



पुर्ना International School

Shree Swaminarayan Gurukul, Zundal

CLASS - IX

SUBJECT - SCIENCE

[SAMPLE PLAN]

BIOLOGY

APRIL - MAY

SESSION - 2021 - 2022

INDEX

| S.NO | MONTH | NAME OF THE LESSON |
|------|-------------|--------------------------------------|
| 1. | APRIL – MAY | CH – 5 THE FUNDAMENTALS UNIT OF LIFE |
| 2. | JUNE – JULY | CH – 6 TISSUE |
| 3. | AUGUST | CH- 7 DIVERSITY IN LIVING ORGANISMS |
| 4. | SEPTEMBER | REVISION |

CLASS - 9
SUB – BIOLOGY

CH – 5 THE FUNDAMENTALS UNIT OF LIFE

Cell

It is the structural and functional unit of life.

- **Cell is termed as the structural unit of life as it provides structure to our body.**
- **Cell is considered as the functional unit of life as all the functions of the body take place at cell level.**

Discovery of cell:

- Discovered by Robert Hooke in 1665.
- Robert Brown in 1831 discovered the nucleus in the cell.

Cell Theory:

Cell theory states that:

- All living organisms are composed of cells.
- Cell is the fundamental unit of life.
- All new cells come from pre-existing cells.

Types of Organisms on the Basis of Number of Cells

There are two kinds of organisms on the basis of cells:

(i) Unicellular Organisms: The organisms that are made up of single cell and may constitute a whole organism, are named as unicellular organisms.

For example: Amoeba, Paramecium, bacteria, etc.

(ii) Multicellular Organisms: The organisms which are composed of a collection of cells that assume function in a coordinated manner, with different cells specialized to perform particular tasks in the body, are named as multicellular organisms.

For example: Plants, human beings, animals, etc.

Shape and Size of Cells

- Cells vary in shape and size. They may be oval, spherical, rectangular, spindle shaped, or totally irregular like the nerve cell.
- The size of cell also varies in different organisms. Most of the cells are microscopic in size like red blood cells (RBC) while some cells are fairly large like nerve cells.

Types of Cells

The cells can be categorized in two types:

1. Prokaryotic Cell
2. Eukaryotic Cell

1. Prokaryotic cell

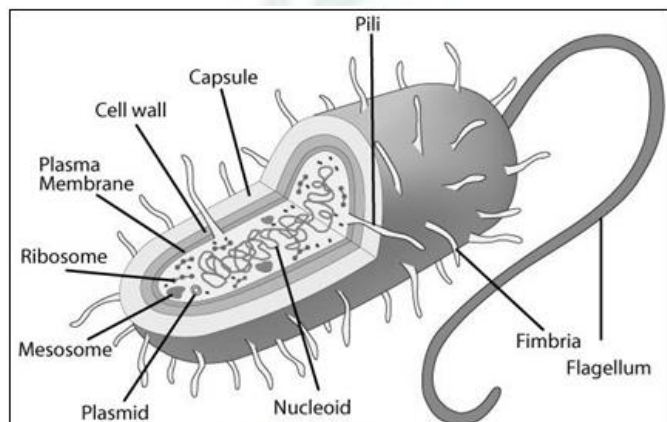
Prokaryotic cells are cells in which true nucleus is absent. They are primitive and incomplete cells.

Prokaryotes are always unicellular organisms. For example, archaebacteria, bacteria, blue green algae are all prokaryotes.

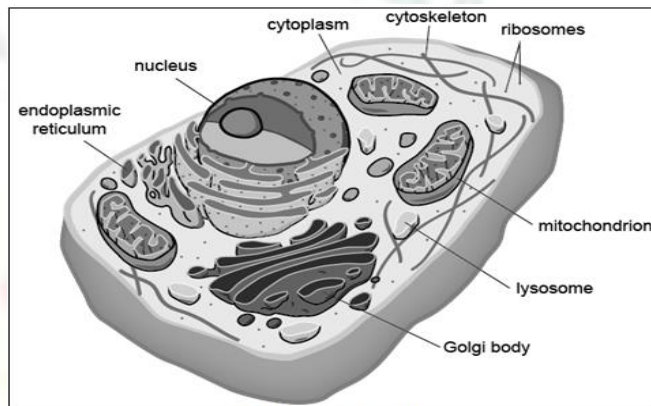
2. Eukaryotic Cell

Eukaryotic cells are the cells in which true nucleus is present. They are advanced and complete cells.

Eukaryotes include all living organisms (both unicellular and multicellular organisms) except bacteria and blue green algae.



Prokaryotic cell



Eukaryotic cell

Difference Between Prokaryotic and Eukaryotic Cells:

| S. No. | Prokaryotic cell | Eukaryotic cell |
|--------|--|--|
| 1. | Size of cell is generally small (1-10 mm). | Size of cell is generally large (5-100 mm). |
| 2. | Nucleus is absent. | Nucleus is present. |
| 3. | It contains single chromosome. | It contains more than one chromosome. |
| 4. | Nucleolus is absent. | Nucleolus is present. |
| 5. | Membrane bound cell organelles are absent. | Membrane bound cell organelles such as mitochondria, plastids, endoplasmic reticulum, golgi apparatus, lysosomes, etc., are present. |
| 6. | Cell division takes place by fission or budding. | Cell division takes place by mitotic or meiotic cell division. |

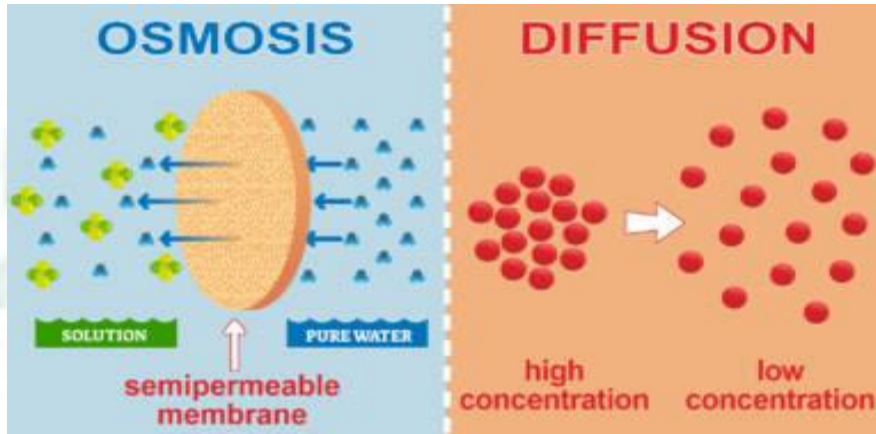
Diffusion

The movement of molecules from a region of their high concentration to a region of their lower concentration is known as **diffusion**.

Osmosis:

The movement of water molecule through selectively permeable membrane along the concentration gradient is called **Osmosis**.

Plant cell tends to absorb water through osmosis.






If the medium surrounding the cell has a higher water concentration than the cell, the cell will gain water by osmosis. Such a solution is known as a **HYPOTONIC SOLUTION**.

If the medium has exactly the same water concentration as the cell, there will be no net movement of water across the cell membrane. Such a solution is known as an **ISOTONIC SOLUTION**.

If the medium has a lower water concentration than the cell will lose water by osmosis. Such a solution is known as a **HYPERTONIC SOLUTION**.

Hypertonic vs. Isotonic vs. Hypotonic Solutions

| Hypertonic | Isotonic | Hypotonic |
|---|---|---|
| Higher solute OUTSIDE | Equal solute | Higher solute INSIDE |
| Higher water INSIDE | Equal water | Higher water OUTSIDE |
| Water moves OUT | No net movement | Water moves IN |
| Cell SHRINKS | Normal | Cell SWELLS |
|  |  |  |

STRUCTURE OF CELL

Cell is generally composed of three basic components:

(i) Cell wall and cell membrane

(ii) Nucleus

(iii) Cytoplasm

(i) Cell membrane or Plasma membrane:

- Plasma membrane is the covering of the cell that separates the contents of the cell from its external environment.
- It is a living part of the cell and is present in cells of plants, animals and microorganisms.
- It is very thin, delicate, elastic and selectively permeable membrane.
- It is composed of lipid and protein.

Function

- It allows or permits the entry and exit of some materials in and out of the cell.
- It also prevents movement of some other materials. The cell membrane is called selectively permeable membrane.

(ii) Cell wall:

- Cell wall is non-living, thick and freely permeable covering made up of cellulose.
- It is present in eukaryotic plant cells and in prokaryotic cells.

Functions:

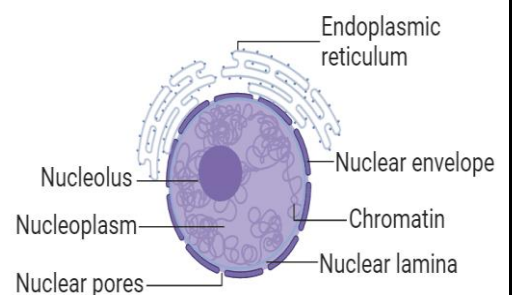
- It determines the shape and rigidity to the plant cell.
- It protects the plasma membrane.
- It prevents desiccation or dryness in cell.
- It helps in the transport of various substances in and out of the cell.

(iii) Nucleus: (BRAIN OF THE CELL)

- Nucleus is dense and spherical organelle.
- Nucleus is bounded by two membranes, both forming nuclear envelope. Nuclear envelope contains many pores known as nuclear pores.
- The fluid which present inside the nucleus is called nucleoplasm.
- Nucleus contains chromosomes and chromosomes contain genes which are the centres of genetic information.

Functions:

- Nucleus controls all the metabolic activities of the cell.
- It regulates the cell cycle.



- Nucleus is the storehouse of genes. It is concerned with the transmission of hereditary traits from the parent to offspring.

(iv) Cytoplasm:

- It is a jelly-like, viscous, colourless semi-fluid substance that occurs between the plasma membrane and the nuclear membrane.
- The aqueous ground substance of cytoplasm is called cytosol that contains a variety of cell organelles and other insoluble waste products and storage products, like starch, glycogen, lipid, etc.

Functions:

- Protoplasm acts as a store of vital chemicals like amino acids, proteins, sugars, vitamins, etc.
- It is the site of certain metabolic reactions, like glycolysis, synthesis of fatty acids, nucleotides, etc.

Cell organelles:

Inside the cell there are different parts performing different activities to keep the cell alive and functional. These parts are called Cell organelles. They are explained below:

1. Golgi Apparatus:

- Golgi apparatus consists of a set of membrane bound, fluid filled vesicles, vacuoles and flattened cisternae (closed sacks).
- Cisternae are usually arranged parallel to each other.

Functions:

- Its main function is to store, modify, package and dispatch the substances.
- It is also involved in the synthesis of cell wall, plasma membrane and lysosomes.

2. Endoplasmic Reticulum:

- It is a membranous network of tube like structures extending from nuclear membrane to plasma membrane.
- It is absent in prokaryotic cells and matured RBCs of mammals.

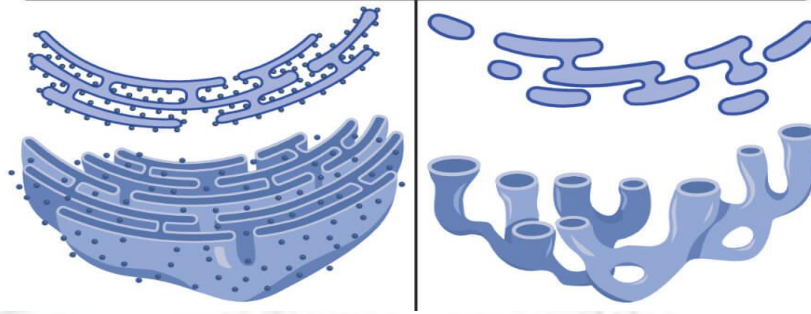
There are two types of endoplasmic reticulum:

- (i) Rough Endoplasmic Reticulum (RER): Here ribosomes are present on the surface for the synthesis of proteins.
- (ii) Smooth Endoplasmic Reticulum (SER): Here ribosomes are absent and is meant for secreting lipids.

Functions:

- It gives internal support to cell.
- It helps in transport of various substances from nuclear membrane to plasma membrane or vice versa.
- RER helps in synthesis and transportation of proteins.
- SER helps in synthesis and transportation of lipids.

Differences Between Rough and Smooth Endoplasmic Reticulum



3. **Ribosomes:**

- These are extremely small, dense and spherical bodies which occur freely in the matrix (cytosol) or remain attached to the endoplasmic reticulum.
- These are made up of ribonucleic acid (RNA) and proteins.

Function:

They play a major role in the synthesis of proteins.

4. **Mitochondria:**

- They are small rod-shaped organelles.
- It is a double membrane structure with outer membrane being smooth and porous whereas inner membrane being thrown into a number of folds called cristae.
- They contain their own DNA and ribosomes.
- They are absent in bacteria and red blood cells of mammals.

Functions:

- They are the sites of cellular respiration, hence provide energy for the vital activities of living cells.
- They store energy releases during reactions, in the form of ATP (Energy currency of the cell). Therefore, they are also called 'power house' of the cell.

5. **Centrosome and Centrioles:**

- Centrosome is found only in eukaryotic animal cells. It is not bounded by any membrane but consists of centrioles.
- Centrioles are hollow cylindrical structures arranged at right angle to each other and made up of microtubules.

Function:

Centrioles help in cell division and also help in the formation of cilia and flagella.

6. **Plastids:**

- Plastids are present in most of the plant cells and absent in animal cells.
- They are usually spherical or discoidal in shaped and double membrane bound organelles.
- They also have their own DNA and ribosomes.

Plastids are of three types:

- (a) **Chloroplasts:** These are the green coloured plastids containing chlorophyll. Chloroplasts aid in the manufacture food by the process of photosynthesis.
- (b) **Chromoplasts:** These are the colourful plastids (except green colour).
- (c) **Leucoplasts:** These are the colourless plastids.

Function:

- Chloroplasts trap solar energy and utilise it to manufacture food for the plant.
- Chromoplasts impart various colours to flowers to attract insects for pollination.
- Lecooplasts help in the storage of food in the form of starch, proteins and fats.

7. Lysosomes:

Lysosomes are small, spherical, sac like structures which contain several digestive enzymes enclosed in a membrane.

Functions:

- Lysosomes help in digestion of foreign substances and worn-out cell organelles.
- They provide protection against bacteria and virus.
- They help to keep the cell clean.
- During the disturbance in cellular metabolism, for example when the cell gets damaged, lysosomes may burst and the enzymes digest their own cell. Therefore, lysosomes are also known as **suicide bags** of a cell.

8. Vacuoles:

- Vacuoles are liquid/solid filled and membrane bound organelles.
- In plant cells, vacuoles are large and permanent. In animal cells, vacuoles are small In size and temporary.
- In mature plant cell, It occupies 90% space of cell volume.
- Due to its size, other organelles, including nucleus shift towards plasma membrane.

Function:

- They help to maintain the osmotic pressure in a cell.
- They provide turgidity and rigidity to the plant cell.

9. Peroxiomes:

- They are small and spherical organelles containing powerful oxidative enzymes.
- They are bounded by a single membrane.
- They are found in kidney and liver cells.

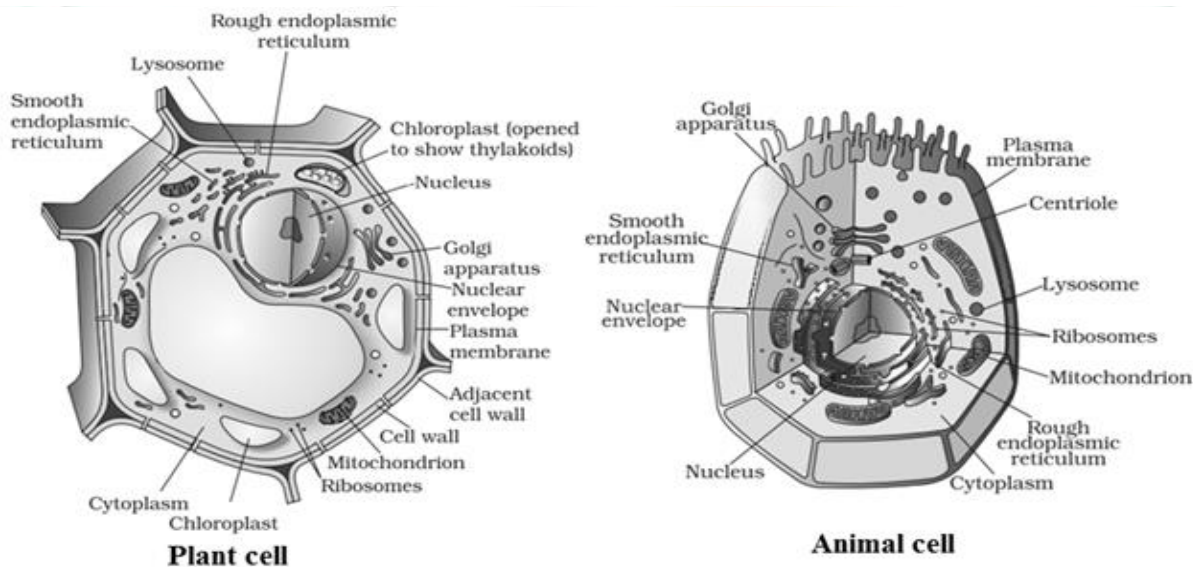
Function:

- They are specialized to carry out some oxidative reactions, such as detoxification or removal of toxic substances form cell.

Difference Between Animal Cell and Plant Cell:

| S. No. | Animal cell | Plant cell |
|--------|--|--|
| 1. | Animal cells are generally small in size. | Plant cells are larger than animal cells. |
| 2. | Cell wall is absent. | Plasma membrane of plant cell is surrounded by a rigid cell wall of cellulose. |
| 3. | Plastids are absent except in case of protozoan Euglena. | Plastids are present. |
| 4. | Here vacuoles are many, small and temporary. | They have a permanent and large central sap vacuole. |
| 5. | They have centrosome and centrioles. | They lack centrosome and centrioles. |

Structure of Plant cell and Animal cell:



Textbook Questions –

1. Who discovered cells, and how?

Ans. In 1665, an English scientist named Robert Hooke discovered cells. He examined a thin slice of cork under a self-designed microscope and observed that the cork resembled the structure of a honey comb. Hooke named these tiny compartments as 'cells'.

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

Ans - Cell is termed as the structural unit of life as it provides structure to our body. **Cell is considered as the functional** unit of life as all the functions of the body take place at cell level. like respiration, digestion, excretion etc in both unicellular and multicellular entities.

Page: 61

3. How do substances like CO₂ and water move in and out of the cell? Discuss.

Ans - CO₂ moves by diffusion – These cellular waste accumulates in high concentrations in the cell, whereas the concentration of CO₂ in the external surroundings is comparatively lower. This difference in the concentration level inside and out of the cell causes the CO₂ to diffuse from a region of higher (within the cell) to a lower concentration.

H₂O diffuses by osmosis through the cell membrane. It moves from a region of higher concentration to a lower concentrated region through a selectively permeable membrane until equilibrium is reached.

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

Ans - It allows or permits the entry and exit of some materials in and out of the cell.

It also prevents movement of some other materials. The cell membrane is called selectively permeable membrane.

Page: 63

5. 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: _____ _____ | 2. Nuclear region: well defined and surrounded by a nuclear membrane. |
| and known as _____ | 3. More than one chromosome. |
| 3. Chromosome: single | 4. _____ _____ _____ |
| 4. Membrane-bound cell organelles absent. | |

Ans -

| Prokaryotic Cell | Eukaryotic Cell |
|---|---|
| 1. Size: Generally small (1-10 μm) $1 \mu\text{m} = 10^{-6}\text{m}$ 2. The nuclear region is poorly defined due to the absence of a nuclear membrane and known as the nucleoid. 3. There is a single chromosome. 4. Membrane-bound cell organelles absent. | 1. Size: Generally large (5-100 μm) 2. Nuclear region: well defined and surrounded by a nuclear membrane. 3. There are more than one chromosomes. 4. Membrane-bound cell organelles present. |

Page: 65

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

Ans - The two organelles which have their own genetic material are:

1. Mitochondria
2. Plastids

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

Ans - In the event of any damage to cells and when revival of cells is not possible, Lysosomes burst and enzymes digest such cells. This is why lysosomes are often referred to as 'suicide bags'.

8. Why are lysosomes known as suicide bags?

Ans - When there is damage to the cell and when revival is not possible, lysosomes may burst, and the enzymes digest their own cell. Consequently, lysosomes are known as suicide bags.

9. Where are proteins synthesised inside the cell?

Ans - Protein synthesis in cells takes place in ribosomes. Hence, ribosomes are also referred to as protein factories. Ribosomes are particles that are found attached to the rough endoplasmic reticulum.

Page: 67

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

Ans - The following table depicts the differences between plant cells and animal cells.

| Characteristic | Plant Cell | Animal Cell |
|----------------|---|---------------------------|
| Cell wall | Present | Absent |
| Shape of cell | Distinct edges, shape is either rectangular or square shaped. | Round and irregular shape |

| | | |
|-----------------------|---|---|
| Nucleus | Present. Lies on one side of the cell | Present. Lies in the center of the cell |
| Lysosomes | Rarely present | Always present |
| Plastids | Present | Absent |
| Structure of Vacuoles | Single or a few large vacuole that is centrally located | Presence of numerous and small vacuoles |

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

Ans - The following are the differences between prokaryotic and eukaryotic cells.

| Prokaryotic Cell | Eukaryotic Cell |
|---|--|
| 1. Size: Generally small (1-10 μm) $1 \mu\text{m} = 10^{-6}\text{m}$ | 1. Size: Generally large (5-100 μm) |
| 2. The nuclear region is not well defined as the nuclear membrane is absent and is referred to as the nucleoid. | 2. Nuclear region: well defined and girdled by a nuclear membrane. |
| 3. There is a single chromosome. | 3. There are more than one chromosomes. |
| 4. Membrane-bound cell organelles absent. | 4. Membrane-bound cell organelles present. |

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

Ans - Plasma membrane is the covering of the cell that separates the contents of the cell from its external environment. It acts as a mechanical barrier, exchange of material from its surroundings through osmosis or diffusion in a cell won't take place. Consequently, the cell would die due to the disappearance of the protoplasmic material.

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

Ans - The Golgi apparatus consists of stacks of membrane-bound vesicles whose functions are as follows:

- storage of substances
- packaging of substances
- manufacture of substances

Without the golgi apparatus, the cells will be disabled from packing and dispatching materials that were produced by the cells. The golgi apparatus is also involved in the formation of cells. Hence, in the absence of golgi apparatus, cells will not be produced.

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

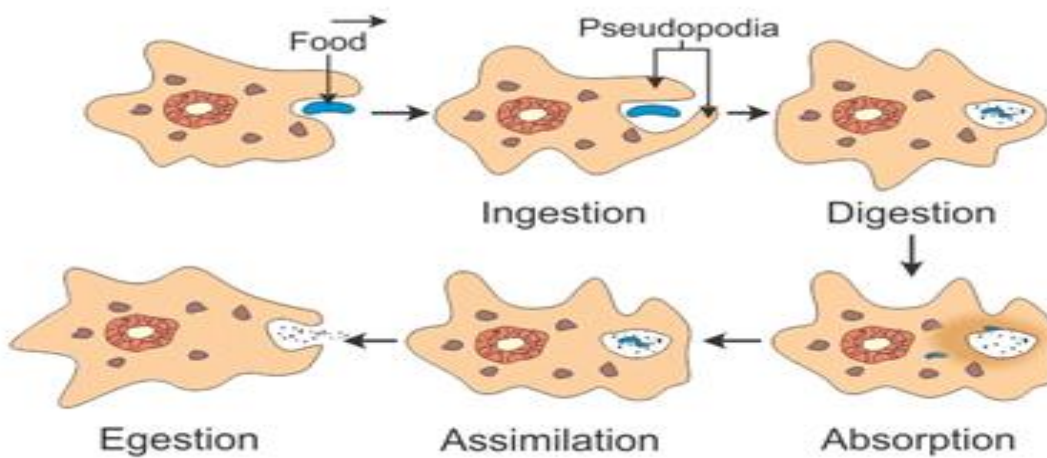
Ans - Mitochondria are known as the powerhouse of the cell. It is because it releases the energy required for different activities of life. Mitochondria releases energy in the form of ATP(Adenosine triphosphate) molecules, essential for numerous chemical activities of life. Hence ATP is often referred to as ‘energy currency of the cell’.

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

Ans - Lipids and proteins are synthesised in the ER [Endoplasmic Reticulum].

7. How does an Amoeba obtain its food?

Ans - Amoeba envelops its food through the process of endocytosis or phagocytosis, where pseudopodia is created by flexibility of the plasma membrane. Amoeba takes in food using temporary finger-like extensions of the cell surface which fuse over the food particle forming a food-vacuole.. Amoeba secretes digestive enzymes to bring about digestion of the engulfed particle once food is trapped.



8. What is osmosis?

Ans - The process of movement of a water molecule from a region of higher concentration to a region of lower concentration through a semipermeable membrane is known as osmosis.

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

Ans - There are two ways in which a cell divides:

- Mitosis
- Meiosis

Mitosis is the type of cell division that is involved in the growth and repair of body whereas meiosis is a type of cell division which results in the formation of gametes.

Short answer questions –

Q1. Why does the skin of your finger shrink when you wash clothes for a long time?

Ans. Soap solution is very concentrated - Hypertonic solution, so water moves out of your finger cells by osmosis.

Q 2. We eat food composed of all the nutrients like carbohydrates, proteins, fats, vitamins, minerals and water. After digestion, these are absorbed in the form of glucose, amino acids, fatty acids, glycerol etc. What mechanisms are involved in absorption of digested food and water?

Ans. Diffusion and osmosis respectively

Q 3. Name the organelles which show the analogy written as under

(a) Transporting channels of the cell _____

Ans. Endoplasmic reticulum

(b) Power house of the cell _____

Ans. Mitochondria

(c) Packaging and dispatching unit of the cell _____

Ans. Golgi body

d) Digestive bag of the cell _____

Ans. Lysosome

(e) Storage sacs of the cell _____

Ans. Vacuole

(f) Kitchen of the cell _____

Ans. Chloroplast

g) Control room of the cell _____

Ans. Nucleus

Multiple Choice questions –

1. Which of the following can be made into crystal?

- (a) A Bacterium (b) An Amoeba (c) A Virus (d) A Sperm

Ans.(c) A Virus

2. Chromosomes are made up of

- (a) DNA (b) protein (c) DNA and protein (d) RNA

Ans.(c) DNA and protein

3. Which cell organelle plays a crucial role in detoxifying many poisons and drugs in a cell?

- (a) Golgi apparatus (b) Lysosomes (c) Smooth endoplasmic reticulum
(d) Vacuoles

Ans.(c) Smooth endoplasmic reticulum

4. The undefined nuclear region of prokaryotes are also known as

- a) Nucleolus (b) nucleus (c) nucleic acid (d) nucleoid

Ans – d) nucleoid

5. Which of the following is not function of a vacuole ?

- a) Storage (b) Providing turgidity and rigidity to the cell (c) Waste excretion
d) Locomotion

Ans – d) Locomotion

HOTS

i) Rahul's mother was going to make pickle. For this she cut the vegetables into small pieces and put them in the sun for few hours. Rahul was observing all her activities very curiously and asked his mother if why she had put the salted vegetables in the sun. What will be the reason ?

Ans - So that the vegetables may lose all the water by diffusion and evaporation and become dry.

ii) Anjali wanted to eat rice and kidney bean (rajmah). She requested her mother to cook the same on next day. At night her mother took a cup of kidney beans and put them in a container having some water and she kept the container covered overnight. Next day it was observed that the kidney beans got swollen and were ready to be cooked. What is this phenomenon due to which kidney beans got swollen is known as?

Ans – Osmosis and Endosmosis

ACTIVITY

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 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 as a difference in the water concentration is observed. Thereby, endosmosis occurs as the cells act as a semipermeable membrane.
- (ii)** Potato A is essential in this experiment as it is significant to compare different scenarios seen in potato cups B, C and D. The potato A in this experiment clearly shows that the potato cavity on its own cannot bring about water movement.
- (iii)** Cup in A does not show any change in the water flow concentration for osmosis to occur, which requires the concentration to be higher than the other. Cells in cup D are dead, thus there is no existence of a semipermeable membrane for water flow. Consequently, osmosis does not occur.