UNIT 3 MICROORGANISMS

Living things such as humans, animals, and plants can be seen easily. Have you seen other living things such as the ones shown in each circle above? These living things cannot be seen with our naked eyes and can be found in soil, water, and air, as well as in our bodies. What are these living things?

Microorganisms

Have you heard of the word microorganism? The word microorganism is a combination of the words micro and organism. Micro means very small or tiny and cannot be seen with the naked eyes. Organism means living thing. Therefore, what does microorganism mean?

Most microorganisms can only be seen using specialised equipment called microscopes. Microorganisms can survive on their own or in groups. What are the types of microorganisms that exist around us?

Fungi

Fungi can be found in the air, water, soil, and on other living things. They survive by decomposing or breaking down the objects they live on. The decomposed matter is absorbed as nutrients. Fungi reproduce by producing spores. Examples of fungi are mould, yeast, and *Penicillium*.


Penicillium


yeast


Rhizopus (bread mould)

Bacteria


Spirillum


Streptococcus


Escherichia coli


Salmonella

Bacteria exist in spherical, rod or spiral form. They can be found in the air, water, soil, and on other living things such as humans, animals, and plants. They live by absorbing nutrients from other living things. Examples of bacteria are *Spirillum*, *Streptococcus*, *Escherichia coli*, and *Salmonella*.

- Fungi is a group of fungus.
- Bacteria is a group of bacterium.

Algae

Algae has the characteristics of plants. They have chlorophyll and can produce their own food through the photosynthesis process. Examples of algae are *Chlorella*, *Chlamydomonas*, and *Volvox*.


Chlorella


Volvox


Chlamydomonas

Volvox

Paramecium


Paramecium


Amoeba

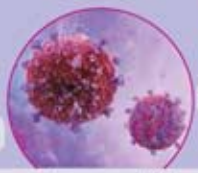
Protozoa

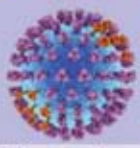
Protozoa have the characteristics of animals because they can move to find food. They can mainly be found in ponds, lakes, and rivers. Examples of protozoa are *Paramecium* and *Amoeba*.

Virus

Viruses are the smallest microorganisms. They can only live and reproduce when they are inside other living things. Viruses can only be seen using electron microscopes. Examples of viruses are Bacteriophage, *Human Immunodeficiency Virus (HIV)*, and *Influenza virus*.


Bacteriophage


Human Immunodeficiency Virus (HIV)


Influenza virus

State the meaning of microorganisms and explain the different types of microorganisms found around us.

SCIENCE INFO

Coronavirus (CoV) is a type of virus that causes respiratory infections. In 2019, the latest coronavirus was identified in China and it is known as Coronavirus disease 2019 (COVID-19). The virus caused a lot of human deaths.

Life Processes of Microorganisms

Just like all other living things, microorganisms go through life processes.

Let's investigate to prove that microorganisms undergo life processes too.

LET'S TEST Life Processes of Microorganisms

Activity 1 : Microorganisms Breathe

Group Activity

21st Century Learning Skills

Aim: To prove that microorganisms breathe

Do microorganisms breathe?

Apparatus and materials: sugar, yeast, warm water, balloon, beaker, teaspoon, tablespoon, plastic bottle, string, ruler, filter funnel

Steps:

1. 

Measure 250 mℓ of warm water and pour it into a plastic bottle.

2. 

Then, add two tablespoons of sugar and three teaspoons of yeast into the bottle using a filter funnel.

3. 

Fix a balloon onto the bottle as shown in the picture.

4. 

Shake the bottle.

5. 

Take turns to record the circumference of the balloon at the intervals of 10 minutes for 30 minutes. Record your observation in a table.

6. Present your findings to the class.

Questions:

1. What can you observe from the circumference of the balloon?
2. Give an inference for your observation.
3. What can you conclude from this activity?

Activity 2: Microorganisms Move

Group Activity

Aim: To prove that microorganisms move

Be careful when handling cover slips.

Apparatus and materials: microscope, dropper, glass slide, cover slip, beaker, petri dish, water collected from a pond or a river

Steps:

1. 

Take some water sample collected from a pond or a river using a dropper. Place a drop of the water sample on a glass slide. Cover it with a cover slip.

2. 

Place the glass slide on the stage of a microscope.

3.

Adjust the objective lens to obtain a clear image of the microorganisms.

4.

Move the slide to the centre until a clear image is viewed.

5.

Adjust the position of the mirror until you are able to focus on the image of the microorganisms.

6.

Observe the position of the microorganisms that you are able to see. Sketch their positions every minute for three minutes. Discuss your findings.

Questions:

1. Did the position of the observed microorganisms change?
2. What can you conclude from this activity?

movement of microorganisms

Place a small piece of cotton on the glass slide after placing a drop of water. This makes observing the movement of the microorganisms easier.

Activity 3: Microorganisms Grow

Aim: To prove that microorganisms grow

Apparatus and materials: ziplock bag, magnifying glass, spray bottle, a slice of bread, water

Steps:

Avoid touching the bread mould with your hands.

1. 

Spray some water on both sides of the bread.

2. 

Put the bread in a ziplock bag. Remove some air from inside the bag and seal it carefully.

3. 

Place the bag containing the bread in a dark place such as in a cupboard or a drawer.

4. 

Start observing the surface of the bread on the fifth day until the seventh day. Observe the size of the bread mould.

Questions:

1. What can you observe on the surface of the bread?
2. What is the change in the size of the bread mould from the fifth to the seventh day?
3. What can you conclude from this activity?

After conducting the experiments, Chua and his friends shared their observations.

The circumference of the balloon increased.

I managed to see the protozoa move and change their positions.

The size of the bread mould increased.

From these activities, what conclusions can you make regarding the life processes of microorganisms?

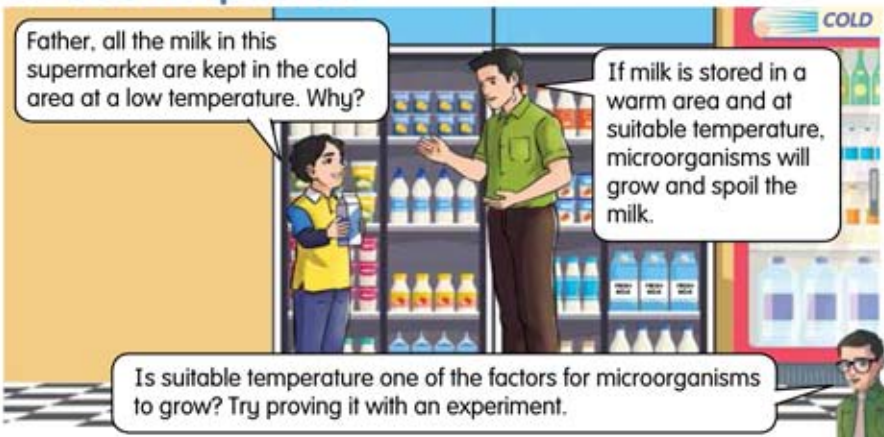
Factors Affecting the Growth of Microorganisms

Mr Hadi, why doesn't the yeast in these packets grow?

The yeast in the packets do not grow because they are still inactive. Microorganisms will grow when all the conditions needed for them to grow are met.

What are the conditions needed for microorganisms to grow? Look at the situation below.

Suitable Temperature



EXPERIMENT

Suitable Temperature

1. **Aim:** _____
2. **Problem statement:** Does suitable temperature affect the condition of the milk?
3. **Hypothesis:** _____
4. **Variables:**
   (a) manipulated: _____
   (b) responding: _____
   (c) constant: _____
5. **Apparatus and materials:** Bunsen burner, two bottles with caps, thermal flask, beaker, fresh milk
6. **Steps:**
   (a) Prepare three glasses that are filled with the same amount of fresh milk.
   (b) Pour the milk from the first glass into a bottle labelled A. Close the bottle and keep it in a refrigerator.
   (c) Pour the milk from the second glass into a bottle labelled B. Close the bottle and keep it at room temperature.
   (d) Pour the milk from the third glass into a beaker. Boil the milk using the Bunsen burner. Then, pour it into the thermal flask. Close the thermal flask and leave it on the table.
   (e) Observe the condition of the milk daily for three days.
   (f) Record your observation in a table.

7. **Data:** _____
8. **Interpreting the data:**
   (a) _____ temperature spoils the condition of the milk the fastest.
   (b) _____ temperature is suitable for microorganisms to grow.
9. **Conclusion:**
   (a) The hypothesis is (accepted/not accepted).
   (b) The condition of the milk will _____ if the temperature of the milk is _____.

Other than suitable temperature, what other factors affect the growth of microorganisms? Understand the situations below.

Presence of Water

Why does dried bread last longer than fresh bread? Does the absence of water cause the microorganisms not to grow?

That was what I was thinking too. Fresh bread has moisture which makes it easier for mould to grow.

Let's conduct an experiment using two pieces of dried bread. We use two pieces of dried bread labelled A and B but only B is dipped in water.

bread A

bread B

Based on the suggested materials, plan and conduct an experiment to investigate if the presence of water has an effect on the growth of microorganisms.

Presence of Air

These asparagus are vacuum packed. Do vacuum packed vegetables last longer?

Yes. In my opinion, vegetables last longer when there is no air in the vacuum pack. When there is no air, microorganisms cannot grow.

I agree with your hypothesis. Let's conduct an experiment using apple slices. Several apple slices will be vacuum packed while the other slices will not be vacuum packed.

How does the presence of air affect the growth of microorganisms?

Presence of Nutrients

Why do we need to add sugar into the yeast in the previous experiment?

I think that yeast needs nutrients to grow and become active.

Let's investigate the growth of bacteria in distilled water and fresh milk. Fresh milk contains nutrients while distilled water does not contain any nutrients.

distilled water

fresh milk

Does the presence of nutrients affect the growth of bacteria? Observe the growth of bacteria in the experiment above after three days.

Suitable Acidity

How do preserved mangoes remain fresh for a longer time?

I think that the acidity of the preserved liquid is unsuitable for the growth of microorganisms.

Let's conduct an experiment using apple slices to investigate whether acidity affects the growth of microorganisms. One apple slice is soaked in vinegar while the other slice is soaked in tap water.

Based on all the conducted experiments, what conclusions can you make regarding the factors that affect the growth of microorganisms?

Uses of Microorganisms

Did you know that bread is soft and fluffy because of the actions of microorganisms? Some actions of microorganisms by fungi, bacteria, algae, and protozoa are useful to us.

Wow, this bread is so soft and fluffy!

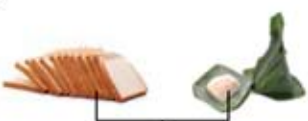
How do the actions of microorganisms benefit us?

Manufacture of food products

Bacteria and fungi are used to make cheese.

Fungi are used to make tempeh.

Bacteria are used in manufacturing yogurt.



Yeast is used to make bread and fermented rice.

Production of medicine

Some fungi are used to produce penicillin, an antibiotic which prevents the growth of harmful bacteria.

Some fungi, bacteria, and viruses are used to produce vaccines that stimulate the production of antibodies to fight against harmful viruses.

Production of organic fertilisers

Animal faeces mixed with sawdust is decomposed by bacteria to produce organic fertiliser.

Treatment of sewage

Bacteria help the decomposition process of faeces by breaking down organic waste found in sewage treatment plants.

Harmful Effects of Microorganisms

The actions of microorganisms also have harmful effects.

Cause food spoilage

Fungi that grow on food cause food to turn bad.

Cause tooth decay

Bacteria in the mouth produce acid from sugar and food particles. The acid causes tooth decay.

Cause food poisoning

Food poisoning can occur due to the actions of microorganisms such as *Salmonella* through contaminated sources.

Cause damage to plants

Fungi that grow on leaves can disrupt the process of photosynthesis.

Cause infectious diseases

Influenza

Influenza is also known as flu. It occurs when the body is infected with the *Influenza virus*.

Mumps

Mumps is a type of disease caused by viruses. It causes swelling of the cheek and neck.

Ringworm

Ringworm is a skin infection caused by fungi.

Measles

Measles is a disease caused by a virus.

What are other infectious diseases caused by microorganisms?

Explain the effects of microorganisms in our daily lives.

FUN ACTIVITY

Mould Terrarium

Group Activity

Apparatus and materials: clear container with a lid, food scraps, water, spray bottle

1. Do not open the container lid.
2. Do not touch the microorganisms with your hands.

Steps:

1.

Arrange the food scraps in a clear container. Ensure some distance between the food scraps.

2.

Spray some water on each food scrap. Close the lid properly.

3. Predict your observation based on the following questions.
   - Which food scrap will spoil first?
   - What type of microorganism will be observed?
4. Take turns to answer these questions and record them on a piece of paper.
5.

Each group will place their terrarium at different places. Observe the terrarium every three days for six days. Compare the observation with your prediction.

Questions:

1. What microorganism can you observe?
2. What did the microorganism do to the food scraps?
3. Which food scrap had the most growth of microorganism? Why?

3.1.1, 3.1.5, 3.1.6

Guide the pupils to correctly discard the terrarium.

FUN SCIENCE

Making Tempeh

Make tempeh using 500 g of soya beans, half teaspoon of tempeh starter, ziplock bag, and water.

Be careful when handling gas stoves.

Steps:

1. 

Soak some soya beans overnight in warm water. Then, remove the soya bean hulls.

2. 

Boil the soya beans until they are ¾ cooked or boil for 45 minutes to 1½ hours.

3. 

Leave the soya beans to cool. Then, sprinkle the tempeh starter and mix well.

4. 

Make holes on a ziplock bag. Fill it with the soya beans and seal it.

5. 

Keep the sealed soya beans at room temperature with good air circulation. Observe the tempeh after 36 to 48 hours.

MIND REFLECTION

1. Microorganisms are very small living things that cannot be seen with our naked eyes.

2. There are five types of microorganisms:
   - fungi
   - bacteria
   - algae
   - protozoa
   - virus

3. The life processes of microorganisms are as follows:
   - breathe
   - move
   - grow

4. Factors that affect the growth of microorganisms are as follows:
   - suitable temperature
   - presence of water
   - presence of air
   - presence of nutrients
   - suitable acidity

5. The actions of microorganisms have the following effects:

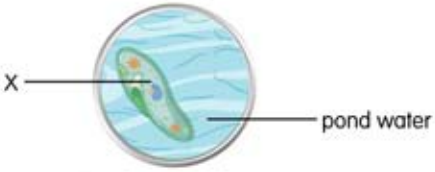
Benefit	Harm
• manufacture of food products • production of medicine • production of organic fertilisers • treatment of sewage	• cause food spoilage • cause tooth decay • cause food poisoning • cause damage to plants • cause infectious diseases

MIND TEST

Answer all questions in the Science exercise book.

1. State the types of microorganisms that fit the characteristics given below.
   (a) the smallest
   (b) produce their own food
   (c) have animal characteristics
   (d) reproduce through spores
   (e) are in spherical, rod or spiral forms

2. The picture below shows a drop of pond water that is observed under a microscope.



   (a) Name X.
   (b) Predict the position of X after 5 minutes.
   (c) Give an inference for your answer in 2(b).

3. The picture shows three balls of dough that have been left for 20 minutes. The initial size of the balls of dough and the amount of sugar added to each ball of dough are the same.

   (a) State one observation.
   (b) Give an inference for your observation in 3(a).
   (c) Name the life process of the microorganism based on the situation above.

   (d) The picture below shows a ball of dough that is added with yeast but not sugar.

   Does the size of the ball of dough increase after 20 minutes? Why?

4. Produce a graphical presentation about the effects of the actions of microorganisms in our daily lives based on your creativity.