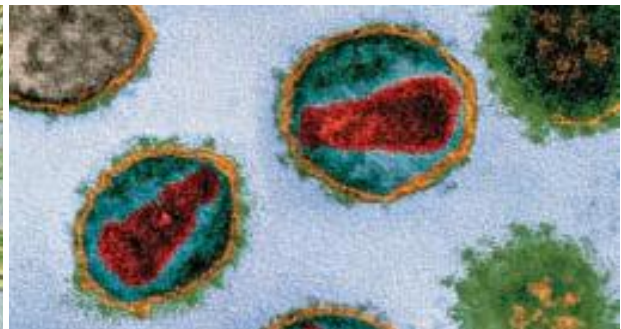
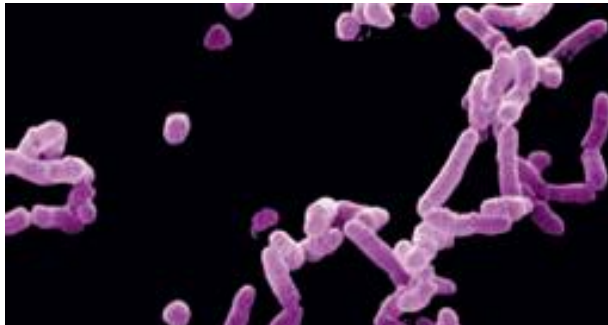


UNIT
7

The simplest living things

What do you remember?

- What do all living things have in common?
- What three vital functions do all living things carry out?
- What is the chemical composition of all living things?
- Where can you find microorganisms?



Content objectives

In this unit, you will ...

- Identify the main characteristics of microorganisms
- Examine the structure and vital functions of bacteria
- Learn how viruses are structured
- Observe microorganisms under the microscope

Key language

Expressing facts

*Parasites feed off living things.
Saprophytes live on decomposing matter.*

Describing

*Viruses cannot live independently of their host.
Algae have no true tissues or organs.*

Giving instructions

Label each jar. Observe the samples.

1. What is the Monera kingdom?

The Monera kingdom contains unicellular, microscopic, prokaryotic organisms. They do not have an organised nucleus.

Bacteria belong to the Monera kingdom. They can live almost anywhere. They sometimes form colonies, but each individual cell remains independent. The first living things on Earth, more than 3,500 million years ago, were probably bacteria.

Bacteria nutrition

Most bacteria are **heterotrophs**: they do not produce their own food.

- **Parasites** feed off living things. They cause illnesses like tuberculosis and cholera.
- **Saprophytes** live on dead or decomposing matter. They transform organic substances into inorganic substances. Some saprophytes are useful: lactobacilo is used to make yoghurt.
- **Symbionts** live on the bodies of other living things to provide mutual benefit. They can be found in the digestive system of many mammals. There, intestinal bacteria help with digestion.

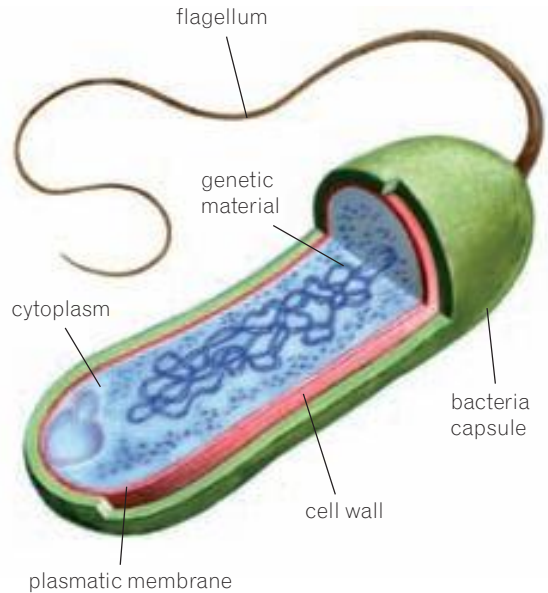
Some bacteria are **autotrophs**. For example, cyanobacteria make their own food through photosynthesis.

Bacteria reproduction

Bacteria generally reproduce by binary fission, producing two daughter cells. Each daughter cell grows, and then divides again.

How many groups are there?

Bacteria can be classified into four groups by their shape.

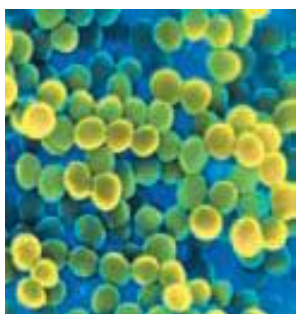


Bacteria cell structure

Activities

1. Draw a bacteria cell and label it: *cell wall*, *cell membrane*, *cytoplasm*.
2. Compare bacteria. Complete the chart:

Nutrition		
Parasites	Saprophytes	Symbionts



Coccus. Spherical



Bacillus. Rod-shaped



Vibrio. Curved-rod shaped



Spirillum. Helical

2. What is the Protocist kingdom?

The Protocist kingdom includes unicellular and multicellular living things. They are all eukaryotes and have no tissues. Protozoa and algae are found in this kingdom.

What are protozoa?

The main characteristics of protozoa are:

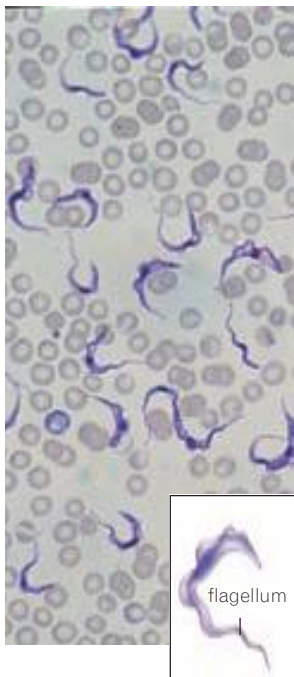
- **Unicellular.** A single cell carries out all the vital functions.
- **Heterotrophs.** They feed on bacteria, organic remains and other microscopic organisms.
- They live in both salt water and fresh water. Some protozoa float on water, **zooplankton**, and are food for aquatic animals.
- Some are parasites, and cause illnesses.

How many groups are there?

There are four groups of protozoa. They are classified according to the way they move.

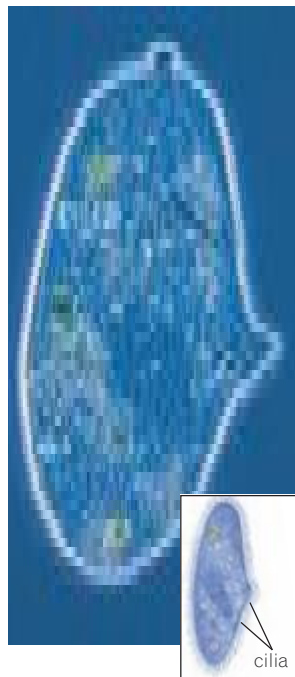
Did you know that...?

Plasmodium, which cause malaria, need both a vertebrate and a mosquito to complete their life cycle.



Flagellates

Movement: using a flagellum or tail.
 Nutrition: some are parasites.
 Fact: *Trypanosoma* causes sleeping sickness.



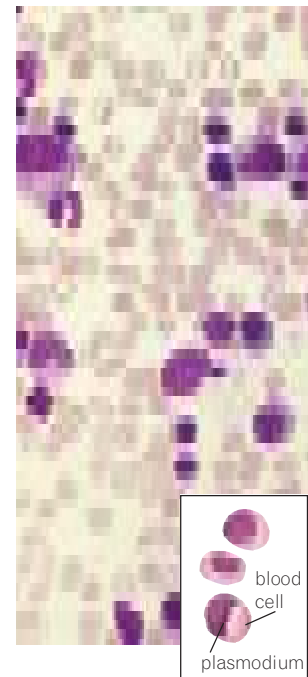
Ciliates

Movement: using cilia: hair-like organs.
 Nutrition: Some are parasites.
 Fact: *Paramecium* is shaped like a slipper. It has two nuclei.



Rhizopods

Movement: using pseudopods: projections of cell cytoplasm.
 Nutrition: Some are parasites, others are not.
 Fact: *Entamoeba histolytica* causes dysentery.



Sporozoa

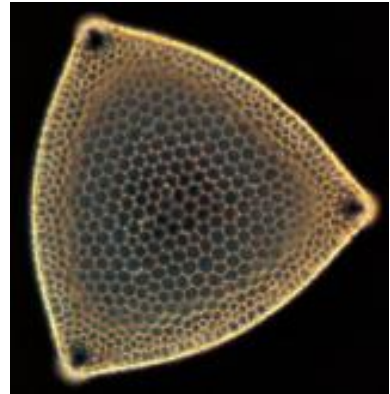
No movement.
 Nutrition: All are parasites.
 Fact: *Plasmodium* causes malaria.

What are algae?

The main characteristics of algae are:

- **Unicellular** or **multi-cellular**. Unicellular algae sometimes form colonies. Each cell can carry out the vital functions. All the cells of multicellular algae look the same and have the same functions. Therefore, algae have no true tissues or organs.
- **Autotrophs**. They contain chlorophyll and other pigments which capture sunlight for photosynthesis. They can be classified by their pigment: **green, brown** or **red**.
- Some live in salt water and fresh water, but others live on tree trunks or rocks. Some unicellular algae, like diatomea, float on water forming **phytoplankton**, and are food for aquatic animals.

Algae provide food for humans too, for example, ice cream is made from algae. Industrial uses include medicines and fertilisers.



Diatomea. These unicellular algae have a silica shell formed by two interlocking valves.

How many groups are there?



Green algae

Colour: mainly green
Habitat: on the surface of salt water or fresh water
Example: *Euglena*, *Ulva*



Brown algae

Colour: green, yellowish pigment
Habitat: salt water, on rocky coasts and on the surface of water.
Example: *Diatomeas*, *Sargazos*



Red algae

Colour: green and red
Habitat: deep in warm, still ocean water
Example: *Coralina*

Did you know that...?

Many aquatic animals feed on zooplankton and phytoplankton.

Example:
the blue whale



Activities

3. Compare protocists and monera. Examples:
... live in are autotrophs, but ... are
4. Describe how each group of protozoa move.
Example: ... move using... ..do not move.
5. What do algae have in common with plants?
6. Compare protozoa and algae. Draw a Venn diagram.

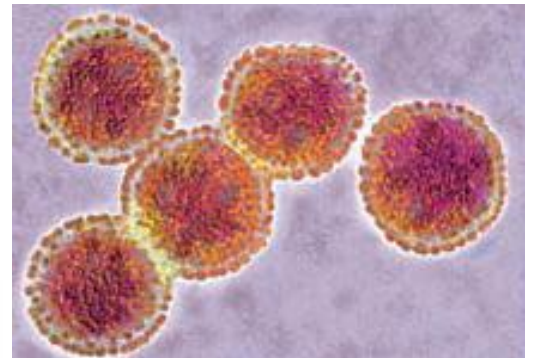
3. What are viruses?

Viruses are not cells, so they are not really living things. They cannot carry out any vital functions by themselves. They infect living cells, and then they can reproduce. They are always obligate parasites: they cannot live independently of their host.

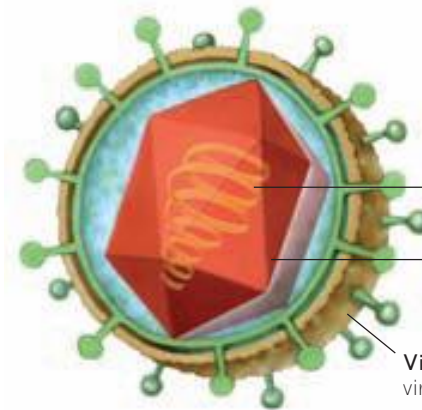
What is a virus like?

The main characteristics of viruses are:

- **Extremely small.** They can only be seen through an electron microscope.
- **Unable to move.**
- **Extensive habitat.** They are found on the ground, in the air and in water.



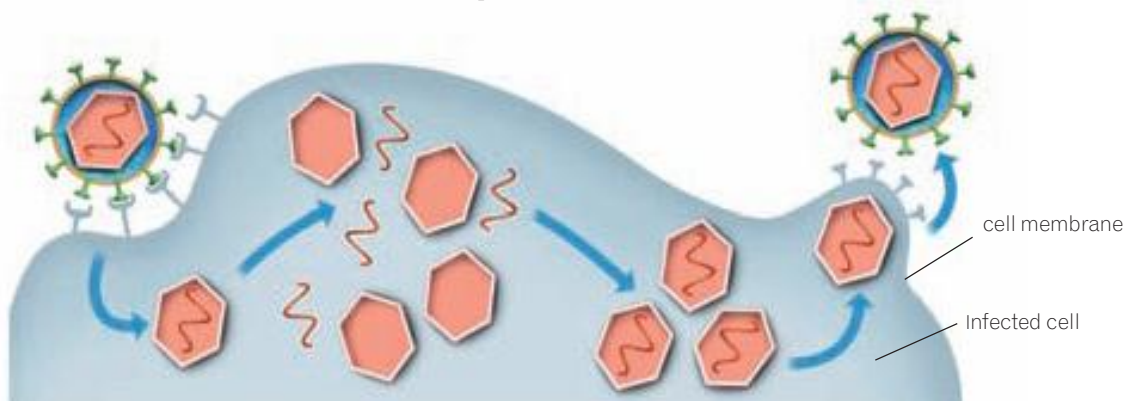
Flu virus seen under an electron microscope



- **Nucleic acid.** Genetic material inside the capsid
- **Capsid.** A protein shell. It can have different shapes.
- **Viral envelope.** It covers the capsid. Only some viruses like influenza or HIV viruses have one.

Virus infection process

1. The virus enters the cell.
2. Reproduction: viruses use the infected cell to make the viral components.
3. The viral components assemble.
4. New viruses leave the cell.



Did you know that...?

Rabies, a fatal disease in humans, is caused by a virus. Louis Pasteur and Emile Roux developed the first rabies vaccination in 1885.



Activities

7. Which vital function do viruses share with other living things?
8. Draw and label a virus.

4. What are infectious diseases?

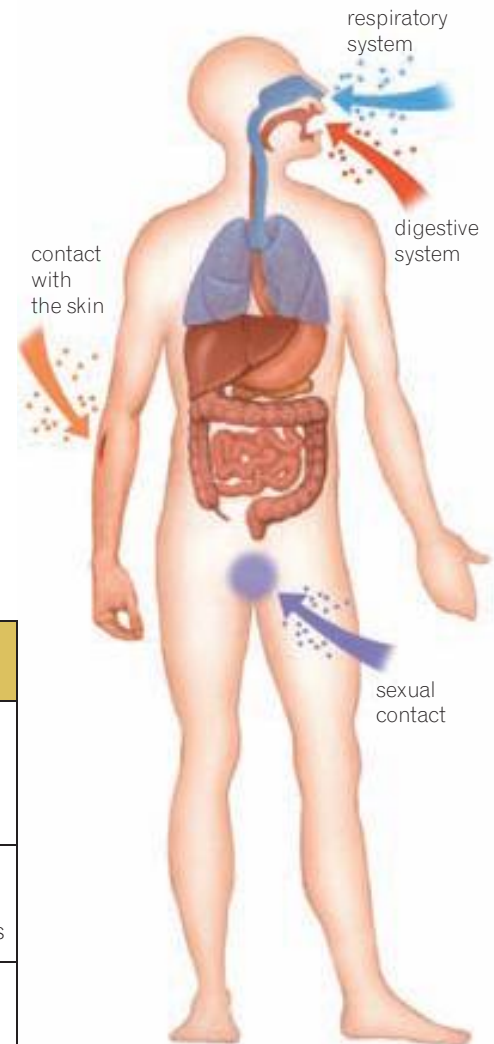
An infectious disease occurs when a pathogenic microorganism invades a living thing, and causes an illness.

Microorganisms reproduce very quickly inside the body. However, the effects of an infection are not immediate. First, there is an **incubation period**. Then, various symptoms of the illness are observed, for example, a high temperature.

When microorganisms are transmitted from a sick person to a healthy one, **contagion** occurs. Transmission can take place in many ways: see the diagram and chart.

Symptoms are the effects that a disease has on the body, and can be observed.

Vectors are insects that carry a disease from one person to another. Mosquitos (*Anopheles*) can carry *Plasmodium* which causes malaria, if they bite an infected person.



How microorganisms enter the body

Some illnesses caused by microorganisms

Illness	Microorganism	Transmitted through	Symptoms
Cold	virus	the air	stuffed up nose, sneezing, high temperature, coughing
AIDS	virus	sexual and blood contact	general weakness, weakened defences
Pneumonia	bacteria	the air	fever, coughing, pulmonary infection
Salmonellosis	bacteria	spoiled food	high temperature, nausea, vomiting, diarrhoea
Cholera	protozoan	contaminated water	nausea, vomiting, stomachache, severe diarrhoea
Malaria	protozoan	the bite of the female <i>Anopheles</i> mosquito	headache, intermittent vomiting, fever
Athlete's foot	microscopic fungus	physical contact through the skin	itching and cracked skin, scaly skin between the toes

Activities

- Use the diagram and chart to classify the entry points for each illness. Copy the diagram and label it with the illnesses.
- Choose two more common illnesses. Copy the chart headings and complete them for both illnesses.

Hands on

Taking and classifying samples. Observing microorganisms

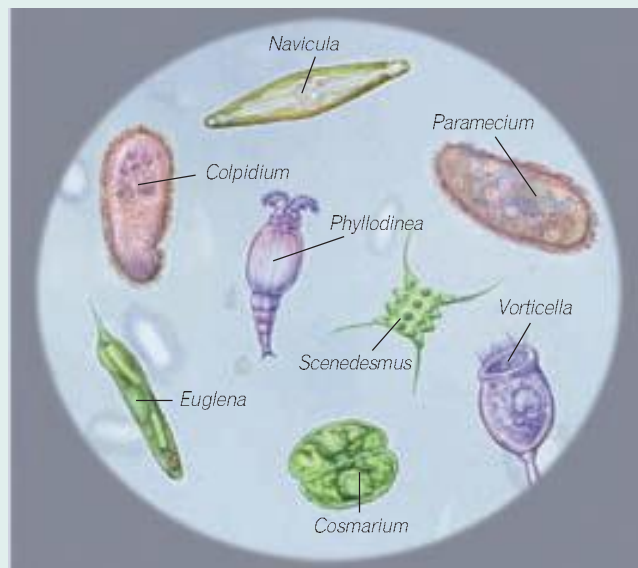
Scientists obtain data from nature by collecting samples. They do this for different reasons:

- **To compare.** For example, on farms, blood samples are taken from animals. These are compared to check the animals' health.

Compare two water samples. Then classify the microscopic living things in the water.

1. Take the samples. Put water from a puddle into a glass jar with a screw top. Alternative: put water in a bowl and mix it with some soil and dried leaves. Let it rest for a few days. Put some tap water into another clean jar. Label each jar.
2. Observe the samples. Using a pipette, put three drops of puddle water onto a microscope slide. Include a fragment of vegetation or clay. Put three drops of clean water onto another slide. Look at the puddle water through the microscope. First observe it with low magnification, then increase it. Study all parts of the slide for a few minutes. Repeat the process with the tap water.
3. Identify the living things. Look at drawings of freshwater microscopic organisms to recognise the samples under the microscope.
4. Classify the living things. Can you classify them into groups?

- **To classify.** Classification helps scientists to organise and understand the natural world.



Activities

11. Did you see any microorganisms in the tap water? Did that surprise you? Why or why not?
12. Did you identify any living things in the puddle water? Draw and label them. Remember to write down the microscope magnification.
13. Would you drink puddle water? Why or why not?
14. Compare vaccines and antibiotics. See page 81. Make a Venn diagram.
15. Can antibiotics cure a cold? See page 81. Explain your answer.
16. How does intestinal flora help human beings? See page 81.

5. How can you fight infectious diseases?

You can protect yourself from infection in several ways:

- **Personal hygiene:** wash your hands before eating.
- Eat and drink only **fresh food and drinks**.

Vaccines

A vaccine contains dead or weakened microorganisms from a specific illness. These microorganisms cannot produce the illness, but they can protect against it.

Vaccines teach the body how to fight an illness. Therefore vaccination is a **preventive measure**. Your body can fight against microorganisms if it is exposed to them. Most vaccines protect the body indefinitely. Others require a **booster dose**, another dose, later on.

Antibiotics

Antibiotics are produced by certain bacteria and fungi. They prevent the microorganisms that cause illnesses from growing. Antibiotics are **curative measures** and must always be prescribed by a doctor. They cannot fight illnesses caused by viruses.

Did you know that...?

Penicillin was first discovered by **Alexander Fleming**. It was later developed as an antibiotic. Penicillin has saved millions of lives.



6. Are all microorganisms harmful?

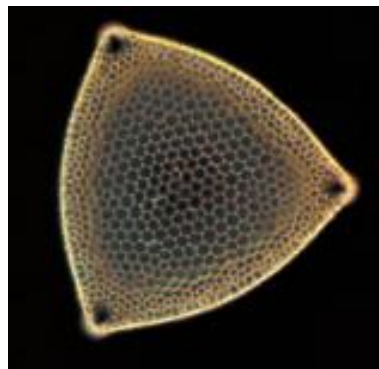
All **viruses** are **pathogenic**. They are parasites that cause illnesses. A few bacteria, protozoa or microscopic fungi are pathogenic.

Many microorganisms are beneficial:

- **Intestinal flora** are bacteria that live in human and animal digestive systems. They are useful because they produce vitamins.
- Other bacteria are used to obtain **antibiotics**.



Decomposer microorganisms transform dead animals and plants into inorganic substances. Some are harmful.



Plankton is the primary food for many aquatic animals.

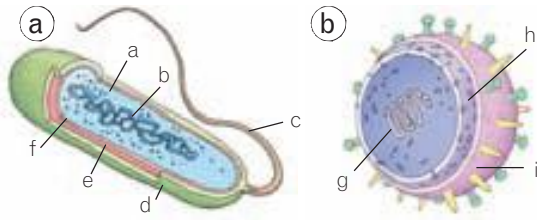


Some bacteria are used to **make food**, like cheese.

Activities

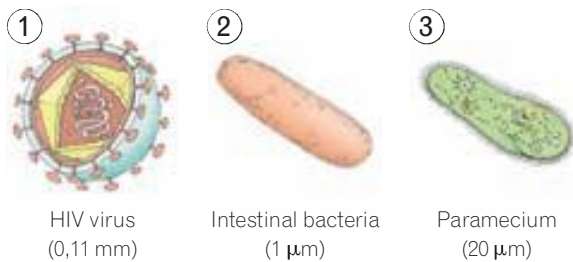
17. Look at the drawings of a bacteria and a virus.

- Label them. What characteristics helped you?
- What do these organisms have in common?



18. What type of organism or structure, 1-3, corresponds to each description?

- They are not really cells; they are obligate parasites.
- Autotrophs or heterotrophs with prokaryotic cells.
- Heterotrophous, eukaryotic, unicellular organisms.



19. Microorganisms are microscopic living beings. They are measured in micrometres: one millionth of a metre, or one thousandth of a millimetre (μm).

- How big, in millimetres, is each microorganism in the picture in activity 18?
- Classify each microorganism: eukaryotic or prokaryotic.
- Which of these microorganisms is not considered a living thing?
- What makes prokaryotic microorganisms different from eukaryotic microorganisms?

20. Unlike certain bacteria and pathogenic protozoa, cyanobacteria and unicellular algae do not produce diseases.

Why do you think this is?

21. Compare bacteria, protozoa and algae: cell type, nutrition and habitat. Create a table.

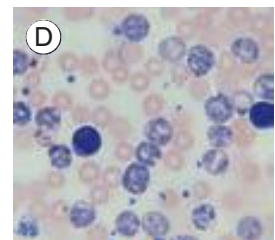
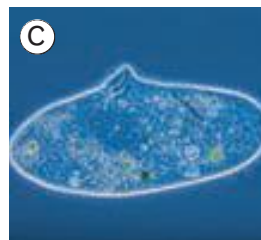
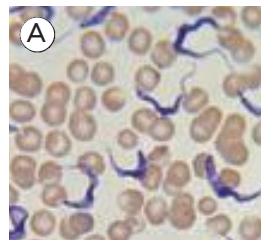
22. **Investigate.** Red tide is a natural phenomenon. It is caused by an accumulation of living things. Red tide affects the world's coasts, especially in spring and summer. Each year it causes the death of many fish, shellfish, molluscs, mussels, oysters, cockles and other marine bivalves.

- What type of living things cause red tide?
- How do you think the marine animals become infected?
- Can red tide affect people? Why or why not?

23. Many bacteria live symbiotically inside the digestive tract of herbivorous animals, like the giraffe, elephant or cow.

- Are these bacteria autotrophs or heterotrophs?
- Where do they obtain their nutrients?

24. Look at the protozoa in photos A-D.





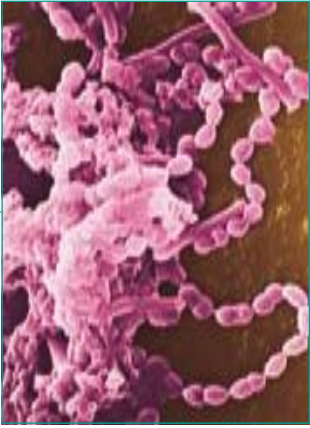

What type of structures enables each to move?

25. Cavities in teeth are produced by microorganisms like streptococcus and lactobacillus.

- What type of microorganism are they?
- Are cavities considered an infectious disease? Why or why not?
- What is the best way to prevent cavities?


26. Research beneficial microorganisms in the food industry. Display your results in a poster.

What should you know?

MICROORGANISMS	Monera Kingdom	<p>The Monera kingdom includes unicellular, microscopic, prokaryotic organisms.</p> <p>Bacteria belong to the Monera kingdom. They are classified according to shape:</p> <ul style="list-style-type: none"> • Coccus: Spherical • Bacillus: Rod-shaped • Vibrio: Curved-rod shaped • Spirillum: Helical 	
	Protoctist Kingdom	<p>The Protoctist kingdom includes unicellular and multicellular living things. They are all eukaryotes and have no tissues. They are generally very small and include:</p> <ul style="list-style-type: none"> • Protozoa are unicellular. They are heterotrophs. They live in both salt and fresh water. Some are parasites. They are classified by the way they move: flagellates, ciliates, rhizopods and sporozoa. • Algae may be unicellular or multicellular. They are autotrophs. They sometimes form colonies. They live in salt and fresh water. Algae are classified as green, brown and red. 	
	Micro-organisms	<p>Microorganisms can be harmful or beneficial.</p> <p>Harmful microorganisms: A few microorganisms cause illnesses. Contagion occurs when microorganisms are transmitted from a sick person to a healthy one.</p> <p>Beneficial microorganisms:</p> <ul style="list-style-type: none"> • Decomposer microorganisms • Plankton • Intestinal flora • Some are used to make food • Some are used to obtain antibiotics and other medicines. 	
VIRUSES	<p>Viruses are extremely small.</p> <p>They are not cells, so they are not true living things.</p> <p>They are obligate parasites, that is, they cannot live without the host.</p> <p>They consist of a capsid, an external shell and nucleic acid.</p>		

Projects

EXPERIMENT: Put moist bread in a plastic box. Observe the changes after a few days. What causes them?

 **WEB TASK:** Find out about friendly and unfriendly microbes.

Rock stars...

Stereoscopic microscopes illuminate solid objects from above. They are used to obtain magnified, three-dimensional images. They are very useful for studying rocks.

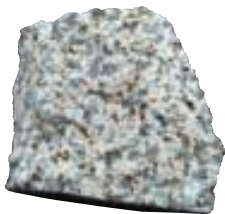


Images from a stereoscopic microscope



1. Match these rocks to their corresponding image above.

①



granite

②



limestone

③



sandstone

2. Describe each rock sample. For example:

Granite	is	black white grey reddish cream. heterogeneous homogeneous. smooth rough sandy.
---------	----	--

and instruments

There are many different meteorological instruments used to study the Earth's atmosphere and weather. For example:



A **thermometer** measures temperature.



A **rain gauge** or **pluviometer** measures rainfall.



A **hygrometer** measures humidity in the air.

3. Look at these photos. What do you think the weather is like in each place?



A

The Sahara Desert



B

The North Pole



C

A rain forest



D

A deciduous wood

4. Match each text to its corresponding photo.

① Temperature: high
Precipitation: very abundant
Humidity: very high.

② Temperature: extremely high.
Precipitation: very low.
Humidity: very low.

③ Temperature: very low
Precipitation: very abundant
Humidity: very high

④ Temperature: medium
Precipitation: abundant
Humidity: high

5. Say what the weather is like where you live.

Where I live the temperature is...