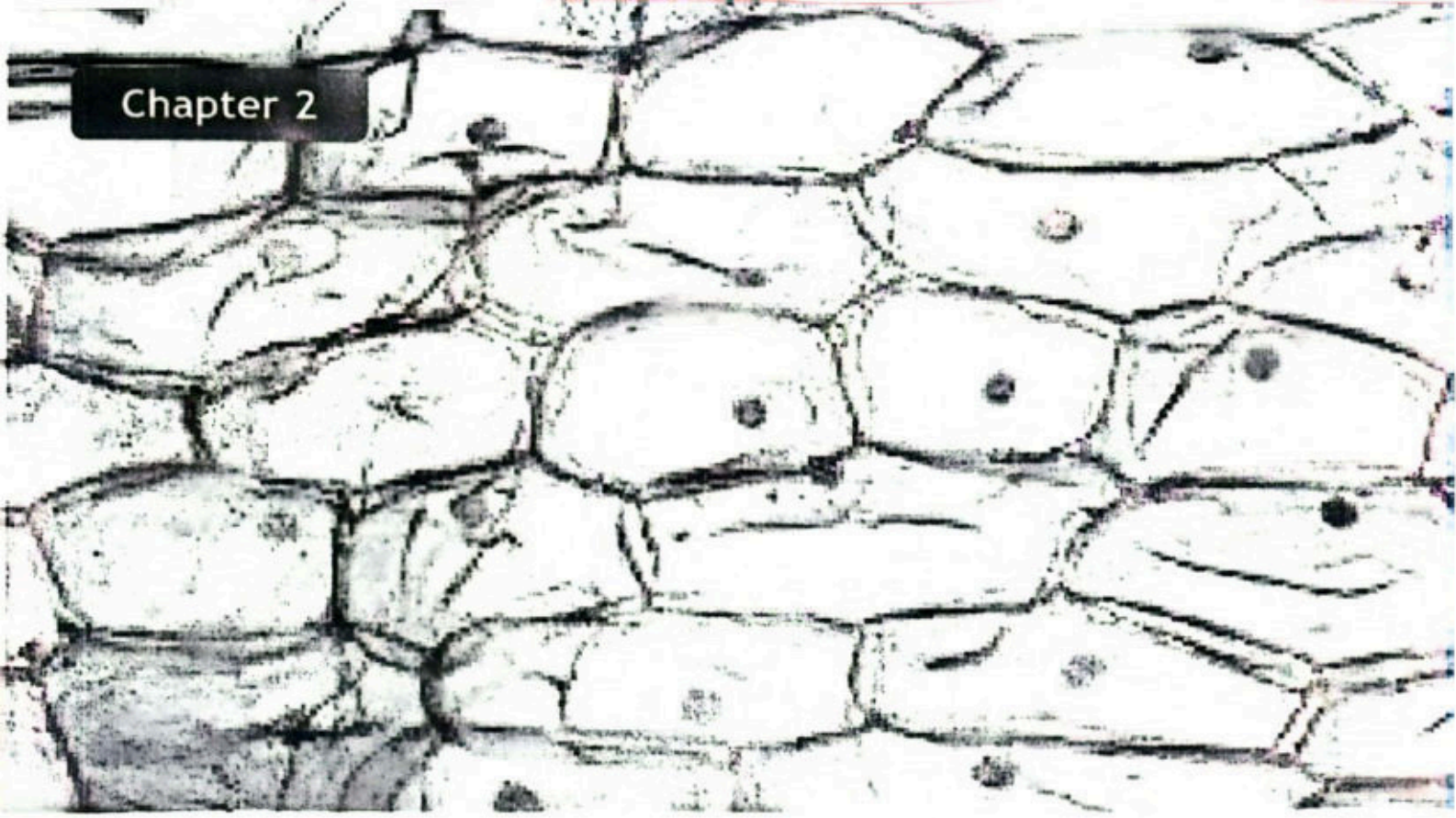


CELLS AND TISSUES

SLOs: After completing this lesson, the student will be able to:

1. Define cell as the basic unit.
2. Describe different organelles of a cell.
3. Differentiate between plant cell and animal cell.
4. Describe different types of tissues in plants (epidermal, xylem) and animals (epithelial, muscular and nervous).
5. Make a three -D model of plant and animal cell.

2.1 CELL

Robert Hooke was an English scientist. In 1665 he looked at the thin pieces of cork under a simple microscope. He observed that the cork was made of tiny empty spaces with walls around them. Under the microscope the cork looked like a honeycomb. The honeycomb like spaces reminded Hooke of small rooms called 'cells' in a monastery. So he called these spaces in the cork **'cells'**. Today we know that he saw the thick, outside cell walls of the cork. Organisms are made of cells. All cells are produced from other cells through cell division.

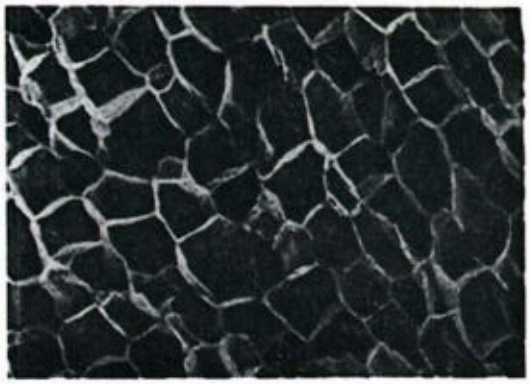


Fig.2.1: Cork cells

When you read, the contraction of muscle cells move your eyes. When you move your hand, nerve cells will transmit message from brain to the muscle cells of your hand.

The cells are defined as the structural and functional unit of all unicellular organisms e.g., Amoeba and multicellular organisms e.g., frog. Cells respond to environmental changes. Cell is the smallest unit and building block of living things. In every cell some of the basic functions take place, whether it is unicellular or multicellular organisms. So, the cells are called the functional unit of living things.

Cells are of various shape and sizes. Cells perform a wide range of activities such as movement, respiration, growth and reproduction etc.

Cellular structures and functions

The cell contains highly organized structures called **cell organelles**. There are some structures in the cell that are not organelles. These structures are cell wall, cell membrane, cytoplasm and cytoskeleton.

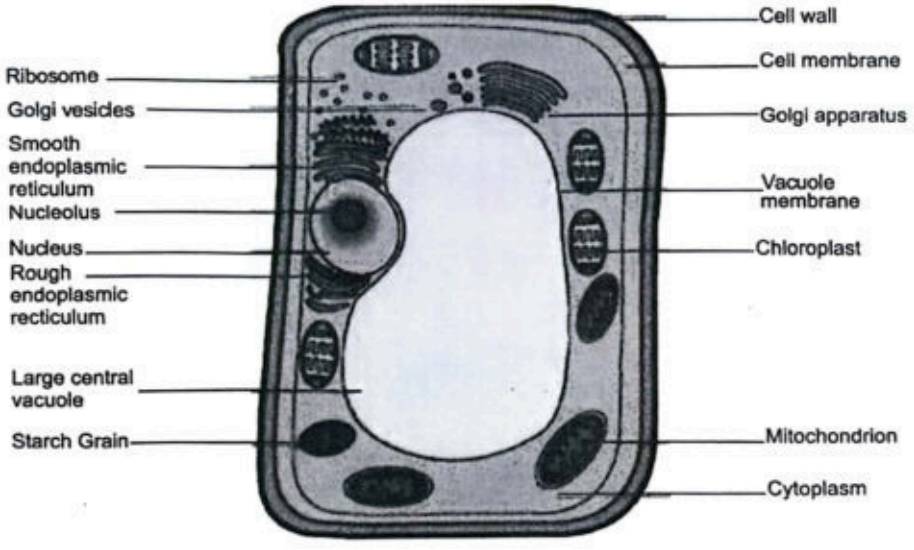


Fig.2.2: Plant cell (as seen under electron microscope)

a. Cell wall

The cell wall is present in plant cells, prokaryotes, fungi and some protists. Animal cells do not have cell walls. The cell wall is an extra cellular structure in plant cells. The cell wall protects the plant cell, maintains its shape. The cell wall is secreted by the cell. The cell wall is porous. It allows free passage of dissolved water and dissolved materials.

b. Cell membrane

The cell membrane is the covering of the cytoplasm. It is found in all living prokaryotic and eukaryotic cells. Cell membrane is a semipermeable membrane. It maintains the internal composition of cell.

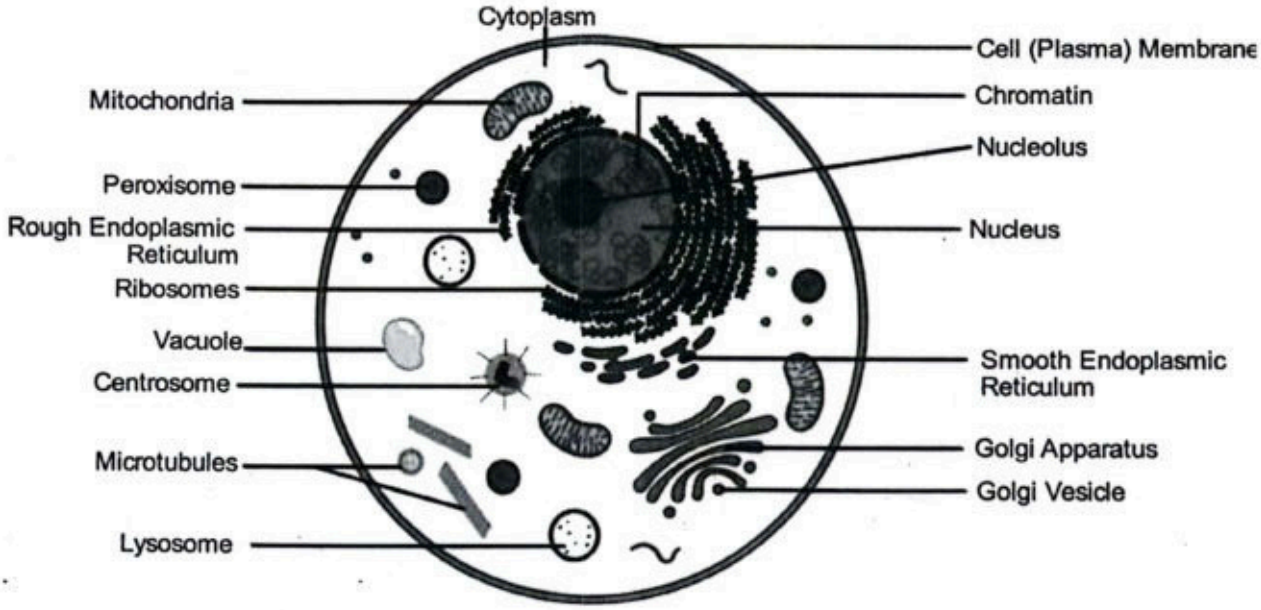


Fig.2.3: Animal cell (as seen under electron microscope)

c. Cytoplasm

It is present between plasma membrane and nuclear envelope. Cytoplasm is semi-viscous and semitransparent substance. It contains water in which proteins, carbohydrates, lipids and inorganic salts are dissolved. Cytoplasm provides space for the functioning of the organelles. Cytoplasm acts as the site for various biochemical reactions. For example, breakdown of glucose during cellular respiration takes place in cytoplasm.

Cytoskeleton

Cell contains a supportive network of the fine fibres, which are called cytoskeleton. Microfilaments are thinner and macro-filaments are thicker and intermediate filament is between the two. They are also major components of cilia and flagella. Cytoskeleton is responsible for the cell shape and movement.

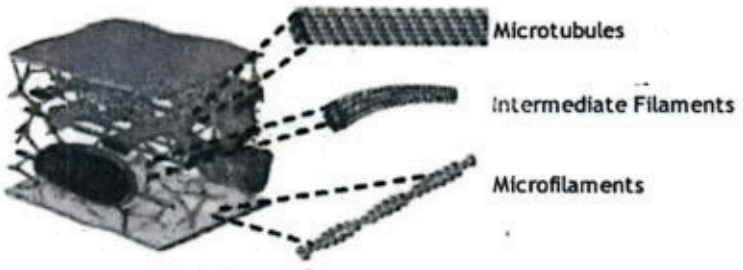


Fig. 2.4: Cytoskeleton

2.2 CELL ORGANELLES: STRUCTURE AND FUNCTIONS

The term organelles literally means "little organs." Organelles are small organized structures within the cytoplasm of all eukaryotic cells. They have specific structure and functions. We will discuss here nucleus, ribosomes, endoplasmic reticulum, Golgi complex, lysosomes, mitochondria, centriole, vacuoles and plastids.

Nucleus

In eukaryotic cells a prominent nucleus occurs. Nucleus is bounded by a double membrane known as **nuclear envelope.** The nuclear envelope has many pores. The fluid inside the nucleolus is called **nucleoplasm.** The dark staining region in the nucleus is called **nucleolus.** The thread like structures in the nucleus are called **chromosomes.** Chemically chromosomes consist of deoxyribo nucleic acid (DNA) and protein. The **centromere** is a constriction in chromosome. A chromosome consists of two chromatids. Nucleus controls all the activities of the cell.

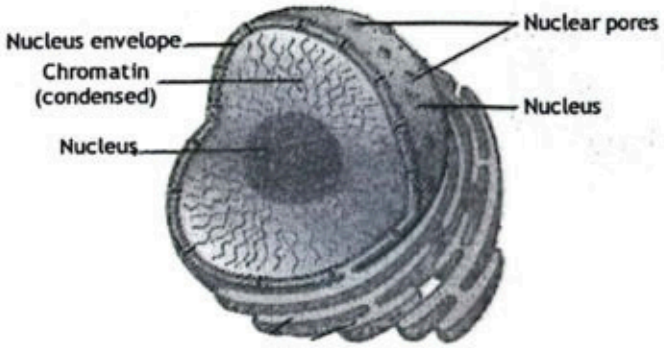


Fig. 2.5: Structure of nucleus

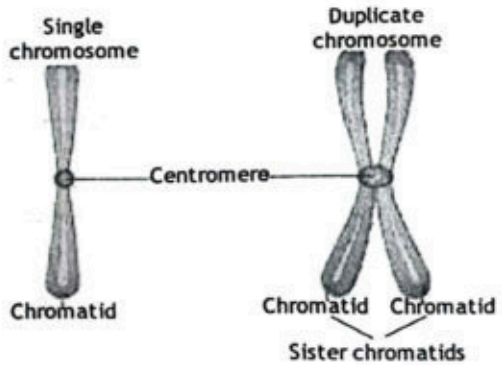


Fig. 2.6: Chromosome

Ribosomes

Ribosomes are granular bodies. They may exist in two forms:

(a) Attached with the endoplasmic reticulum. (b) Freely dispersed in the cytoplasm. Ribosomes are made of equal amount of ribonucleic acid (RNA) and proteins.

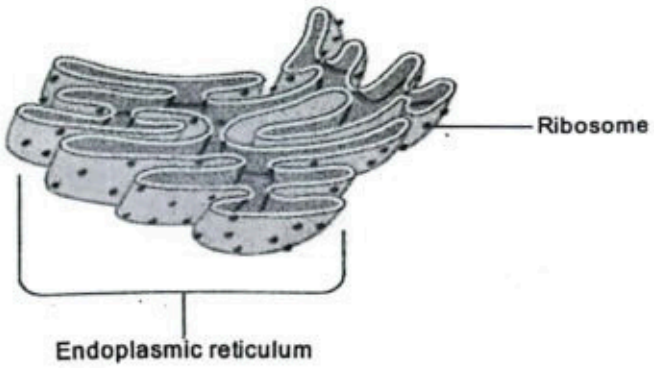


Fig. 2.7: Ribosomes

Endoplasmic reticulum

Endoplasmic reticulum (ER) is a network of inter connected channels. The ER is continuous with plasma membrane, nuclear membrane and Golgi apparatus. The two types of ER are smooth ER and rough ER. **Smooth** ER has no ribosomes attached with it. Smooth ER plays an important role in lipid formation. Smooth ER forms vesicles in which large molecules are transported to other parts of the cell. In liver it helps to detoxify drugs. **Rough ER** has ribosomes attached to it. Rough ER is involved in protein synthesis.

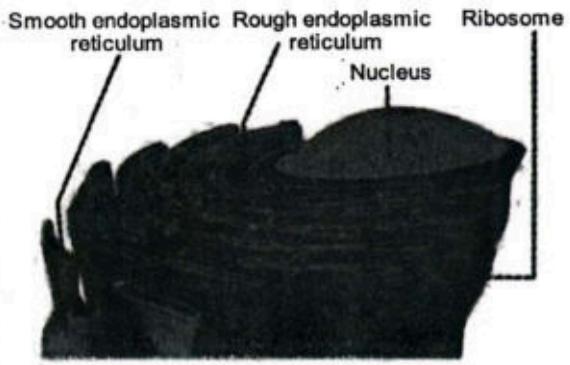


Fig.2.8: Endoplasmic reticulum

Golgi apparatus

It was discovered by Italian scientist Camillo Golgi in 1898. It is also known as Golgi bodies and Golgi complex. The electron microscope has shown that it is a stack of flattened sacs formed of membranes. The inner (cis) face of the sac is directed towards the endoplasmic reticulum. The outer (trans) face of the stack is directed towards the plasma membrane. **Vesicles** are seen at the edges of the stack. Golgi apparatus receives vesicles that bud off from the ER and modify them. They store the secretion and finally release them in secretory cells. They also give rise to lysosomes.

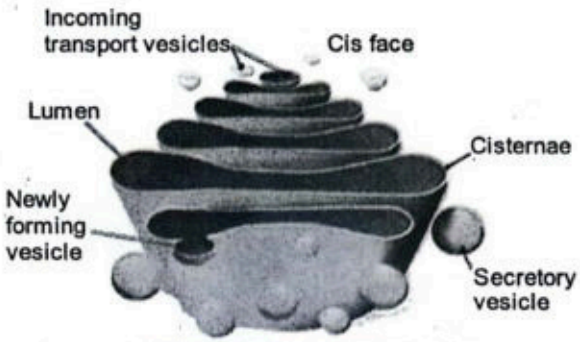


Fig. 2.9: Golgi apparatus

Lysosomes

Lysosomes are roughly spherical structures bounded by a single membrane. Lysosomes contains various **hydrolytic enzymes** which breakdown proteins, nucleic acids, lipids and carbohydrates. Lysosomes serve as recycling centers for damaged organelles.

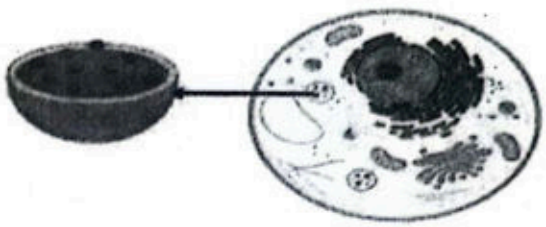


Fig 2.10: Lysosome

Mitochondria

Mitochondria (singular: mitochondrion) are special rod like or elongated tiny organelles. Under Electron Microscope a mitochondrion is a double membrane structure. The outer membrane is smooth. The inner membrane is folded to form **cristae**. Cristae provide a much greater area. Mitochondrial solution is called **matrix**. Mitochondria produce energy in form of Adenosine triphosphate (ATP).DNA, ribosomes and enzymes are present in mitochondria.

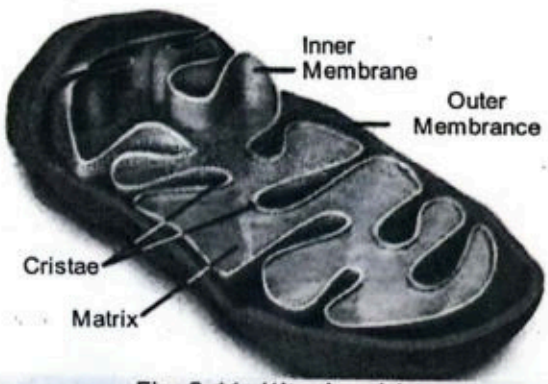


Fig. 2.11: Mitochondria

Centriole

In an animal cell a pair of centrioles is located near the outer surface of the nucleus. The two centrioles are usually placed at a right angle to each other in a structure called **centrosome**. Just before cell division the centrioles duplicate and each pair migrates to the opposite side of the nucleus. The spindle fibres are then formed between the two opposite pairs of centrioles.

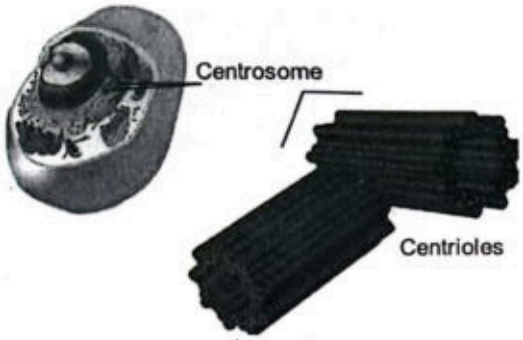


Fig.2.12: Centrioles

Vacuole

A vacuole is a saclike structure, bounded by a single membrane. It is filled with fluid. A mature plant cell has large central vacuole. An animal cells have many small vacuoles in their cytoplasm.

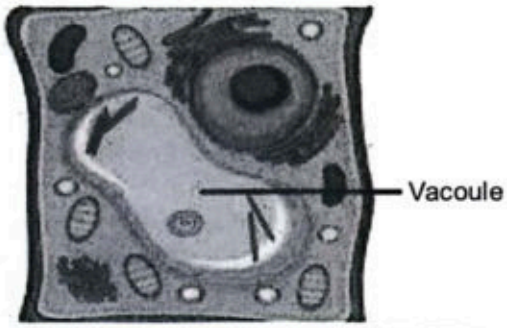


Fig.2.13: Vacuole in a plant cell

Plastids

Plastids are present in plants. They are membrane bounded structures and contain different pigments. There are three types of plastids.

Leucoplasts are colourless. These are found in the underground parts of the plants e.g., roots, tuber. They store food.

Chromoplasts have colour other than green. These are present in petals of flowers and ripened fruits. They help the plants in pollination.

Chloroplasts have green coloured pigments called **chlorophyll**. These are located in the green parts of the plant. These are the site of photosynthesis. They are bounded by a smooth double membrane. The inner membrane is folded to form hollow coin like structures call **thylakoids**. The sacs of thylakoids are called **grana**. The fluid surrounding the grana is called **stroma**.

Do You Know?

There is no cell wall in animal cells as the presence of a cell wall would make it difficult or even impossible for animals to move.

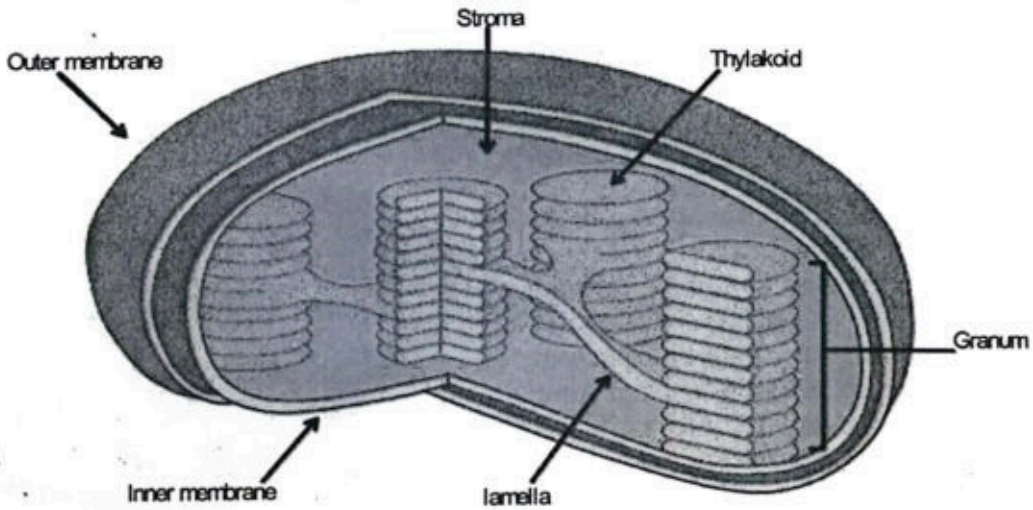


Fig.2.14: Chloroplast

2.3 DIFFERENCES BETWEEN ANIMAL CELL AND PLANT CELL

Cells are of various shapes and sizes, but all have the same parts. These are cytoplasm, nucleus, ribosomes, edoplasmic reticulum, Golgi apparatus and mitochondria. However animal and plant cells do not look exactly the same or have all the same organelles, since they have different needs. For example plant cells contain chloroplast since they need to perform photosynthesis but animal cell do not. In animal cell the cell membrane is the outer boudry. In plant cell there is a cell wall around the cell membrane. Plant cells have cell membrane but animal cells do not have cell wall. Both plant and animal cells have vacuoles. A plant cell contains a large, singular vacuole that is used for storage and maintaining the shape of the cell. In contrast, animal cells have many, smaller vacuoles.

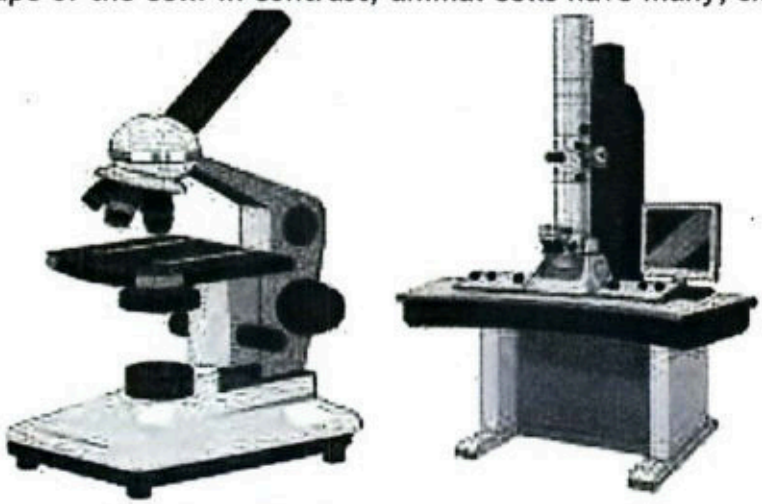


Fig. 2.15: Light microscope and Electron microscope

For Your Information

Electron microscopes differ from light microscopes in that they produce an image of a specimen by using a beam of electrons rather than a beam of light. Electrons have much a shorter wavelength than visible light, and this allows electron microscopes to produce higher-resolution images than standard light microscopes.

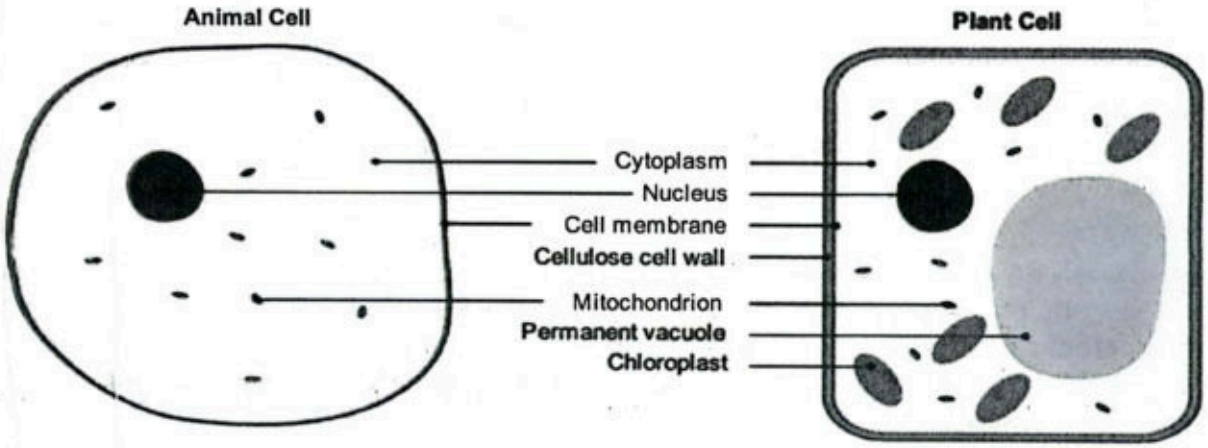


Fig.2.16: Animal cell and plant cell (as seen under light microscope)

Table 2.1 The difference between plant cell and animal cell.	
Plant cell	**Animal cell**
1. A plant cell is surrounded by a rigid cell wall.	1. An animal cell does not have a cell wall.
2. Presence of a large vacuole is seen in plant cells.	2. There are very small vacuoles as compared to plant cells are seen in animal cells.
3. Larger in size.	3. Smaller in size.
4. Plant cells have plastids.	4. Animal cells do not have plastids.
5. Centrosomes are absent in plant cells	5. Animal cells have centrosomes.
6. Plant cells do not have cilia.	6. Animal cells have cilia.
7. Lysosomes are very rare in plant cells.	7. Animal cells have lysosomes.

2.4 PLANT AND ANIMAL TISSUES

Tissues are group of cells that have similar structure and act together to perform a specific function. There are different types of tissues both in plants and animals.

Plant tissues

Plant tissues have been divided into two main groups:

a. Simple tissues

b. Compound tissues

Simple tissues

Simple tissues are composed of only one type of cells having same function. The simple tissues consist of two main types:

a. Meristematic tissues

b. Permanent tissues

Meristematic Tissues

Meristematic tissues are composed of cells having power of division. These are found at the apex of the root and shoot.

Permanent tissue

The cells of the permanent tissue do not divide. One of the type of permanent tissue is epidermal tissue.

Epidermal tissue

Epidermis is one cell thick layer. It covers the whole plant body i.e., root, stem and leaf. The cells of the epidermal tissue are living, thick walled and closely packed with no intercellular spaces. The epidermis of leaf has pores called **stomata** (singular stoma), for exchange of gases. Root and stem epidermal cells grow hairlike extensions, which increase its surface area.

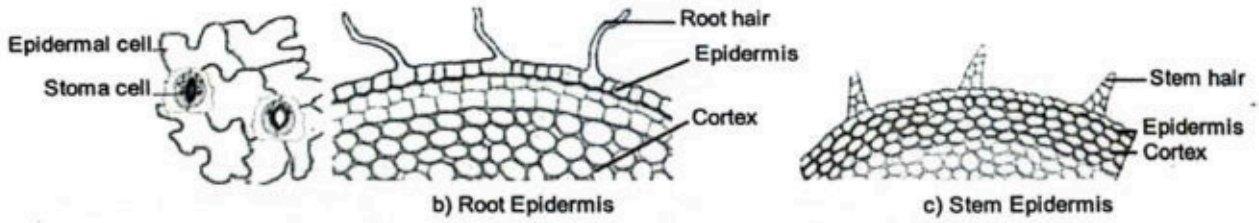


Fig. 2.17: Epidermal tissues (Leaf Epidermis, Root Epidermis, Stem Epidermis)

Compound tissues

The two types of compound tissues in plants are **xylem** and **phloem**. Together they form the **vascular bundle**. Both xylem and phloem are composed of more than one type of cells. Thus the tissues, which are composed of different kinds of cells performing a common function are called compound tissue.

Xylem

Xylem has two main functions. They conduct water and mineral salts and provide structure and support in stem. Xylem consists of two main types of cells named **tracheids** and **vessels**. Tracheids are elongated cells having tapering end walls that overlap with adjacent tracheids. The cell wall is lignified and has pits. Tracheids are hollow and empty dead cells when mature and only their cell walls remain. Tracheids have mechanical strength and give support to the plant. Vessels are very long, tubular structures formed by the fusion of several cells end to end in a row. Each cell is called **vessel element**. It is a dead empty cell having dissolved end walls.

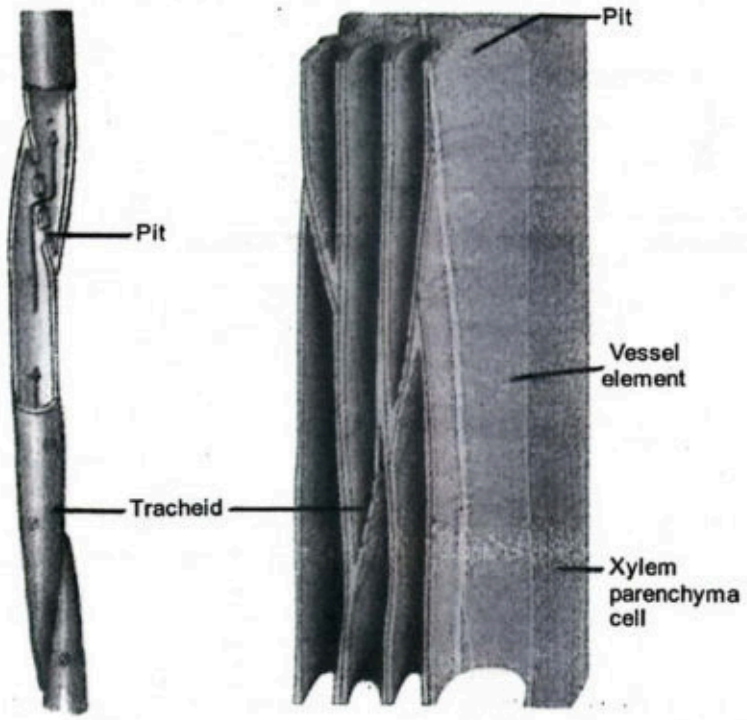


Fig. 2.18: Xylem

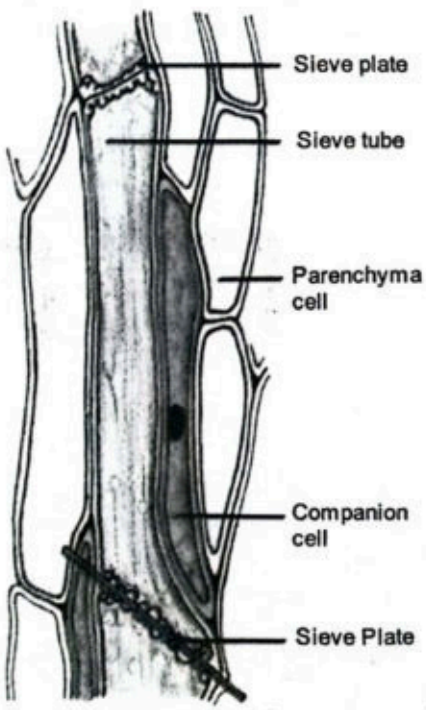


Fig. 2.19: Phloem

Phloem

It has a tubular structure. It conducts prepared food from leaves to stem and roots etc. Phloem tubes are composed of living cells and have no mechanical function.

There are two main types of cells in the phloem, namely sieve tube element and companion cell. **Sieve tubes** are formed by end-to-end fusion of cells called **sieve tube elements.** Sieve tube elements have porous end walls called **sieve plates.** The cytoplasm is continuous through sieve plate. The cells attached to the sieve tube elements are called **companion cells.** They regulate the movement of food through the sieve tube.

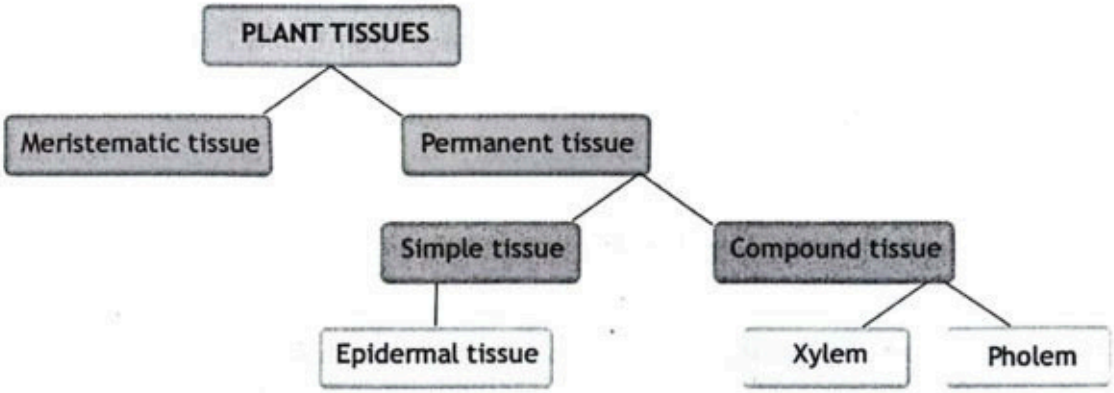


Fig. 2.20: Types of plant tissues

Animal Tissue

Animal tissues are divided into four groups namely epithelial tissue, connective tissue, muscular tissue and nervous tissue.

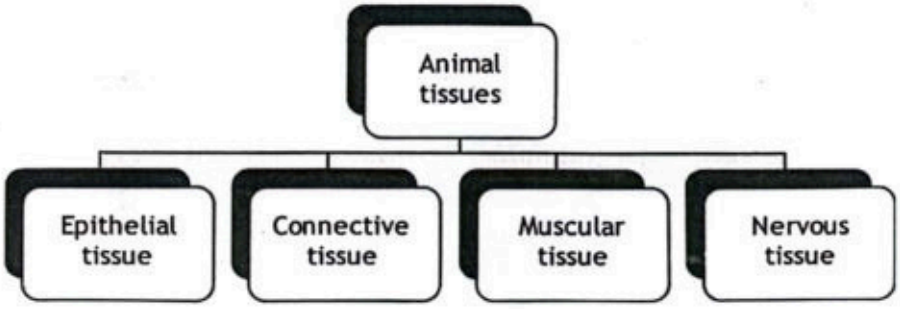


Fig.2.21: Types of animal tissues

1. Epithelial Tissue

Epithelial tissue is also called **epithelium.** It consists of tightly packed cells that form a continuous layer or sheet covering the entire body surface and lining most of the inner cavities. There are four types of epithelia.

a. Squamous Epithelium

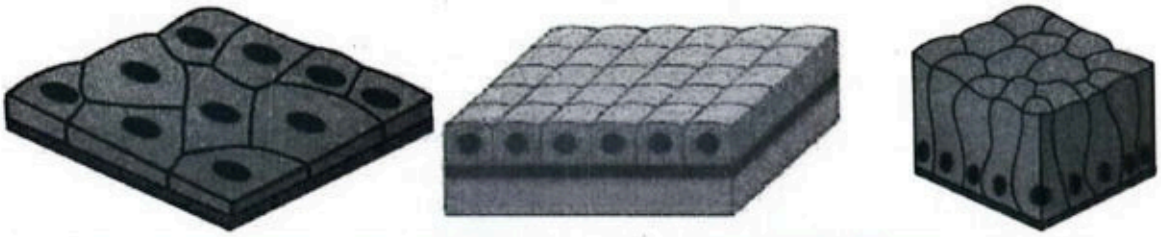
The cells are thin and flattened and arranged as single layer. It is present in the alveoli (tiny air sacs) of lungs, cheek, blood vessels etc. Its function is passage of material by diffusion and filtration.

b. Cuboidal Epithelium

Cells are cube shaped, arranged in a single layer. It is present in tubes of kidney and ducts of glands etc. Its function is secretion and absorption.

c. Columnar Epithelium

These cells are long and narrow. It lines stomach, intestine etc. Its function is secretion, absorption and protection.



Squamous Epithelium | Cuboidal Epithelium | Columnar Epithelium

Fig.2.22: Epithelial Tissue

d. Ciliated Epithelium

Cells are columnar in shape but bear cilia at their free surfaces. These cells line the respiratory passages. It transports materials through tubes or passage way.

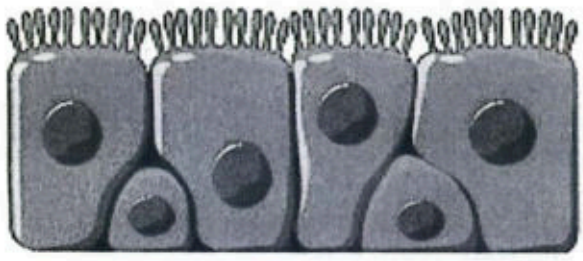


Fig. 2.23: Ciliated epithelium

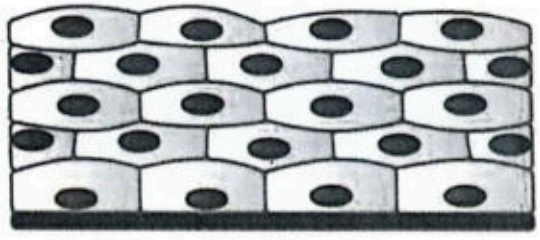


Fig 2.24: Stratified epithelium

e. Stratified Epithelium

The tissue is made of a number of layers. It is present in oesophagus, skin etc. Its function is protection.

2. Connective Tissue

They connect and support the body's various tissues and organs. They include soft connective tissues as well as specialized forms such as cartilage, bone, adipose (fat) tissue, and blood. **Dense connective tissue** contains elastin fibers in addition to collagen fibers, which allows the tissue to return to its original length after stretching found in structures such as tendons and ligaments. **Adipose connective tissue** is present throughout the body. It is found under the skin and between internal organs. The tissue is also known as **body fat**. It stores and release energy. It also provides insulation. **Areolar connective tissue** holds organs in place and attaches epithelial tissue to other underlying tissues.

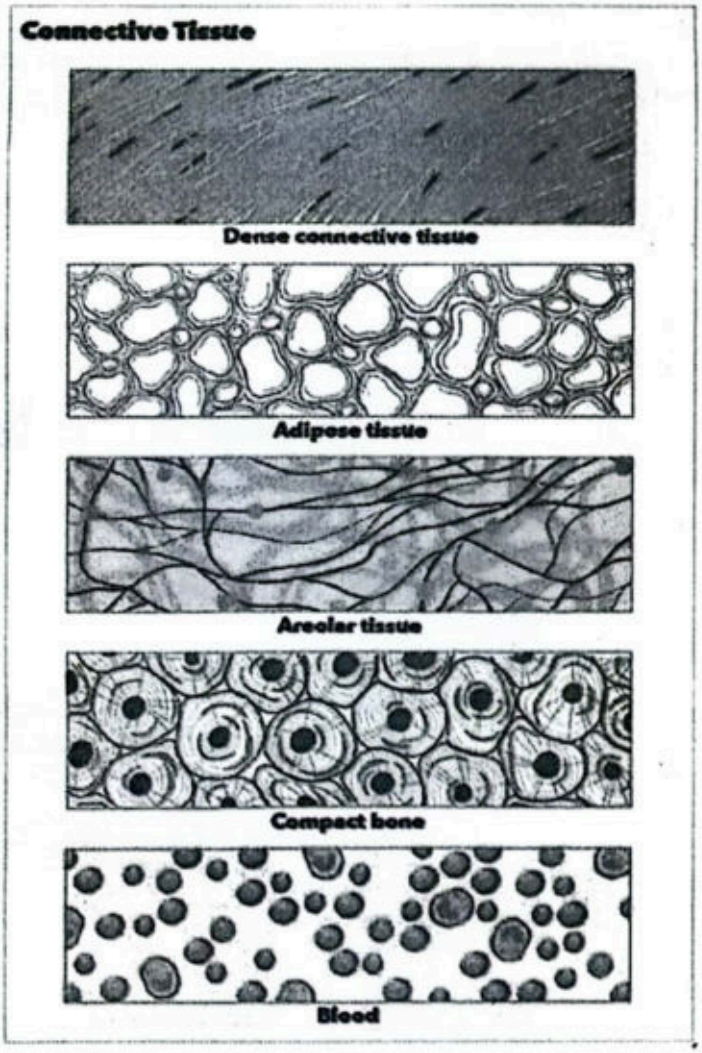


Fig. 2.25: Connective tissues

3. Muscular tissue

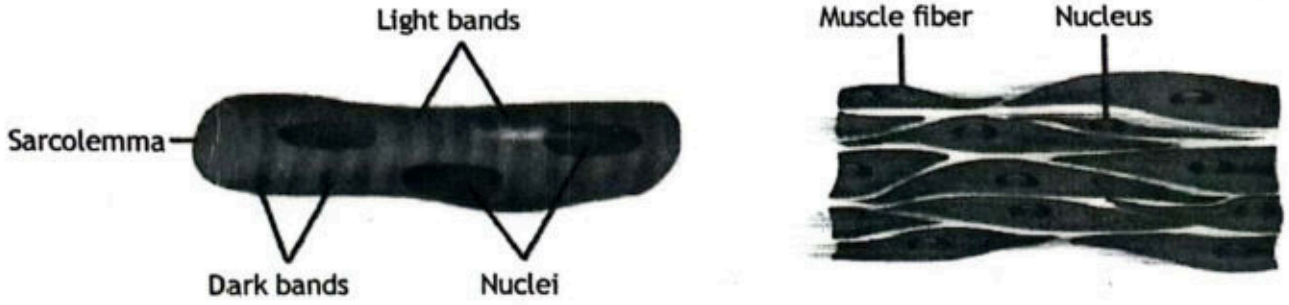
Muscle tissue is a type of contractile tissue composed of muscle cells. These cells are also described as muscle fibres because of their large size and elongated nature. Muscle fibers are of three types.

(i) Skeletal muscles

Striated muscle fibres are also called **skeletal muscles**. These muscles are elongated, unbranched and multinucleated. Moreover, these muscles are attached to the bones and helps in body movements.

(ii) Smooth muscles

Smooth muscles are also called **involuntary** or **un-striated muscles**. These muscles are present as a fusiform (spindle-like shape, that is wide in the middle and tapers at the ends) elongated sheets. A single nucleus is present in these muscles and myofibrils (contractile threads) are present longitudinally in these cells.

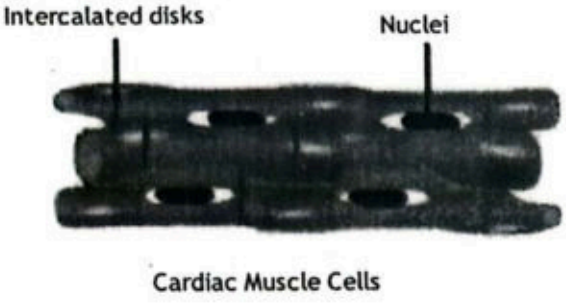


(a) Striated muscles (b) Smooth muscles

Fig. 2.26: Muscular Tissue

(iii) Cardiac muscles

Cardiac muscles are extensively branched and these branches join to form a compact network. Light and dark bands along with a single nucleus can be observed in the cells of these muscles. These muscles are found in the heart. Intercalated discs are the specialized junctions between cardiac muscle fibres. These allow electrical transmission. Intercalated discs are important because cause cells in the heart to beat as one.



Cardiac Muscle Cells

Fig. 2.27: Cardiac muscles

Muscle Type	Description	Function	Location
Smooth muscle	Has elongated, spindle shaped cells. It does not appear striated, or striped, and each cell has one nucleus.	Controls involuntary movement.	Intestine, bladder, stomach, uterus
Cardiac muscle	It is striped, or striated, with light and dark bands.	Controls involuntary movement of the heart.	Heart
Skeletal muscle	It is long, thin fibres with striation. It is also multinucleated. Fibres are crossed with a regular pattern of fine red and white line, giving it a unique appearance.	Controls the voluntary movement of the body.	Attached to bones by tendons

4. Nervous Tissue

Neurons are the cells of nervous system. They are responsible for coordination in the animal bodies. To accomplish this job their structure is very unique. A neuron cell has a **cell body** and two types of cytoplasmic fibres. One of them are **dendrites** which conduct nerve impulses to the cell body. Others are **axons** which conduct messages away from the cell body. The dendrites and axons make it possible for neurons to communicate with far away cells of the body.

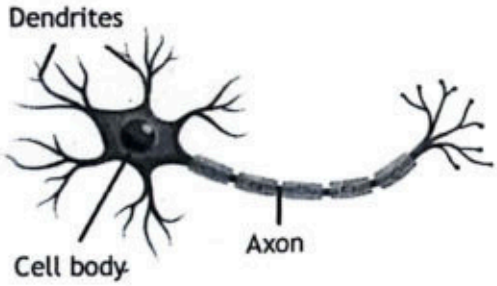
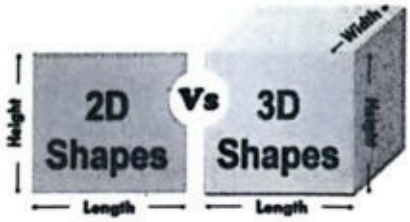


Fig. 2.27: Nervous tissue

2.5 MAKING A THREE -D MODEL OF PLANT AND ANIMAL CELL

3D modelling is the process of creating three-dimensional representations of an object or a surface. It is the mathematical representation of a three-dimensional surface



1. By Using Gelatine

A. Materials needed

a. **Cytoplasm:** Clear gelatin will work as the cytoplasm, which is present in both animal and plant cells.
b. **Nucleus:** For the nucleus, nucleolus and nuclear membrane: Purchase a pitted fruit, such as a plum or peach. The pit is the nucleolus, the fruit is the nucleus, and the skin is the nuclear membrane. (If you are not expected to deliver this level of complexity, a simple round food item will do). You will need this for either a plant or animal cell.
c. **Centrosomes:** These are only present in animal cells, are supposed to be spiky, try putting bits of toothpick through a gumdrop or other small gummy item.
d. **Golgi apparatus:** It is present in both plant and animal cells, using cut-out pieces of cardboard, wafers, crackers, sliced bananas.
e. **Lysosomes:** In either type of cell, use small, round candies or chocolate chips.
f. **Mitochondria:** Which are also present in both animal and plant cells, are somewhat oblong, so try using certain types of un-shelled nuts.
g. **Ribosomes:** You will need something small. Try sprinkles, peppercorns, or plain pepper. These are present in both plant and animal cells.
h. **Rough endoplasmic reticulum:** Which is present in both animal and plant cells. It looks much like the Golgi apparatus, in that it is a structure of flat, folded sections clumped together; though unlike the Golgi apparatus it has a rough-looking surface. You could use similar materials for it, but try to find a way to stick something rough or textured to it (perhaps sprinkles) in order to make the two distinct.
i. **Smooth endoplasmic reticulum:** Looks more like a tangled and irregularly sized series of connected tubes. For this, you will need something smooth and bendy. Use cooked spaghetti.
j. **Vacuoles:** You will choose different shapes for animal versus plant cells. For an animal cell, use a few moderately sized pieces of plastic or rubber having same color. Vacuoles in plant cells are much, much larger.
k. **Microtubules:** It can be modeled using uncooked pieces of spaghetti or straws.
l. **Chloroplasts:** (plant cell only), use peas, green jelly beans, or green beans cut in half. Keep them green.

B. Get a gelatin mold. You will need a mold to make your cell. Animal and plant cells have different shapes and will require different molds.

a. For a plant cell, the first thing you'll need is a rectangular baking dish, preferably made out of porcelain. The dish itself will be your cell wall and membrane, in your model.

b. For an animal cell, you will want a round or oblong baking dish. This dish can be your cell membrane.

C. Make the gelatin. Cook the gelatin by boiling water on the stovetop, and then mixing the gelatin in. Carefully pour the hot liquid into the baking pan. Let the pan cool for about half an hour until it is almost hardened. **Do not wait until the gelatin has completely settled.**

D. Procedure

Add your cell parts: Start putting your cell parts into the gelatin. Here's how you might want to arrange the pieces:

a. Put the nucleus near the middle (unless you are modeling a plant cell).

b. Place the centrosome near the nucleus. This is only present in animal cells.

c. Put the smooth endoplasmic reticulum near the nucleus. This is present in both animal and plant cells.

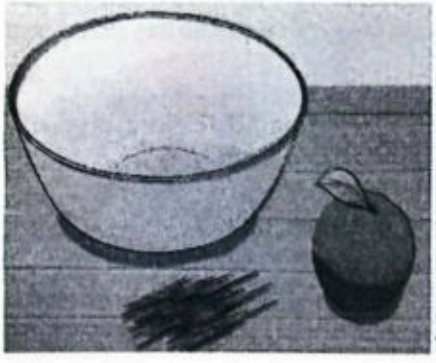
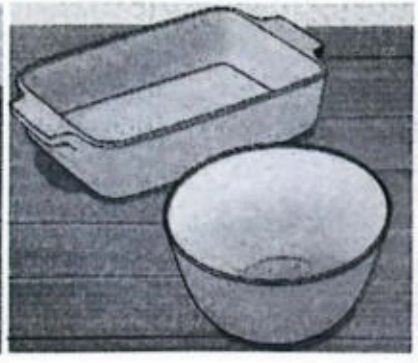
d. Place the Golgi apparatus, which is present in both animal and plant cells, near the nucleus (though farther away than the endoplasmic reticulum).

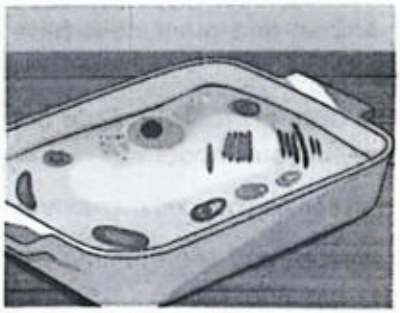
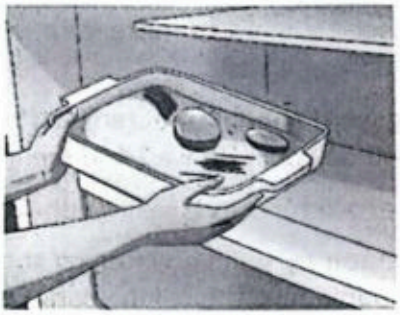
e. Add the rough endoplasmic reticulum onto the other side of the smooth endoplasmic reticulum (away from the nucleus). This is present in both plant and animal cells.

f. Arrange everything else wherever you have room. Try not to crowd too much into one space. In a real cell, there are a few structures that float all around the cytoplasm. These can be mixed in almost randomly.

Put the model into the refrigerator. Allow the gelatin to settle for an hour or two until it is completely solidified.

Make a table or key that defines each part. After you have added your cell pieces, write up a list of what part of a cell each item corresponds to (e.g., "Gelatin = Cytoplasm," "Licorice = Rough ER"). You will probably need to be able to tell people about the parts of your cell later on.


2. By Using Craft Item

1. **Materials needed:** Here are a few options:
   a. You can use a styrofoam cell base. Craft or art stores and will have styrofoam balls (if making an animal cell) roughly the size of a basketball or a styrofoam rectangular cube (if making a plant cell).
   b. Cardstock can be used to form a number of cell structures, such as the Golgi apparatus or rough endoplasmic reticulum.
   c. Straws can be used to form tube-like structures. The microtubules could be constructed out of stirring straws, while flexible straws or tubes can be used to model the smooth endoplasmic reticulum.
   d. Use beads of various sizes and shapes as other cell structures, such as mitochondria or chloroplasts. Try to keep them on an appropriate scale compared to the other structures in the model cell.
   e. Modeling clay can be used to create any structure that is difficult to replicate using preexisting materials.
   f. Paint can be used to fill in the cytoplasm and differentiate between it and the exterior of the cell. You can also paint any clay structures you have created.
2. **Cut out a 1/4 section of the styrofoam base.** Measure the base and make dots at the points that equal half the length of a side. Draw lines showing where to cut. Then use a knife or scissors to cut and remove a 1/4 section.
   a. For the plant cell, do this by drawing the centre line on any two adjoining sides and continue those lines all the way around until they circle back.
   b. If doing this for the animal cell, draw the lines like you were making the equator and the meridians on a globe.
3. **Paint it.** Paint the inside of the 1/4 section in order to help your cell parts stand out. You can also paint the outside in a different colour to contrast it with the cytoplasm.
4. **Make the cell parts.** Create them from the craft items listed above.

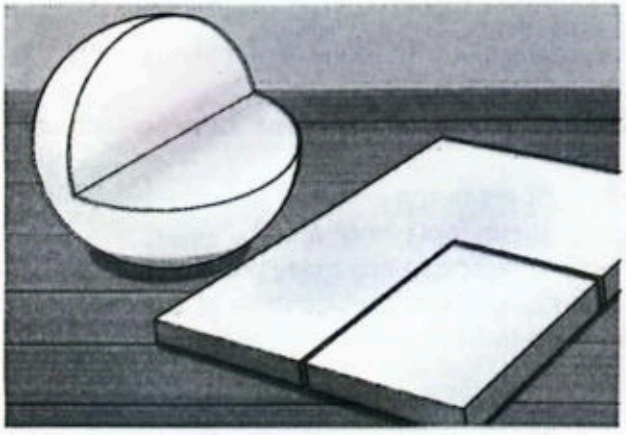
The trickiest of these will be the parts that you must model out of clay. Keep these structures as simple as possible while remaining true to the basic structure you are modeling. It may be best to only make the simplest of structures out of clay and leave more complex parts--say, the smooth endoplasmic reticulum--to be replicated using tubes or some other item.

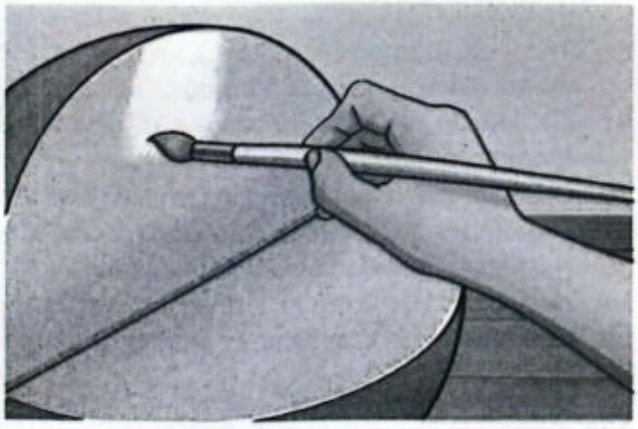
5. Add the cell parts. Add the parts to your cell base (the styrofoam). This can be done by using hot glue, regular glue, toothpicks, pins, staples, or a number of other methods. In some cases you may also need to literally dig or carve out space in the styrofoam to fit in the parts.

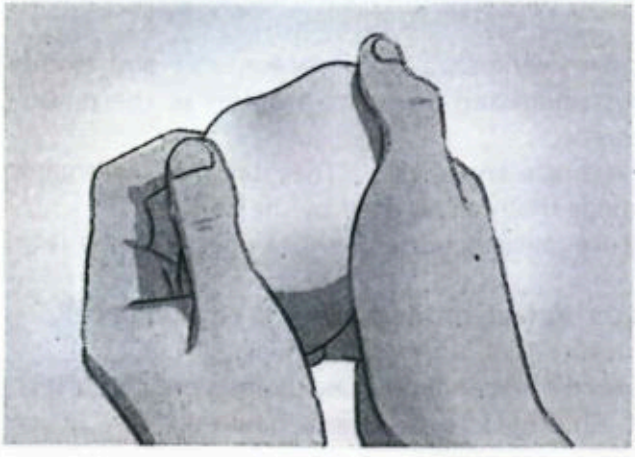
The Golgi apparatus and rough endoplasmic reticulum can be shaped out of cardstock using your hands. In this case, make slices into the styrofoam and slide pieces of cardstock in to form the folded shapes of these structures.

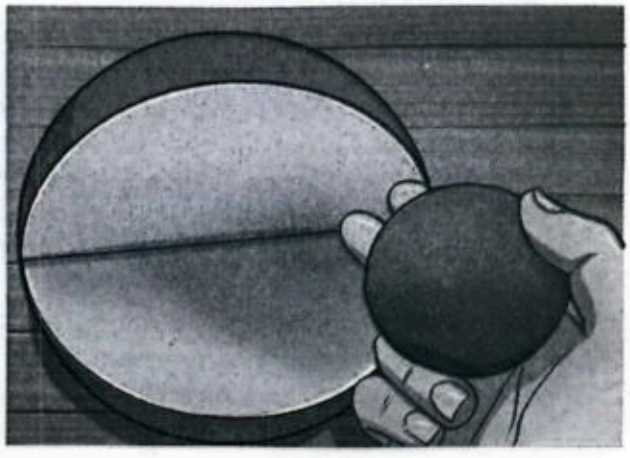
Make a table or key that defines each part. After you've added your cell pieces, write up a list of what part of a cell each item corresponds to. You'll probably need to be able to tell people about the parts of your cell later on.

It depends, because plant cells have more functions, but it is easier to distribute the organelles onto a flat, rectangular surface. The animal cell has less functions, but it is more difficult to distribute it, since it is circular.









Tips

1. You will be able to add parts more quickly if you have a friend or parent help.
2. Make sure the gelatin has enough time to solidify after you have added the "organelles." Try to keep it in the fridge overnight.
3. You might want to papier-mâché (A malleable mixture of paper and glue, or paper, flour, and water, that becomes hard when dry, used to make boxes, trays, or ornaments.) the styrofoam for safety reasons. Add extra layers for good measure.

SUMMARY

1. In 1665 Rober Hooke observed that the cork was made of tiny empty spaces with walls under a simple microscope, He named them as 'cells'.
2. Cells are the smallest unit and building block of living things.
3. Cells are the functional unit of living things.
4. Every cell is surrounded by a cell memrane.
5 Cells perform a wide range of activites such as movement, respiration, growth and reproduction etc.
6. Organelles are small organized structures within the cytoplasm of a cell.
7. The cell wall is present in plant cells. Animal cells do not have cell walls.It protects the plant cell, maintains its shape. It allows free passage of dissolved water and dissolved materials.
8. The cell membrane is the covering of the cytoplasm. It is found in all living cells. It maintains the internal composition of cell.
9. Cytoplasm is semi-viscous and semitransparent substance, present between plasma membrane and nuclear envelope.
10. Cytoskeleton is a supportive network of the fine fibers in the cell.
11. Organelles are small organized structures within the cytoplasm of a cell.
12. Nucleus is bounded by a double membrane nuclear envelope having many pores. A nucleus has nucleoplasm, nucleolus and chromosomes. Nucleus controls all the activities of the cell.
13. Chemically chromosomes consists of DNA and protein. It consists of centromere and two chromatids.
14. Ribosomes are the site of protein synthesis.
15. The endoplasmic reticulum is a series of internal membranes with many functions e.g., protein synthesis and transport.
16. Golgi apparatus are a series of flattened membrane sacs that process, sort and modify proteins synthesized on the endoplasmic reticulum and transport proteins to the plasma membrane, to the outside the cell and lysosome.
17. Lysosomes are spherical and bounded by a single membrane. They breakdown organic molecules like proteins into simpler compounds that can be used by the cell.
18. Mitochondrion is a double membrane structure. Mitochondria provides energy in the form of Adenosine triphosphate (ATP).
19. A pair of centrioles are located near the outer surface of the nucleus in an animal cell.
20. A vacuole is a sac like single membrane structure that stores substances.
21. Plastids are membrane bound structures and are of three types. Leucoplasts are colourless. Chromoplasts have colour other than green. Chloroplasts are green coloured.

22. Tissues are a group of cells with similar structure and specific functions. The four groups of animal tissues are epithelial tissue, connective tissue, muscular tissue and nervous tissue.
23. Epithelium or epithelial tissue *is* a thin, continuous, protective layer of compactly packed cells with a little intercellular matrix.
24. The five types of epithelia are squamous epithelium, cuboidal epithelium, columnar epithelium, ciliated epithelium and stratified epithelium.
25. Connective tissues, support and connect different tissues and organs of the body. They are widely distributed in every part of the body.
26. Muscle tissue is characterized by properties that allow movement. Muscle cells are excitable; they respond to a stimulus.
27. The plant epidermis is a protective tissue that covers the entire surface of the plant. The epidermis protects the plant from infection and water loss.
28. Xylem is a type of vascular tissue present in plants, which primarily transports water and nutrients from roots to stem and leaves. They also provide mechanical support.
29. The phloem is composed of living tissue that actively transports sugars to plant organs such as the fruits, flowers, buds, and roots.

EXERCISE

Section I: Multiple Choice Questions

Select the correct answer:

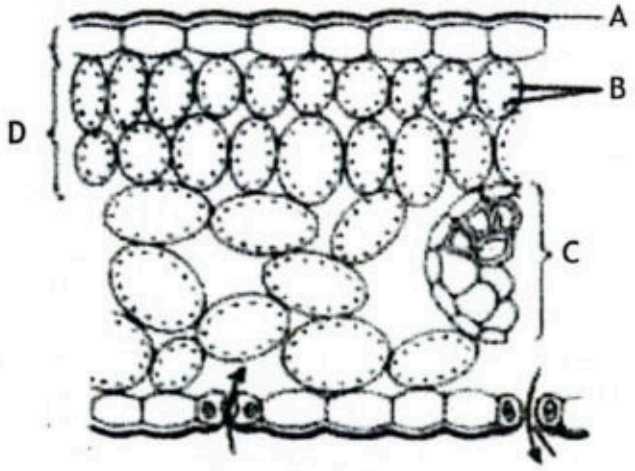
1. A network of channels extending from cell membrane to nuclear membrane is called:

   A) centriole B) ribosomes C) centrosome D) endoplasmic reticulum

2. The site of enzyme synthesis in cell is :

   A) lysosomes B) ribosomes C) Golgi aparatus D) endoplasmic reticulum

3. The diagram shows cells in peal of the green leaf. Which region contains cells which are responsible for transport of water and food?



4. What are the functions of xylem and phloem in green plants?

	Xylem	Phloem
A)	support and transport of sugars	transport of water
B)	transport of sugar	support and transport of water
C)	support and transport of water	transport of sugar
D)	transport of water	support and transport of sugars

5. What are the functions of mitochondria?

A) lipid synthesis B) protein synthesis

C) photosynthesis D) cellular respiration

6. Which of the following is present in all eukaryotic cells?

A) cell wall B) cilia C) membrane bound organelles D) flagellum

7. Which of the following cell organelles does not contain DNA?

A) nucleus B) lysosomes C) chloroplast D) mitochondria

8. Which of the following statements describes a way in which plants cells and animal cells are similar?

A) They have cell walls B) They both make sugars from Sunlight

C) They both contain mitochondria D) They both are prokaryotic

9. A 3-D modelling is:

A) Mathematical representation of a three-dimensional surface

B) Animation story board modelling

C) Creating sketching for a 3-D model

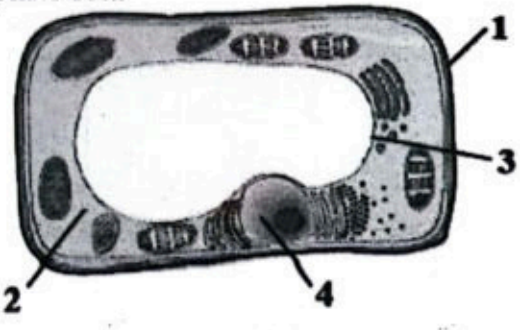
D) None of these

10. The thin extensions of the inner mitochondrial membrane are known as:

A) stroma B) thylakoid C) cristae D) matrix

Section II: Short Response Questions

1. Following diagram shows a plant cell.



Keeping in view the parts labeled 1 to 4, answer the following questions:

a. Give the number indicating the structure which controls the cell activities?
b. Name a biochemical process taking place in part 2.
c. What will happen to cell if part 1 is removed?
d. What will happened if part 3 is overfilled with water?

2. Can you make the distinctions between:
   a. Organ and organelles
   b. Cytoplasm and cytoskeleton
   c. Nucleus and nucleolus
   d. Chromosome and chromatids
   e. Rough and smooth endoplasmic reticulum
   f. Permanent and meristematic tissue
   g. Chromoplast and chloroplast
   h. Simple and compound tissue
3. Write the functions of:
   a. Nucleus
   b. Ribosomes
   c. Endoplasmic reticulum
   d. Golgi apparatus
   e. Mitochondria
   f. Lysosomes
   g. Centriole
   h. Vacuole
   i. Leucoplast
   j. Chromoplast
   k. Chloroplast
   l. Cell wall
   m. Vacuole
4. List the functions of cells.
5. How is a cell wall different from a plasma membrane?
6. Why animals have no cell wall?
7. What is the meaning of 3D Model?

Section III: Extensive Response Questions

1. Describe the structure and functions of the following with diagram.
   a. Cell wall
   b. Cell membrane
   c. Nucleus
   d. Ribosomes
   e. Endoplasmic reticulum
   f. Golgi apparatus
   g. Mitochondrion
   h. Centriole
   i. Vacuole
   j. Chloroplast

2. Compare and contrast an animal cell with a plant cell.
3. What is a tissue? Describe the following types of tissues in plants:
   a. Epidermal tissue
   b. Xylem
   c. Phloem
4. What are the types of animal tissue? Describe epithelial tissue.
5. Define connective tissue. Explain the structure and functions of connective tissue.
6. Write the description, functions and location of smooth muscle, cardiac muscle and skeletal muscle.
7. Describe the structure and function of nervous tissue.
8. Construct a 3-D model of plant cell and animal cell by using Gelatin or using craft items to represent cell organelles.
9. Draw and label:
   a. An animal cell
   b. A plant cell
   c. Xylem tissue
   d. Phloem tissue
   e. Striated muscle
   f. Smooth muscle
   g. Cardiac muscle