Let's Do SCIENCE

Primary 6

Textbook A

The 5E Model – Guided Inquiry

The Let's Do Science series is based on the Biological Sciences Curriculum Study (BSCS) 5E teaching and learning instructional model. The 5E model is centered on the idea that students understand science concepts best by using prior knowledge to pose questions and find answers through guided inquiry.

This hands-on approach, integrated with engineering and design skills, has students learn science by doing science. Teachers guide the learning process and are able to assess student performance by evaluating student explanations and the application of newly acquired knowledge and skills.

Engage

The Engage phase of the 5E model provides students with the opportunity to demonstrate their prior knowledge and understanding of the topic or concept. Students are presented with an activity or question which serves to motivate and engage students as they begin the lesson. Teachers identify and correct any misconceptions and gather data from students which will guide informed teaching and learning.

Essential to stimulating and engaging students is the use of mixed media such as colorful photos, illustrations and diagrams found throughout the textbooks and activity books. Let's Do Science also includes extensive digital resources such as narrated videos, interactive lessons, virtual labs, slideshows and more.

Explore

This phase encourages exploration of concepts and skills through hands-on activities and investigations. Students are encouraged to work together and apply various process skills while gaining concrete, shared learning experiences. These experiences provide a foundation for which students can refer to while building their knowledge of new concepts. This student-centered phase comes before formal explanations and definitions of the concept which are presented by the teacher.

Explain

This phase follows the exploration phase and is more teacher-directed. Students are initially encouraged to draw on their learning experiences and demonstrate their understanding of the concept through explanations and discussion. After the students have had the opportunity to demonstrate their understanding of the concept, the teacher then introduces formal definitions and scientific explanations. The teacher also clarifies any misconceptions that may have emerged during the Explore phase.

Elaborate

In the Elaborate phase, students refine and consolidate their acquired knowledge and skills. Opportunities are provided for students to further apply their knowledge and skills to new situations in order to broaden and deepen their understanding of the concept. Students may conduct additional investigations, share information and ideas, or apply their knowledge and skills to other disciplines.

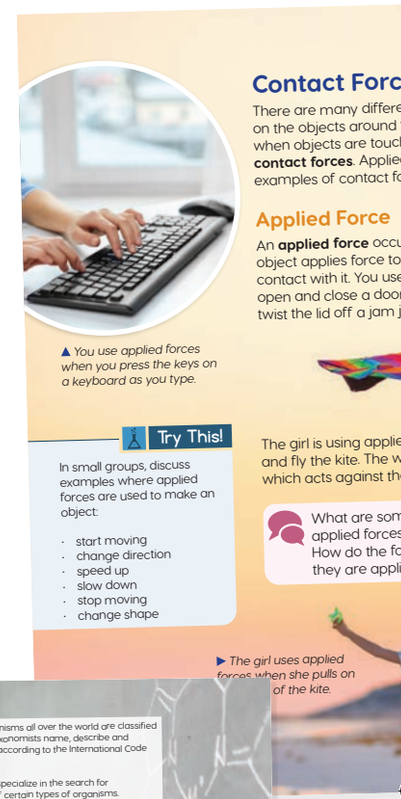
Evaluate

This final phase includes both formal and informal assessments. These can include concept maps, physical models, journals as well as more traditional forms of summative assessment such as quizzes or writing assessments. Students are encouraged to review and reflect on their own learning, and on their newly acquired knowledge, understanding and skills.

Let's Do Science

Let's Do Science is based on the United States Next Generation Science Standards (NGSS). The series consists of full-color textbooks and full-color activity books for Grades K to 6.

Let's Do Science engages students with a highly visual presentation of the disciplinary core ideas in the textbooks and places an emphasis on applying scientific knowledge using NGSS practices through numerous scientific investigations. Let's Do Science sees engineering as an essential element of science education and as such is tightly integrated into both the textbooks and activity books.



Think Deeply

Topic-related questions for group discussion aimed at deepening students' understanding of the topic.

Engineer It!

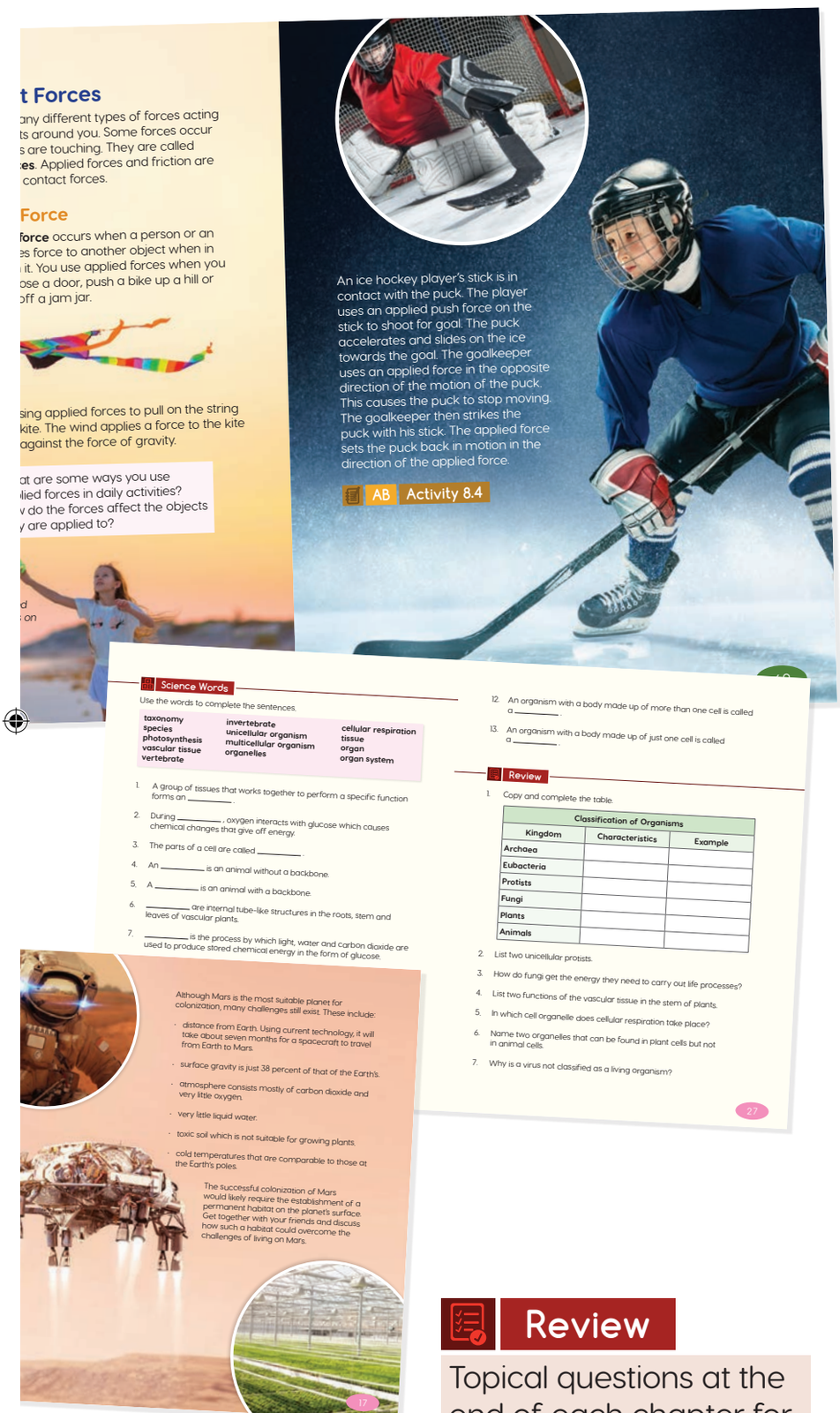
Goes beyond inquiry by encouraging students to design, model and build to engineer solutions to defined problems.

In the Field

Inspirational science-related professions to stir interest in science-related careers.

A Closer Look

Invokes enthusiasm in science by presenting interesting topics beyond the syllabus.



Amazing Fact!

Interesting facts to build interest and enthusiasm.

Did You Know?

Extra information to build students' knowledge base of the current topic.

Try This!

Optional hands-on activities to be conducted in groups or at home.

AB Activity

Links students to the Let's Do Science Activity Book at the appropriate juncture.

Discussion

Topic-related questions and situations for class discussion to build a deeper understanding of topics.

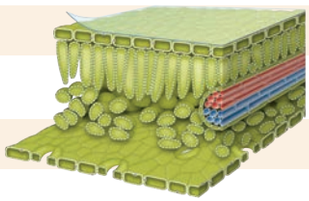
Review

Topical questions at the end of each chapter for formative assessment.

Science Words

Lists the essential science vocabulary covered in each chapter.

Contents



Science Skills

Scientists ask questions about the world around them. To find the answer to these questions, scientists use special skills to collect, analyze and interpret data. They communicate the things they find out.

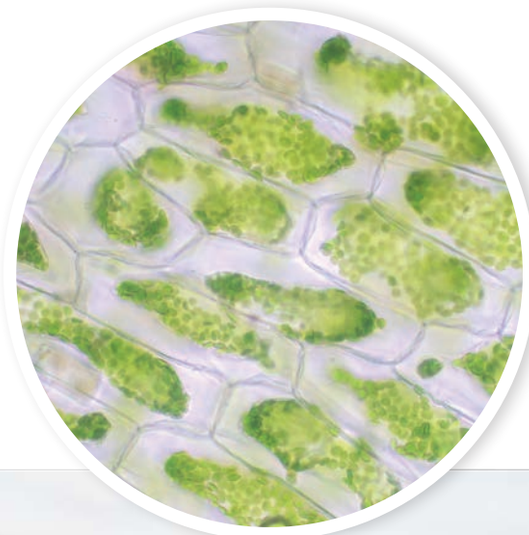
Let's look at how you can use these skills so you can be a scientist too.

Observing

You make observations when you gather information about something using your senses. You can observe how something looks, feels, sounds, smells or tastes.

Scientists often use tools and instruments that allow them to observe things closely. Such tools include hand lenses, microscopes and telescopes.

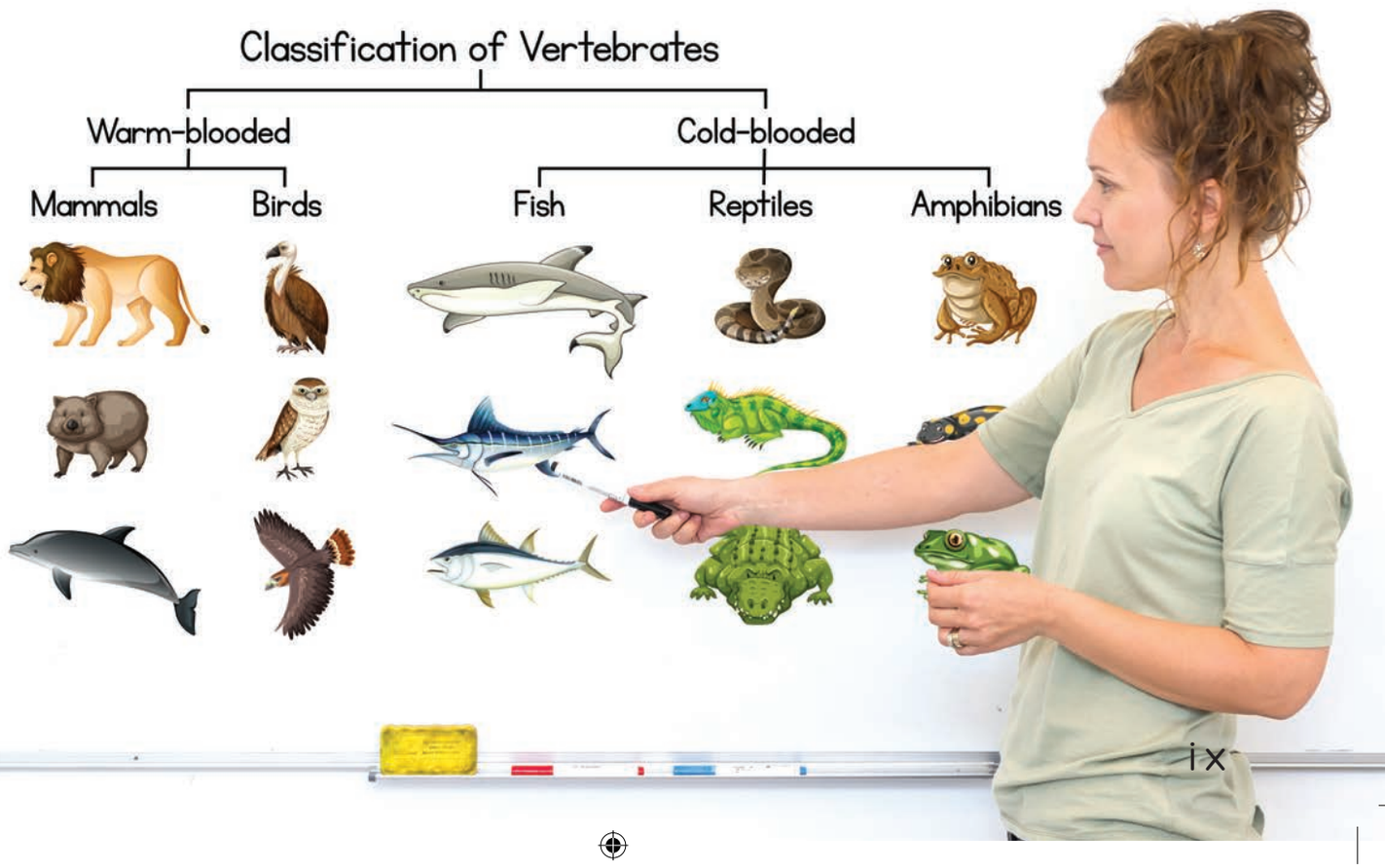
It is important to accurately record your observations in a way that can be easily understood by others. You can make notes, and create charts and tables. You can also draw and label diagrams.



Comparing and Classifying

Scientists compare the things they observe. To compare means to observe the properties or characteristics of two or more things and identify their similarities and differences.

Classification is the process of placing things into groups based on similarities in their properties or characteristics. Objects around us can be classified by the properties of the materials they are made of. Organisms can be classified by their features, such as the presence or absence of a backbone.



Measure

Measuring is an important science skill. It allows you to quantify your observations. Distance, time, volume, mass and temperature are some quantities that can be measured.

To measure accurately, you often need to use tools such as rulers, beakers, thermometers and stopwatches.

Make a Model

Scientists often construct models to predict, test and observe real-life phenomena.

Models can be physical objects, such a model of a miniature wind turbine to simulate electricity generation or a model of the Earth's surface to simulate weathering and erosion.

Models can also be in the form of diagrams. A food web diagram is a model that shows the flow of energy in an ecosystem. A map is a diagrammatic model of an area of land or water.

Infer

You infer when you make a guess about something based on what you know or what you observe.

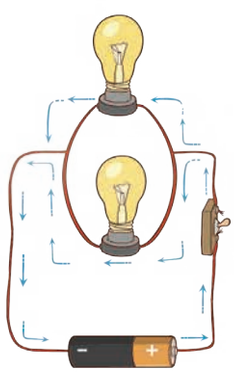
If you see footprints in the snow, you can infer that an animal has passed by after the last snowfall.

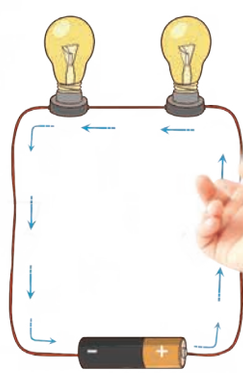
If you discover an animal jaw bone with large canine teeth, you can infer that the animal likely ate other animals.

Communicate

You communicate when you show or tell other people what you find out.

Communication can be in the form of a written report, visual displays or an oral presentation.





Scientific Method

Scientists ask questions based on observations of the world around them. To find the answers to their questions, they carry out tests and investigations following the scientific method.

Why is it useful for scientists to follow the same scientific method?

The scientific method is a logical set of steps that is followed to help guide an investigation. It also helps to ensure the investigation is carried out fairly and in a manner that can be understood and repeated by other scientists.

Make Observations

The scientific method begins by making observations about the world around you. You may observe that plants in one area grow faster and taller than plants in other areas. You may notice that you feel hotter in a darker-colored shirt than a lighter-colored shirt. You may observe that ice melts faster in a cup made of one material than a cup made of another material.

Such observations lead you to ask questions about why these things occur.

Ask Questions

Before a science investigation begins, it's important to ask questions about what you would like to find out.

Asking questions helps you to define the investigation. Your investigation should be designed to find the answer to your questions.

You can also use prior knowledge and experiences to provide possible answers to your questions.

Make a Prediction

Once you have asked questions based on your observations, it's time to make a prediction and form a hypothesis. A **hypothesis** is a statement about what you think your investigation will show.

A hypothesis is more than just a guess. It is a statement based on knowledge you already have or things you have observed in the past.

Based on past gardening experience, you may predict that plants will grow faster and taller in humus-rich potting soil than in sandy soil.

Based on a previous investigation, you may already know that metal is a better conductor of heat compared to wood or plastic. These past experiences can help you predict the results of an investigation.

Why is it important to write a procedure that can be easily followed by others?

Plan and Carry Out an Investigation

Once you have stated your hypothesis, it's time to plan and conduct an investigation that will test your prediction. In planning your investigation, you should include all the materials you will need and a procedure that clearly shows the steps you will take to conduct the investigation.

Your materials and procedure should be written in a way that allows the investigation to be easily followed and repeated by others. In your procedure, include the data you will collect and the way it will be recorded.

Variables

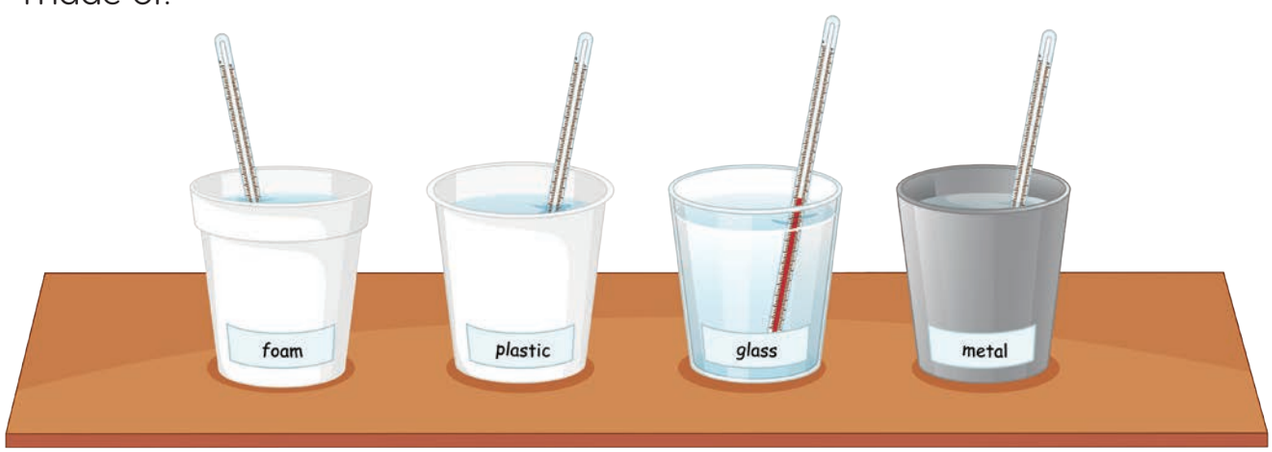
An important part in a science investigation are variables. A **variable** is any factor that can be controlled or changed during the investigation. There are three main variables – the independent variable, the dependent variables and the controlled variables.

The **independent variable** is the one condition in the investigation that you can change. Usually it is the thing that is being tested. If you were investigating which materials are good conductors of heat, the independent variable would be the type of material.

The **dependent variable** is the factor that you measure or observe. The dependent variable should change due to changes in the independent variable.

In an investigation on materials that are good conductors of heat, the dependent variable could be temperature of water in a cup. You would expect the temperature of the water to change as you change the independent variable – the type of material the cup is made of.

Imagine conducting an investigation about the growth rates of different seedlings. What would be the independent variable? What would be the dependent variable?



The **controlled variables** are variables that do not change during the investigation. Controlled variables could include the type and size of a container, the source and temperature of water and the types of instruments used to take measurements. The purpose of the controlled variables is to ensure that the only influence on changes in your observations is due to the independent variable.

Imagine you were carrying out an investigation into the effect of temperature on plant growth. What would be your controlled variables?

Collecting and Recording Data

Make observations and collect data as stated in your procedure. The data should be recorded in an organized way that can be read and understood by others.

Often, data is recorded in a visual manner, such as charts, graphs and diagrams. Data can also be entered into computer software which can make it easier to analyze and present the data.

Analyze and Interpret Data

Once your observations have been accurately recorded, it's time to analyze and interpret the data to see if your hypothesis is supported.

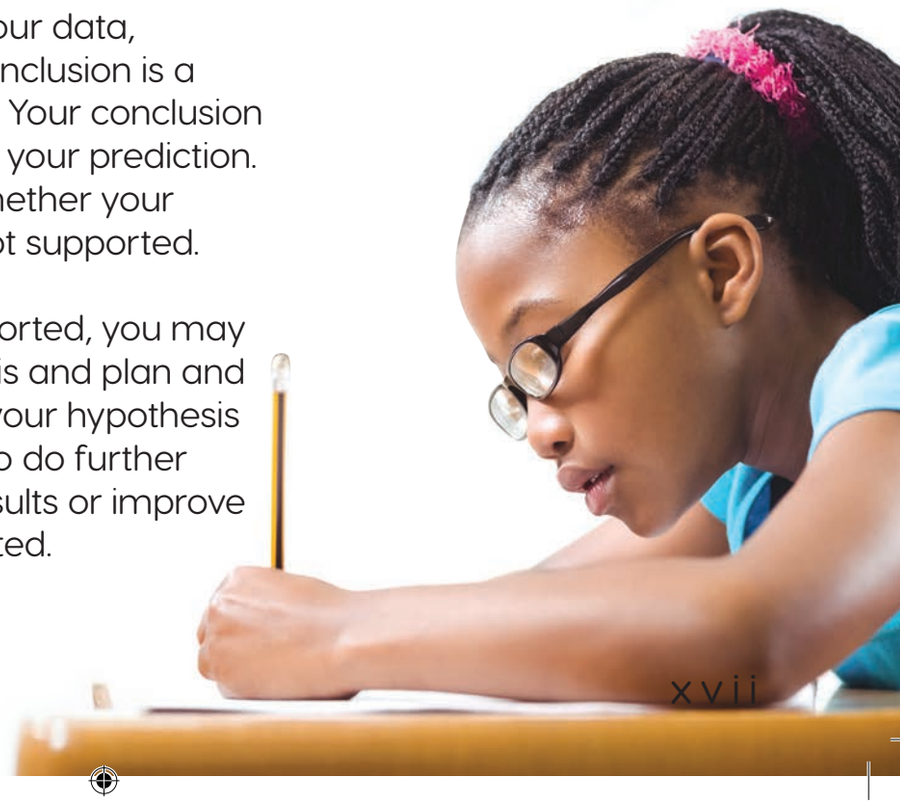
You **analyze** when you look closely at recorded data. You look for patterns to help explain your results. A pattern is when data repeats in a predictable way.

You **interpret** when you understand and explain what the data means. In interpreting data, you use your prior knowledge, experience, and skills to explain patterns and trends identified in the analysis of the data.

An important part of analyzing and interpreting is to check the accuracy of the data collected. If there are inaccuracies or inconsistencies in the data, you may need to adjust your procedure and repeat the investigation.

Draw a Conclusion

By analyzing and interpreting your data, you reach a conclusion. Your conclusion is a summary of the data collected. Your conclusion should indicate the accuracy of your prediction. Your conclusion should state whether your hypothesis was supported or not supported.



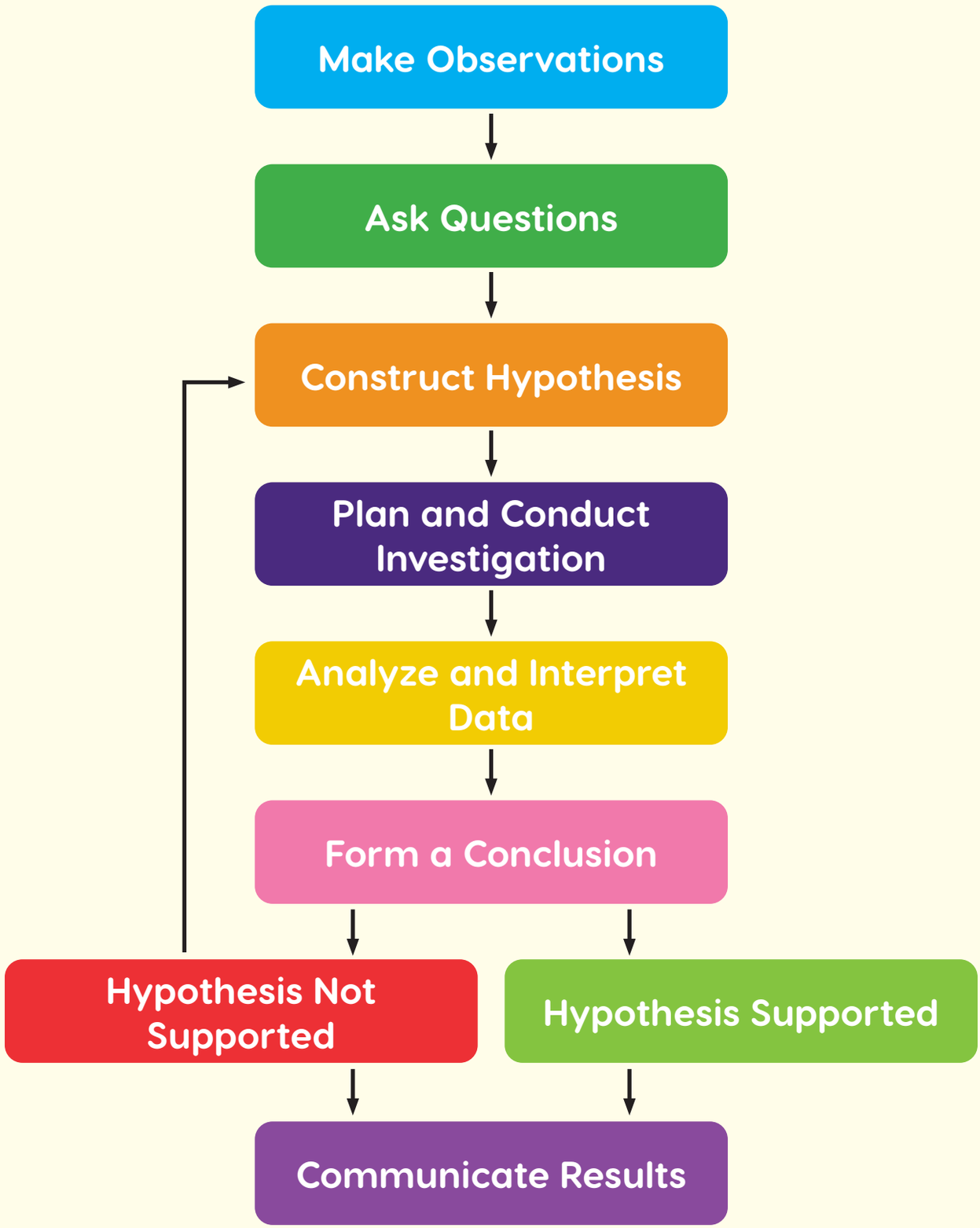
If your hypothesis was not supported, you may decide to form a new hypothesis and plan and conduct a new investigation. If your hypothesis was supported, you may wish to do further investigations to confirm the results or improve the accuracy of the data collected.

Communicate

The final step in a science investigation is to communicate your findings to others. This allows you to share what you have discovered and also allows others to assess the accuracy of your investigation.

The people you communicate your results with may wish to conduct a similar investigation and compare results. They may also wish to conduct further investigations to find out more. If they do, they'll also communicate their results so others can learn from their investigations too.

Scientific Method Flowchart



Science Safety

In the Laboratory

Follow these safety rules when in your science laboratory or when carrying out any science investigation.

- Do not enter the laboratory without a teacher.
- Follow your teacher's instructions. If you have any questions or are unsure of what to do, raise your hand and ask your teacher.
- Do not eat, drink, play or run in the laboratory.
- Wash your hands with soap when entering and before leaving the laboratory. Dry your hands properly, especially if you will be working with electrical equipment. If any chemical or hazardous material gets on your hands, inform your teacher immediately.
- Wear appropriate safety gear when carrying out scientific investigations. Safety gear includes a lab coat, safety goggles and gloves. Tie long hair back and do not wear open-toed shoes.
- Be careful when handling sharp tools or working with burners and hot substances.

- Do not panic if an accident occurs. Be aware of eyewash stations, fire extinguishers, exit doors and other safety equipment and procedures in case of an emergency.

- Keep your workspace clean and organized. Report any spills or breakages to your teacher. Clean up any spills straight away and dispose of the cleaning products safely.

- When cleaning up, ensure all materials and substances go into the correct bin or container. Do not pour any liquid down the sink unless your teacher has instructed you to do so.

- Look after the equipment you use and return it to its proper location in the same condition you received it. Wipe your workstation down after use.

In the Field

- Make sure you are accompanied by an adult when on field trips or doing other activities outside of the schoolyard.

- On long trips, make sure you take enough water and food. Bring insect repellent if necessary.

- On sunny days, take Sun protection such as a long-sleeved shirt, hat and sunscreen.

- Do not touch plants, animals or other organisms unless instructed to do so by your teacher.

Try This!

Create a poster of the rules to be followed in your science laboratory or classroom. Display the poster in a place for everyone to see.

1 Life on Earth

In this chapter you will ...

- describe the ways in which organisms can be classified.
- briefly describe the characteristics of the organisms in each kingdom.
- list the organelles that make up cells and identify differences in animal and plant cells.
- describe the process of cellular respiration.
- describe how cells are organized within multicellular organisms.

Why is it important to name, describe and classify organisms into groups?

Go Online!

Access interactive content relating to this topic on the NGScience website.
ngscience.com

What are the parts and functions of cells?

Think Deeply

Scientists classify organisms by their chances of becoming extinct. If an animal is likely to become extinct, it is classified as endangered. Gorillas are classified as critically endangered. Threats to their survival include hunting, habitat destruction and disease. Why is it important to protect endangered animals? What things can people do to reduce their chances of becoming extinct?

Classification

To organize and gain a better understanding of organisms, scientists classify them into groups based on shared characteristics. The process of naming and classifying organisms is called **taxonomy**.

Carl Linnaeus was a Swedish scientist and university professor who spent much of his time collecting and studying organisms of all kinds. In 1735, he published a book, called Systema Naturae, that proposed a system for classifying and naming organisms. This system of classification, called binomial nomenclature, is still used by scientists around the world today.

Using the same system of classification allows scientists to describe organisms in a precise way. This enables them to easily share their knowledge and discoveries.

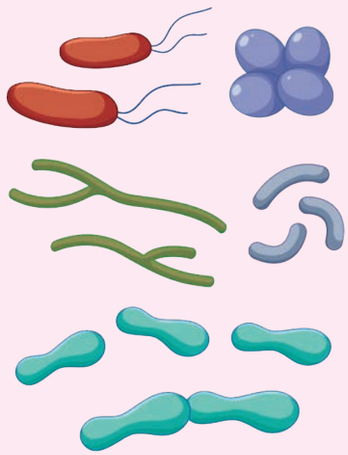
The broadest and most general group of organisms are called kingdoms. There are six kingdoms recognized by scientists:

- archaea
- eubacteria
- protists
- fungi
- plants
- animals

The Six Kingdoms of Life

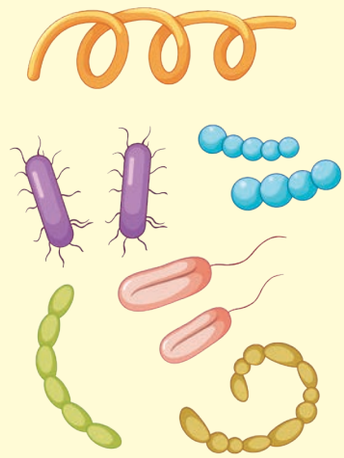
Archaea

- unicellular
- no nucleus
- decomposers
- can move from place to place



Eubacteria

- unicellular
- no nucleus
- decomposers
- can move from place to place



Protists

- unicellular and multicellular
- nucleus
- producers and consumers
- some can move from place to place

Fungi

- unicellular and multicellular
- nucleus
- decomposers
- cannot move from place to place

Plants

- multicellular
- nucleus
- producers
- cannot move from place to place

Animals

- multicellular
- nucleus
- consumers
- can move from place to place

Did You Know?

Rotifers are amongst the smallest animals on Earth. Most cannot be seen using only your eyes. They form part of zooplankton in aquatic environments. They are able to reproduce rapidly and are an important component in aquatic ecosystem food chains.

Think Deeply

Look at the animals on pages 6 and 7. Identify the animals that belong to the same:

- kingdom
- class
- family
- genus

By looking closely at the characteristics of organisms, scientists are able to classify them into smaller and smaller groups. Let's take a look at this classification system by looking at how a lion is classified.

Lions belong to the kingdom Animalia which includes all animals – from microscopic invertebrate zooplankton to giant vertebrates such as elephants and whales.

At the next classification level for lions is the **phylum** Chordata. All of the animals in this phylum have a backbone – they're all vertebrates.

Below a phylum is the **class** Mammalia. All animals in the class Mammalia are mammals. Mammals are warm-blooded animals with a body covered with hair or fur. Females give birth and feed milk to their young.

Mammals that get their energy by eating mostly other animals are carnivores. They are classified together in the **order** Carnivora.

Within the order Carnivora is the **family** Felidae. All members of this family are cats – tigers, lions, lynx and domestic cats too. Within the cat family are the big cats – tigers, lions and leopards. These animals belong to the **genus** *Panthera*.

The smallest unit of classification is a species. A **species** is a group of similar organisms that are able to reproduce young of the same kind.

All species are given a two-part scientific name. The first part of the name is the organism's genus. The second part of the name is called the specific name. The two-part scientific name for lions is *Panthera leo*.

AB Activity 1.1

Try This!

Conduct research to find out the scientific names of some of your favorite animals. Find out what other animals belong to the same order, family or genus.

Go Online!

Learn more about binomial nomenclature on the NGScience website.
QuickCode: **Z3Z6**

Kingdoms

Bacteria

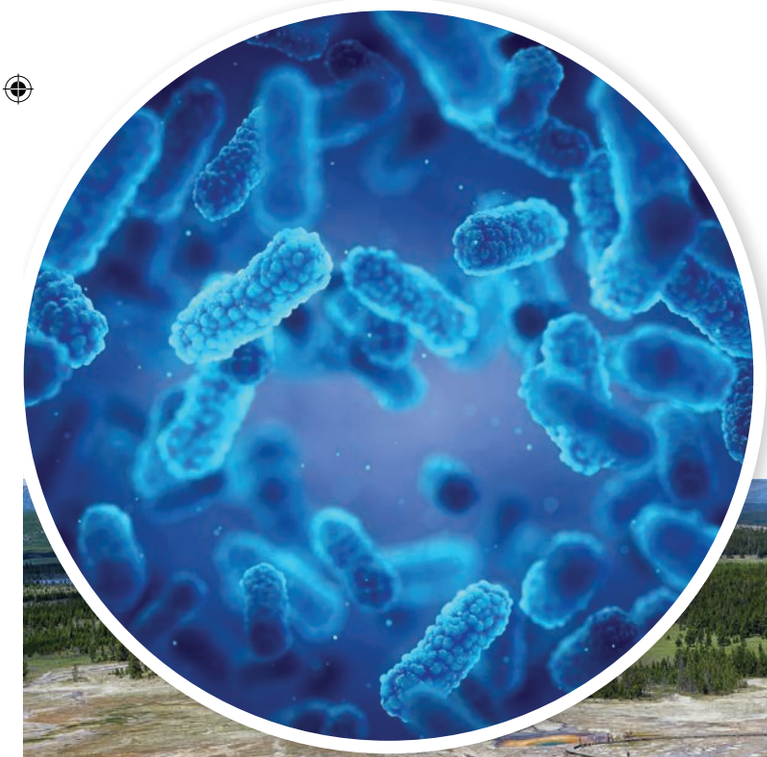
Bacteria (singular bacterium) are amongst the simplest and oldest organisms on Earth. All bacteria were once classified into the same kingdom. However, after a closer look at their genetic makeup scientists agreed they should be divided into two kingdoms – archaea and eubacteria.

All bacteria are unicellular microorganisms and most can only be seen using powerful microscopes. Bacteria are unique from other microorganisms in that they do not have a nucleus.

Did You Know?

An organism that can survive in extreme conditions is called an extremophile. Extremophiles, like archaea, are able to thrive in conditions that most other organisms cannot.

▼ *Archaea live in extreme environments including hot springs.*



Archaea live in extreme environments and are often classified by where they can be found. Such extreme environments include the deep ocean floor, volcanic vents, hot springs and in the intestines of animals.

▼ *The bright colors of the Grand Prismatic Spring in Yellowstone National Park, USA is caused by archaea.*

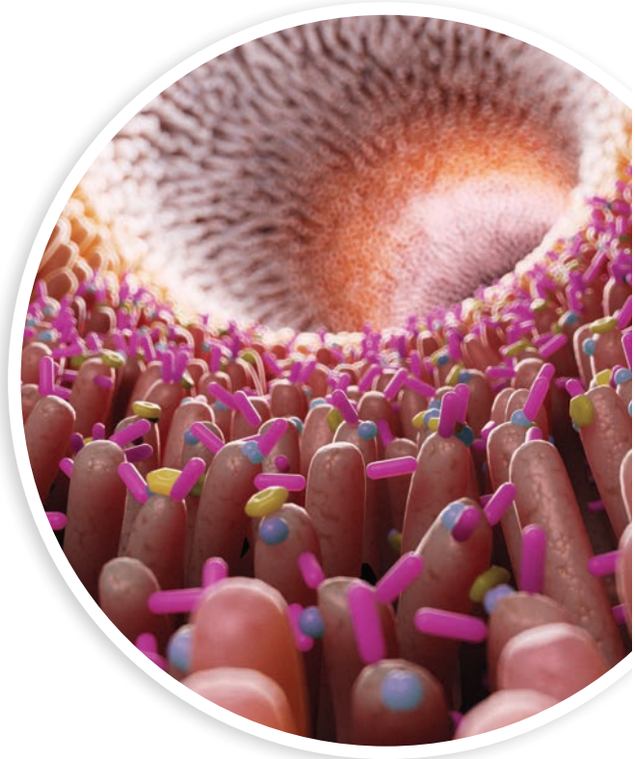
Eubacteria are called true bacteria. They can be found in all natural environments – in the air, in water and soil. They also live and reproduce in the bodies of other organisms, including humans.

Bacteria reproduce asexually whereby an individual bacterium divides to form two identical daughter bacteria. Reproducing in this way allows bacteria to reproduce rapidly.

Bacteria can cause diseases and infections in plants, animals and people. *Salmonella* and *E. coli* are bacteria that can cause food poisoning in people and some animals.

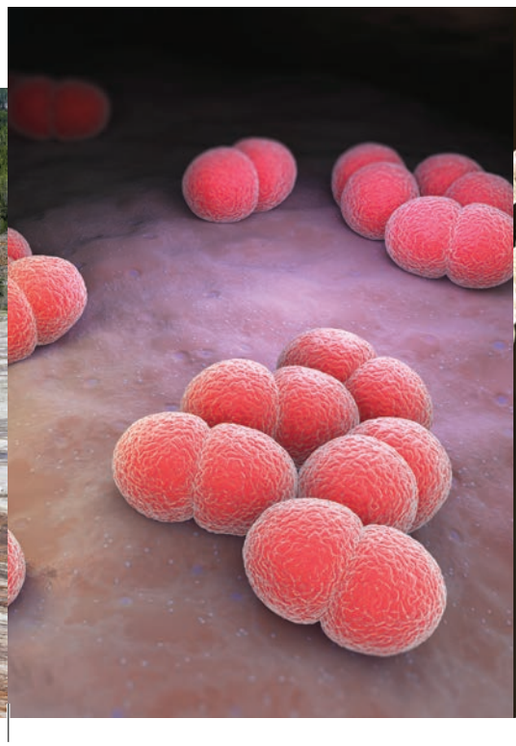
Bacteria can also be helpful. Many organisms need bacteria to help them get the nutrients they need. Bacteria in your stomach help you to get nutrients from the food you eat.

Bacteria are often classified by the shape of their unicellular bodies, such as rods, spirals and spheres.

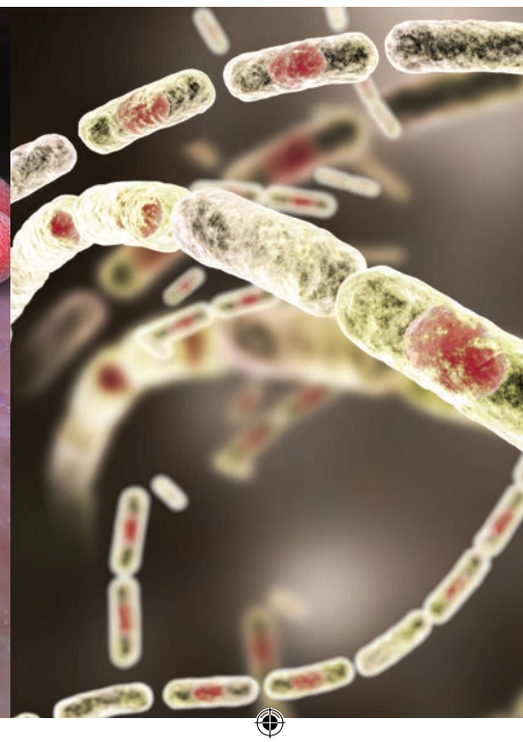


▲ *Trillions of bacteria can be found inside the human body.*

▼ *Coccus are spherical.*

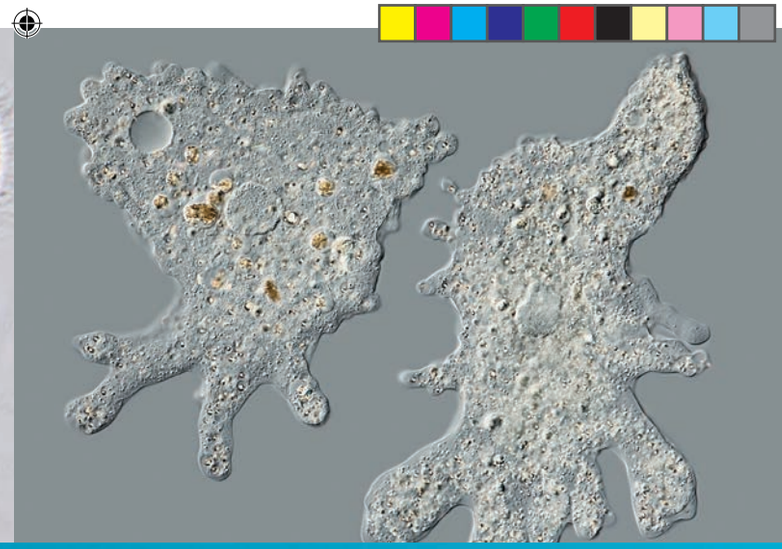


▼ *Bacillus are rod-shaped.*



▼ *Spirillus are spiral-shaped.*

▲ *Paramecium and many other unicellular protists reproduce by dividing.*

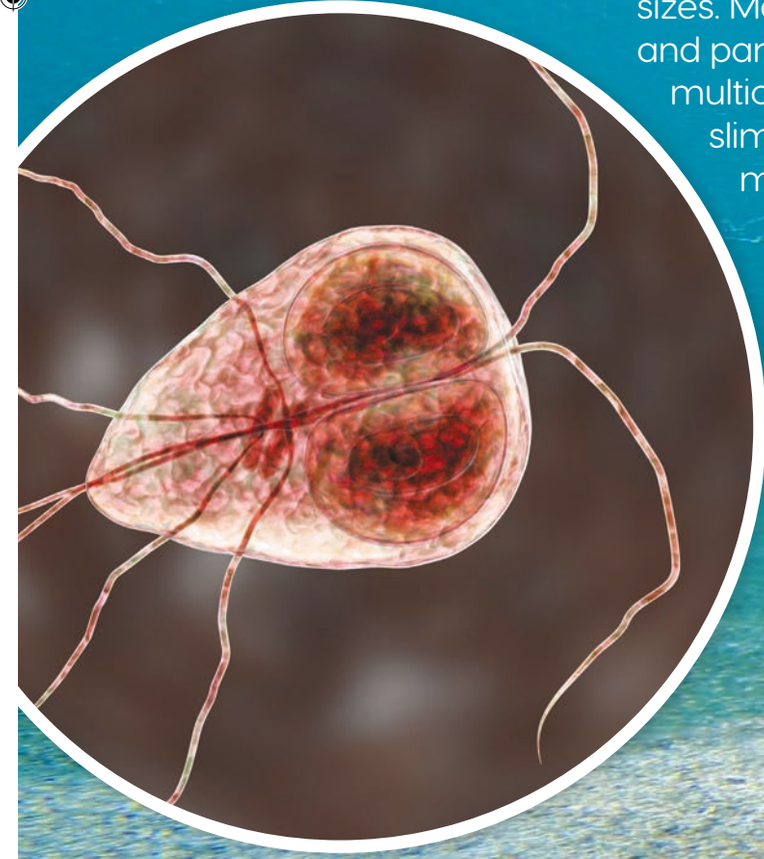


▲ *amoebas*

Protists

Protists are organisms that belong to the kingdom Protista. Protists are not classified based on the characteristics they share; instead they are classified together because they do not clearly fit into the other kingdoms of life.

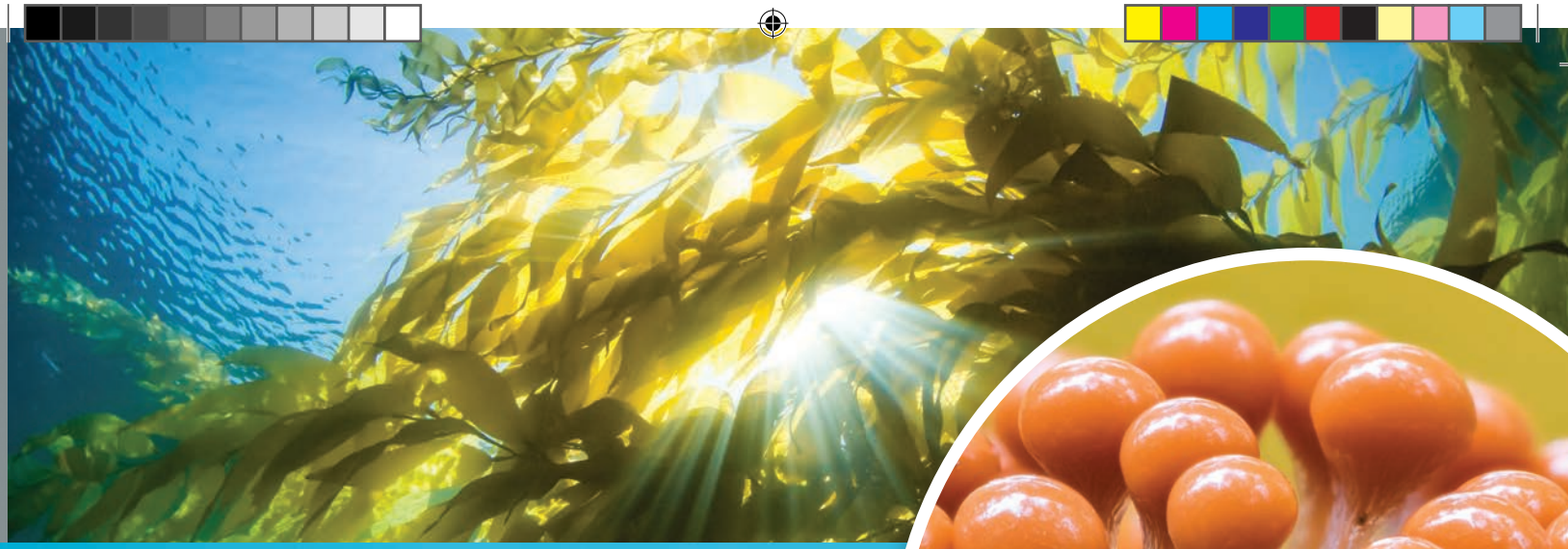
▼ *Giardia duodenalis is a microscopic protist that colonizes the small intestine of humans and can cause diarrhea.*



Protists come in a diverse range of shapes and sizes. Most protists, like plasmodiums, euglenas and parameciums, are unicellular. There are also multicellular protists, such as the giant kelp and slime molds. Unlike bacteria, the cells that make up protists contain a nucleus.

Protists live in a diverse range of habitats. They can be found in freshwater and saltwater aquatic environments. They can be found on land, underground and as parasites inside the bodies of other organisms.

Why are protists classified into the same kingdom?



▲ *kelp*

Some protists are plant-like, such as diatoms and euglenas, and are able to photosynthesize. Others are animal-like and obtain energy by feeding on other organisms or by absorbing nutrients from their environment. Amoebas are unicellular protists that engulf and feed on other organisms such as algae and bacteria.

Most protists reproduce asexually. But some multicellular protists have more complex life cycles.

▲ *slime mold*

▶ *red algae*

▲ *mold decomposing bread*

▲ *Bread mold as seen under a microscope.*

Fungi

Fungi (singular fungus) include organisms such as mushrooms, puffballs and molds.

Most fungi are multicellular and reproduce by releasing microscopic spores into the air. New fungi grow from the spores. Yeasts are unicellular and reproduce asexually by budding whereby a small bud forms and splits off to form a new daughter cell.

Fungi are **decomposers** – they get the energy they need by breaking down the remains of other organisms and absorbing the organic matter. You can see this when mold forms on spoiled food.

Go Online!

Discover more about fungi in a video on the NGScience website.
QuickCode: **B7M1**

In nature, fungi break down the remains of plants and animals. In doing so, they play an important role in ecosystems by returning nutrients to the soil.

Some fungi can cause diseases in plants, animals and people. Mildews are fungi that decompose the leaves of plants which can limit their ability to photosynthesize. Ringworm and candida are fungal infections that can affect people and other animals.

Fungi can also be helpful to people in many ways. Many mushrooms are important food sources. Yeast is used in the preparation of bread and cheese.

The medicine penicillin, an important antibiotic, is obtained from the fungus *Penicillium notatum*.

▲ *honey fungi in a hollowed log*

AB Activities 1.2 – 1.3

Try This!

If there is a forest in your area, plan a trip with your family or friends to go on a fungi hunt. Take a pencil and notebook and sketch the fungi you spot.

What are the characteristics of fungi?

▶ *orchid*

Think Deeply

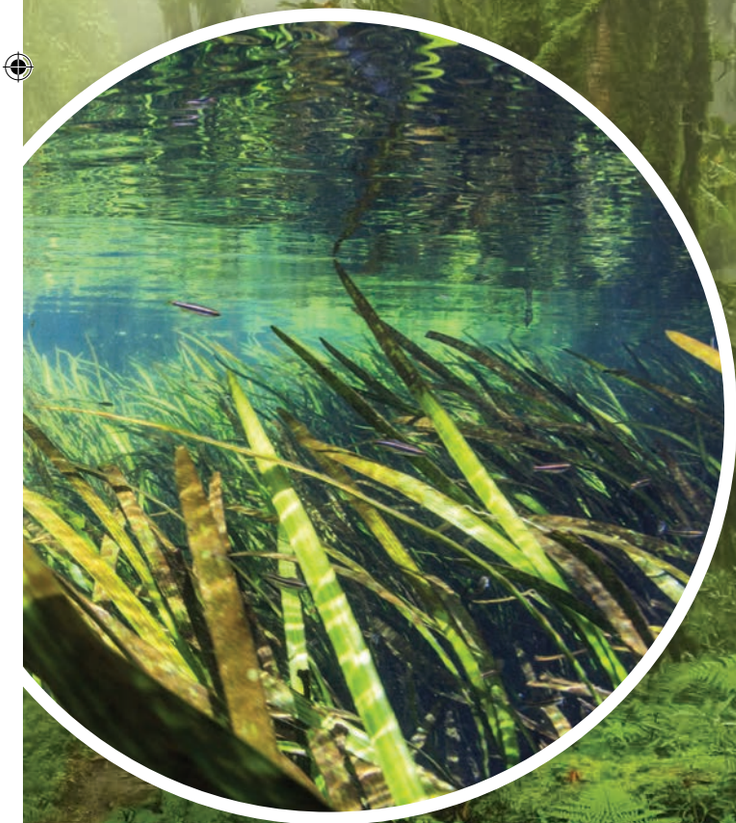
Plants are a very diverse group of organisms. What are two characteristics that all members of the plant kingdom share?

Plants

Plants are multicellular organisms that get the energy they need by photosynthesizing. **Photosynthesis** is the process by which light energy, water and carbon dioxide are used to produce stored chemical energy in the form of a sugar called glucose. The glucose is stored by the plant and used to carry out life processes. As primary producers in all ecosystems, plants are important food sources for many other organisms.

Most plants are terrestrial, meaning they grow on land. They are usually anchored to the ground by roots. Some plants can grow by attaching themselves to other plants, such as the trunks of trees.

Plants can also be found floating or submerged in freshwater aquatic environments. Only a few plants, such as seagrasses and mangroves, can survive in the ocean's salt water.



▲ *underwater seagrass*

Plants are a very diverse group of organisms. So far, almost 400,000 different species have been named and classified. Plants can be classified in different ways. They can be classified by how they reproduce, the structures they possess or whether they have vascular tissue.

Vascular tissue are internal tube-like structures in the roots, stem and leaves that transport water, nutrients and food around the plant.

Plants with vascular tissue are called **vascular plants**. Angiosperms (flowering plants), gymnosperms (conifers and cycads) and ferns are vascular plants.

Plants without vascular tissue are called **non-vascular plants**. Without structures to transport water, nutrients and food, non-vascular plants are usually smaller in size than vascular plants. Bryophytes, which include mosses, liverworts and hornworts, are non-vascular plants.

Amazing Fact!

The Rafflesia is a parasitic plant that in some species produces the largest flowers in the world. Being parasitic, the plant has no roots, stem or leaves. Rafflesia flowers produce a strong odor of rotting meat. This attracts flies and other insects which help in pollination as they fly from flower to flower.

▼ *Rafflesia*

AB **Activity 1.4**

▼ *bird of paradise*

▲ *hawksbill sea turtle*

▲ *leafy sea dragon*

Animals

Animals are a diverse group of multicellular organisms that live in all parts of the Earth. They have a large range of adaptations that allow them to live in a great variety of habitats – from lush tropical forests, the freezing North and South Poles to the dark and deep ocean. So far, about 1.5 million animals have been named and described by scientists and many more are discovered every year.

Unlike plants, which get the energy they need through photosynthesis, animals are consumers. They feed on other organisms to get the energy they need.

Most animals have body parts that enable them to move from place to place. Many animals also have sense organs to take in information about the world around them. Their sense organs allow them to move in response to changes around them. Animals also move about in search of food, to escape from danger or to find a mate. Animals take in oxygen from the air or water and most reproduce sexually.

▲ *rabbit*

▶ *common toad*

▲ *honeybees*

▲ *earthworms*

Within the animal kingdom, scientists divide animals into two main groups based on the presence or absence of a backbone. Animals that have a backbone are classified as **vertebrates**. Many of the animals we are most familiar with, like mammals, birds, reptiles, amphibians and fish are vertebrates.

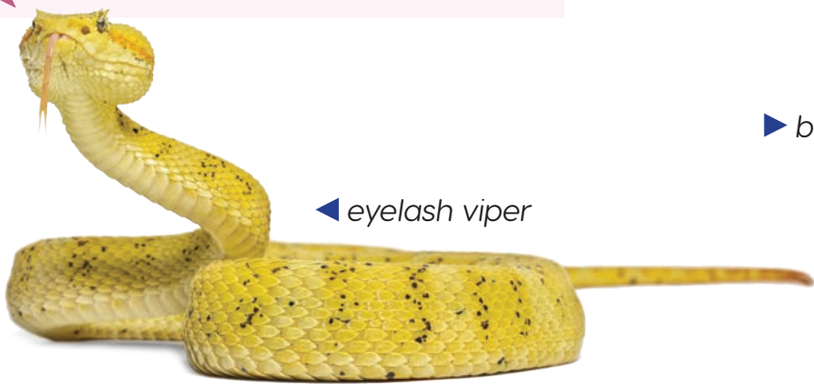
Animals without a backbone are classified as **invertebrates**. They account for about 95 percent of the animals on Earth. Some invertebrates, like worms and jellyfish, have soft bodies. Others, like insects and crustaceans, have a hard outer covering called an exoskeleton. The exoskeleton provides protection and often helps to prevent water loss.

Without a backbone or internal skeleton of bones, invertebrates are generally smaller in size than vertebrates.

Try This!

With a classmate, list some of your favorite animals. Discuss what makes the animals different from other animals.

What are some characteristics most animals share?



◀ *eyelash viper*

▶ *barn owl*

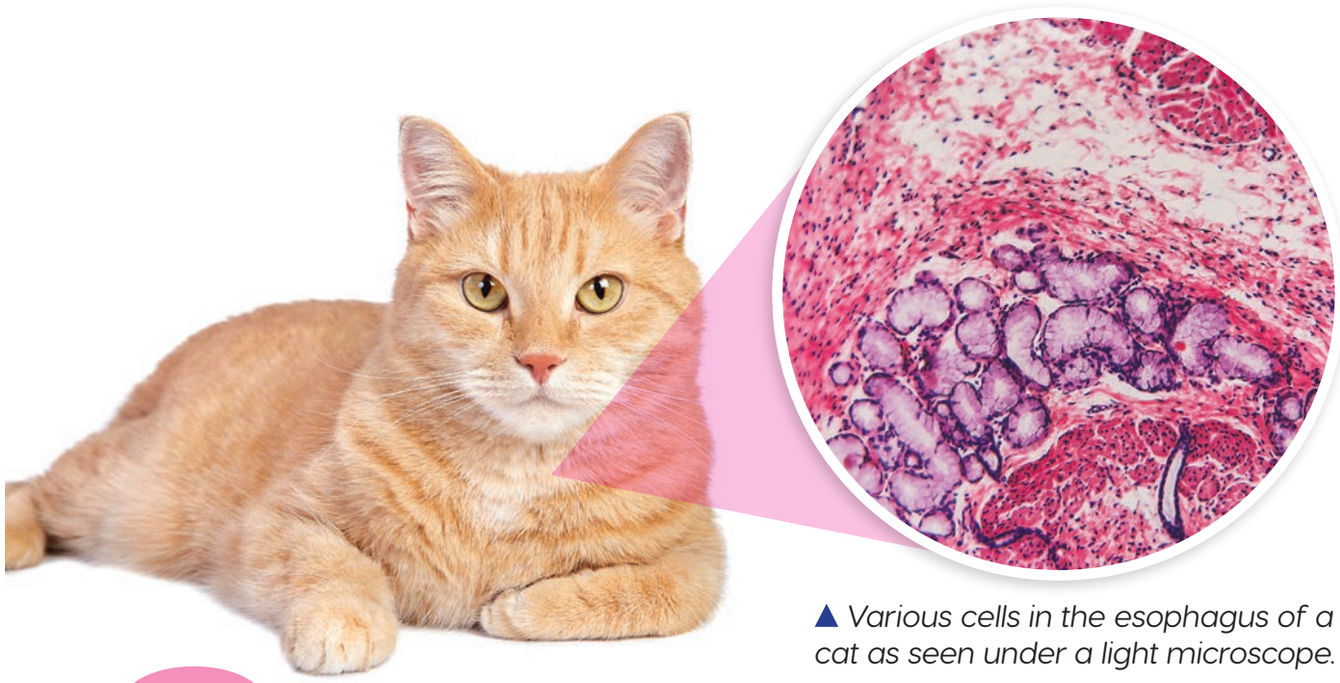
Cells

▲ *Acetabularia is a type of unicellular green algae. Each umbrella-like structure is an organism made up of just one cell.*

There is a great variety of organisms on Earth. From microscopic bacteria and protists to the millions of different plants and animals that inhabit all areas of our planet. Organisms show great diversity in shape, size and the places they live, but all organisms have at least one thing in common – they are made of one or more cells. **Cells** are the smallest units within an organism that can carry out life processes. They are often referred to as the 'building blocks of life'.

Some organisms are made up of only a single cell. They are **unicellular organisms**. Others, like most fungi, plants and animals are made up of many cells. They are called **multicellular organisms**.

Humans are multicellular organisms. Scientists estimate that our bodies are made up of trillions of different cells that all play a role in helping our bodies function.



▲ *Various cells in the esophagus of a cat as seen under a light microscope.*

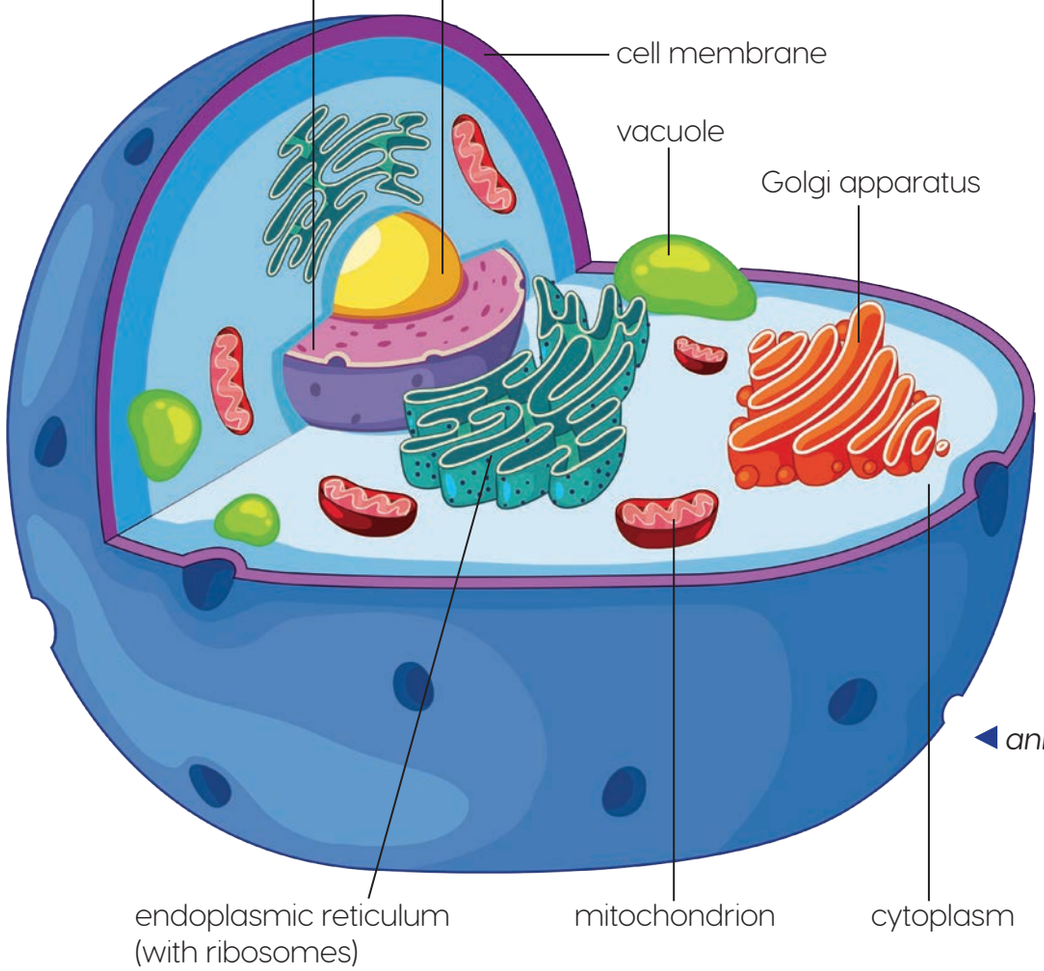
Most plant and animal cells have the same internal parts, called **organelles**. Each organelle has a specific role in helping the cell to function as a whole system. Let's take a look at the parts of an animal cell.

Animal Cells

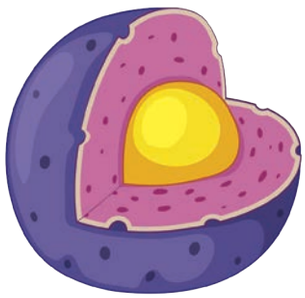
Surrounding an animal cell is a **cell membrane** – a thin layer that surrounds the cell. Its main function is to regulate the interactions that occur between the cell and its external environment. It allows only certain substances to pass in and out of the cell.

Try This!

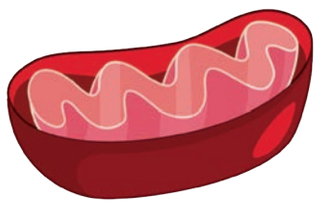
Take a chicken egg and place it carefully into a beaker of vinegar and let it sit for two days. Observe the egg once the shell has dissolved. Discuss which part of the egg cell you are observing. Discuss its properties.



animal cell



▲ *nucleus*



▲ *mitochondrion*

▲ *golgi apparatus*

▲ *endoplasmic reticulum*

Inside the cell is the cytoplasm. The **cytoplasm** is a watery gel-like substance that holds and supports the cell organelles except for the cell nucleus. It helps to protect the organelles and also gives the cell its shape.

The **nucleus** is often referred to as the control center of the cell. It is a large, round organelle that controls all of the internal cell activities and processes such as growth and metabolism. At the center of the nucleus is the **nucleolus** which is where ribosomes are made.

Mitochondria (singular mitochondrion) are often referred to as the powerhouses of the cell. They break down digested food and release the energy needed to power the cell.

The **Golgi apparatus** is the organelle that packages and transports proteins for delivery to different destinations within the cell.

The **endoplasmic reticulum (ER)** is an organelle attached to the nucleus. Its main function is to produce proteins for the rest of the cell. The protein is made in **ribosomes**, which are small, round organelles on the surface of the ER.

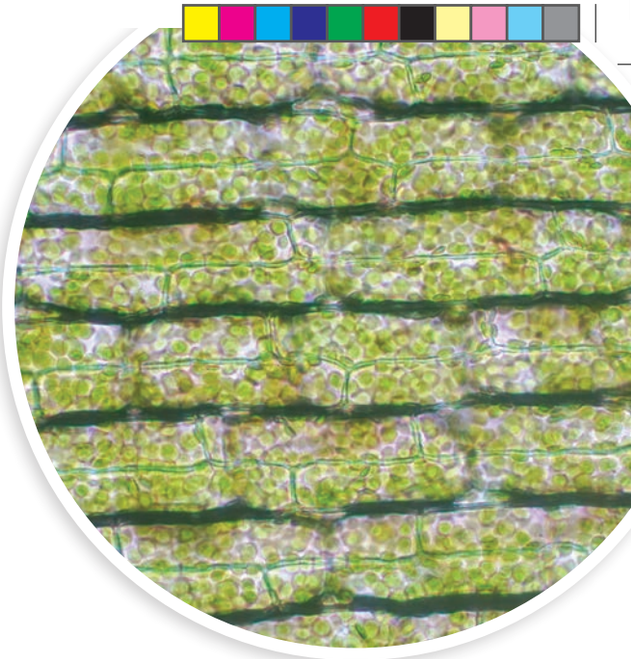
Vacuoles are storage spaces for water, wastes and other cellular material.

What are the main functions of the organelles in an animal cell?

Plant Cells

Like animal cells, plant cells have a cell membrane, nucleus, mitochondria, ER and ribosomes. Plant cells also have vacuoles, but they are usually larger than the vacuoles in animal cells. Like animal cells, the organelles in plant cells float in the cytoplasm.

Plant cells are different from animal cells in that they have a **cell wall** – a rigid structure that surrounds the cell membrane. The main function of the cell wall is to provide support and protection.



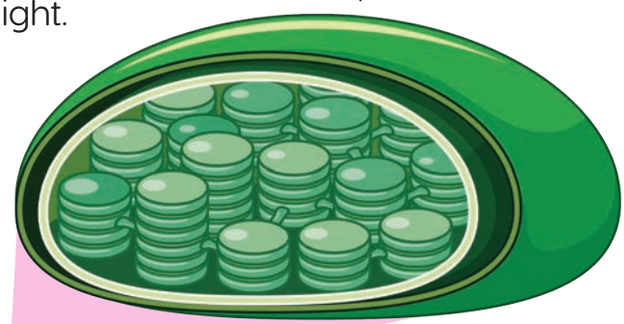
▲ *Plant cells as seen under a light microscope.*

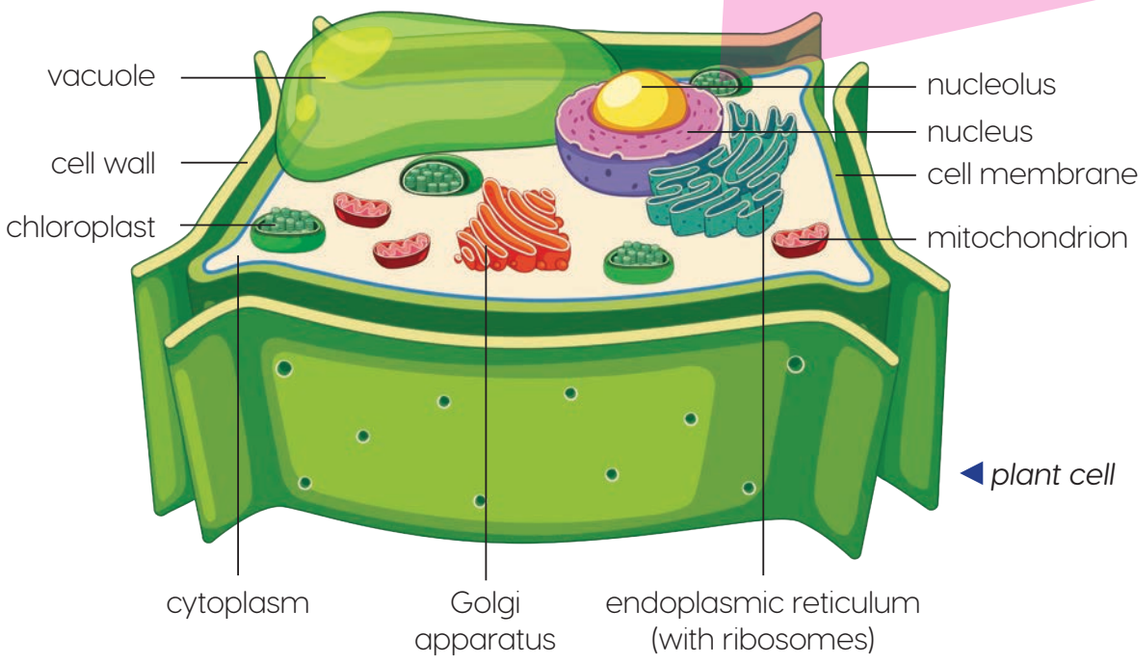
Many plant cells also contain chloroplasts. Photosynthesis takes place in the chloroplasts. Chloroplasts contain **chlorophyll** which is a green pigment that captures the energy from sunlight.

AB **Activity 1.5**

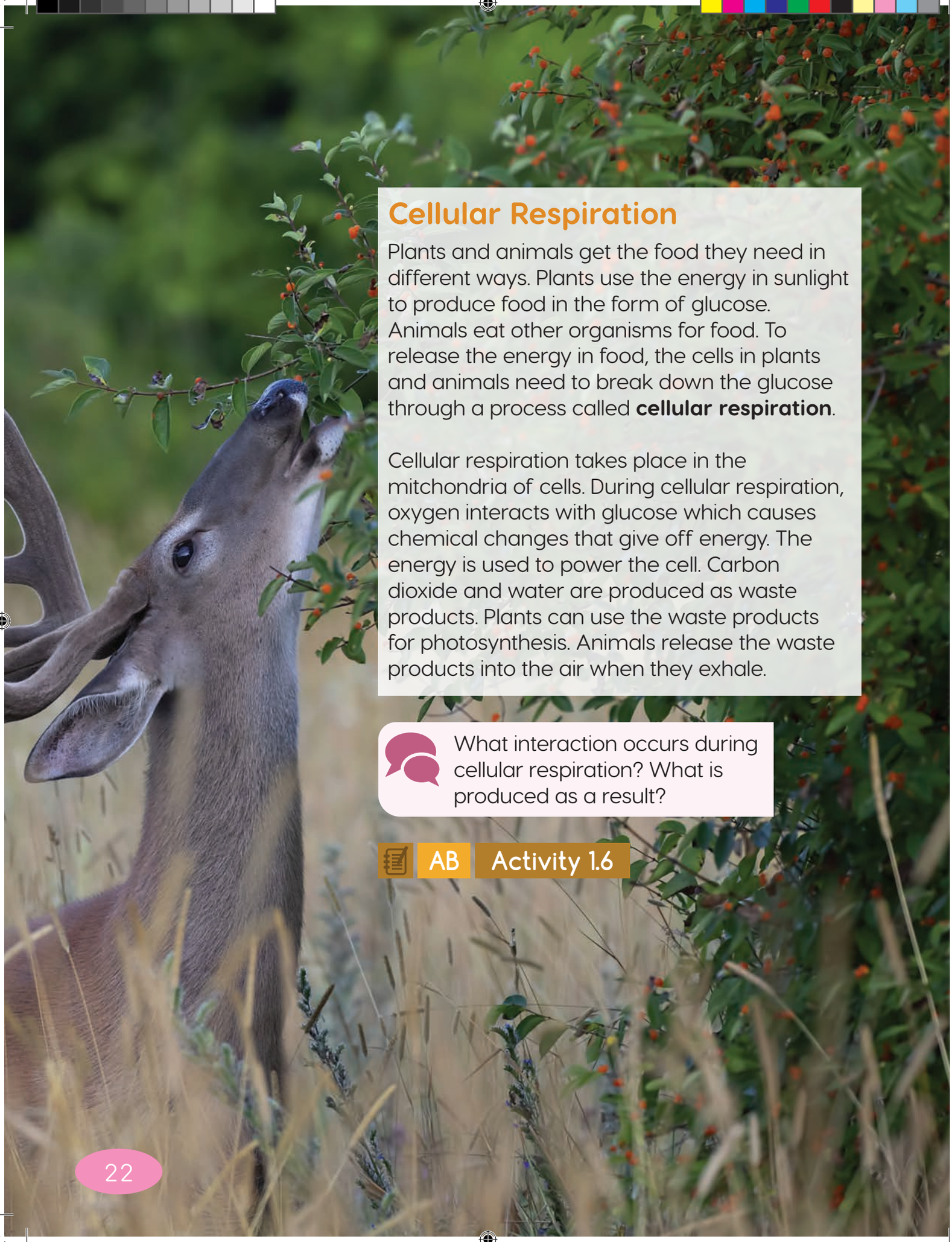
Why do plant cells generally have a more regular shape than animal cells?

▼ *chloroplast*





◀ *plant cell*



Cellular Respiration

Plants and animals get the food they need in different ways. Plants use the energy in sunlight to produce food in the form of glucose. Animals eat other organisms for food. To release the energy in food, the cells in plants and animals need to break down the glucose through a process called **cellular respiration**.

Cellular respiration takes place in the mitchondria of cells. During cellular respiration, oxygen interacts with glucose which causes chemical changes that give off energy. The energy is used to power the cell. Carbon dioxide and water are produced as waste products. Plants can use the waste products for photosynthesis. Animals release the waste products into the air when they exhale.

What interaction occurs during cellular respiration? What is produced as a result?

AB Activity 1.6

Cell Organization

In unicellular organisms, the single cell itself carries out all of the life processes needed for survival. The many cells that make up multicellular organisms are organized in a way that allows them to work together to perform specific functions.

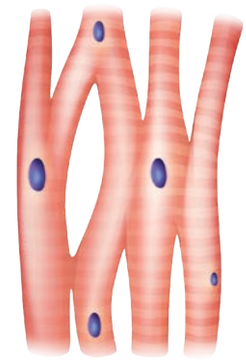
A group of similar cells that work together to perform the same function forms **tissue**. Muscle is an example of tissue. Muscle is made up of groups of muscle cells.

A group of tissues that work together to perform a specific function forms an **organ**. The heart is an organ made up of different tissues. Its primary function is to pump blood throughout the body.

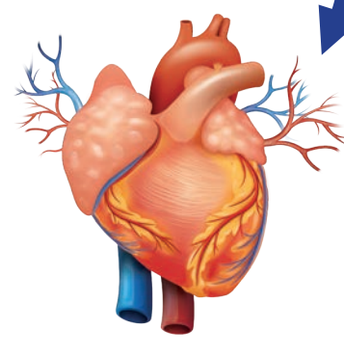
Organs that work together to perform a specific function form an **organ system**. The circulatory system is comprised of the heart and blood vessels.

All of the organ systems working together make up an organism. Within our bodies, the skeletal system, muscular system, circulatory system, respiratory system and other systems all work together to help us move about and carry out life processes.

muscle cell

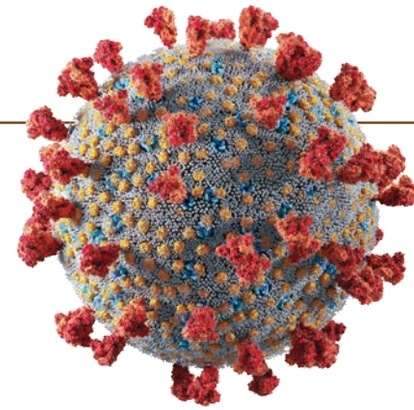


muscle tissue



heart (organ)

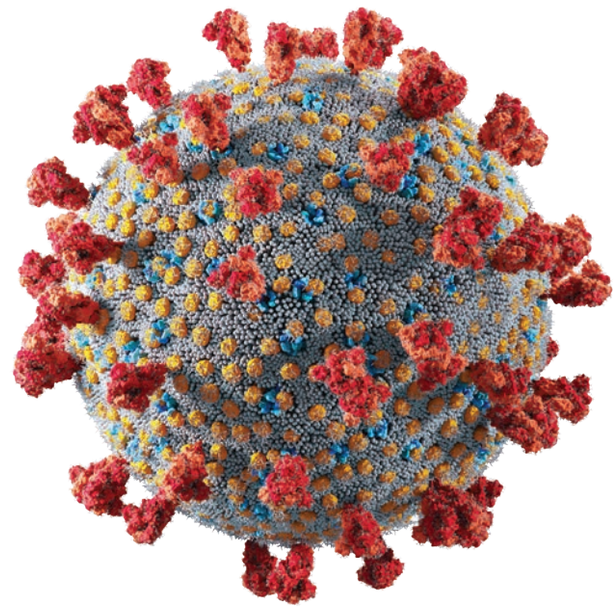
AB Activity 1.7



A Closer Look

Viruses – Cell Invaders!

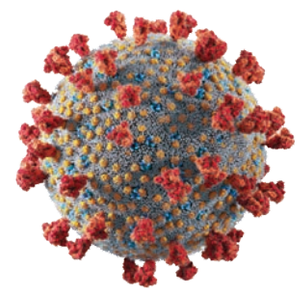
If you have ever had the flu or the common cold, you've had a virus in your body. Viruses are microscopic germs, but they are not classified as living organisms. They are not made of cells, they cannot obtain or store energy and they can only replicate when inside the cells of other organisms.

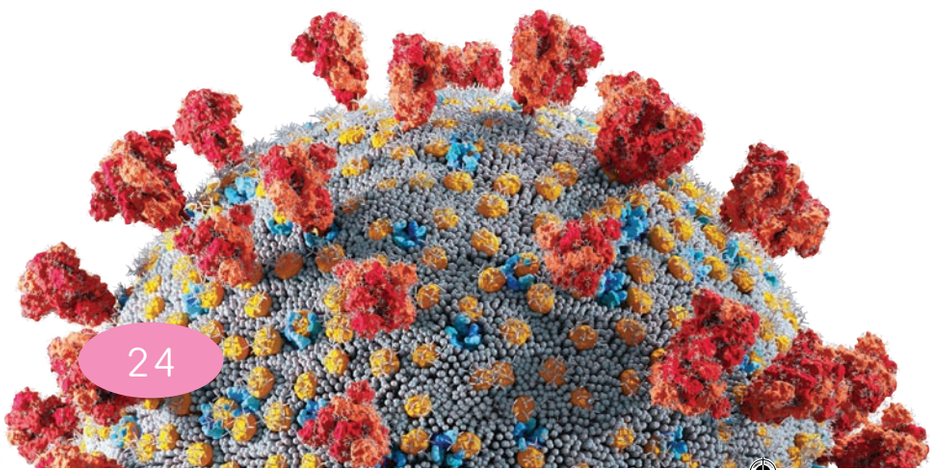


A **virus** is a strand of genetic instructions surrounded by an outer covering. It can invade and take over the cells of all types of organisms, from animals and plants to microorganisms including bacteria. The cell that is invaded by a virus is called a host cell.

Once inside a host cell, the virus releases its genetic material and instructs the host cell to replicate it many times. Host cells can replicate millions of copies of a virus in just a few hours. Once replicated, the host cell bursts open and the newly replicated virus is released. Each new virus can go on to invade other host cells.

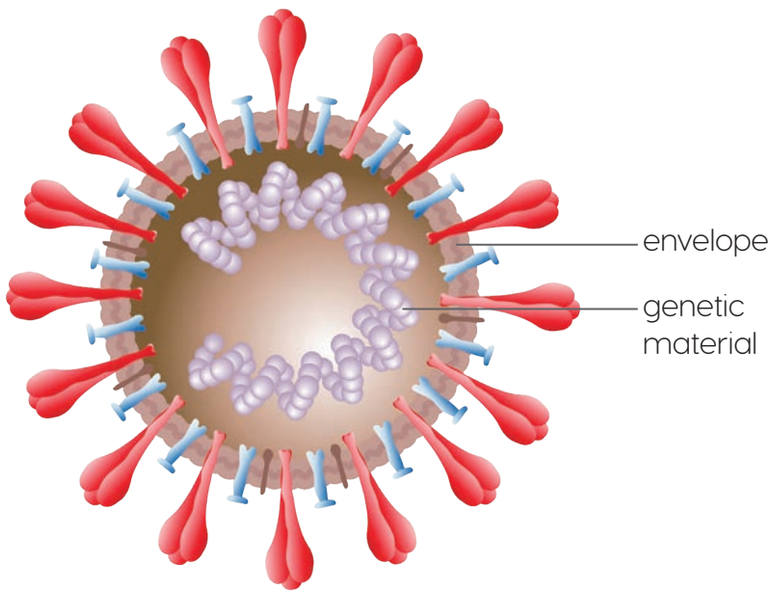
Most viruses are harmless to people, but some can cause us to get sick. Viruses can cause illnesses such as the common cold, the flu, cold sores and chickenpox.





We get sick from a virus when it infects or kills many of our cells, causing an immune response from our bodies. Often, the virus will infect cells in certain parts of the body. The common cold, for example, is caused by a rhinovirus that affects the nose and throat. The runny nose and sore throat you get when you have a cold is your body's immune system fighting the infection. Many viruses can only replicate at specific temperatures. A fever is your immune system's response to fight the virus by increasing your body temperature.

A vaccine is a special type of medicine that can be used to help your body fight a virus. A vaccine often contains a weakened, modified version of the virus itself. Rather than causing you to get sick, the vaccine causes your body to produce virus-fighting proteins called antibodies. If the virus enters your body in the future, your immune system already knows how to fight the virus. Because less people get sick when they are vaccinated, vaccines also help to stop the spread of viruses.



▲ *An artist's impression of the coronavirus that causes COVID-19.*

▲ *Vaccines can help your body fight off viruses.*

Did You Know?

A pandemic is the name given to a viral or other infectious disease that has spread worldwide. In 2020, there was a pandemic due to the spread of a virus called SARS-CoV-2 which caused the infection COVID-19. The virus infected the lower airways and lungs. People infected had symptoms such as a dry cough, difficulty breathing and mucus in the lungs. The virus mainly spread through tiny droplets released into the air when a person exhales, coughs or sneezes. What things can people do to prevent a virus such as COVID-19 from spreading?

Science Words

Use the words to complete the sentences.

taxonomy	**invertebrate**	**cellular respiration**
species	**unicellular organism**	**tissue**
photosynthesis	**multicellular organism**	**organ**
vascular tissue	**organelles**	**organ system**
vertebrate		

1. A group of tissues that works together to perform a specific function forms an _____ .

2. During _____ , oxygen interacts with glucose which causes chemical changes that give off energy.

3. The parts of a cell are called _____ .

4. An _____ is an animal without a backbone.

5. A _____ is an animal with a backbone.

6. _____ are internal tube-like structures in the roots, stem and leaves of vascular plants.

7. _____ is the process by which light, water and carbon dioxide are used to produce stored chemical energy in the form of glucose.

8. The process of naming and classifying organisms is called _____ .

9. A _____ is a group of similar organisms that are able to reproduce young of the same kind.

10. A group of similar cells that works together to perform the same function forms _____ .

11. Organs that work together to perform a specific function form an _____ .

12. An organism with a body made up of more than one cell is called a _____ .

13. An organism with a body made up of just one cell is called a _____ .

Review

1. Copy and complete the table.

Classification of Organisms		
Kingdom	**Characteristics**	**Example**
Archaea		
Eubacteria		
Protists		
Fungi		
Plants		
Animals		

2. List two unicellular protists.

3. How do fungi get the energy they need to carry out life processes?

4. List two functions of the vascular tissue in the stem of plants.

5. In which cell organelle does cellular respiration take place?

6. Name two organelles that can be found in plant cells but not in animal cells.

7. Why is a virus not classified as a living organism?

Taxonomists

Accurately classifying organisms and sharing information on newly discovered species is essential to our understanding of biodiversity. This important job is done by a **taxonomist**. A taxonomist often works in the field, searching for new organisms and collecting samples that are then taken to a laboratory for closer analysis.

A taxonomist determines which family, genus or species an organism belongs to. If it has characteristics different from all known organisms, then that's where the fun starts! If it belongs to a known genus, then a taxonomist can give a newly-discovered species its own species name. If it does not belong to an existing genus, the new organism gets its own two-part scientific name.

To ensure that organisms all over the world are classified in the same way, taxonomists name, describe and classify organisms according to the International Code of Nomenclature.

Taxonomists often specialize in the search for and classification of certain types of organisms. Some taxonomists specialize in the classification of microorganisms. Others specialize in the classification of specific types of fungi, plants or animals.

If you were a taxonomist, what type of organisms would you specialize in? If you found a new species, what would you name it?

2 Plants

In this chapter you will ...

- list the ways in which plants can be classified and the characteristics that define the plants in each group.
- list the types and describe the function of vascular tissue.
- construct an argument and provide evidence that plants have internal and external structures that function to support survival, growth and reproduction.
- compare and contrast flowering and non-flowering plants by the stages in their life cycles.

How are plants classified? What are the characteristics of the plants in each group?