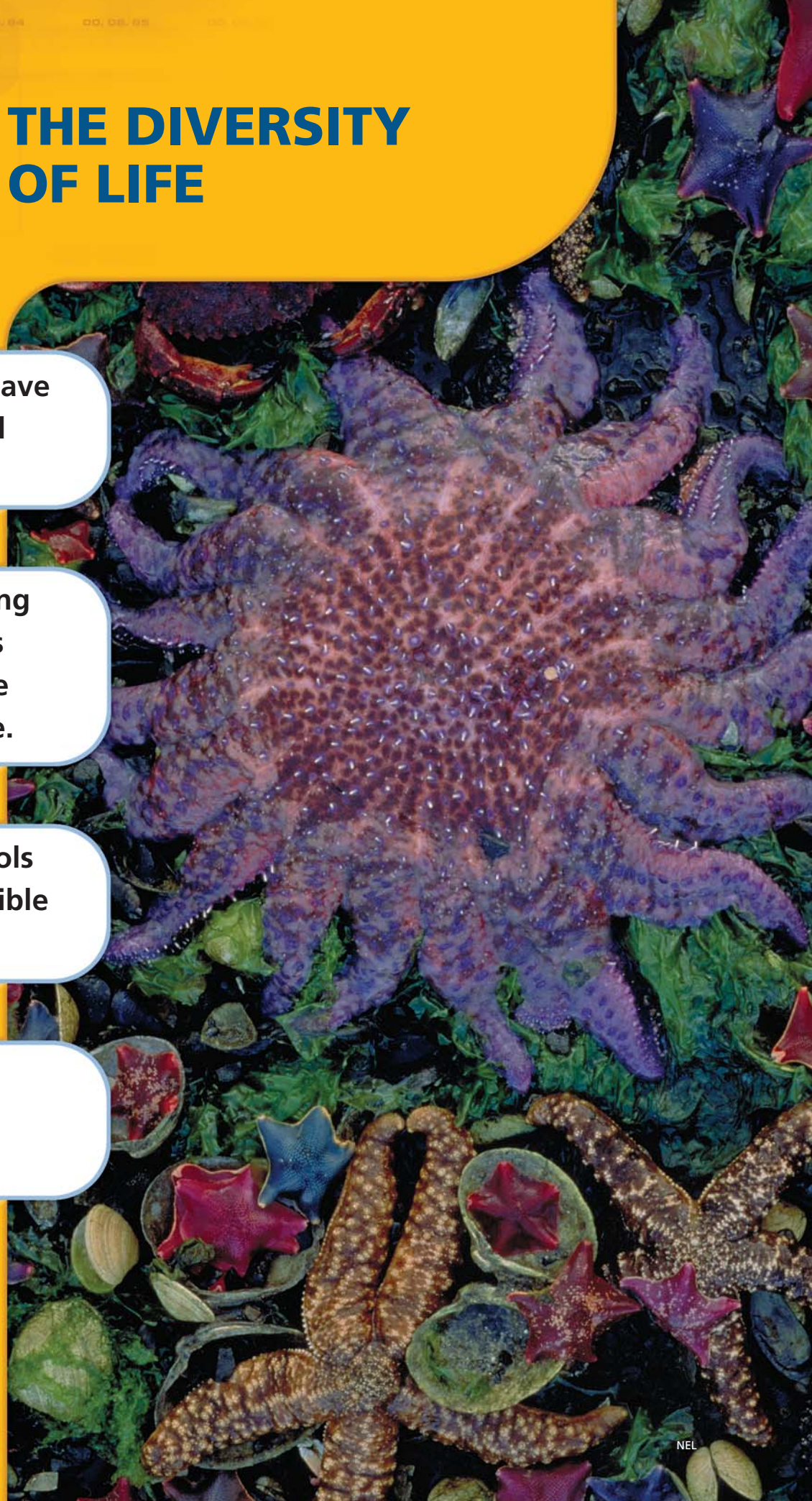
UNIT A

THE DIVERSITY OF LIFE



CHAPTER 1 Living things have similarities and differences.

CHAPTER 2 Classifying living things helps us understand the diversity of life.

CHAPTER 3 Magnifying tools make the invisible world visible.

CHAPTER 4 Living things adapt to their environments.

Preview

Welcome to life—the most amazing show on Earth! Our planet is crawling, swimming, hopping, and buzzing with living things. They come in every colour, shape, and size you can imagine, from giant trees that tower over us to tiny bacteria that can only be seen with a microscope. There is life on barren mountaintops, in sunbaked deserts, in the deepest oceans, and in the icy waters of the Antarctic Ocean. In fact, there isn't any place on Earth where life doesn't exist. Even more amazing, Earth is the only place where life does exist—as far as we know.

Look at the photo on this page. How many different living things can you see? Why does life come in so many different forms? Do you know what makes all forms of life alike in some ways? Do you know what makes them like you?

In this unit, you will discover the answers to these questions and many other questions about living things. You will learn how scientists observe living things and classify them into groups. Like a scientist, you will use a microscope to investigate living things that are too tiny for just your eyes to see. As you do these activities, you will follow the same steps that scientists follow as they explore the incredible diversity of living things. What you discover might surprise you!

TRY THIS: MAKE A LIVING WORLD WEB

Skills Focus: questioning, predicting

1. Create a web that shows what you already know about the variety of life on Earth. Write the words "Life on Earth" in the centre. Radiating from the centre, write different questions about the diversity of life on Earth. For example, you could include questions such as these: What does it mean to be living? What kinds of living things exist? How do living things adapt to survive? What do I know about living things?
2. Beside each question, write a "best guess" answer. Do not worry about being correct. Use your imagination!

A tidal pool in Burnaby Narrows, Queen Charlotte Islands, British Columbia, contains a variety of life like these colourful sea stars.

CHAPTER 1

Living things have similarities and differences.

KEY IDEAS

- Living things share characteristics.
- Living things share basic needs.
- Living things are diverse.

It is easy to see how the dolphins and the snorkelling child in the photo are different from each other. The dolphins are in their natural habitat, while the child is using fins and a snorkel to swim in the water. But how are they the same? The dolphins and the child are just two examples of the incredible diversity of living things on Earth. In this chapter, you will discover that dolphins and children, as well as every other living thing, are surprisingly alike in many ways.

The Characteristics of Living Things

1.1

The world around us is made up of both living and non-living things. But how do we tell the difference? Look at **Figure 1**. Which things are living and which are non-living? Are the rocks living things? Is the lake itself a living thing? What is the difference between the twigs growing on the tree's branches and the twigs in the bird nest?

Figure 1
What living things do you see in this picture? What non-living things do you see?

LEARNING TIP

You have already studied living things in earlier grades. Look at the headings in this chapter and review what you know about the similarities among living things.

One way to identify living things, or **organisms,** is to look at the characteristics they have in common.

Living things

- are made of one or more cells
- grow and develop
- reproduce
- respond

Non-living things, such as rocks and buildings, do not have these characteristics.

LEARNING TIP

Important vocabulary words are highlighted. These are words that you should learn and use when you answer questions. These words are also defined in the glossary at the back of this book.

Living things are made of one or more cells. A **cell** is a tiny, microscopic structure that is the basic unit of all living things. Some living things, such as the bacteria shown in **Figure 2**, are made up of only one cell. Other living things, such as the deer shown in **Figure 3**, contain many cells. You are made of trillions of cells.

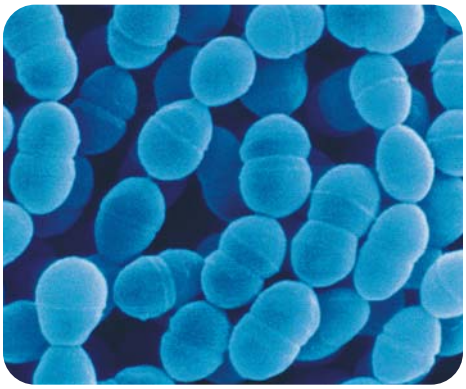


Figure 2
Bacteria

Figure 3
Deer

Living things grow and develop. Some organisms, such as a butterfly, change shape as they grow and develop. **Figure 4** shows the life cycle of a butterfly. Other organisms, such as a cat or a human, are born looking like miniature adults. Most organisms have a life span—the maximum time that they can live. Some bacteria live for only a few hours. A mayfly's life span is one to three days, and a human's life span is over 110 years. Some plants and fungi can live for more than 10 000 years!

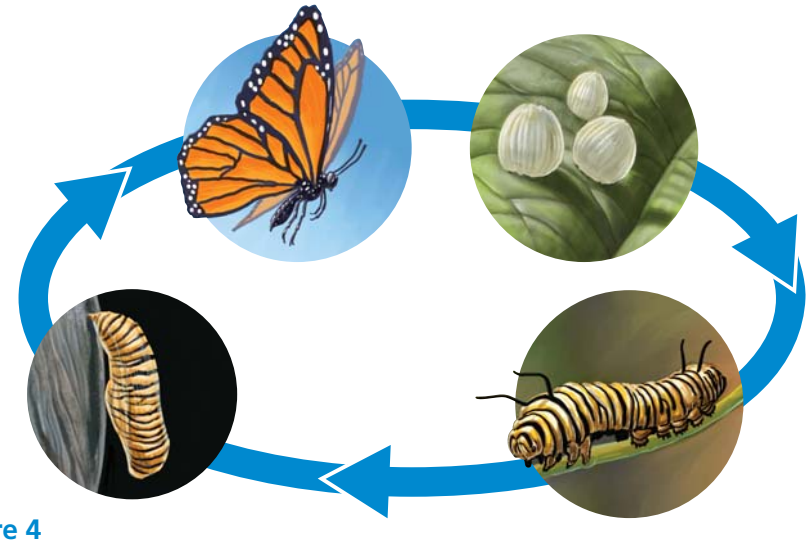


Figure 4
A caterpillar grows and develops into a butterfly.

Living things reproduce to form more of the same kind of organism. These offspring are also able to reproduce. There are many methods of reproduction. Some organisms, such as humans, give birth to live young. Other organisms, such as birds and fish, hatch from eggs. **Figure 5** shows a bald eagle nesting in a tree. Plants develop from seeds or spores. Bacteria reproduce by splitting into two identical cells.

Figure 5
A bald eagle

Living things respond. For example, if you touch something hot, you respond by quickly pulling your hand away. Or if you look into a bright light, you respond by squinting your eyes. Some plants, such as sunflowers, respond to light by turning towards it (**Figure 6**).

CHECK YOUR UNDERSTANDING

1. Look at **Figure 1**. What is the difference between the fish in the lake and the fish in the net?
2. Which main characteristic of living things does each statement represent?
   - You are constantly losing skin cells.
   - A rabbit gives birth to babies.
   - Lobsters can live for 50 years.
   - A tadpole develops into a frog.
   - Bacteria divide to form two identical, smaller cells.
   - A sow bug rolls itself into a ball when it is touched.
3. Choose an organism that lives in your community. Use the characteristics of living things to show that it is a living thing.

Figure 6
Sunflowers take their name from the way they turn to face the Sun.

1.2 The Needs of Living Things

TRY THIS: IDENTIFY A PLANT'S NEEDS

Skills Focus: observing, inferring, communicating

Obtain a geranium or bean plant from your teacher. Cut two pieces of aluminum foil into shapes, such as rectangles or triangles. Attach each foil shape to a leaf using a paper clip, as shown in **Figure 1**. Put the plant in a window, where it will get plenty of sunlight. After three or four days, remove the foil shapes from the leaves. Record your observations in your notebook.

1. What happened to the leaves with the shapes?
2. What does this tell you about the needs of plants?

Figure 1
Make sure that the foil shape covers at least half of the leaf and that it covers both the top and the bottom.

Figure 2
Aphids suck the sap from plants.

All organisms have the same basic needs. They must find these things within their environments, or they will die.

Living things need nutrients and energy. Nutrients are substances that organisms need to keep healthy and grow. Nutrients are found in foods and in the soil. Organisms also need energy to grow and develop, and to reproduce. Different organisms use different types of energy. Plants use the Sun's energy to make their own food. The aphids in **Figure 2** feed on plants. Spiders and birds eat the aphids. In this way, the Sun's energy is passed from one living thing to another.

Living things need water. Water is the main ingredient of the cells of all living things. You, for example, are about two-thirds water! Without water, you could live for only a few days. Some organisms, such as the cactus in **Figure 3**, can live in a very dry environment by storing moisture in their stems or leaves.

Figure 3
A prickly pear cactus in Fraser Canyon, British Columbia.

Living things need air. You, and other organisms that live on land, get oxygen from the air. Fish use oxygen in the water. Marine mammals, such as the orca in **Figure 4**, come to the surface for oxygen. Green plants use carbon dioxide, water, and sunlight to make food.

Figure 4
The orca breathes air at the surface.

Living things need a habitat, or a place to live. A habitat may be a hole in a tree or an isolated mountaintop (**Figure 5**). It is a place where an organism has living space and the right conditions, such as nutrients and energy, water, air, and temperature, to survive. Usually, many organisms share a habitat. For example, coral reefs provide a habitat for many plants, animals, and other marine organisms.

Figure 5
The habitat of the mountain goat includes steep cliffs and rocky slopes.

CHECK YOUR UNDERSTANDING

1. In your notebook, make a table like the one below. Use what you have learned about the needs of organisms to complete your table.

Need of organism	Two examples of how organisms meet this need
nutrients and energy	- Plants get energy from the Sun. -
water	
habitat	

2. How do you meet each of the basic needs listed in the table? (For example, you get energy from the food you eat.)

1.3 Design Your Own Experiment

SKILLS MENU

○ Questioning	● Observing
○ Predicting	● Measuring
● Hypothesizing	○ Classifying
● Designing Experiments	● Inferring
● Controlling Variables	● Interpreting Data
○ Creating Models	● Communicating

What Factors Affect the Growth of a Potato?

All plants need energy from the Sun, water, and a habitat that provides the right temperature to live. Each of these needs is a factor, or variable, in the plant's survival. Design an experiment to test how sunlight, water, and temperature affect the growth of two potatoes.

Question

How does the amount of energy from the Sun, water, or temperature affect the growth of potatoes?

Hypothesis

Write a hypothesis that answers the question. Make sure that you complete your hypothesis with a short explanation of your reasons. Write your hypothesis in the form "If . . . then . . . because . . . ."

LEARNING TIP

For help with this activity, read the Skills Handbook sections "Designing Your Own Experiment," "Hypothesizing," and "Controlling Variables."

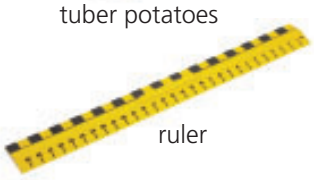
Materials

- apron
- 2 tuber potatoes
- ruler

Decide what other materials you will need. Check with your teacher to make sure that these materials are safe for you to use.

apron

tuber potatoes



ruler

Procedure

- Design a procedure to test your hypothesis. A procedure is a step-by-step description of how you will conduct your experiment. It must be clear enough for someone else to follow your instructions and do the exact same experiment.
- Submit your procedure, including any safety precautions, to your teacher for approval. Also submit a diagram, at least half a page in size, showing how you will set up your experiment.

Data and Observations

Create a table to record your observations. Record your observations as you carry out your experiment.

LEARNING TIP

When you make observations, it is important to be accurate and complete. Read the Skills Handbook section "Observing" to learn about the different types of observations and why each one is important.

Analysis

1. Describe the growth of the potato that received the lesser amount of the variable you tested. How well did it grow?
2. Describe the growth of the potato that received the greater amount of the variable you tested. How well did it grow?
3. How does the variable you tested affect the growth of potatoes?

Conclusion

Look back at your hypothesis. Did your observations support, partly support, or not support your hypothesis? Write a conclusion that explains the results of your experiment.

Applications

1. How could you use what you learned from your experiment when growing plants at home?
2. Why would your conclusions be important information for a garden store or for a grocery store that doesn't want the potatoes to grow?

CHECK YOUR UNDERSTANDING

1. How did your understanding of the needs of living things help you form a hypothesis for your experiment?
2. What was the independent variable in your experiment? What was the dependent variable?
3. Why was it important to change only one variable?

1.4 Living Things Are Diverse

You have learned that all living things are alike in some ways. They share certain characteristics and they have the same basic needs. But aside from these similarities, living things come in an astonishing variety of forms (**Figure 1**). In fact, the most amazing thing about life is the variety, or diversity, of living things on Earth.

Figure 1
What are some of the differences between the scarlet macaw and the whale shark?

For example, living things come in all sizes, from the towering giant sequoia (**Figure 2**) to organisms that are so small they cannot be seen with the naked eye (**Figure 3**). Magnifying tools, such as microscopes, have allowed scientists to identify thousands of tiny organisms, including some that live on and inside our bodies. You will use magnifying tools to look at living things in Chapter 3.

Figure 2
The largest giant sequoias are as tall as a 26-storey building.

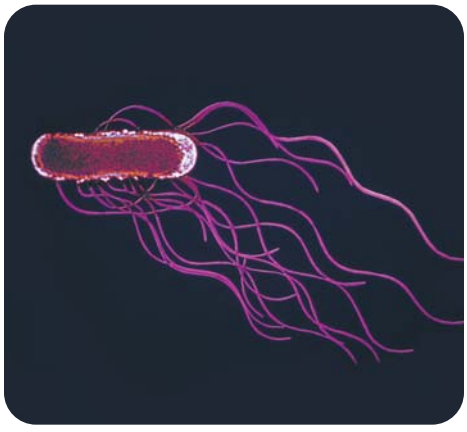


Figure 3
A bacterial cell can only be seen under a microscope.

Organisms also get their food in different ways. Plants can make their own food. They use sunlight to turn carbon dioxide and water into food in a process called photosynthesis [foh-toh-SIN-thuh-sis]. However, there are some plants, like the Venus flytrap, that capture and eat small insects (**Figure 4**). Fungi, such as mushrooms, live right on their food source. Animals have to look for their food sources. For example, think about how you get your food. You have to search for your food, even if it's just in the kitchen. In general, animals eat plants, other animals, or the remains of living things (**Figure 5**).

Figure 4
The Venus flytrap is able to make its own food and feed on insects that it captures.

Figure 5
The great blue heron eats fish, turtles, and frogs.

LEARNING TIP

Look at the three pairs of photos in this section. Think about what is being compared in each pair of photos.

Organisms move in every imaginable way. Some move along on legs (**Figure 6**). Those with wings, such as robins and bats, are able to fly overhead. Some organisms, such as fish and marine mammals, swim through the water using fins or flippers. Plants, on the other hand, remain in one place for their entire lives.

There is a great diversity of organisms on Earth and new organisms are discovered every day. Scientists have now identified over 1.7 million different organisms; however, they believe there may be more than 10 million organisms that have not yet been identified. In the next chapter, you will look at how all these diverse organisms can be organized.

Figure 6
Although this giant desert centipede doesn't have 100 legs (as its name implies), it does have two legs on each of its body segments.

CHECK YOUR UNDERSTANDING

1. What are some of the ways that organisms differ from one another?

Awesome SCIENCE

The living world is full of strange and wonderful creatures—and lots of surprises!

SPIDERS BY THE MILLION!

Scientists were amazed to discover a 24-hectare spider web covering a field of clover east of McBride, British Columbia. When they took a closer look, they found tens of millions of spiders (about two spiders per square centimetre), frantically engaged in the mystery building project. The scientists don't believe that the monster web was meant to be a giant insect trap because the spiders did not seem interested in the insects caught in it. But they still don't know what it was. One scientist joked that maybe the spiders were trying to catch a sheep! How could the scientists find out more about this strange phenomenon? What would you want to find out?

GREAT IMPOSTERS

With eyes like these, it's no wonder that the swallowtail caterpillar scares off predators. Or are they eyes? In fact, they're eyespots—markings that look like the eyes of a much larger creature. Eyespots are an example of mimicry. They are an effective way to keep from becoming someone's lunch!

The hawk moth is another great mimic. The snake-like appearance of the hawk moth caterpillar scares predators looking for a tasty feast. As a mature moth, its brown wings and shape easily blend into the bark of a tree. This makes it nearly impossible to see. Can you find other examples of organisms that use mimicry to survive?

REALLY SMALL-SCALE FARMING AND RANCHING

Humans are not the world's only farmers, or even the world's first farmers. In fact, the world's first farmers were leaf-cutter ants. These tiny ants cut out small pieces of leaves, chew them up, and leave them to decompose. The fungus that grows on the decaying mass is harvested and used as the ants' main food supply.

Other ants are ranchers, herding aphids onto young, sap-rich plants. The ants protect the aphids from predators to get their "milk"—the honeydew that the aphids excrete. The ants feed this milk to their young. What other characteristics do ants and humans share?

JUST GROW IT AGAIN!

What would you get if you cut a flatworm into four pieces? Wait two weeks and you'll have four new worms! A flatworm can regenerate, or grow back, a lost part of its body.

How does this happen? The secret is in the cells. A flatworm has stem cells that can be sent into action when its body has been damaged. Stem cells are not specialized. They can become any type of cell. For the flatworm, they develop into tissue for the other half of the worm's body. How could understanding regeneration be helpful to humans?

OPEN WIDE!

The leatherback turtle is the largest and most ancient species of sea turtle living today. Although it does not have any teeth, it can sure bite hard! It uses two upper "fangs" to capture a jellyfish. Then it uses long, backward-facing spines in its mouth to swallow the meal. In fact, the leatherback's mouth protects it so well that it can eat a poisonous Portuguese man-of-war jellyfish without even getting stung!

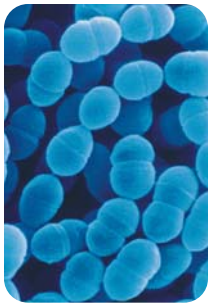
GIANT DRAGONS DO EXIST!

It is 3 m long and has razor-like teeth and poisonous saliva. If that's not bad enough, it can run as fast as a dog for short distances. Fortunately, the Komodo dragon is found on only a few small islands in Indonesia. While it gets the name "dragon" from its fearsome characteristics, it is actually the world's largest lizard. In addition to its speed and its ability to spot objects up to 300 m away, it's the dragon's sense of smell that makes it so deadly. Whipping its long tongue in and out, the Komodo dragon samples the air and can find a meal 4 km away. What can you infer about the sense organs on the Komodo dragon's tongue?

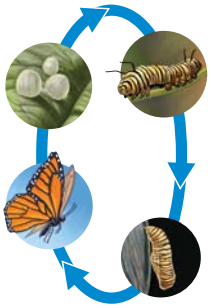
1 Chapter Review

Living things have similarities and differences.

Key Idea: **Living things share characteristics.**



They are made of one or more cells.



They grow and develop.

They reproduce.

They respond to light.

Vocabulary

organisms p. 5
cell p. 6

Key Idea: **Living things share basic needs.**

Nutrients and energy

Water

Air

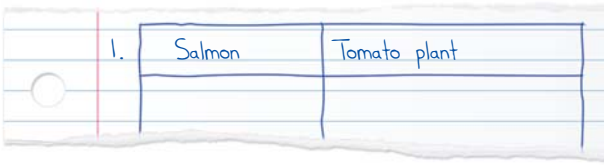
Habitat

Key Idea: **Living things are diverse.**

Review Key Ideas and Vocabulary

When answering the questions, remember to use the chapter vocabulary.

1. Create two columns on a piece of paper. Compare a salmon and a tomato plant, based on the characteristics of living things.



2. How is each of the following organisms meeting its needs?
   - Worms burrow into the ground.
   - Mudpuppies are solitary. They build walls around their territory to keep others away.
   - The Gila monster stores fat in its tail.
   - A Venus flytrap snaps shut when it senses an insect on its leaves.
   - A frog soaks up water through its skin.
3. What do scientists mean when they talk about the "diversity of life"?

Use What You've Learned

4. Volcanoes grow over time. Use what you have learned about the characteristics and needs of living things to explain whether or not volcanoes are living things.

5. Look at the photo below. Name an organism that could survive in this environment. How would the organism meet each of its needs?

6. When would it be important to understand the differences between living and non-living things?

Think Critically

7. List at least five benefits of living on a planet that has such a diversity of organisms.

Reflect on Your Learning

8. List three questions that you still have about living things. Glance through the rest of this unit. Do you think your questions will be answered in the topics that are covered? If not, where can you go to find the answers?