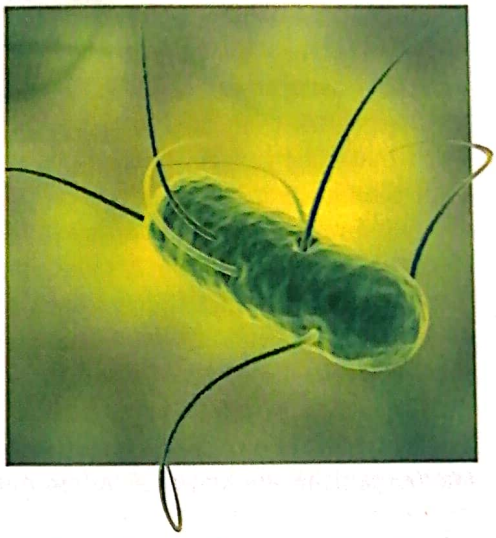

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2 Microorganisms

WHAT ARE MICROORGANISMS?

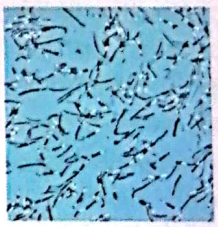
You can see a large number of living organisms around you. However, do you know that there is a larger number of living organisms around you and inside your body that you cannot see with the naked eye?

ACTIVITY 1 (Experimental investigation): To observe microorganisms

Take a drop of pond water and look at it carefully. Can you see any living organisms in it? Now put this drop of water on a glass slide and examine it under a light microscope. Can you see many tiny one-celled organisms floating or moving about swiftly?

Collect some moist soil from a field.

a. Looking through a microscope



b. Microbes in pond water

FIG. 2.1

Put it into a beaker. Add some water to it and mix well. After the soil has settled down, observe a drop of water under a microscope. What do you see?

Scrape your tooth with a toothpick and observe the scraping under a microscope. Can you see tiny rod-like organisms in it?

IN THIS CHAPTER

TYPES OF MICROORGANISMS ◆ USEFUL MICROORGANISMS ◆ HARMFUL MICROORGANISMS ◆ FOOD PRESERVATION

*For detailed instructions, see inside front cover.

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This activity shows that tiny organisms live in water, soil and even inside your body. These are so small that they cannot be seen with the naked eye. They are called microorganisms or microbes.

Organisms that are so small that they can only be seen through a microscope, are called **microorganisms** or **microbes**.

a. Cocci b. Bacilli c. Spirilla

Fig. 2.2 Different types of bacteria

These organisms have a great impact on humans in many ways. Some cause diseases, whereas others cure them. Some provide us food, whereas others spoil food.

The study of microorganisms is known as **microbiology**. Scientists who study microorganisms are known as **microbiologists**.

WHERE ARE MICROBES FOUND?

Most microorganisms are hardy and can be found in almost any kind of environment. They are found in the hottest of deserts and in the coolest icy polar regions. Some microbes live in cracks in the sea floor. Some microorganisms can even survive a volcanic eruption. Microorganisms are found in salt water, in marshland and even inside our body.

Microorganisms are hardy because they form a hard outer covering called a **cyst** around themselves. They do this when conditions are not favourable, such as under extreme conditions of temperature and dryness. They survive by remaining inactive within the cyst until conditions are favourable again.

TYPES OF MICROORGANISMS

There are five major groups of microorganisms. These are as follows:

- **bacteria** (singular: bacterium)
- **algae** (singular: alga)
- **protozoa** (singular: protozoan)
- **fungi** (singular: fungus)
- **viruses** (singular: virus)

Bacteria

Bacteria are simple, unicellular living things. They are found almost everywhere—in air, water, soil, and in bodies of most other organisms, including human beings. They grow and multiply very fast. One bacterium divides to form two bacteria in 10-30 minutes.

Nearly 2,50,00,00,000 bacteria are present in one gram of garden soil. Each bacterial cell can exist singly, but sometimes they cling together to form chains or groups. Bacteria are found in three different shapes (Fig. 2.2):

- **rod-shaped**, called **bacilli**
- **spherical**, called **cocci**
- **spiral**, called **spirilla**

Algae

Algae are simple plant-like organisms that have cell walls and chlorophyll within the cells. Algae can be unicellular or multicellular. They make their own food by photosynthesis. They have no true roots, stems or leaves.

Almost all algae live in water—in ponds, lakes and seawater. Some algae are found in snow and some in hot springs. They also grow in moist soil, barks of trees and rock surfaces. The green growth often seen in water and on the surface of wet rocks is algae.

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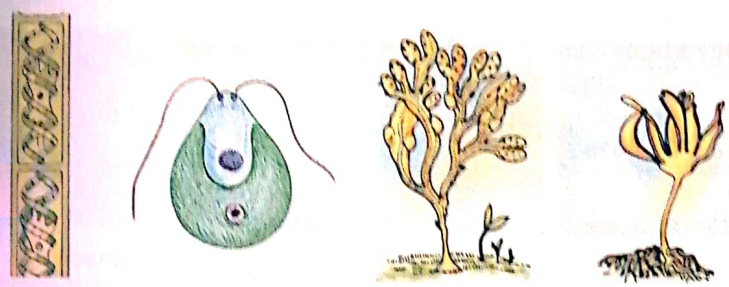
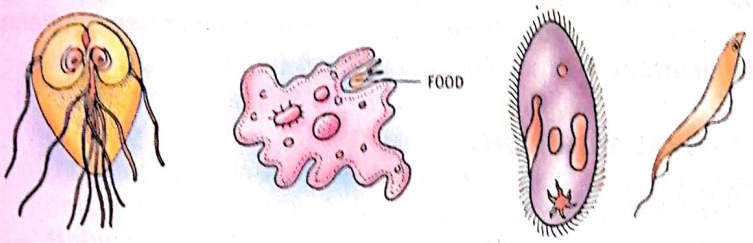


a. *Spirogyra* (filamentous algae) b. *Chlamydomonas* c. *Fucus* d. *Laminaria*

Fig. 2.3 Different types of algae



a. *Giardia* b. *Amoeba* engulfing food c. *Paramecium* d. *Trypanosoma*

Fig. 2.4 Some protozoa

Protozoa

Protozoa are unicellular organisms that have animal-like characteristics. They can move from place to place. They capture and eat food. Some protozoa live in fresh or salt water. Others live in soil. Some are parasites that live in the bodies of other organisms, including human beings. *Amoeba*, *Giardia* and *Paramecium* are some examples of protozoa (Fig. 2.4).

Fungi

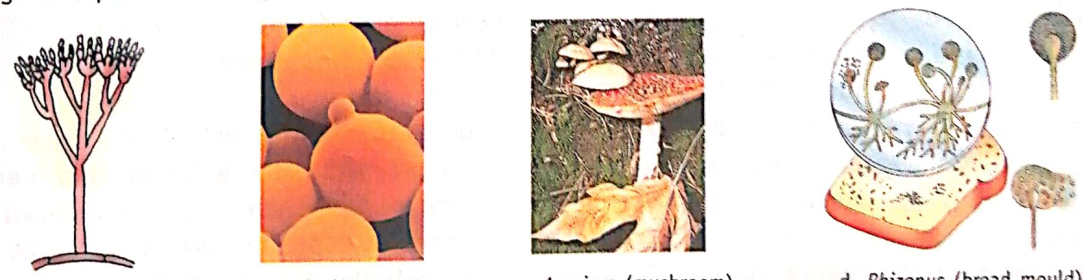
Fungi are plant-like organisms that do not contain chlorophyll. They may be unicellular or multicellular. Yeasts are unicellular, whereas bread mould is multicellular. Mushrooms are large multicellular fungi (Fig. 2.5). Fungi cannot make their own food. They are either parasites or **saprophytes** (saprophytes are organisms that feed on waste and dead plants and animals).

Though fungi are present everywhere, from deserts to very cold regions, they grow best in dark, warm, moist places.

Viruses

Viruses are the smallest microorganisms. They do not have a cellular structure like other microorganisms. They are so small that they cannot be seen by a light microscope. To observe viruses, scientists use an **electron microscope**, which magnifies an object to more than 2,00,000 times.

Viruses cannot reproduce by themselves, respond to changes or use energy or grow. This seems to indicate that viruses are not living organisms. However, when a virus enters the living cell of an organism, say a human, it is able to reproduce. It uses the energy of the host cells for this purpose. After the formation of thousands of viruses, the host cell often dies.



a. *Penicillium* b. Yeast c. *Agaricus* (mushroom) d. *Rhizopus* (bread mould)

Fig. 2.5 Some fungi

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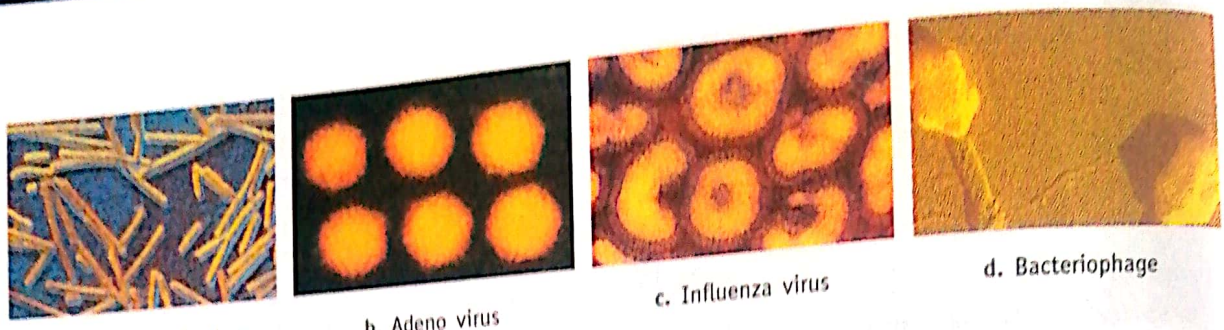

a. Tobacco mosaic virus b. Adeno virus c. Influenza virus d. Bacteriophage

FIG. 2.6 Some viruses

It bursts and the new viruses spread and invade other cells. As a large number of host cells die, the person falls ill.

Since reproduction is a very important characteristic of life, scientists regard viruses as a link between living and non-living. They have been placed on the dividing line between the living and the non-living.

ORAL QUESTIONS

1. All microbes are harmful. Do you agree? Give reasons.
2. Name the types of microorganism that:
   a. have chlorophyll: _____ b. do not have a cellular structure: _____
3. Give one property because of which viruses are regarded as being on the borderline of living and non-living.
4. Which of these are closer to plants—algae or protozoa? In what aspect?
5. Where do you normally expect to find algae—in the soil, in a pond or in the air?

USEFUL MICROORGANISMS

Microorganisms are useful in the following ways.

- In food and beverage industry
- In making medicines and vaccines
- In agriculture
- In cleaning the environment

Food and beverage industry

Bacteria help us in making certain foods. *Lactobacillus* is a bacterium that sours milk and is used to make curd from milk. Cheese is also made by the action of bacteria on milk. Vinegar is produced by the action of bacteria. Bacteria are also used in the production of tea, coffee and cocoa.

- **Making curd and cheese:** Bacteria is used in preparation of some of our most common foods, as we see in Activity 2.

ACTIVITY 2 (Experimental investigation): Making curd

Heat some milk in a pan until it is lukewarm (40–45 °C). Add a teaspoon of curd to it and stir. Cover and leave it for 6–8 hours. The milk in the pan will get converted to curd. If you live in a cold place, preheat an oven to about 80 °C; switch it off and keep the milk-curd mixture in it for 6–8 hours.

Curd contains a bacterium called *Lactobacillus*. When a little curd (called the starter) is added to milk, it multiplies and converts the milk into curd.

Curd or *dahi* is known as plain yogurt

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IT'S A FACT!

Curd is a nutritious food. It also aids in digestion. *Lactobacillus* bacteria inhibit the growth of illness-causing bacteria inside the intestinal tract and promote beneficial bacteria needed for digestion. These friendly bacteria help in the absorption of minerals and aid in the synthesis of vitamins of B group.

in many countries. It also is available in many flavours such as fruit and chocolate. Industrially also, yogurt is prepared by adding *Lactobacillus* bacteria to milk.

The production of cheese also starts by curdling of milk using *Lactobacillus* bacteria. Different bacteria are then added, depending on the type of cheese being made.

- **Making bread:** Yeast plays an important role in preparation of food. You may be familiar with Activity 3.

ACTIVITY 3 (Experimental investigation): Effect of yeast on dough

Take about $^1/_2$ kg flour (*atta* or *maida*). Put warm water in a cup so that the cup is $^1/_3$ full. Add 2–3 teaspoons of sugar to the warm water and mix well. Now, add half teaspoon of yeast powder to the warm water. Cover the cup and leave for $^1/_2$ hour. Then add this sugar-and-yeast solution to the flour. Add more warm water to the flour and knead to form a dough. Cover the dough and keep in a warm place for 2–3 hours. Does the dough rise?

You will see that the dough has risen and its volume has increased.

The yeast uses sugar for food. In the process of breaking down of sugar, alcohol is formed and carbon dioxide is given off. This process is known as **fermentation**. The bubbles of carbon dioxide given off cause the dough to rise. This dough can be used to make bread. When this dough is baked, more bubbles of gas are formed due to the heat. As the gas escapes, the bread rises and becomes soft and fluffy. The heat during the baking process also evaporates the alcohol.

- **Making *idli, dosa* and *dhokla*:** *Idli* and *dosa* are prepared from a mixture of *dal* and rice, which has been ground to a fine paste. The mixture is allowed to stand for a few hours. As fermentation occurs naturally (due to bacteria present in the mixture), the mixture rises and becomes sour. *Dhokla*, a popular food item in Gujarat, requires yeast to be added to its mixture, to make it soft and fluffy. In this case, fermentation may not take place naturally.

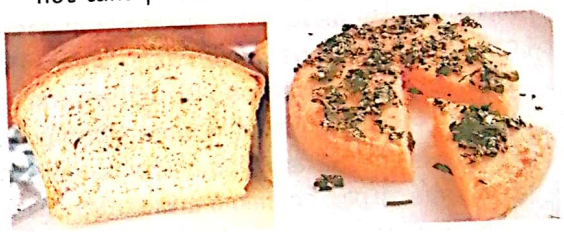

FIG. 2.7 The fluffy texture of bread and *dhokla*

- **Manufacture of alcohol and alcoholic drinks:** You have seen that during fermentation of sugar by yeast, alcohol is produced as a result.

ACTIVITY 4 (Experimental investigation): Fermentation of sugar by yeast

Take some warm water in a cup so that it is $^1/_3$ full. Add 2–3 teaspoons of sugar to it and mix well. Now add half a teaspoon of yeast to it. Cover the cup and keep in a warm place for 4–5 hours. Now smell the solution. Can you smell alcohol in it?

The process of fermentation of sugar by yeast is used in the manufacture of alcohol and alcoholic drinks such as beer and wine. One of the main differences between wine

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and beer production is the source of the sugars. Wine is prepared by fermentation of sugar in grapes, and beer by fermentation of sugar in germinating barley.

- **Other uses of microorganisms in the food industry:** Some seaweeds such as kelp are used as food in many countries such as China and Japan. Kelp is a rich source of potassium and iodine. A substance called **algin** obtained from algae is used to thicken foods, such as ice-creams and jellies.

Making medicines and vaccines

- Bacteria and fungi are used to make medicines called **antibiotics**. These medicines kill or stop the growth of disease-causing microorganisms, and hence are used to cure diseases. Penicillin comes from a species of mould called *Penicillium*. Streptomycin, tetracycline and erythromycin are some other common antibiotics made from bacteria or fungi. Antibiotics are also used to control some diseases of animals and plants.

IT'S A FACT!

Some bacteria develop resistance to antibiotics. In a population of bacteria, there are some hardy ones that are not killed by the antibiotic. These bacteria reproduce very quickly, and soon most of the bacteria become resistant. It is therefore advisable that antibiotics should not be taken unless prescribed by a doctor. They should always be taken in proper doses and the course prescribed by the doctor should be completed.

- Microorganisms are used to make **vaccines**, which protect humans and other animals from several diseases. Diseases such as cholera, typhoid, tuberculosis, hepatitis, chickenpox, measles, polio and smallpox can be prevented by vaccination. Vaccines consist of dead or weakened microbes. When these are swallowed or injected into the body of a patient, the body produces **antibodies** to fight them. The antibodies remain in the body and protect it from any future attack of the disease germs. The body is then said to have developed **immunity** against that disease. Vaccination is therefore called **immunization**.

Fig. 2.8 A child being vaccinated against polio

- Bacteria and yeast are used in making vitamin B complex tablets.
- The human hormone called **insulin** can also be obtained from bacteria. Insulin obtained from bacteria is used to help diabetic patients whose body produces little or no insulin.

In agriculture

The bacterium *Rhizobium* lives in the root nodules of plants, such as gram, pea and bean. These bacteria absorb the nitrogen of the atmosphere and convert it into nitrates which serve as natural fertilizers for plants. You have read about these in Chapter 1. Some blue-green algae can also fix atmospheric nitrogen.

In cleaning the environment

- Microorganisms such as bacteria, fungi and protozoa help by decomposing the tissues of dead organisms to get their food. Without bacteria, piles of dead organisms would cover the earth.
- When microorganisms decompose organic

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matter, they break down plant and animal tissues into simple substances, which are restored to the soil. Thus, the nutrients that were taken from the soil by plants and animals are restored and are used again by living organisms.

- Some bacteria decompose sewage and other wastes in water. This is nature's method of keeping the environment free from pollution.
- Since algae can photosynthesize, they give off oxygen. It is thought that most of the oxygen that we have on the earth was initially produced by algae in the oceans.

IT'S A FACT!

According to scientists, if dead tissues were not decomposed, they would have formed a heap on this earth about 20 km high!

Some other uses of microorganisms

- Certain bacteria and protozoa normally live in the digestive systems of some animals, such as cows, goats and sheep. They help the animals digest grass and plants by breaking down cellulose which the animals themselves cannot do.
- Bacteria are useful in tobacco, leather and jute industries. **Tanning** (to make animal skin into leather by treating it with chemicals) is done with the help of bacteria. In the jute industry, jute plants are submerged in water, where bacterial action separates the fibres from the rest of the tissues. The fibres are then woven into jute cloth.
- In the villages, animal waste, leafy waste from crops, etc., is decomposed by bacteria in the absence of oxygen to produce **methane**, which is used as a fuel. It is one of the chief constituents of **biogas**.

HARMFUL MICROORGANISMS

Microorganisms cause diseases

The microorganisms that cause diseases are known as **pathogens** or **germs**. To cause disease the germs have to first enter our body. They can enter in the following ways.

- **Through air:** When a person suffering from common cold or flu sneezes, coughs or spits, germs are released in the air. A healthy person breathing this air can get infected. Some diseases that spread through air are common cold, flu, chickenpox, mumps, tuberculosis, measles and polio.
- **Through food and water**, e.g. cholera, typhoid, hepatitis.
- **Through direct contact** with a sick person, e.g. ringworm, common cold, flu, chickenpox.
- **Through insects** such as mosquitoes, flies and fleas. These are **carriers** of germs. For example, the female *Anopheles* mosquito carries the malaria germs. When it bites a healthy person, he/she can get infected with malaria. When houseflies sit on dirt, germs stick to their bodies. When they sit on food, they transfer the germs to the food. The person consuming the food can become sick. The female *Aedes* mosquito acts as carrier for the dengue virus.

FIG. 2.9 The *Anopheles* mosquito spreads malaria.

- **Through cuts and wounds**, e.g. tetanus.

Microorganisms also cause diseases in animals and plants. For example:

- **Anthrax** is a disease that affects humans and cattle. It is caused by a bacterium.
- A virus causes the dangerous **foot and mouth disease** in cattle.
- **Citrus canker** is a bacterial disease that affects trees of citrus fruits and is spread by air.
- **Yellow vein mosaic** which affects vegetables like *bhindi* is a viral disease spread by insects.

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- **Rust of wheat** is a fungal disease spread by air and seeds.

Fig. 2.10 Rust of wheat

IT'S A FACT!

During 1845–1847 in Ireland, the potato crop was destroyed by the potato blight fungus, causing many people to starve.

Preventing the spread of communicable diseases

Diseases spread by microorganisms that can spread from an infected person to a healthy person through air, food, water and direct contact are called **communicable diseases.** Some simple methods of limiting the spread of communicable diseases are to keep the infected person separated from others and to advice him/her to keep a handkerchief on the nose and mouth while sneezing. Diseases spread by insects such as mosquitoes can be contained by not allowing them to breed. To prevent mosquitoes from breeding we should not allow water to collect anywhere in our neighbourhood.

Microorganisms spoil food

Bacteria and fungi are responsible for spoilage of food. The souring of milk, putrefaction of meat, rotting of potatoes, vegetables and fruits are due to the action of bacteria.

Growth of mould can make food unfit for consumption.

Yeast can also make fruit juices, tomato juice, etc., unfit for consumption due to fermentation.

Microorganisms growing on food sometimes produce toxic substances. These make the food poisonous. Consuming such food can cause a serious illness called **food poisoning.**

Fig. 2.11 a. A piece of bread, and b. an apple spoilt by growth of microorganisms

FOOD PRESERVATION

How do we stop food from getting spoilt because of the growth of microorganisms on it? We can do this by:

- killing the microbes in the food, and
- stopping them from growing again.

These steps ensure that the food lasts a longer time without getting spoilt. This is known as food preservation.

The following are some common methods for food preservation.

- **Heating** food to a high temperature kills microbes. For example, milk and water are boiled to kill microbes. Ultra-heat treatment (UHT) is the partial sterilization of milk by heating it for a short time, around 1–2 seconds, at a temperature exceeding 135 °C. UHT milk available in tetrapacks has a shelf life of 6 months or more, until opened.

Fig. 2.12 UHT milk

- **Pasteurization of milk** consists of heating it to a high temperature of 70 °C for about half a minute and then cooling it quickly. This kills most of the bacteria without affecting the flavour. This method was invented by **Louis Pasteur.**
- **Cooling** food stops microbes from growing

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and reproducing, and hence preserves food. A refrigerator keeps food at about 5 °C, and keeps it from spoiling for a few days. A deep freezer preserves food at below –18 °C, and can prevent it from getting spoilt for a few months. However, once the food is taken out of the freezer and warmed, microorganisms start growing again and so the food must be consumed soon after.

- **Chemical preservatives** such as sodium benzoate and sodium metabisulphite help control microbial growth. They are used to preserve jams, squashes and ketchups. Other preservatives that are commonly used are:
  - **Salt**, which checks the growth of bacteria by forcing microorganisms to lose water by a process called osmosis. It is used for preserving meat, fish, pickles, chips, etc.
  - **Sugar** inhibits the growth of bacteria and is used as a preservative in jams, jellies and squashes. It also makes microbes lose water by osmosis.
  - **Oil** and **vinegar** provide an environment in which microorganisms cannot grow. They are used to preserve vegetables, fruits, fish, meat and pickles.
- **Drying** or **dehydration** of food consists of removing water from it. This stops microorganisms from growing as they cannot grow without water. Cereals, pulses, spices and dry fruits are preserved by this method.
- **Canning:** Canning consists of sterilizing the food and then sealing it in airtight containers. This prevents it from getting spoilt for over a year.

FIG. 2.13 Canned food

ORAL QUESTIONS

1. While making cake or *dhokla*, the dough rises because of a substance that is produced during fermentation. What substance is this? Why does it cause the dough to rise?
2. To prevent a disease caused by a certain microbe, doctors inject the same microbes in a person's blood. How is it ensured that this **prevents** the disease instead of **causing** it? What is this process of injecting microbes called?
3. Microbes that live inside the bodies of animals normally cause diseases. However, some of them also help animals. Give an example to prove this point.
4. Pasteurization means boiling the milk to kill germs. Do you agree? Give reasons.

OUR HERITAGE

The traditional system of medicine in India called **Ayurveda** developed in the first millennium BCE (years from 1000 BCE to 1 BCE). Two books *Charakasamhita* and *Sushrutasamhita* describe how to protect the healthy and to prolong life. They include details of the examination, diagnosis and treatment of numerous diseases.

NEW WORDS

MICROBES—tiny organisms that can only be seen through a microscope

MICROBIOLOGY—study of microorganisms

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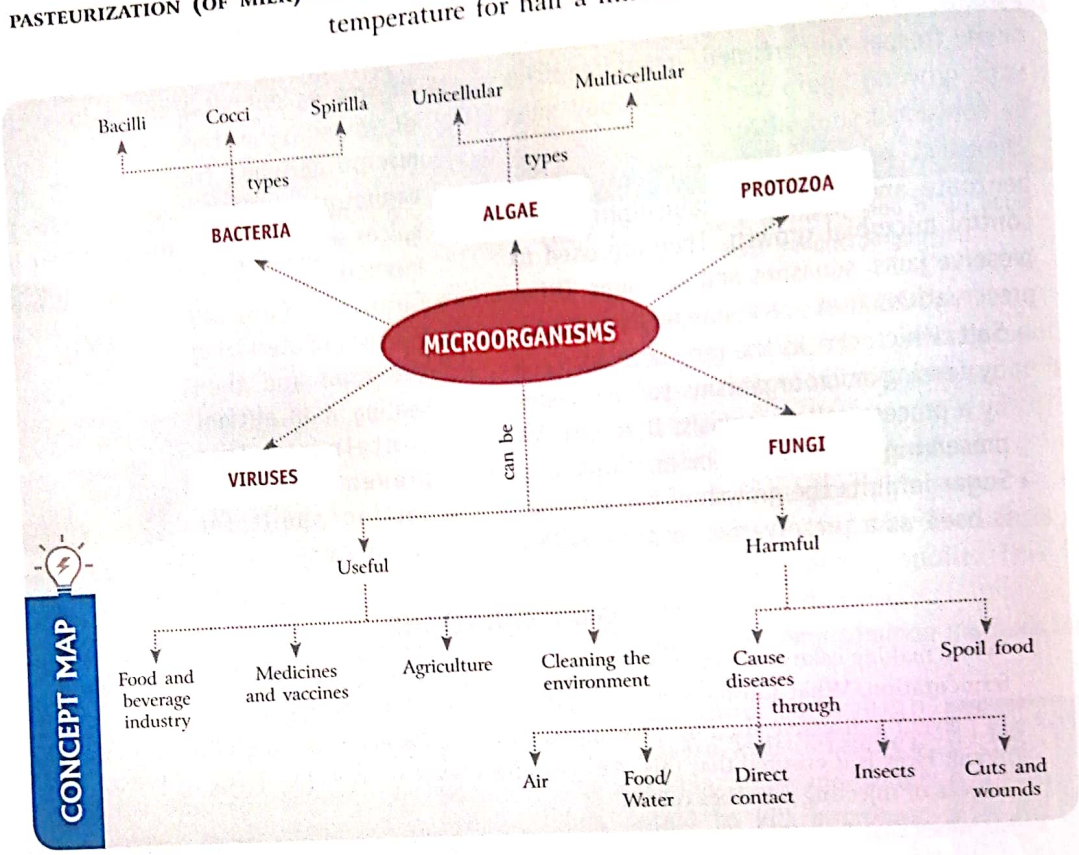
MICROBIOLOGISTS—scientists who study microorganisms

VACCINE—dead or weakened germs that help protect the body against future attack by the germs

PASTEURIZATION (OF MILK)—a method of preserving milk by heating it to a high temperature for half a minute and then cooling it quickly



NOW YOU KNOW

- Organisms that are small and can be seen only through a microscope are called microorganisms or microbes. They are present all around us and also inside our bodies.
- Microorganisms belong to five major groups—bacteria, algae, protozoa, fungi and viruses.
- Bacteria are single-celled organisms. They may be rod-shaped, spherical or spiral.
- Algae are simple plant-like organisms with chlorophyll in their cells. They may be unicellular or multicellular.
- Protozoans are unicellular animal-like organisms.
- Fungi are plant-like organisms that do not contain chlorophyll. They may be unicellular or multicellular.
- Viruses are very small and do not have a cellular structure. They are regarded as being on the dividing line between the living and the non-living.

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- Microorganisms are used in the food and beverage industry, in making medicines and vaccines, in agriculture and in cleaning the environment.
- Yeast ferments sugar to produce alcohol and gives out carbon dioxide. This is used to make bread and alcoholic beverages.
- Microorganisms cause diseases in humans, other animals and plants, and spoil food.
- Food can be preserved by killing microbes in food and stopping them from growing again.
- Some methods of food preservation are: heating, cooling, pasteurization (of milk), adding chemical preservatives, drying and canning.

EXERCISES

A. Choose the most appropriate answer.

1. Which of the following cannot be classified as either living or non-living?
   a. fungi b. bacteria c. viruses d. protozoa
2. *Amoeba* is a
   a. bacterium. b. virus. c. fungus. d. protozoa.
3. Which of the following make their own food by photosynthesis?
   a. algae b. viruses c. fungi d. protozoa
4. The unicellular organisms that sour milk to make curd are
   a. bacteria. b. viruses. c. fungi. d. protozoa.
5. Which of the following is responsible for making bread soft and fluffy?
   a. finely ground flour
   b. sugar
   c. alcohol given off during fermentation of sugar
   d. carbon dioxide gas given off during fermentation of sugar
6. Which of these do not have a regular cell structure?
   a. bacteria b. viruses c. algae d. protozoa
7. Which of these are found as both unicellular and multicellular organisms?
   a. bacteria b. viruses c. algae d. protozoa
8. The bacterium *Lactobacillus* is useful in making
   a. cheese. b. cake. c. alcohol. d. all of these
9. Microorganisms spread through
   a. air. b. cuts. c. water. d. all of these
10. Which of these does not prevent growth of bacteria?
    a. salt b. sugar c. water d. oil

B. VERY SHORT-ANSWER QUESTIONS: Give one-word answers.

1. What is the study of microorganisms known as?
2. Microbes are disease-causing microorganisms. True or false?
3. All fungi are unicellular. True or false?

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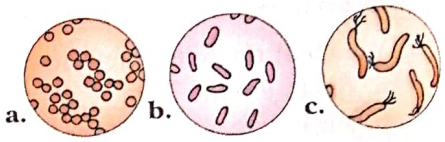
4. Under unfavourable conditions, microorganisms form a _____ around themselves.
5. What are spherical bacteria called?
6. A virus can reproduce on its own. True or false?
7. Where are algae mostly found—in water or on land?
8. Is the decomposition of the bodies of dead plants and animals by microorganisms desirable or undesirable?
9. Name the class of medicines usually made from fungi or bacteria that can cure dangerous diseases.
10. Is yeast a bacterium or a fungus?
11. The female *Aedes* mosquito is a carrier of the _____ virus.
12. The foot and mouth disease is caused by a _____
13. Food poisoning is caused by a toxin getting accidentally mixed with food. True or false?
14. What is heating milk to a high temperature and then cooling it quickly called?
15. Salt forces microbes to lose water. True or false?

C. SHORT-ANSWER QUESTIONS (TYPE I): Answer in a sentence or two.

1. What is a microorganism?
2. Name the five groups into which microorganisms are divided. Which of these have only unicellular organisms?
3. Name the three types of bacteria shown in this figure.
4. What kinds of living organisms are classified under algae? Give two examples.
5. Under what circumstances can viruses reproduce?
6. Give one important use of algae.
7. How does cooling help in food preservation?
8. What causes food poisoning?
9. What is pasteurization?



D. SHORT-ANSWER QUESTIONS (TYPE II): Answer these questions.

1. How does mosquito help in spreading viruses/microorganisms?
2. Microorganisms are found even in places where no other life forms can exist. What makes microorganisms so hardy?
3. Which microorganism is used to make bread soft and fluffy? Discuss how this happens.
4. What is fermentation? Discuss its use in making alcoholic beverages.
5. How do viruses cause diseases?
6. How does a vaccine work?
7. How does salt prevent food spoilage?
8. What is 'dehydration' of food? In what way is this technique useful?
9. Which microorganisms act as decomposers? How is this activity useful to us?

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E. LONG-ANSWER QUESTIONS: Answer these questions.

1. Why are viruses considered to be on the borderline of living and non-living?
2. Discuss three important ways in which bacteria are useful to us and two ways in which they are harmful.
3. Discuss the different ways in which communicable diseases spread from person to person.
4. Discuss five methods of food preservation.

HOTS QUESTIONS: Think and answer.

1. Why do you think:
   a. curd sets faster in summer than in winter?
   b. curd turns sour faster in summer than in winter?
2. The sealed packets in which food items such as chips are sold are usually filled with nitrogen. How do you think that helps?
3. Why should you always wash your hands before handling food and after coming from the toilet?
4. Evolution, i.e. changes in an organism to adjust to the environment, as suggested by Charles Darwin, is a very slow process that takes place over tens of thousands of generations, over millions of years. However, in bacteria, developing resistance to antibiotic, which is a type of evolution, takes place within our own lifetime. Can you say why it occurs so quickly in bacteria?

BE A SCIENTIST

Ancient Egyptians applied mouldy bread on infected cuts and wounds to heal them. Why do you think this helped in healing the wounds? Nowadays we do not use mouldy bread to cure infection. What do we use instead?

ENRICHMENT ACTIVITIES

In the Library—Research Project

Here are some important milestones in the discovery of microorganisms. In each case, find out the name of the scientist.

This Dutch scientist (1632–1723) improved the microscope and first saw microorganisms with its help.

This French scientist (1822–1895) is considered to be the father of bacteriology—the study of bacteria. He discovered that bacteria in the air spoil food and also cause diseases.

This English surgeon (1827–1912) first used an antiseptic to kill bacteria while operating on his patients. He used carbolic acid as an antiseptic to disinfect the operation theatre, the surgical tools and surgical cuts. Within five years, he was able to bring down the death rate in major operations from 45 per cent to 12 per cent.

My Virtual Library—Research/Activities on the Internet

- ❒ Visit rsgr.in/lsc-8 and click on LINK 5 for videos, quizzes and games on microorganisms.
- ❒ Visit rsgr.in/lsc-8 and click on LINK 6 to find about microorganisms and diseases.
- ❒ Visit rsgr.in/lsc-8 and click on LINK 7 to watch an animated movie on germs.

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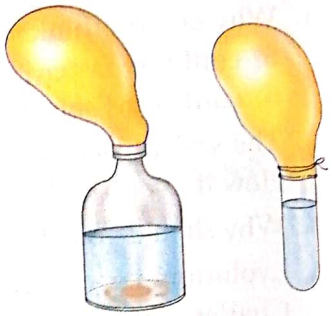
In the Laboratory—Experimental Project / Making a Model

❒ **To make a carbon dioxide balloon** You have seen that yeast is used for fermentation. Yeast ferments sugar by feeding on the sugar and expelling carbon dioxide in the process. To fill a balloon with carbon dioxide given off during fermentation, proceed as follows. Then, also test the gas to prove that it is carbon dioxide.

You will need ◆ a packet of dry yeast ◆ half litre of warm water (40 °C –50 °C) ◆ two tablespoons sugar ◆ a large rubber balloon ◆ a one-litre empty water bottle

Procedure:



- Loosen out the balloon by blowing it up repeatedly.
- Add the packet of yeast and the sugar to the cup of warm water and stir.
- Once the yeast and sugar have dissolved, pour the mixture into the bottle.
  You'll notice the water bubbling as the yeast produces a gas.
- Attach the balloon to the mouth of the bottle.
- After several minutes, you'll notice that the balloon blows up.
- Now fill another test tube about ¼ with lime water. Carefully remove the filled balloon so that the gas inside does not escape. Fit the balloon on the test tube with lime water and shake it well.
- Did the lime water turn milky? What does this show?

As the yeast feeds on the sugar, it produces carbon dioxide. This gas slowly fills the balloon.

A very similar process happens when bread is baked. Carbon dioxide from yeast forms thousands of tiny balloon-like bubbles in the dough. These cause the dough to rise and give the loaf its airy texture.

❒ **Make your own lens**

You will need ◆ a glass tumbler ◆ water ◆ some old newspaper

Procedure:

- Take a glass tumbler with smooth straight walls. Fill it with water.
- Place a piece of newspaper on one side of the tumbler and look from the other side.
- Can you see a magnified image of the print in the newspaper?

This is your own home-made magnifying lens. Experiment with glass vessels of different shapes and sizes. Which shape and size gives the most magnification?

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