7 Transportation in Animals and Plants

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You have learnt earlier that all organisms need food, water and oxygen for survival. They need to transport all these to various parts of their body. Further, animals need to transport wastes to parts from where they can be removed. Have you wondered how all this is achieved? Look at Fig. 7.1. Do you see the heart and the blood vessels? They function to transport substances and together form the circulatory system. In this chapter, you shall learn about transport of substances in animals and plants.

7.1 Circulatory System

Blood

What happens when you get a cut on your body? Blood flows out. But what is blood? Blood is the fluid which flows in blood vessels. It transports substances like digested food from the small intestine to the other parts of the body. It carries oxygen from the lungs to the cells of the body. It also transports waste for removal from the body.

How does the blood carry various substances? Blood is composed of a fluid, called plasma in which different types of cells are suspended.

Why is the colour of blood red?

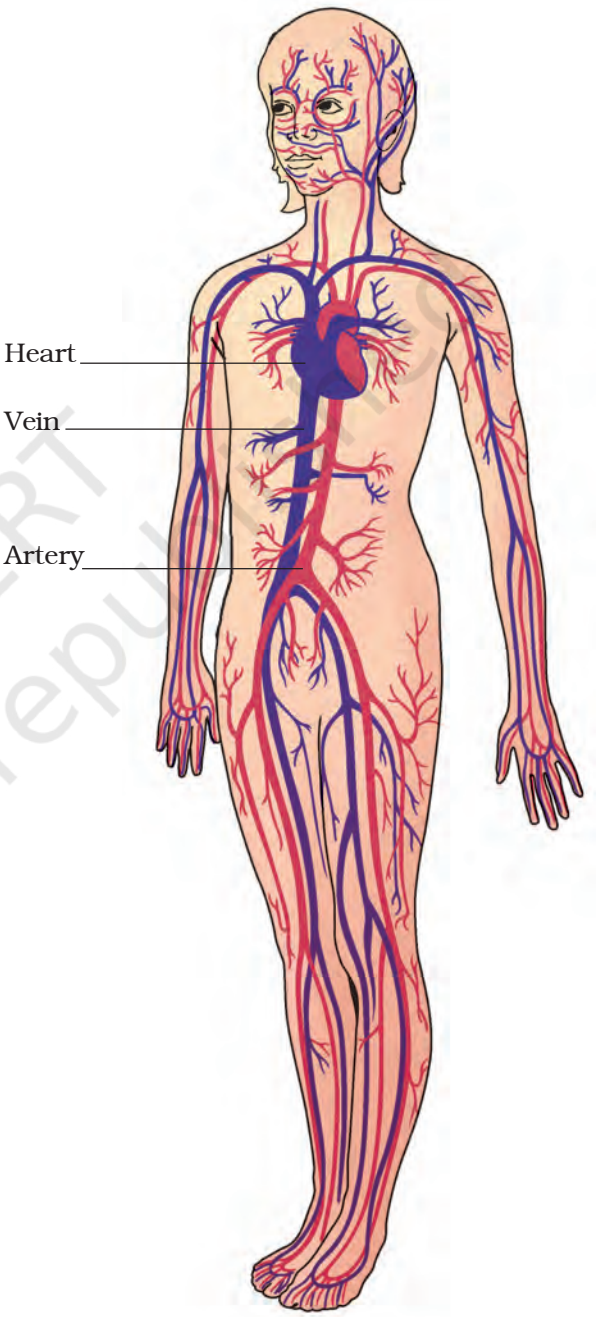


Fig. 7.1 Circulatory system
(Arteries are shown in red colour and veins in blue)

One type of cells are the **red blood cells** (RBC) which contain a red pigment called **haemoglobin**. Haemoglobin binds with oxygen and transports it to all the parts of the body and ultimately to all the cells. It will be difficult to provide oxygen efficiently to all the cells of the body without haemoglobin. The presence of haemoglobin makes blood appear red.

The blood also has **white blood cells** (WBC) which fight against germs that may enter our body.

Boojho fell down while playing a game and his knee got injured. Blood was coming out from the cut. After some time, he noticed that bleeding had stopped and a dark red clot had plugged the cut. Boojho was puzzled about this.

The clot is formed because of the presence of another type of cells in the blood, called **platelets**.

Blood vessels

There are different types of blood vessels in the body. You know that during inhalation a fresh supply of oxygen fills the lungs. Oxygen has to be transported to the rest of the body.

Also, the blood picks up the waste materials including carbon dioxide from the cells. This blood has to go back to the heart for transport to the lungs for removal of carbon dioxide as you have learnt in Chapter 6. So, two types of blood vessels, **arteries** and **veins** are present in the body. (Fig. 7.1)

Arteries carry oxygen-rich blood from the heart to all parts of the body. Since the blood flow is rapid and at a high pressure, the arteries have thick elastic walls.

Let us perform an activity to study the flow of blood through arteries.

Activity 7.1

Place the middle and index finger of your right hand on the inner side of your left wrist (Fig. 7.2). Can you feel some throbbing movements? Why do you think there is throbbing? This throbbing is called the **pulse** and it is due to the blood flowing in the arteries. Count the number of pulse beats in one minute.

How many pulse beats could you count? The number of beats per minute is called the **pulse rate**. A resting person, usually has a pulse rate between 72 and 80 beats per minute. Find other places in your body where you can feel the pulse.

Record your own pulse beats per minute and those of your classmates. Insert the values you obtained in Table 7.1 and compare them.

Fig. 7.2 Pulse in the wrist

Table 7.1 Pulse rate

S. No.	Name	Pulse per minute
1.		
2.		
3.		
4.		
5.		

Veins are the vessels which carry carbon dioxide-rich blood from all parts of the body back to the heart. The veins have thin walls. There are valves present in veins which allow blood to flow only towards the heart.

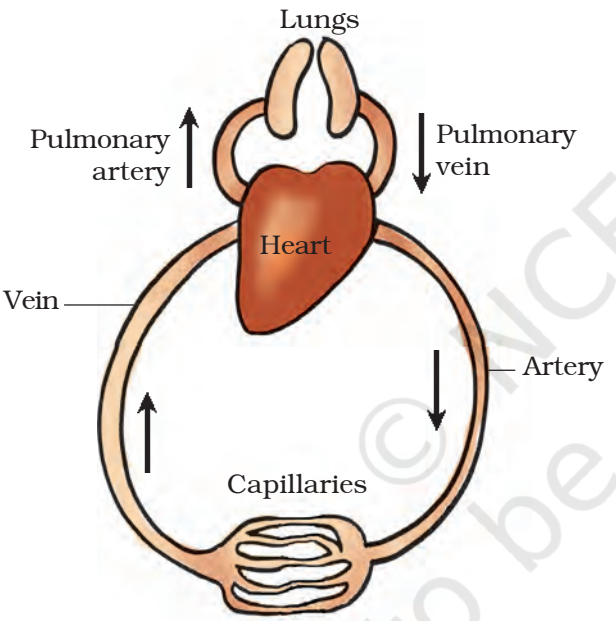
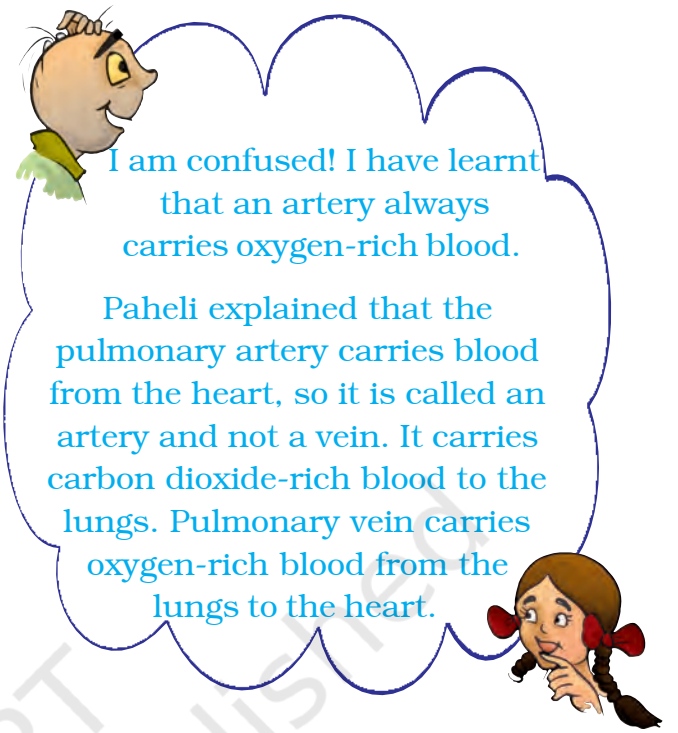


Fig. 7.3 Schematic diagram of circulation

Blood Donation

Hundreds of people die due to unavailability of blood. Voluntary blood donation is harmless and painless and can save precious lives. Blood can be donated at hospitals and other places authorised by the government. Donated blood are stored with special care in Blood Banks.



Refer to Fig. 7.3. Do you see the arteries divide into smaller vessels? On reaching the tissues, they divide further into extremely thin tubes called **capillaries**. The capillaries join to form veins which empty into the heart.

Heart

The heart is an organ which beats continuously to act as a pump for the transport of blood, which carries other substances with it.

Imagine a pump working for years without stopping! Absolutely impossible. Yet our heart works like a pump non-stop. Let us now learn about the heart.

The heart is located in the chest cavity with its lower tip slightly tilted towards the left (Fig. 7.1). Hold your fingers inwards on your palm. That

makes your fist. Your heart is roughly the size of your fist.

What will happen if the blood rich in oxygen and the blood rich in carbon dioxide mix with each other? To avoid this from happening, the heart has four chambers. The two upper chambers are called the **atria** (singular: atrium) and the two lower chambers are called the **ventricles** (Fig. 7.4). The partition between the chambers helps to avoid

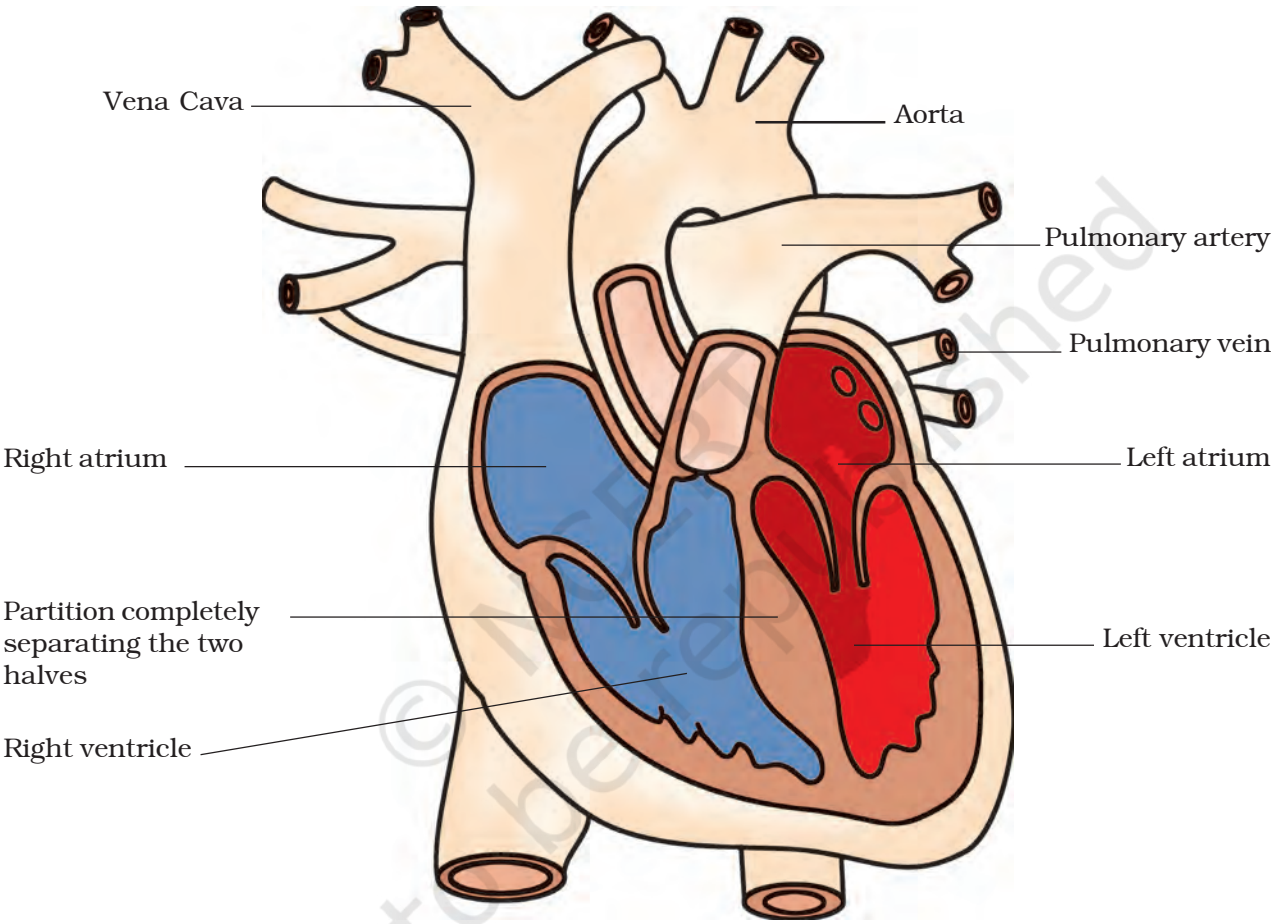


Fig. 7.4 Sections of human heart

Paheli wonders which side of the heart will have oxygen-rich blood and which side will have carbon dioxide-rich blood.

mixing up of blood rich in oxygen with the blood rich in carbon dioxide.

To understand the functioning of the circulatory system, start from the right side of the heart in Fig. 7.3 and follow the arrows. These arrows show the direction of the blood flow from the heart

to the lungs and back to the heart from where it is pumped to the rest of the body.

Heartbeat

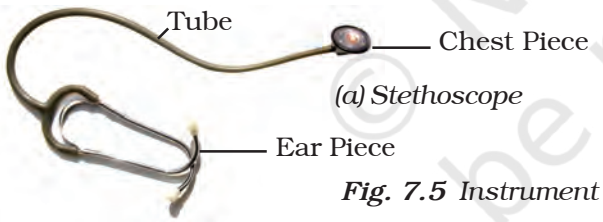
The walls of the chambers of the heart are made up of muscles. These muscles contract and relax rhythmically. This rhythmic contraction followed by its relaxation constitute a heartbeat. Remember that heartbeats continue every moment of our life. If you place your hand on the left side of your chest, you can feel your heartbeat. The doctor feels your heartbeats with the help of an instrument called a stethoscope.

A doctor uses the stethoscope as a device to amplify the sound of the heart. It consists of a chest piece that carries a sensitive diaphragm, two ear pieces and a tube joining the parts. Doctors can get clues about the condition of your heart by listening through a stethoscope.

Let us construct a model of a stethoscope with the materials that are available around us.

Activity 7.2

Take a small funnel of 6–7 cm in diameter. Fix a rubber tube (50 cm long) tightly on the stem of the funnel. Stretch a rubber sheet (or a balloon) on the mouth of the funnel and fix it tightly with a rubber band. Put the open end of the tube on one of your ears. Place



(a) Stethoscope


(b) Model of stethoscope

Fig. 7.5 *Instrument to hear heartbeat*

Table 7.2 Heartbeat and pulse rate

Name of student	While resting		After running (4–5 minutes)	
	Heartbeat	Pulse rate	Heartbeat	Pulse rate

the mouth of the funnel on your chest near the heart. Now try to listen carefully. Do you hear a regular thumping sound ? The sound is that of heart beats. How many times did your heart beat in a minute ? Count again after running for 4–5 minutes. Compare your observations.

Record your own pulse rate and heart beat and that of your friends while resting and after running and record in Table 7.2. Do you find any relationship between your heart beat and pulse rate? Each heart beat generates one pulse in the arteries and the pulse rate per minute indicates the rate of heart beat.

The rhythmic beating of the various chambers of the heart maintain circulation of blood and transport of substances to the different parts of the body.

Boojho wonders if sponges and *hydra* also have blood? Animals such as sponges and *Hydra* do not possess any circulatory system. The water in which they live brings food and oxygen as it enters their bodies. The water carries away waste materials and carbon dioxide as it moves out. Thus, these animals do not need a circulatory fluid like the blood.

Let us now learn about the removal of waste other than carbon dioxide.

The English physician, William Harvey (A.D.1578–1657), discovered the circulation of blood. The current opinion in those days was that blood oscillates in the vessels of the body. For his views, Harvey was ridiculed and was called "circulator". He lost most of his patients. However, before he died, Harvey's idea about circulation was generally accepted as a biological fact.

7.2 Excretion in Animals

Recall how carbon dioxide is removed as waste from the body through the lungs during exhalation. Also recall that the undigested food is removed during egestion. Let us now find out how the other waste materials are removed from the body. You may wonder where these unwanted materials come from!

When our cells perform their functions, certain waste products are released. These are toxic and hence need to be removed from the body. The process of removal of wastes produced in the cells of the living organisms is called **excretion**. The parts involved in excretion form the **excretory system**.

Excretory system in humans

The waste which is present in the blood has to be removed from the body. How can this be done? A mechanism to filter the blood is required. This is done by the blood capillaries in the **kidneys**. When the blood reaches the two kidneys, it contains both useful and harmful substances. The useful substances are absorbed back into the blood. The wastes dissolved in water are removed as **urine**. From the kidneys, the urine goes into the urinary **bladder** through

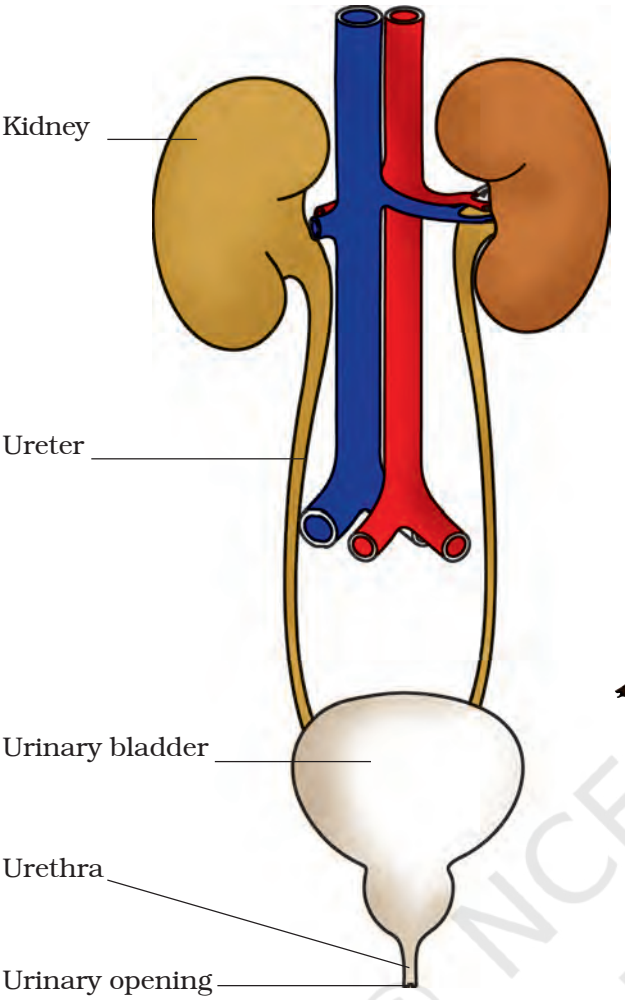


Fig. 7.6 Human excretory system

tube-like **ureters**. It is stored in the bladder and is passed out through the urinary opening at the end of a muscular tube called **urethra** (Fig. 7.6). The kindeys, ureters, bladder and urethra form the excretory system.

An adult human being normally passes about 1–1.8 L of urine in 24 hours. The urine consists of 95% water, 2.5% urea and 2.5% other waste products.

We have all experienced that we sweat on a hot summer day. The sweat contains water and salts. Boojho has seen that sometimes in summer, white patches are formed on our clothes, especially in areas like underarms. These marks are left by salts present in the sweat.

Does sweat serve any other function? We know that the water kept in an earthen pot (*matka*) is cooler. This is because the water evaporates from the pores of the pot, which causes cooling.

Paheli wants to know whether other animals also urinate?

The way in which waste chemicals are removed from the body of the animal depends on the availability of water. Aquatic animals like fishes, excrete cell waste as ammonia which directly dissolves in water. Some land animals like birds, lizards, snakes excrete a semi-solid, white coloured compound (uric acid). The major excretory product in humans is urea.

Sometimes a person's kidneys may stop working due to infection or injury. As a result of kidney failure, waste products start accumulating in the blood. Such persons cannot survive unless their blood is filtered periodically through an artificial kidney. This process is called **dialysis**.

Similarly, when we sweat, it helps to cool our body.

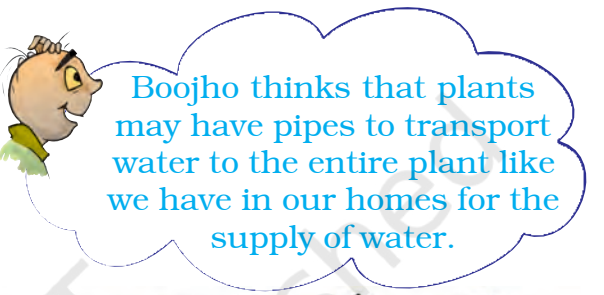
7.3 Transport of Substances in Plants

In Chapter 1 you learnt that plants take water and mineral nutrients from the soil through the roots and transport it to the leaves. The leaves prepare food for the plant, using water and carbon dioxide during photosynthesis. You also learnt in Chapter 6 that food is the source of energy and every cell of an organism gets energy by the breakdown of glucose. The cells use this energy to carry out vital activities of life. Therefore food must be made available to every cell of an organism. Have you ever wondered how water and nutrients absorbed by the root are transported to the leaves? How is the food prepared by the leaves carried to the parts which cannot make food?

Transport of water and minerals

Plants absorb water and minerals by the roots. The roots have root hair. The root hair increase the surface area of the root for the absorption of water and mineral nutrients dissolved in water. The root hair is in contact with the water present between the soil particles [Fig. 7.7 (a)].

Can you guess how water moves from the root to the leaves? What kind of transport system is present in plants?



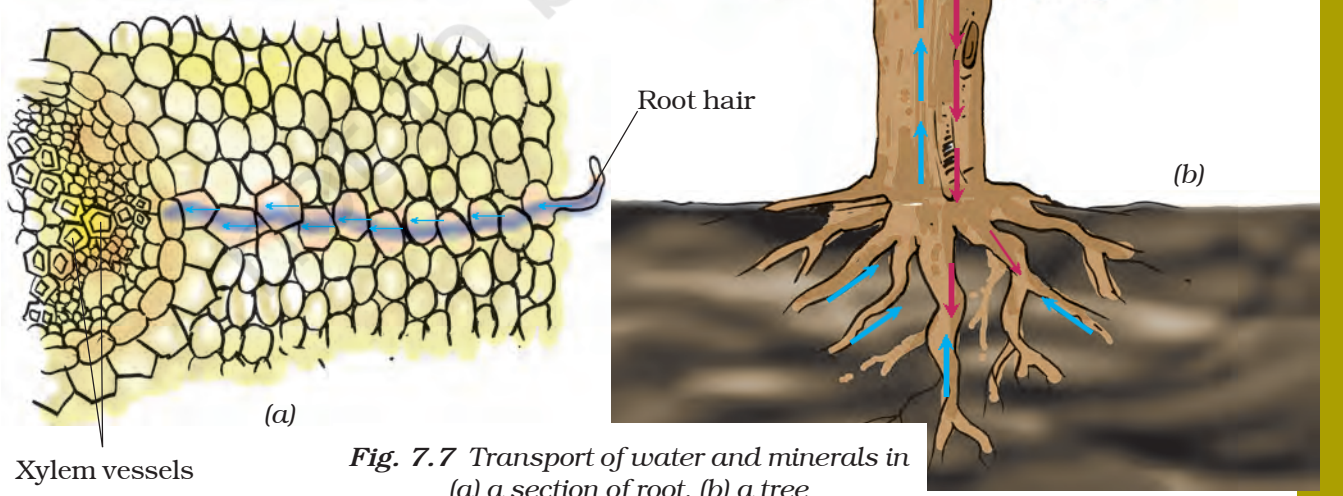
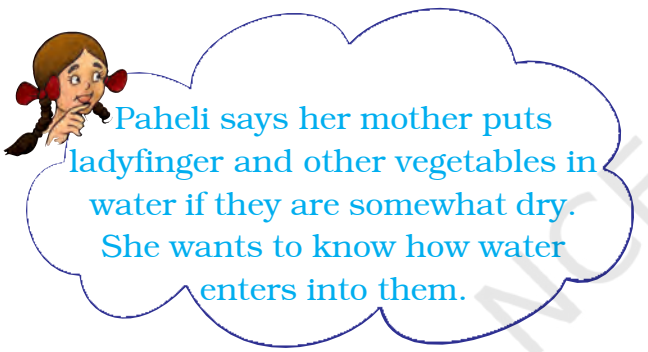


Fig. 7.7 Transport of water and minerals in (a) a section of root, (b) a tree

Well, Boojho is right. Plants have pipe-like vessels to transport water and nutrients from the soil. The vessels are made of special cells, forming the **vascular tissue**. A **tissue** is a group of cells that perform specialised function in an organism. The vascular tissue for the transport of water and nutrients in the plant is called the **xylem** [Fig. 7.7 (a)].

The xylem forms a continuous network of channels that connects roots to the leaves through the stem and branches and thus transports water to the entire plant [Fig. 7.7 (b)].



You know that leaves synthesise food. The food has to be transported to all parts of the plant. This is done by the vascular tissue called the **phloem**. Thus, xylem and phloem transport substances in plants.

Activity 7.3

We would require a glass tumbler, water, red ink, a tender herb (e.g., Balsam), and a blade for this activity.

Pour water to fill one-third of the tumbler. Add a few drops of red ink to the water. Cut the base of the stem of the herb and place it in the glass as shown in Fig. 7.8(a). Observe it the next day.

Fig. 7.8 (a) *Stem placed in coloured water*

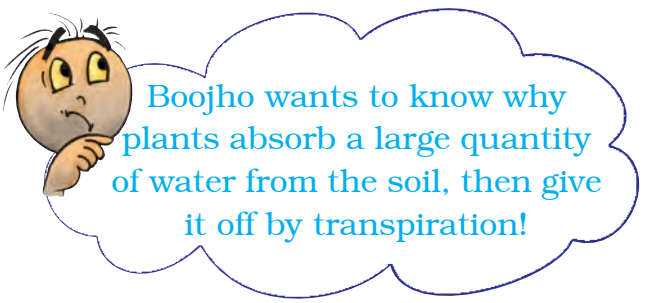
(b) (c)

Fig. 7.8 (b) *Water moves up in the stem*
(c) *Enlarged view of open end of stem*

Does any part of the herb appear red? If yes, how do you think the colour reached there?

You can cut the stem across and look for the red colour inside the stem (Fig. 7.8(b) and 7.8(c)).

From this activity we see that water moves up the stem. In other words, stem conducts water. Just like the red ink, minerals dissolved in water also move up the stem, along with water. Water and minerals go to leaves and other plant parts, through narrow tubes (xylem) inside the stem (Fig. 7.7(b)).



Transpiration

In Class VI you learnt that plants release a lot of water by the process of transpiration.

Plants absorb mineral nutrients and water from the soil. Not all the water absorbed is utilised by the plant. The water evaporates through the stomata present on the surface of the leaves by the process of transpiration. The evaporation of water from leaves generates a suction pull (the same that you produce when you suck water through a straw) which can pull water to great heights in the tall trees. Transpiration also cools the plant.

Keywords

Ammonia	Heart beat	Tissue
Artery	Kidneys	Urea
Blood	Phloem	Ureter
Blood vessels	Plasma	Urethra
Capillary	Platelets	Uric acid
Circulatory system	Pulse	Urinary bladder
Dialysis	Red blood cell	Vein
Excretion	Root hair	White blood cell
Excretory system	Stethoscope	Xylem
Haemoglobin	Sweat	

What you have learnt

- In most animals the blood that circulates in the body distributes food and oxygen to different cells of the body. It also carries waste products from different parts of the body for excretion.
- Circulatory system consists of the heart and blood vessels.
- In humans, blood flows through arteries and veins and the heart acts as a pumping organ.
- Blood consists of plasma, RBC, WBC and platelets. Blood is red due to the presence of a red pigment, haemoglobin.
- The human heart beats about 70–80 times per minute in an adult person. This is called heart rate.
- Arteries carry blood from the heart to all parts of the body.
- Veins carry blood from all parts of the body back to the heart.
- Removal of waste products from the body is called excretion.

- Excretory system of humans consists of two kidneys, two ureters, a urinary bladder, and urethra.
- Salts and urea are removed along with water as sweat.
- Fish excrete waste substances such as ammonia which directly dissolve in water.
- Birds, insects and lizard excrete uric acid in semi-solid form.
- Water and mineral nutrients are absorbed by roots from the soil.
- Nutrients are transported along with water to the entire plant via the vascular tissue called xylem.
- The vascular tissue for the transport of food to the various parts of the plant is phloem.
- A lot of water is lost by plants in the form of vapour through stomata during transpiration.
- Transpiration generates a force which pulls up water absorbed by the roots from the soil, to reach the stem and leaves.

Exercises

1. Match structures given in Column I with functions given in Column II.

	Column I		Column II
(i)	Stomata	(a)	Absorption of water
(ii)	Xylem	(b)	Transpiration
(iii)	Root hairs	(c)	Transport of food
(iv)	Phloem	(d)	Transport of water
		(e)	Synthesis of carbohydrates

2. Fill in the blanks.
   (i) The blood from the heart is transported to all parts of the body by the _____ .
   (ii) Haemoglobin is present in _____ cells.
   (iii) Arteries and veins are joined by a network of _____ .
   (iv) The rhythmic expansion and contraction of the heart is called _____ .
   (v) The main excretory product in human beings is _____ .
   (vi) Sweat contains water and _____ .
   (vii) Kidneys eliminate the waste materials in the liquid form called _____.
   (viii) Water reaches great heights in the trees because of suction pull caused by _____.

3. Choose the correct option:
   (a) In plants, water is transported through
      (i) xylem (ii) phloem
      (iii) stomata (iv) root hair
   (b) Water absorption through roots can be increased by keeping the plants
      (i) in the shade
      (ii) in dim light
      (iii) under the fan
      (iv) covered with a polythene bag
4. Why is transport of materials necessary in a plant or in an animal? Explain.
5. What will happen if there are no platelets in the blood?
6. What are stomata? Give two functions of stomata.
7. Does transpiration serve any useful function in the plants? Explain.
8. What are the components of blood?
9. Why is blood needed by all the parts of a body?
10. What makes the blood look red?
11. Describe the function of the heart.
12. Why is it necessary to excrete waste products?
13. Draw a diagram of the human excretory system and label the various parts.

Extended Learning — Activities and Projects

1. Find out about blood groups and their importance.
2. When a person suffers from chest pain, the doctor immediately takes an ECG. Visit a doctor and get information about ECG. You may even look up an encyclopaedia or the internet.

Did you know?

There is no substitute for blood. If people lose blood from surgery or injury or if their bodies cannot produce enough blood, there is only one way to get it — through transfusion of blood donated by volunteers. Blood is usually in short supply. Donating blood does not decrease the strength of the donors.