1 CELL

LEARNING OBJECTIVES

	♦	INTRODUCTION
	♦	VARIATIONS OF CELLS
	♦	STRUCTURE AND FUNCTION OF CELL
	♦	PLANT CELL
	♦	ANIMAL CELL

1. INTRODUCTION

INTRODUCTION

A cell is the smallest part of the body of an organism which is able to carry out all the basic functions of life, like **metabolism**, **growth** and **reproduction**. It is the structural and functional unit of all known living organisms. It is the simplest unit of a living being and is also called the "**building block of life**". Cells may be compared to bricks. Bricks are assembled to make a building. Similarly, cells are assembled to make the body of every organism.

MICROSCOPE

- A special device known as a microscope is required to observe the tiny parts of cells which are invisible to the naked eye. The type of microscope most often used in schools is the **compound microscope.**
- A microscope is a combination of lenses that give a magnification ranging from 300 to 1500 times, or 300X to 1500X. A microscope gives a vastly magnified and enlarged view of an object, clearly showing minute details of each and every part. Since compound microscopes use light to make the object look bright (the higher the magnification, the higher the light fall-off; *i.e.,* more light is needed as we increase magnification), these devices are also known as **light microscopes.**
- An **electron microscope,** however, magnifies objects over 50,000 times. The image produced by the electron microscope is projected onto a fluorescent screen or recorded on film. The first commercial electron

microscopes were built in 1930s. With its help, scientists could see structures inside a cell that could not be seen with an optical microscope.

- **Viewing an object under a microscope**: To see any object under a microscope, the following points need to be considered:

  Prepare the slide of specimen or object to be seen.

  Adjust the microscope for viewing.

- **Preparation of slide:** Objects to be viewed under a microscope are placed on a thin, transparent slide.

  Slides are made through the following steps:

  The glass slide is cleaned and placed on a flat surface.

  The specimen is placed (mounted) on the slide. A drop of water may be added for mounting living cells.

  Stain or dye may be added for better contrast. Some common stains are iodine, methylene blue, crystal violet, etc.

  A thin, plastic cover slip is placed over the sample. This cover slip protects the specimen and creates a smooth surface.

- **Adjustment of microscope:** The mirror is cleaned, and the slide is placed under the lens. Now, the microscope lenses and eyepiece need to be adjusted and focused in order to get a clear image. Microscope can be adjusted according to the magnification required, for low power or high power.

DISCOVERY OF CELL

- **Robert Hooke (1665):-** He observed a thin section of **bark** of a tree under self-designed microscope. He coined the term cell.

  He wrote a book- **Micrographia**.

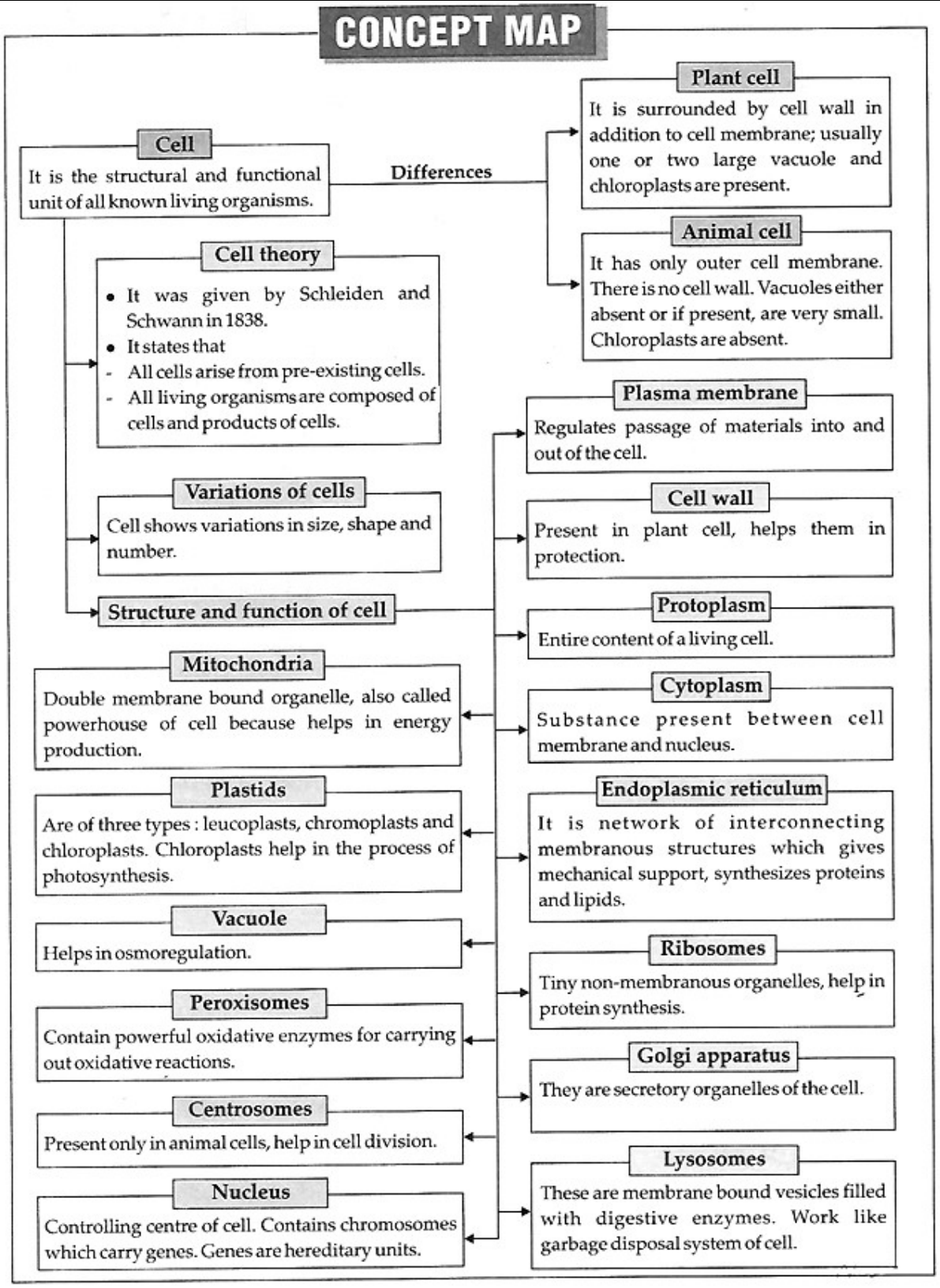
- **Anton Van Leeuwenhoek (1674)** was first to observe living cells.
- **N. Grew (1682):** Proposed cell concept which states that cell is unit of structure of organisms.
- **Knoll & Ruska (1932):** Designed the electron microscope which was employed to study the ultra-structure of cell and various cell organelles.

CELL THEORY

The concept that all living organisms, whether plants or animals, are made up of cells was elaborated as cell theory by **German botanist Matthias Schleiden** and **British Zoologist Theodor Schwann**. They put forward the cell theory of life. The main points of this theory are follows:

- All living organisms are composed of cells and products of cells.
- All cells arise from pre-existing cells.

CONCEPT MAP


Cell
It is the structural and functional unit of all known living organisms.
Differences
Plant cell
It is surrounded by cell wall in addition to cell membrane; usually one or two large vacuole and chloroplasts are present.
Animal cell
It has only outer cell membrane. There is no cell wall. Vacuoles either absent or if present, are very small. Chloroplasts are absent.
Cell theory
• It was given by Schleiden and Schwann in 1838.
• It states that
- All cells arise from pre-existing cells.
- All living organisms are composed of cells and products of cells.
Variations of cells
Cell shows variations in size, shape and number.
Structure and function of cell
Plasma membrane
Regulates passage of materials into and out of the cell.
Cell wall
Present in plant cell, helps them in protection.
Protoplasm
Entire content of a living cell.
Cytoplasm
Substance present between cell membrane and nucleus.
Endoplasmic reticulum
It is network of interconnecting membranous structures which gives mechanical support, synthesizes proteins and lipids.
Ribosomes
Tiny non-membranous organelles, help in protein synthesis.
Golgi apparatus
They are secretory organelles of the cell.
Lysosomes
These are membrane bound vesicles filled with digestive enzymes. Work like garbage disposal system of cell.
Mitochondria
Double membrane bound organelle, also called powerhouse of cell because helps in energy production.
Plastids
Are of three types : leucoplasts, chromoplasts and chloroplasts. Chloroplasts help in the process of photosynthesis.
Vacuole
Helps in osmoregulation.
Peroxisomes
Contain powerful oxidative enzymes for carrying out oxidative reactions.
Centrosomes
Present only in animal cells, help in cell division.
Nucleus
Controlling centre of cell. Contains chromosomes which carry genes. Genes are hereditary units.

2. VARIATIONS OF CELLS

VARIATIONS OF CELLS:

There are millions of living organisms. They all have different shapes and sizes and consist of different types of cells. Living cells show variations in size, shape and number, leading to the vast variety in nature.

NUMBER OF CELLS

Different organisms have different number of cells. For example, human body has trillions of cells with different shapes and sizes.

On the basis of the number of cells present in organisms these are classified as unicellular and multicellular. Organisms, such as **Amoeba**, **Paramecium**, **Euglena** and **bacteria** are made up of single cell. These are examples of unicellular organisms. Although made up of a single cell, they perform all activities are carried out by a single cell.

Plants and animals that can be seen with the naked eye are made up of many cells. They are multicellular organisms. All multicellular organisms begin life as a single cell, which is the fertilized egg. The fertilized egg cell multiplies, and the number of cells increase as the organism develops.

In a multicellular organism, the lower levels of organization are as follows:

Cells → Tissues → Organs → Organ Systems → Organism

Table: Differences between unicellular organisms and multicellular organisms

	Unicellular organisms	**Multicellular organisms**
1.	Organisms are made up of one cell.	Organisms are made up of many cells.
2.	One cell carries out all the functions.	Different cells carry out different functions.
3.	Death of one cell leads to death of the organism.	Death of one cell does not lead to the death of the organism.
4.	Unicellular organisms do not show levels of organization.	Multicellular organisms show various levels of organization.
5.	Examples: Amoeba, bacteria, Paramecium, etc.	Examples: Man, cow, dog, tree, etc.

PROKARYOTES AND EUKARYOTES

- Prokaryotes are the organisms which have primitive cells with no well-defined nucleus and membrane bound cell organelles.
- Prokaryotic cells have single chromosome lying naked in the cytoplasm, not surrounded by the nuclear membrane.
- Organisms like bacteria and blue-green algae having such cells are called prokaryotes. More complex organisms have eukaryotic cells which contain nucleus and other organelles.

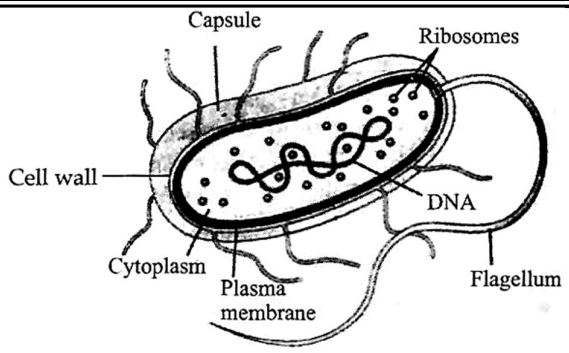


Fig.: Structure of a prokaryotic cell

Eukaryotes have well defined nucleus with a nuclear membrane and double membraned cell organelles. All organisms other than bacteria and cyanobacteria are eukaryotes.

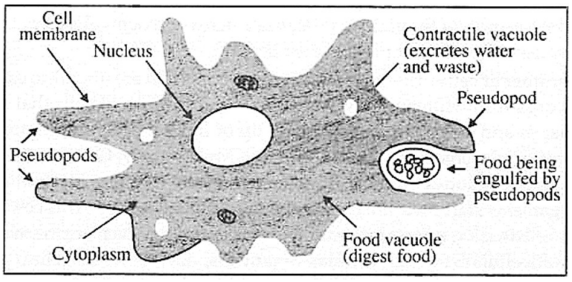
Table: Differences between prokaryotes and eukaryotes

	Prokaryotes	Eukaryotes
1.	Cell nucleus is absent.	Cell nucleus is present.
2.	Membrane bound organelles like mitochondria, Golgi bodies, etc. are absent.	Membrane bound organelles are present.
3.	DNA content is low.	DNA content is high.
4.	Cell division is quick (around 20 minutes).	Cell division is slow (hours).

- **Cell shape**: Cells come in a variety of shapes - depending on their function. Look at the structure of Amoeba. What type of shape does Amoeba have? The shape of Amoeba appears to be irregular. Unlike other organisms, it does not have definite shape. It keeps on changing its shape.

  Why do Amoeba change its shape?

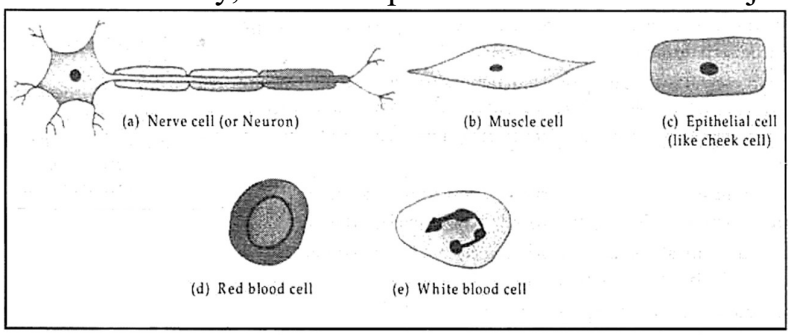
  The change in shape is due to formation of **pseudopodia**. Pseudopodia are finger like projections protruding out of its body. The protrusions help Amoeba in movement and capturing food.



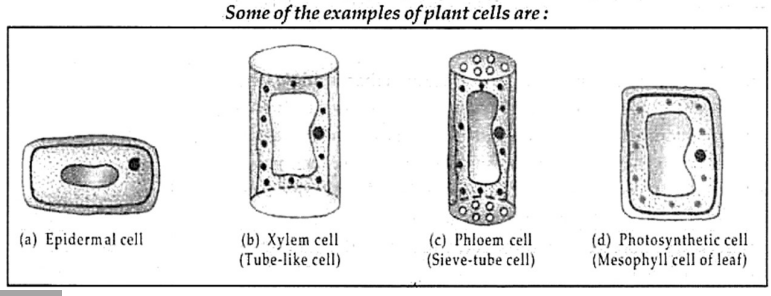
Amoeba capturing food

Similarly in human beings, white blood cell (WBC) has the ability to change its shape. They eat up or kill bacteria that enter the blood and save us from many diseases.

The cells are different in shapes and sizes so that they can perform different functions. Or we can say, cells are specialized to do different job.



Some of the examples of plant cells are :



SHAPE OF CELL

Shape of cell mainly depends upon the specific function it performs.

(i) Elongated - Nerve cell
(ii) Discoidal/ saucer- RBC
(iii) Spindle - Muscle cell
(iv) Spherical - Eggs.
(v) Branched - Pigment cell of the skin
(vi) Slipper shaped - Paramecium
(vii) Cuboidal - Germ cell of gonads
(viii) Polygonal - Liver cells.

SIZE OF CELLS

The size of cells in living organisms may be as small as a millionth of a metre (micrometer or micron) or may be as large as a few centimeters. Most of the cells are microscopic and not visible by naked eyes.

VARIATION IN CELL SIZE

	Cell	Size
1.	Egg of an ostrich	Largest cell in world (170mm × 130mm).
2.	Neuron	Longest cell in our body (upto 1m).
3.	RBC	Smallest cell in our body (7-9 μ).
4.	PPLO or Pleuro Pneumonia Like Organism (Bacteria).	Smallest cell in the world (0.1 to 0.5 μ)

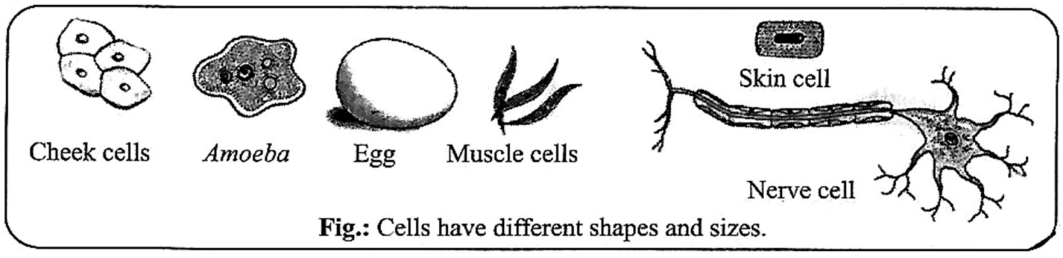


Fig.: Cells have different shapes and sizes.

3. STRUCTURE AND FUNCTION OF CELL

CELL STRUCTURE

Cell membrane or plasma membrane or plasmalemma:

The outermost living cover or envelope of every cell is called membrane. The limiting boundary of each cell which separates the cytoplasm from its surroundings is called cell membrane.

Term plasma membrane was given by **Karl Wilhelm Nageli**.

The Fluid Mosaic Model is the most widely accepted model for the structure of the plasma membrane, proposed by **S.J. Singer** and **Garth L. Nicolson**. This model describes the plasma membrane as a fluid phospholipid bilayer with embedded proteins, rather than a rigid, trilaminar structure. The "mosaic" aspect refers to the diverse proteins embedded within the lipid bilayer.

FUNCTION

- Plasma membrane is also called selectively permeable membrane because it allows the entry and exit of selected materials in and out of the cell while it also prevents the movement of some other materials.
- Plasma membrane bounds the semi-fluid content of the cells.
- Plasma membrane protects the cell from injury and provides an outer boundary to the cell.
- The membrane allows the flow of materials and information between different organelles within the cell as well as between one cell and another.
- The membrane has carrier proteins for active transport.

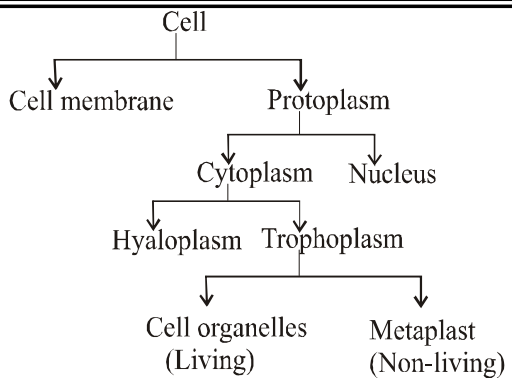
CELL WALL:

Discovered by Robert Hooke

The outermost covering of the plant cell is called cell wall. It is absent in animal cell. It is rigid, thick, porous and non- living structure. Middle lamellae consist of Ca & Mg pectates (Plant cement). Amount of Calcium is more.

Function

(i) It provides a definite shape to cell.
(ii) It is a protective and supportive coat.
(iii) It is permeable and allows entry of molecule of different size.
(iv) It counteracts the osmotic pressure.
(v) It provides rigidity to the cell.



PROTOPLASM (ESSENCE OF LIFE)

The entire matter found inner to the cell membrane is called as protoplasm. All the living components of a cell lie in the protoplasm and perform their functions.

- Protoplasm - termed by Purkinje
- Physical basis of life - Huxley

It can be divided into 2 parts:

(A) Nucleus (B) Cytoplasm

(A) NUCLEUS: Headquarter of the cell. Discovered by - **Robert Brown (1831)** "Nucleus is double membrane bound dense protoplasmic body, which controls all cellular metabolism and encloses the genetic information of cell".

Structure: It is made up of following four contents:

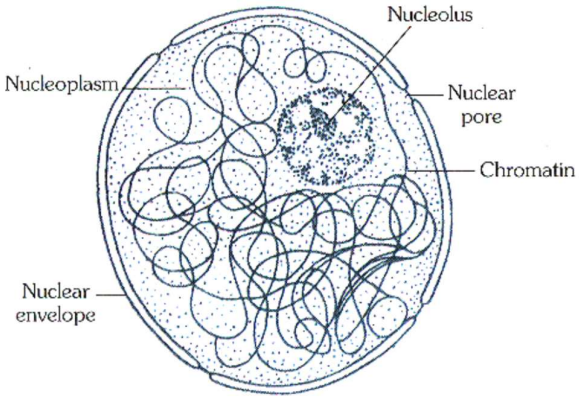
(a) Nuclear membrane / Nuclear envelope / Karyotheca

(b) Nuclear sap / Nucleoplasm / Karyolymph.

(c) Nucleolus.

(d) Chromatin threads.

Nuclear envelope: Nucleus is surrounded by two membranes, that separates nucleoplasm from cytoplasm. The outer membrane is continuous with endoplasmic reticulum. The nuclear membrane has minute pores. These are called nucleopores.



Structure of a nucleus

Nucleoplasm: The part of protoplasm which is enclosed by nuclear membrane. It contains chromatin threads and nucleolus.

Nucleolus: Discovered by **Felice Fontana**. Usually, one nucleolus is present in each nucleus but sometimes more than one nucleoli are present. It is a store house of RNA & site of r-RNA transcription and processing of ribosome assembly.

Chromatin Threads: A darkly stained network of long and fine threads called chromatin threads.

Chromatin threads are intermingled with one another forming a network called chromatin reticulum. At the time of cell division, the chromatin threads separate apart from one another and become smaller and thicker, are called chromosomes.

Functions of Nucleus:

(i) It controls all the metabolic activities of the cell and regulates the cell cycles.

(ii) It helps in transmission of hereditary characters from parents to offsprings.

(iii) Nucleus plays a central role in the cellular reproduction (division of single cell to form two cells).

(iv) Along with environment, nucleus also directs the chemical activities of the cell. This determines the development and future form of the cell.

(B) CYTOPLASM: The substance present between cell membrane and nucleus is called cytoplasm. It contains jelly like fluid with various structures floating on it known as cell organelles.

Functions:

(i) It helps in intracellular distribution of molecules, enzymes and nutrients within the cell.

(ii) It helps in exchange of materials between different cell organelles.

(iii) Biosynthesis of nucleotides, proteins and fatty acids takes place in the cytoplasm.

(iv) Breaking down of glucose takes place in the cytoplasm.

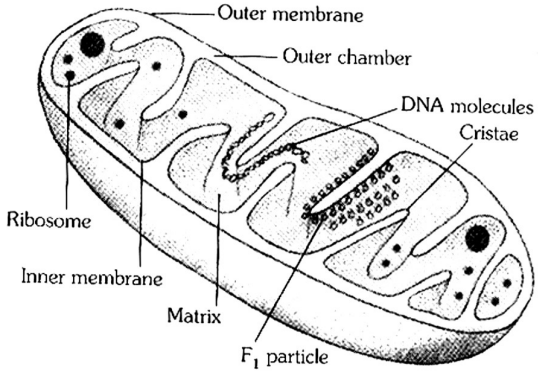
Cell organelles/Cytoplasmic organs: Cell organelles are the living parts of a cell having definite shape, structure and function. They are playing an important role in cell activities and embedded into cytosol. Cell organelles are often called as "**small organs**" and also bounded by a plasma membrane like fluid-mosaic membrane.

Mitochondria: It is a rod-shaped structure found in cytoplasm of all eukaryotic cells except mammalian RBC's. It is absent in prokaryotes. It is powerhouse of cell or ATP- mill in cell and cell within cell / **second largest organelle of cell**.

Mitochondria term given by Benda (1897).

Structure:

- It is double membrane bound cell organelle.
- The outer membrane is smooth and straight. The inner membrane is in folded into the cavity. These finger-like infoldings are called as **cristae**.
- Mitochondrial matrix have enzyme for **kreb's cycle**. Beside these enzymes matrix have a complete protein synthesis apparatus (Ribosome- 70-s, DNA & RNA, enzymes) so mitochondria called as semi-autonomous cell organelle.



A longitudinally cut mitochondrion showing its internal structure

Function:

Its main function is to produce and store the energy in the form of ATP, that's why is also known as **powerhouse of the cell**.

- Mitochondrial matrix- Site of Kreb's cycle.
- Peri- mitochondrial space- Site of link reaction.
- Oxysomes - Site of ETS.

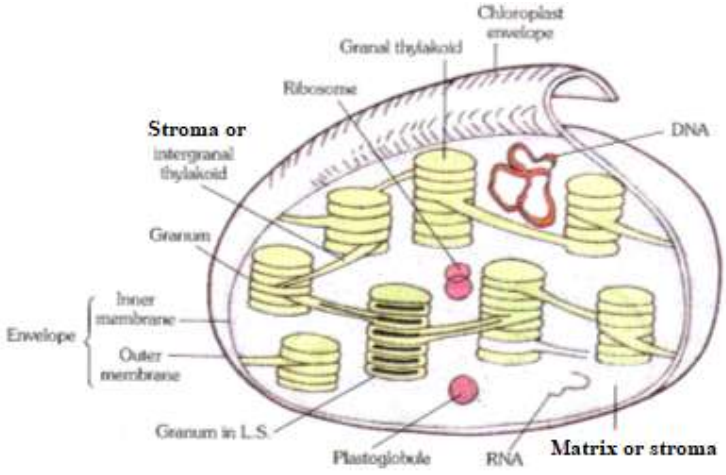
PLASTIDS:

Plastid term used by **Haeckel**, Chloroplast term given by **Schimper**.

Structure:

It is double membrane bound cell organelle and is the largest organelle of cell.

Plastids have following 2 parts:



Schematic 3-dimensional structural diagram of a chloroplast

Grana: It constitutes of the lamellar system.

- These are found in layer on top of each other, these stacks are called as grana.
- Each lamella is made up of unit membrane.
- Each granum of chloroplast is formed by superimposed; closed compartments called thylakoid.
- Different grana are connected with the help of tubular connection, called stroma lamellae or fret channels or inter granum.

Function: Site of light reaction.

Stroma: It is a granular transparent substance filled in cavity of chloroplast. It is also called as matrix. Grana are embedded in it.

It contains enzymes of Calvin cycle or dark reaction. Rubisco is the most abundant enzyme on the earth. It made 16% protein of the chloroplast.

Function: Site of dark reaction.

Functions:

- Chloroplasts, the green plastids, help in photosynthesis and thus, help in the synthesis of food.

These are called kitchen rooms of the cell.

- Chromoplasts are coloured plastids which provide colour to the flowers and the fruits.

Leucoplasts help in the storage of food.

GOLGI COMPLEX

Discovered by Camillo Golgi (1898) in nerve cells of owl.

Other names:

(i) Lipochondrion (ii) Idiosome,

(iii) Baker's body. (iv) Dalton complex

(v) Dictyosomes- In plants

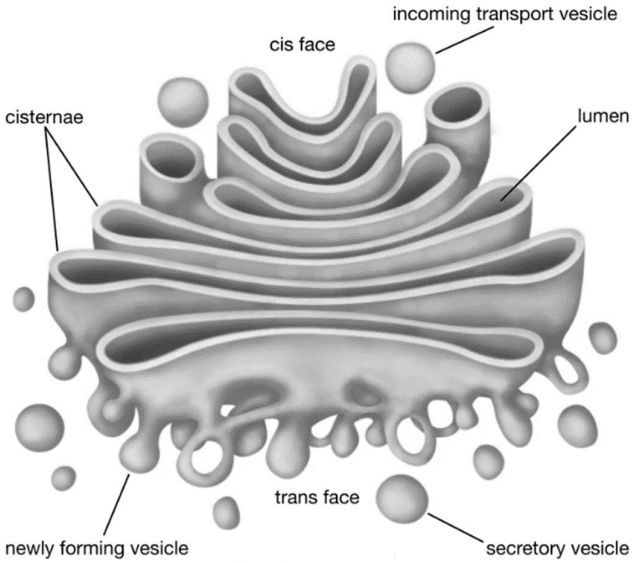
Position: It is located near the nucleus.

Golgi bodies are pleomorphic structure, because component of Golgi body differ in structure & shape in different cells. Golgi apparatus has a convex forming face and a concave maturing face. The forming face receive vesicles from endoplasmic reticulum. The maturing face produces secretory vesicles and lysosomes.

Structure: It is formed of four types of contents.

(i) Cisternae (ii) Tubules (iii) Vacuoles (iv) Vesicles

Golgi body is single membrane bound cell organelle.



Golgi apparatus

Function:

- It is involved in cell- secretion and acts as storage, modification and condensation or packaging membrane.
- It forms the acrosome of sperm
- It forms the lysosomes and secretory vesicles.
- It is the site for formation of glycolipids and glycoproteins.
- Synthesis of cell wall material (Polysaccharide synthesis).
- Cell plate formation (phragmoplast) during cell formation.
- Vitelline membrane of egg is secreted by Golgi body.

ENDOPLASMIC RETICULUM

First observed by **Garnier (1897)**- Termed as **Ergastoplasm**.

E.R. name proposed by **K.R. Porter**. (Credit for discovery of ER goes to Porter Claude and Fullam)

Components of Endoplasmic Reticulum:

(i) Cisternae: Flat & unbranched

(ii) Vesicles: Ovate structure

(iii) Tubules: net like structure

It is also known as "System of Membranes".

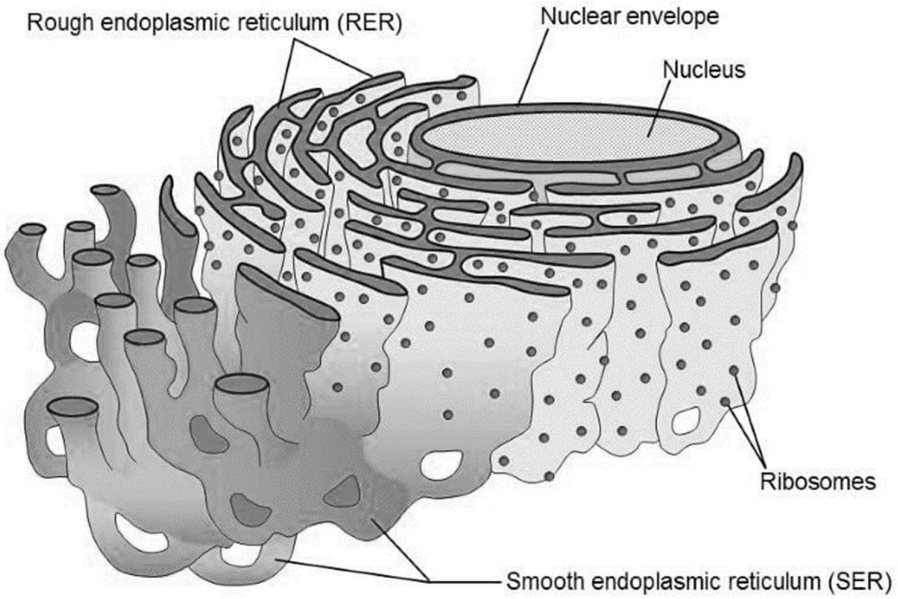
TYPES OF ENDOPLASMIC RETICULUM:

(a) Rough E.R. /Granular E.R.

- Ribosomes present
- Concerned with protein synthesis

(b) Smooth E.R./ Agranular E.R.

- Ribosomes absent
- Concerned with glycogen and lipid metabolism



Endoplasmic Reticulum

Function:

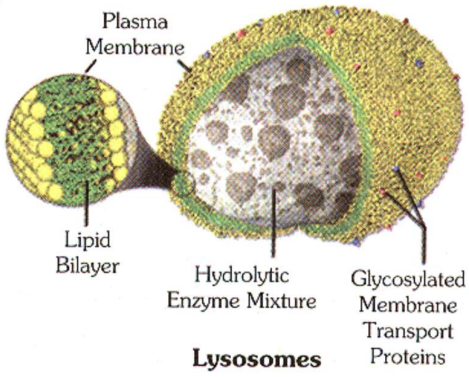
- Mechanical support. (make skeleton of cell)
- Rough E.R. - synthesis of protein
- Smooth E.R.- Glycogen and lipid metabolism
- Detoxification
- Circulation
- Formation of lysosomes, Golgi-body & Micro-bodies - All the organelles are formed by E.R. which have membrane except chloroplast and mitochondria.
- E.R. provides the precursor of secretory material to Golgi body.

LYSOSOME

First observed and the term coined by **Christian De Duve (1955)**. Lysosomes are spherical bag like structures (0.1– 0.8m) which is covered by single unit membrane. Lysosomes are filled about 50 different types of digestive enzymes termed as acid hydrolases. Lysosomes are highly polymorphic cell organelles. Because, during functioning, lysosomes have different morphological and physiological states. Mostly found in animal cells and in some plant cells e.g. neurospora, cauliflower and bean.

Types of Lysosomes

- Primary lysosomes or storage granules
- Digestive vacuoles or Heterophagosomes
- Residual bodies
- Autophagic lysosomes or cytolysosomes or autophagosomes



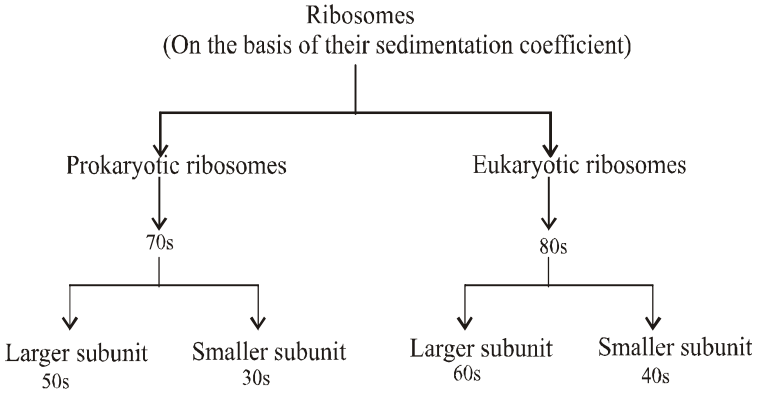
Function:

- It involves in digestion of foreign materials received in cell by phagocytosis and pinocytosis.
- Digestion of old or dead cell organelles. Autophagy also takes place during starvation of cell.
- Sometimes all lysosomes of a cell burst to dissolve the cell completely.
  That's why lysosomes are also known as **suicidal bags**.

RIBOSOME (ENGINE OF CELL)

Claude (1941) first observed them and called microsome.
Plade (1955) coined the term Ribosome.

- Except mammalian RBC all living cells have Ribosomes. (Both prokaryotes & Eukaryotes)
- These are the smallest and membrane less cell organelles.



Function:

Site of protein synthesis, so these are also called protein factories.
At the time of protein synthesis, several ribosomes become attached to m-RNA with the help of smaller subunits. This structure is called polyribosome or polysome or ergosome.

PEROXISOMES / URICOSOMES.

- Discovered by **Rhodin** & **Tolbert**.
- Peroxisome term was first used by De Duve.

In plants peroxisomes occur in cells of green tissues and concerned with photorespiration. (Glycolate pathway). It contains per-oxide forming enzymes.

Function:

(i) Oxidation of fatty acids.

(ii) Concerned with photorespiration.

(iii) In animal cells peroxisomes concerned with peroxide (H_2O_2) metabolism.

VACUOLES:

Vacuoles of animal cells arise from Golgi-complex. It is surrounded by tonoplast. In animals the vacuoles are smaller in size and larger in number while in plants it is larger in size and fewer in number. Vacuoles are storage sacs for liquid or solid contents.

Function:

(i) These serve for storage.

(ii) Transport of dissolved, secretory or excretory substances.

(iii) Vacuoles help the plant cells to remain turgid.

(iv) They play an important role in growth by helping in the elongation of cells.

(v) They provide an aqueous environment for the accumulation and storage of water-soluble compounds (sugars, minerals, pigments, etc.).

(vi) In protozoans like Amoeba and Paramecium, vacuoles help in digestion and excretion.

CENTROSOME:

Discovered by **Benden**.

Named by Boveri as the centrosome.

The centrosome is generally found in animal cells; only a few types of plant cells show its presence.

It is situated near the nucleus of the cell and is star shaped. Each centrosome has two centrioles, which are placed perpendicular to each other. Each centriole consists of 9 triplets of tubulin microtubules, arranged in a (9 + 0) pattern.

Function:

(i) In animal cells, centrioles play an important role in the initiation of cell division by organizing spindle fibres between the two poles of the cell.

(ii) The location of centrioles during cell division determines the plane of division.

(iii) They form the basal bodies (granules) of cilia and flagella in microorganisms, zoospores, and motile gametes.

(iv) Form tail of sperm They help in forming the tail of sperm.

Let us summarize the functions of different parts of a cell.

Cell	Functions
Cell membrane	1. It gives form and support to the cell.
	2. It allows the entry and exit of cellular materials.
Nucleus	1. It controls all the activities of the cell.
	2. It is responsible for generic characteristics.
	3. It synthesizes and stores proteins.
Endoplasmic reticulum	It is involved in the synthesis, storage and transport of cell products.
Mitochondria	These tiny spherical or rod-like bodies act as sites of energy production. So, they are also called the
Ribosomes	These granular structures act as sites of protein synthesis.
Golgi apparatus	They are responsible for the secretion of enzymes, hormones, and proteins.
Lysosomes	They are capable of digesting damaged cells and a variety of extra-and intra-cellular materials.
Vacuoles	These fluid-filled spaces store excess water, useful minerals, salt, food substances, pigments and waste products.

4. PLANT CELL

PLANT CELL

- Cells are comparatively larger in size.
- Cell wall is present
- Plastids are present.
- Only one large vacuole is present.
- Golgi bodies are present.
- Lysosomes are either absent or very few in number.
- Centrosome and centrioles are absent.

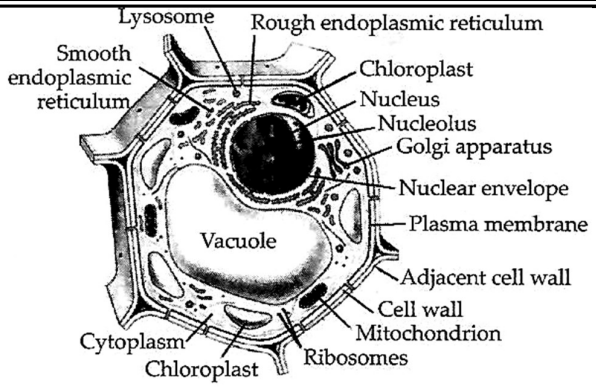


Fig.: Plant cell

ORGANELLES FOUND ONLY IN PLANT CELLS

Cell Wall: The plant cells have a thick and rigid cell wall around them, outside the cell membrane. It is composed of tough material called cellulose.

Function:

(i) It gives shape and support to plant cell.

(ii) It protects the cell from mechanical injury.

(iii) It contains pores that allow materials to pass through the cell membrane.

PLASTIDS: Plastids are double membrane bound organelles. They occur in most plant cells and are absent in animal cells. Plastids are found in the cytoplasm. Depending upon their pigment colour, they are classified into two main types:

(i) Leucoplasts: It is colourless organelle that store starch or other plant nutrients.

For example - Starch stored in potato.

(ii) Chromoplast: It contains different coloured pigment. The most important type of chromoplast is chloroplast. Chloroplasts are green- coloured organelles present in cytoplasm of plant cells. The process of food making by plants (known as photosynthesis) takes place in chloroplasts. Hence, chloroplasts are the food producers of the cell. Like the mitochondria, plastids also have their own genome i.e., DNA and ribosomes. They are self-replicating organelles like the mitochondria i.e., they have the power to divide. Chloroplast contains green colour pigment called chlorophyll in them. Chlorophyll absorbs energy from the Sun and helps the plant in the process of photosynthesis.

Structure of chloroplast: Each chloroplast is a double membranous structure. Two membranes contain and protect the inner parts of the chloroplast. Inner to the membrane, matrix is present that is divided into two portions called Grana and stroma.

(i)Grana consists of membranous or lamellar system. This lamellar system is made up of thylakoid. One thylakoid stock is called a granum. Each thylakoid

have chlorophyll molecules on their surface that trap sunlight and take part in process of photosynthesis.

The stacks of sacs are connected by stromal lamellae. The lamellae act like the skeleton of chloroplast, keeping all the sacs a safe distance from other and increasing the efficiency of organelle.

(ii) The stroma is an area inside of the chloroplast where all chemical reactions occur, and starch (sugars) is synthesized.

Functions of Plastid: Chloroplast is the site of photosynthesis. In chloroplast, carbon dioxide and water combine in the presence of sunlight energy to produce food such as glucose. Thus, chloroplasts help in synthesis of food by green plants.

$$CO_2 + H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{Glucose} + \text{Oxygen} + \text{Water}$$

Now, we have studied that plants and animals are similar in many respects, but they are also different in some respects. Let us know see the important similarities and dissimilarities between plant cells and animal cells.

5. ANIMAL CELL

ANIMAL CELL

- Cells are usually small in size.
- Cell wall is absent.
- Plastids are absent.
- Vacuoles either absent, or if present they are more in number and smaller in size.
- Prominent Golgi bodies are present.
- Lysosomes are more in number.
- Centrosome with centrioles are present.

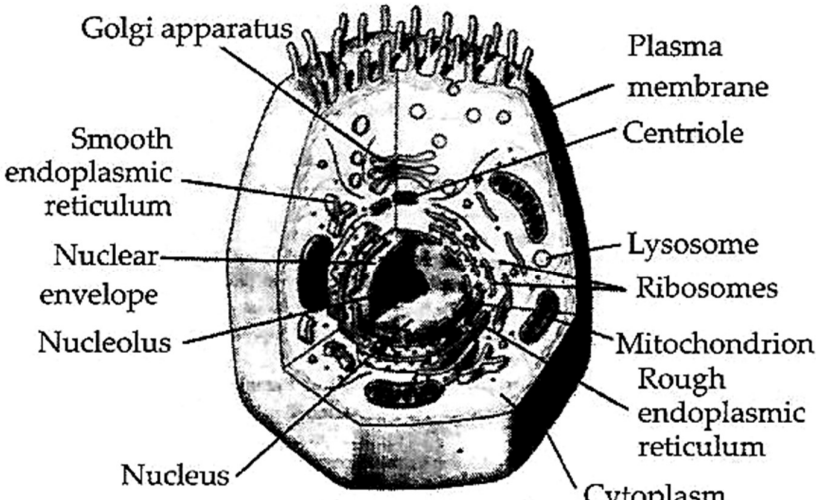


Fig.: Animal cell

ORGANELLES FOUND ONLY IN ANIMAL CELLS:

Cilia and flagella: Cilia are short, hair like projections that occur in large numbers on the outside surface of certain animal cells. They cover the entire surface of a cell.

For example, Paramecium is a single celled organism, that has cilia on its surface. Cilia are the organs of locomotion in Paramecium.

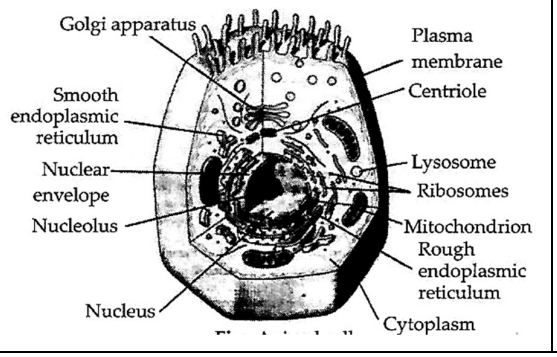
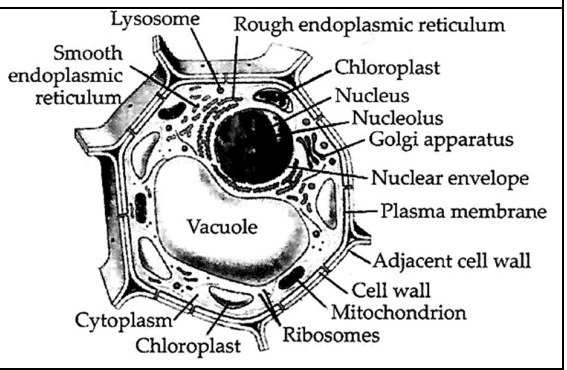
Flagella are long, thread like structures at one end of the cell. There are usually a few flagella on a cell. For example. Euglena, a single celled organism, has flagellum at its mouth region in the front. Like cilia, flagella also helps in movement of organism.

PLANT CELL AND ANIMAL CELL

In general, plant cells are larger than animal cells.

The major differences between a plant cell and an animal cell are given in the following table:

Major differences between animal and plant cell

	Animal Cell	Plant Cell
1.	Cells are usually small in size.	Cells are comparatively larger in size.
2.	Cell wall is absent.	Cell wall is present
3.	Plastids are absent.	Plastids are present.
4.	Vacuoles either absent, or if present they are more in number and smaller in size.	Only one large vacuole is present.
5.	Prominent Golgi bodies are present.	Golgi bodies are present.
6.	Lysosomes are more in number.	Lysosomes are either absent or very few in number.
7.	Centrosome with centrioles are present.	Centrosome and centrioles are absent.
		

CELL

WORK SHEET LEVEL–I

SINGLE CORRECT ANSWER TYPE QUESTIONS

CELL

1. Which of the following is not true about cells?
   1) cells do not live forever
   2) new cells are produced to replace the old cells which die as well as for the growth of an organism.
   3) if the size of an organism is bigger, the size of its cell is also bigger.
   4) different types of cells have different functions.
2. Some cells of our body can be about a foot long. These are
   1) nerve cells 2) muscle cells 3) bone cells 4) gland cells
3. Cell is best defined as
   1) the smallest part of a living being.
   2) the part that can be seen only under microscope.
   3) the structural and functional unit of life
   4) Both (1) & (3)
4. DNA and RNA are found in the
   1) nucleus 2) cell wall 3) cell sap 4) vacuole
5. Bacteria are considered more as plants than animals because of the presence of
   1) DNA 2) plasma membrane
   3) cell wall 4) mitochondria
6. The functional unit of the life is called_____.
   1) cell 2) egg 3) nucleus 4) none of these
7. Which cell organelle is known as the control centre of the cell?
   1) nucleus 2) chloroplast
   3) mitochondria 4) endoplasmic reticulum
8. Who observed the living cell for the first time?
   1) Antonie von Leeuwenhoek 2) Robert Brown
   3) Robert Hooke 4) Both (1) & (3)
9. The dictum-“Omnis cellula-e-cellula” was proposed by
   1) Schwann 2) Virchow 3) Schleiden 4) Robert Brown

10. Which of the following shows the correct level of organization?
    1) Cell → Tissue → Organ → Organ system → Organism
    2) Tissue → Cell → Organ → Organ system → Organism
    3) Cell → Tissue → Organ system → Organ → Organism
    4) Cell → Organ → Tissue → Organ system → Organism

STRUCTURE AND FUNCTION OF CELL

11. "Cells are basic structural units of living organisms." It is called so because
    1) cells exhibit a variety of shapes and sizes
    2) number of cells varies from organism to organism
    3) the smallest living part of an organism is cell
    4) Both (1) & (3)
12. Cheek cells are made up of
    1) muscle cells 2) epithelial cells 3) nerve cells 4) brain cells
13. The component of the cell with hereditary material is
    1) nucleus 2) protoplasm 3) cytoplasm 4) plastid
14. The small rod-shaped structure bound by a double membrane which helps in the oxidation of food to release energy is
    1) mitochondrion 2) Golgi complex 3) nucleus 4) vacuole
15. The "kitchen of the cell" is called
    1) cell wall 2) nucleus 3) vacuoles 4) plastids
16. Which of the following organelles is semiautonomous organelle?
    1) Mitochondria 2) Ribosomes 3) Chloroplast 4) Both (1) & (3)

PLANT CELL AND ANIMAL CELL

17. Plant cells can usually be distinguished from animal cells because only plant cells possess
    1) mitochondria and lysosomes 2) chromosomes and lysosomes
    3) chloroplast and cell wall 4) chloroplast and Golgi complex
18. What is the function of chloroplast in plants?
    1) to absorb carbon dioxide during photosynthesis.
    2) to break up water into hydrogen and oxygen during photosynthesis.
    3) to synthesize food in the presence of sunlight.
    4) to form starch and glucose in sunlight.

19. The colourless plastids are called _____and their main function is _____.
    1) chloroplasts, photosynthesis
    2) leucoplasts, respiration
    3) chromoplasts, protection from sunlight
    4) leucoplasts, storage of food
20. The outermost boundary of an animal cell is
    1) plasma membrane 2) nucleus
    3) cytoplasm 4) cytoskeleton

LEVEL–II

CELL

21. Cells that have a high energy requirement generally have many
    1) Ribosomes 2) Nucleus 3) Mitochondria 4) Chloroplast
22. The main constituent of cytoplasm is C, N, O, H. These are derived from
    1) Protein 2) Carbohydrate 3) Water 4) None of these
23. How many cells are present in human body?
    1) One million cells 2) One billion cells
    3) One trillion cells 4) More than a trillion cells
24. The scientist who described cell as "many little boxes" was
    1) Robert Hooke 2) Theodor Schwann
    3) Anton Van Leeuwenhoek 4) Rudolf Virchow
25. The characteristic of a nerve cell that relates directly to its function is its
    1) Long extensions 2) Flat shape
    3) Ability to change shape 4) Ability to engulf bacteria
26. Cell membrane is mainly composed of
    1) lipids and starch 2) lipids and proteins
    3) lipids and sugars 4) sugars and proteins
27. Which of the following cells does not have a nucleus?
    1) Brain cell 2) cardiac muscle cell
    3) paramecium 4) mature human RBC

STRUCTURE AND FUNCTION OF CELL

28. Given below are four steps for preparing a temporary mount of human cheek cells.

(i) Taking scraping from inner side of the cheek and spreading it on a clean slide.

(ii) Putting a drop of glycerin on the material.

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

(iv) Rinsing the mouth with fresh water and disinfectant solution.

What is the correct sequence of the steps?

1) (i)-(ii)-(iii)-(iv) 2) (iv)-(i)-(iii)-(ii) 3) (iv)-(i)-(ii)-(iii) 4) (i)-(iii)-(ii)-(iv)

29. Match the following select the correct option from the codes given below.

A	Term for component present in the cytoplasm	(i)	Organelle
B	The living substance in the cell	(ii)	Protoplasm
C	This is necessary for photosynthesis	(iii)	Chlorophyll
D	Empty structure in the cytoplasm	(iv)	Tissues
E	A group of cells	(v)	Vacuole

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

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

30. In a biology lecture, the teacher was dictating the organelles of a cell as endoplasmic reticulum, mitochondria, nucleus, ribosome, centriole and centrosome. Which cell was she referring to?

1) prokaryotic cell

2) plant cell

3) animal cell

4) it is not possible to predict from the given data.

31. Which of the following cell organelles is not membrane bound?

1) mitochondria 2) lysosomes 3) sphaerosomes 4) ribosomes

32. All organelles have double membrane except

1) nucleus 2) lysosomes 3) chloroplast 4) mitochondria

33. Which of the following is a storage organelle?
1) mitochondria 2) leucoplast 3) chloroplast 4) ribosome

34. Arrange the cell organelles useful for intracellular digestion, intracellular respiration, intracellular movements and cell secretion in a sequence.
P. Golgi complex Q. Lysosomes
R. Mitochondria S. Microtubules
1) Q-R-S-P 2) R-Q-P-S 3) S-P-Q-R 4) P-S-R-Q

35. Smallest cell organelle is
1) Mitochondria 2) Ribosome 3) Vacuole 4) Lysosome

36. When the concentration of water and solutes on either side of the cell membrane is same, the solution is said to be:
1) Hypertonic 2) Isotonic 3) Hypotonic 4) None of these

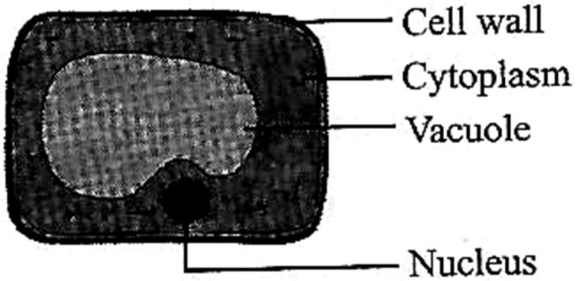
PLANT CELL AND ANIMAL CELL

37. A cell that contains a cell wall, chloroplasts and a central vacuole is
1) Plant cell 2) Animal cell 3) Yeast cell 4) Bacterial cell

38. Which of the following organelles is found in plant cells but not in animal cells?
1) Nucleus 2) Mitochondrion 3) Chloroplast 4) Golgi apparatus

39. Which organelle is usually found associated with the nucleus of the cell in animals?
1) endoplasmic reticulum 2) vacuole
3) chromosome 4) mitochondrion

40. The cell shown below cannot be an animal cell because it has



(i) Cytoplasm (ii) Nucleus (iii) Cell wall (iv) Large vacuole
1) (i) & (ii) 2) (i) & (iii) 3) (ii) & (iv) 4) (iii) & (iv)