

## **Cells, Tissues and Organs - The Building Blocks of the Body**

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If we pull out or pinch off any tiniest bit from any part of a plant or an animal and examine it under microscope we will find hundreds and thousands of unit structures of well-defined shapes – the cells. In fact, every organism including human beings starts life only as a single microscopic cell. This single cell undergoes repeated divisions to produce more and more cells, which acquire different shapes to suit a variety of functions.

### **OBJECTIVES**

After completing this lesson, you will be able to:

- recognize that cell is the unit of structure and function of all forms of life;
- draw and describe the structural details of a cell that are common to both plant and animal cells and state their functions;
- differentiate between a plant cell and an animal cell;
- recognize that basic functions of life occur both at the level of a cell as well as an organism;
- explain the need for cell division as related to growth, development and reproduction;
- describe and draw sketches of the different stages of mitosis in an animal cell;
- explain briefly the role of meiosis (no description is required);
- give a brief account of animal tissues – epithelial, connective, muscular and nervous tissues;
- differentiate between protective (covering) and conducting tissues in plants (excluding finer details);
- trace the increasing complexity of organization of life from cell to organ, to organ system and to the organism.

### **24.1 CELL: THE UNIT OF STRUCTURE AND FUNCTION OF LIFE**

All plants and all animals, whether tiny or large, are made of small units – the cells. Every function of the body is basically the outcome of the activity of the cells comprising the body.

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### 24.1.1 Function of cells in living beings

- **Growth:** Growth is the result of new cells being produced by cell division. Any substance added to increase the bulk of the body of the organism is also due to the activity of the cells.
- **Reproduction:** No matter how an organism reproduces, whether sexually or asexually, it is again the cells that carry out the process. The male sperm is a cell and so is the female egg. When you grow a new plant from a cutting, such as rose or sugarcane, it is again the cells in the cutting that re-divide and result in growth of a new plant.

### 24.1.2 Functions of cells in plants

- **Absorption of water and minerals from soil:** Even the tiniest parts of the root are made of cells and these cells absorb water and minerals from the soil.
- **Production of food (starch):** The food (starch), which the plant produces, is through the activity of the green cells of the leaf. The green cells contain a green pigment, chlorophyll, which traps sunlight for food synthesis.
- **Produce colourful flowers:** The colour of flowers is due to the pigments developed inside the cells.

### 24.1.3 Function of cells in human beings

- **Movement:** The movement of the limbs or the body as a whole (locomotion) is the result of contraction of muscle cells.
- **Tasting food while eating:** Taste of any food that you have, is the result of the taste cells (sensory) of your tongue.
- **Digestion of food and its absorption:** The enzymes produced by cells of the digestive glands digest food, and the intestinal cells absorb it.
- **Transport of oxygen in the body:** The oxygen, supplied to the body parts, is absorbed by the red blood cells from inside the lungs and then transported to all parts of the body.

Similarly, you think of any activity inside a plant, an animal or a human being, you will find that there is always a cell carrying it out.

### CHECK YOUR PROGRESS 24.1

1. Mention whether the following statements are true (T) or false (F).

i) Skin is made up of cells.	T/F
ii) Tears are secretions of the tear gland cells.	T/F
iii) Bones are made up of hard material without any cells.	T/F
iv) Petals have no cells.	T/F
v) Sperm is a cell but the egg is not.	T/F

### 24.2 STRUCTURE OF A CELL

All kinds of cells, whether in plants or in animals, contain the same basic structures. Each such structure also has the same basic function. A generalized cell consists of three main parts: **plasma membrane, cytoplasm and nucleus** (Fig. 24.1).

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- a) **Plasma membrane:** It is the outermost membrane enclosing the cell.
- It holds within and protects all the cell contents.
  - It is very thin and flexible.
  - It is a living membrane full of activity.
  - It allows some substances to pass inward or outward while preventing the others. Thus, it is **selectively permeable**.

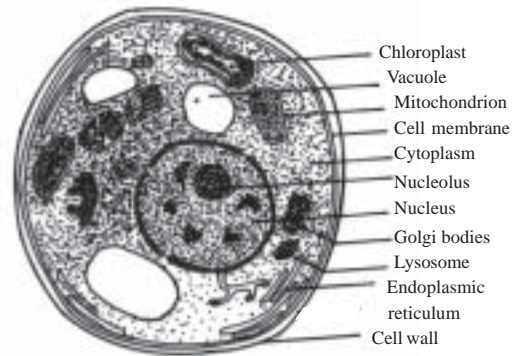


Fig. 24.1 A generalized animal cell

- b) **Cytoplasm:** Cytoplasm is the living part of the cell enclosed by the plasma membrane excluding the nucleus.
- It contains several structures that behave like ‘mini-organs in the cell’, each performing a particular task. Such structures are called **organelles** meaning ‘little organs’.

An organelle is any structure in a cell in which certain functions and processes are localized.
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- c) **Nucleus:** The nucleus is a small ovoid or spherical mass located somewhat in the centre of the cytoplasm.
- This is the **largest organelle**.
  - It is bounded by a **nuclear membrane**.
  - The nuclear membrane surrounds a semi-solid substance, the **nucleoplasm**.
  - The nucleoplasm contains a network of darker fibres (chromosomes) called **chromatin network**.
  - Nucleus contains one or more rounded **nucleoli** (*sing. nucleolus*).

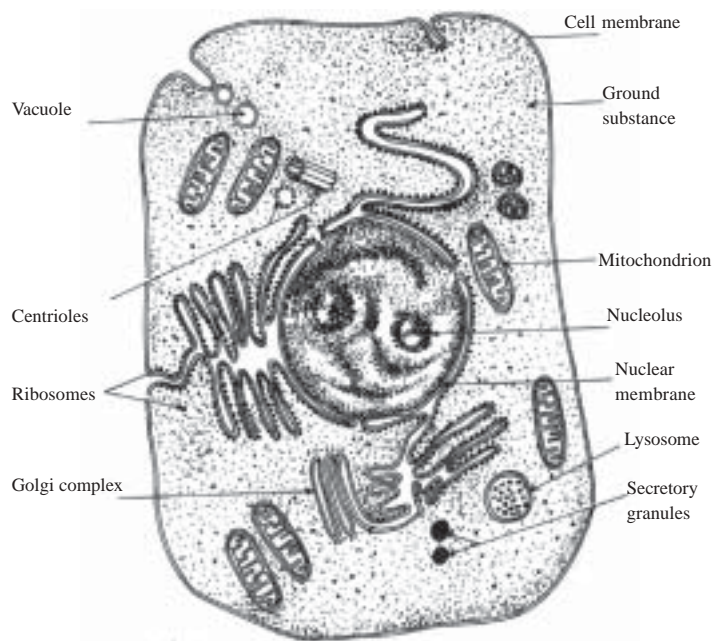
#### Functions of the nucleus

- i) The nucleus coordinates the activities of the entire cell.
- ii) It plays an important part in cell division.
- iii) It contains genes, which determine the inheritance of characteristics from the parents to the offspring.

#### 24.2.1 Organelles in the cytoplasm

The main organelles found in the cytoplasm are: **endoplasmic reticulum, ribosomes, mitochondria, golgi bodies, lysosomes, centrosome** (in animal cells only) and **plastids** (in plant cells only) (Fig. 24.2).

- a) **Endoplasmic reticulum (ER):** An irregular network of double membrane distributed in the entire cytoplasm.
- It provides a supportive framework to the cell.
  - It helps in the transport of various products from one part of the cell to the other or from within the cell to the outside.



*Fig. 24.2 A generalized animal cell showing finer details (organelles) as observed under an electron microscope.*

**b) Ribosomes:** These are granules either scattered freely in the cytoplasm or attached to the endoplasmic reticulum.

- Ribosomes are the sites for the synthesis of proteins.

**c) Mitochondria:** These are minute bodies scattered in the cytoplasm.

- They carry out cellular respiration.
- They breakdown glucose by using oxygen and release energy in the form of a compound, **adenosine triphosphate (ATP)**, for the activities of the cell.

**d) Golgi bodies** (also called **Golgi apparatus** or **Golgi complex**): Very small vesicles of various shapes generally located near the nucleus (similar structures in a plant cell are called **dictyosomes**).

- These produce secretions of the cell such as enzymes, hormones, etc.

**e) Lysosomes:** These are small vesicles of different shapes.

- They contain digestive enzymes, which destroy and digest the worn out cell organelles or any foreign substances like bacteria that may enter the cell.
- They help to digest stored food during the starvation of the cell.
- Too many damaged cells are rapidly destroyed by the cell's own lysosomes – a kind of self-destruction and hence these are also known as **suicide bags**.

**f) Centrosome** (in animal cells only): It is located near the nucleus and contains 1 or 2 **centrioles**.

- It initiates and regulates cell division.

**g) Plastids** (in plant cells only): These are of various shapes – oval, spherical or disc-like. The most common ones are chloroplasts that contain **chlorophyll**.

#### **24.2.2 Parts other than the organelles**

The vacuoles and granules are the non-living parts of a cell.

**a) Vacuoles:** These are clear spaces with water or other substances in solution.

- Plant cells often have several and more number of large-sized vacuoles while the animal cells have smaller and fewer ones.
  - Vacuoles help in storage of water and other substances.
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- b) **Granules:** These are small particles, crystals or droplets.
- Granules containing starch, fat, etc. serve as food for the cell.

**Table 24.1 : Basic differences between plant and animal cells**

<b>Plant cell</b> (special features not found in animal cells)	<b>Animal cell</b> (special features not found in plant cells)
<p><b>Cell Wall:</b> Rigid protective layer present outside the plasma membrane.</p> <ul style="list-style-type: none"> <li>• Chiefly made of cellulose</li> <li>• Supports and protects the cell</li> <li>• Freely permeable allowing substances to pass through in and out without any hindrance</li> </ul> <p><b>Chloroplasts:</b> Oval-shaped green structures containing chlorophyll</p> <ul style="list-style-type: none"> <li>• Trap sunlight for preparing food (starch)</li> </ul> <p><b>Vacuoles:</b> Very big and numerous and act as storage areas</p>	<p><b>Centrioles:</b> 1 or 2 centrioles enclosed in a centrosome located just near the nucleus, which participates in cell division</p>

### CHECK YOUR PROGRESS 24.2

- Mention whether the following statements are true (T) or false (F).
  - Cell division is necessary for the movement of the body. T/F
  - Cell membrane permits inflow and outflow of all molecules. T/F
  - Chloroplast and not chlorophyll is an organelle. T/F
  - Ribosomes are often called suicide bags. T/F
- Fill in the blanks.
  - The cell wall is mainly formed of \_\_\_\_\_
  - The \_\_\_\_\_ is selectively permeable.
  - Centrioles are found only in \_\_\_\_\_ cells.
  - Inside nucleoplasm is the \_\_\_\_\_ network of \_\_\_\_\_

### 24.3 CELL DIVISION – THE NEED TO PRODUCE NEW CELLS

New cells need to be produced for many reasons.

- Growth:** To increase the number of cells for the growth in size of the organs as well as that of the body as a whole.
- Replacement:** To replace the cells that are normally dying. For example, 20 million red blood cells in our body are destroyed every minute. These are replaced by new cells formed by the division of their parent cells in the bone marrow. Similarly, dead skin cells on the body surface are being replaced regularly by new cells.

- c) **Repair:** There may be cuts or injuries in the body. New cells produced by cell division of the bordering cells fill up the gap to repair these cuts or wounds.
- d) **Reproduction:** To produce sex cells in which the number of chromosomes is reduced to half of that of the normal body cells. When the sex cells (egg and sperm) fuse, the normal number of the chromosomes is restored.

### 24.3.1 Types of cell division

There are two types of cell division.

- **Mitosis:** Cell division leading to growth and repair
  - **Meiosis:** Cell division leading to the production of sex cells
- a) **Mitosis:** Mitosis is the kind of cell division that occurs in all body cells, while meiosis takes place in sex cells only. Its major events are largely similar in both animal and plant cells but for the sake of simplicity, we will describe mitosis in an animal cell.

The sequence of events in mitosis is as follows:

- The chromosomal material (chromatin network) inside the nucleus condenses to form the chromosomes (the number specific for the species, e.g. 46 in humans)
- The centrosome (in animal cell) divides into two equal parts called centrioles, each of which migrates to the opposite poles of the cell.
- A spindle of ray-like fibres is formed between the centriole.
- The chromosomes duplicate themselves to form chromatids. Each chromosome consists of two chromatids held by a centromere.
- The nuclear membrane disappears.
- The chromatids (daughter chromosomes) of each chromosome separate from each other, move to the opposite poles of the spindle, chromosomes then turn into a network of chromatin threads at the two poles.
- The nuclear membrane reappears around each of the two new clusters of the chromatin material.
- A furrow appears in the cell membrane at the two sides in the middle of the cell, which deepens to divide the parent cell completely into two new daughter cells.

#### Two main differences in mitosis in a plant cell and an animal cell

- In plant cells, there is no centrosome and no centrioles inside it. However, the spindle is formed.
  - Upon the completion of mitosis, the cytoplasm in plant cell does not constrict (furrow is not formed). Instead, a **cell plate** or a new cell wall is laid down in the cytoplasm at the middle of the cell. It divides the original cell into two daughter cells.
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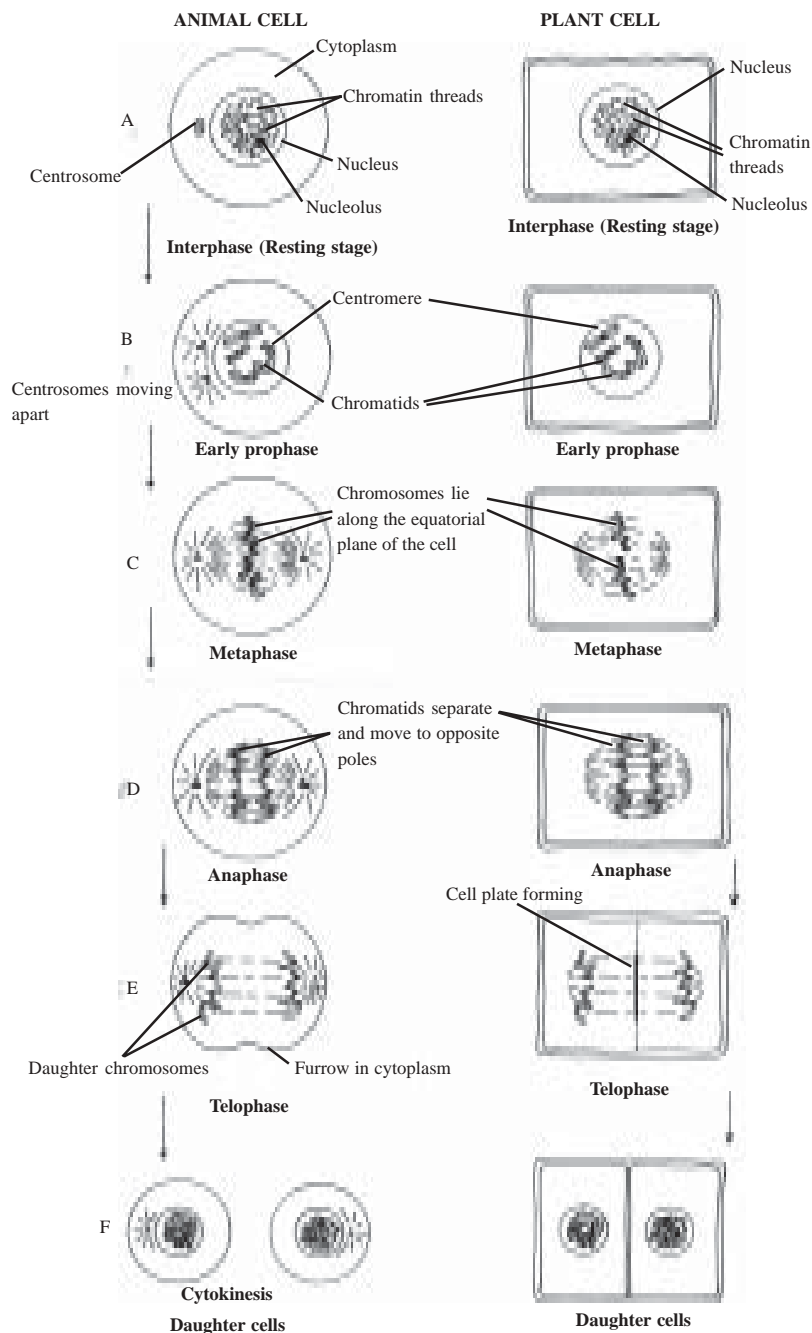


Fig. 24.3 Comparison of mitotic division in a plant cell and an animal cell

- b) Meiosis:** This type of cell division occurs in cells involved in sexual reproduction. Meiosis takes place in reproductive organs, such as the testis and the ovary, in animals that produce eggs and sperms, and in the anthers and the ovary, in flowering plants to produce pollen grains and the ovule, respectively.

During meiosis the number of the chromosomes is halved in the resulting sex cells so that when the male cell and the female cell combine during fertilization, the normal number of chromosomes in the species is restored.

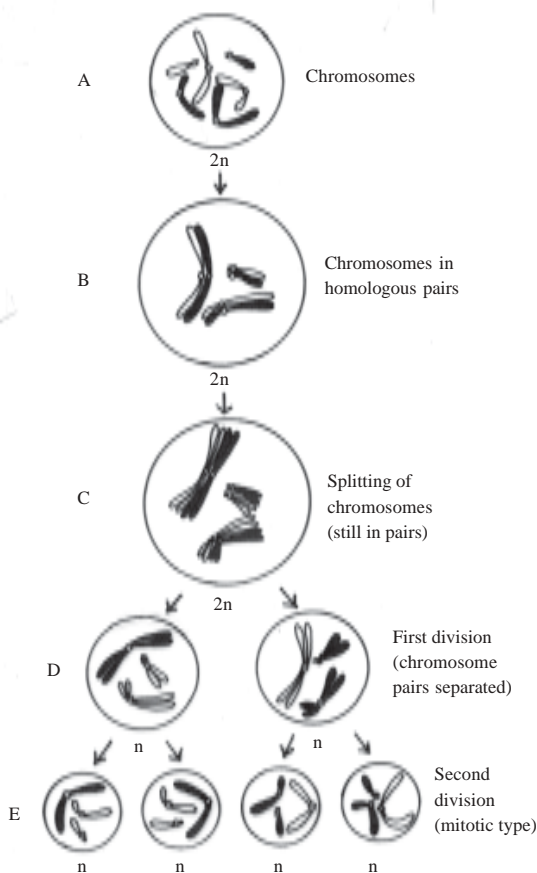


Fig. 24.4 Meiosis: The cell division that leads to formation of the sex cells

### Stages in meiosis

Broadly, meiosis is completed in two phases or stages (Fig. 24.4).

**Stage I:** A reduction division that involves production of two cells with half the number of chromosomes in each.

**Stage II:** The immediately following second division is mitotic and produces four cells at the end.

### Characteristic features of the first meiotic division

- Chromatin fibres condense into **chromosomes**.
  - The chromosomes arrange in **matching (or homologous) pairs**. A matching pair means one chromosome having been received from the mother and the corresponding one received from the father.
  - Each chromosome in such a pair is made of two chromatids. Thus, each pair of chromosomes is now a group of four **chromatids**.
  - The nuclear membrane disappears, the homologous chromosomes separate and move apart. Thus, the pairs are broken.
- The cytoplasm divides into two cells, each of which now has half the number of original chromosomes. At the same time, each chromosome is already split into two chromatids still held together by a centromere.
  - The two chromatids of each chromosome in the two cells separate and move apart to become surrounded by nuclear membranes and thus, four cells are formed.

### Meiosis in a human cell

- The 46 chromosomes organise in homologous pairs (23 pairs).
- Each pair breaks, but each separated chromosome is already split into two chromatids that are still held together.
- The cell divides into two daughter cells (this is the first meiotic division which actually is a reduction division) and now each of the two resulting cells has only 23 single chromosomes.
- Each of the two resulting cells undergoes the second (mitotic) type of division in which the two chromatids of each of the 23 chromosomes separate apart (just as in mitosis) and the two cells divide to form four cells (these are the sex cells).



**CHECK YOUR PROGRESS 24.3**

1. List the four basic needs of organisms for which cell division is necessary.
2. Name the type of cell division that occurs during the following events:
  - i) repair of skin and injury
  - ii) formation of eggs and sperms in animals
  - iii) increase in the length of the stem in plants

**24.4 SPECIALIZATION OF CELLS – FORMATION OF TISSUES**

Most organisms are made of more than one cell, actually in millions and millions. These cells are variously specialized in their shape, size and function. Such specialized cells are called **tissues**.

**Groups of similar cells with similar functions are called tissues.**

All animals and plants have a large variety of tissues. Here, we shall describe the more common types of these tissues.

**24.4.1 Animal tissues**

Animal tissues are grouped under four main categories: **epithelial, connective, muscular and nervous tissues**.

**a) Epithelial tissue**

- Thin protective layer (or layers) of cells
- Generally located on the outer surface of the body, on the surface of the internal organs and the lining of the body cavities

There are three distinct types of epithelial tissues (Table 24.2, Fig. 24.5).

**Table 24.2 Different types of epithelial tissues**

Type	Nature of cells	Example/location	Function
<b>Squamous epithelium</b>	Thin plates of somewhat hexagonal or irregular cells	Cells of the outermost layer of skin	Protection of underlying parts in the body from injury, harmful substances and from drying up
<b>Cuboidal epithelium</b>	Thick and cuboidal cells	Some parts in kidney tubules and in glandular ducts	Secretion
<b>Columnar epithelium</b>	Tall-elongated cells arranged in a straight or folded row. At some places these cells have cilia at their free ends ( <b>ciliated columnar epithelium</b> )	Inner lining of the stomach and the intestine Inner lining of trachea (wind pipe)	Secretion, absorption  Lashing movement of cilia pushes the material forward

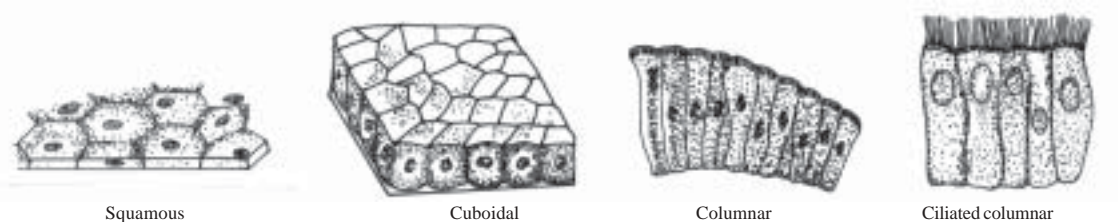


Fig. 24.5 Different types of epithelial tissue

b) **Connective tissue**

- Connect various tissues and organs or support them to keep them in position.

The various types of connective tissues are given below (Table 24.3, Fig. 24.6).

**Table 24.3 Subcategories of connective tissue**

Subcategory	Nature of tissue	Example/Location	Function
<b>Fibrous tissue</b>	Cells usually separated from one another by intercellular spaces. This space is filled with solid or liquid material	Tendon Ligament Adipose (fat) tissue	Connect muscle to bone Connect two bones Packing and binding of most organs, store fat
<b>Cartilage</b>	Non-porous tissue, thickened intercellular substance Semi-transparent and elastic	In nose, ears, walls of windpipe and at ends of long bones	Provide support and strength
<b>Bone</b>	Hard and porous, consists of both living cells and rigid mass of non-living salts	Ribs, thigh bone, backbone, etc.	Provide support and strength, help in movement
<b>Fluid connective tissue</b>	Contains both cellular and liquid parts	Blood and lymph	Transport of gases and chemical substances, protection from disease-causing germs

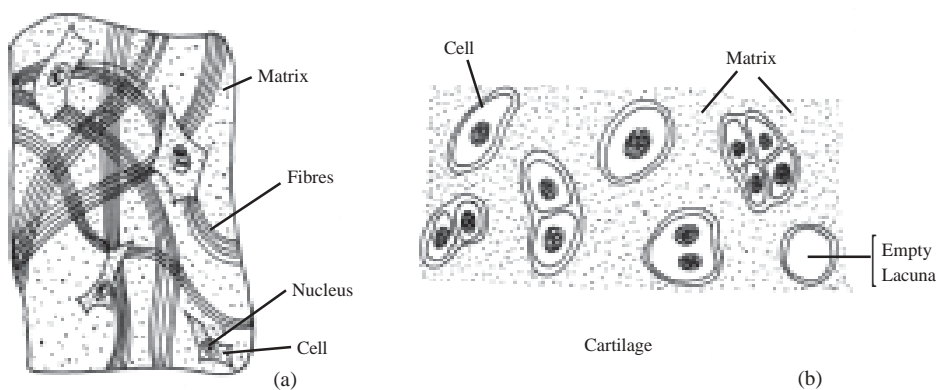


Fig. 24.6 Types of connective tissue (a) fibrous tissue (b) cartilage

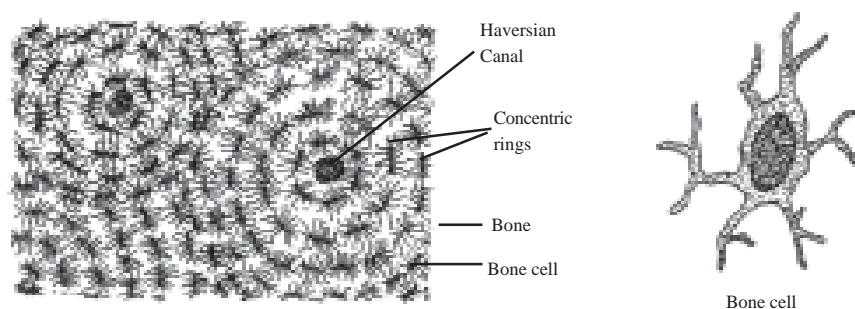


Fig. 24.6 Types of connective tissue (c) Bone

### c) Muscular tissue

- Brings about all kinds of movements in the body.

The various subcategories of muscular tissue are listed in Table 24.4 (Fig. 24.7).

**Table 24.4 Subcategories of muscular tissue**

Subcategory	Nature of muscle	Example/Location	Function
<b>Striped or striated</b> (Voluntary)	Occur in groups of fibres, cells are multinucleated, show bundles of light and dark bands	Muscles of arms, legs, face, neck, etc.	Cause movements that are under the control of will
<b>Unstriated or unstriated</b> (Involuntary)	Slender tapering cells	Wall of blood vessels, urinary bladder, uterus, etc. Iris muscles regulate the size of pupil of the eye	Movement of the parts or contents of the part not under the control of will
<b>Cardiac</b> (heart muscles) (Involuntary)	Specialized striped muscles, short and branched	Only heart muscles	Contract without will and without any outward stimulation, do not get tired

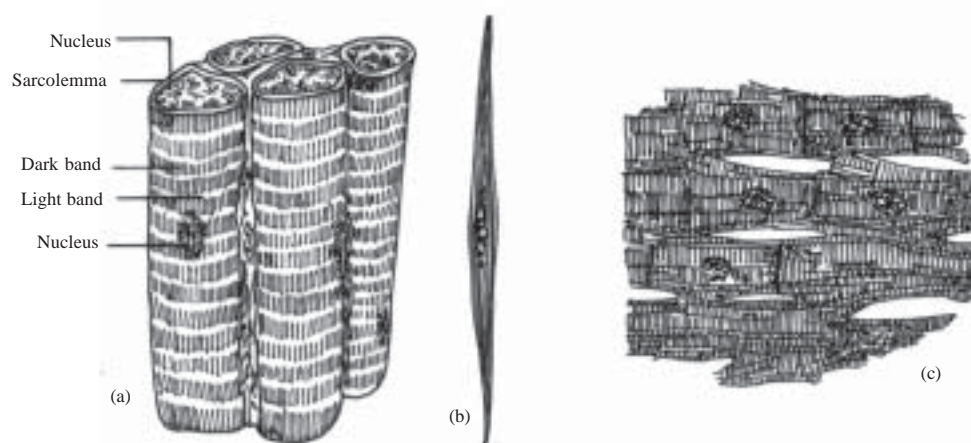


Fig. 24.7 Different types of muscular tissue (a) Striped muscle, (b) Unstriated muscle, (c) Cardiac muscle

d) **Nervous tissue**

Nervous tissue constitutes the nervous system (brain, spinal cord, sense receptors etc.) The nerve cells are called **neurons**. These are highly specialized. Each nerve cell consists of a cell body called **cyton** (or **perikaryon**) containing a nucleus in the centre and one or more elongated hair-like extensions called **dendrons** (or **dendrites**). One of these extensions, the **axon**, may be very long. It is usually covered by a **medullary sheath**, which is not continuous, the gaps in it are called the **Nodes of Ranvier**.

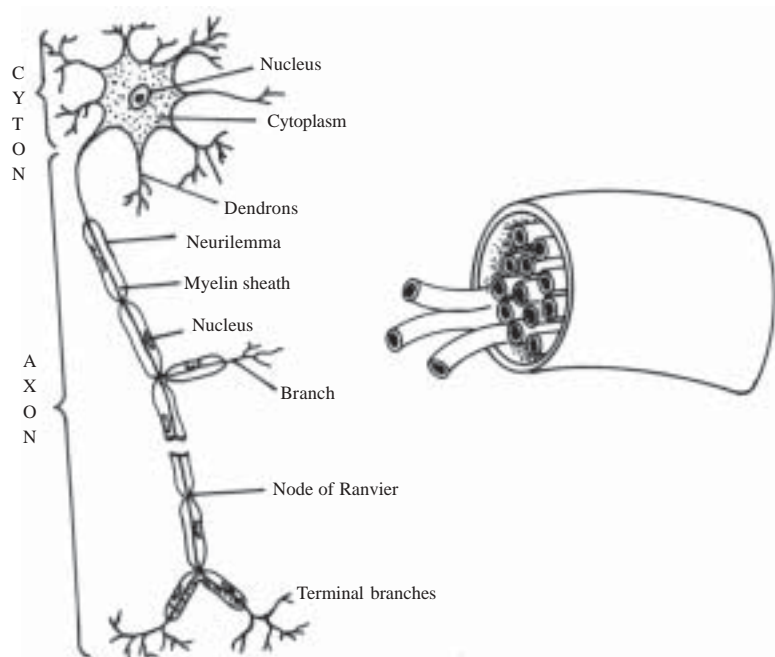


Fig. 24.8 The nervous tissue—A nerve cell (neuron) and a nerve

A bundle of axon fibres forms a nerve. The dendrites carry the impulse (message) towards the cell while the axon carries the message away from the cell. The function of nervous tissue is perception of the stimuli from the environment and responding to them.

#### 24.4.2 Plant tissues

Plant tissues are basically of two types – **meristematic** and **permanent**.

a) **Meristematic tissue:** It is found at the growing points of a plant such as at the tips of the roots, stems and branches. The chief characteristics of meristematic tissue are as follows:

- The cells are small and have large nuclei.
- The cells divide actively and add new cells to the plant.
- The new cells produced are transformed into mature permanent tissues.

b) **Permanent tissue:** It is made up of cells, which have lost their ability to multiply. According to their function, the permanent tissues are of three types.

- i. **Protective tissue:** This tissue is found on the surface of plant organs like the leaves, stem, roots, etc. The cells have thick walls. For example,

epidermis (outermost layer of cells) of leaves, which secretes a waxy waterproof covering.

ii. **Supporting tissue:** It provides support to various parts of the plant. It is of several types, such as

- cells that **fill up** the interior of potatoes, which store food,
- cells that provide **temporary support** to the plant, such as in the pith (central region) of roots and stem, and those that fill up the interior of the leaf (the chlorophyll-containing cells),
- cells that are more **elongated and thick at the corners**; found in the leaf stalks and in the stems below the outer epidermis and provide support,
- have long, narrow and thick cells, which have become dead, have **very thick walls**, and provide strength to the plant.

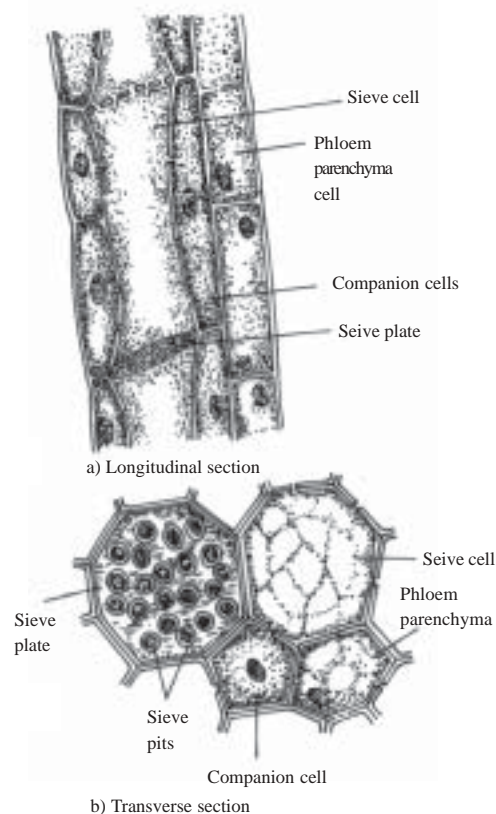


Fig. 24.9 Conducting tissue in plants—phloem

iii. **Conducting tissue:** It is also called the **vascular tissue**. It provides passage for the fluids to move up and down in the plant. It is of two types—**xylem** and **phloem** (Fig. 24.9). Xylem is located more towards the centre of the stem. It allows water and minerals absorbed from the soil to travel upwards in the plant. **Phloem** is located outward of the xylem and serves to conduct the food (sugar) synthesized in the leaves to flow downward and upward so as to reach all other regions.

#### CHECK YOUR PROGRESS 24.4

1. Choose the most appropriate answer.

- A tissue is a group of cells with
  - same structure but different functions.
  - different structures but similar function.
  - same structure and same function.
  - different structures and different functions.
- Which one of the following is a matching pair of an example and its kind of tissue?
  - Blood – Epithelial tissue
  - Muscle – Connective tissue
  - Cartilage – Nervous tissue
  - Bone – Connective tissue

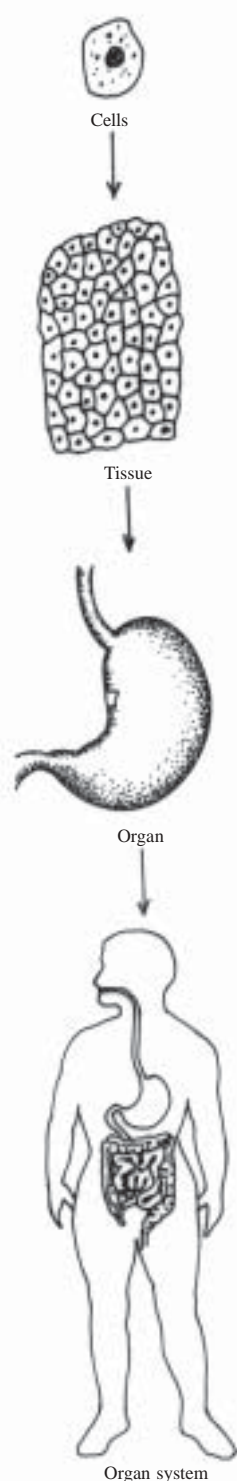


Fig. 24.10 Levels of organisation in the living world

- iii. The plant tissue which transports prepared food material from the leaves to other parts of the plant is called
  - i) parenchyma.
  - ii) collenchyma.
  - iii) xylem.
  - iv) phloem.
2. Name the kind of tissue found at the following places:
  - i) Surface of the human skin
  - ii) Inside the salivary glands
  - iii) In the brain
  - iv) Inner lining of the wind pipe

### 24.5 LEVELS OF ORGANIZATION – INCREASING COMPLEXITY FROM CELL TO ORGANISM

There are various levels of organisation which increase in their complexity from the cell stage to the organismic level (Fig. 24.10).

*Cell is the lowest level of organization in all living beings.* Every action of the organism is ultimately the outcome of the activity of the cell. Every cell has its own life. It feeds, respire, excretes, responds and even reproduces, and after getting old and aged it dies.

*Tissue is a group of similar cells that perform a particular function.* Human body, for example, has a muscular tissue made of muscle cells, which brings about movement by contraction.

*Organ is formed of many tissues, which work in a cooperative and a coordinated manner to perform a specific function in the body.* For example, the heart is an organ consisting of the muscle, nerve, and blood. But as a whole it is concerned with one or more very specific tasks. Similarly, the plant leaf is an organ formed of several tissues but its one main task is to manufacture food.

*Organ system is formed of many organs that act together to perform a specific life process, such as digestion.* All the organs concerned with one specific process collectively constitute an organ system. The digestive system, respiratory system or the reproductive system are some of the organ systems in animal body. In plants, there are only two organ systems – the root system and the shoot system.

*Organism is the whole living being by which different life processes are performed.*

### CHECK YOUR PROGRESS 24.5

1. Circle the organs out of the following:  
tongue, blood, bone, lungs, leaf, xylem, flower, finger



2. Name any three organ systems found in the human body.
3. Which are the two organ systems found in a maize plant.
4. Rearrange the following in their correct sequence from the lowest to the highest level of organisation:  
organ, cell, organ system, organism, tissue

### LET US REVISE

- Cell is the smallest unit of structure and function in an organism.
- Every organism starts as a single cell.
- A cell primarily consists of cell membrane, cytoplasm and nucleus.
- Plant cells have an extra rigid cell wall made up of cellulose.
- Cytoplasm contains several organelles, each of which has a specific function.
- Ribosomes are the site of protein synthesis, mitochondria produce chemical energy (ATP), golgi apparatus produces secretions, lysosomes destroy foreign substances around them.
- Plant cells have plastids as very special organelles. The chloroplasts among them are concerned with production of food (starch).
- Nucleus contains the genetic material in the chromosomes. Also, it controls the activities of the cell.
- Similar cells with similar functions packed together form a tissue.
- Different tissues arranged together to perform some specific activities make up an organ.
- Related organs together constitute an organ system.
- Animal tissues constitute epithelial, connective, muscular and nervous tissues.
- Epithelial tissue consists of squamous epithelium, cuboidal epithelium, columnar epithelium, ciliated epithelium and glandular epithelium.
- Connective tissue consists of cartilage, bone, fat, blood, etc.
- Muscular tissue consists of striped, unstriped and cardiac muscles.
- Nervous tissue consists of neurons whose long axons are bundled together to form a nerve.
- Plant tissues are of two types – meristematic (actively dividing cells) and permanent.
- Permanent tissues include protective tissue (epidermis) and supporting tissues (parenchyma, collenchyma, sclerenchyma) and conducting tissues (xylem, phloem).

### TERMINAL EXERCISES

#### A. Multiple choice type questions.

1. The structural and functional unit of the living body is
    - a) Lungs
    - b) Cell
    - c) Stomach
    - d) Tissue
-

2. Transport of substances within the cell is performed by
  - a) Nucleus
  - b) Chromosomes
  - c) Endoplasmic reticulum
  - d) Lysosomes
3. Division of a cell into two daughter cells by the formation of a cell plate occurs in the body of
  - a) Human beings
  - b) Apple tree
  - c) Cat
  - d) Elephant
4. The connective tissue that connects muscles to bones is
  - a) Tendon
  - b) Ligament
  - c) Blood
  - d) Cartilage
5. Meristematic tissue in a plant is found in one of the following parts
  - a) Tip of the leaf
  - b) Tip of the root
  - c) Base of the stem
  - d) Base of the flower

**B. Descriptive type questions.**

1. List any common three features found both in plant and animal cells.
  2. Mention three features found only in plant cells and one found only in animal cells.
  3. Differentiate between the following:
    - i) Centrosome and chromosome
    - ii) Nucleolus and nucleus
    - iii) Organ and tissue
    - iv) Conducting and protective tissue in plants
    - v) Chromosome and chromatid
    - vi) Cell and tissue
    - vii) Organ and organelles
    - viii) Organ and organism
    - ix) Organ and organ system
  4. State the major functions of the following:
    - i) Plasma membrane
    - ii) Lysosome
    - iii) Golgi apparatus
    - iv) Ribosomes
    - v) Mitochondria
-

5. "First meiotic division is the reduction division." What does the word reduction refer to in this statement?
6. Why is it necessary that the sex cells (gametes) must be produced by meiosis?
7. The diagram alongside represents a stage in the mitotic type of the cell division.

- i) Is it a plant cell or an animal cell?
- ii) Which stage does it represent?
- iii) How many chromosomes have been shown in it?
- iv) Name the stage that precedes it and the one that follows it.



8. Given below are the jumbled spellings of some of the cell structures and tissues. A special point about each of them is also given on the side. Write the correct name of each of the item in the jumbled spellings.
 

a) SPASDITL ( _____ )	Organelles found only in plant cells
b) HCRM000EMS ( _____ )	Carriers of heredity
c) LEMYX ( _____ )	A conducting tissue
d) ILIAC ( _____ )	Structures present on a kind of epithelial cells
e) SOLESOMY ( _____ )	An organelle that destroys foreign substances
f) SUNCLUE ( _____ )	The cell organelle that regulates cell activities

### ANSWERS TO CHECK YOUR PROGRESS

#### 24.1

1.
  - i) T
  - ii) T
  - iii) F
  - iv) F
  - v) F

#### 24.2

1.
    - i) F
    - ii) F
    - iii) T
    - iv) F
  2.
    - i) Cellulose
    - ii) Plasma membrane or cell membrane
    - iii) Animal
    - iv) Chromatin, chromosomes
-

### 24.3

1.
  - i) growth
  - ii) repair
  - iii) replacement
  - iv) reproduction
2.
  - i) mitosis
  - ii) meiosis
  - iii) mitosis

### 24.4

1.
  - i) c)
  - ii) d)
  - iii) d)
2.
  - i) Epithelial (squamous)
  - ii) Epithelial (columnar)
  - iii) Nervous
  - iv) Epithelial (ciliated)

### 24.5

1. Tongue, lungs, leaf, flower, finger
2. Nervous system, digestive system, respiratory system, etc.
3. Shoot system, root system
4. Cell, tissue, organ, organ system, organism

## GLOSSARY

**Axon:** The process of a neuron that conducts impulses away from the cell.

**Cell:** The structural and functional unit of the living body.

**Cell wall:** A layer that surrounds the plant cells.

**Chlorophyll:** The green-coloured matter contained in the chloroplast of plant cells.

**Chloroplast:** The plant cell organelle that contains chlorophyll.

**Egg:** The female sex cell also called the ovum or the female gamete.

**Heredity:** Transmission of characteristics from parent to the offspring.

**Nucleolus:** A well-defined part inside the nucleus.

**Pith:** The soft spongy tissue in the centre of most stems.

**Tissue:** A group of structurally similar cells that perform the same function.

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