

Experiment-5: Demonstration of Osmosis Through Cell-to-Cell Movement

Principle:

The process by which a solvent (water) moves from a region of higher water concentration (lower solute concentration) to a region of lower water concentration (higher solute concentration) through a selectively permeable membrane is called **osmosis**.

Essentials:

A large potato, a blade/knife, a beaker, water, and sugar.

Procedure:

1. A beaker was taken and filled approximately halfway with water.
2. The potato was peeled, its ends were cut off, and a hole was made at one end.
3. The hole was half-filled with sugar solution, and the potato was placed in the water in such a way that the hole remained above the water surface.
4. The initial level of the sugar solution in the hole was marked by a pin, and the experimental setup was left undisturbed for some time.

Observation:

After some time, it was observed that the level of the sugar solution in the potato hole had increased, while the water level in the beaker had decreased.

Conclusion:

Water was present outside the potato, whereas sugar solution was present inside the hole. The **potato cell wall was permeable**, whereas the **cell membrane was selectively permeable**. Water moved from outside the potato through the potato cells and into the cavity containing the sugar solution by osmosis.

As water moved through a series of potato cells from one cell to another to reach the cavity, the process was demonstrated as **cell-to-cell osmosis**.

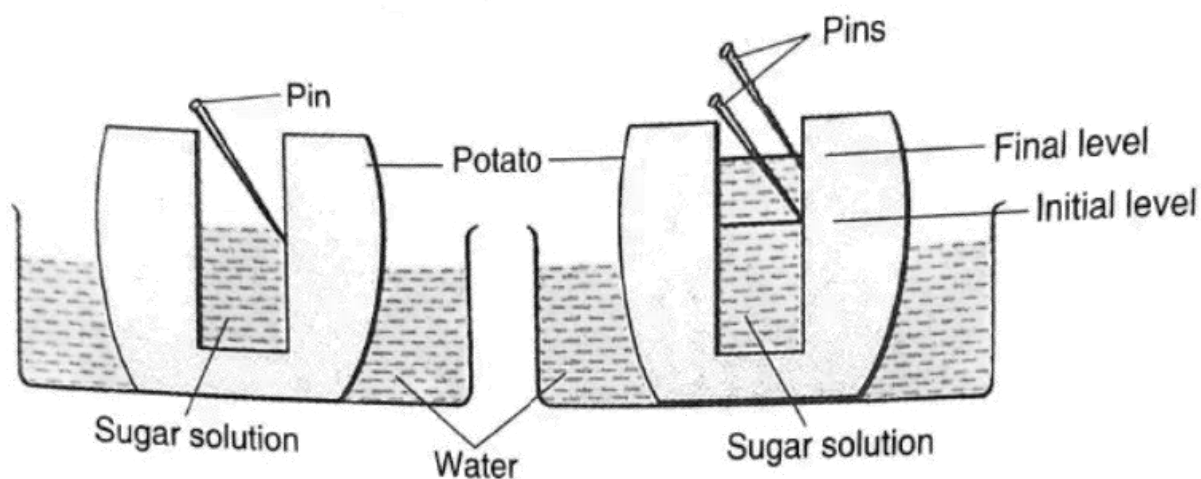


Fig. Demonstration of osmosis by potato osmometer.

Experiment–6: Experiment to demonstrate the ascent of Sap in a Plant

Principle:

The upward movement of water and dissolved mineral salts (sap) from the absorption region of the roots to the leaves and other aerial parts of a plant is called the **ascent of sap**.

Essentials:

A *Peperomia* plant, a glass bottle, water, safranin, and cotton.

Procedure:

1. A suitable amount of water was taken in a glass bottle, and a small amount of safranin solution was added to it to prepare colored water.
2. A healthy *Peperomia* plant was placed in the bottle in such a way that only its roots were immersed in the colored water.
3. The mouth of the bottle was fitted around the stem and sealed with cotton to hold the plant in position and prevent excessive evaporation.
4. The experimental setup was kept undisturbed for about one hour for observation.

Observation:

After about one hour, the red color of the safranin moved upward through the stem and reached the leaves. The stem and leaf veins became reddish in color.

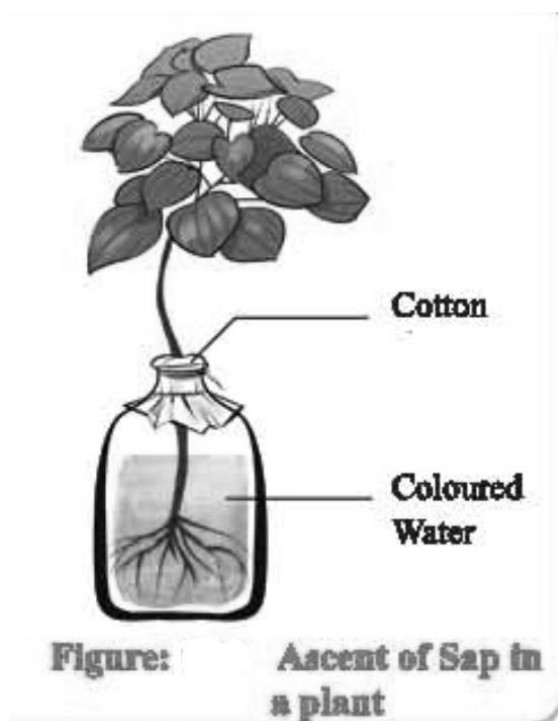
Conclusion:

The colored water was observed to move upward from the roots through the stem to the leaves.

This demonstrated the **upward movement of water through the conducting tissues (xylem)**, which is known as the **ascent of sap**.

Precautions:

1. A fresh and healthy *Peperomia* plant should be used for the experiment.
2. The roots of the living *Peperomia* plant should be completely immersed in the colored water.
3. The plant should be placed carefully so that the roots remain in contact with the colored water throughout the experiment.
4. The experimental setup should be kept undisturbed during the observation period.



Experiment–7: Demonstration of water loss from a plant as water vapor through transpiration

Principle:

Water is lost from the aerial parts of a plant in the form of water vapor through the process of **transpiration**.

Essentials:

A fresh potted plant, a cellophane bag, thread or clip, and water.

Procedure:

1. A fresh, healthy potted plant was placed on a table, and the required amount of water was added to the pot.
2. A leafy branch of the plant was covered with a transparent cellophane bag, and the mouth of the bag was tied tightly with thread or secured with a clip.
3. Care was taken to ensure that no outside air or moisture could enter the bag and that the water vapor produced by the leaves could not escape.
4. The experimental setup was kept undisturbed for about one hour.

Observation:

After one hour, small water droplets were observed on the inner surface of the cellophane bag. The inner surface of the bag became moist due to the accumulation and condensation of water vapor.

Conclusion:

As there was no scope for water to get into the cellophane bag, it was clear that the water drops were escaping from the leaves. So, we saw that a plant releases water in vapor form through its aerial parts.

Precautions:

1. A fresh and healthy plant should be selected for the experiment.
2. The cellophane bag should be transparent and clean.
3. The mouth of the cellophane bag should be tied tightly around the branch so that outside moisture cannot enter and the water vapor released from the leaves cannot escape.
4. The experimental setup should be kept undisturbed during the experiment.



Figure: Test of transpiration

Experiment–8: Comparison of Pulse Rate and Blood Pressure at rest and after exercise

Principle:

By measuring blood pressure and pulse rate, we can obtain information about the movement of blood through the blood vessels.

Materials/Essentials:

A stopwatch, sphygmomanometer, and stethoscope.

Procedure:

1. Three persons were selected for the measurement of blood pressure and pulse rate. They were Sohan (aged 13 years), Zannat (aged 11 years), and Shad (aged 28 years). *[You can use your chosen name and age here]*
2. The blood pressure and pulse rate of the three persons were measured at rest.
3. Each person was asked to sit comfortably on a chair at rest. The left arm was placed on a table, and the cuff of the sphygmomanometer was wrapped around the upper arm, neither too tightly nor too loosely.
4. The chest piece of the stethoscope was placed over the brachial artery below the cuff, and the earpieces were placed in the ears.
5. The screw of the air pump of the sphygmomanometer was tightened, and air was pumped into the cuff until the mercury level reached approximately **200 mmHg**.
6. The screw of the sphygmomanometer was then loosened gradually to allow the air to escape slowly. When the first Korotkoff sound was heard, the corresponding mercury level was recorded as the **systolic blood pressure**.
7. As the pressure continued to decrease, the sounds were heard rhythmically. When the sounds disappeared, the corresponding mercury level was recorded as the **diastolic blood pressure**.
8. The blood pressure readings were recorded in the table below.
9. The pulse rate was determined by placing the fingers over the radial artery at the wrist and counting the pulse for one minute. The reading was recorded in the table.
10. The same procedure was followed to measure the blood pressure and pulse rate of Zannat and Shad.
11. After **10–20 minutes of exercise**, the blood pressure and pulse rate of all three persons were measured again using the same procedures.

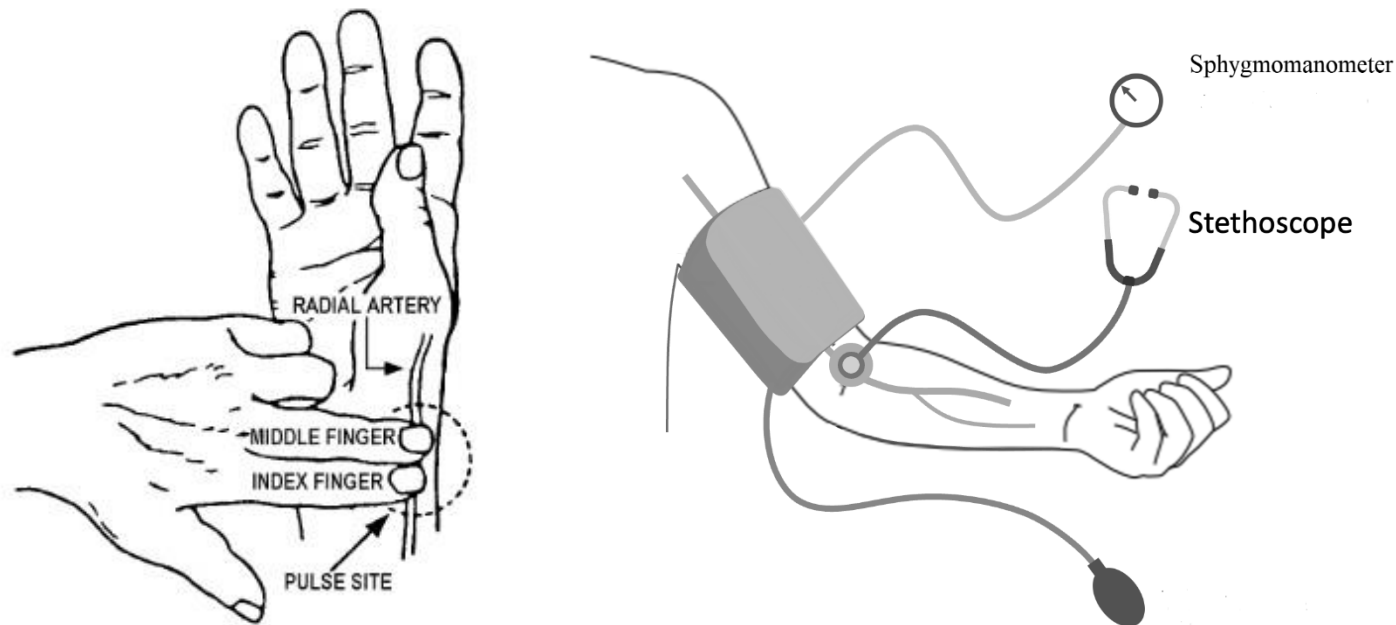


Fig: Experiment on the measurement of pulse rate and blood pressure

Observation:

The following readings were obtained:

Name	Blood Pressure at Rest (mmHg)	Pulse Rate at Rest (beats/min)	Blood Pressure After Exercise (mmHg)	Pulse Rate After Exercise (beats/min)
Sohan	130/90	72	135/95	76
Zannat	125/85	73	130/90	78
Shad	120/80	75	130/90	80

Comparison:

It was observed from the table that **both blood pressure and pulse rate increased after exercise in all three persons.**

Conclusion:

It was concluded that physical exercise caused an increase in **pulse rate and blood pressure**. The increase in pulse rate occurred because the heart rate increased to supply more oxygen and nutrients to the working muscles.

Precautions:

1. The arm and the sphygmomanometer should be kept approximately at the **same level as the heart** during measurement.
2. The cuff of the sphygmomanometer should be wrapped around the upper arm properly, neither too tightly nor too loosely.
3. The systolic and diastolic blood pressures should be measured carefully.
4. The pulse rate should be counted carefully for a full one minute.
5. The person being examined should remain relaxed and seated quietly during the resting measurement.