9 Life Processes in Animals

மருந்தென வேண்டாவாம் யாக்கைக்கு அருந்தியது
அற்றது போற்றி உணின்.

If your food is fully digested before you eat again, you won't need medicine for pain.

(Thirukkural 942*)*

In the Grade 6 Science textbook *Curiosity*, chapter 'Living Creatures: Exploring their Characteristics', we learnt about processes essential for survival of living beings like nutrition, respiration, excretion, and reproduction. These are collectively called life processes. In this chapter, we will learn about life processes such as nutrition and respiration in detail.

0777CH09

Observe your surroundings and **notice** what animals eat. Animals eat different types of food. Bees and sunbirds suck the nectar of flowers, while infants of humans and many other animals feed on their mother's milk. Snakes, like python, swallow the animals they prey upon. Some aquatic animals filter tiny food particles floating nearby and feed upon them.

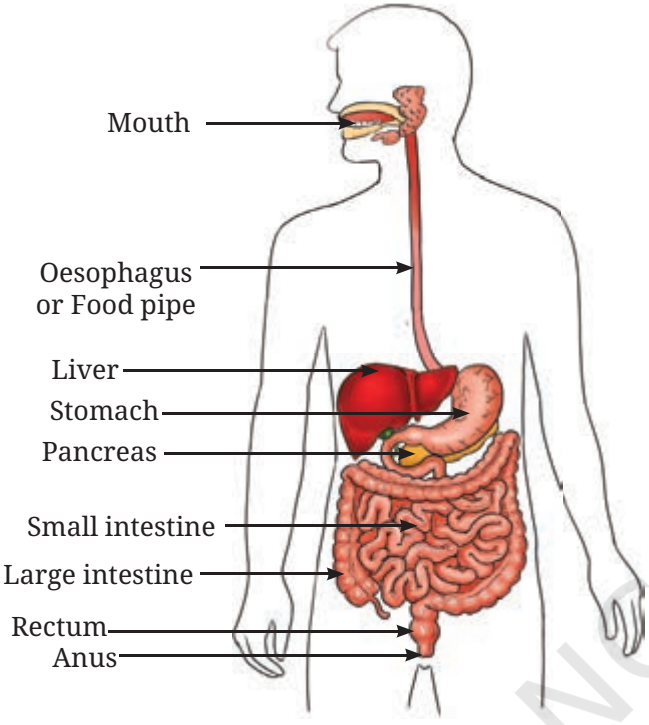


Fig. 9.1: Human digestive system

Animals, including humans, obtain energy from food, which enables them to carry out various life processes. Animals consume food that contains complex components, such as carbohydrate, protein, and fat. These complex food components have to be broken down into simpler forms before the body can use them. But how does this process happen?

Breaking down of complex food components into simpler forms occurs in a long tube called the **alimentary canal**. This process starts in the mouth and ends at the anus (Fig. 9.1). As food moves through this canal, digestive juices secreted at different parts break it down into simpler forms. This simpler form of food is absorbed by different parts of our alimentary canal and transported to various parts of our body to carry out various functions.

9.1 Nutrition in Animals

How do the complex food components get broken down into simpler forms and used by the body in various animals? Is this process the same in all animals or does it vary? Let us first try to understand this process in humans.

9.1.1 Digestion in human beings

Let us trace the journey of food inside our body as it passes through different parts of the alimentary canal.

Beginning with the mouth cavity

The journey of the food you eat begins when it enters your mouth. Your teeth break down food you eat into smaller pieces by the processes of crushing and chewing. This process of initial breakdown of food into fine pieces is called **mechanical digestion**. Think about your favourite food. Does your mouth feel watery?

This happens because of more **saliva** that gets released when you recall your favourite food.

What do you think is the role of saliva in your mouth? What do you feel when you eat other types of food, such as *chapati*? Let us find out.

Take a small piece of *chapati* or a bite-sized portion of boiled rice and chew it properly for 30–60 seconds. At first, the *chapati* or rice has its usual taste, but as you continue chewing, do you notice a change in taste? The food begins to taste sweet! Have you ever wondered why this happens?

Chapati or rice contains starch, which is a type of carbohydrate. Our saliva contains a digestive juice that helps break down starch into sugar. This explains why starchy food, like *chapati*, tastes sweet when you chew it for a long time. Saliva helps to break down components of food into simpler ones.

Science and Society

A healthy mouth requires good oral hygiene. We should brush our teeth and clean our tongue twice a day, and rinse our mouth with water after each meal to prevent tooth decay and bad smell in the mouth. Find out the ways our elders were maintaing oral hygiene.

Activity 9.1: Let us investigate

- Take two test tubes and label them as 'A' and 'B'.
- Take one teaspoonful of boiled rice in test tube A, and take a teaspoonful of boiled rice after chewing it for 30–60 seconds in test tube B.
- Add 3–4 mL of water in both the test tubes.
- Note the initial colour of the rice-water mixture in Table 9.1.
- Add 3–4 drops of iodine solution into each test tube with the help of a dropper. Mix the content of each test tube separately and observe.

Record your observations in Table 9.1.

Table 9.1: Action of saliva on starch

Test tube	Initial colour before adding iodine	Final colour after adding iodine	Possible reason for the change in colour, if any
A: Boiled rice			
B: Chewed boiled rice			

Did you observe that the colour of boiled rice turned blue-black in test tube A, while in test tube B, chewed boiled rice either did not change colour or turned only a very light blue-black colour? What causes the change of colour in test tube A? In Grade 6, we learned that iodine gives a blue-black colour when it reacts with starch. In test tube A, the appearance of the blue-black colour **indicates** the presence of starch. In test tube B, which contains chewed boiled rice, if there is no change in colour, it indicates that the starch is no longer present; if there is only a slight change in colour, it indicates that starch is present only in very small amount. It has been broken down into simple sugars by the action of saliva. If the colour still appears in test tube B, what changes would you make in the activity to **explore** it further? Would the colour change if chewing time is increased? Try to find out by repeating the activity.

Now, we know that saliva secretion in the mouth helps break down starch into sugars. This process of breaking complex food components into simpler forms in the body is called digestion. Food is partially digested in the mouth. Let us learn how this partially digested food gets further digested through the alimentary canal.

Food pipe (Oesophagus): A passage from the mouth to the stomach

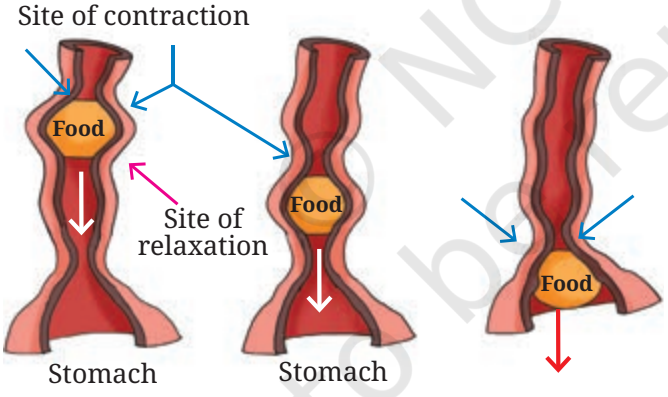


Fig. 9.2: Movement of food in the food pipe

When you chew your food, your saliva not only helps in digesting the starch but also moistens it, making it soft and easy to swallow. Your tongue helps in mixing chewed food with saliva and pushing this softened food into a long, flexible tube called the food pipe or **oesophagus** (Fig. 9.2). But how does the food move down?

The walls of the food pipe gently contract and relax in a wave-like motion to push the food down into the stomach. This movement takes place throughout the alimentary canal and pushes the food forward.

Stomach

In the stomach, the walls contract and relax to churn the food. The churned food is then mixed with a secretion from the inner lining of the stomach. The secretion from stomach contains digestive juice, acid, and mucus.

The digestive juice of the stomach breaks down proteins present in the food into simpler components.

The acid not only helps break down proteins but also kills many harmful bacteria. The mucus protects the stomach lining from the acid, preventing damage. In the stomach, the food is partially digested and transformed into a semi-liquid mass, preparing it for the next stage of digestion.

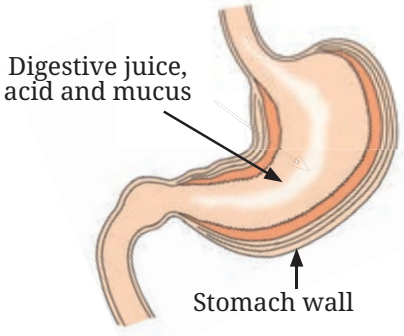
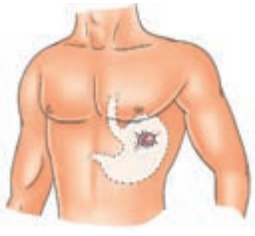


Fig. 9.3: Stomach

Fascinating Facts

How did scientists learn about digestion in the human body?



Alexis St. Martin's shotgun wound

The discovery of how the stomach works happened by chance. In 1822, a man named Alexis St. Martin was accidentally shot in the stomach. He was treated by a doctor, William Beaumont. However, his wound never fully healed, leaving a small permanent hole. This opening allowed Dr. Beaumont to observe digestion in the stomach as it happened. He conducted experiments on how different foods were broken down and studied how emotions affect digestion.

Small Intestine

After its journey through the stomach, the partially digested food moves into the small intestine. Look at Fig. 9.4. It is a sketch of a stretched-out alimentary canal. Guess how long it is. You will be surprised that although it is called small intestine, it is almost 6 metres long—almost twice the height of your classroom! You will be surprised to know that the small intestine is the longest part of the alimentary canal.

The small intestine receives digestive secretions from three sources—the inner lining of the small intestine itself, and two more structures associated with the alimentary canal—the liver and the pancreas (Fig. 9.4). The **liver** secretes bile, which is mildly basic in nature. Recall the neutralisation reaction in chapter 'Exploring Substances: Acidic, Basic, and Neutral'. Bile neutralises acids present in the food moving down from the stomach and breaks down fats into tiny droplets, making its digestion easier.

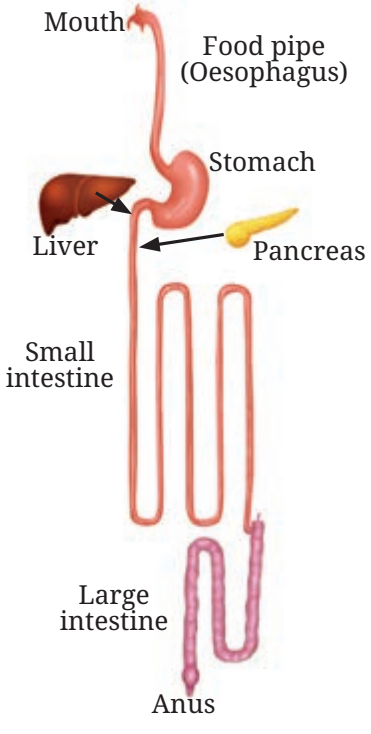


Fig. 9.4: Alimentary canal if it is stretched out

The **pancreas** secretes pancreatic juice, which is also basic in nature and helps neutralise acids present in the food. Additionally, pancreatic juice also breaks down carbohydrates, proteins, and fats. The digestive juice secreted by the wall of the small intestine further breaks down fats, proteins, and partially digested carbohydrates into simpler forms.

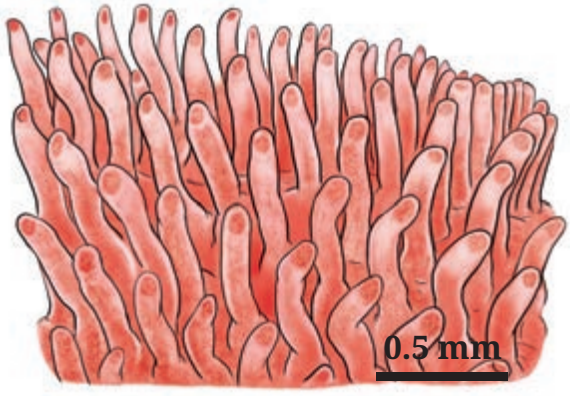


Fig. 9.5: Inner lining of the small intestine

The digested nutrients pass on from the small intestine into the blood present in blood vessels found in the walls of the small intestine. This process is called **absorption** of nutrients. How are these nutrients absorbed from the small intestine? The inner lining of the small intestine is thin and has thousands of finger-like projections (Fig. 9.5) that increase the surface area for efficient nutrient absorption. These finger-like projections allow the digested nutrients to pass into the blood, which carries them to different parts of the body. These nutrients provide energy, support growth and repair, and help the body function properly.

Science and Society

Celiac disease is a condition in which the body reacts to gluten, a protein found in wheat, barley, and rye. This reaction damages the inner lining of the small intestine, where nutrients are absorbed. As a result, the intestine cannot function properly. The only way to manage celiac disease is to avoid foods that contain gluten. Millets (like *jowar*, *bajra*, and ragi) are good alternatives because they are naturally gluten-free.

Large intestine

After most of the nutrients are digested and absorbed in the small intestine, what happens to the undigested food? It moves into the large intestine. The large intestine is about 1.5 metres in length. It is shorter than the small intestine. Then why is it called the large intestine? The reason is that it is wider than the

small intestine. The large intestine absorbs water and some salts from the undigested food, thus making the waste semi-solid. This semi-solid waste is called **stool**. The stool is then stored in the lower part of the large intestine, called the **rectum**, until the body is ready to get rid of it. Eating fibre-rich foods like fruits, vegetables, and whole grains helps the large intestine function properly by making the stool easier to pass. Finally, it is expelled through the anus—a process known as **egestion**. This is how your body removes the waste it does not need, keeping you healthy!

Isn't it fascinating how the digestive system works, absorbing nutrients from food and eliminating waste?

Fascinating Facts

The large intestine contains various small living organisms, such as bacteria, that help in digestion. They help in keeping our digestive system healthy. They break down undigested food, especially fibre, and produce essential nutrients. Fibre-rich food, and especially 'fermented foods' (like curd, buttermilk, *shrikhand, kanji,* pickles, *gundruk,* and *poita bhat*) are good for a healthy digestive system and overall well-being.

Science and Society

The importance of digestion in maintaining good health has been recognised for centuries. The *Charaka Samhita*, an ancient Ayurvedic text, highlights the role of easily digestible foods and the judicious use of spices like ginger, black pepper, and cumin to enhance digestion. Advances in science in the area of nutrition also emphasise eating meals at proper timings, practising mindful eating, and avoiding overeating as key factors in maintaining digestive health.

9.1.2 Do all animals digest food the same way as humans do?

I have seen cows keep chewing the food even when they are not actively grazing or eating anything. Why?

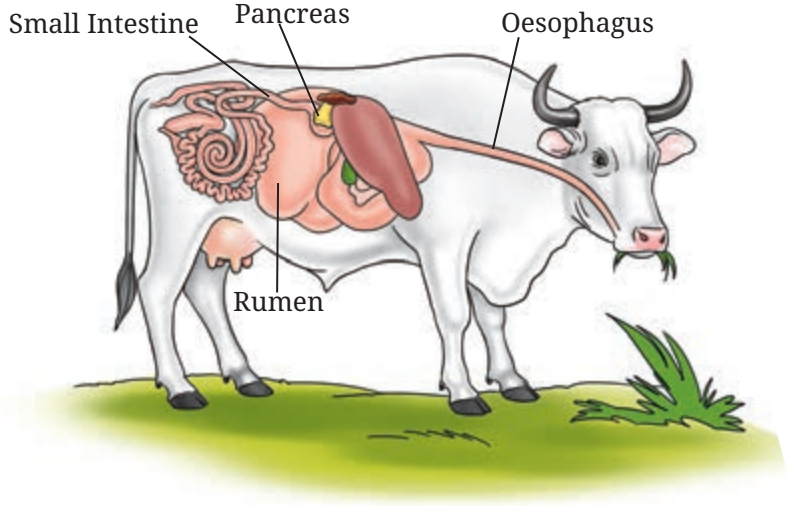


Fig. 9.6: Digestive system of a ruminant

Grass-eating animals, such as cows (Fig. 9.6) and buffaloes, partially chew the grass and swallow it into their stomachs. In the stomach, partial digestion of the food takes place. The partially digested food is brought back to the mouth for gradual chewing. This process is called rumination, and these animals are called ruminants. A cow spends about 8 hours a day just chewing the food! The thoroughly chewed food again passes down the alimentary canal for further digestion.

Birds do not have teeth, but they have a chamber called a gizzard (Fig. 9.7). Food is broken down by the contraction and relaxation of the walls of the gizzard, often with the help of grit (small stones) that the birds swallow.

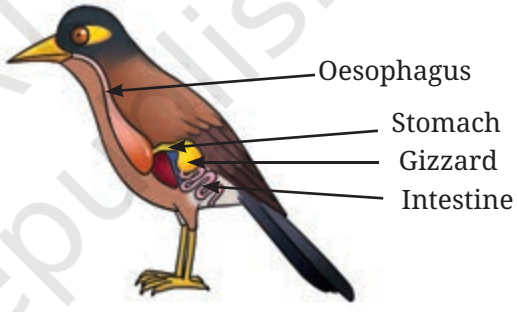


Fig. 9.7: Digestive system in birds

This shows that animals exhibit variations in the structure and function of the alimentary canal to adapt to different ways of digesting different kinds of food.

We have learnt that the nutrients from digested food are carried to different parts of the body. Some of the nutrients help build and repair the body, while others, like sugar, are broken down inside the body to release energy. The process by which nutrients are converted into usable energy is called **respiration**. Let us now explore how this process occurs in animals.

9.2 Respiration in Animals

We learnt in Grade 6 chapter 'Living Creatures: Exploring their Characteristics', that all living beings respire. Is the process of respiration the same in all animals? Let us first understand the process of respiration in humans.

9.2.1 Respiration in humans

You know that we breathe in (inhale) and breathe out (exhale) air continuously to obtain oxygen and release carbon dioxide. How is this oxygen used in the body? Are breathing and respiration different? Let us find out.

How do we breathe?

The process of inhaling and exhaling air is called breathing. It is difficult to live without food for a week; without water for a day or two, but without breathing, we usually cannot survive more than a few minutes. Why is that? All of us are alive because we breathe. Not just humans, plants and other animals also breathe. But how do we breathe?

Just as food follows a specific pathway in the digestive system, our body also has a specific system for breathing and respiration. This system is called **respiratory system.** The respiratory system consists of various parts as shown in Fig. 9.8. In this system, the exchange of gases follows a specific pathway. The pathway through which the air is inhaled and exhaled involves various parts of the respiratory system assisting in the process of breathing and respiration.

The respiratory system begins with a pair of nasal openings called **nostrils** through which we inhale and exhale air (Fig. 9.8). The inhaled air passes into a pair of small passages called the **nasal passages**. Have you noticed tiny hair inside your nostrils? These hair, along with mucus, help trap dust and dirt from the air we breathe in. This is why we should breathe through the nose and not through the mouth. From the nasal passages, the air reaches our lungs through the windpipe. The windpipe forms two branches, which enter the two lungs. In the lungs, these branches further divide into smaller and finer branches that end in small balloon-like sacs called alveoli (Fig. 9.8). Our lungs are protected by the rib cage.

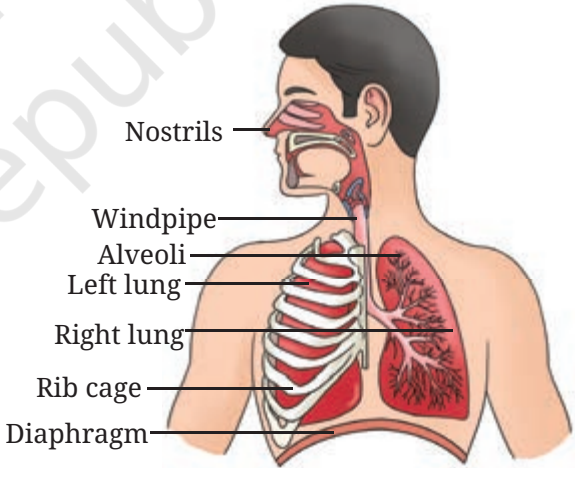


Fig. 9.8: Human respiratory system

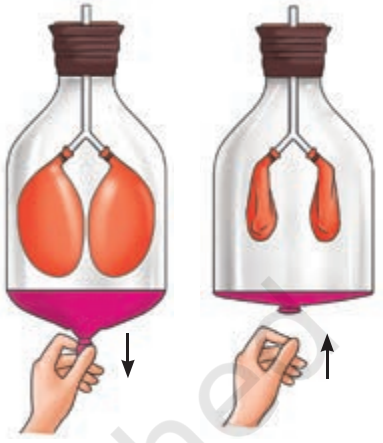
Science and Society

While a lot of the dust is filtered out from the inhaled air, often small infectious particles can get through the lungs. For example, during the COVID-19 pandemic, the SARS-CoV-2 virus affected the respiratory system, leading to breathing difficulties and often causing serious lung problems.

Let us understand the mechanism of breathing by making a simple model.

Activity 9.2: Let us make a model

- Take a wide transparent plastic bottle with a lid. Remove its bottom.
- Make a hole in the lid of the bottle.
- Take a Y-shaped hollow tube, as shown in Fig. 9.9.
- Fix two deflated balloons to the forked end of the tube. Secure them with rubber bands to make them airtight.
- Insert the straight end of the tube tightly through the lid from the open base of the bottle and seal the lid with clay to make it airtight.
- To the open base of the bottle, attach a thin rubber sheet tightly using a large rubber band.



(a) Inhalation *(b) Exhalation*

Fig. 9.9: Model to show mechanisms of breathing

Pull the rubber sheet from the centre of the base downwards and watch the balloons (Fig. 9.9a). What do you observe? Now, release the rubber sheet upwards and observe the balloons (Fig. 9.9b). What changes do you see in the balloons? When you pull the rubber sheet downwards, the balloons inflate. Conversely, when you release the rubber sheet upwards, the balloons deflate.

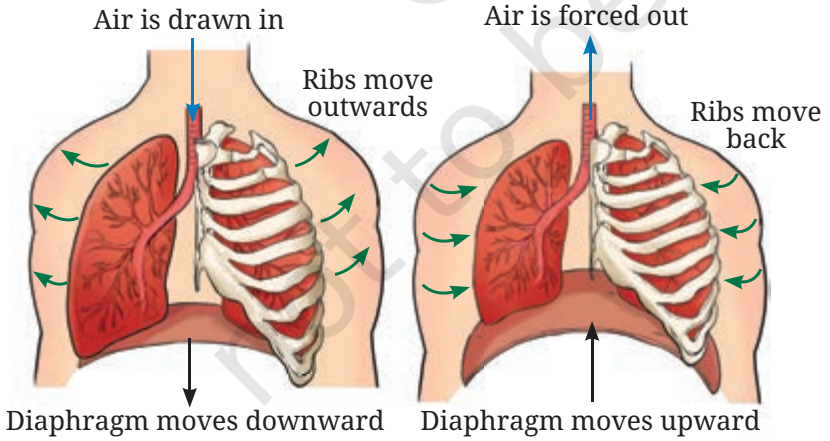


Fig. 9.10: Mechanism of breathing

When you breathe in (inhale), your chest expands as the ribs move up and outwards. The diaphragm (a dome-shaped muscle below the lungs) moves downwards during inhalation (Fig. 9.10a). This increases the space inside the chest, and air enters the lungs. When you breathe out (exhale), the ribs move down and inwards, and the diaphragm moves upwards (Fig. 9.10b), reducing space and pushing air out of the lungs.

What do the balloons in the model mentioned in Fig. 9.9 represent? What does the rubber sheet represent? In this model, the balloons represent the lungs, and the rubber sheet represents the diaphragm.

Science and Society

Breathing Practices for a Healthy Life

Breathing exercises have been practised across different cultures in India and worldwide for centuries. *Pranayama* is well known for improving respiratory health, mind relaxation, and concentration.

In Ladakh, people practise *Tummo* breathing, a technique that improves lung function and helps keep the body warm even in cold weather. Similarly, deep breathing techniques are used to promote well-being. Some traditions combine deep breathing with chanting, using rhythmic breath control to enhance relaxation and mental clarity.

What do we breathe out?

Activity 9.3: Let us explore

To be demonstrated by the teacher

- Take an equal amount of freshly prepared lime water in two test tubes, A and B, as given in Fig. 9.11.
- In test tube A, pass the air using a syringe/*pichkari* (Fig. 9.11a). This is the same air that you inhale.
- In test tube B, repeatedly blow air through your mouth into the lime water using a straw (Fig. 9.11b).

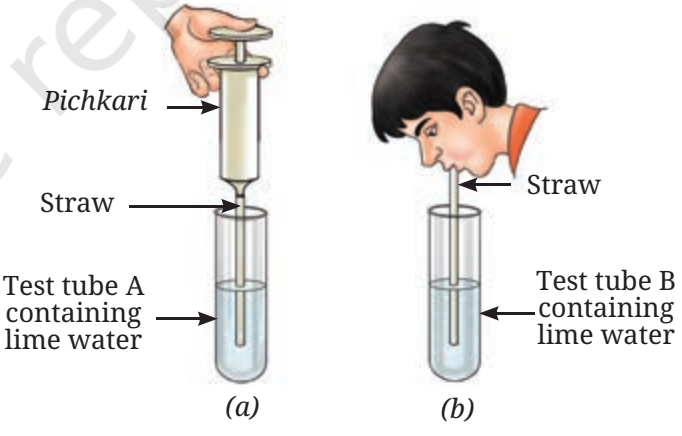


Fig. 9.11: (a) Air is passed into lime water with a pichkari/syringe (b) Air is exhaled into lime water

- Do you observe any changes in the colour of the lime water?

The lime water in test tube B turns milky (or cloudy), but the lime water in test tube A does not. What does this indicate? Lime water turns milky when it reacts with carbon dioxide. Therefore, this indicates that the exhaled air contains more carbon dioxide than the air we inhale.

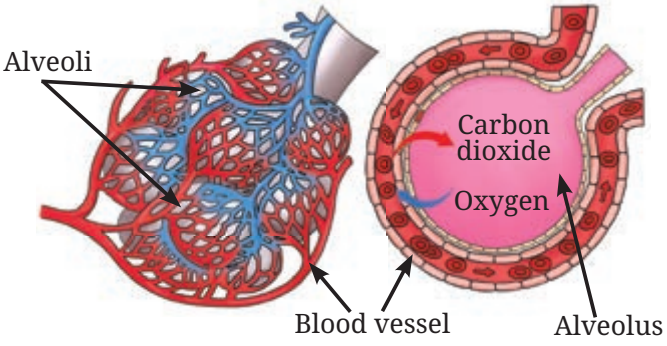


Fig. 9.12: Gas exchange through alveoli

How does the exchange of gases happen?

Through the process of breathing, fresh air from outside enters the lungs and fills the alveoli. The alveoli have thin walls surrounded by fine tubes containing blood (Fig. 9.12). Blood carries carbon dioxide from the body to the alveoli, where it is released into the air. At the same time, oxygen from the alveoli passes into the blood and is transported to all parts of the body.

Have you ever wondered how the food you eat gives you energy? The key is not only the food but also the oxygen we breathe! When we eat food, our body breaks it down into simple substances like sugar (glucose). Oxygen helps break down glucose to release energy. This process is called respiration. The word equation of the process of **respiration** is as follows—

Glucose + Oxygen ⟶ Carbon dioxide + Water + Energy

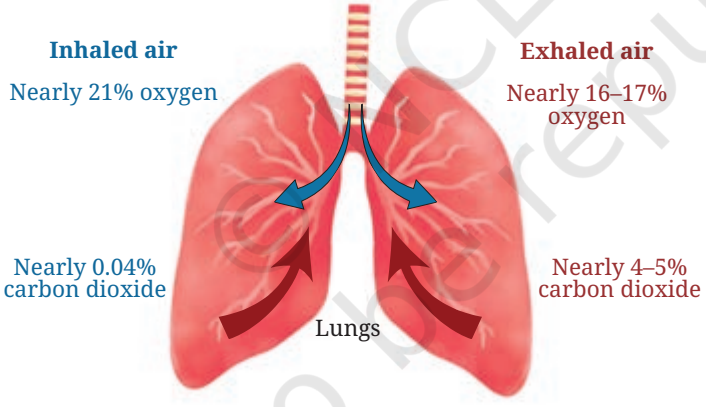


Fig. 9.13: The percentage of oxygen and carbon dioxide in inhaled and exhaled air

During breathing, we inhale air from our surroundings and exhale air having more carbon dioxide than the inhaled air. Note that not all the oxygen is used up (Fig. 9.13). Some other animals can use a larger fraction of the oxygen during respiration. This exchange of gases ensures that each segment of our body gets oxygen to produce energy and remove waste products. In simple words, breathing brings in oxygen and removes carbon dioxide, while respiration uses oxygen to break down food and release energy. This energy helps us walk, run, play, and even think!

Breathing is a physical process, while respiration is a chemical process that occurs inside the body. Both the processes are essential for our survival!

Our body has a unique system for the transport of nutrients, oxygen, and other substances. This system is called the circulatory system. It includes the heart, blood, and blood vessels. The heart pumps blood through blood vessels, ensuring the transport of nutrients, oxygen, and other substances to all parts of the body, while waste products are carried away.

Science and Society

Smoking is extremely harmful to health. It damages the lungs and increases the risk of serious diseases, including lung cancer and other respiratory illnesses. It leads to persistent coughing and frequent infections.

In addition to harming the smoker, smoking releases toxic chemicals into the air, putting others at risk. When non-smokers inhale this polluted air, they experience passive smoking, which can be especially dangerous for children, pregnant women, and the elderly. Due to these risks, avoiding smoking helps protect both personal health and the well-being of those around us.

9.2.2 Do other animals breathe the same way as humans do?

You have learnt that different animals live in different habitats. You may have observed birds flying and fish swimming. How do they breathe? Animals, such as birds, elephants, lions, cows, goats, lizards, and snakes, breathe through their lungs. Although all these animals have lungs, the structure of their lungs are quite different. Most aquatic animals like fish, have specialised structures known as **gills** (Fig. 9.14). These are richly supplied with blood vessels. The exchange of oxygen and carbon dioxide between the blood and the gases dissolved in water takes place across the gills.

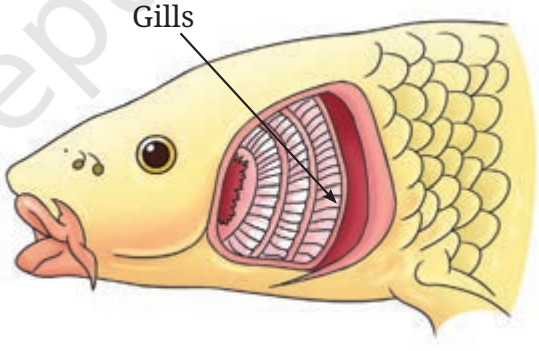


Fig. 9.14: Breathing body parts in a fish

Amphibians, like frogs, live both on land and in water. They use different body parts for breathing at various stages of their life. For example, tadpoles breathe through gills, while adult frogs use lungs for breathing on land and skin for gas exchange when they stay in water. This adaptation helps them survive both in water and on land, showing how animals have adapted over time to different environments. Earthworms use their moist skin for the exchange of oxygen and carbon dioxide.

Thus, different animals have different breathing mechanisms to suit their unique habitats. Apart from the digestive system, the respiratory system, and the circulatory system, there are other systems which work in coordination with each other in the body and perform different functions to sustain life. You will study about them in higher grades.

In a Nutshell

- Life processes such as nutrition, circulation, respiration, excretion, and reproduction are essential for the survival of living beings. These processes are collectively called life processes.
- The human digestive system consists of an alimentary canal which includes the mouth, oesophagus, stomach, small intestine, large intestine, and anus, and its associated parts, the liver and the pancreas.
- The digested food is primarily absorbed through the walls of the small intestine.
- The nutrients absorbed are distributed through the blood to different parts of the body where they are used for performing various functions.
- The large intestine absorbs most of the remaining water and some salts from the undigested food.
- Grass-eating animals such as cows and goats are called ruminants. They chew the food partially and swallow it. Later, the partially digested food is returned to the mouth, and the animal chews it thoroughly.
- Breathing involves the movement of air into the lungs (inhalation) and out of the lungs (exhalation).
- The exchange of oxygen and carbon dioxide occurs in the alveoli of the lungs.
- Respiration uses oxygen from inhaled air to break down glucose into carbon dioxide and water. The process by which nutrients are converted into usable energy is called respiration.
- The circulatory system transports nutrients and oxygen to all parts of the body. It includes the heart, which pumps blood through blood vessels, delivering oxygen and nutrients while also removing waste from the body.
- Breathing is a physical process and respiration is a chemical process.
- Different animals have different breathing mechanisms adapted to suit their habitats.

Let Us Enhance Our Learning

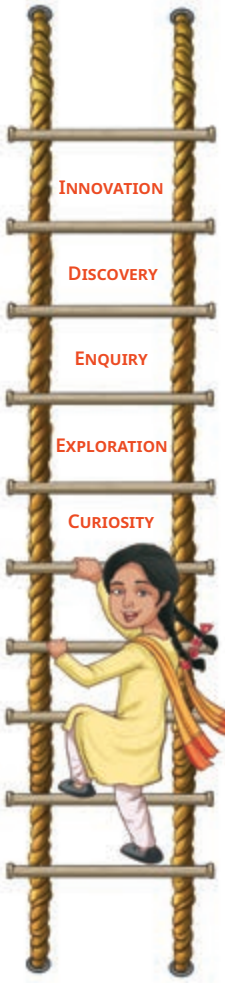
1. Complete the journey of food through the alimentary canal by filling up the boxes with appropriate parts—

Food → Mouth → ____ → Stomach → ____ → ____ → Anus

2. Sahil placed some pieces of *chapati* in test tube A. Neha placed chewed *chapati* in test tube B, and Santushti took boiled and mashed potato in test tube C. All of them added a few drops of iodine solution to their test tubes—A, B, and C, respectively. What would be their observations? Give reasons.
3. What is the role of the diaphragm in breathing?
   (i) To filter the air
   (ii) To produce sound
   (iii) To help in inhalation and exhalation
   (iv) To absorb oxygen
4. Match the following

Name of the part	Functions
(i) Nostrils	(a) fresh air from outside enters
(ii) Nasal passages	(b) exchange of gases occurs
(iii) Windpipe	(c) protects lungs
(iv) Alveoli	(d) tiny hair and mucus help to trap dust and dirt from the air we breathe
(v) Ribcage	(e) air reaches our lungs through this part

5. Anil claims to his friend Sanvi that respiration and breathing are the same process. What question(s) can Sanvi ask him to make him understand that he is not correct?
6. Which of the following statements is correct and why?
   Anu: We inhale air.
   Shanu: We inhale oxygen.
   Tanu: We inhale air rich in oxygen.
7. We often sneeze when we inhale a lot of dust-laden air. What can be possible explanations for this?
8. Paridhi and Anusha of Grade 7 started running for their morning workout. After they completed their running, they counted their breaths per minute. Anusha was breathing faster than Paridhi. Provide at least two possible explanations for why Anusha was breathing faster than Paridhi.



9. Yadu conducted an experiment to test his idea. He took two test tubes, A and B, and added a pinch of rice flour to the test tubes, half-filled with water and stirred them properly. To test tube B, he added a few drops of saliva. He left the two test tubes for 35–45 min. After that, he added iodine solution into both the test tubes. Experimental results are as shown in Fig. 9.15. What do you think he wants to test?

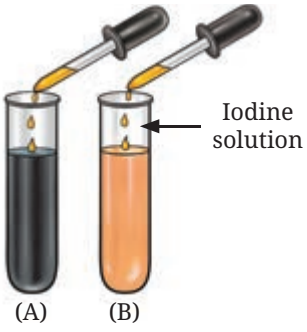


Fig. 9.15: Experimental results

10. Rakshita designed an experiment taking two clean test tubes, A and B and filled them with lime water as shown in the figure. In test tube A, the surrounding air that we inhale was passed on by sucking air from the pipe, and in test tube B, the exhaled air was blown through the pipe (Fig. 9.16). What do you think she is trying to investigate? How can she confirm her findings?

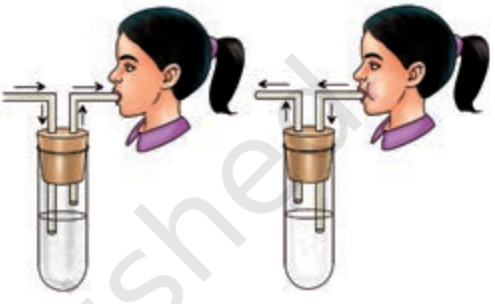
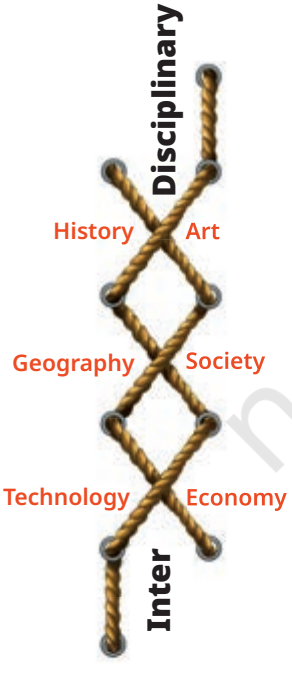


Fig. 9.16: Experimental set-up

Exploratory Projects



- What are the good practices for maintaining oral hygiene? Try to gather information on the same from books/newspapers/ conversation with elders. Prepare a report.
- Find out different ways to maintain a healthy digestive system. Suggest some food items that help to maintain good digestive health. Make a report and present it in class.
- Using coloured clay, prepare a 3-D model of the digestive system and label all parts of the digestive system using black paper strips.
- What is air quality and AQI? Find out the effect of air quality on the respiratory systems of people working in various fields — farmers, factory workers, or street vendors.
- Try to read about the box-breathing technique (Fig. 9.17). What are its benefits?
- Both birds and mammals have lungs for breathing, but birds can fly at high altitudes where oxygen levels are low. How might their respiratory system be adapted to help them survive in such conditions?

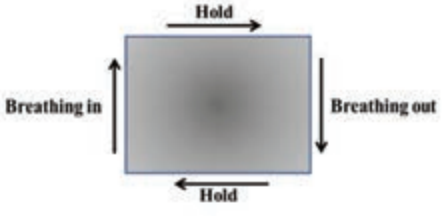


Fig. 9.17: Box-breathing