
(*c*) digestive enzymes.
(*d*) both (*a*) and (*c*).

7. Ribosomes are made up of :-
(*a*) DNA + Protein (*b*) RNA + Protein
(*c*) RNA + Lipid (*d*) RNA + Phosphate

8. The fluid mosaic model of plasma membrane was proposed by:-
(*a*) Schleiden and Schwann.
(*b*) Singer and Nicolson.
(*c*) Rudolf Virchow.
(*d*) A.V. Leeuwenhoek.

9. Grana and stroma are the parts of which cell organelles?
(*a*) Mitochondria (*b*) Chloroplast
(*c*) Ribosome (*d*) Golgi bodies

10. The function of glyoxysomes is:-
(*a*) protein metabolism.
(*b*) fat metabolism.
(*c*) carbohydrate metabolism.
(*d*) protein synthesis.

11. Who coined the term mitochondria?
(*a*) Altman (*b*) Benda
(*c*) De duve (*d*) Camillo golgi

12. Which organelle is not visible when student observes a human cheek cell under a microscope?
(*a*) Nucleolus (*b*) Endoplasmic reticulum
(*c*) Nucleus (*d*) Chloroplast

13. Cell wall of which organism is not composed of cellulose?
(*a*) Bacteria (*b*) *Hydrilla*
(*c*) Banyan tree (*d*) Cactus

14. A poorly developed zone in the centre of a cell that has DNA molecule is called as:
(*a*) nucleolus of prokaryote.
(*b*) nucleoid of prokaryote.
(*c*) nucleus of prokaryote.
(*d*) nucleus of eukaryote.

15. 1 μm is equal to
(*a*) 10^{-6} m (*b*) 10^{-9} m
(*c*) 10^{-8} m (*d*) 10^{-3} m

16. Out of the following which substances are not stored in vacuoles?
(*a*) Amino acids (*b*) Proteins
(*c*) DNA (*d*) Sugars

17. The main function of Golgi body is:
(*a*) Phosphorylation (*b*) Translocation
(*c*) Glycosylation (*d*) Fermentation

18. What is the meaning of "Omnis cellula-e cellula" ?
(*a*) Non-living things can help in the formation of living cells.
(*b*) A cell can arise on its own.
(*c*) New cells arise from pre-existing cells.
(*d*) All organisms are made up of cell and its products.

19. Semi-autonomous cell organelle is:
(*a*) Mitochondria (*b*) Ribosomes
(*c*) Plasma membrane (*d*) Peroxisomes

20. The amount of protein and lipid in the plasma membrane of red blood cells are:
(*a*) 42% and 55% respectively.
(*b*) 40% and 52% respectively.
(*c*) 32% and 62% respectively.
(*d*) 52% and 40% respectively.

21. Where TCA cycle takes place?
(*a*) Cytoplasm
(*b*) Inner membrane of mitochondria
(*c*) Outer membrane of mitochondria
(*d*) Mitochondrial matrix

22. The nuclear membrane originates from:
(*a*) Golgi cisternae (*b*) E.R
(*c*) Golgi vesicle (*d*) lysosomes

23. Turgidity of cell is maintained by:
(*a*) vacuole (*b*) lysosome
(*c*) plastid (*d*) golgi body

24. Ingestion of solid food by plasma membrane is called:
(*a*) endosomes (*b*) pinocytosis
(*c*) cytokinesis (*d*) phagocytosis

25. The membrane surrounding the vacuole is called:
(*a*) cell wall (*b*) tonoplast
(*c*) plasma membrane (*d*) cell membrane

26. Association of several ribosomes is called:
(*a*) polysome (*b*) informosome
(*c*) both (*a*) and (*b*) (*d*) none of these

27. Four daughter cells formed after meiosis are:
(*a*) genetically similar.
(*b*) genetically different.
(*c*) anucleated.
(*d*) multinucleated.

28. A chromosome have subterminal centromere is called:
(*a*) telocentric. (*b*) acrocentric.
(*c*) metacentric. (*d*) sub-metacentric.

29. Genetic material of prokaryotic cells lies in:
(*a*) nucleus (*b*) nucleolus
(*c*) nucleoid (*d*) centrosomes

30. The larger subunit of 80S ribosome is:
(*a*) 50S (*b*) 60S
(*c*) 40S (*d*) 30S

Subjective Questions

Very Short Answer Type Questions

1. What are the two components of plasma membrane?

2. Cell wall of a plant cell is made up of which component?

3. Give one example each of an unicellular and a multicellular organism.

4. Name the scientist involved in the discovery of golgi apparatus.

5. What is the intracellular source of digestive enzyme?

6. Where are genes located?

7. Mention the types of chromosomes based on the position of centromere.

8. Name the organelle involved in the formation of lysosomes?

9. What is the significance of meiosis?

10. How cisternae of golgi complex is different from the cisternae of endoplasmic reticulum?

11. What do we understand by the term "semi-autonomous organelle"?

12. What are chromosomes made up of?

13. How meiosis is different from mitosis?

14. Name the only cell organelle seen in prokaryotic cell.

15. What is the energy currency of the cell?

Short Answer Type Questions

1. Explain why the presence of vacuole is important in plants?

2. State any two function of nucleus.

3. Explain the term endocytosis.

4. Why is Golgi apparatus called the secretory organelle of the cell?

5. What is cell sap? Give its composition.

6. Answer the following:
(*a*) RBC placed in concentrated salt solution.
(*b*) Ribosomes are removed from the cell.

7. Write the name of different plant parts in which chromoplast, chloroplast and leucoplast are present.

8. Write two differences between smooth endoplasmic reticulum and rough endoplasmic reticulum?
9. What is cytosol and cytoskeleton?
10. Draw a diagram of prokaryotic cell and label at least 3 parts.
11. How can we say that a prokaryotic ribosome is different from eukaryotic ribosomes?

Long Answer Type Questions

1. How a bacterial cell is different from an onion peel cell?
2. Describe the structure of mitochondria. Also state its two important functions.
3. Write three differences between plasma membrane and the cell wall. Also, write two functions of each.

Case Study Type Questions

Case Study-I

Based on the type of pigments plastids can be classified into chloroplasts, chromoplasts and leucoplasts. Leucoplasts are colourless plastids. They are further categorized into 3 types namely amyloplasts, elaioplasts and aleuroplasts.

1. What is the function of amyloplasts?
   (*a*) Store carbohydrates or starch.
   (*b*) Provide colour to various flowers and fruits.
   (*c*) Help in photosynthesis.
   (*d*) Provide support to the plants.
2. Which plastids are responsible for providing specific colour to fruits and flowers?
   (*a*) Leucoplasts
   (*b*) Chromoplasts
   (*c*) Chloroplasts
   (*d*) Aleuroplasts
3. Which of the following statement is correct?
   (*a*) Both plant cell and animal cell possess plastids.
   (*b*) Only animal cells possess plastids.
   (*c*) Only plant cells possess plastids.
   (*d*) Both plant cell and animal cell lack plastids.
4. Which of the following plastid contain photosynthetic pigment?
   (*a*) Leucoplasts
   (*b*) Chloroplasts
   (*c*) Chromoplasts
   (*d*) None of these
5. Which type of plastid is more common in roots and flowers of the plant respectively?
   (*a*) Leucoplasts and Chromoplasts
   (*b*) Chromoplasts mainly
   (*c*) Chloroplasts and amyloplasts
   (*d*) Elaioplasts and amyloplasts

Case Study-II

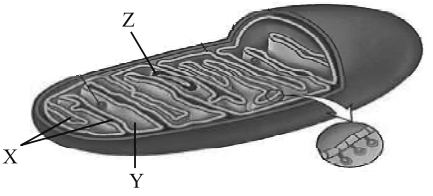
Cell is the fundamental structural unit of living organisms. It is also the basic functional unit of life. Cells in organisms divide for growth of body, for replacing dead cells, and for forming gametes for reproduction. The process by which new cells are made is called cell division. There are two main types of cell division: mitosis and meiosis.

1. How many daughter cells are formed in meiosis?
   (*a*) 2
   (*b*) 3
   (*c*) 1
   (*d*) 4
2. What is the nuclear DNA content of each daughter cell after mitosis?
   (*a*) Same as that of mother cell
   (*b*) One-fourth as that of mother cell
   (*c*) Half as that of mother cell
   (*d*) Double as that of mother cell
3. The variations in the offspring can come through
   (*a*) Mitosis
   (*b*) Test cross
   (*c*) Meiosis
   (*d*) Both (*a*) and (*c*)
4. Mitosis, in plants, occurs
   (*a*) in meristematic tissues.
   (*b*) during the growth of leaves, flowers and fruits.
   (*c*) both (*a*) and (*b*).
   (*d*) neither (*a*) or (*b*).

Case Study-III

This structure is visible under light microscope as small spheres. It is present in all eukaryotic cells which undergo aerobic respiration. It is a double membrane bound organelle. It generates energy in the form of ATP. It has inner folds called cristae which help in increasing the surface area for

absorption. They have their own DNA, RNA and ribosome through which they are able to replicate and forms proteins hence known as semi-autonomous organelle.



1. Identify the cell organelle and mention its common name:

(*a*) Plastids; kitchen of the cell

(*b*) Mitochondria; power house of the cell

(*c*) Lysosome; suicidal bags

(*d*) Ribosome; factory of protein

2. Name the components labelled as X, Y and Z in the diagram:

(*a*) Crista, mitochondrial matrix and DNA

(*b*) Crista, DNA molecule and mitochondrial matrix

(*c*) DNA, mitochondrial matrix and lumen

(*d*) Mitochondrial matrix, crista and DNA

3. What is the function of the component labelled as X:

(*a*) Site of Kreb's cycle.

(*b*) Site of protein synthesis.

(*c*) Duplication of organelle.

(*d*) Increases surface area of respiration.

4. Which structure of mitochondria act as the site of Kreb's cycle?

(*a*) X

(*b*) Z

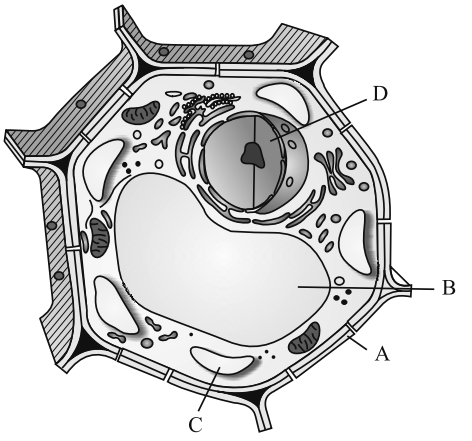
(*c*) Y

(*d*) None of these

Case Study-IV

Cell is the structural and functional unit of life. In the living organisms, the cells are of two types namely: Prokaryotic and eukaryotic cells. Both plant and animal cells are eukaryotic. Though plant and animal cells show some similar basic structure but they also differ from each other in a number of ways.

Study the above paragraph and answer the following questions.



1. Identify whether the given cell is prokaryotic or eukaryotic.

(*a*) Prokaryotic, Presence of cell wall

(*b*) Prokaryotic, Presence of true nucleus

(*c*) Eukaryotic, Presence of true nucleus

(*d*) Eukaryotic, Presence of cell wall

2. Match Column-I (labellings) and Column-II (cell component)

Column-I	Column-II	
A	(i)	Vacuole
B	(ii)	Nucleus
C	(iii)	Cell wall
D	(iv)	Chloroplast

(*a*) A-(ii), B-(iii), C-(i), D-(iv)

(*b*) A-(iii), B-(i), C-(iv), D-(ii)

(*c*) A-(iii), B-(iv), C-(ii), D-(i)

(*d*) A-(iv), B-(i), C-(iii), D-(ii)

3. Identify whether it is a plant cell or an animal cell?

(*a*) Plant cell, Presence of chloroplasts

(*b*) Plant cell, Presence of incipient nucleus

(*c*) Animal cell, Presence of chloroplast

(*d*) Plant cell, Presence of nucleus

4. Cell wall of the plant cell is composed of:

(*a*) Peptidoglycan (*b*) Hemicellulose

(*c*) Chitin (*d*) Cellulose

Introduction

There is immense biological diversity among organisms on Earth, which includes an estimated 8.7 million described species. This diversity is evident in the wide range of sizes, shapes, structures, and functions found across different organisms. These organisms are classified into various taxonomic ranks such as phyla and divisions, reflecting the complexity and variety of life forms on our planet.

Yet there are similarities among them in few of the **basic functions**. All living organisms are made up of a **common basic unit**. After various research and study in this concept, scientists concluded that the basic unit is the cell. The cell is a unit which makes, performs and activates several functions and activities of the organism. Thus, they are termed as the basic functional and structural unit of the cell. The cell is separated from the surrounding environment through a membrane. The cell has several functions, abilities and organelles in it. This function and ability changes as the position or the organism changes. Also the cell number changes per organism that is why some organisms are unicellular and some multicellular. In unicellular organisms the cell performs all the functions and work of the organisms while in multicellular ones it is well developed and divided among the organisms body.

Cytology → The science dedicated to the study of cell structure.

Cell biology → The Study of all the structures and functions along with the reproduction of the cell.

Type of Cells

There are differences among the cells as some have organelles while others lack them. They are: prokaryotic cells and eukaryotic cells. This division is made on the basis of the differences among major features: Cell organelles (Compartmentalisation), Cytoskeletal structures and Organisation of nuclear material.

Prokaryotic Cells – Bacterium

- **Antonie Von Leeuwenhoek** was first to discover bacteria from the teeth scum and stored rain water which was called as wild animalcules.

Occurrence

- Prokaryotes are included in Kingdom **Monera** and thus are commonly called as **Monerans**. The common ones are **bacteria**, **cyanobacteria** (Blue-green algae), ***Mycoplasma*** or PPLO (Pleuro-pneumonia like organisms), ***Spirochaetes and Rickettsiae***.
- Bacteria is the simplest and commonest type of organisms occurring all over in almost all habitats. The habitat are diverse and varied, even found in the hot springs, beneath the icebergs, in intestine of man, deep in the soil, deep in sea water, etc.

Size

- Bacteria have range of cell sizes.
- Smallest bacterium is ***Dialister*** (0.15 to0.3 μm in diameter).
- Largest bacterium is ***Spirochaetes*** (about 500 μm).
- Normally the size of ***Bacillus*** lies from 0.3 μm to 15 μm.

Shape

E. J. Cohn studied bacteria and identified the following four basic shapes of bacteria:

- **Coccus**: **Spherical** shaped bacteria.
  For example: *Streptococcus pneumoniae*

Test Prep

Chromosomes

Strasburg (1875) discovered and described the chromosome structure that appeared in the nucleus during the cell division process. At the time of cell division the chromatin material gets condensed to form rod-shaped structures called chromosomes. Chromosomes contain information for inheritance of characters from parents to next generation in the form of DNA. Each chromosome consists of two chromatids and both the chromatids of the chromosomes are connected by a structure called centromere. Chromosomes are composed of DNA and protein.

"2n" number of chromosomes are present in a diploid cell while "n" number of chromosomes is present in a haploid cell. For example every normal human being has 46 chromosomes in each body cell except gametes i.e. sperm and ovum which are haploid.

Types of chromosomes on the basis of position of centromere;

(i) Telocentric: When the centromere is terminal in position.

(ii) Acrocentric: When the centromere is sub-terminal in position.

(iii) Metacentric: When the centromere is located at the middle of the chromosomes.

(iv) Sub-metacentric: When the centromere is present slightly away from the midpoint of the chromosomes.

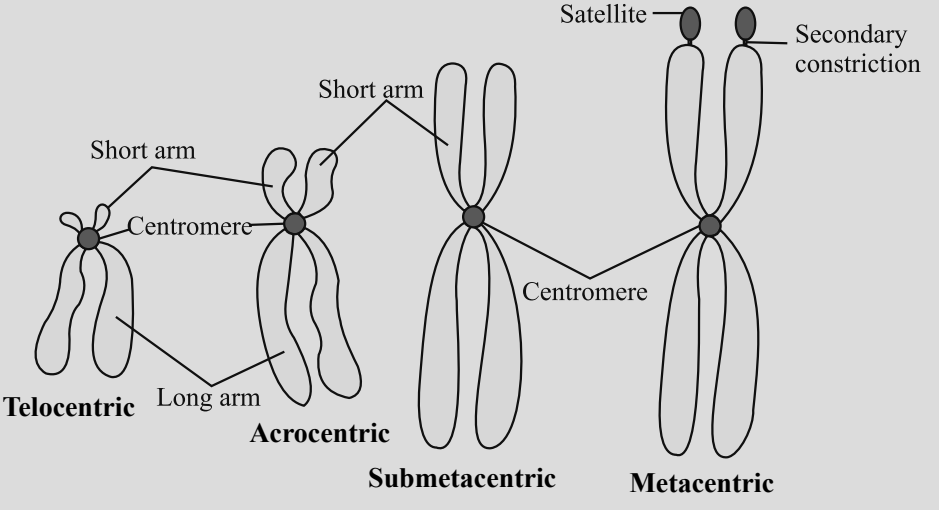


Fig. 20: Types of Chromosomes

Cell Reproduction or Cell Cycle

- The cell cycle encompasses three fundamental stages: Cell growth (involving the synthesis and duplication of various cellular components), DNA replication (the phase during which DNA is replicated), and cell division (culminating in the division of a mature adult cell into two daughter cells).
- In the context of a typical eukaryotic cell cycle, considering human cells cultured under various conditions, these cells undergo division approximately once every 24 hours.
- Contrastingly, Yeast cells exhibit a remarkable ability to complete the entire cell cycle in a much shorter timeframe, achieving this process in about 90 minutes.

Cell Cycle and its Phases

- The cell cycle is divided into two main phases: Interphase and M Phase (Mitosis phase).
- M Phase involves actual cell division (mitosis), while Interphase occurs between two successive M phases.
- In a 24-hour average human cell cycle, cell division proper lasts around an hour, with Interphase lasting over 95% of the cycle duration.

Multiple Choice Questions

1. What is the chemical nature of carrier molecules that across plasma membrane?

(*a*) Sugary (*b*) Starchy

(*c*) Proteinaceous (*d*) Fatty acidic

2. Why mouth is rinsed before preparing a temporary mouth of cheek cell?

(*a*) Remove food particles

(*b*) Make it alkaline

(*c*) Avoid injury

(*d*) Make it acidic

3. What characteristics can be noted by a student while observing an onion peel slide under a microscope?

(*a*) Cells attached edge to edge without intercellular space.

(*b*) Presence of single nucleus in the cell.

(*c*) Presence of cell wall around each rectangular cell.

(*d*) All of these.

4. Following are four steps for preparing a temporary mount of human cheek cells:

(i) Scrap from the inner side of the cheek and spread it on a clean slide.

(ii) Put a drop of glycerine on the glass slide.

(iii) Add two or three drops of methylene blue.

(iv) Rinse the mouth with fresh water and disinfectant.

Identify the correct sequence of these operations.

(*a*) (i)—(ii)—(iii)—(iv)

(*b*) (iv)—(i)—(ii)—(iii)

(*c*) (iv)—(i)—(iii)—(ii)

(*d*) (i)—(iii)—(ii)—(iv)

5. Lysosomes are considered as suicidal bags of the cell. The reason is:

(*a*) Lysosomes contain poison required to kill the cell.

(*b*) Lysosomes contain hydrolytic enzymes to digest the cell contents.

(*c*) Lysosomes contain genes to stop cellular activities.

(*d*) Lysosomes do not permit oxidation process of the cell.

6. Which of the following is associated with beta-oxidation of fatty acid?

(*a*) Peroxisomes (*b*) Centrosomes

(*c*) Glyoxisomes (*d*) All of these

7. Choose the odd one out.

(*a*) The movement of water across a semi permeable membrane is affected by the amount of substances dissolved in it.

(*b*) Membranes are made of organic molecules like proteins and lipids.

(*c*) Molecules soluble in organic solvents can easily pass through the membrane.

(*d*) Chitin is present in the cell membrane of plants.

8. Which microbodies is associated with detoxification?

(*a*) Spherosomes (*b*) Peroxisomes

(*c*) Glyoxysomes (*d*) Lysosomes

9. Which of the following microscopes is used to observe sub-cellular structures?

(*a*) Simple microscope (*b*) Compound microscope

(*c*) Electron microscope (*d*) All of these

10. Which of the following is called as equational division?

(*a*) Meiosis (*b*) Cytokinesis

(*c*) Mitosis (*d*) Amitosis

11. Total number of pairs of chromosomes in human beings are:

(*a*) 22 (*b*) 23

(*c*) 46 (*d*) 44

12. The process of osmosis is the movement across the cell membrane of:

(*a*) Salts from hypotonic solution to hypertonic solution.

(*b*) Salts from hypertonic solution to hypotonic solution.

(*c*) Water from hypotonic solution to hypertonic solution.

(*d*) Water from hypertonic solution to hypotonic solution.

13. The breakdown of pyruvate to give CO_2, water and energy takes place in:

(*a*) cytoplasm. (*b*) mitochondria.

(*c*) chloroplast. (*d*) nucleus.

14. Red colour of tomato and chilly is due to:-

(*a*) chloroplast. (*b*) chromoplast.

(*c*) amyloplast. (*d*) leucoplast.

15. Movement of molecules during diffusion can be described by all of the following except:

(*a*) Each molecule moves randomly.

(*b*) Solute molecules always move down the concentration gradient.

(*c*) Each molecule moves independently of other molecules.

(*d*) Net movement of solute molecules is from region of lower concentration to region of higher concentration.

16. Mitoplast is:-

(*a*) outer membrane less chloroplast.

(*b*) outer membrane less mitochondria.

(*c*) granum less chloroplast.

(*d*) well developed nucleus.

17. A cell is having two boundaries, the outer being cell wall and inner being plasma membrane. The inherent property of this pair moving from outside to inside is:

(*a*) semipermeable and Permeable.

(*b*) semipermeable and Semipermeable.

(*c*) permeable and Semipermeable.

(*d*) permeable and Permeable.

18. Cells vary in their size. Arrange the following cells in ascending order of their size and select the correct option among the following:

(i) *Mycoplasma* (ii) Ostrich egg

(iii) Human RBC (iv) Bacteria

(*a*) (i) < (iv) < (iii) < (ii)

(*b*) (i) < (ii) < (iii) < (iv)

(*c*) (ii) < (i) < (iii) < (iv)

(*d*) (iii) < (i) < (ii) < (iv)

19. Many elements are found in living organism either free or in the form of compounds. One of the following is not found in living organism:

(*a*) Magnesium (*b*) Iron

(*c*) Sodium (*d*) Silicon

20. When the concentration of solutes differs on two sides of a membrane permeable only to water, then:

(*a*) Water will move across the membrane by active transport.

(*b*) Water will move across by the process of osmosis.

(*c*) Water will move across through plasmolysis.

(*d*) Water will move across by diffusion.

Competitive Corner

1. Which of the following carry hereditary characters to the offspring in the organism? **[Delhi-NTSE: 2017-18]**

(*a*) Ribosome (*b*) Chromosome

(*c*) Plasma (*d*) Lysosome

2. A cell will swell up if:

(*a*) The concentration of water molecules in the cell is higher than the concentration of water molecules in surrounding medium.

(*b*) The concentration of water molecules in surrounding medium is higher than water molecules concentration in the cell.

(*c*) The concentration of water molecules is same in the cell and in the surrounding medium.

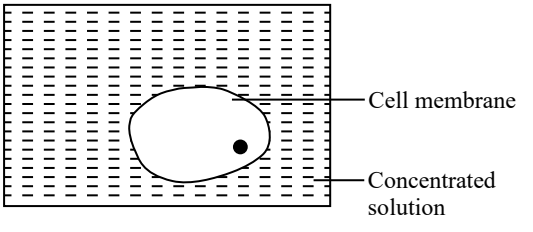
(*d*) Concentration of water molecules does not matter.

3. The part of the nucleus that plays major role for synthesis of ribosome: **[Kerala-NTSE: 2017-18]**

(*a*) Chromatin (*b*) Nuclear pore

(*c*) Nucleoplasm (*d*) Nucleolus

4. The given diagram shows a cell placed in a hypertonic solution. What would happen when the cell is taken out from the hypertonic solution and is placed in freshwater for a long time?



(i) The cell will recover its shape slowly.

(ii) The cell will shrink first.

(iii) The cell will burst eventually.

(iv) Water molecules will move into the cell by osmosis.

Select the correct option.

(*a*) (i) and (ii) (*b*) Only (iv)

(*c*) (i), (iii) and (iv) (*d*) (i), (ii), (iii) and (iv)

Explanations

School Level

Quick Recall

Fill in the Blanks

1. Cell **2.** Robert Hooke
3. Leeuwenhoek **4.** *Mycoplasma*
5. 10-100 mm **6.** Unicellular
7. Lipids, protein **8.** Robert Brown
9. Osmosis **10.** Chromoplast
11. Outside **12.** Cellulose
13. Eukaryotes **14.** Membrane bound
15. Digestive enzymes **16.** Powerhouse
17. 50-90% **18.** Meiosis

True and False Statements

1. True **2.** False **3.** False **4.** True **5.** False
6. False **7.** True **8.** False **9.** False **10.** True
11. False **12.** True **13.** False **14.** False **15.** False

Match the Following

1. (*d*) **2.** (*a*) **3.** (*c*) **4.** (*a*) **5.** (*c*)

Assertion & Reason Type Questions

1. (*a*) **2.** (*d*) **3.** (*a*) **4.** (*c*) **5.** (*a*)

Statement Type Questions

1. (*d*) **2.** (*d*) **3.** (*a*) **4.** (*d*) **5.** (*d*)

Multiple Choice Questions

1. (*a*) **2.** (*d*) **3.** (*c*) **4.** (*b*) **5.** (*d*)
6. (*d*) **7.** (*b*) **8.** (*b*) **9.** (*b*) **10.** (*b*)
11. (*b*) **12.** (*d*) **13.** (*a*) **14.** (*b*) **15.** (*a*)
16. (*c*) **17.** (*c*) **18.** (*c*) **19.** (*a*) **20.** (*d*)
21. (*d*) **22.** (*b*) **23.** (*a*) **24.** (*d*) **25.** (*b*)
26. (*a*) **27.** (*b*) **28.** (*b*) **29.** (*c*) **30.** (*b*)

Subjective Questions

Very Short Answer Type Questions

1. Protein and lipid.

2. Cellulose.

3. ❒ *Amoeba* is an example of unicellular organism.
❒ Human being is an example of multicellular organism.

4. Golgi apparatus was discovered by Camillo Golgi.

5. Lysosomes.

6. Genes are located on chromosomes.

7. Chromosomes are classified into four categories based on the location of the centromere:
- ❖ Metacentric
- ❖ Sub-metacentric
- ❖ Acrocentric
- ❖ Telocentric

8. Golgi apparatus.

9. The significance of meiosis is exchange of genetic material during reproduction which leads to genetic variations.

10. The cisternae of Golgi complex are flat, disc-shaped and sac-like that forms two faces namely cis and trans while in ER, cisternae are long, flat, tubular and parallelly arranged structures.

11. Organelles like chloroplast and mitochondria have their own genetic material (DNA) and are capable of self-duplication (replication), thus they are referred to as semi-autonomous organelles.

12. Chromosomes are composed of DNA and proteins.

13. The main difference between the mitosis and meiosis is that mitosis produces two identical diploid cells and meiosis produces four haploid daughter cells.

14. Ribosomes

15. Adenosine triphosphate (ATP)

Short Answer Type Questions

1. Vacuole is a single membrane bound organelle that constitute almost 50%-90% of the volume of cell. It helps in maintaining the turgor pressure against cell

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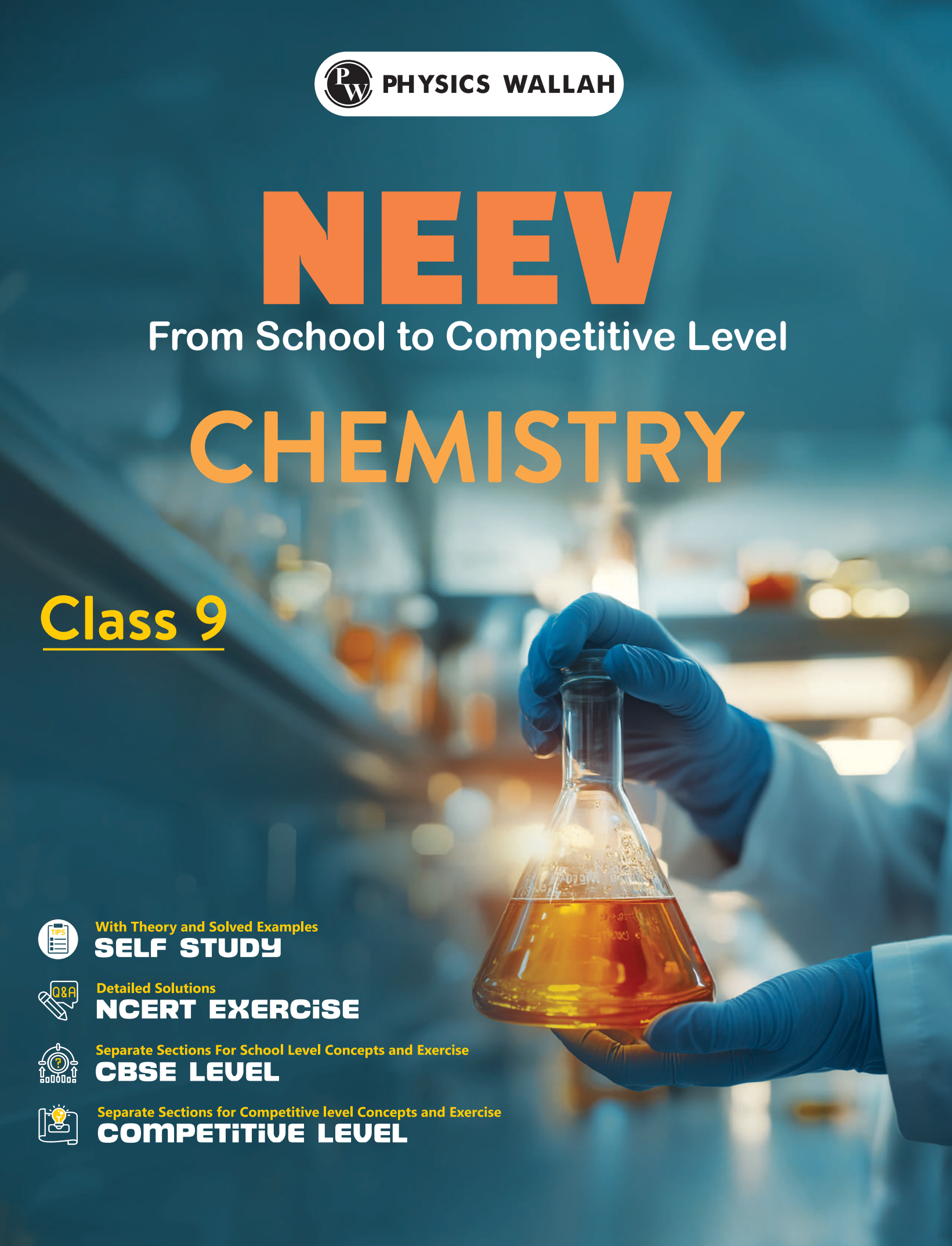

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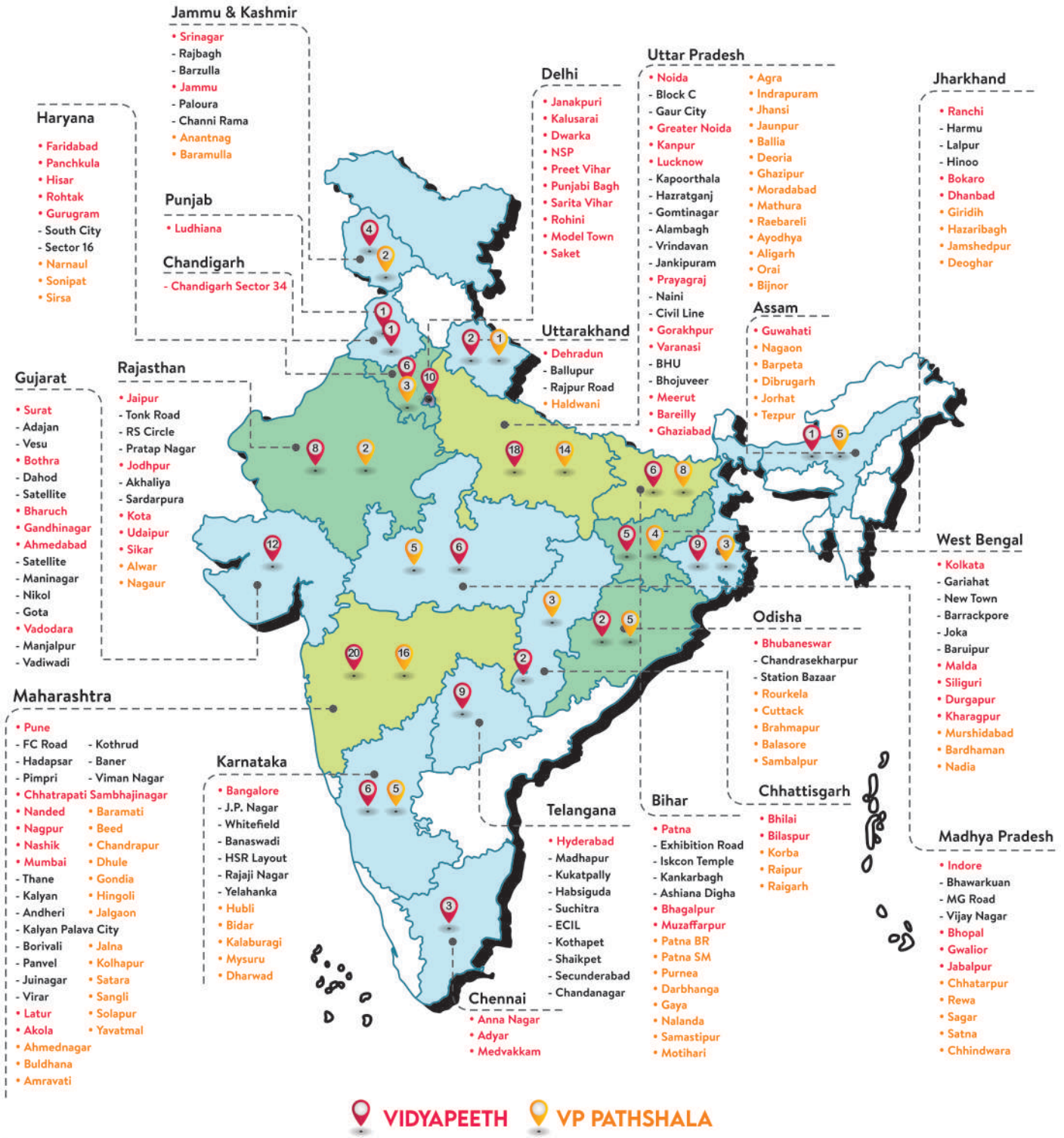

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