Let's Do SCIENCE

Primary 5

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

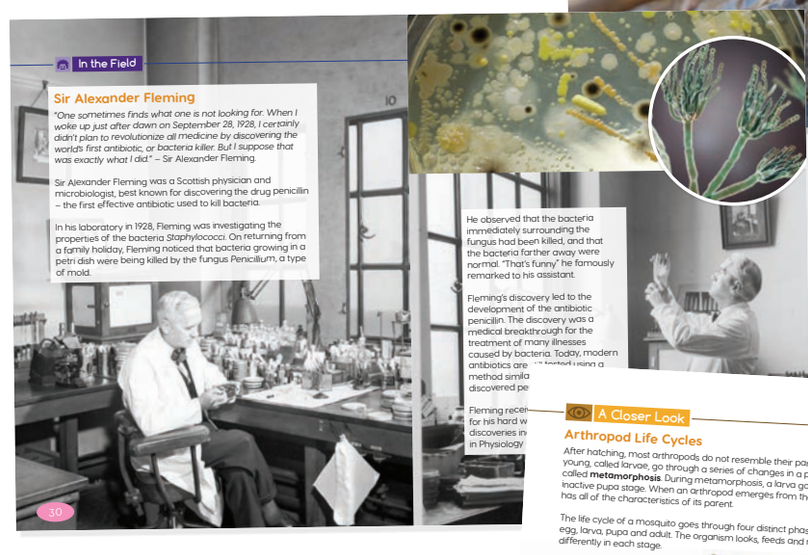
Let's Do Science is based on the United States Next Generation Science Standards (NGSS). The series consists of full-color textbooks and full-color activity books for Grades K to 6.

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.

The Let's Do Science textbooks include the following features:

Think Deeply

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



Engineer It!

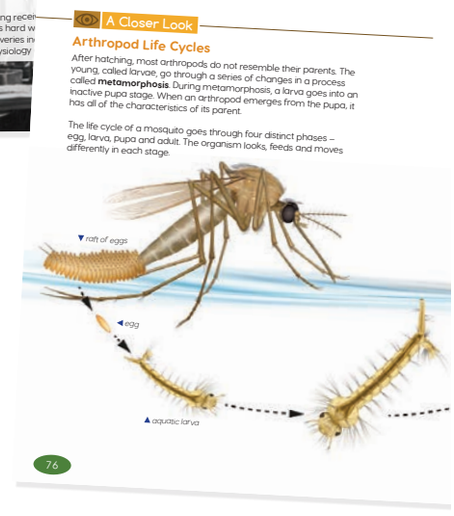
Goes beyond inquiry by encouraging students to design, model and build to engineer solutions to defined problems.

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.

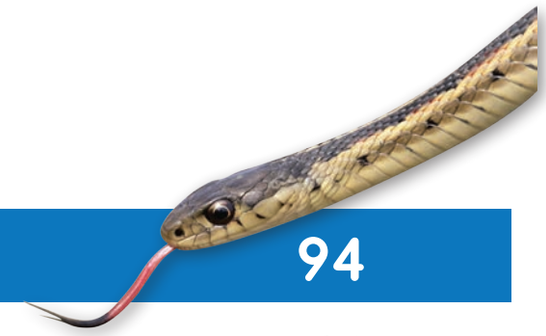
Review

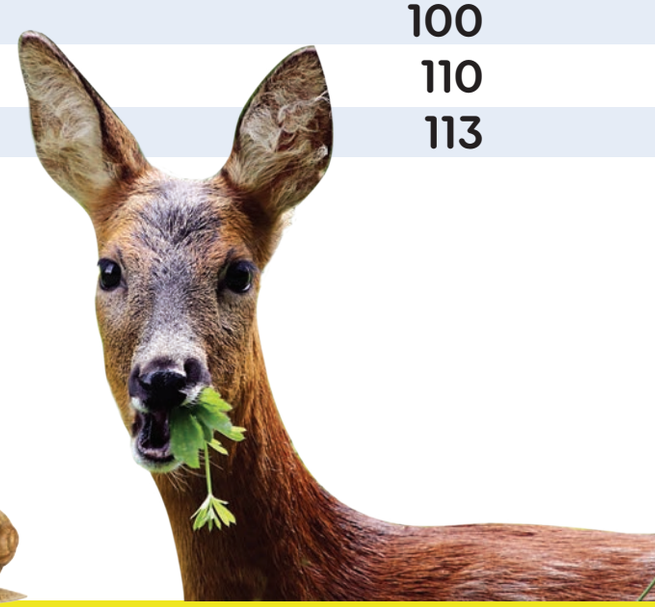
Topical questions at the end of each chapter for formative assessment.

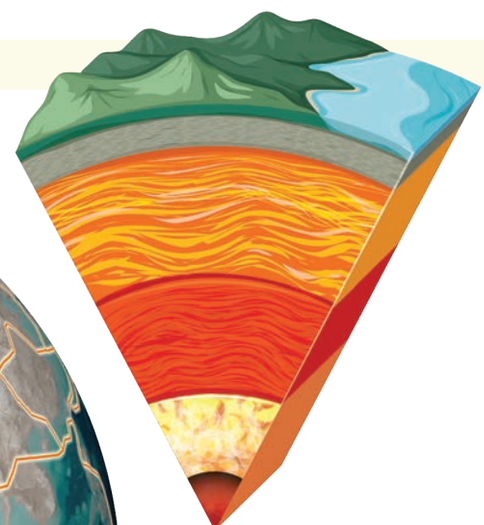
Science Words

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.

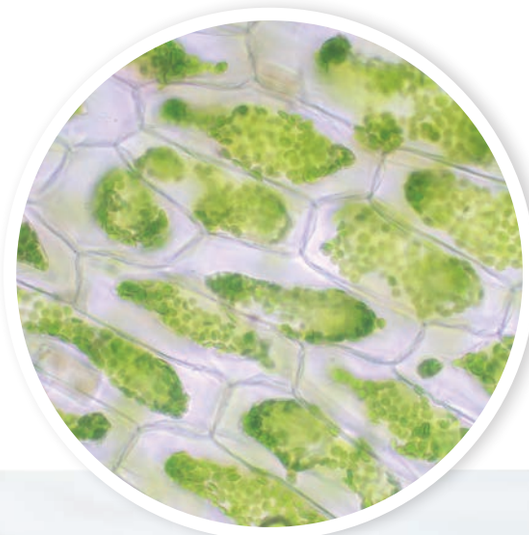
Let's look at how you can use these skills so you can be a scientist too.

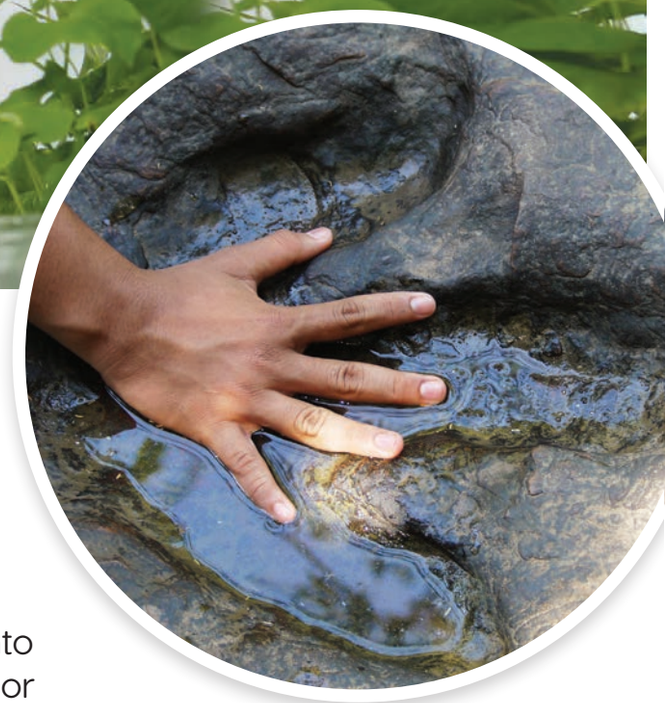
Observing

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.

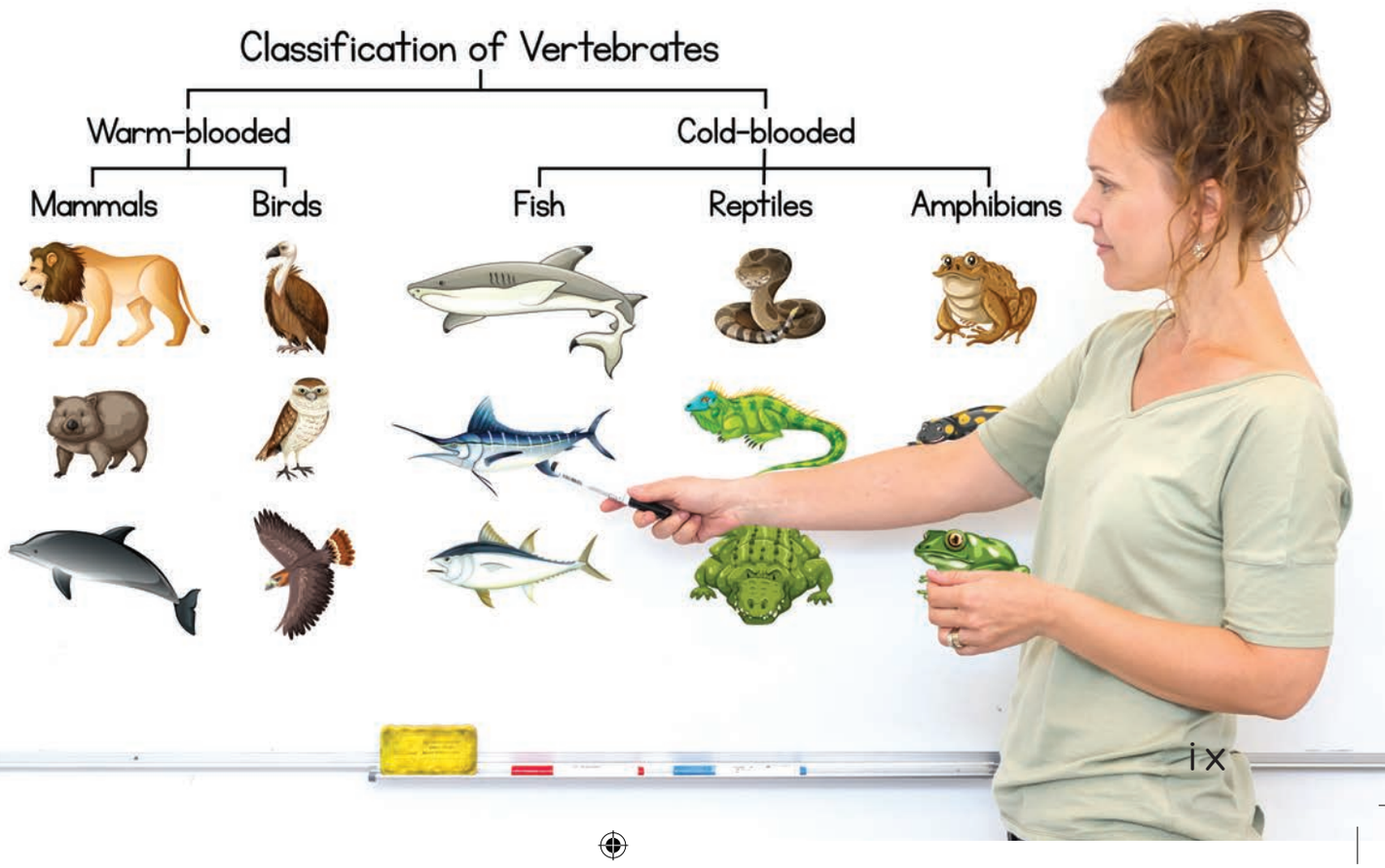




Comparing and Classifying

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.

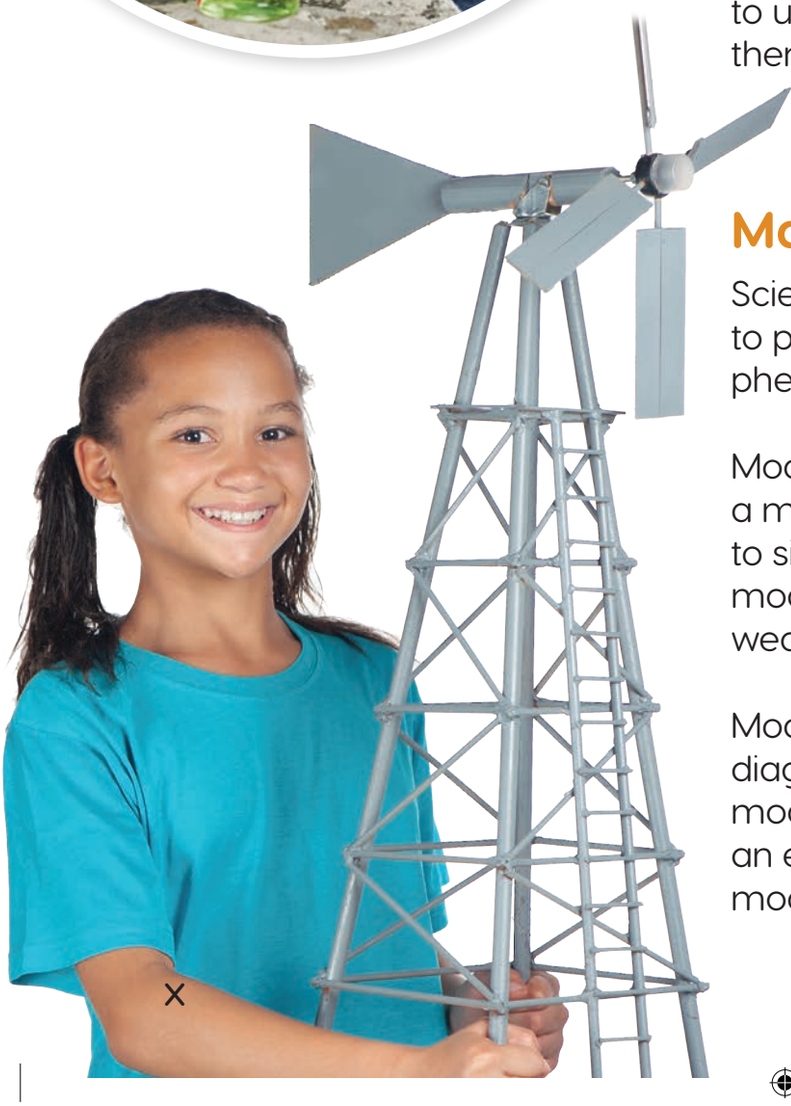
Classification is the process of placing things into groups based on similarities in their properties or characteristics. Objects around us can be classified by the properties of the materials they are made of. Organisms can be classified by their features, such as the presence or absence of a backbone.



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.

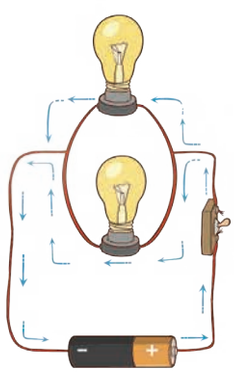
If you see footprints in the snow, you can infer that an animal has passed by after the last snowfall.

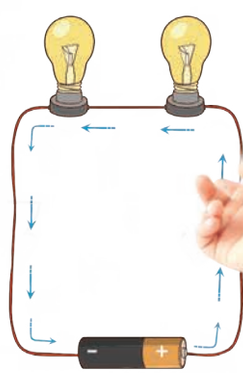
If you discover an animal jaw bone with large canine teeth, you can infer that the animal likely ate other animals.

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

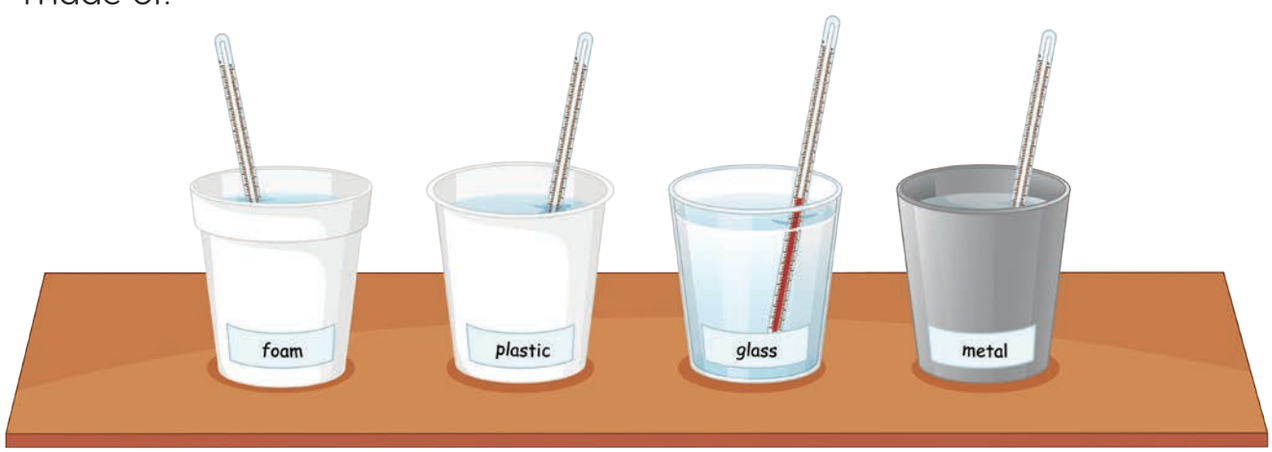
An important part in a science investigation are variables. A **variable** is any factor that can be controlled or changed during the investigation. There are three main variables – the independent variable, the dependent variables and the controlled variables.

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.

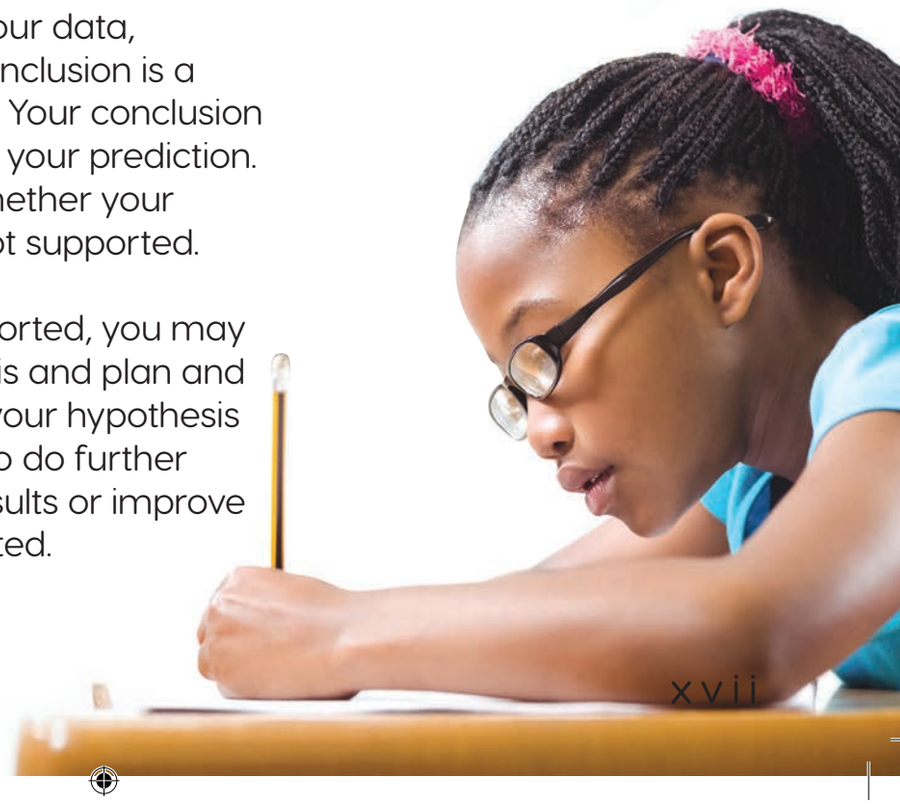
You **analyze** when you look closely at recorded data. You look for patterns to help explain your results. A pattern is when data repeats in a predictable way.

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.



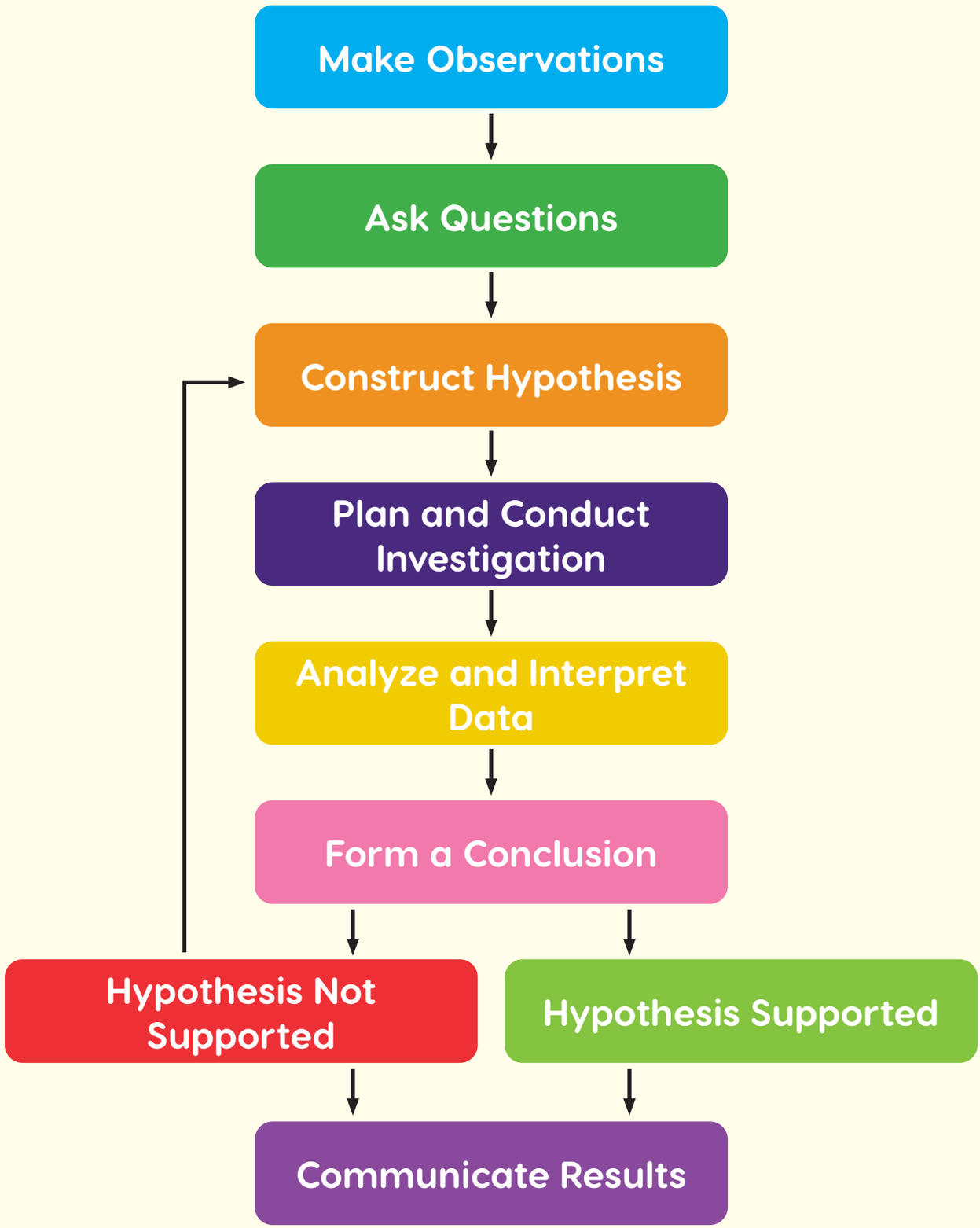
If your hypothesis was not supported, you may decide to form a new hypothesis and plan and conduct a new investigation. If your hypothesis was supported, you may wish to do further investigations to confirm the results or improve the accuracy of the data collected.

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.

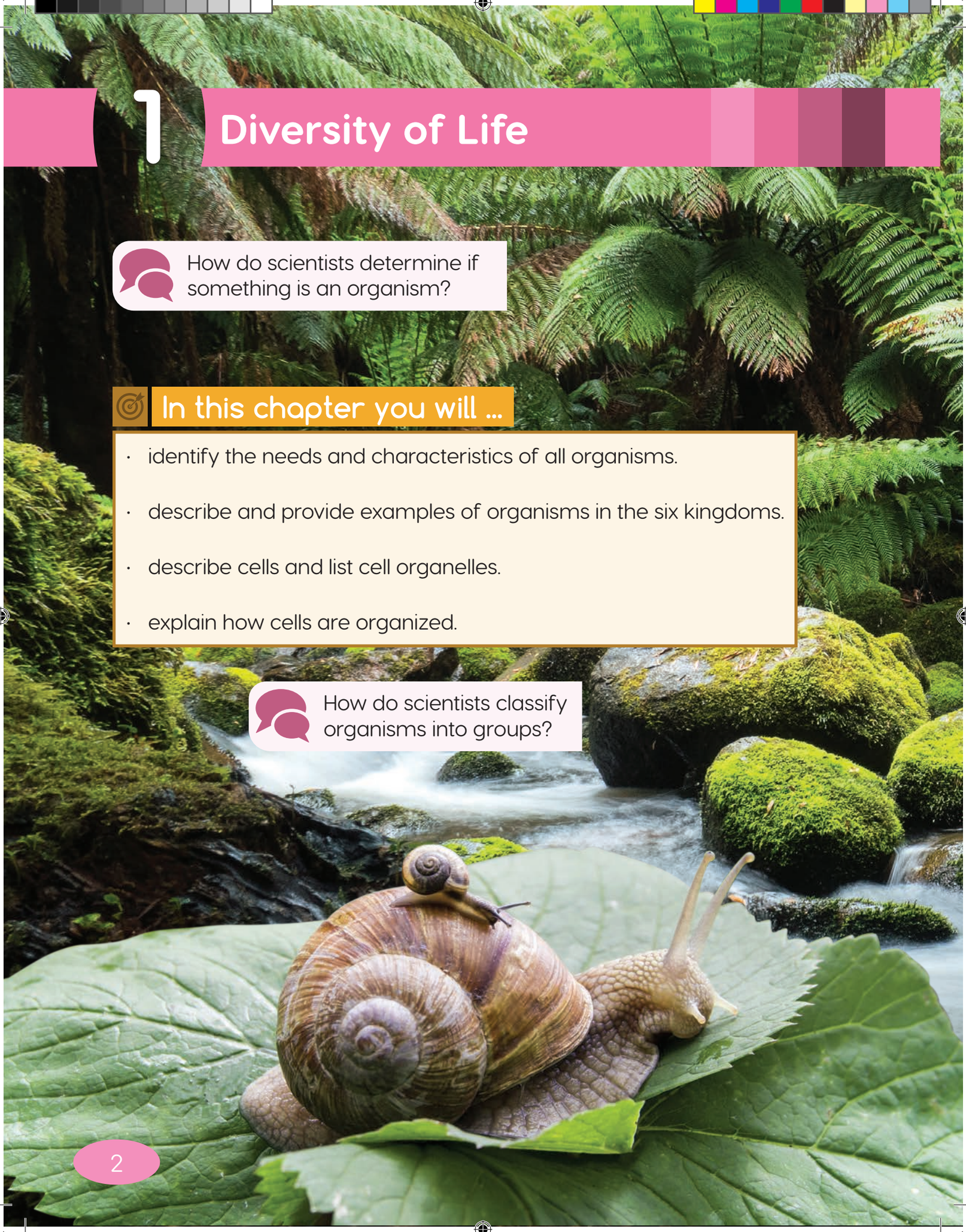
1 Diversity of Life

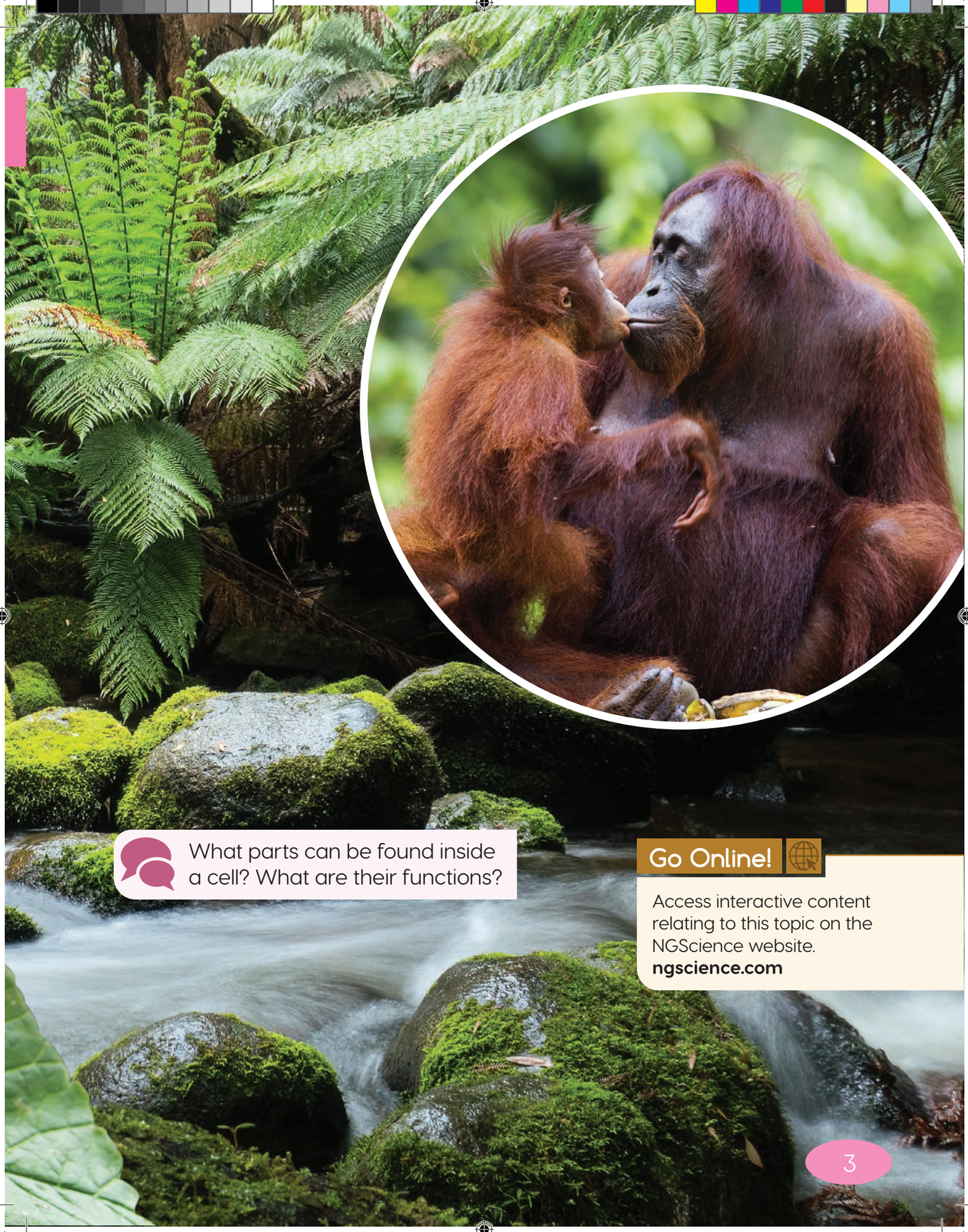
How do scientists determine if something is an organism?

In this chapter you will ...

- identify the needs and characteristics of all organisms.
- describe and provide examples of organisms in the six kingdoms.
- describe cells and list cell organelles.
- explain how cells are organized.

How do scientists classify organisms into groups?





What parts can be found inside a cell? What are their functions?

Go Online!

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

What Are Organisms?

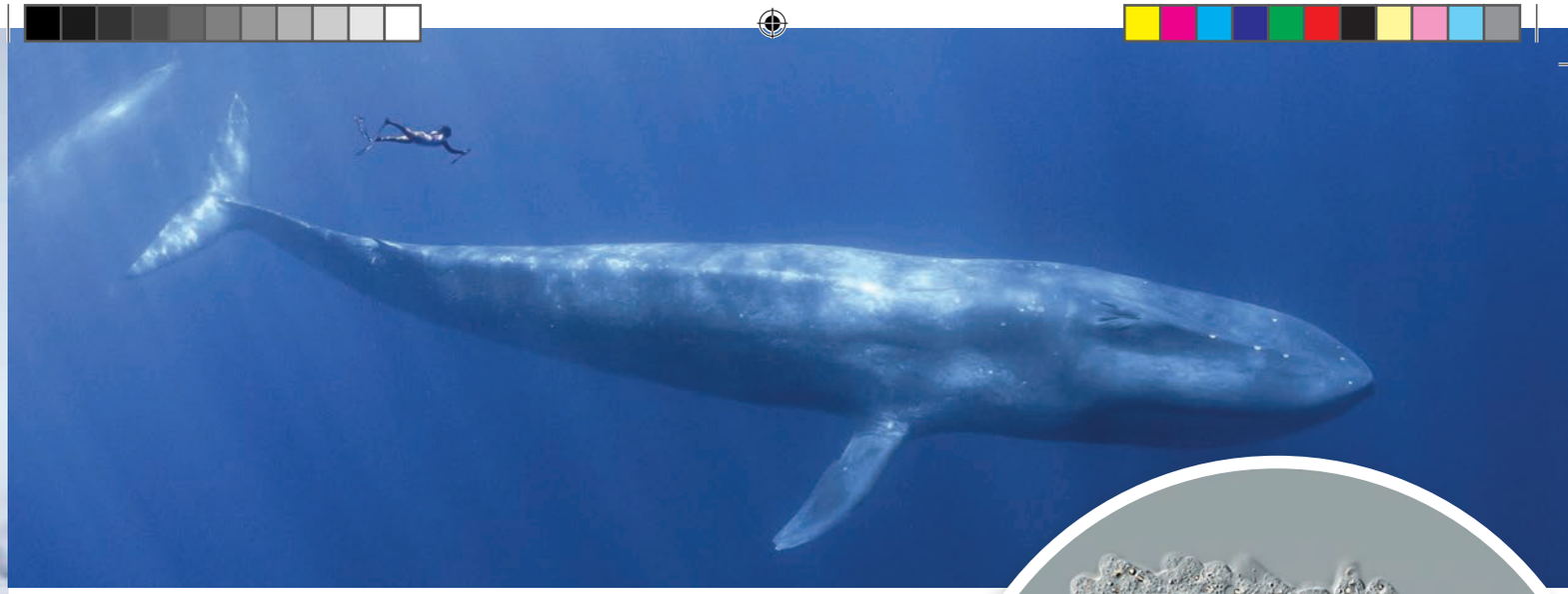
Classification is an important part of science. It is the process of observing and placing things into groups based on characteristics they share. One way scientists classify things is as living things and non-living things. A living thing is an **organism**.

In order for something to be classified as an organism, scientists look closely at its characteristics and functions.
All organisms:

- are made of one or more cells.
- obtain and use energy.
- reproduce.
- respond to changes.
- grow.

What characteristics and functions of the deer let scientists know it is a living thing?

AB Activity 1.1



▲ *blue whale*

Cells

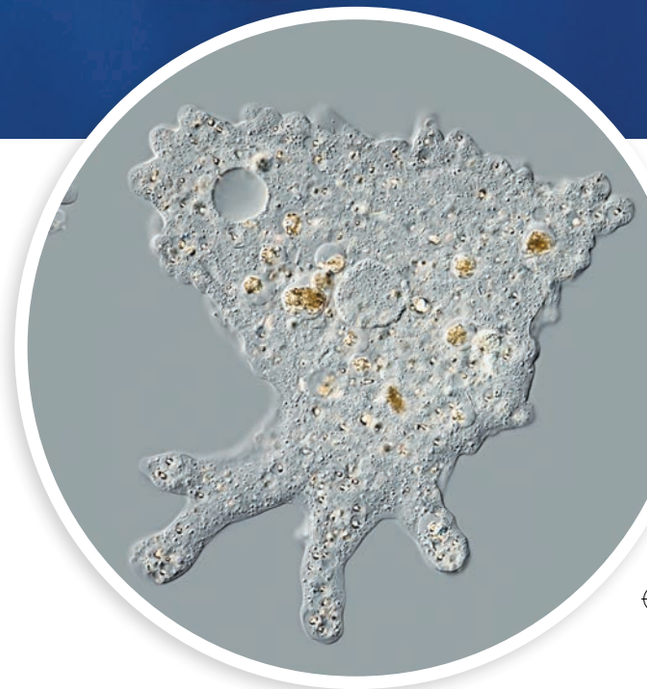
Organisms come in a great variety of shapes and sizes, and can be found in all areas of the Earth. Some, like microscopic amoebas, are so small, we need to use a microscope to see them. Others, like the blue whale, can reach lengths of over 25 meters – that's about as long as a basketball court!

From microscopic amoebas to giant blue whales, all organisms are made of 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, like parameciums, diatoms and bacteria, are made up of only a single cell. They are **unicellular organisms**. Others, like most of the plants and animals you are familiar with, 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.

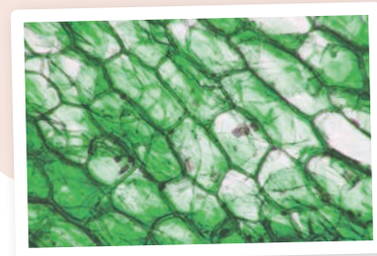
AB Activities 1.2 – 1.3



▲ *amoeba*

Did You Know?

Cells were first discovered in 1665 by the English scientist Robert Hooke. When observing cork under a microscope, he noticed a series of small boxes which he called 'cells'.



▲ *Goshawk feeding on a Eurasian magpie.*

▲ *House Sparrows feeding on a raspberry cane.*

Obtaining and Using Energy

All organisms need energy to carry out life processes. Life processes include growth, reproduction and the repair and maintenance of structures. Some organisms, like many animals, use energy to move their body parts or to move from place to place.

Different organisms obtain energy in different ways. Plants are organisms that photosynthesize – they capture light energy from the Sun and convert it into food. The food is distributed throughout the plant.

Animals obtain energy by eating other organisms. Fungi obtain energy by breaking down and absorbing the remains of dead organisms.

AB Activity 1.4

▼ *Plants are organisms that use the energy in sunlight to produce food.*

Reproduction

All organisms are able to reproduce. This means they are able to make more of their own kind. There are two main types of reproduction – sexual reproduction and asexual reproduction.

Sexual reproduction involves two parents. Each parent produces a special reproductive cell which join together to form a single cell. This process is called **fertilization**. The offspring that develops from the fertilized cell will have characteristics from both parents.

Asexual reproduction involves only one parent. The offspring are genetically identical to the parent. Most unicellular organisms reproduce asexually. Bacteria and many other unicellular organisms reproduce by dividing into two identical daughter cells.

AB Activity 1.5

▲ *Parameciums reproduce by dividing into two identical daughter cells.*

Go Online!

Some simple organisms, such as yeast and freshwater hydra, reproduce asexually by budding. Find out more on the NGScience website.
QuickCode: **D6S9**

◀ *Lions and other mammals reproduce sexually.*

Growth and Development

Organisms grow and develop as they get older. All of the stages in an organism's life – from first entering the world, growing larger and developing new parts, to reproducing young of its own make up its life cycle.

When the sex cells from a flowering plant are fertilized, the fertilized cell develops into a seed. Under the right conditions, the seed will germinate and start to grow. It will grow leaves and start to make its own food. It will eventually develop flowers and fruits and go on to produce new plants of the same kind.

When multicellular organisms grow, they usually change in size and shape. The number of cells that makes up their bodies increases.

Unicellular organisms also grow and change shape as they get older. They usually get larger in size before reproducing by dividing.

▲ *When an eagle spots prey, it responds by diving and catching it.*

Response to Change

An eagle flies high in the sky. It uses its keen sense of sight to search for fish in the lake below. When it spots a fish, it dives down and catches it in its sharp talons.

Spotting the fish in its environment is an example of a stimulus. The way the eagle acted when it spotted the fish is a response. All organisms respond to stimuli in their environment.

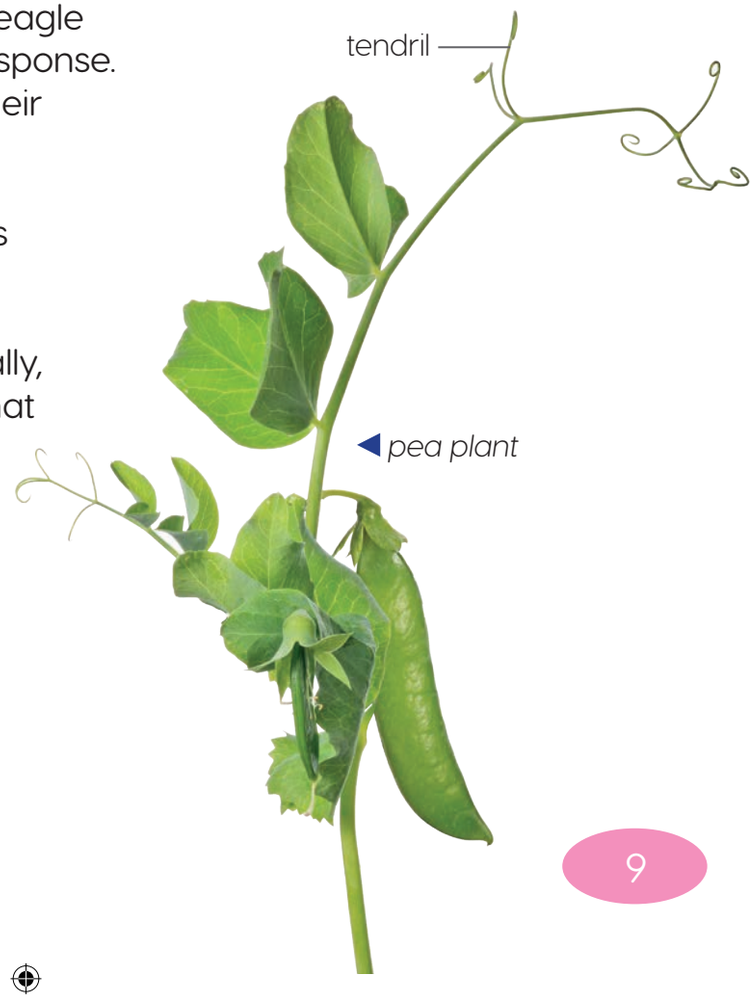
A stimulus is any change that causes an organism to act in a certain way. The way an organism reacts to the stimulus is called a response. Generally, an organism will respond in a way that increases its chances of survival.

A stimulus could be a change in light, temperature, sound, chemical changes to an environment or contact with other organisms.

AB Activity 1.6

Amazing Fact!

Pea plants have specialized stems, called tendrils, that curl and twine around the objects they touch as they grow. How does this response help the pea plant survive?



◀ *pea plant*

Classifying Organisms

Earth is home to a great diversity of organisms. To organize and gain a better understanding of organisms, scientists classify them into groups based on the features they share. The process of naming and classifying organisms is called taxonomy.

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

How is classifying organisms useful?

AB Activity 1.7

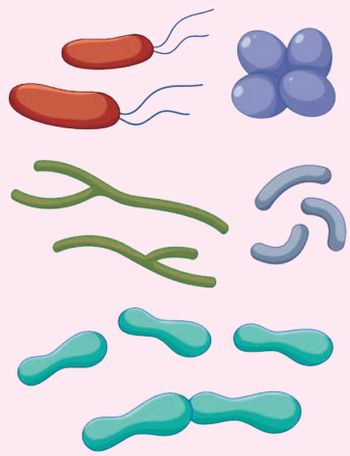
The broadest and most general group of organisms are called kingdoms. There are six kingdoms recognized by scientists:

- ancient bacteria
- bacteria
- protists
- fungi
- plants
- animals

All of the organisms in each kingdom share basic characteristics or traits. The chart below shows some shared characteristics of the organisms within each kingdom.

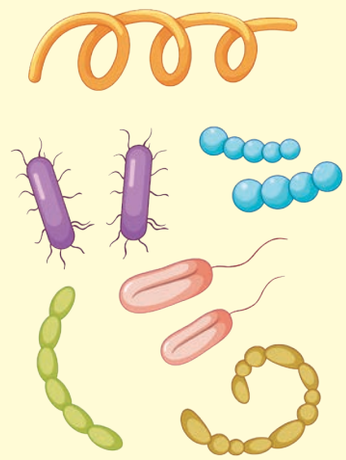
The Six Kingdoms of Life

Ancient Bacteria



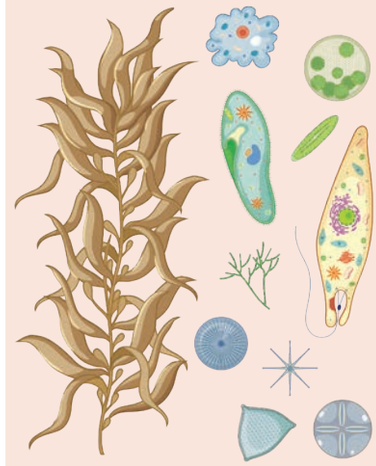
- unicellular
- no nucleus
- decomposers
- can move from place to place

Bacteria



- 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

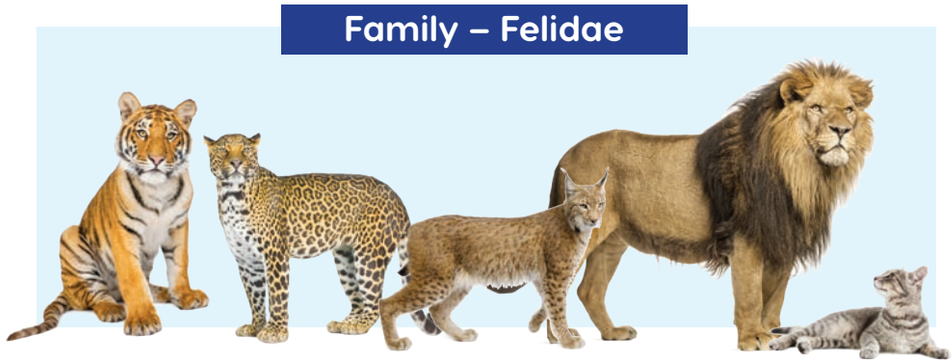
Animals

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

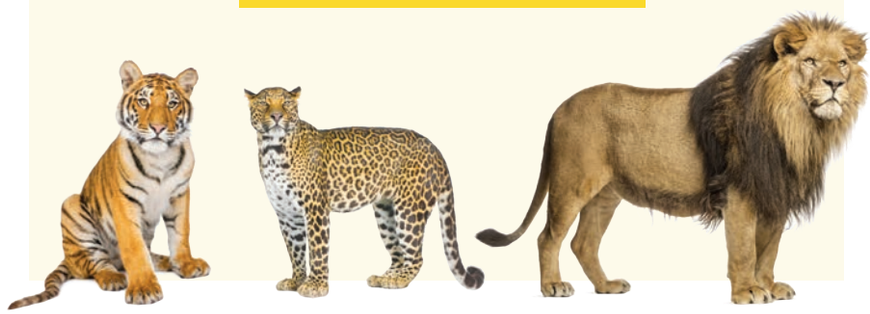
By looking closely at the characteristics of organisms, scientists are able to classify them into smaller and smaller groups. Let's take a look at this classification system by looking at how a tiger is classified.

Order – Carnivora

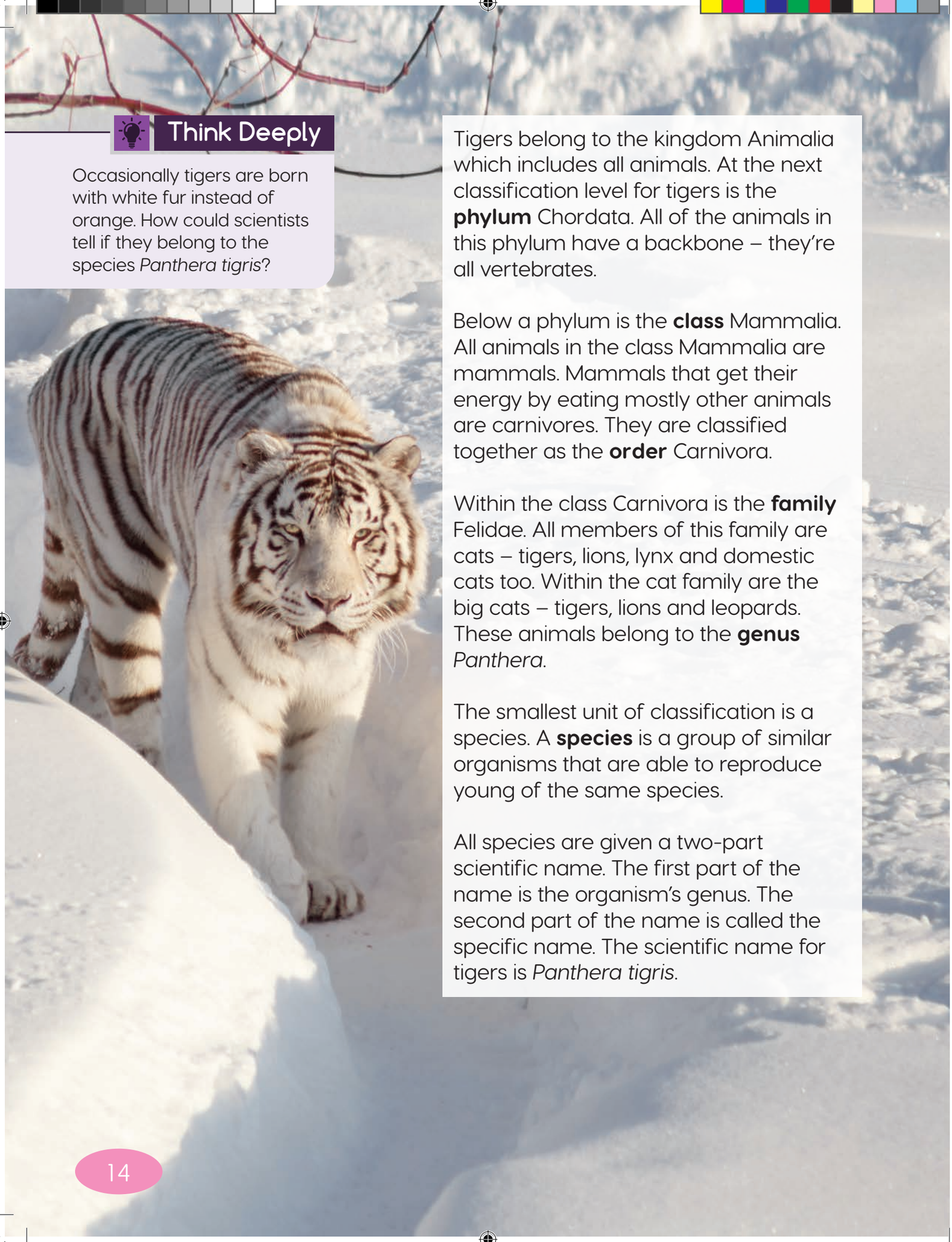
Family – Felidae



Genus – *Panthera*



Species – *Panthera tigris*



Think Deeply

Occasionally tigers are born with white fur instead of orange. How could scientists tell if they belong to the species *Panthera tigris*?

Tigers belong to the kingdom Animalia which includes all animals. At the next classification level for tigers 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 that get their energy by eating mostly other animals are carnivores. They are classified together as the **order** Carnivora.

Within the class 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 species.

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 scientific name for tigers is *Panthera tigris*.

Kingdoms

Bacteria

Bacteria (singular bacterium) are amongst the simplest and oldest organisms on Earth. All bacteria are unicellular microorganisms and most can only be seen using powerful microscopes. Bacterial cells do not have a nucleus.

Bacteria are divided into two kingdoms – eubacteria and archaebacteria.

Eubacteria can be found in all natural environments – in the air, in water and soil and even in the bodies of other organisms, including humans. **Archaebacteria** live in extreme environments such as the deep ocean floor, volcanic vents and hot springs.

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

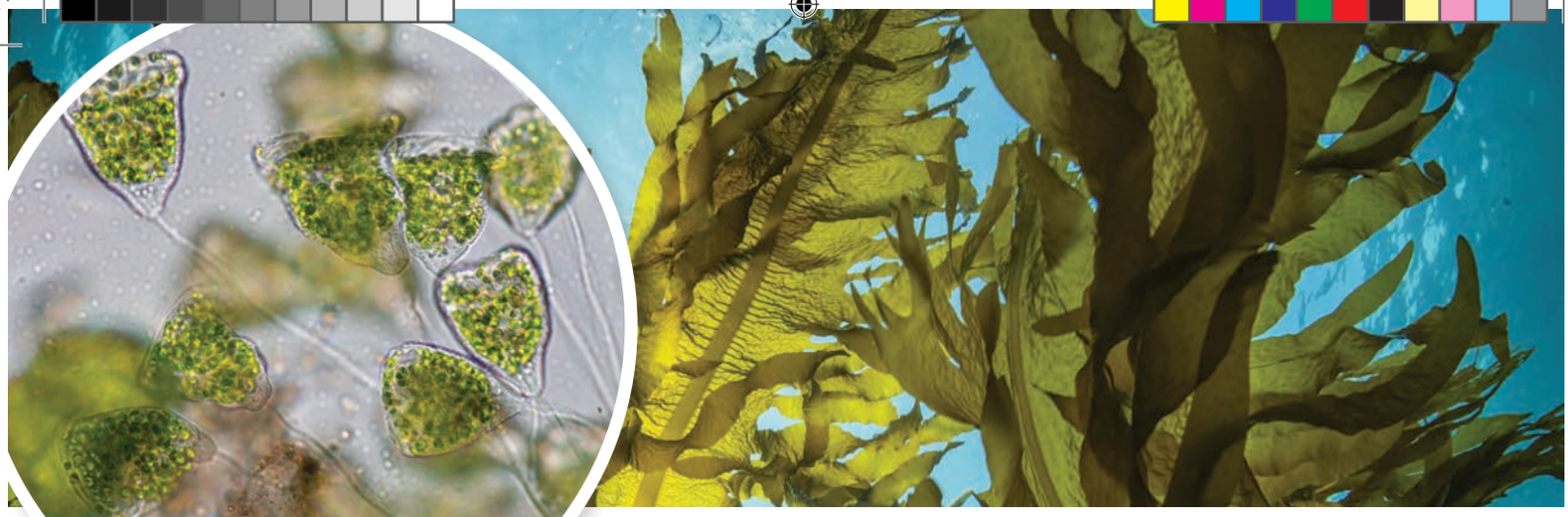
Bacteria can cause diseases and infections in plants, animals and people. *Salmonella* and *E. coli* are bacteria that can cause food poisoning in people and some animals. Bacteria can also be helpful. Many organisms need bacteria to help them get the nutrients they need. Bacteria in your stomach help you to get nutrients from the food you eat.

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

▲ *escherichia bacteria*

▲ *streptococcus bacteria*

▲ *spirilla bacteria*



▲ *Kelp are multicellular protists. They can grow to lengths of over 50 meters.*

▲ *Vorticella are unicellular aquatic organisms often found attached to plants and rocks.*

Protists

Protists are organisms that belong to the kingdom Protista. They come in a diverse range of shapes and sizes. Most protists, like diatoms, euglenas and vorticellas, are unicellular. There are also multicellular protists, such as the giant kelp and slime molds.

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.

Did You Know?

Protists do not have many characteristics in common. They are classified together as they do not fit clearly into any of the other kingdoms.

▼ *Slime molds are decomposers. They breakdown dead organic matter and absorb the remains.*

AB Activity 1.8

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 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. 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. 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*.

What are the characteristics of fungi?

▲ *fly agaric mushroom growing on the forest floor*

Go Online!

Mycorrhizae are microscopic fungi found in soil. They play an important role in helping plants take in water and nutrients. Discover more about mycorrhizal fungi on the NGScience website.
QuickCode: **X2T6**

AB **Activity 1.9**

▶ *bracket fungus growing on a log*

A Closer Look

What Is a Virus?

You might know of viruses as the microscopic germs that can cause us to get sick. Unlike microscopic organisms such as bacteria, viruses are not alive. 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 material 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.

AB Activity 1.10

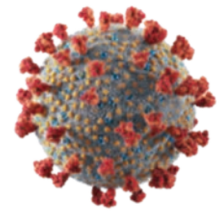
Most viruses are harmless to people, but some can cause us to get sick. Viruses can cause illnesses such as the common cold, the flu, cold sores and chicken pox.

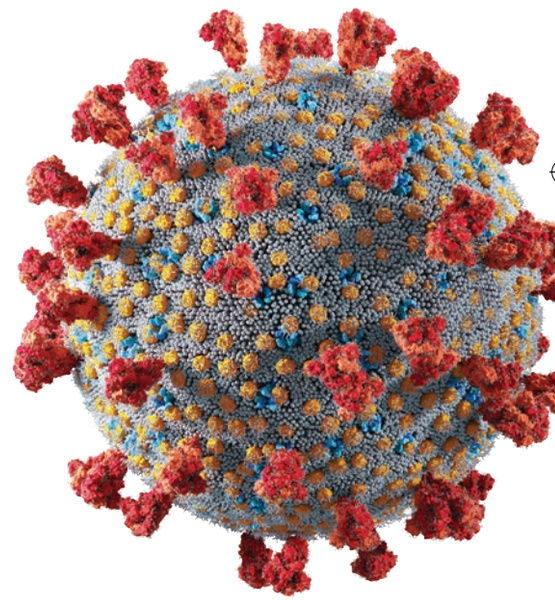
We get sick from a virus when it infects or kills many of our cells, causing an immune response from our bodies. Often, the virus will infect cells in certain parts of the body. The common cold, for example, is caused by a rhinovirus that affects the nose and throat. The runny nose and sore throat you 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.

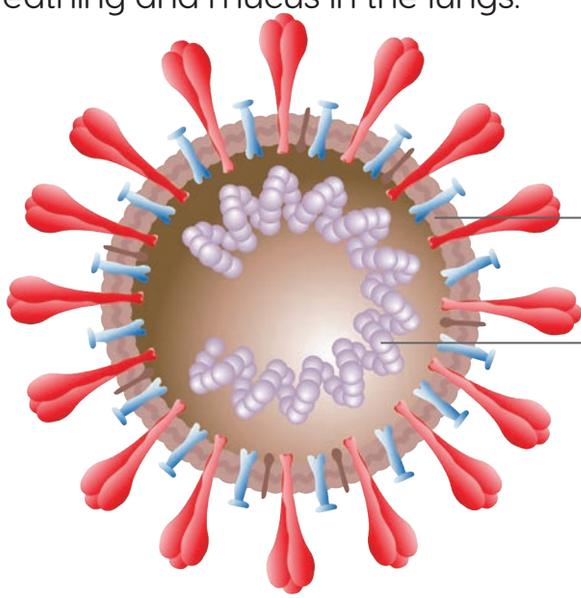
In 2020, there was a global spread of a virus called Covid-19. This virus infected the lower airways and lungs. People infected with Covid-19 had symptoms such as a dry cough, difficulty breathing and mucus in the lungs.

Think Deeply

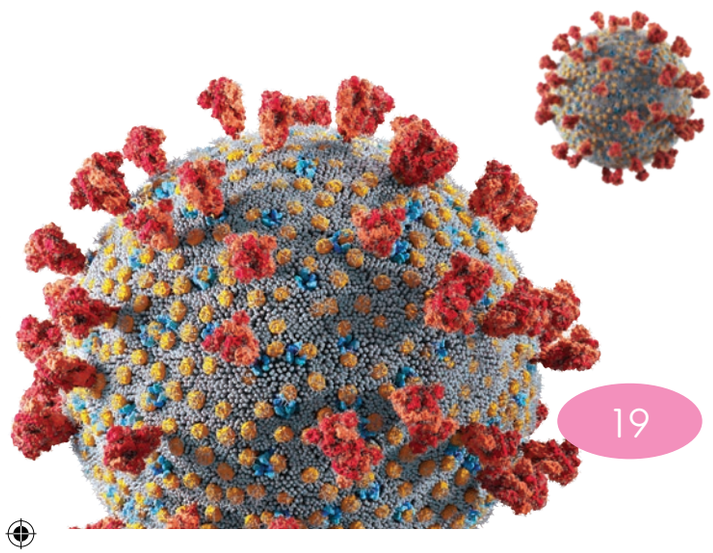
What things did people do to slow the spread of Covid-19? Why were these measures necessary?

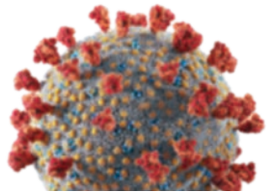


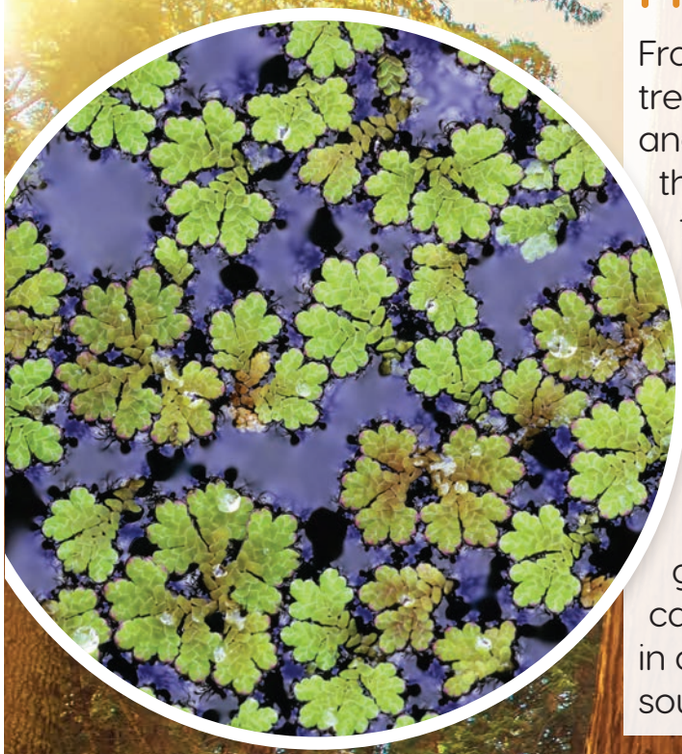




▲ *An artist's impression of the coronavirus that causes Covid-19.*







Plants

From tiny mosquito ferns to giant sequoia trees, plants can be found in all shapes, sizes and colors. Plants can be found in all areas of the Earth – in icy tundras, dry deserts and in fresh and salt water too.

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 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.

Amazing Fact!

The tallest trees on Earth are a type of sequoia called coast redwoods. They can reach heights of up to 115 meters (377 ft). With the thickest bark of all trees, they are also immune to most diseases.

▲ *Flowering plants and conifers are vascular plants.*

Plants can be classified in different ways. One way scientists classify plants is by the presence or absence of 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**. Flowering plants, conifers 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. Mosses, liverworts and hornworts are non-vascular plants.

What are the characteristics of plants?

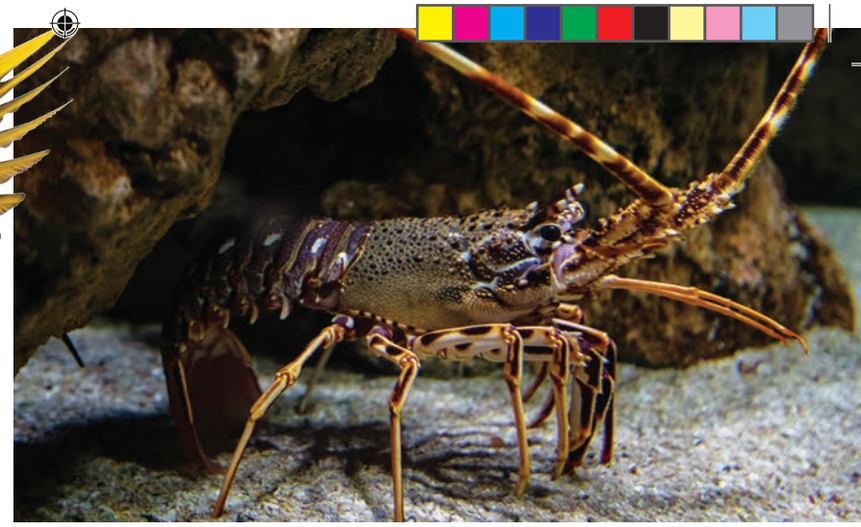
Think Deeply

Imagine you discover a new species of plant in a forest. How could you determine if it is a vascular plant or a non-vascular plant?

▼ *liverwort*

▼ *mosses growing on rocks in a stream*

▼ *macaw*



▲ *rock lobster*

Animals

Millions of different kinds of animals live on Earth. They can be found in the freezing poles to the hottest deserts. They can be found in bodies of fresh and salt water and underground too. They come in a great diversity of shapes and sizes.

Unlike plants, which get the energy they need by photosynthesizing, animals feed on other organisms to get the energy they need.

Most animals have body parts that enable them to move from place to place. 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.

▼ *meerkat*

▼ *blue pit viper*

▼ *red-eyed tree frog*

▲ *jellyfish*

▶ *African elephant*

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.

What are the characteristics of animals?

◀ *locust*

AB Activity 1.11

What's Inside Cells?

Plants and animals are multicellular organisms. They are made up of cells of many different kinds and come in a variety of shapes and sizes. The shape and size of a cell is often suited to the function it performs for the organism.

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

The outermost part of an animal cell is the **cell membrane** – a thin layer that surrounds the cell. The main function of the cell membrane is to regulate the interactions that occur between the cell and its external environment. It controls the substances that go in and out of the cell.

Inside the cell is the cytoplasm. The **cytoplasm** is a watery substance that holds 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 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 release the energy from digested foods.

Did You Know?

The English scientist, Robert Hooke, was the first person to observe cells. He did so in 1665, when looking at a slice of cork under a microscope he made. Shortly after, Antonie Philips van Leeuwenhoek, a self-taught scientist, made a more powerful microscope and became the first person to observe unicellular organisms.

Amazing Fact!

The human body is made up of trillions of cells of which there are about 200 different kinds. Cells are continuously reproducing. Every day, billions of cells die and are replaced by new cells.

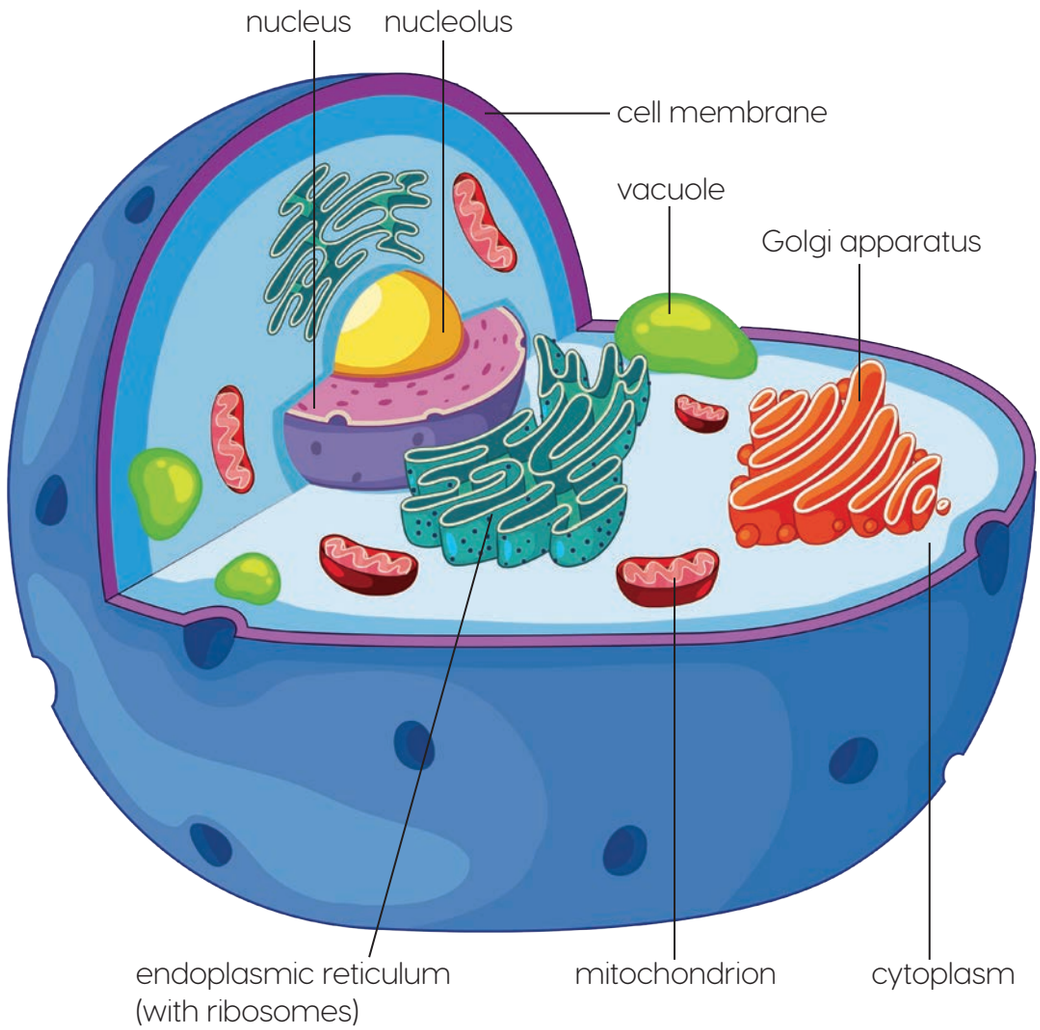
The **Golgi apparatus** is the organelle that packages and transports proteins for delivery to different destinations within the cell.

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.

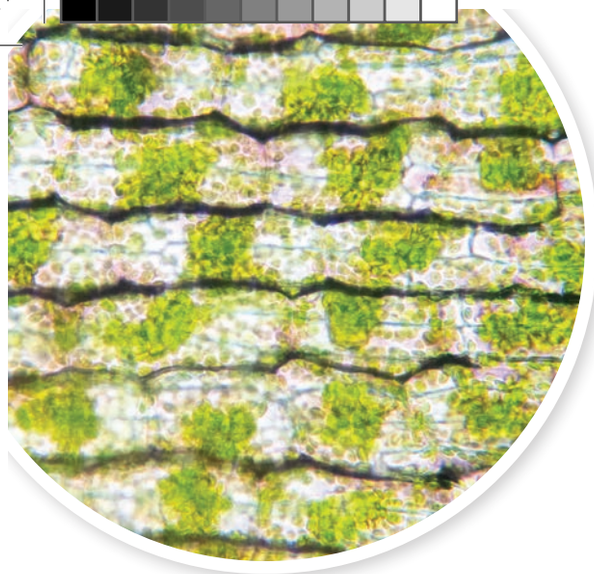
Vacuoles are storage spaces for water, wastes and other cellular material.

Did You Know?

Animal cells are generally smaller than plant cells. As they lack a cell wall, they are also irregular in shape compared to plant cells.



What organelles can be found in animal cells? What are their functions?



▲ *plant cells with chloroplasts*

Think Deeply

Halle viewed unicellular protists under a microscope and noticed they contained chloroplasts. What can she infer about how they obtain the energy they need?

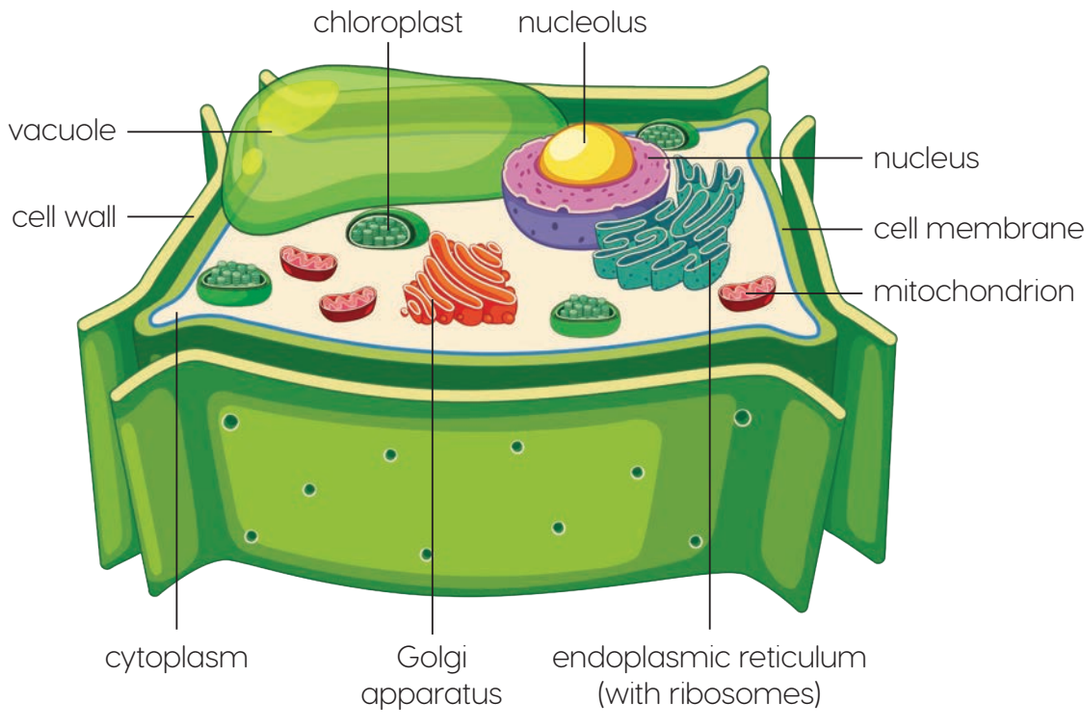
Plant Cells

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.

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 Activities 1.12 – 1.13



In what ways are plant cells similar to animal cells? How are they different?

Cell Organization

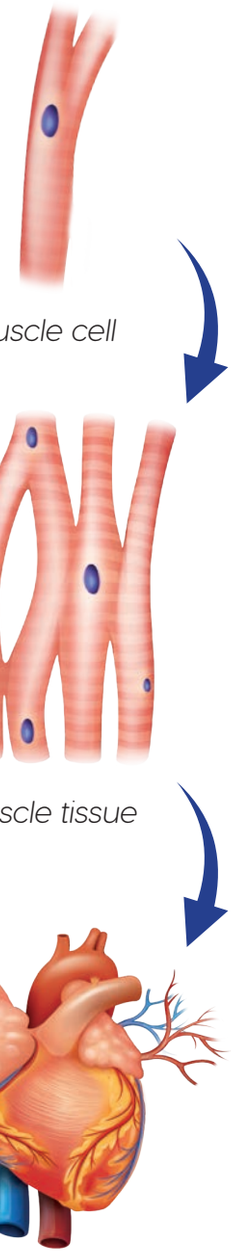
Multicellular organisms are made up of many different kinds of cells. The cells are organized in a way that allows them to work together to perform specific functions.

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

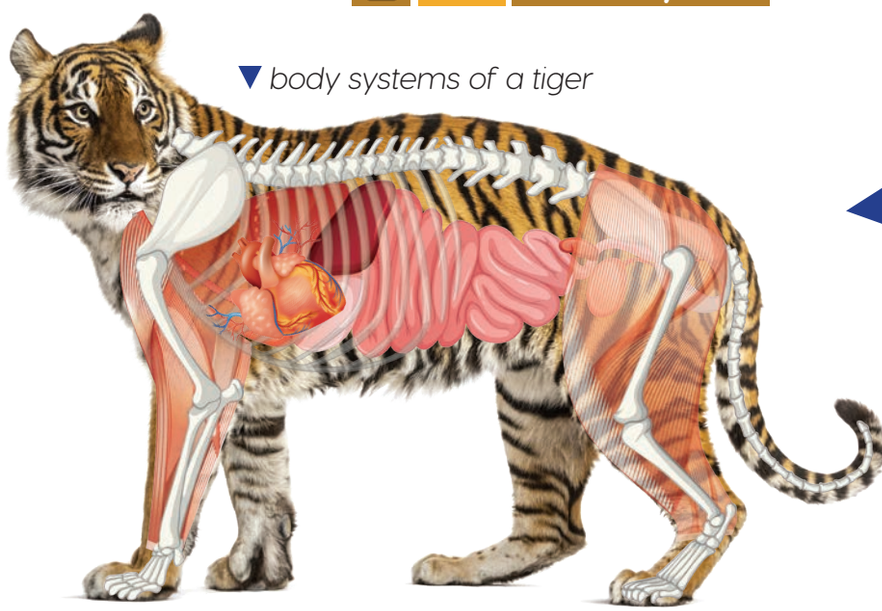
Tissues work together too. A group of tissues that work together to perform a specific function forms an **organ**. The heart is an organ made up of different tissues. The function of the heart is to pump blood around the body.

Organs working 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 an organism. Within a tiger the skeletal system, muscular system, circulatory system, respiratory system and other systems all work together to help the tiger move about and carry out life processes.



AB Activity 1.14



▼ *body systems of a tiger*

Science Words

Use the words to complete the sentences.

organism	**vascular plants**
cells	**non-vascular plants**
unicellular organism	**vertebrates**
multicellular organism	**invertebrates**
sexual reproduction	**organelles**
asexual reproduction	**photosynthesis**
virus	

1. Plants produce their own food through the process of _____ .
2. _____ are animals with a backbone.
3. _____ are animals without a backbone.
4. An organism made of just one cell is a _____ .
5. An organism made of more than one cell is a _____ .
6. A _____ is a strand of genetic material that can invade and take over cells.
7. _____ are the smallest units within an organism that can carry out life processes.
8. A living thing is called an _____ .
9. _____ do not contain vascular tissue.
10. _____ contain vascular tissue.
11. Reproduction that involves fertilization is called _____ .
12. Reproduction involving just one parent is called _____ .
13. The parts of a cell are called _____ .

Review

1. List five characteristics of organisms.

2. True or false.
   (a) Animals are unicellular organisms.
   (b) Animals cells do not have a cell wall.
   (c) Photosynthesis takes place in the nucleus of a cell.
   (d) Ferns and mosses belong to the same kingdom.

3. What is a virus?

4. Describe and provide an example of a decomposer.

5. Copy and complete the tables.

   (a)

Plant Classification		
Type of Plant	**Description**	**Examples**
Vascular Plants		
Non-vascular Plants		

   (b)

Animal Classification		
Type of Animal	**Description**	**Examples**
Vertebrates		
Invertebrates		

6. What is chlorophyll? Where is it found?

7. Draw a labeled diagram to show how cells are organized within a vertebrate animal.

Sir Alexander Fleming

"One sometimes finds what one is not looking for. When I woke up just after dawn on September 28, 1928, I certainly didn't plan to revolutionize all medicine by discovering the world's first antibiotic, or bacteria killer. But I suppose that was exactly what I did." – Sir Alexander Fleming.

Sir Alexander Fleming was a Scottish physician and microbiologist, best known for discovering the drug penicillin – the first effective antibiotic used to kill bacteria.

In his laboratory in 1928, Fleming was investigating the properties of the bacteria *Staphylococci*. On returning from a family holiday, Fleming noticed that bacteria growing in a petri dish were being killed by the fungus *Penicillium*, a type of mold.