

# Transportation In Plants And Animals 12

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To stay alive, all living organisms need to transport materials from one part of the body to another. Food and oxygen are transported to all the cells in the body for respiration and growth. Waste products are transported from the cells to the organs that excrete them.

There are various methods by which materials are transported in plants and animals.

## TRANSPORTATION OF MATERIALS IN PLANTS

All parts of a plant need water, minerals and food. A transport system moves these materials throughout the plant. Flowering plants have a well developed transport system called a vascular system. The vascular system is composed of xylem and phloem.

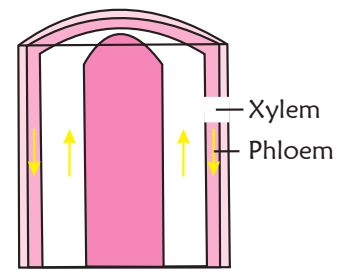
Xylem vessels comprises of long tube like structure which are hollow from within. Xylem transports water and minerals upwards from the roots. Phloem transports glucose made in the leaves to other parts of the plants.

Vascular tissues extend from the tip of the roots to the tip of the leaves. The cells of xylem are joined end to end forming long tubes. Similarly phloem cells also form long tubes for transportation of food.

The transportation of water and dissolved mineral salts, from the root to the stem and leaves take place through the xylem. The root cells absorb water and mineral salts continuously from the soil. This produces a force that pushes the water upwards. The evaporation of water from the leaf surface also produces a pulling force which cause the water to move upwards.



The food prepared by the leaves is transported to all parts of the plant in the form of a solution through a process known as 'translocation'. Translocation takes place mainly through the cells of phloem. However, in some plants, substances, made in the roots are also transported to the leaves through the phloem tissues.



## Absorption of Water

Water enters the plant through the thin root hair. Root hair are unicellular. They are outgrowths from the layer of outer cells of the root. This outer layer is known as the 'epidermis'. The epidermis is a thin layer that allows water to pass through, but not other substances. Such a thin layer of cells is known as 'semi-permeable membrane'.

Water enters the cells by a process called osmosis. Osmosis is the passage of water across a semi-permeable membrane from an area where there are more to an area where there are less. The root hair are in close contact with the water surrounding the soil particle. This water has dissolved mineral in it. Normally water molecules are more crowded outside the root hair than inside. So they move by osmosis through the root hair.

They then move through the root tissues to the xylem in the root and then move through the xylem up the stem to the leaves.

Thus, the process by which solvent molecules (water) move from a region of high concentration to a region of low concentration through a semi-permeable membrane is known as osmosis.

## Transpiration

Large quantities of water are absorbed by the plant for photosynthesis. However, excess water escapes in the form of water vapour from the stomata of leaves, lenticels of the stem and fruits or centicle of leaves. The process of losing water in the form of water vapour from a living plant is known as transpiration. There is a relationship between absorption and transpiration. As water is given out by transpiration, more water is absorbed. If water is lost through transpiration more quickly than it is absorbed by the root hair, the plant cell will loss water. The leaves, stem and flowers will droop. This is called wilting.

### FACTORS AFFECTING TRANSPIRATION

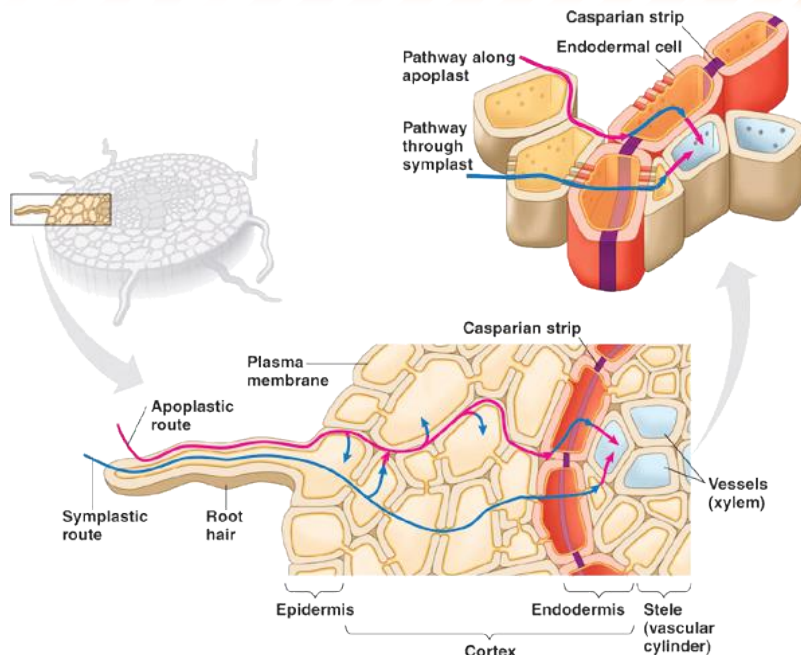
- The rate of transpiration is faster during the day under the bright sunlight since the stomata are open. Stomata remain closed during dark and no transpiration takes place at night.
- More transpiration takes place on a hot day as compared to a cold day.
- Transpiration rate is higher if the wind is blowing as the water vapour is removed faster from the leaves.

- If the air is humid, the rate of transpiration is slow. In rainy season, transpiration is less since the humidity level is higher.

Transpiration is different from evaporation and is influenced by protoplasmic activities.

## Transportation of Minerals

Most of the minerals needed by plants are dissolved in water in the soil. Molecules of minerals are often more crowded inside the root hair than are in the soil. Root hair can still absorb minerals from the soil. The movement of molecules from an area where they are less crowded to an area where they are more crowded minerals are then transported through the xylem to all parts of the plant. The water and minerals absorbed by roots are conducted upwards to the leaves, flowers and other parts of plant. The upward movement of sap that contains water and minerals is called ascent of sap.



Active transportation of minerals into root hair

## Translocation of Food

Sugar molecules formed in the leaves during photosynthesis are transported throughout the plant by phloem. Phloem has cells called sieve tubes which are placed one above the other to form long tubes through which food is transported. The contents of phloem can move in upward as well as downward direction whereas water in xylem move only in upward direction.

## TRANSPORTATION OF MINERALS IN ANIMALS

The transport of nutrient in unicellular organisms such as amoeba, paramecium, bacteria, etc., is very simple. The nutrients reach every part of the cell by diffusion. In simple aquatic multicellular organisms, such as hydra and jellyfish, oxygen and nutrients are transported by water that circulates through their bodies.

## Transportation in Humans

The process of diffusion is too slow to work in higher animals. In such animals, including humans, a well developed pick up and delivery system, known as the 'circulatory system' is present. In the circulatory system the blood delivers food and oxygen to every cell in the body. It also carries wastes away from every cell in the body. The circulatory system consists of the heart, the blood vessels and the blood.

## The Heart

The heart is a muscular organ that beats 60 to 80 times in minute through out your life. Its function is to pump blood to all parts of the body. You can feel your own heartbeats by placing your hand on your chest towards the left. A doctor uses stethoscope to listen to your heartbeat. This helps to diagnose diseases.

Each side of the heart is divided into two parts or chambers. The top chambers with comparatively thinner walls are called auricles. The two lower chambers with thick muscular walls are called ventricles. The right side of the heart, i.e., the right auricle and ventricle, receives blood with carbon dioxide from all parts of the body and sends it to the lungs. Its left side, i.e., the left auricle and ventricle, receives oxygen rich blood from the lungs and sends it to all parts of the body.

- The left auricle receives blood as it comes back to the heart from the lungs.
- The right auricle receives blood from the rest to the body.
- The right ventricle pumps the blood to the lungs.
- The left ventricle pumps the blood to the rest of the body.
- The heart has a number of valves that allow the blood to flow in one direction only.

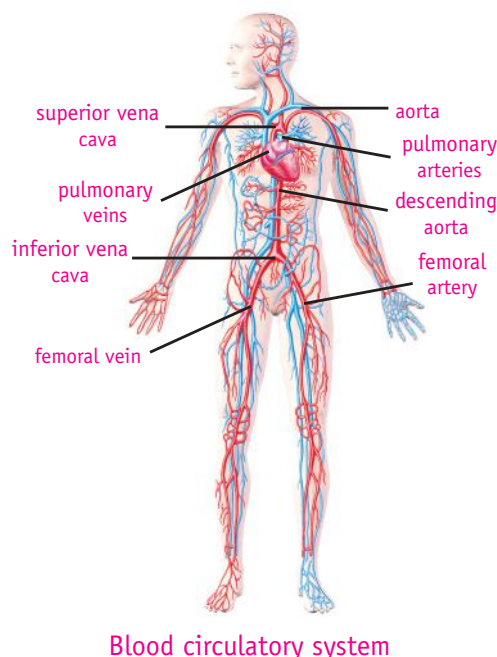
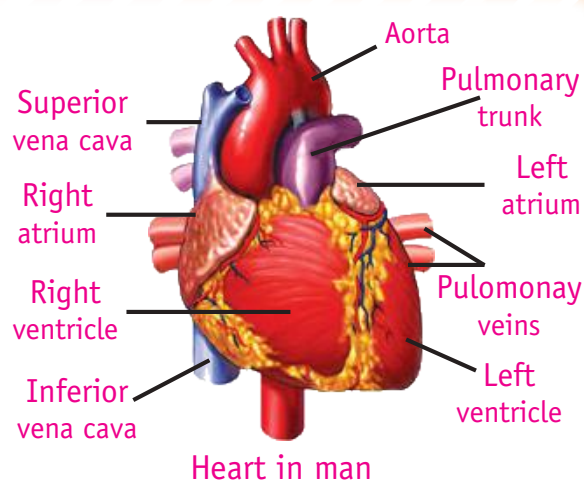
**Add to your knowledge :** During one complete cycle, the blood passes twice through the heart. Hence it is referred to as double circulation.

## The Blood Vessels

With each heartbeat, blood is pumped into blood vessels called arteries. Arteries carry blood a way from the heart. To feel the blood rushing through the arteries place two fingers in the hollow spot on the wrist. The throbbing sensation or pulse that you can feel is actually blood rushing through the arteries.

Arteries branch into smaller and smaller arteries and finally into capillaries. Capillaries are the thinnest blood vessels, about as thick as one of your hair. They have very thin walls. It is through these thin capillary walls that.

- Oxygen is picked up from the alveoli in the lungs.
- Digested food is picked up in the small intestine.



- The oxygen and digested food are passed on to each cells of the body.
- Carbon dioxide and other wastes are picked up from every cell.
- Carbon dioxide is passed into the alveoli and wastes are passed into the kidneys.

After passing through the capillaries and picking up carbon dioxide, the blood flows into blood vessels called veins. Veins carry the blood back to the heart. The blood enters the right side of the heart and is pumped to the lungs where it gives up carbon dioxide and picks up oxygen. This oxygen rich blood travels back to the left side of the heart. It is again sent to all other parts of the body and the process is repeated again and again. This forms the circulatory system.

## The Blood

Blood is a liquid tissue. The human body have 5 litres of blood. It consists of a fluid known as 'plasma three types of blood cells floa'.

### Plasma

Plasma is the liquid part of the blood. It is yellowish in colour and contains about 90% water. It has food, wastes, enzymes, etc. dissolved in it. It also contains proteins that help the blood to clot.

### Blood Cells

There are three types of blood cells.

**Red Blood Cells (RBCs)** : RBCs are disc shaped cells. They contain a red coloured protein containing called haemoglobin. It is the pigment that absorbs oxygen and transports it to the cells all over the body. It carries oxygen to different parts of the body. Oxygen combines with haemoglobin to form a compound called oxyhaemoglobin.



This is a reversible reaction. When blood reaches cells and tissues which need oxygen, oxyhaemoglobin again changes to oxygen and haemoglobin. This oxygen is used by the cells for respiration. Haemoglobin then becomes free to carry more oxygen.

**White Blood Cells (WBCs)** : WBCs are slightly larger than red blood cells. They are fewer in number than red blood cells. Their function is to fight against diseases by destroying harmful bacteria and other foreign material. They are able to move on their own. This helps them to pass through the walls of blood vessels and to reach infected part of the body.

**Platelets** : Platelets are smaller than red blood cells. They help the blood to clot whenever there is a wound on the body. This blocks the flow of blood and prevents blood lose.

### Do You Know ?

Many invertebrates (animals without a backbone) such as coral, jelly fish and flat worms, do not have blood because they are able to absorb nutrients through their skin directly and move gases and wastes from and to the environment.

## Blood Transfusion

A badly injured person may lose a lot of blood. A blood loss of 40 per cent or more can cause death. The doctor must give the patient blood donated by another person (called a donor) to make up for the blood loss.

This procedure is called blood transfusion. Donated blood is stored in blood banks after careful testing. There are four kinds of blood groups known as A, B, AB and O. Different persons have different blood groups. Doctors have to be careful and match the blood of the patient with that of the donor before carrying out blood transfusion. This is because if bloods of unmatched groups get mixed, the red blood cells stick together and it can lead to death.

## HEARTBEAT AND PULSE

All the heart muscles do not contract at the same time. The two auricles contract first, forcing the blood into ventricles. The two ventricles contract a fraction of a second later. For this reason, each heartbeat can be heard as two sounds. The weak contraction of auricles makes one sound. The sound is followed by a stronger sound caused by the contraction of ventricles. The doctors listen to this two-part heartbeat (lub-dub) using a device called stethoscope.



When the left ventricle contracts, blood moves into the arteries under high pressure. The walls of the arteries are stretched by this pressure. When the ventricles relax, the pressure goes down. The stretching and relaxing of the arteries with each heartbeat is felt as throbbing called pulse. It is easy to feel the pulse at the side of the neck or wrist.

## The Excretory System

During life activities such as cellular respiration, several chemical reactions take place in the body. These are known as 'metabolism'. These chemical reactions produce waste products such as carbon dioxide, water, salts, urea, and uric acid. A build-up of these wastes is harmful to the body. The excretory organs remove these wastes. This process of removal of metabolic wastes from the body is known as 'excretion'.

## Excretion in Animals

In lower animals such as amoeba, paramecium, hydra, and spongia, there are no special excretory organs. Waste products such as ammonia are excreted by the process of diffusion through the body surface. Larger animals have special organs for excretion such as tubular structures called nephridia in earthworms and leeches, Malpighian tubules in insects, and kidneys in vertebrates.



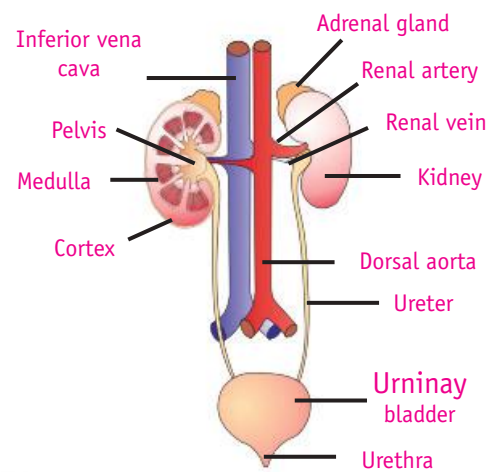
Substances to be excreted out are mainly :

- (i) Urea and Uric acid
- (ii) Water
- (iii) Extra salts which are not needed by our body
- (iv) Extra Vitamins and Minerals
- (v) Unwanted Medicines and Antibiotic

## Excretory Organs in Humans

Excretion in humans is carried out mainly by the urinary system.

The urinary system is responsible for removing most of the wastes from the body in the form of urine. Urine consists of 95% water, 2.5% urea and 2.5% other waste products. The main organs of this system are the kidneys. They are located on each side of the backbone, just above the waist. Their main function is to filter wastes from the blood. You use a filter paper to separate solid impurities from a solution. The kidneys work in the same way. The kidneys consists of a large number of coiled tubes called nephrons. Each kidney contains about one million nephrons.

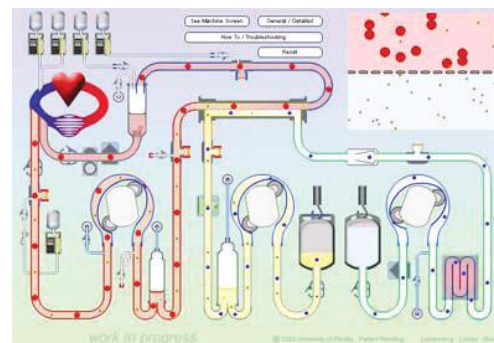


Nephrons are the tiny filtering units of the kidney. They filter out excess water, salts urea from the blood as it passes through. The clean blood leaves the kidneys and continues its circulation in the body. The wastes collected in the kidneys form a liquid called urine. It passes from the kidneys through two tubes called urethra into an elastic sac called urinary bladder. The bladder stores the urine until it is excreted from the body through the urethra. A human being passes out about 1.5 to 2.5 litres of urine every day. The kidneys must function properly to keep the body healthy.

An examination of urine tells a lot about whether various organs in the body are functioning normally. The doctor therefore used the urine test to help diagnose diseases in the body. If there is excess sugar, enzymes, blood or other materials in the urine it indicates that some organs may not be functioning properly, for example: the presence of sugar in urine indicates that the person may be suffering from diabetes.

## Artificial Kidney

A normal human being has two kidneys which work with same efficiency. If one kidney is damaged, then the other kidney is sufficient of excretory needs. But failure of both kidneys would lead to death. The reason being that due to the result of kidney failure the waste products start accumulating in the blood. Such a person cannot survive unless their blood is filtered periodically through an artificial kidney. This process



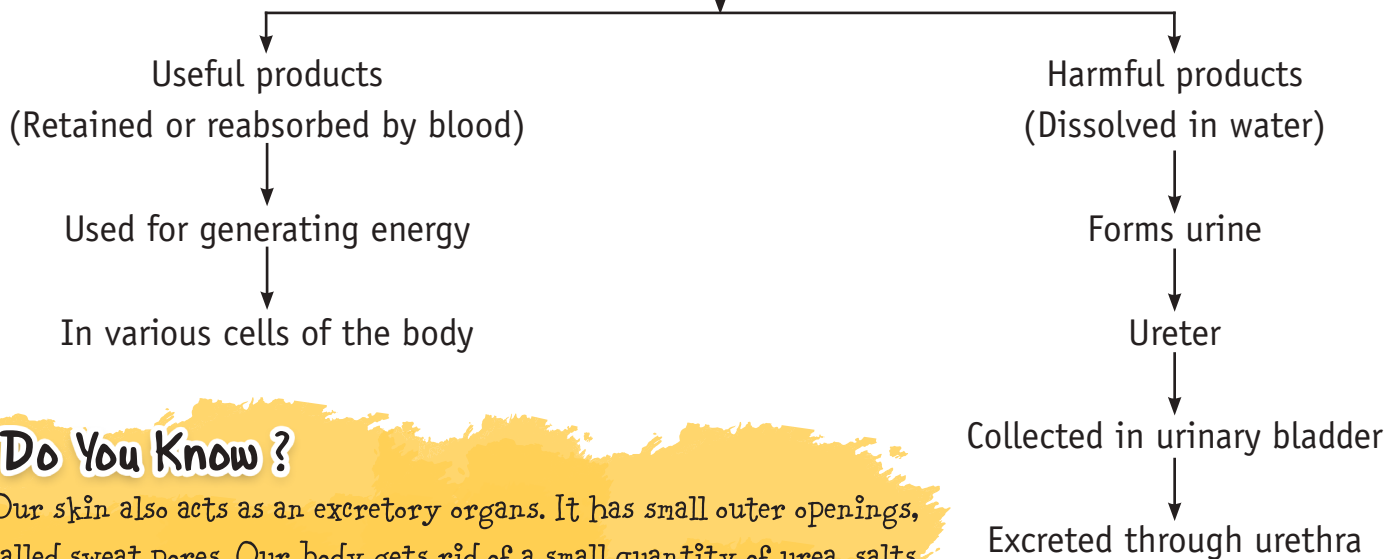
Dialysis machine

is called dialysis. In dialysis the patients blood is taken from the radial artery in his arm through the machine in which cello phone membrane act as filtrating media and removes urea and excess salts and then purified blood is returned to a vein in the same arm.

## Blood

Contains useful and harmful substances

## Kidney



### Do You Know ?

Our skin also acts as an excretory organs. It has small outer openings, called sweat pores. Our body gets rid of a small quantity of urea, salts and water through sweat. Sweat contains about 99% water, 0.2% to 0.5% salts and a very small amount of urea. Sweating is important because it helps in regulating body temperature. It helps to keep the body cool by losing body heat as sweat evaporates off the skin.

## Sweating

Besides kidneys our skin also help into eliminating wastes. It excretes excuse of water, aurea, salts and other metabolic wastes in the form of sweat. These waste products are carried by the blood from all parts of the body to sweat glands in the skin.

## Excretion in Plants

Plants also produce excretory materials in their cells through these are produced much more slowly than in animals. They have no excretory organs to help expel them out. The different methods of excretion are as follows.

The waste gases carbon-dioxide, oxygen and water vapour produced during respiration and photosynthesis are expelled through the stomata of leaves and lenticles of stems. Other waste products are converted into insoluble compounds which remain in the cells.

When dead leaves, bark or any other parts fall of a tree, the waste products they contain also get rid of Several of the plant wastes are useful to us, for example, gums, resins, sandal wood oil,



eucalyptus oil, tannins, that found in the bark of many trees are used in the tanning of leather, rubber and alkaloids very poisonous compounds, some of which like quinine, morphine, etc., are used as medicines.



### Know the Keywords :

Blood : The red colour fluid that flows in vessels.

Blood vessel : The tubes that enclose and transport blood from one organ to other organ.

Artery : Blood vessel that carries oxygenated blood to different parts of the body.

Vein : Blood vessel that carries deoxygenated blood.

Haemoglobin : The iron pigment present in red blood cells.

Auricle : The upper two chambers of the heart with thinner wall.

Ventricle : The lower two chambers of the heart with thick muscular walls.

Excretion : The removal of metabolic wastes from the body.

Xylem : The vascular tissues which transports water.

Phloem : The vascular tissues which transports food.

Plasma : The liquid part of the blood.

Stethoscope : The instrument used to measure heartbeat.

Kidneys : Organs present in human body which perform the process of filtration of blood to form urine.

Dialysis : The process of artificial filtration of blood in case of kidney failure.



### Point to Remember

- Waste products are transported from the cells to the organs that excrete them.
- The process of losing water in the form of water vapour from a living plant is known as transpiration.
- The heart is a muscular organ that beats 60 to 80 times in minute through out your life.
- The kidneys consists of a large number of coiled tubes called nephrons.

## EXERCISE TIME

### A. Answer the following questions :

1. What do you meant by sweating ?
2. Give the functions of phloem and xylem.
3. Name the waste products of plant which need to be excrete out ?
4. What do you mean by circulation ?
5. What is the translocation of food ?
6. How does a doctor measure the heartbeat ?
7. Why the colour of blood is red ?
8. Can a person survive with one kidney ?
9. What is the function of root hairs present in plant ?
10. What is arteries ?

**B. Fill in the blanks :**

1. \_\_\_\_\_ is a pigment which carries oxygen.
2. \_\_\_\_\_ help in clotting of blood.
3. Sponge and hydra do not possess \_\_\_\_\_.
4. Bile pigments impart \_\_\_\_\_ colour to urine.
5. The transfer of food through the phloem in the plant is called \_\_\_\_\_.
6. \_\_\_\_\_ is process of artificial filtration of blood.

**C. Match the following :**

**Column 'A'**

1. Chlorophyll
2. Green colour of leaves
3. Transportation of water
4. Cells which fight against germs
5. Red colour of blood
6. Liquid part of blood

**Column 'B'**

- (i) phloem
- (ii) haemoglobin
- (iii) xylem
- (iv) chlorophyll
- (v) plasma
- (vi) white blood cells

**D. Tick (✓) the correct option :**

1. The blood cells which transport oxygen are :

- (i) RBCs  (ii) blood platelets  (iii) blood plasma

2. The blood cells which help in blood clotting are :

- (i) RBCs  (ii) WBCs  (iii) blood platelets

3. The number of chambers present in human heart are :

- (i) 2  (ii) 4  (iii) 6

4. The vascular tissue which translocates the food in the plant is :

- (i) xylem  (ii) phloem  (iii) cambium



Creative Work

- **By an activity show that water is conducted in plants through the xylem.**
- **Draw a neat and label diagram of excretory system.**