The Invisible Living World

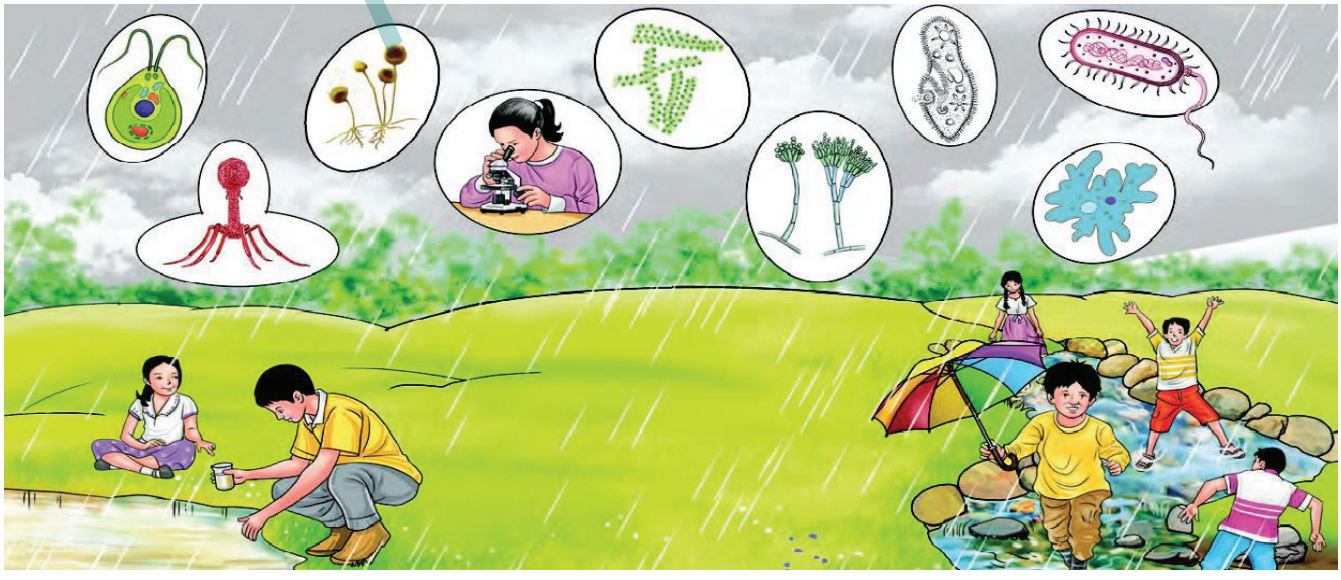
1

Learners will be able to:

- Able to define microorganisms.(CG-3)
- Classify different types of microorganisms.(CG-3)
- Give examples of each kind with reference to their observation of the surroundings.(CG-3)
- Conduct simple experiments to observe microorganisms.(CG-6)
- Record their observation and compare their characteristics.(CG-3)
- Explain the application of microorganisms in day to day life.(CG-3)

Probe and Ponder

- Have you ever wondered what you might see if the invisible world around you became visible?
- How do you think your observation of this hidden world might change the way you think about size, complexity, or even what counts as 'living'?
- Have you thought how these tiny living beings interact with each other?
- **Share your questions.**



The human eye can only see objects that are above a certain size. For a long time, many tiny things around us remained unknown. Long ago, people discovered that a curved piece of glass could make small things look bigger. The piece of glass was shaped like a lentil seed — thick in the middle and thin at the edge — hence they called it a **lens.** Over time, lenses were improved to become more powerful. Each new tool, from simple magnifying glasses to microscopes, helped humans see what their eyes could not. The invention of the microscope opened a fascinating hidden world filled with tiny living creatures. We will **explore** some of these life forms in this chapter.

You have already learnt about the amazing variety of living beings. Just look around — there are so many beautiful plants and animals! They are of all shapes, sizes, and colours. Some living beings are tiny, while others are really big. They differ not only in their structure but also in many other features. All these living beings, whether plants or animals, are called **organisms**. Have you ever noticed the smallest organism around you that is visible to the naked eye? Think about it — how small a thing can your eyes actually see?

You might have seen some people using reading glasses. How does it help them see better? Or what happens when we use a magnifying glass to observe something?

Activity 1.1: Let us observe

- Take a round-bottom flask made up of glass as shown in Fig. 1.1. Fill it with water.
- Close the mouth of the flask with a cork.
- Now, place the flask on an open book and look at the letters through it.

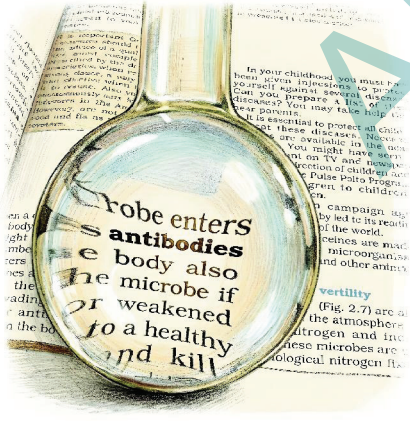


Fig. 1.1: Round-bottom flask

Do you notice something interesting? The letters appear larger when seen through the flask! This happens because the flask filled with water acts like a magnifying glass. Now, use a real magnifying glass to look at small organisms, like an ant. Were you able to see the details of its body more clearly?

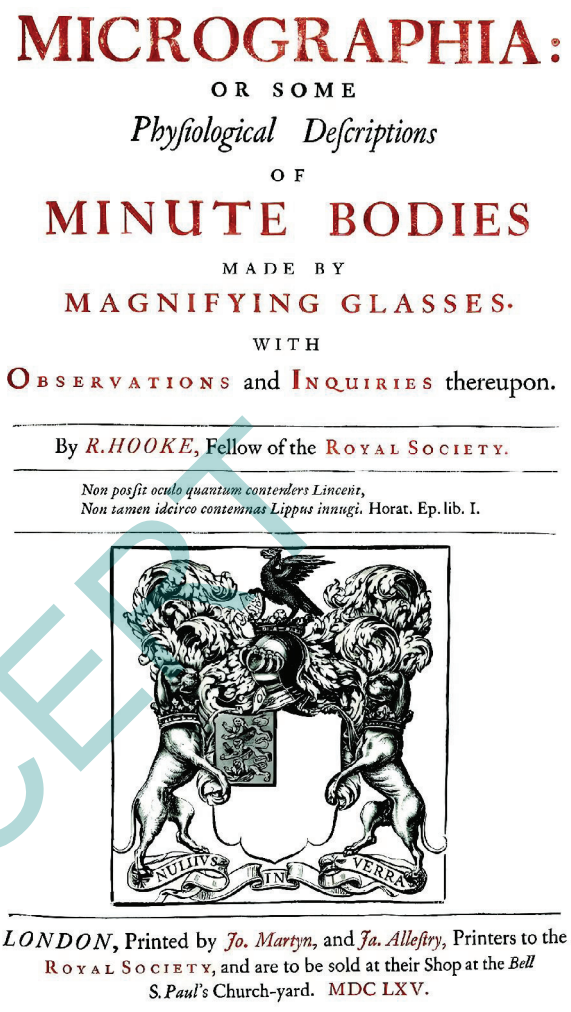
For a long time, people were curious to explore the tiny organisms around them, but they could not see them with their naked eyes. So, how did we finally discover this invisible world? Do you know which scientific discovery helped us see the tiny world for the first time?

Ever heard of...

In 1665, a scientist named Robert Hooke published a book called Micrographia. He was a careful observer, and a skilled artist. In this book, he showed detailed drawings of tiny things that people had never seen before — things he saw using a tool we now call a microscope.

His microscope made things look 200 to 300 times bigger, than what one could see with the unaided eye. One day, he looked at a thin slice of cork and saw it was made of many small, empty spaces. These compartments reminded him of a honeycomb. He drew what he saw and called each small space a cell. This was the first time the word cell was used in science to describe the basic unit of life.

Around the same time in 1660s, Antonie van Leeuwenhoek, a Dutch scientist, made better lenses that allowed him to build more useful microscopes. He was the first person to clearly see and describe tiny living things like bacteria and blood cells. Because of this, he is known as the Father of Microbiology.


MICROGRAPHIA:
OR SOME
Physiological Descriptions
OF
MINUTE BODIES
MADE BY
MAGNIFYING GLASSES.
WITH
OBSERVATIONS and INQUIRIES thereupon.

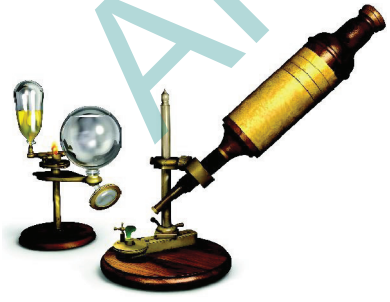
By *R. HOOKE*, Fellow of the ROYAL SOCIETY.

Non posſit oculo quantum contendere Lincei,
Non tamen idcirco contemnas Lippus inungi. Horat. Ep. lib. I.

NULLIVS IN VERBA

LONDON, Printed by *Jo. Martyn*, and *Ja. Allestry*, Printers to the ROYAL SOCIETY, and are to be sold at their Shop at the *Bell* S. *Paul's* Church-yard. MDC LXV.

(a)



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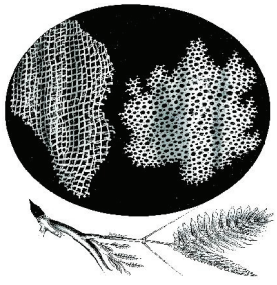


(c)

Fig. 1.2: (a) Micrographia book; (b) Microscope of Robert Hooke; (c) Cork cells as published in the Micrographia

1.1: What is a Cell?

All living beings are made up of **cells**. You might wonder what cells actually look like. Let us take a closer look at the basic structure of a cell using a microscope.

Activity 1.2: Let us study a cell (Teacher demonstration activity)

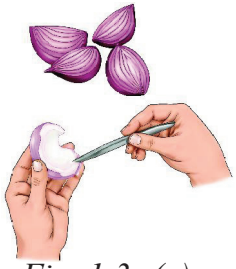
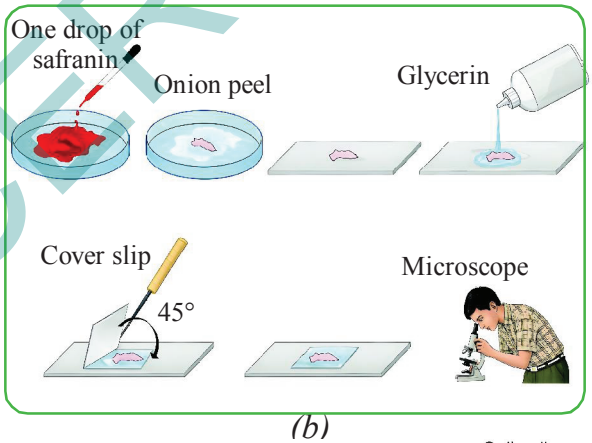


Fig. 1.3: (a) Removing onion peel from an onion bulb

- Take an onion bulb from your kitchen or garden and wash it throughly with water.
- Cut the onion bulb vertically into pieces.
- Take one piece of onion and pull out the thin, transparent layer from its inner surface with the help of forceps. This layer is called the onion peel.
- Place the peel in a petri dish containing a few drops of safranin (red-coloured stain) for 30 seconds. This will give a pinkish colour to the cells and help us see them clearly.
- With the help of thin brush transfer the onion peel to another petri dish containing water to rinse the peel and remove extra stain.
- Now, carefully place the stained onion peel on the glass slide using a thin brush, ensuring it does not break or fold.
- Put a drop of glycerin over the onion peel on the slide.
- The glycerin will prevent drying of the cells and improve clarity for better visualisation of cells.
- Slowly place a coverslip over the peel using a needle, such that no air bubbles get trapped.
- Use blotting paper to gently wipe off any extra glycerin around the edges of the coverslip.
- View the slide under a microscope or a foldscope. Compare it with Fig. 1.3(c).
- What similarities do you find in Fig. 1.3(c) and Fig. 1.3(d)?

You will observe nearly rectangular structures under the microscope. These are the cells of the onion peel, which are closely arranged without any space between them. Try to observe the peels of the leaves of different plants around you. You will find that all plants are made up of cells. What do you think the body of an animal is made of?



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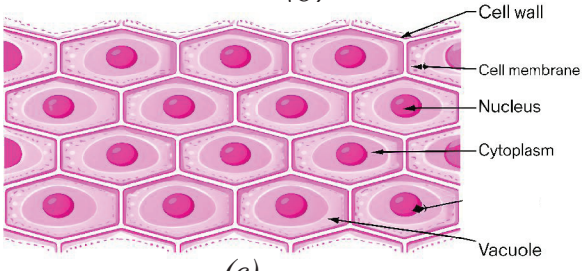


(c)

(d)

Fig. 1.3: (b) Mounting the onion peel in glycerin using a needle; (c) Structure of onion peel under the microscope; and (d) A wall made of brick

Activity 1.3: Let us investigate

- Rinse your mouth with clean water.
- Use the blunt end of a clean toothpick, and gently scrape the inside of your cheek.
- Place the scraped material in a drop of water on a clean glass slide and spread it evenly.
- Add a drop of methylene blue (a blue-coloured stain) over the material on slide. Adding stain improves the visibility of the material under the microscope by increasing contrast.
- After one minute, add a drop of glycerin over the material on the slide to prevent the cells from drying.
- Now, carefully place a clean coverslip on the material, and remove the excess glycerin from the edges of the coverslip using blotting paper.
- Observe the slide under a microscope and draw what you see in your notebook.

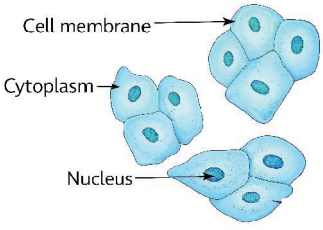


Fig. 1.4: Mount of human cheek cells

What did you observe? You will observe a polygon shaped structure as shown in Fig. 1.4. These are cheek cells, which form the inner lining of your mouth.

What similarities and differences did you observe between the cells of onion peel in Activity 1.2 (Fig.1.3(c)) and human cheek cells in Activity 1.4?

You have observed that cells have three main parts — a thin outer lining, a central region, and a small round structure inside it. The outer layer is called the **cell membrane**. The round structure in the middle is the **nucleus**, which is also covered by a thin membrane. The space between the cell membrane and nucleus is filled with **cytoplasm**. These three — cell membrane, cytoplasm, and nucleus — are the basic parts of a cell. Some cells, like onion peel cells, have an extra outer layer called the **cell wall**. What is the importance of these structures in a cell? What functions do they perform? Are these functions important for the maintenance of life?

The cell membrane encloses the cytoplasm and nucleus. The cell membrane separates one cell from another. It is porous and allows the entry of materials essential for life processes and the exit of waste material.

Cytoplasm contains other components of the cell and compounds, such as carbohydrates, proteins, fats, and mineral salts. Most of the life processes take place within the cytoplasm.

The nucleus regulates all activities that occur within the cell. It also regulates growth.

The cell wall in the plant cell provides rigidity and strength to plants. This is why all cells are arranged compactly with each other and look firm in structure.

A step further

Cells in all parts of a plant have tiny rod-shaped structures called **plastids**. Some plastids, like **chloroplasts**, contain chlorophyll, which makes them green and helps in photosynthesis. In non-green parts, some plastids help in the storage of substances. Plant cells also have a large, empty-looking space called a **vacuole**. This helps the plant cell store important substances, get rid of waste, and maintain the shape of the cell. This gives strength and support to the plant. In animal cells, vacuoles are usually not present, if present, they are usually small. These small vacuoles store certain substances dissolved in water (Fig. 1.5). So, a cell is not just a simple bag of liquid — it is a complex structure made up of many different parts, each with its own special function to allow the cell, and in turn the entire organism to work.

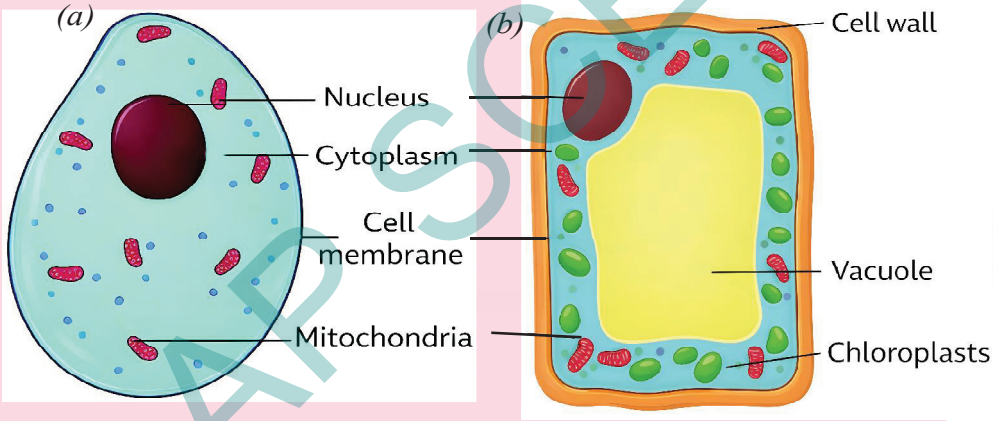


Fig. 1.5: A schematic drawing of (a) An animal cell and (b) A plant cell. (The colours are to show different parts of the cell)

We have now understood the basic structure of cell. And we now also understand that plant and animal cells differ in shape and structure.

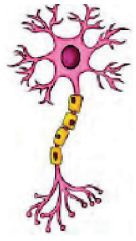
Do different animal cells also vary in their shape and structure?

1.1.1 Variation in shape and structure of cells

The **muscle** cell and the **nerve** cell of a human are shown in Fig. 1.6(a) and (b). What are the similarities and differences you see in them?

A muscle cell (Fig. 1.6(a)) is shaped like a spindle, while a nerve cell (Fig. 1.6(b)) is very long and has branches. Similarly, some cells are round in shape, while others are long and thin. The number of cells also varies in different organisms. Why do cells look so different from each other? Does the shape and structure of a cell relate to its function?

(a) Muscle cell



(b) Nerve cell

Fig. 1.6: Different cells in humans

The unique shape, size, and structure of cells help them carry out their specific functions. But how do these cells help in performing various functions in the body? Let us find out.

You observed in Activity 1.3 that inner cheek cells are thin and flat. They form a protective lining on the inner surface of the cheek. Nerve cells also known as **neurons** carry messages in our body. The elongated shape and branched structure help them reach different parts of the body and pass on messages quickly. Similarly, plant cells also show variation. In plants, too, cells may be rectangular, elongated, oval, or even tube-like. Some plant cells form long tubes that help carry water throughout the plant.

You have already studied the digestive system in Grade 7. Different parts of the digestive system are made up of different types of cells. A group of muscle cells are present in the food pipe. These cells contract and relax in a wave-like manner, pushing the food down to the stomach. This movement is possible because muscle cells are thin, flexible, and spindle-shaped. The stomach also has different types of cells for performing different functions. Muscle cells in the stomach wall help churn the food. Other cells in the inner lining of the stomach produce digestive juices and acid that help break down the food. All these cells work together to make digestion possible.

1.2: What Are the Levels of Organisation in the Body of a Living Organism?

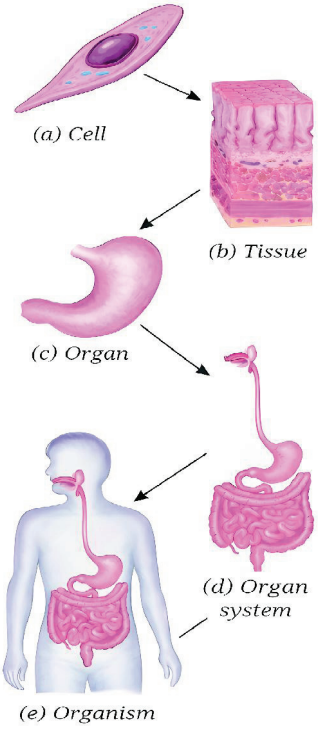


Fig. 1.7. levels of organisation of life

The body of a living organism is organised in a complex way. **Cell** (Fig. 1.7a), is the basic unit of life, just like a brick is the basic unit of wall (Fig. 1.3d). A group of similar cells forms a **tissue** (Fig. 1.7b). Different tissues are organised to form an **organ** (Fig. 1.7c). Several organs work together to form an **organ system** that performs a major function of the body (Fig. 1.7d). All the organ systems together make up a complete **organism** (Fig. 1.7e) — like a plant or an animal. So, the levels of organisations are:

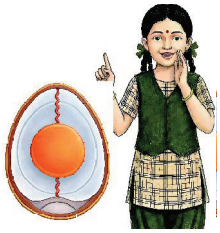
Cell → Tissue → Organ → Organ system → Organism

These levels of organisation help us understand how simple building blocks like cells come together to form a complex living being.

The life of complex living organisms begins with a single cell— 'zygote'. The zygote of any organism has an amazing ability to divide repeatedly to form a complete living being made up of many cells. Such living beings are called **multicellular** organisms. Animals, including humans, and plants are all examples of multicellular organisms.

Ever heard of...

The yolk (the yellow part of an egg) of an ostrich egg is a single cell — the largest known cell in the living world — measuring about 130 mm to 170 mm in diameter. The egg contains extra non-cellular material: a shell for protection and a white liquid that nourishes the cell during its continued development.



1.3: What Are Microorganisms?

Some living organisms are made up of just one or very few cells. They are so small that they can not be seen with the naked eye. These are called **microorganisms**. Some microorganisms, like bacteria and Amoeba, are made of just one cell (unicellular). Others, like some fungi and algae, have many cells (multicellular). Microorganism are found all around us — in water, soil, air, and even inside our body! But what do their cells look like? Are they like the plant and animal cells we just learnt about, or are they different? To observe the cells of a microorganism, again, we need to use a microscope which magnifies their size and makes them visible to us. Scientists have also created a low-cost and foldable paper microscope or foldscope. Foldscopes may not provide the same level of details like high-powered laboratory microscopes. However, these make microscopic world accessible to many people.

Let us now take a closer look at the fascinating world of microbes.

Activity 1.4: Let us observe pond water/ stagnant water

- Take a container and collect pond or stagnant water in it with the help of your teacher or elder(s).
- Use a dropper and place a drop of pond or stagnant water on a microscope or foldscope slide. Put a coverslip and observe it under the microscope or foldscope.
- Observe the tiny organisms found in the pond or stagnant water.

Activity 1.5: Let us observe soil suspension

- Take a beaker and collect some moist soil in it from the nearby field or garden. Do not touch the soil with your bare hands — use a spoon or gloves.
- Pour some water into the beaker and stir it with a glass rod. The liquid, which may look dirty, has very fine particles of soil, and is called **soil suspension.** Keep it aside for some time and let the mixture settle.

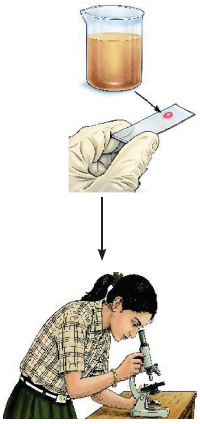


Fig. 1.8. Observation of soil suspension under the microscope

- Use a dropper and take a drop of water from the top layer. Place the drop on a microscope slide.
- Cover it gently with a coverslip and observe it under the microscope (Fig. 1.8).

You may observe small moving organisms similar to those you saw in Activity 1.4. This indicates that even **soil suspension** contains a variety of tiny creatures that cannot be seen with the unaided eye. The tiny creatures that cannot be seen with the naked eye are called microorganisms (micro means very small; organisms means living beings) or **microbes.**

Activity 1.6: Let us study

A group of students studying in Grade 8 performed Activities 1.4 and 1.5. They also collected information from the library and internet. They recorded the data obtained after observing pond water in Table 1.1 and the data obtained after observing soil suspension in Table 1.2. They identified the microorganisms as protozoa, algae, fungi, and bacteria. You can record if you find any of these categories of organisms.

Table 1.1: Organisms present in pond water

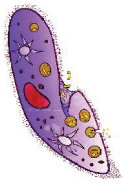
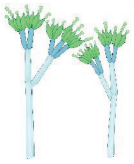
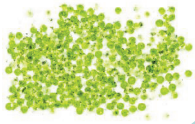
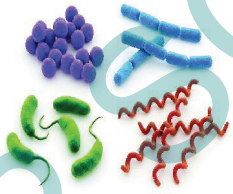
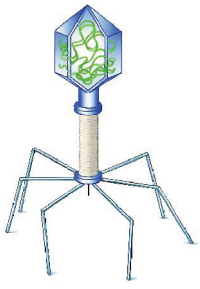
S. No.	Diagram	Remarks
1.	Amoeba (Protozoa) 	Single cell, moving, irregular shape
2.	Parameceium (Protozoa) 	Single cell, moves from one place to another, movement takes place with the help of specialised structures
3.	Chlamydomonas (Algae) 	Single cell, looks green because of the presence of green pigment, movement takes place with the help of specialised structures

Table 1.2: Organisms present in soil suspension

S. No.	Diagram	Remarks
1.	Bread mould (Fungi) 	Branched filament without chlorophyll having sac-like structure
2.	Mould (Fungi) 	Branched filament without chlorophyll having brush-like structure
3.	Algae 	Spherical, presence of chlorophyll — a green pigment
4.	Bacteria 	Spherical, comma, spiral or rod-shaped, one long hair-like structure and many small hair-like projections around the cell

Did you also observe any of these microorganisms or something different? Record in your notebook and discuss in your class. In Tables 1.1 and 1.2, you have identified a variety of microorganisms. They are everywhere, and we can only see them with a microscope — a device that magnifies them 100 to 400 times. Though microorganisms are small in size, they play an important role in our lives.



Bacterio Phage

Ever heard of...

Viruses are microscopic and acellular. Viruses multiply when they enter a living cell. They may infect plants, animals, or bacterial cells and may cause a disease.

1.4: How Are we Connected to Microbes?

Fig. 1.9: Fruit with microorganisms growing on it.

Can we find microorganisms in other places, too?
Let us have a discussion:

Have you ever seen a lemon, tomato, orange, or any other food item rot after being left outside for some time? If yes, you may have noticed a powdery or cotton-like growth on them (Fig. 1.9). This happens because they have been infected by microbes. But where did these microbes come from? How did they come in contact with the food? This happens because microorganisms can be found everywhere, be it in water, soil, air, or even in some food items.

But why do micro organisms not infect the pickles and murabbas?

This is because you add many spices with salt or sugar to it which act as preservatives. High concentration of salt or sugar do not allow these organisms to grow on them.

You can use a foldscope or a microscope to explore surfaces of leaves, stems, roots, or any other part to see them. Like plants and animals, microorganisms also show great diversity. Some of them can even be found in extreme climatic conditions, such as hot water springs and snow cold zones as well as at moderate temperatures. You already know some of these organisms live inside our bodies, especially in our gut! You have studied in the chapter 'Life Processes in Animals' in Grade 7 General Science that our intestine has many bacteria that help in digestion. Like plants and animals, microorganisms vary in shape, size, and structure. In Tables 1.1 and 1.2, you would have observed microorganisms of different shapes — spherical, rod-shape, or irregular.

How does the diversity of microorganisms play a role in our daily life? How do they help clean the environment?

1.4.1 Key players in cleaning the environment

Let us attempt to understand this by doing an activity.

Activity 1.7: Let us do

- Take an empty container and fill it halfway with garden soil.
- Add some fruit and vegetable peels to the container. Thereafter, put a layer of soil on it and leave it aside.
- After 2–3 weeks, observe the changes that have taken place.

- Do you observe any difference in the contents of the container?

Fig. 1.10: Recycling of nutrients by making manure

You may find that peels of fruits and vegetables have turned into a dark-coloured material. This is **manure**, which is rich in nutrients and helps increase the fertility of the soil. But how did the peels of fruits and vegetables turn into manure?

In Activity 1.6, you saw that soil contains various kinds of microorganisms. Some of these microorganisms, like fungi and bacteria, act on the plant waste and slowly break it down into simpler, nutrient-rich manure. You may have seen gardeners in your school or in a field near your house collecting dry leaves and plant waste and putting them into pits. Do you now understand why they do this? It is to make natural manure.

A Step Further

Compost Vs Manure: compost is made from plant and kitchen waste, it is prepared by decomposition of plant organic materials Manure is made from animal dung and urine and decomposed naturally, it has strong foul smell unlike compost . Both compost and manure are formed with the help of microorganisms.(Decomposers)

Our scientific heritage

Ancient Indian texts, particularly the Vedas, have references of the word 'Krimi' which means different tiny entities including 'Drishya' (visible) and 'Adrishya' (invisible). Various Vedic texts mention their beneficial and harmful effects. Atharvaveda also refers to 'Krimi'.

If you look around carefully, you might see decaying plants and fallen leaves stored in a container or lying in the garden, disappear after some time from the surroundings. This is because microorganisms breakdown and turn them into simpler substances rich in nutrients.These nutrients go back to the soil and help plants grow better. Microorganisms also decompose bodies of dead animals. So, microbes help recycle the waste and return important nutrients to nature. Manure formation occurs at optimal temperature and appropriate moisture level.

Isn't it interesting? By now, you must have understood that bacteria and some fungi are types of microorganisms that play an important role in our lives. And guess what, these helpful bacteria can also decompose animal wastes like dung!

From Activity 1.7, we can also infer that microorganisms not only help in plant growth, but also clean our environment by breaking down waste.

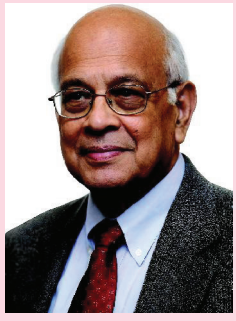
Now, think what would have happened if microorganisms did not exist on Earth?

A step further

Microbes as a source of biogas

Many microorganisms, like bacteria and fungi, live in an oxygen free environment. Some of these bacteria have the ability to decompose plant and animal waste present in the environment or household wastewater. During the process, they release a mixture of gases containing carbon dioxide, and a high proportion of another gas, methane. This gas has been used as a fuel source for cooking, heating, generating electricity, and to even run vehicles.

Be a Scientist



Dr. Ananda Mohan Chakrabarty (1938–2020) was a scientist who studied bacteria. In 1971, he developed a special bacterium that could break down oil spills, helping to clean the environment. His discovery received a patent in 1980. **Patent** is a copyright given to a person so that no one else can copy, use or sell his/her invention without permission. His work showed how microorganisms could be used to solve environmental problems like pollution. He is remembered for his contributions to science and for protecting the environment using microbes. What are the other problems which you think can be solved with the help of microorganisms?

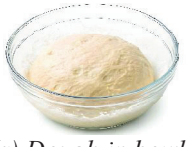
How does the diversity of microorganisms help in our kitchen?

1.4.2 Microorganisms and food

Let us try to understand by performing activities in the kitchen.

Activity 1.8: Let us perform

- Take two bowls A and B.
- In each, take 200 g of flour (atta or maida) and add a pinch of sugar.
- Now, in bowl A, add a small amount of yeast powder and mix it well with the flour.
- In bowl B, do not add any yeast, so that we can compare the results of the two bowls.
- Knead the flour of the two bowls with warm water to make soft dough (Fig. 1.11).



(a) Dough in bowl A

(b) Dough in bowl B

Fig. 1.11: Change in the volume of flour after addition of yeast, sugar, and warm water

- Cover the dough with a damp cloth and keep it in a warm place.
- Observe both the bowls after 4–5 hours.

Did you find any change in the volume, smell, or texture of the dough? If not, leave the dough for some more time. After some time, you may notice that the dough in bowl A, where yeast was added, has risen slightly, become fluffy, and has a different smell compared to the dough kneaded without yeast. Why does this happen? What is the role of yeast? Why did we add sugar and warm water to the flour?

Yeast is a type of microorganism. It belongs to a group of microorganisms, called **fungi**. Yeast grows well in warm conditions. You may recall from chapter 'Life Process in Animals' in Grade 7 that, like other organisms, yeast also respires and breaks down food to release energy for their growth and carry out life processes. During this process, carbon dioxide is released, which forms bubbles that makes the dough soft and fluffy. Yeast also produces a small amount of alcohol during this process, which gives the dough a slightly different smell. This special property of yeast is used in the process of making breads, cakes, and more! In addition to yeast, some bacteria, such as Lactobacillus, help in fermentation of batter for making idli and dosa, and dough for making bhatura.

Activity 1.9: Let us prepare

- Take two small glass bowls — label them 'A' and 'B'.
- Pour lukewarm milk in bowl A, and cold milk in bowl B.
- Now, add a small spoonful of curd to each bowl and mix well using a spoon.
- Cover both bowls. Keep bowl A in a warm place and bowl B in a cool place (like a refrigerator) for a few hours or overnight.
- Observe the changes in the glass bowls. Write your predictions and observations in Table 1.3.

Table 1.3: Testing for curd formation using milk in different conditions

	Change in the appearance of milk		Change in the colour of milk		Possible Reason
	Bowl A	Bowl B	Bowl A	Bowl B	
Prediction					
Observation					

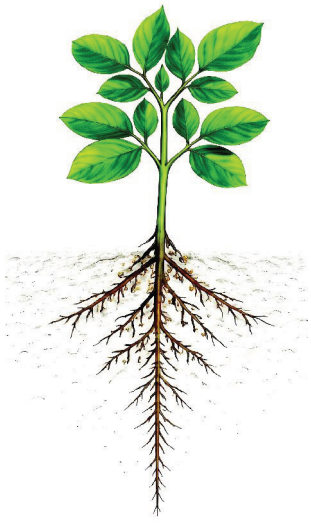


Fig. 1.12: Root nodules of Cowpea plant which contain Rhizobium

You will observe that in bowl A, the milk has turned into curd after a few hours and has become little sour. Whereas in bowl B, the milk has not curdled, but it might be a little sour. Do you know why this happens? The curd contains several types of bacteria. One of them is Lactobacillus. This bacterium feeds on the sugar in the milk (lactose), multiplies, and ferments the milk to form curd. Instead of producing alcohol (like yeast), these bacteria produce lactic acid, which makes curd sour. These bacteria grow well in warm conditions. That is why curd is formed in bowl A but not in bowl B.

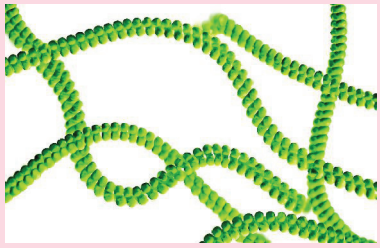
We can categorise the microorganisms into different categories, such as protozoa, fungi, bacteria, some algae, and more. Some bacteria, such as Rhizobium, form the swollen regions called nodules and live in them as shown in Fig. 1.12. Roots of certain legumes, such as beans, peas, and lentils have root nodules that contain Rhizobium bacteria. These bacteria trap nitrogen from the air and make it useful for the plants. This helps plants grow better without chemical fertilisers. That is why farmers grow legumes in rotation with other crops. This naturally increases the nitrogen in the soil and keeps it healthy for the next crop.

1.4.3 Amazing microalgae: tiny helpers in water

Microalgae are microscopic plant-like organisms that live in water, soil, air, and even on trees. They make their own food using sunlight. While doing this, they also release oxygen and produce more than half of the Earth's oxygen supply. They are rich in nutrients and serve as a food source for many aquatic animals. Some, like Spirulina, Chlorella, and Diatoms, are also used by humans as health supplements and medicines. Microalgae also help in cleaning water and are used to make biofuel. In some regions of AP like Konam reservoir of Vishakhapatnam and Srisailam reservoir of Kurnool district are utilized for water purification and as a feed to aquatic organisms

However, pollution, climate change, and habitat destruction are threatening microalgal diversity and abundance. It is important to conserve these tiny organisms to protect the environment and maintain oxygen balance on Earth.

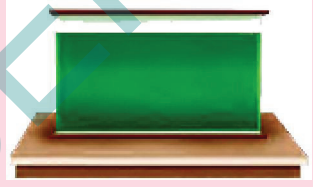
Ever heard of...



Spirulina, a microalgae, is called a superfood because of its health benefits. Spirulina is also a good source of vitamin B_{12}, which is essential for our body. It has a lot of protein— more than 60 per cent of its body weight—and only a small amount of fat and sugar.

Nowadays, farming of Spirulina is becoming a feasible livelihood opportunity. You can grow Spirulina easily by following these steps:

1. Set a clear glass tank in a bright place away from direct sunlight.
2. Cover the tank with a shade net, or keep the tank at a place with moderate temperature conditions.
3. Fill the tank with pond water.
4. Add living Spirulina collected from a pond.
5. Stir the growing Spirulina twice a week.
6. After 3–6 weeks, Spirulina may be harvested from the tank by filtering it through a fine cloth.



Conservation of microalgae is a good practice for ensuring food security and livelihood development.

1.5 Why Is Cell Considered to Be a Basic Unit of Life?

The body of all living organisms are made up of tiny building blocks called cells. A single cell contains various components that help organisms perform various functions. The bodies of all plants and animals are made up of many cells. Therefore, they are called **multicellular** (many-celled) organisms. In multicellular organisms, cells carry out specialised functions individually but also cooperate with each other to increase the chance of survival.

Some microorganisms, such as bacteria and protozoa, are made up of just one cell. These are called **unicellular** (single-celled) organisms. They carry out all the functions necessary for their survival in a single cell. Other microbes, like algae and fungi, are made up of one or more cells. For example, yeast is a unicellular fungus while mould is a multicellular fungus.

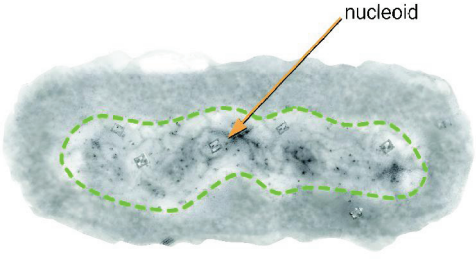


Fig. 1.13: A bacterial cell showing the nucleoid region

Like animal and plant cells, the cells of microorganisms are also surrounded by a cell membrane. Cells of fungi additionally have a cell wall, but they do not have chloroplasts, so they cannot make their own food through photosynthesis. Bacteria do not have a well-defined nucleus and a nuclear membrane. Instead they have a nucleoid. This feature distinguishes them from cells of yeast, protozoa, algae, fungi, plants, and animals.

We have only looked at a few basic cell structures here. The cell has other components about which you will learn in higher classes. For observing subcellular components, we need microscopes with high magnification. An electron microscope magnifies the cell about 10,00,000 times, where we can see more structures present in a cell.

By now, you must have understood that all living beings, including microorganisms, are made up of one or more cells. Their cells differ in size, shape, and structure. Plant and animal cells also have some differences. Understanding these differences helps us learn how these organisms function differently.

In this chapter, we have learnt about the beneficial microorganisms. However, there are some microbes that cause diseases in plants and animals including humans. We will learn about some of the diseases caused by microbes in the next chapter.

Keywords

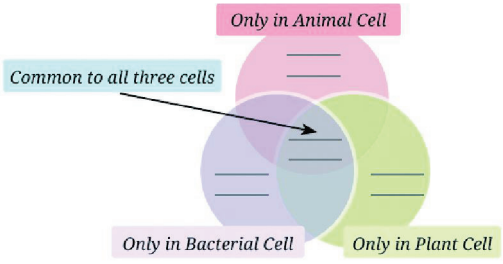
Organisms | Cells | Cell membrane
Nucleus | Cytoplasm | Cell wall
Plastids | Chloroplasts | Vacuole
Muscle | Nerve | Neurons
Tissue | Organ system | Micro Organisms
Soil suspension | Microbes | Manure
Biogas | Fungi | Multi&Uni-Cellular

Snapshots

- Microorganisms are small-sized organisms and are not visible to the unaided eye.
- They can live in all kinds of environments, and even in the bodies of plants and animals.
- They are either unicellular or multicellular. Bacteria and protozoans are unicellular; fungi can be unicellular or multicellular, while plants and animals are multicellular.
- The cell is a basic unit of life.
- The body of all living organisms is made up of cells. A cell contains various components which help the organisms perform their functions and survive.
- A typical cell is bounded by a cell membrane, filled with cytoplasm and contains a nucleus. Plant, fungal, and bacterial cells have an extra covering, called a cell wall, around the cell membrane. Bacteria lack a well-defined nucleus.
- Cells differ in shape and size. Their shape is related to the function performed by them.
- Bacteria, fungi, and protozoa are different kinds of microorganisms.
- Viruses are also small in size, but they are different from other microorganisms since they reproduce only inside the host organism.
- Microorganisms can be beneficial or harmful to us.
- Some microorganisms decompose the plant and animal waste into simple substances and clean up the environment.
- Some microorganisms reside in the root nodules of legumes, such as peas, beans, and lentils. They trap nitrogen from the air and increase the soil fertility.
- Yeasts are fungi which are used in the process of making breads, cakes, pastries, idlis, dosas, and bhaturas.
- Lactobacillus is used in the curd formation at home and fermentation process in food industry.

Keep the curiosity alive

1. Various parts of a cell are given below.
   Write them in the appropriate places in the following diagram.



   Nucleus — Cytoplasm
   Chloroplast — Cell wall
   Cell membrane — Nucleoid

2. Visali took two test tubes and marked them A and B. She put two spoonfuls of sugar solution in each of the test tubes. In test tube B, she added a spoonful of yeast. Then she attached two incompletely inflated balloons to the mouth of each test tube. She kept the set-up in a warm place, away from sunlight.
   (i) What do you predict will happen after 3–4 days? She observed that the balloon attached to test tube B was inflated. What can be a possible explanation for this?
      (a) Water evaporated in test tube B and filled the balloon with the water vapour.
      (b) The warm atmosphere expanded the air inside the test tube B, which inflated the balloon.
      (c) Yeast produced a gas inside the test tube B which inflated the balloon.
      (d) Sugar reacted with warm air, which produced gas, eventually inflating the balloon.

Fig. 1.14: Experimental set-up

   (ii) She took another test tube, 1/4 filled with lime water. She removed the balloon from test tube B in such a manner that the gas inside the balloon did not escape. She attached the balloon to the test tube with lime water and shook it well. What do you think she wants to find out?
3. A farmer was planting wheat crops in his field. He added nitrogen-rich fertiliser to the soil to get a good yield of crops. In the neighbouring field, another farmer was growing bean crops, but she preferred not to add nitrogen fertiliser to get healthy crops. Can you think of the reasons?

4. Sneha dug two pits, A and B, in her garden. In pit A, she put fruit and vegetable peels and mixed it with dried leaves. In pit B, she dumped the same kind of waste without mixing it with dried leaves. She covered both the pits with soil and observed after 3 weeks. What is she trying to test?
5. Identify the following microorganisms:
   (i) I live in every kind of environment, and inside your gut.
   (ii) I make bread and cakes soft and fluffy.
   (iii) I live in the roots of pulse crops and provide nutrients for their growth.
6. Devise an experiment to test that microorganisms need optimal temperature, air, and moisture for their growth.
7. Take 2 slices of bread. Place one slice in a plate near the sink. Place the other slice in the refrigerator. Compare after three days. Note your observations. Give reasons for your observations.
8. A student observes that when curd is left out for a day, it becomes more sour. What can be two possible explanations for this observation?
9. Observe the set-up given in Fig. 1.15 and answer the following questions.
   (i) What happens to the sugar solution in flask A?
   (ii) What do you observe in test tube B after four hours? Why do you think this happened?
   (iii) What would happen if yeast was not added in flask A?

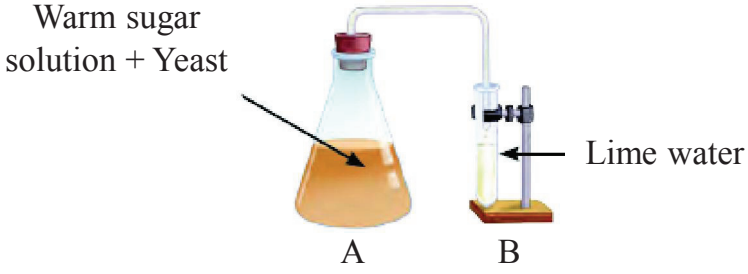


Fig. 1.15 : Experimental set-up

Discover, design and debate

- India has a long history of biogas production. One of our oldest biogas plant was set up in late 1850s. Find out about the Biogas Program initiated by the Ministry of New and Renewable Energy, Government of India.
- Fermented food items like fermented soybeans and fermented bamboo shoots are consumed as traditional food in some parts of India. With the help of your parents and teachers, list some traditional food items from your area that utilise the process of fermentation. Investigate the ingredients used in the preparation of these fermented food items; the method of preparing them; the microorganism responsible for the fermentation of the food, and the cultural and nutritional importance of the fermented food.
- Study the different parts of a macro fungus mushroom using a magnifying glass and microscope/foldscope. Take the help of students from senior classes and explore the internal structure of different parts of mushrooms under the microscope/foldscope in your school laboratory.
- Interact with an entrepreneur and learn the steps for cultivation of mushroom.

Reflect on the question framed by your friends and try to answer....

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Health

2

Learners will be able to:

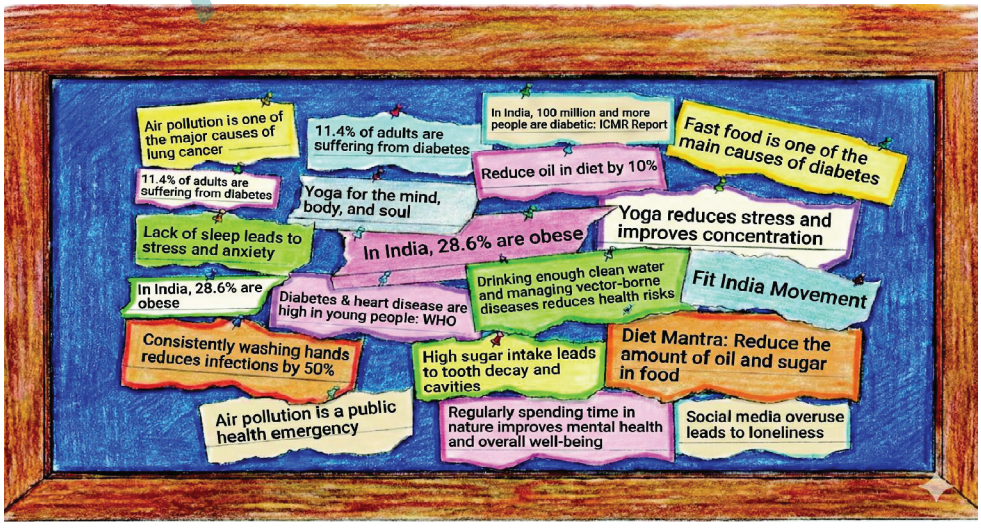
- Explain the ways to follow for being healthy.(CG-4)
- Differentiate between communicable and non-communicable diseases.(CG-4)
- Conduct simple investigations to know the causes of communicable diseases.(CG-6)
- Apply the knowledge of being healthy in daily life by maintaining good health.(CG-4)
- Describe the ability of our body to fight against diseases.(CG-4)
- Appreciates the contributions of scientists in medicines to hlep us cure from diseases.(CG-9)

P8K6S4

Probe and Ponder

- How does your body respond to an infection such as common cold?
- We rarely see cases of smallpox or polio these days, but diseases like diabetes and heart problems are more common. Why?
- Could climate change lead to new types of diseases?
- How do emotions like stress or worry affect us and make us sick?
- Why do some groups of people get affected more than others during disease outbreaks?
- **Share your questions.**

Bulletin Board



2.1 Health: Is It More Than Not Falling Sick?

What do the news clippings on the bulletin board tell you about people's health in our country? Is being healthy just about not having diseases? Health also includes feeling good physically, staying positive, and having strong relationships. A healthy person takes care of their body, maintains a positive mindset, and enjoys social life. Let us now explore what it truly means to be healthy.

Activity 2.1: Let us observe

A Grade 8 student moved to a new school in another city. With no friends in his new environment and busy parents, he felt lonely. To cope, he spent more time on his phone and social media, but this made him feel worse. He stopped trying to make friends, had headaches, lost weight, and could not sleep well. A doctor advised less screen time and meeting a counsellor. The school counsellor arranged help to support him in making friends and improving his health.

Think and **Reflect:** What was the cause of the boy's health problems? How did his habits and surroundings affect his well-being?

Fig. 2.1: Aspects of health

As per the World Health Organization (WHO), health is defined as a 'state of complete physical, mental, and social well-being, and not merely the absence of disease' (Fig. 2.1). A healthy person can perform various tasks more efficiently and cope well in different and difficult situations. A healthy person can adjust well with peer groups and other members of society. Let us understand more about health.

Our scientific heritage

Ayurveda teaches us that true health is a balance of body, mind, and surroundings. Following dinacharya (daily routine) and ritucharya (seasonal routine) helps maintain this balance. Eating fresh, wholesome food suited to one's prakriti (body constitution) is essential. Regular exercise, cleanliness, restful sleep, and a calm mind support overall well-being. This can also be achieved through practices like yoga, meditation, and mindfulness.

2.2 How Can We Stay Healthy?

Staying healthy means eating nutritious food, maintaining hygiene, staying in a clean place, exercising regularly, getting proper sleep, spending time with family and friends, and having a positive attitude. What we should do and what should not do to keep ourselves healthy?

Activity 2.2: Let us list

Eat a balanced diet

Stay physically active

Say no to smoking or alcohol

Manage stress

Get enough sleep

Fig. 2.2 How to be healthy

❖ List some good habits that your parents, teachers, or elders often encourage you to follow. How many of these are already a part of your daily routine? Which ones would you like to start following? Add to the list below:

- Keep yourself clean and maintain personal hygiene.
- Eat a healthy and balanced diet.
- Exercise regularly.
- Make time to relax or meditate every day.

❖ Now, think about habits that are not good for your health. Add more to the list below:

- Spending too much time on mobile phones or other digital screens.
- Eating fast food and other junk food every day.
- Sleeping very late or not getting enough sleep.
- Skipping meals, especially breakfast.

Taking care of our body and mind is important. Healthy habits support a healthy body as well as a healthy mind.

Discuss your findings with your friends and teacher. From the activity you participated in and the discussions, you may have realised that our health depends on many factors. These factors include our lifestyle (how we live) and our environment (our surroundings).

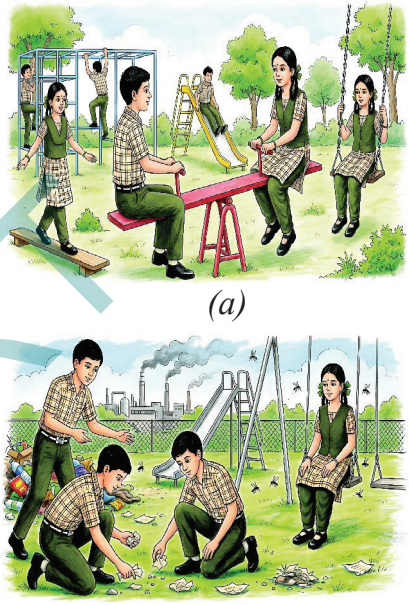
2.2.1 Maintain a healthy lifestyle

- Eat a balanced diet with plenty of fruits, vegetables, and whole grains.
- Avoid processed, fatty, or sugary food and drinks.
- Stay physically active by playing outdoors, walking, running, cycling, or exercising.
- Limit screen time and spend more time in nature.
- Get enough sleep to help your body and mind rest and recover.
- Practice yoga or simple breathing exercises like pranayama regularly.
- Say 'NO' to harmful substances things like tobacco, alcohol, and addictive drugs (Fig. 2.2).

2.2.2 Keep the environment clean

Activity 2.3: Let us compare

- Look at Fig. 2.3a and Fig. 2.3b. Which playground would you like to play in, and why?
- Most of us would like to play in the playground shown in Fig. 2.3a as it is clean, well-maintained, and looks beautiful. The playground in Fig. 2.3b is polluted, dirty, unhygienic, and full of flies and mosquitoes. People living in such areas may fall sick more often.
- In addition to inculcating good habits and adopting a healthy lifestyle, we must keep ourselves and our surroundings clean.
- Have you ever found it hard to breathe in a place with a lot of smoke or dust? That is because clean air and water are important for our health. In cities, air pollution from vehicles and factories can cause problems like coughing or asthma. The Air Quality Index (AQI) helps us know how clean the air is. A cleaner environment helps us stay healthy and feel better.
- But health is not only about the body.
  Our feelings and relationships matter too. Even if we eat well and live in a clean place, we may not feel good if we are lonely or upset. Spending time with friends and family, talking, laughing, and having fun help keep our minds healthy too.



(a)

(b)

Fig. 2.3: Two different playgrounds

2.3 How Do We Know That We Are Unwell?

Our body usually works in a certain way to keep us healthy. When we feel unwell, it means something inside us may not be working as it should. We may have symptoms, such as pain, tiredness, or dizziness, and signs like fever, rash, high blood pressure, or swelling that indicate we are unwell. A symptom is what we feel (like pain), while a sign is something that can be seen or measured (like high body temperature when we have fever). These help doctors understand what might be making us unwell.

2.4 Diseases: What Are the Causes and Types?

A disease is a condition that affects the normal working of the body or mind. It can happen when one or more organs or organ systems stop functioning properly. Some diseases are caused by germs like bacteria, viruses, fungi, worms, or even by protozoa (single-celled organisms). These disease-causing organisms are called **pathogens**. Other diseases may result from poor nutrition or an unhealthy lifestyle. Some diseases last for a short time, while others can continue for a long time and need regular treatment or care.

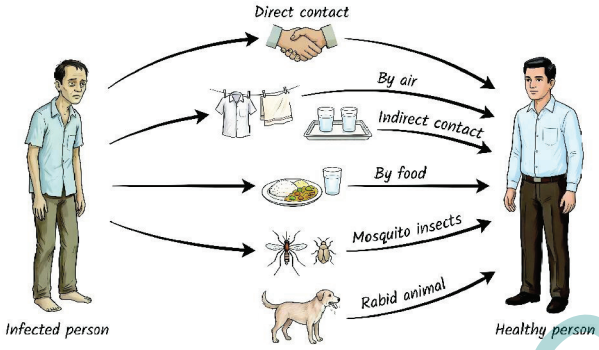


Fig. 2.4: Common methods of transmission of diseases

Diseases can be grouped into two major types based on their causes and how they spread:

- Non-communicable diseases— Some diseases, like cancer, diabetes, or asthma, are not caused by pathogens and do not spread from one person to another. They are usually linked to lifestyle, diet, and/or environment.
- Communicable diseases— Diseases caused by pathogens are called communicable diseases. They can spread from one person to another. Some examples of communicable diseases are typhoid, dengue, flu, chickenpox, and COVID-19.

In recent years, non-communicable diseases (NCDs) like diabetes, heart disease, and cancer have become more common in India. This is happening because of changes in how people live — such as eating more processed food, getting less exercise, and living longer lives. Today, most deaths in India are caused by NCDs. Understanding the difference between these two types helps us know how diseases spread and how to prevent them.

2.4.1 How are communicable diseases caused and spread?

All communicable diseases are caused by pathogens. These pathogens can enter our body through the air we breathe or by consuming contaminated food or water and more. But how do these pathogens spread from one person to another? One common way is through air, when an infected person coughs or sneezes, or through direct contact like shaking hands, or indirectly by sharing personal

items of an infected person. Some of the communicable diseases spread through contaminated drinking water or food. Some pathogens are also spread by insects like mosquitoes and houseflies — these insects are called **vectors** (Fig. 2.4).

By understanding how diseases spread, we can take simple steps to protect ourselves and others. Let us find out how these communicable diseases spread and how we can prevent them.

Activity 2.4: Let us find out

- Grade 8 students listed some common communicable diseases in Table 2.1 during a community campaign and a library survey.
- Check the information listed by referring to books, trusted websites, or asking your science teacher. Add any missing details.
- Study the table and think about what simple steps can help prevent each disease.

Table 2.1: Some common communicable diseases affecting humans

Diseases	Causal agent	Site of infection	Symptoms	Preventure measures
Diseases spread through the air				
Common cold and Influenza 	Virus	Respiratory tract	Nasal congestion and discharge, sore throat, fever, cough, body ache	Washing hands frequently, not sharing personal items, covering the mouth and nose
Chicken pox 	Virus	Respiratory tract, skin	Mild fever, itchy skin, rashes, blisters	Complete isolation of the patient, covering the mouth and nose, vaccination
Measles 	Virus	Skin, Respiratory tract	Fever, sore throat, and reddish rashes on the neck, ears and other parts of the skin	Isolation of the patient, covering the mouth and nose, maintaining good hygiene, vaccination

Tuberculosis (TB) 	Bacteria	Lungs	Cough, fever, fatigue, loss of appetite, night sweats	Avoiding close contact with TB-infected people, covering the mouth and nose, maintaining good hygiene, getting vaccinated
Diseases spread through contaminated water and food				
Hepatitis A 	Virus	Liver	Fatigue, fever, loss of appetite, nausea, vomiting, jaundice, pain in the upper right abdomen	Drinking boiled water, vaccination
Cholera 	Bacteria	Intestine	Diarrhoea and dehydration	Maintain personal hygiene and good sanitary habits, consumption of properly cooked food and boiled drinking water, vaccination
Typhoid 	Bacteria	Intestine	Headache, abdominal discomfort, fever, and diarrhoea	Maintain personal hygiene and good sanitary habits, consumption of properly cooked food and boiled drinking water, vaccination
Ascariasis (roundworms) 	Worms	Intestine	Worms in stool, loss of appetite, poor growth, diarrhoea, weight loss, anaemia	Maintain personal hygiene and good sanitary habits, consumption of properly cooked food and boiled drinking water

Diseases transmitted by insects				
Malaria 	Protozoa	Skin, blood	High fever, profuse sweating, periodic chills	Use of mosquito nets and repellents, wearing long–sleeved clothes, control of mosquito breeding in and around your home
Dengue fever (Break bone fever) 	Virus	Skin, blood	Fever, headache, muscle and joint pain, nausea	Use of mosquito nets and repellents, wearing long-sleeved clothes, control of mosquito breeding in and around your home, avoiding areas with still water

By studying the Table 2.1, we can understand how infectious diseases spread and how to prevent them. Here are some simple but important precautions:

- Keeping ourselves and our surroundings clean.
- Practising basic hygiene every day.
- Washing hands with soap and water to remove pathogens.
- Covering our mouth and nose while coughing or sneezing.
- Wearing a mask in crowded places provides protection.
- Avoid sharing of personal items like towels and handkerchiefs.
- Keeping our home, food, and water clean.
- Staying at home and resting when we are unwell helps the body recover and minimises spreading the disease to others.

- Are diseases always caused by infections?
- Are any diseases eradicated or eleminated?

Some infectious diseases are caused by worms that live inside our bodies, especially in the digestive system. They feed on nutrients and live as **parasites** — organisms that live in or on another living being. These worms usually spread through contaminated food, water, soil, or contact with infected people or animals.

2.4.2 How are non-communicable diseases caused?

You learnt that non-communicable diseases like cancer, diabetes, and asthma are linked to lifestyle, diet, and/or environment. They are the most common cause of death in India. In Grade 6, you also learnt about diseases like scurvy, anaemia, and goitre, which are caused by a lack of specific nutrients in the diet. These are called **Nutritional deficiency diseases** are also non-communicable.

Diseases such as cancer, diabetes, and asthma may often persist for a long time (more than 3 months) and are referred to as **chronic diseases.**

Diabetes is a common disease which is becoming more prevalent in adults as well as children. In fact, India now has one of the highest numbers of people with diabetes in the world. It often develops due to a combination of hormonal imbalances, unhealthy eating habits, lack of physical activity, being overweight or obese, and other reasons.

Let us learn more about the causes of non-communicable diseases and their prevention.

Activity 2.5: Let us survey

- Find out the three most common lifestyle-related diseases in your neighbourhood
- Talk to a doctor, nurse, health worker or even a family member who knows about health and what kind of lifestyle changes can help prevent or manage these diseases.
- You can also consult trusted health websites, books, teachers and doctors.
- Fill in Table 2.2 and learn more about lifestyle-related diseases.

Table 2.2: Non-communicable diseases

S.No	Name of common lifestyle-related diseases	Signs and symptoms	Suggested lifestyle change(s)
1.	Obesity		Eating a balanced diet and exercising regularly
2.	Diabetes	• Frequent urination • Excessive thirst • Weight loss • Tiredness • Slow healing of wounds	
3.	High blood pressure		
4.	.....	.....	.....

Be a scientist

Dr. Kamal Ranadive (1917–2001) was a pioneering biomedical researcher. She studied how hormones and certain viruses are linked to cancer, helping improve its treatment and prevention. Her work also showed how tobacco, diet and pollution can raise the risk of cancer, highlighting the importance of a healthy lifestyle.

2.5 How to Prevent and Control Diseases?

You might have heard the phrase 'Prevention is better than cure.' It is important to protect ourselves from both communicable and non-communicable diseases.

Activity 2.6: Let us read

Odisha — community-led sanitation campaign

In Bhadrak district, Odisha, a community sanitation campaign helped more people build and use toilets. This reduced open defecation significantly, and improved child health, with fewer cases of diarrhoea and infections.

What do you infer from this case study? Simple steps like good sanitation can greatly reduce the spread of communicable diseases. Find about such community campaigns held in your location. Share in your class and discuss with your peers about the impact of such initiatives.

Ability of the body to fight diseases

You would have noticed that some people get sick more frequently than others, although living in a similar environment. Do you know why? The natural ability of our body to fight diseases is known as **immunity**. Our body has a special system called the immune system that helps fight against diseases.

You might have taken some drops or injections in your childhood to protect yourself from certain diseases, such as polio, measles, tetanus, and hepatitis. These are **vaccines** that help prevent serious infections caused by viruses and bacteria.

A vaccine helps our body fight certain diseases by training the immune system to recognise and attack harmful germs. providing what is known as **acquired immunity** — protection developed after exposure to a pathogen or a vaccine. Vaccines can be made in different ways — from weakened or dead pathogens (like viruses or bacteria), or from inactive or harmless parts of the pathogen. Some newer vaccines instruct our own body cells

to make a harmless part of the germ.

which our immune system then learns to fight. For example, a tetanus shot, often given after an injury protects against infection by the tetanus-causing bacteria. It contains an inactivated bacterial toxin that helps the immune system develop protection without causing the disease.

Do you know when the first vaccine was discovered?

Edward Jenner and the smallpox vaccine

Smallpox was a deadly disease that caused blisters and killed millions. A milder disease called cowpox, seen in cows, could also infect humans. In the late 1700s, English doctor Edward Jenner discovered that people who had cowpox did not get smallpox. This led to the invention of the first vaccine and helped protect people from smallpox.

Our scientific heritage

Long before modern vaccines, India had a traditional method called variolation to protect against smallpox. It involved using material from a smallpox sore to scratch the skin and create a mild infection and build immunity. People who performed this practice were known as teekedaars.

Think like a scientist

Observations

Jenner observed that milkmaids who had cowpox did not catch smallpox, likely because the two viruses are related.

Hypothesis

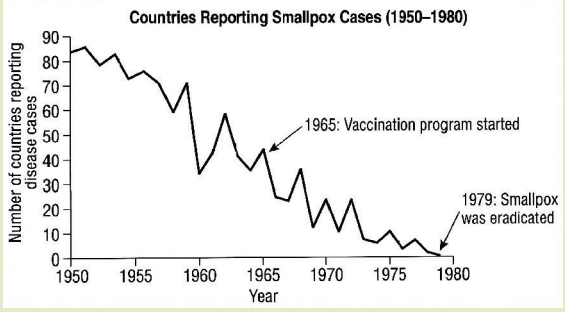
Content in the pus of cowpox blisters protected people from smallpox.

Experimentation

He tested this by injecting cowpox sap into a boy, who later showed no illness when exposed to smallpox.

Result

He found that people who were infected with cowpox sap were now resistant to smallpox.

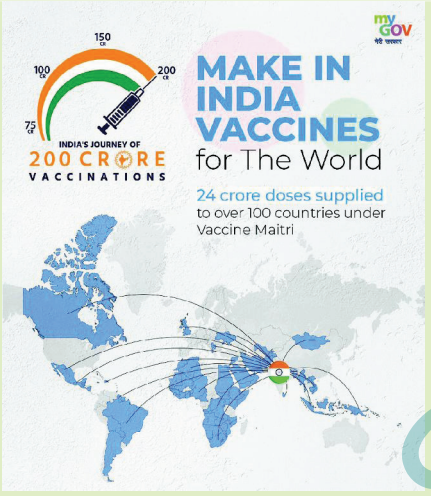


Application

Mass vaccination eventually helped eradicate smallpox worldwide.

Vaccines are one of the most effective ways to protect people of all ages — from infants to the elderly — against many serious diseases. They help prevent illnesses, reduce the spread of infections, and save millions of lives every year. It is important to remember that vaccines are preventive, not curative — they can help minimise serious diseases before they happen, but do not treat them once someone is already sick. Some people may fear or doubt vaccines, but scientists and doctors carefully test them for safety. Getting vaccinated not only protects you but also the people around you.

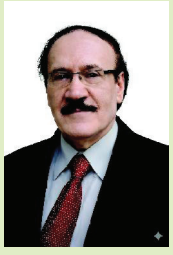
Ever heard of..



India's Role in Vaccine Production

India is one of the world's largest vaccine producers. It manufactures vaccines on a massive scale and supplies them to many countries. Indian vaccine companies played a key role during the COVID-19 pandemic and continue to support global health efforts.

Be a scientist



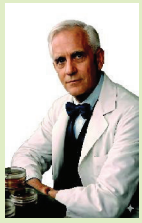
Dr. Maharaj Kishan Bhan was a well-known Indian doctor and scientist. As Secretary of the Department of Biotechnology, he helped promote science and innovation in India. He played a key role in developing the Rotavirus vaccine, which protects children from diarrhoea. He believed in using research to create affordable healthcare and made a big difference in India's health and biotechnology sectors.

2.5.1 Treatment of diseases

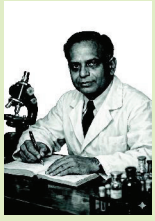
If our immune system fails to protect us against an infectious disease, we fall ill and need to visit a doctor. The doctor may give us medicines called **antibiotics**, which kill the bacteria that might have caused the disease. Antibiotics work only against bacterial infections because they target parts of bacterial cells that are different from human or other animal cells. They do not work against viruses or diseases caused by protozoa.

Think like a scientist

Discovery of the first antibiotic, Penicillin and Tetracycline



Penicillin was discovered in 1928 by Alexander Fleming, a bacteriologist from London. While studying harmful bacteria, he noticed that a mould on a discarded petri dish stopped the bacteria from growing. He realized the mould released a substance that killed the bacteria. This chance discovery led to the discovery of penicillin, the first antibiotic used to treat bacterial infections.



Discovery of Tetracycline :

Dr. Yellapragada Subba Rao, born in 1895 in Bhimavaram of Andhra Pradesh, was a biochemist. He discovered many drugs(medicines). He is called a "Wizard man of the wonder drugs". In his childhood, he lost his brother due to disease plague. He felt very sad and decided to find a medicine for that disease. Finally, he discovered tetracyline to cure plague.

Though antibiotics are effective in protecting us against bacterial infections and have saved millions of lives since their discovery, their indiscriminate use has led to a decline in their effectiveness (Fig. 2.5a). Nowadays, there are news headlines about antibiotic resistance, a phenomenon where bacteria that were earlier killed by a given antibiotic are found to survive and multiply despite treatment with that antibiotic. This makes common infections harder to treat and increases the risk of complications, prolonged illness, and even death.

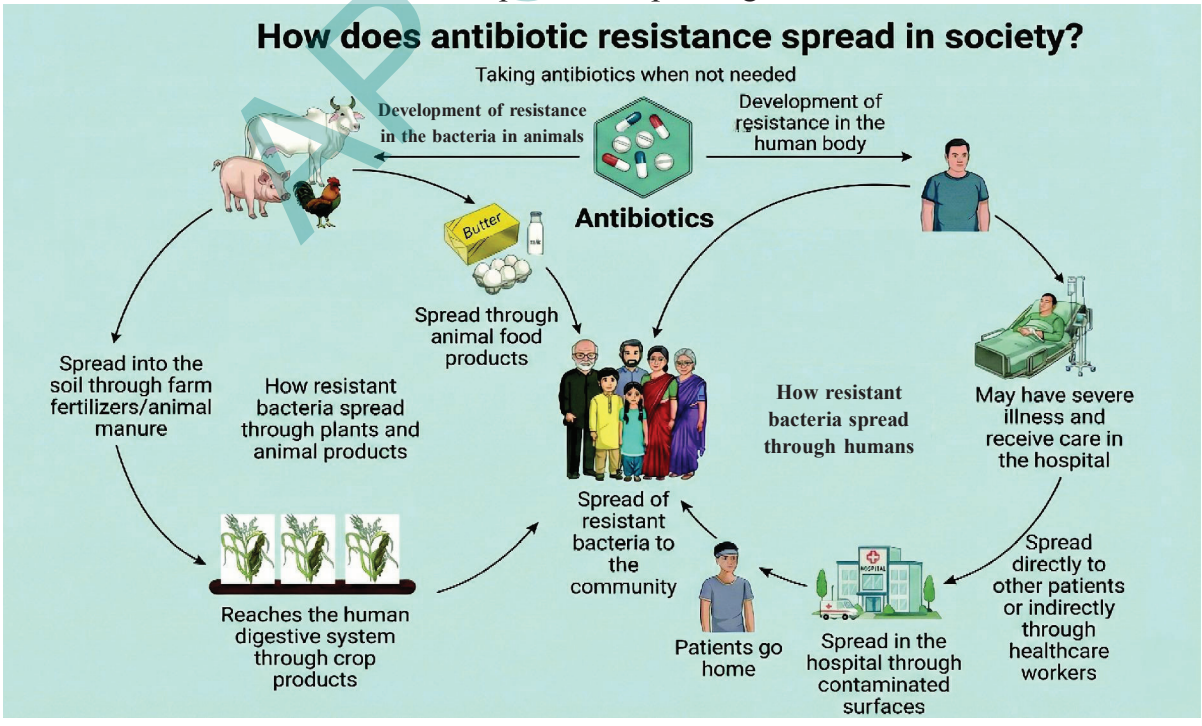


Fig.2.5(a) spread of antibiotic-resistant bacteria in community

Activity 2.7: Let us infer

- Study the infographic given in Fig. 2.5b. How do you think the antibiotic resistance has been developed in bacterial pathogens? What precautions may be taken to r antibiotic resistance?
- To tackle the problem of antibiotic resistance, we must use antibiotics wisely- only when prescribed by a doctor, in the correct dose, and for the right duration. Avoiding unnecessary use helps prevent the rise of resistant bacteria and keeps antibiotics effective for future generations.

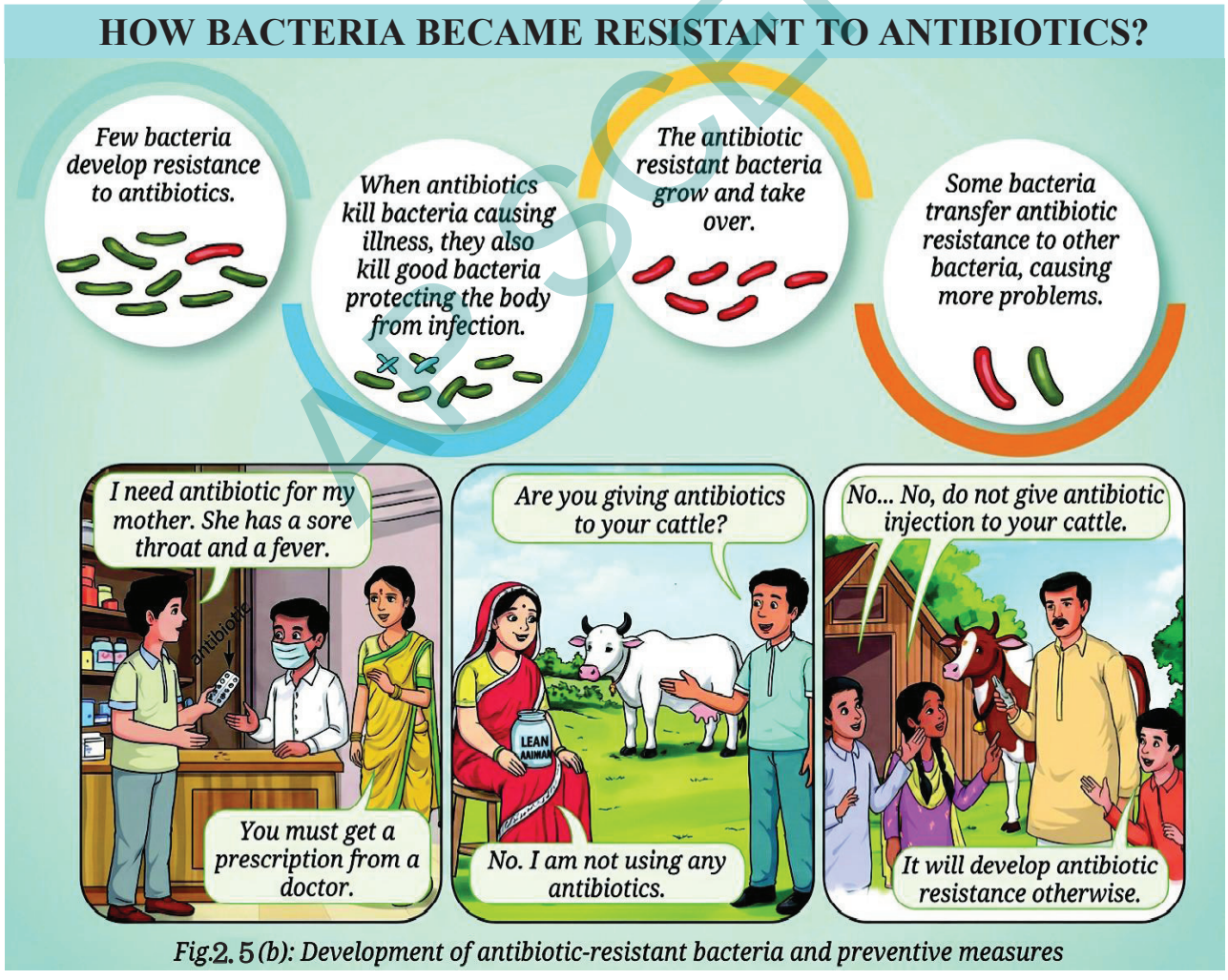


Fig.2. 5 (b): Development of antibiotic-resistant bacteria and preventive measures

Traditional medicine systems like Ayurveda, Siddha, and Unani have been used in India for many years to manage common health problems. They use natural substances like herbs, oils, and minerals for managing illnesses and promoting recovery, and focus on a healthy lifestyle and balanced diet. While these systems can help with some conditions, and are useful for everyday well-being, they may not be effective for all diseases and at all stages.

Therapies for non-communicable diseases focus on managing symptoms and improving quality of life through medication, lifestyle changes, and rehabilitation. Early diagnosis and continuous care are key to control the disease progression and prevent complications.

Keywords

Air Quality Index **Pathogens** **Vectors**

Parasites **Deficiency disesases** **Chronic diseases**

Immunity **acquired immunity** **Antibiotics**

Basic hygiene

Snapshots

- Health means complete physical, mental, and social well-being — not just the absence of disease.
- Being happy helps us stay active and healthy, and good health also improves our mood. Health and happiness are closely related.
- A disease affects the normal working of the body or mind.
- Symptoms are what we feel (like pain or tiredness); signs are what can be seen or measured (like fever or rash).
- Non-communicable diseases like diabetes and heart disease are caused by lifestyle and environmental factors, not germs. They can often be prevented with healthy habits, lifestyle changes, and regular exercise.
- Infectious diseases are caused by pathogens like bacteria, viruses, or worms.
- Our immune system helps protect us from harmful pathogens.
- Vaccines train the immune system using dead, weakened, or harmless parts of a germ to prevent disease.
- Diagnosis and treatment are important for managing and curing diseases.

Keep the curiosity alive

1. Group the diseases shown in the images as communicable or non-communicable.


Cold and flu


Typhoid


Diabetes


Asthma


Chicken pox

2. Diseases can be broadly grouped into communicable and non-communicable diseases. From the options given below, identify the non-communicable diseases.
   (i) Typhoid (ii) Asthma (iii) Diabetes (iv) Measles
   (a) (i) and (ii) (b) (ii) and (iii) (c) (i) and (iv) (d) (ii) and (iv)
3. There is a flu outbreak in your school. Several classmates are absent, while some are still coming to school coughing and sneezing.
   (i) What immediate actions should the school take to prevent further spread?
   (ii) If your classmate, who shares the bench with you, starts showing symptoms of the flu, how can you respond in a considerate way without being rude or hurtful?
   (iii) How can you protect yourself and others from getting infected in this situation?
4. Your family is planning to travel to another city where malaria is prevalent.
   (i) What precautions should you take before, during, and after the trip?
   (ii) How can you explain the importance of mosquito nets or repellents to your sibling?
   (iii) What could happen if travellers ignore health advisories in such areas?
5. Your uncle has started smoking just to fit in with his friends, even though it is well known that smoking can seriously harm health and even cause death.
   (i) What would you say to him to make him stop, without being rude?
   (ii) What would you do if your friend offers you a cigarette at a party?
   (iii) How can schools help prevent students from indulging in such harmful habits?
6. Saniya claims to her friend Vinita that "Antibiotics can cure any infection, so we don't need to worry about diseases." What question(s) can Vinita ask her to help Saniya understand that her statement is incorrect?
7. Imagine you are in charge of a school health campaign. What key messages would ou use to reduce communicable and non-communicable diseases?
8. It is recommended that we should not take an antibiotic for a viral infection like a cold, a cough, or flu. Can you provide the possible reason for this recommendation?
9. Which disease(s) among the following may spread if drinking water gets contaminated by the excreta from an infected person?
   Hepatitis A, Tuberculosis, Poliomyelitis, Cholera, Chickenpox.

10. The following table contains information about the number of dengue cases reported in a hospital over a period of one year:

S.No	1	2	3	4	5	6
Month	January	February	March	April	May	June
No. of dengue cases	10	12	15	18	22	40

S.No	7	8	9	10	11	12
Month	July	August	September	October	November	December
No. of dengue cases	65	65	65	30	30	20

Make a bar graph of the number of cases on the Y-axis and the month on the X-axis. Critically analyse your findings and answer the following:

(i) In which three months were the dengue cases highest?

(ii) In which month(s) were the cases lowest?

(iii) What natural or environmental factors during the peak months might contribute to the increase in dengue cases?

(iv) Suggest a few preventive steps that the community or government can take before the peak season to reduce the spread of dengue.

11. When our body encounters a pathogen for the first time, the immune response is generally low but on exposure to the same pathogen again, the immune response by the body is much more compared to the first exposure. Why is it so?

Discover, design, and debate

- Read about Indian scientists like Suniti Solomon, Asima Chatterjee, Dr. Yellapragada Subbarao, Dr. Mary Poonen Lukose for their contributions in the field of health and diseases.
- The deadly disease smallpox was eradicated by vaccination. Discover how this was done and why it worked. Debate whether everyone should be required to get vaccinated to protect others.
- According to current guidelines, learn the correct sequence of steps for performing cardiopulmonary resuscitation (CPR) on an adult in case of sudden stoppage of breathing. School may invite a doctor or a professional to demonstrate a mock drill.
- Invite a doctor to the school. Students may be encouraged to interact with the doctor on the issues of malnutrition, under-nutrition, and over-nutrition.
- If you are given an opportunity to create a health card, what all would you like to include in it. Create your own health card and have discussion about it.

Nature's Harmony

3

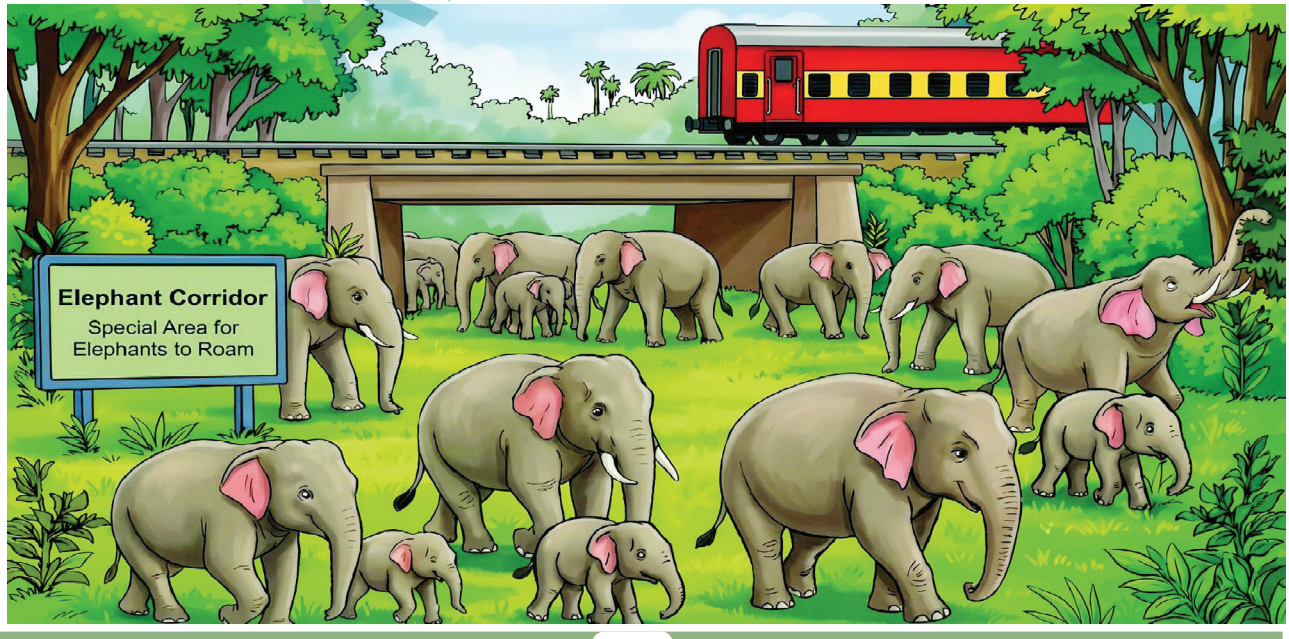
Learners will be able to:

- Define the term "ecosystem."(CG-3)
- Identify the differences between biotic (living) and abiotic (non-living) components within a given ecosystem.(CG-3)
- Describe the different trophic levels.(CG-3)
- Interpret a food chain and a food web.(CG-3)
- Identify different types of ecosystems.(CG-3)
- Respond to the imbalances in an ecosystem due to the human interference.(CG-6)

G6P1F5

Probe and Ponder

- How might the loss of forest cover and changes in rainfall patterns lead to elephants to enter human farms and villages?
- Imagine you are a tree in a dense forest. What kind of relationships would you have with water, sunlight, other animals, and other components of the forest?
- Do you think the Earth can thrive without humans? Can humans survive without the earth?
- If two kinds of birds compete for the same fruit, how might their way of living change over time?
- Can human actions cause natural disasters?
- **Share your questions**



In several parts of India, particularly in states like Odisha, Jharkhand, West Bengal, Assam, Chhattisgarh and even in our state elephants often enter farms and villages. When vegetation is scarce and waterholes dry up in their natural habitat, elephants may wander in to nearby farms or plantations in search of food like bananas and sugarcane. This can lead to in crop damage and at times, even harm people and domestic animals.

Changes in rainfall and temperature affect vegetation. Cutting down trees for constructing roads and buildings makes it worse. This leads to the shrinking and drying of forests, the natural home of animals. When forests cannot support wildlife, animals tend to move into human habitats. Elephants are adapted to forest life, but sudden changes make it hard for them to survive. Wildlife ecologists have identified corridors in many parts of the country to allow safe movement of animals. These corridors connect forest habitats, enabling wildlife—such as elephants to travel in need between large forest areas without coming into conflict with human settlements.

This chain of events shows how closely nature's elements are connected. To understand such interconnections, we must study the components of our environment. What are the components of environment?

3.1 How Do We Experience and Interpret Our Surroundings?

You have learnt in General Science Grade-6 chapter 'Diversity in the Living World' that different habitats have different kinds of plants and animals. A habitat is simply place where an organism lives. It could even be just the bark of a tree. The plants and animals interact with each other and adapt to survive in the surrounding conditions they live in. Explore two nearby habitats and identify both the living organisms and the non-living components in each.

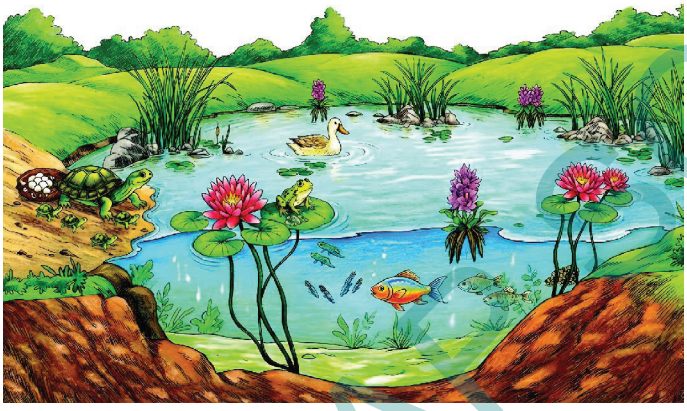
Activity 3.1: Let us explore

Caution: Explore the habitat in groups with your teacher.

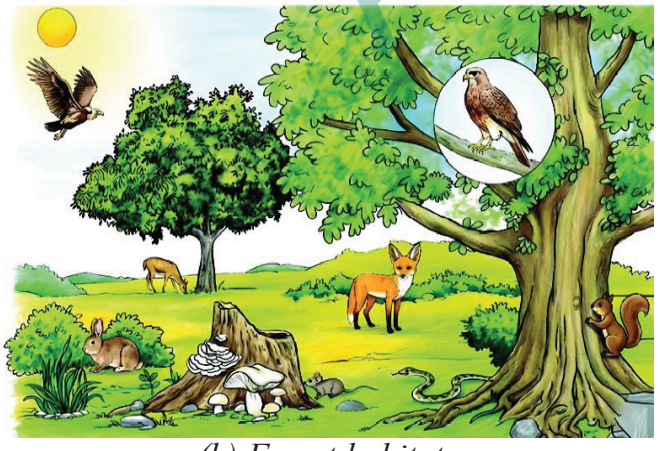
- Identify two habitats in your surroundings.
- These could be any two of the following a pond, a forest, an agricultural farm, or even a large tree like banyan, mango.
- List the living beings and non-living things that you observe in these habitats.
- **Record** your observations in Table 3.1

Table 3.1: Different components of two habitats

Pond		Forest	
Living beings	Non-living things	Living beings	Non-living things
Fish	Water	Plants	Soil
		Grass	
		Trees	
		Birds	



(a) Pond habitat



(b) Forest habitat

Fig. 3.1: Two types of habitats

What common characteristics do you observe in the two habitats in Activity 3.1? The similarities are that both habitats have living beings as well as non-living things. However, the types of living beings are different and the non-living things also vary. The living beings you have recorded in Table 3.1 are termed as the **biotic** components and non-living things as the **abiotic** components of a habitat. Have you ever thought of why some organisms live on land while others live in water? Every organism needs specific conditions to survive. From this activity, you can see that different habitats offer different living conditions.

In Activity 3.1, you listed fish as a biotic component of the pond. How do fish survive in a pond? A pond provides food, oxygen, shelter, and space to grow — conditions essential for survival of organisms. Fish obtain their biotic needs, such as food, from small plants and animals, and abiotic needs, such as oxygen, from water.

Other animals also inhabit the pond, such as

frogs, fresh turtles, snakes, dragonflies, mosquitos, snails, and ducks, along with plants like algae, diatoms, duckweeds, and lotus. They all interact with the other living beings and non-living things present in the places where they grow and thrive.

Each habitat has biotic components and abiotic components such as air, sunlight, water, temperature, and soil. Different organisms living in the same habitat may use the resources in different ways. A forest might be warm during the day and cool at night. A snake that comes out at night and a rodent active during the day both live in the same habitat, but they face different conditions. This is how living organisms coexist in harmony in the same habitat.

Ever heard of ....

Animals which are active during night are called Nocturnals. For example, Cats, Rats, Bats, Owls, crickets, firefly and fishes like cuttle fish etc. These creatures generally have highly developed senses of hearing, vision and smell. Animals like bats, emit a high pitched sound which bounces off objects to find prey or protect from predators. Some desert animals become Nocturnals in order to escape extreme day time heat, eg, Fennec Fox.

3.2 Who All Live Together in Nature?

You have observed fish in a pond in Activity 3.1. Did you see only a single fish? Most likely, you may have seen many fish of the same kind. This group of fish of the same kind living together in a pond habitat is called a **population** of that particular fish. In this way, we can observe and record populations of different kinds of organisms in a single habitat.

Activity 3.2: Let us record

We can understand the population of a particular type of plant or animal by counting them at a given place and time.

- Divide students into four to five groups.
- Each group may identify any two organisms, plant(s) or animal(s).
- Mark an area of 1 m × 1 m in your school garden.
- Identify four organisms in this area, and count their numbers.
- Record the number of the organisms in Table 3.2.
- Compile the data from all groups.

Table 3.2: Number of particular organisms at a given space and time

Name of organism	Population (Number of individual organisms)
Plant 1 : _____	20
Plant 2 : _____	05
Animal 1 : _____	
Animal 2 : _____	

In the given example, there is a population of 20 _____ plants and is only 5 _____ plants in the same 1 × 1 m^2 area.

From Activity 3.2, we can explain that the population is a group of the same type of organisms in a habitat at a given time.

Can a habitat have only one type of living organism? What might happen then? If all organisms are the same, they would have the same requirements-food, water, space-leading to competition and possible scarcity of resources. What else do you think could happen?

In Activities 3.1 and 3.2, you observed that different group of organisms live together in a habitat. A **community** comprises different populations sharing the same habitat. The biotic components of a habitat, such as the plants, animals, and microorganisms together form the community. These organisms interact and depend on one another for survival.

Ever heard of ...

You may have seen brightly coloured flowers blooming around you. Have you ever looked closely at their parts? A flower has a stalk, green leafy structures called **sepals**, coloured **petals** and two reproductive parts.

Carpels (female) and **stamens** (male). Stamens burst release yellow dust like **pollen grains**. Wind, 'water insects, bats and birds helps carry pollen from the stamens to the carpels of the same and different flowers. This process is called **pollination** (Fig.3.2). It is essential for the formation of fruits and seeds.

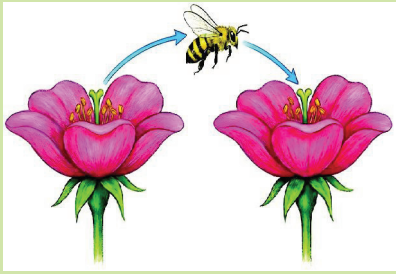


Fig. 3.2: Insect pollination

3.3 Does Every Organism in a Community Matter?

Let us find out the role of different organisms in a community.

Activity 3.3: Let us record

- Researchers conducted a study to see how fish in ponds affect seed production in the plants nearby. They observed two ponds — A with fish and large number of flowering plants around it; B without fish and fewer flowering plants around it (Fig. 3.3). Think of a reason for these observations.

Pond A *Pond B*

Fig. 3.3: Pond A with fish and Pond B without fish

- Compare the number of dragonflies, bees, and butterflies in both the ponds. Do you find any relationship between the number of dragonflies and bees/butterflies? We observed that in Pond A (with fish) the number of dragonflies were less as compared to Pond B. Why?

- Fish eat dragonfly larvae, so ponds with fish had fewer dragonflies.
- Dragonflies usually eat flies, bees and butterflies With fewer dragonflies, more bees, flies, and butterflies were found. These insects help pollinate flowers from nearby areas moving pollen from one flower to another, which helps plants produce seeds.
- So, flowers near ponds with fish may produce more seeds than those near ponds without fish.

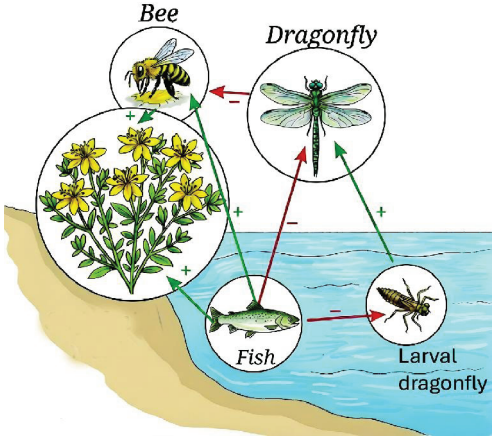


Fig. 3.4: The red arrows represent the direct effect and green arrows represent the indirect effect

- What does this study show? How does the population of fish in a pond affect the seed production in nearby plants?
- This study shows how biotic components (fish, dragonflies, pollinators, plants) and abiotic components (temperature, water, nutrients) interact with and affect each other (Fig. 3.4). Similarly, can overfishing by humans change this balance? How do you think it may affect the living and non-living parts of the habitat?

3.4 What Are the Different Types of Interactions Among Organisms and their Surroundings?

In General Science, Grade 7, you learn about how plants and animals need air, water, soil, and sunlight to grow. Living organisms, or the biotic community, depend on non-living things, that is abiotic components for their survival. Plants and animals also depend on each other for nutrition, respiration, and reproduction. These are interactions among the biotic components. Both types of interactions — among biotic components, and between biotic and abiotic components — are important for survival in any habitat.

Fig. 3.5: Biotic and abiotic interactions

Look at Fig. 3.5, and try to identify interactions among biotic components, and between biotic and abiotic components based on your learnings till now.

Activity 3.4: Let us relate and identify

- Based on the given criteria, identify and describe the interactions between biotic and abiotic components shown in Fig. 3.5.

  Criterion 1

  Interactions between abiotic and biotic components. These may influence life processes like nutrition, respiration, and reproduction in biotic components.

  Criterion 2

  Interaction between two abiotic components these may influence the physical characteristics of a habitat.

Criterion 3

Interaction among the biotic components. These may influence the availability of resources needed for life processes like nutrition, respiration, and reproduction.

- Relate your learning with your observations.
- Record your observations in Table 3.3 at the appropriate places. Table 3.3 is filled with examples for your reference.

Table 3.3:Interaction of biotic and abiotic components in a habitat

Criterion 1: Interactions between biotic and abiotic components	Criterion 2: Interaction between two abiotic components	Criterion 3: Interaction among the biotic components
Earthworms live in moist soil.	The day temperature is high due to the bright sunlight.	A frog eats insects.
Many microbes are present in the pond.	Water is evaporating fast due to the sunlight.	A water snake eats fish.
A fish lays eggs in water.	Air current is blowing slowly on the water surface creating gentle waves.	Frogs and fish may compete for small insects larvae.
	The soil near the pond is moist.	A fish lays eggs in water near vegetation to protect them from other fish or frogs.

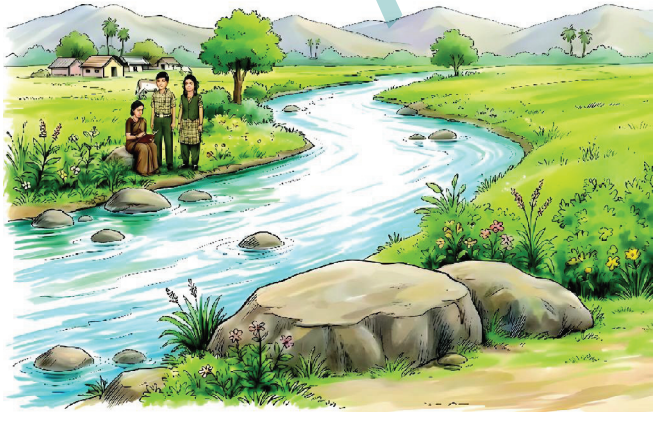


Fig. 3.6: Overlap of terrestrial and aquatic ecosystem

In Activity 3.4, you understood different types of interactions occur within a habitat. From this, you can infer that the biotic components (plants, animals, and microorganisms) and the abiotic components (air, water, soil, sunlight, and temperature) in a habitat interact with each other to form an **ecosystem**. Organisms in an ecosystem interact with abiotic components for food, shelter, and protection. Different communities of living organisms interact with abiotic components in an ecosystem. There are two main types of ecosystems in nature. **Aquatic ecosystem**s include ponds, rivers, and lakes while **terrestrial ecosystem**s include

forests, farms or even large trees like banyan, mango, or pilkhan. Hence, ecosystems can be large or small. Can you find overlapping ecosystems in Fig. 3.6?

Fig. 3.6 shows an overlap of different terrestrial and aquatic ecosystems. In this figure, you can see a small river (an aquatic ecosystem) along with mountains, forests, grassland, and farmland, which are examples of terrestrial ecosystems. Farmland is a **human-made ecosystem**. These ecosystems are interacting with each other at any given point.

In Activity 3.4, we have seen the importance of the components and their interactions in an ecosystem. For example, sunlight, carbon dioxide, and water are essential for producing food in plants; soil provides medium and essential nutrients for plant growth; air provides oxygen for respiration in plants as well as animals; water is essential for all living organisms. This shows how living organisms depend on the non-living component of an ecosystem. Just as biotic components depend on abiotic components, abiotic components also depend on biotic components. For example, plants release oxygen during photosynthesis, roots hold soil in place and prevent erosion, and plants retain soil moisture and help cool the atmosphere.

You can identify and study any ecosystem in your surroundings and observe different types of interactions among the biotic and abiotic components. While studying biotic interactions, notice how organisms depend on each other for food.

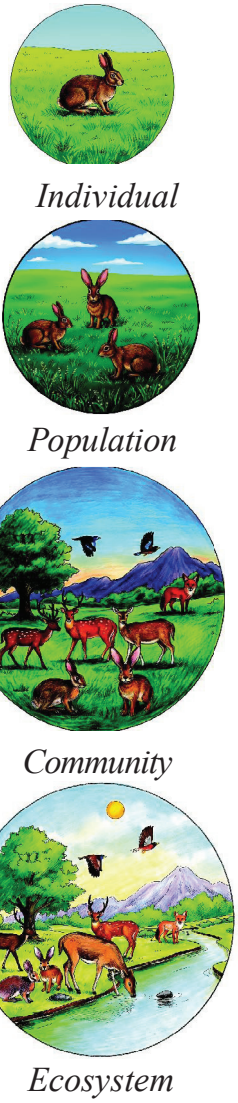


Fig. 3.7: Individual to ecosystem

Activity 3.5: Let us classify

Observe Fig 3.1b, which illustrates a forest ecosystem.

- Study the picture carefully and spot the organisms listed in Table 3.4.
- Using the internet or your school library, find out what do these organisms eat.
- Record your observations in Table 3.4 by identifying whether each organism feeds only on plants and plant products, only on animals, or on both.

Table 3.4: Eating Habits of different organisms

Name of the organism	Performs photosynthesis	Feeds on plants and plant products	Feeds on animals	Feeds on both plants and/or animals
Deer	No	Grass and leaves of plants	No	Only on plants
Horse				
Vulture				
Bengal Fox				
Bird (Shikra)				
Squirrel				
Mouse				
Mushroom				
Tree	Yes			

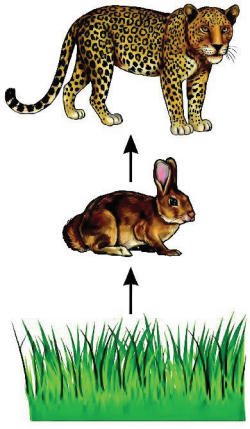


Fig. 3.8: Food chain

How do plants get their food? As you know, plants make their own food by the process of photosynthesis. Thus, they are called **producers** or **autotrophs** (auto=self + troph=food).

Organisms that cannot produce their own food and depend on other organisms for their food are called **consumers** or **heterotrophs** (hetero = other + troph = food). List the heterotrophs from Table 3.4.

Organisms that eat only plants are called **herbivores**, such as deer and hare. Those that eat only animals are **carnivores**, such as leopard. Organisms that eat both plants and animals are **omnivores**, such as crows, foxes, and mice.

Activity 3.5: Who Eats whom ?

In Activity 3.5, we learn about the feeding relationship among organisms. How can we make linkages with the feeding relationship among organisms in a given ecosystem?

Activity 3.6: Let us link (relate)

- Take an example of a grassland ecosystem.
- Consider the following organisms that we can spot in a grassland ecosystem: grass, frog, hare, fox, grasshopper, snake, and eagle.
- In Fig. 3.8, a relationship of who eats whom is shown among some of the organisms.
- Draw the feeding relationships for the remaining organisms by adding arrows, similar to those in Fig. 3.8.

In Fig 3.8, you can see that the grass is eaten by the hare and the hare is eaten by the fox. This is a representation of a food chain in a grassland ecosystem. Which is another food chain that can be drawn for the organisms given in this activity? One example may be as follows:

Grass → Grasshopper → Frog → Snake → Eagle

The interactions between biotic components based on feeding relationships can be represented in the form of a linear chain. A **food chain** is a simple sequence showing 'who eats whom' in an ecosystem. One such example is given in Fig. 3.9.

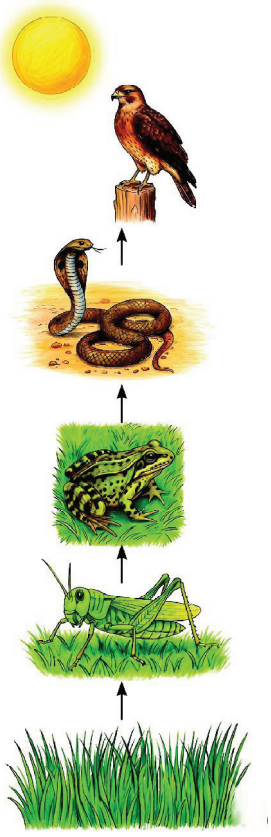


Fig. 3.9: Another food chain in a grassland

Activity 3.7: Let us draw

Fig. 3.10(a) represents a crop field with millets, mouse, and eagle.

- Count the number of each type of organism in Fig. 3.10(a).
- Make a table and set a number in the table against each of the organisms.
- Arrange the numbers in the ascending order, consider the highest number at the base and the lowest at the top.
- Place the mouse, millet, and eagle appropriately in Fig. 3.10(b).
- What figure do you get? It looks like a pyramid. Complete the pyramid in Fig. 3.10(b).

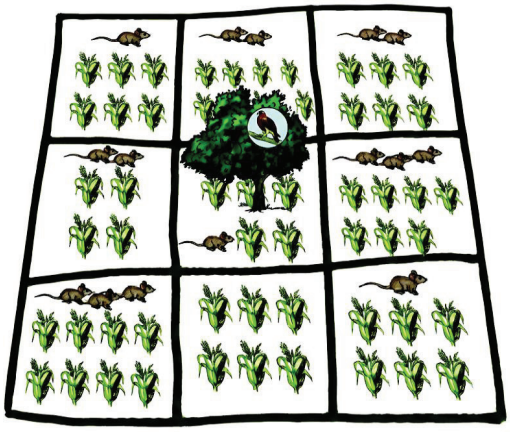


Fig. 3.10: (a) Food chain of millet, mouse, and eagle in a crop field

Each organism in a food chain has a specific position, called a **trophic level** (troph = food):

- Producers (like green plants) are at the first trophic level.

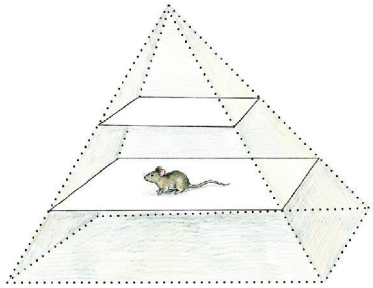


Fig. 3.10: (b) Food chain represented in a pyramid

- Herbivores (like hares and deer) are at the second level.
- Small carnivores (like frogs) are at the third level.
- Large carnivores (like tigers or vultures) occupy the next level.

Activity 3.8: Let us trace and link

- Look at Fig. 3.11.
- Look at the figure and put more arrows for the missing relationship of 'who eats whom'.
- How many other organisms might be connected to one organism through a feeding relationship in an ecosystem?

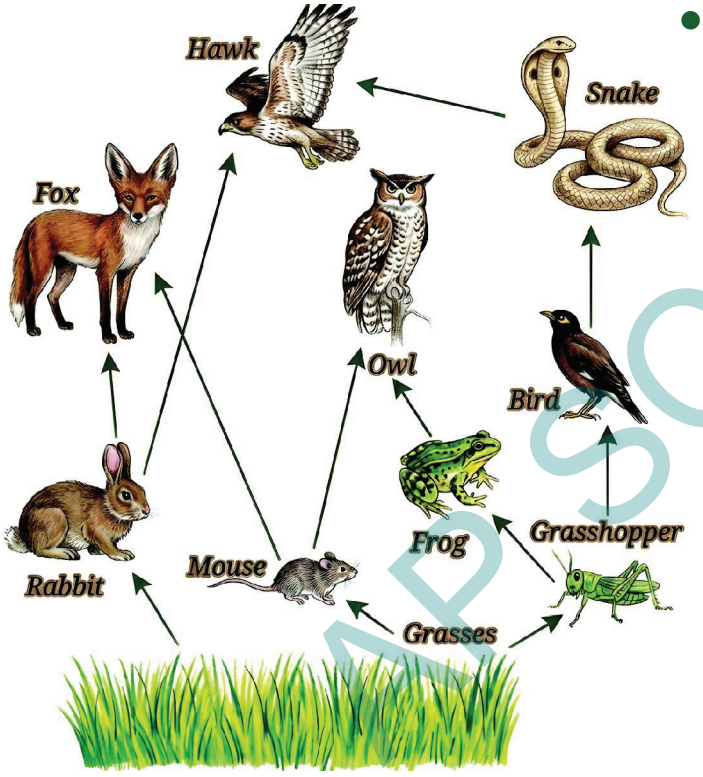


Fig. 3.11: Food web

Look at Fig. 3.11, and observe the relationship between different food chains in an ecosystem. Are these food chains interlinked? Each of the organisms may be eaten by two or more types of organisms. Thus, in an ecosystem, the food chains are interlinked with each other to form a network, called a **food web**.

You know that living organisms grow, perform many functions, develop, and die. During their life cycle, organisms produce a lot of waste, including dead matter and food waste.

3.6 What Happens to Waste in Nature?

Fig. 3.12: Mushroom growing on dead organic matter

You may have seen small umbrella-like structures, mushrooms, growing on dead plants or trees during the rainy season (Fig. 3.12). These are a type of fungi that grow on dead matter. Microorganisms like fungi and bacteria break down complex substances in dead plants and animals into simpler ones. This process returns

important nutrients to the soil. You can also find tiny insects, such as beetles and flies, on animal droppings — like elephant dung— as they help break it down and recycle nutrients, back into the environment. This process is called decomposition and the organisms carrying out the process are called **decomposers** or **saprotrophs** (sapro= rotten + trophs = food). Plants grow in soil and many of the nutrients in soil come from the **decomposition** process. Thus, decomposers play an important role in recycling nutrients. In nature, nothing is wasted — everything is reused. Does nature really waste anything?

Ever heard of...

India is a country with diverse habitats and seasons. Many migratory birds fly thousands of miles and reach different habitats in India. They migrate from different parts of the world to avoid harsh climate, and in search for food. Birds not only enhance the aesthetics of those habitats but also play a significant role in keeping the balance in an ecosystem as pollinators or seed dispersers along the path they migrate. This way they link two habitats. These birds are predators of insect pests and help farmers to control pest populations, and indirectly help in healthy crop growth. Migratory birds, During the winter, birds such as Greater Flamingos and Siberian Cranes migrate to regions in our state like Pulicat Lake, the Nelapattu Bird Sanctuary, and Kolleru Lake. Do you know which birds visit the water body of Khichan village in Jodhpur district during the winter months? Collect postal stamps and covers of migratory birds released by the Indian Postal Department, and collect information about their place of origin and reasons for their migration to different localities in India and more. Showcase the postal stamps in your science laboratory/school library to popularise migratory birds.

3.7 How Does One Change Lead to Another?

Look at Fig. 3.13. It shows how one small change can lead to many others. For example, many plants in a pond start dying because of pollution. With fewer plants less oxygen will be

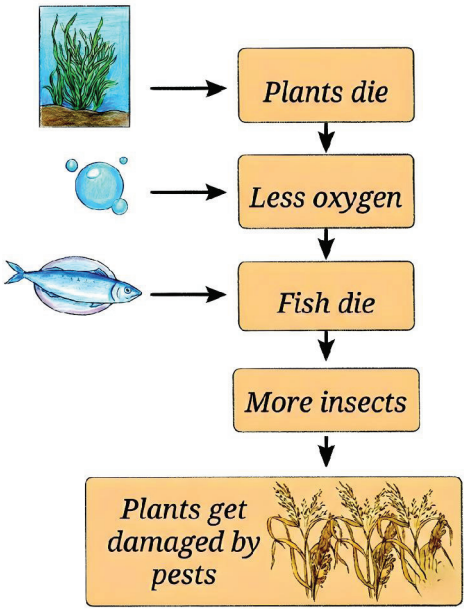


Fig. 3.13: One change leads to another

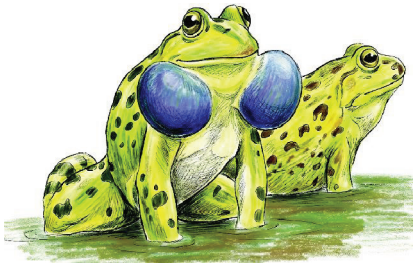


Fig. 3.14: Indian bull frog

produced in water which will lead to a drop in the fish population in that water body. Reduction in fish population will have cascading effects and there will be less number of consumers in the pond. As a result, insects will increase in number. These insects will spread to nearby farmlands. This is how farmers will be compelled to use pesticides to grow their crops which may again adversely affect the environment. Further consequences may emerge in the form of other **environmental issues**. What happens when we intervene in nature?

Activity 3.9: Let us read

In the 1980s, India was a significant exporter of frog legs, especially of the Indian bullfrog (Hoplobatrachus tigerinus) (Fig. 3.14). This large-scale harvesting led to a decline in frog populations. Since frogs eat insects, their reduced numbers resulted in a rise in agricultural pests. This forced farmers to use more synthetic pesticides, which harmed the environment, soil and water quality, and affected the overall environmental and human health. The Government of India banned the export of frog legs to prevent further **ecological damage**.

An ecosystem stays in balance when interactions among organisms and their environment keep populations and resources stable. This balance is dynamic, not fixed, and can be disrupted by natural or human-made changes.

3.8 How Do Interactions Maintain Balance in Ecosystems?

Besides feeding relationships, organisms also compete for common resources like food, water, physical space, or sunlight.

This competition helps control population size and keeps the ecosystem balanced. Without it, one species could multiply too much causing an imbalance in the ecosystem (Fig. 3.15).

There are other types of relationships too. Based on the example given in Fig. 3.16, what do you observe?

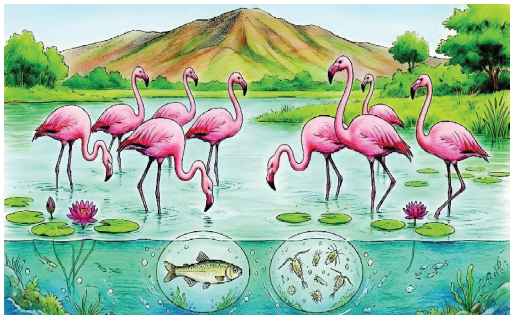


Fig. 3.15: Competition among a community in an ecosystem

- **Mutualism:** Both organisms benefit. For example: Honeybees and flowers.
- **Commensalism:** One organism benefits while the other is not affected. For example: Orchids on trees.
- **Parasitism:** One organism benefits while the other is harmed. For example: Ticks on the body of dogs.

These interactions are all part of the complex web of life in an ecosystem.

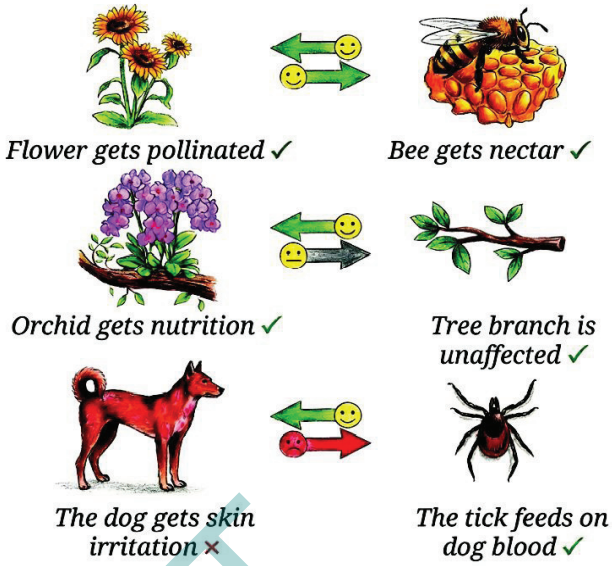
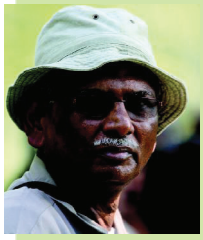


Fig. 3.16: Different types of interactions between organisms

Be a Scientist



Asir Jawahar Thomas Johnsingh (A.J.T. Johnsingh) was a famous Indian wildlife biologist who helped us understand forest ecosystems through the eyes of animals. He was a pioneer in studying wildlife through modern tracking system. His research showed how predators like tigers and leopards rely on prey, such as deer and wild boar, while he was working in Bandipur National Park, Karnataka. He proved that a healthy prey population is key to predator survival. He inspired many youngsters to study wildlife and protect the forests and biodiversity of India.

3.9 What Are the Benefits of an Ecosystem?

We have learnt that biotic components and abiotic components of an ecosystem depend on each other and support various life processes. Humans also benefit from ecosystems. For example, forests provide fresh air, fertile soil, food, fibres, timber, and medicines. Similarly, aquatic ecosystems provide water and food. Ecosystems also offer aesthetic and recreational value. This benefits and supports our well-being and shows how closely nature and humans are connected. However, when we overuse or misuse natural resources, we disturb the balance in nature.

Now let us look at a real-life example of a threatened ecosystem — the Sundarbans.

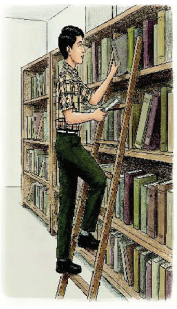
The Sundarbans have the largest mangrove forests in the world. Located where the Ganges and Brahmaputra Rivers meet between India and Bangladesh, the Sundarbans' forests and rivers are home to various flora and fauna, many of which are endangered. The Sundarbans protect us by slowing down strong winds and waves during storms and floods. The trees also absorb carbon dioxide from the air and release oxygen. Because of its importance, The United Nations Educational, Scientific and Cultural Organization (UNESCO) declared the Sundarbans a World Heritage Site in 1987. However, the Sundarbans (Fig. 3.17) are under a serious threat. Mangrove trees are being cut for fuelwood and farming. Illegal hunting and overuse of forest resources are a threat to the wildlife living there. Pollution from industrial waste and untreated sewage in rivers are also damaging the water and habitat. These human activities disrupt the natural way ecosystems work.

Fig. 3.17: Mangrove forest in Sundarbans

Similarly, other ecosystems across India are also under threat. Problems like deforestation, overuse of natural resources, the spread of invasive species, unsustainable land use, and pollution are damaging forests, rivers, scrublands, wetlands, grasslands, and coastal areas. Know about the Coringa and Krishna Delta mangrove forests in Andhra Pradesh.

How can we stop damaging forests, rivers, and wetlands? Think about what actions you and your community can take to protect these important places.

Our Scientific heritage



Protected areas are parts of land or water set aside to conserve wildlife and their habitats. India has many protected areas like national parks, wildlife sanctuaries, biosphere reserves, and community conserved areas. These places help protect entire habitats including endangered animals, birds, and many rare plants. Famous examples include Jim Corbett National Park (Uttarakhand), Manas National Park (Assam), Nilgiri Biosphere Reserve (Western Ghats), Chilka Lake (Odisha), Eaglenest Wildlife Sanctuary (Arunachal Pradesh), Hemis National Park (Leh), Keibul Lamjao National Park (Manipur), Pirotan Island Marine National Park (Gujarat). Protected areas play a big role in saving nature for future generations. In Andhra Pradesh Sri Venkateswara National Park, Papikondalu National Park, the Seshachalam Biosphere Reserve, and others are present.

3.9.1 Human-made ecosystems

Humans have created artificial ecosystems like fish ponds, farms, and parks to meet their needs. When well designed, these can help reduce pollution, support biodiversity, and provide recreational spaces for people. Unlike natural ecosystems, these need human care and management. Can you name any human made ecosystem in your area?

3.9.2 How do healthy ecosystems serve our farms?

Farming, a major livelihood in India, can become unsustainable if not managed well by applying environment friendly farming practices. Humans have been practising farming for thousands of years to grow food. As the population grew, our dependence on agriculture increased. Between 1950 and 1965, India faced a food crisis due to low crop production. In the mid-20th century, the use of tractors, machines, synthetic fertilisers, and pesticides helped increase food production. This period is known as the **Green Revolution**. However, these farming methods are now considered unsustainable because of the overuse of synthetic chemicals, excessive groundwater extraction, and growing only one type of crop for commercial gain. How do these practices harm both the environment and human health?

Many scientists believe that overusing pesticides and growing the same type of crop repeatedly on the same land leads to soil degradation. Understanding ecosystems can help us adopt better and more sustainable farming practices.

Activity 3.10: Let us survey

Visit a nearby farm with your parents or teacher/interact with farmers in your community to find out about the farming practices they adopt.

- Prepare a list of questions for farmers to find out the pesticides and other farm inputs they use, and whether they reuse or recycle materials to improve their crops. Here are some sample questions:
  - How have your farming practices changed over time? And why?
  - What effects do you notice when using synthetic fertilisers and pesticides?
  - Have you seen any changes in soil health after using these synthetic fertilisers and pesticides?
- Interact with farmers based on these questions. Based on your findings, prepare a report.

Fig. 3.18: Natural control of pests by predators—Beetle feeding on pests

What inference do you draw from your interactions with farmers?

Synthetic fertilisers and pesticides have played a vital role in improving crop production and helped countries like India become food secure. However, their long-term use can affect the environment and soil health. Overuse of synthetic fertilisers may reduce soil fertility by decreasing friendly microorganisms in soil and lowering organic matter (humus), which helps bind soil particles. Without enough humus, soil becomes prone to erosion. Also, it reduces the population of natural predators which ultimately increase the population of pests (Fig. 3.18). Heavy irrigation and repeated ploughing can also disturb soil organisms like earthworms and snails, which are important for maintaining ecological balance.

Some pests may develop resistance to pesticides, making them difficult to control. Growing the same crop repeatedly, known as **monoculture**, can reduce crop diversity and affect pollinators, which are crucial for food production.

To make farming more sustainable, some farmers are exploring organic and natural farming methods. These aim to reduce the use of synthetic fertilisers and support sustainable farming, with minimal interference in natural ecosystems. Based on your learning, what practices do you think can help farmers protect the soil, the environment, and our food security for the future?

Our Scientific heritage

The ancient text 'Vrikshayurveda' emphasises on soil health and nourishment. The text strongly advocates for the continuous nourishment of the soil through organic manure like 'Kunapa Jala' (a liquid fertiliser made from animal and plant waste by the process of fermentation; that breaks complex substances into simpler ones) and other composted materials.

Keywords

Biotic Components | Abiotic Components | Ecosystem

Autotrophs | heterotrophs | Decomposers

Food chain | Food web | Trophic level

Green Revolution | Monoculture

Snapshots

- A habitat is a place that provides the right conditions for an organism to live and grow.
- Habitats have biotic components (plants, animals, microbes) and abiotic components (air, water, soil, temperature).
- The interaction between biotic components and abiotic components in an area forms an ecosystem.
- Ecosystems can be terrestrial (forests, grasslands, deserts) or aquatic (ponds, lakes, sea, oceans).
- Organisms often classified as producers (plants), consumers (herbivores, carnivores, omnivores), and decomposers (bacteria, fungi).
- Producers make their own food, while consumers eat plants or animals. Decomposers break down dead matter and recycle nutrients.
- Food chains depict who eats whom in an ecosystem, and food webs show how these chains are interconnected. The positions that different organisms occupy in a food chain are called trophic levels.
- Some organisms live in relationships, like mutualism (both benefit), commensalism (one benefits, other is unaffected), and parasitism (one benefits, one is harmed).
- The benefits that ecosystems offer are crucial for human survival and well-being. They provide clean air, water, food, medicine, and climate regulation.
- Human activities like pollution, deforestation, habitat loss, climate change, invasive species, and overexploitation of natural resources threaten ecosystems. Protecting them through efforts, such as conservation like national parks and sanctuaries is vital.

Keep the curiosity alive

1. Selvam from Cuddalore district, Tamil Nadu, shared that his village was less affected by the 2004 Tsunami compared to nearby villages due to the presence of mangrove forests. This surprised Sarita, Shabnam, and Shijo. They wondered if mangroves were protecting the village. Can you help them understand this?
2. Why is it not possible to have an ecosystem with only producers and no consumers or decomposers?
3. A farmer notices that his cow often has small birds (Cattle Egrets) sitting on its back. He observes that the birds are eating ticks and other parasites from the cow's skin. The cow does not chase the birds away and seems relieved. Which of the following explain the interaction between cow and birds?
   A. Parasitism: Because the bird is taking food from the cow's body.
   B. Commensalism: Because the bird benefits, but the cow is neither helped nor harmed.
   C. Mutualism: Because the bird gets food (ticks) and the cow gets pest control (relief).
   D. Competition: Because both the bird and the cow are competing for space in the field.
4. A Farmer has used chemical fertilizers for many years. Now the soil holds less water, and gets washed away during rains. Explain how too much chemical fertilizer can reduce humus in the soil and lead to soil erosion.
5. Refer to the given diagram (Fig. 3.19) and select the wrong statement.
   i) A community is larger than a population.
   ii) A community is smaller than an ecosystem.
   iii) An ecosystem is part of a community

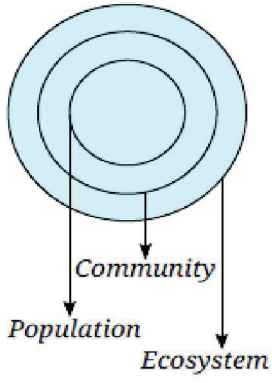


Fig. 3.19: Population, community, and ecosystem

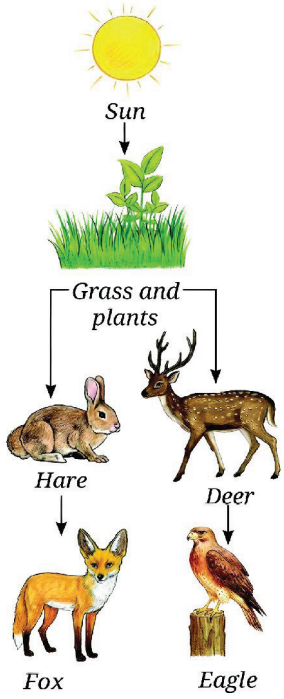


Fig. 3.20: Parts of a food web

6. Observe two different places near your home or school (e.g., a park and a roadside). List the living and non-living components you see. How are the two ecosystems different?
7. Look at this food chain:
   Grass → Grasshopper → Frog → Snake
   If frogs disappear from this ecosystem, what will happen to the population of grasshoppers and snakes? Why?
8. 'Human-made ecosystems like agricultural fields are necessary, but they must be made sustainable.' Comment on the statement.
9. A population is part of a community. If all decomposers suddenly disappear from a forest ecosystem, what changes do you think would occur? Explain why decomposers are essential.
10. If the Indian hare population (Fig. 3.20) drops because of a disease, how would it affect the number of other organisms?
11. In a school garden, students noticed fewer butterflies the previous season. What could be the possible reasons? What steps can students take to have more butterflies on campus?

Discover, design and debate

- Plan a clean-up day at school or a nearby park. Wearing gloves and using bags, collect the litter you find. Discuss the kinds of waste you found. Which was the most common? How can we reduce such waste?
- In Arunachal Pradesh, the Nyishi and Mishmi tribes treat the Tiger as sacred. In Chhattisgarh, the Baiga tribe worships Bagheshwar or Bagesur Dev and believes the Tiger is the protector of the forest. Find out about another Indian tribe that has a special bond with any animal.
- Pick a tree near your home or school. Observe it once a week for 4 weeks. Note any new leaves, flowers, fruits, or visiting birds and insects. Record your observations. You may even upload your findings to www.seasonwatch.in and become a young citizen scientist.

- Interact with farmers and record indigenous practices followed by them for sustainable farming. Create a sustainable herbal garden/natural farm at home or at school. It could be a group activity with students from different grades.

Fig. 3.21: Farming Practices

- Look at Fig. 3.21 to understand the different farming practices adopted by farmers or you may also visit a nearby farm with an elderly person to observe the same. List a few suggestions in your notebook to improve farming practices by adopting eco-friendly and sustainable techniques. You can also make posters or model and display while participating in school functions, science fairs or Krishi Mela. The school may also invite agricultural scientists, farmers, and experts to discuss the prevalent farming practices with the students.

Reflect on the question framed by your friends and try to answer....

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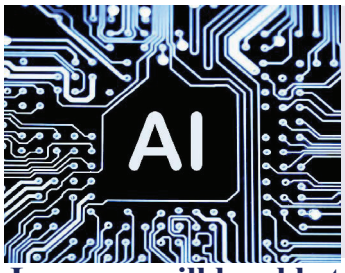


Integrating Artificial Intelligence(AI)

Learners will be able to...

1. Understand basic AI terms such as data, algorithm, model, and dataset.
2. Explain how the scientific method is similar to machine learning.
3. Relate scientific formulas like Density = Mass ÷ Volume to algorithmic processing.
4. Understand how AI helps in cell classification and disease prediction.
5. Use AI tools responsibly in learning.

In Class 8 Science, students learn skills like observation, experimentation, measurement, classification, recording data, and reasoning. When students organise results, find patterns, and draw conclusions, their thinking becomes clear and systematic. Weather forecasts can predict cyclones early. Hospitals use digital reports to detect diseases. Robots perform precise work in factories. These are possible because of Artificial Intelligence (AI). Artificial Intelligence works in a similar way. It collects data, processes it, finds patterns, and gives results. This chapter shows how scientific learning in Semester-1 is connected to technologies like weather forecasting, robotics, healthcare, and communication.

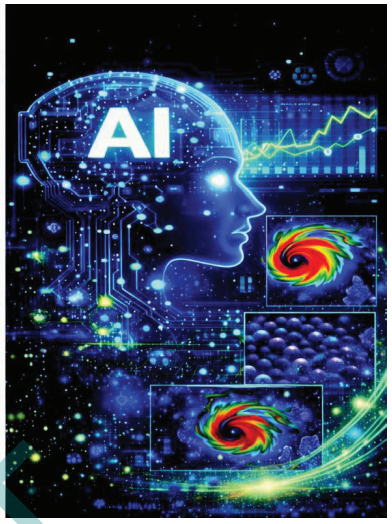
Guidance: Guidance - Begin by connecting scientific concepts with how AI systems collect and process data from the real world. Encourage students to compare observation in science with data analysis in AI. Use simple examples to explain how algorithms follow formulas, similar to scientific calculations. Relate pattern observation in experiments to pattern recognition and predictive modelling in AI. Help students understand cause-effect relationships like how AI models learn from data. Promote computational thinking and logical reasoning as a bridge between science and Artificial Intelligence.

Foundations of AI in Grade 8 Science Learning

The study of forces, matter, pressure, solutions, cells, microorganisms, and health strengthens observation, modelling, and analytical reasoning. These same abilities form the foundation of intelligent systems. When the formula Pressure = Force ÷ Area is applied, the relationship between variables becomes clear. When Density = Mass ÷ Volume is calculated, mathematical reasoning is used. In digital systems, such relationships are processed using Algorithms, which are step-by-step instructions followed by a computer. Each experimental reading, such as temperature, pressure, or mass, becomes Data. Every reading is a Data Point. When many data points are studied together, patterns emerge. The ability of a system to learn from such patterns is called Machine Learning (ML).

Disclaimer: "The use of AI tools by students must be strictly under the direct guidance and supervision of teachers and parents / guardians".

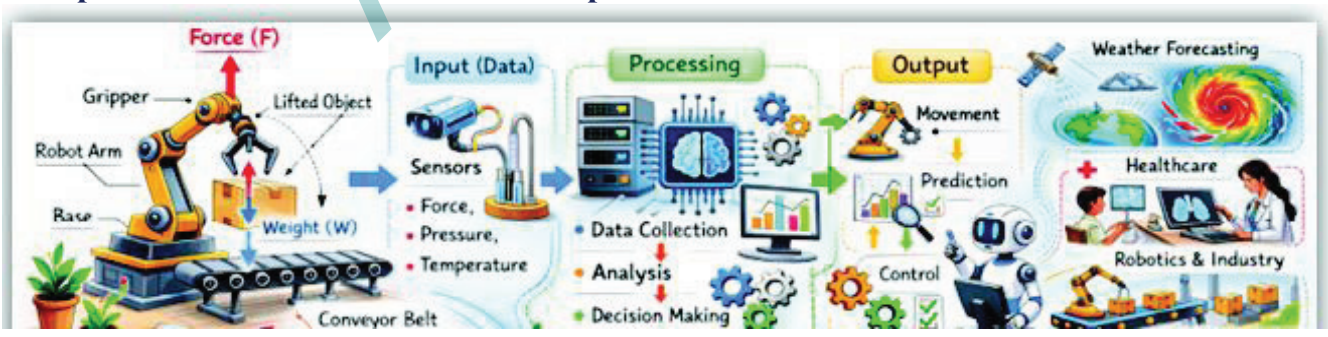
Example 1: Scientific Investigation and AI Learning



Scientific investigation follows organised steps. First, scientists observe carefully and ask a question. They suggest a possible explanation called a hypothesis and test it through an experiment. During the experiment, only one variable is changed to understand cause and effect. Repeating the experiment improves accuracy, and conclusions are drawn based on evidence. Artificial Intelligence systems work in a similar way. They collect input data and organise it into a dataset. An algorithm processes this data to find patterns. Based on these patterns, the system makes predictions. Drawing conclusions from analysed data is called inference. Both scientific investigation and AI depend on systematic steps and evidence-based reasoning.

Thinking with AI :	How is changing one variable in a science experiment similar to adjusting settings in a Machine Learning model to improve its results?
Key Words:	**Variable** – A factor in an experiment that can be changed to observe its effect. **Dataset** – A collection of organised examples used to train an AI system. **Algorithm** – A step-by-step set of instructions followed by a computer to solve a problem. **Inference** – Drawing a conclusion from analysed data. **Machine Learning** – A method by which computers learn patterns from data and improve performance.

Example 2: Forces and Data Relationships

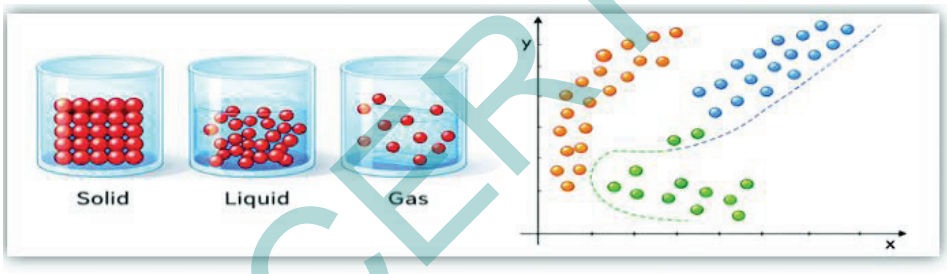


Force is a push or pull that can change the motion or shape of an object. The relationship between force, mass, and motion is studied using scientific experiments. When force increases, the motion of an object may also change. This shows a clear relationship between variables.

In intelligent systems, similar relationships exist between input and output values. In Robotics, machines use a Sensor to detect contact and non-contact forces. The sensor converts physical changes into digital signals. These signals are analysed through Data Processing, and the machine responds accordingly. When a robotic arm lifts an object, it adjusts its grip automatically. This automatic response without direct human control is called Automation.

Thinking with AI :	How do sensors in a robotic system detect force and automatically adjust movement?
Key Words:	**Sensor** – A device that detects physical changes such as force or motion. **Data Processing** – Analysing collected data to produce a result. **Robotics** – The use of intelligent systems to control machines. **Automation** – Performing tasks automatically without human control.

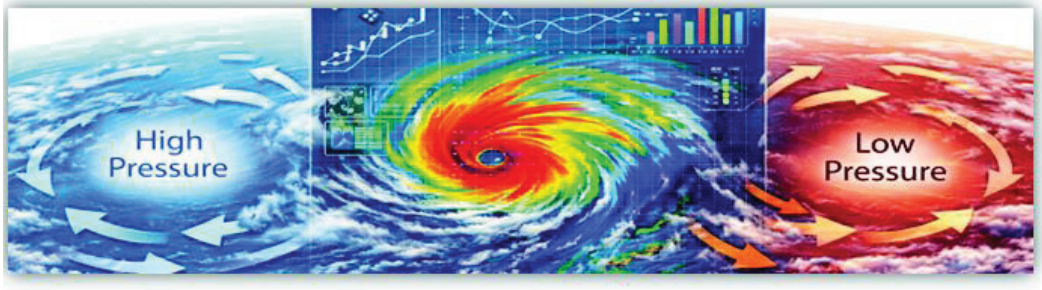
Example 3: The Particulate Nature of Matter and Data Models



Matter is made up of tiny particles that are arranged differently in solids, liquids, and gases. The particle model explains changes of state and diffusion by describing how particles move and interact. This scientific model simplifies complex behaviour for better understanding. In Artificial Intelligence, systems analyse small units of information called data points. When many data points are grouped together, patterns can be identified. This ability to identify patterns is called Pattern Recognition, and it is a part of Machine Learning. Just as the particle model helps explain physical changes, a data model helps explain digital patterns.

Thinking with AI :	How is the particle model in science similar to a data model in Artificial Intelligence?
Key Words:	**Data Point** – A single unit of information used for analysis. **Machine Learning** – Learning patterns from data. **Pattern Recognition** – Identifying similarities in data. **Model** – A simplified representation used for understanding systems.

Example 4: Pressure, Weather and Predictive Modelling



Pressure differences in the atmosphere cause wind movement. Large differences may lead to storms and cyclones. The formula Pressure = Force ÷ Area shows a clear mathematical relationship between variables.Weather forecasting systems collect temperature, humidity, wind speed, and satellite images regularly. This information forms a large Dataset. AI systems use Predictive Modelling to analyse this dataset. Through Pattern Recognition, past weather patterns are studied. Using this analysis, future weather conditions can be predicted. This digital representation of real-world conditions is called a Simulation.

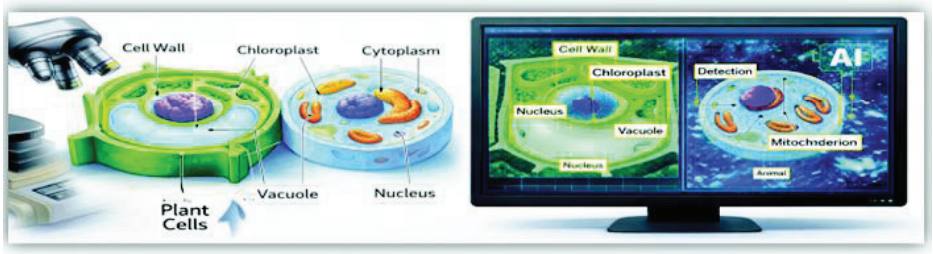
Thinking with AI :	How does studying past weather data help AI predict future cyclones?
Key Words:	**Predictive Modelling** – Using data to forecast future events. **Pattern Recognition** – Finding repeated trends in data. **Variable** – A factor that can change in a system. **Simulation** – A digital model representing real-world processes.

Example 5: Solutes, Solvents and Solutions

This chapter explains how substances mix to form solutions. When a solute dissolves in a solvent, a uniform mixture called a solution is formed. Students learn about saturated and unsaturated solutions, solubility, the effect of temperature on dissolving, and how density determines floating and sinking.The chapter also connects with Artificial Intelligence (AI). Just as particles mix evenly in a solution, AI systems organise data to produce meaningful results. Changes in concentration are similar to how an AI model responds to different amounts of input. Using formulas to calculate density is like how an algorithm applies mathematical rules to analyse information. Observing dissolving patterns relates to pattern recognition and data analysis in AI. Skills such as computational thinking, analytical reasoning, model-based learning, and predictive analysis build a strong foundation for understanding AI.

Thinking with AI :	If a solution looks clear and uniform, how can it be confirmed that the solute has completely dissolved in the solvent? Explain the steps from mixing the substances to observing a uniform solution. How can changes in temperature increase the dissolving process? Describe how observations are recorded, compared, and analysed to draw a conclusion.
Key Words:	**Model** – A trained system that processes input data and produces an output or prediction. **Algorithm** – A step-by-step set of instructions or mathematical rules used to solve a problem or analyse data. **Pattern Recognition** – The ability of a system to identify repeated relationships or trends within data. **Data Analysis** – The process of examining and interpreting data to draw meaningful conclusions.

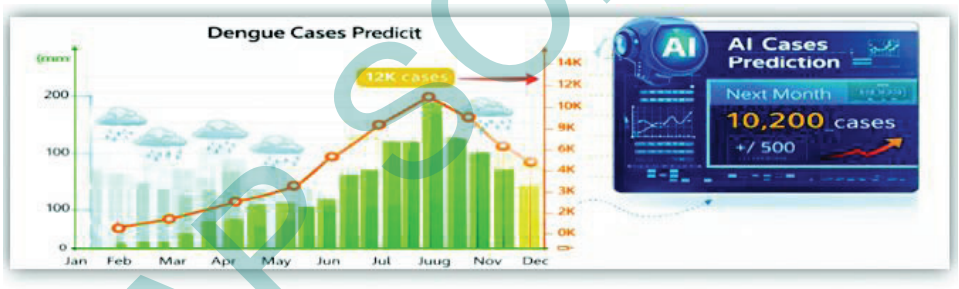
Example 6: Cells, Microorganisms and Image Recognition



Microscopes help scientists observe cells and microorganisms. Structures such as nucleus, membrane, and cytoplasm are identified through careful observation and classification.In AI systems, Computer Vision allows machines to analyse images. Using Image Recognition, intelligent systems detect patterns in stained cell images. These systems are trained using Machine Learning, where a large dataset of labelled cell images is studied. In medical laboratories, this method is used in Digital Pathology to detect abnormal cells or parasites automatically.

Thinking with AI :	What type of labelled image dataset is required for accurate cell classification?
Key Words:	**Image Recognition** – Identifying objects or patterns in images. **Deep Learning** – Advanced learning method using layered models. **Digital Pathology** – Use of AI to analyse medical images. **Classification** – Grouping based on common features.

Example 7: Health, Disease and Data Analysis



Communicable diseases spread through air, water, contact, or vectors such as mosquitoes. Disease data collected monthly shows seasonal patterns. For example, dengue cases often increase during monsoon months.AI systems use Epidemiology data to study disease spread. Large hospital records, climate data, and population movement data are organised into a Dataset. Through continuous Surveillance, patterns are identified. Using Forecasting methods and Machine Learning, predictions are made about possible future outbreaks. This helps health authorities take preventive action in advance.

Thinking with AI :	Why is historical disease data important for accurate outbreak prediction?
Key Words:	**Epidemiology** – Study of how diseases spread in populations. **Surveillance** – Continuous monitoring of data. **Dataset** – Organised collection of data for analysis. **Forecasting** – Predicting future events using data.

Example 8: How Nature Works in Harmony and AI Ecosystem Modelling

Students study how organisms interact with their environment to form ecosystems. Habitats include biotic (living) and abiotic (air, water, soil, sunlight) components. Ecosystems consist of populations, communities, food chains, food webs, trophic levels, and decomposers that maintain balance. Similarly, AI functions like an ecosystem with interconnected components and data flows. Using sensors, satellites, and big data, AI monitors environmental changes, tracks wildlife, studies food webs, detects biodiversity threats, and predicts human impact. For example, AI uses camera traps and image recognition to count animals, while machine learning analyses satellite data to monitor vegetation, water, and soil. Predictive models can simulate effects when a species disappears, such as increased pests after frog decline in India.

Thinking with AI :	A pond ecosystem has fish, dragonflies, bees, and flowering plants all connected through a food web. If AI sensors detected a sudden drop in bee population, what cascade of changes might it predict in the ecosystem? How would an AI decision-support system help ecologists respond quickly?
Key Words:	**Image Recognition** An AI technology that enables computers to identify objects, animals, or patterns in images or videos. **Predictive Modelling** – The use of AI and data to forecast future outcomes or changes, such as predicting the impact of species loss on ecosystems. **Network Analysis** – An AI method used to study relationships and connections between different elements in a system, similar to how organisms are linked in a food web.

Guidance: - Classroom activities should help students connect experiments with scientific concepts and real-life applications. Students must use AI only as a support tool and always verify answers with textbooks and teachers. Personal information should never be shared while using AI platforms.AI responses should be checked carefully, and students should rewrite answers in their own words.AI should be accessed safely under teacher or parental guidance and used responsibly for learning purposes only.

Exploring with AI : Artificial Intelligence can support learning by explaining difficult concepts in simple language, creating revision questions, showing simulations of experiments, and helping analyze data tables by highlighting patterns and relationships. However, AI is only a support tool. It cannot replace real experiments that develop practical skills, teachers who guide learning, or textbooks, which remain the primary and most trusted source of knowledge. AI should be used only to support study.

Safe and Responsible Use of AI

Artificial Intelligence must be used carefully and responsibly. Personal information such as name, address, school details, passwords, or contact numbers must never be shared while using AI tools. Any answer given by AI should always be checked with the textbook to make sure it is correct and suitable for the lesson. AI tools must not be used during examinations or tests. If help is taken from AI, the answer should be written again in original words to show clear understanding. Academic honesty must always be maintained while learning. Responsible use of AI builds discipline and strengthens scientific integrity.

Writing Effective Prompts (Class 8)

A good prompt helps in getting clear and useful answers from AI tools. It should mention the class level, the chapter name, the concept to be explained, and the format required, if necessary. Learning to write prompts step by step helps students improve their thinking and questioning skills.

Example : Note:- "I am a Class 8 student. Explain how pressure differences cause wind formation using the formula Pressure = Force ÷ Area in simple language."

Level 1: Basic Prompt (Simple Information Request)

"I am a Class 8 student. From the chapter Forces, explain what contact and non-contact forces are in simple language."

Level 2: Analytical Prompt (Understanding Relationships)

"I am a Class 8 student. From the chapter Pressure and Weather, explain how pressure differences cause wind movement. Include the formula Pressure = Force ÷ Area and give one real-life example."

Community-Based Projects

The Seasonal Disease Awareness and Prevention Drive connects classroom learning with community awareness. Students record rainfall for a month and observe common seasonal illnesses in their area without collecting personal details.

Using AI tools, they organise the data into tables and create bar graphs. AI may also help identify patterns between rainfall and mosquito-related diseases. Students then design awareness posters to promote cleanliness and prevent stagnant water.

This activity develops scientific thinking, data analysis skills, and responsible use of technology under teacher guidance.

Do AI Make Mistakes?

Artificial Intelligence systems depend greatly on the quality of the data provided to them. If the dataset is incomplete, incorrect, or biased, the predictions and results produced by the system may also be inaccurate. Therefore, verification of information is always essential. AI can support learning by analysing data and identifying patterns, but it cannot replace careful scientific investigation, observation, and reasoning. Human judgment and validation remain important in every stage of learning.

Myth	Truth
AI can replace teachers and textbooks.	AI supports learning, but teachers guide understanding and textbooks remain the primary source of knowledge.
AI predictions are always accurate	AI predictions are based on available data and probabilities, so they may not always be exact.

Do You Know?

Digital Pathology: In modern hospitals, AI systems use Deep Learning to scan medical images and detect abnormal cells that are too tiny for the human eye to see, helping doctors find diseases much earlier. For more information ask AI this topic.

Chapter-wise AI-Supported Exploration

Tasks for Students to Explore with AI (Science – Semester 1)

Chapter	Foundational Level	Analytical Level	Creative Level
Chapter 1: Scientific Inquiry and Intelligent Systems	• Define hypothesis with examples. • List steps of the scientific method.	• Compare the scientific method with machine learning steps. • Analyse a sample experiment and identify dependent and independent variables.	• Design a simple experiment and prepare a structured data table. • Create a flowchart comparing scientific investigation and AI training process.
Chapter 2: Force, Motion and Intelligent Machines	• Identify contact and non-contact forces. • State Newton's laws in simple terms.	• Analyse the relationship between force, mass and motion using examples. • Interpret a force – motion data table.	• Build and test a balloon rocket model. • Design a simple robot movement plan based on applied forces.
Chapter 3: Matter, Particles, and Smart Modelling	• Draw and lable particle diagrams of solids, liquids, and gases. • Define diffusion with examples	• Explain diffusion using particle theory with diagrams. • Analyse how temperature affects particle movement.	• Create a stop-motion or digital animation showint particle movement. • Design a classroom demonstration for diffusion.

Chapter 4: Pressure, Weather and Interpretation	• Define Pressure and Write its formula. • Identify instruments used to measure weather.	• Interpret a weather data table to identify trends. • Interpret a weather data table to identify trends.	• Create a working cyclone model. • Design a weather-report presentation using collected data.
Chapter 5: Solutes, Solvents and Solutions.	• Define solute, solvent, and solution with examples. • Differentiate between saturated and unsaturated solutions.	• Analyse how temperature affects solubility using a data table. • Compare concentration changes with data input in an AI mode.	• Design and record a simple solubility experiment with an observation table. • Create a visual model showing particle mixing the microscopic level.
Chapter 6: Cells Microorganisms, and Classification Systems.	• Label parts of plant and animal cells. • Define microorganisms with examples.	• Compare plant and animal cells using a table. • Analyse the role of microorganism in food and health	• Design a 3D cell model with labelled parts. • Create an AI-based cell classifier concept using observable features.
Chapter 7: Health, Immunity, and Predictive Awareness	• Define immunity and vaccination. • List common communicalbe diseases.	• Analyse dengue or seasonal disease data to identify trends. • Compare natural and artificial immunity.	• Create a community awareness campaign poster. • Design a health cell classifier concept data tracking chart.
Chapter 8: How Nature works in Harmony	• Define ecosystem, habitat, biotic and abiotic components • List parts of an ecosystem: population community, food chain food web, tropic levels and decomposers.	• Compare a natural ecosystem with AI system in terms of components and interactions. • Analyse a food chain and predict what happens if once species decreases in number.	• Draw or design a food web diagram and show how energy flows in ecosystem. • Create a simple model or presentation showing how AI helps in monitoring ecosystems.

Conclusion: The Semester-1 chapters of Class 8 Science develop important skills such as investigation, mathematical reasoning, scientific modelling, data interpretation, and health awareness. These foundational skills are also essential in understanding how Artificial Intelligence systems work. Scientific thinking builds logical reasoning, accuracy, and responsible decision-making. With careful study, disciplined analysis, and ethical use of digital tools, knowledge becomes meaningful and contributes positively to society.