Chapter 2

Living Things

Imagine adding water to a packet of powder and ending up with a tank full of swimming creatures. This may seem like science fiction, but it's true. Brine shrimp are small relatives of crabs and lobsters. Brine shrimp eggs can live for many years in tiny hard cases. When you add water and set up a proper environment for the eggs, the brine shrimp hatch and thrive! A class of seventh graders from Pennsylvania designed an experiment to see if space travel would affect brine shrimp eggs. They sent a packet of the tiny eggs on the space shuttle Discovery in 1998 with U.S. Senator John Glenn. You can find articles about the results of the experiment on the Internet using the search phrase "brine shrimp in space." In this chapter you will learn how to tell if something is living or not, and you will see how the incredible variety of life on Earth is described, categorized, and named.

Key Questions

1. ***Is a cloud in the sky a living thing?***
2. ***How do sweating and shivering keep you alive?***
3. ***How is life on Earth classified?***

2.1 Is It Alive?

Do you know how bread is made? One of the most important ingredients is yeast. Open a packet of yeast and you'll see a bunch of tiny, dried specks. If you drop those specks into a cup of warm water with a little sugar, they'll start to bubble and froth. If you look at the mixture under a microscope (Figure 2.1), you will see individual clumps of yeast growing and even multiplying! Is yeast a living organism? In this section, you'll learn what it means to be alive.

What does it mean to be alive?

What is an organism?

An **organism** is an individual form of life. A tree is an organism and so is yeast. So are you. What makes something alive? As with many questions in science, the answer is not easy and is still argued among scientists. If you've ever had a cold or the flu, you're familiar with the effects of viruses. Viruses are very tiny things that have some of the characteristics of living things, but are not considered alive by many scientists.

The characteristics of living things

So what makes something alive? Having a set of rules is a good way to get closer to the answer. Biologists often use five basic rules to classify something as living or nonliving.

Five Characteristics of Living Things

1. Living things **respond** to their surroundings.
2. Living things **grow** and **develop**.
3. Living things are able to **reproduce**.
4. Living things **use energy**.
5. Living things are made of smaller building blocks called **cells**.

STUDY SKILLS

Make a list of all of the vocabulary terms in this section. For each term:

1. Write its definition, in your own words.
2. Use the term in a sentence.

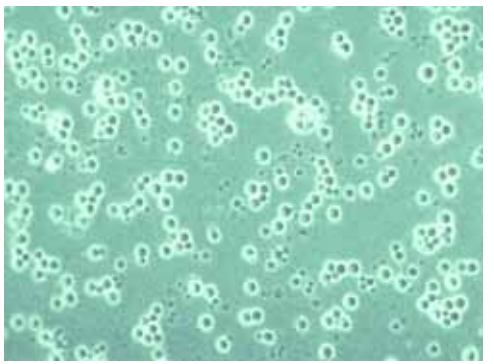


Figure 2.1: *Yeast magnified 100 times. Yeast is a living organism. Each tiny sphere is an individual organism.*

VOCABULARY

organism - an individual form of life.

Response and stimulus Have you ever gone from a dark room out into the sunshine? You respond by squinting your eyes. The brightness of the sun is called a **stimulus** and your reaction to it is called a **response**. All living things respond to a stimulus.

Growth You may think of growth as an increase in size. You have increased in size since you were born. **Growth** also refers to an increase in mass and to an increase in number of cells.

Reproduction The process of making more of the same kind of organism is called reproduction. Because all living things eventually die, reproduction allows life to continue.

Energy All living things take materials from their surroundings such as food, water, and gases. They use these materials to get energy. This energy is needed to carry out all of the life functions.

Cells A **cell** the smallest unit of a living thing. It is the simplest structure that can carry out all of the functions described above. You'll learn more about cells in Unit 2.

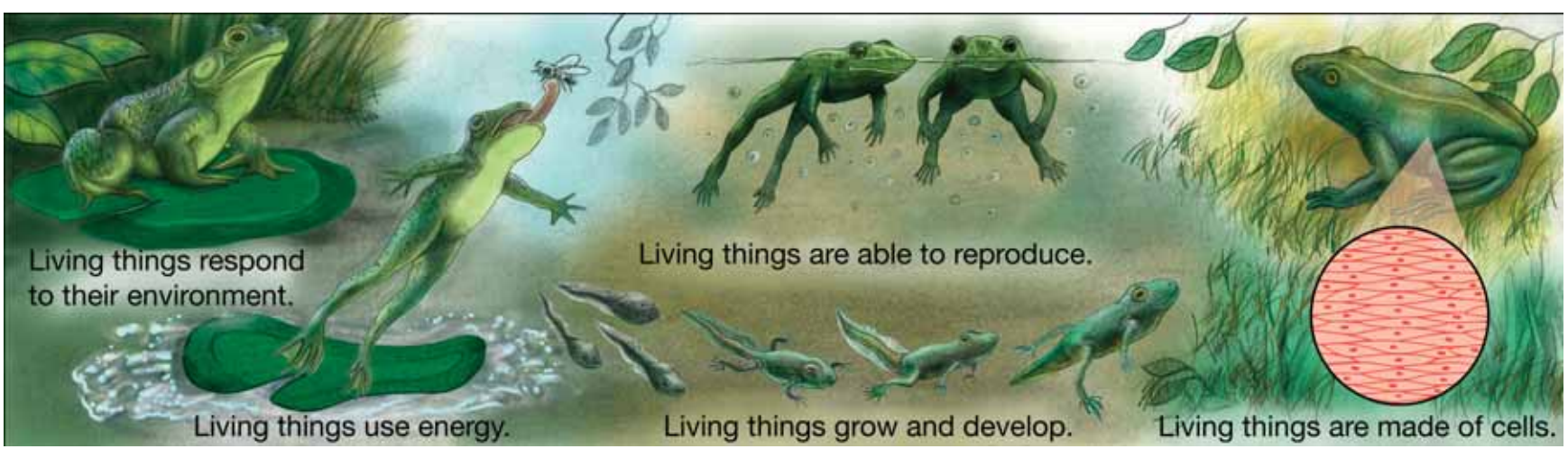
VOCABULARY

stimulus - something that causes a response.

response - how an organism reacts to a stimulus.

growth - an increase in mass.

cell - the smallest unit of a living thing.



Is a barnacle alive?

A trip to the beach

One day at the beach, Zeke picked up one of many rocks that were covered in white bumps (Figure 2.2). He thought the rock would look nice in his marine aquarium so he brought it home and dropped it into his tank. One day, while watching the fish in his tank, Zeke got a surprise. The white bumps on the rock had sprouted tiny legs and were waving back and forth in the water. The rock was alive! (Actually, the white bumps were alive.)

Figure 2.2: *What are the white bumps covering this rock?*

Barnacles

Zeke's rock was covered with tiny organisms called *barnacles* (Figure 2.3). These creatures live in tide pools along the seacoast where waves crash and tides cause water to flow in and out. Inside its shell the barnacle can hold seawater to survive the many hours of drought at low tide. At high tide the shell opens and the barnacle begins to feed. Its long, comb-like legs sweep back and forth to catch tiny organisms called plankton.

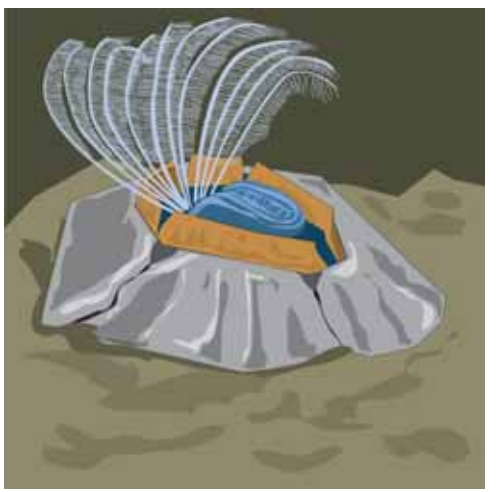


Figure 2.3: *Each bump is an individual barnacle. Barnacles feed by waving their legs back and forth.*

Is a barnacle alive? Let's use the five criteria to decide.

1. Barnacles **respond** to their environment by closing their shells at low tide, and opening them at high tide.
2. Barnacles **grow** and **develop**. They begin life as free-swimming creatures. Once they find a good spot, they "glue" themselves to a rock and form a shell.
3. Barnacles **reproduce**. After fertilization from a male barnacle, females hold the eggs in their shells until they hatch.
4. By waving their legs, barnacles capture food. They **use energy** from the food to move their legs, open and close their shells, and carry out all life processes.
5. If you examined the legs of a barnacle with a microscope you would see that they are made of individual **cells**.

Types of energy

What is energy? You have read that living things use energy. **Energy** is sometimes defined as the ability to cause change or do work. There are many forms of energy (Figure 2.4). Any form can be converted into any other form. Living things can convert one form of energy into another.

Radiant energy *Radiant energy* is also known as electromagnetic energy. Light is made up of waves called electromagnetic waves. There are many different types of electromagnetic waves, including the light we see, ultraviolet light, x-rays, infrared radiation, radio waves, and microwaves. This is the type of energy that reaches Earth from the Sun and is captured by plants.

Chemical energy *Chemical energy* is energy stored in molecules. Energy stored by living things can be in this form. When molecules are rearranged, chemical energy is released. When animals eat plants, they use the chemical energy stored by the plants to move, grow, and reproduce.

Mechanical energy *Mechanical energy* is the energy an object has due to its motion or position. You store mechanical energy when you climb a hill. The energy is released when you go back down the hill.

Electrical and thermal energies *Electrical energy* is carried by the flow of electric current. Nerve impulses in your body are electrical energy. *Thermal energy* flows whenever there is a temperature difference. Heat is a form of thermal energy. Thermal energy flows from your hand to any cooler object that you touch, such as ice cream.

Nuclear energy *Nuclear energy* results from splitting or combining the nuclei of atoms. Nuclear energy gained by splitting uranium atoms is converted to electrical energy in power plants. Nuclear energy from combining hydrogen atoms is how the Sun makes energy.

VOCABULARY

energy - the ability to cause change or do work.

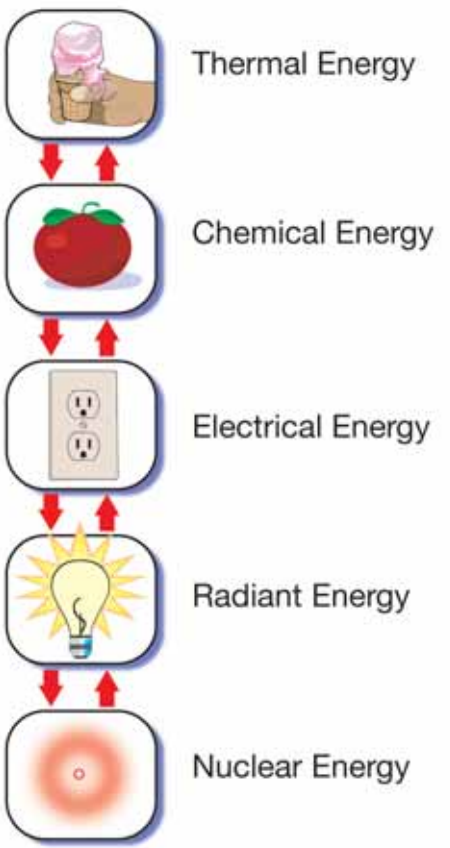
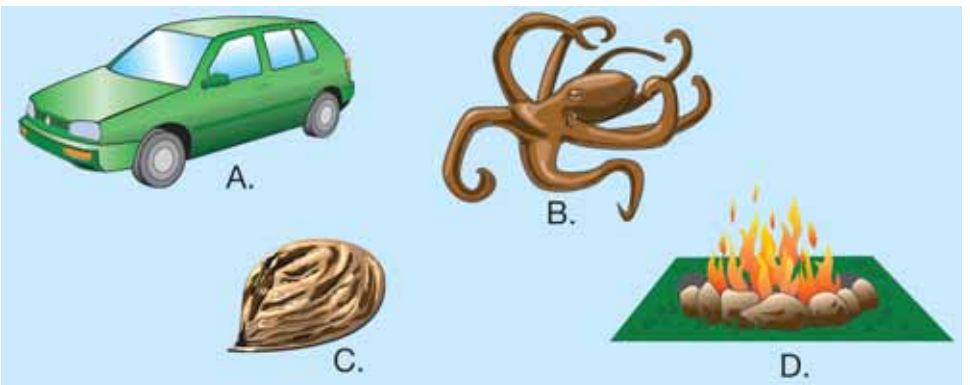


Figure 2.4: *There are many forms of energy. Energy can be converted from one form to another.*

2.1 Section Review

1. List the five rules for classifying something as alive.
2. Which characteristics of a cloud in the sky might qualify it as a living thing? Which rules does a cloud not meet?
3. Classify each object below as living or nonliving. Explain your answer for each.



4. In the picture below, energy is being changed from one form into another. Make a flow chart that shows each form of energy in the order of change.

CHALLENGE

Imagine you are a space scientist. You have landed on a distant planet and are searching for life. You encounter the object below. You take data and make the following observations about the object:

- It is 9.5 cm tall and has a mass of 250 g.
- There are several smaller objects on the ground below it.
- It occasionally sways back and forth.

1. Make a hypothesis whether or not the object is alive. Justify your hypothesis.
2. Design an experiment to test your hypothesis. Sketch your experimental design and list the materials you would use.

2.2 What is a Living System?

You have learned that a *system* is a group of factors that are related in some way. You can think of an individual organism as a *living system*. What variables affect *you* as a system? An obvious answer is the temperature around you (Figure 2.5). The type of food you eat is another variable. Your body responds to different variables in different ways. In this section, you will learn about how living systems are organized and the variables that affect them.

Figure 2.5: *A living system is affected by outside variables. What are the variables affecting the girl in the picture?*

The organization of living systems

Living systems are organized

Is your room disorganized? Even if it is, *you* are not! As a living system, your body is organized to use matter and energy to move, grow, and survive. Living systems—like you—contain many levels of organization. These are described on the next few pages.

Molecules

A *molecule* is a basic unit of matter. Living systems are made of many different molecules. Each type of molecule has an important function. Your body contains molecules that store energy, control life functions, and even hold all of the information needed to make another you! You'll learn more about molecules in Chapter 4.

Cells

A cell is the basic unit of a living system. Each cell is made up of different types of molecules including proteins, carbohydrates, and others. Your body contains trillions of cells, each one a living system on its own. Some organisms are made up of only one cell. Figure 2.6 shows what a one-celled organism called a *euglena* looks like. Organisms that are made of more than one cell are called *multicellular* organisms. You'll learn much more about cells in Chapters 4, 5, and 6.

A cell is the basic unit of a living system.

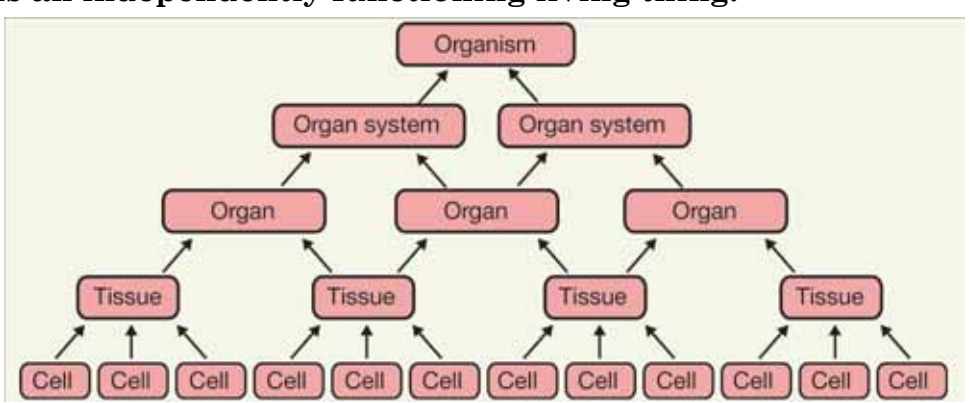
Figure 2.6: *A euglena is a one-celled organism.*

Tissues Your body is made up of many different types of cells. You have skin cells, muscle cells, liver cells, nerve cells, and blood cells, to name just a few. A group of specialized cells that performs a particular function is called a **tissue**. For example, muscle tissue is a tissue that is able to contract. Figure 2.7 shows what your muscle tissue looks like under a microscope.

Organs Tissues combine to form organs, the next level of organization. An **organ** is a group of tissues that works together to carry out a set of functions. For example, your stomach is an organ that contains several types of tissue. Muscle tissue in your stomach contracts to mix food. Another type of tissue makes a chemical that breaks down the food.

Organ systems A group of organs that works together to perform a set of functions is called an **organ system**. For example, your digestive system consists of many organs including the esophagus, stomach, small intestine, and large intestine. Each organ in the system performs a different function that is part of the digestive process.

Organism In multicellular organisms like you, different body parts and organ systems take on different functions. The network of organ systems works together to keep the organism alive. **An organism is an independently functioning living thing.**



VOCABULARY

tissue - a group of specialized cells that performs a particular function.

organ - a group of tissues that works together to carry out a set of functions.

organ system - a group of organs that works together to perform a set of functions.

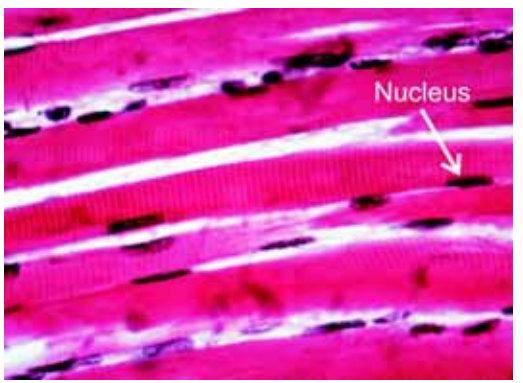


Figure 2.7: *Muscle tissue is made of individual muscle cells. Each individual cell has a dark spot called a nucleus.*

Variables and living systems

Homeostasis

Living things can respond to changes in their surroundings to maintain a steady internal environment. The process of maintaining a life-supporting system is called **homeostasis**. Homeostasis happens at all levels of organization, including the cellular level, and is a characteristic of all living things.

Variables that affect life

All sorts of variables affect an organism's ability to stay alive. These include temperature, food, water, and the level of oxygen (Figure 2.8). All organisms have built-in processes to help them survive when variables change. Organisms can survive within a range of values for each variable. If a change in a variable is too severe, the organism may not be able to maintain homeostasis and could die.

Why do we sweat and shiver?

You experience homeostasis every day, as you'll see in the following story. It was a hot day so Sarah decided to go for a swim in the neighborhood pool. She packed a towel and headed out on her bicycle. As Sarah climbed up a hill, she began to drip with sweat. She couldn't wait to jump into the pool! When she started to swim though, the water was so cold she couldn't stay in very long. Once Sarah got out of the water, she started shivering. The shivering stopped once she felt warm again.

Sweating and shivering are examples of homeostasis

Sweating and shivering are good examples of how your body responds to maintain a steady temperature. Normal human body temperature is 37°C (98.6°F). At this temperature, your cells can perform their functions. When it's too hot and your body temperature begins to rise, glands in your skin produce sweat to cool the temperature back down. When it's too cold and your body temperature begins to lower, shivering is a response that warms your body temperature back up (Figure 2.9).

VOCABULARY

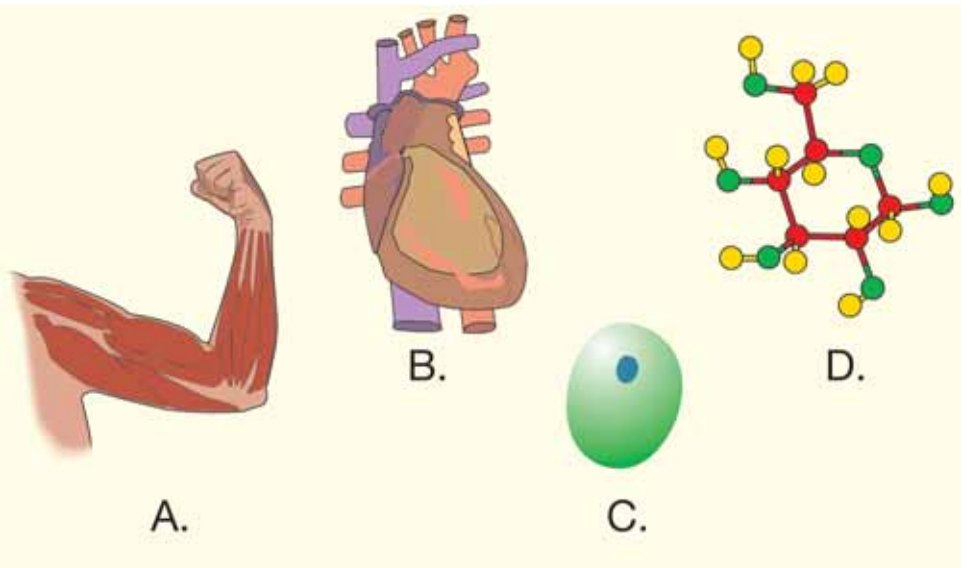
homeostasis - the process of maintaining a life-supporting internal environment.

Figure 2.8: *A few of the variables that affect an organism's ability to stay alive.*

Figure 2.9: *Your normal body temperature is 37°C. Sweating and shivering are your body's way of maintaining that temperature.*

2.2 Section Review

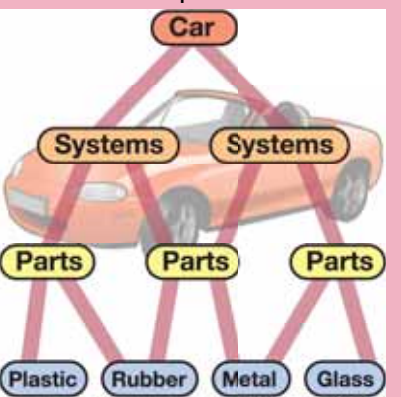
1. Why is a living thing a system?
2. Name three variables that affect a living system.
3. What is a cell?
4. What is a multicellular organism? Name three examples.
5. Identify each picture below as either a molecule, a cell, a tissue, or an organ. Give a reason for your choices.



6. Explain why each of the following scenarios is a good example of homeostasis. What is the variable involved? What is the response?
   a. During the 100 meter run at a track meet, Sonja's heart rate and breathing increased.
   b. Roberto's stomach began to growl during science class.
   c. Because they do not have sweat glands, dogs pant when they're hot.

CHALLENGE

Like a living thing, a car has different levels of organization. A car is made of different materials like rubber and steel. Different materials are grouped into parts like the wheels and headlights. Different parts are grouped together into systems like the cooling system and the drive system. Together, all of the systems make up the car.



Make a chart showing the levels of organization for one of the following systems. You may need to do some research!

1. Your school building.
2. A city.
3. A cookie factory.
4. Choose a system that is not listed.

2.3 Types of Living Things

Look around you. What types of living things do you see? You probably see plants and animals. If you could shrink down to the size of a cell, you'd see other types of living things. At this size, you might see dust mites crawling across the floor (Figure 2.10). You would definitely see bacteria, a microscopic life form that lives just about everywhere. What are the different types of life and how do we classify them?

Figure 2.10: *Dust mites are tiny organisms that live in your home.*

Classifying life

A trip to the grocery store

Ryan was cooking chicken and rice for his family. He looked in the cupboard and found that they were out of rice. He had to get some quick so he ran to the grocery store. The huge store contained thousands of products. He located the aisle marked "pasta, beans, and rice" and quickly found exactly what he was looking for.

The importance of classification

Grocery stores are organized so you can find things easily. Products are grouped in aisles according to their similarities. You wouldn't look in the dairy aisle if you wanted to find canned pineapple! In a similar way, *living things* are classified by similar characteristics. Each different type of organism is called a *species*. It is estimated that there are over ten million different species on Earth. Can you see why it is important to classify living things?

Kingdoms

One system of classification groups all living things into one of six kingdoms: *Archaebacteria*, *Eubacteria*, *Protista*, *Fungi*, *Plantae*, or *Animalia*. To classify a living thing into one of the kingdoms, scientists ask three questions (Figure 2.11):

- Does it have *prokaryotic* (simple) or *eukaryotic* (complex) cells?
- Is it *single-celled* or *multicellular?*
- Does it get energy by making its own food (a *producer*) or by getting food from other organisms (a *consumer*)?

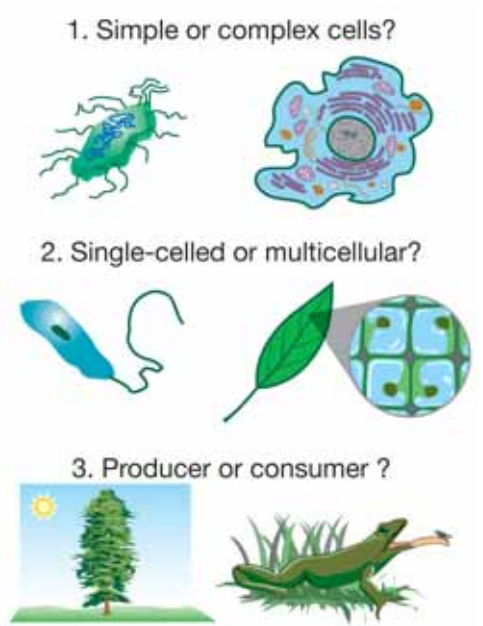


Figure 2.11: *Three questions asked when classifying an organism into a kingdom.*

Bacteria, Kingdom Protista, and Kingdom Fungi

Two Kingdoms of bacteria

Bacteria are the simplest of all living things. They have prokaryotic cells and are single-celled organisms. Some bacteria can produce their own food while others break down food and absorb it. Primitive bacteria have been found living in hot springs and deep sea vents (Figure 2.12). Because of this discovery, many scientists divide bacteria into *two* kingdoms. Under this system, *Kingdom Archaebacteria* are the primitive bacteria and *Kingdom Eubacteria* are the "true" bacteria. Bacteria are discussed in Chapter 7.

Figure 2.12: *These bacteria were found living in a hot spring.*

Kingdom Protista

Members of the Kingdom Protista are called *protists*. Protists are an odd group of organisms. They are mostly single-celled, though there are some multicellular protists. All protists have eukaryotic cells. Some protists can produce their own food while others get their energy by eating other organisms. Figure 2.13 shows a few examples of protists. Protists are discussed in Chapter 7.

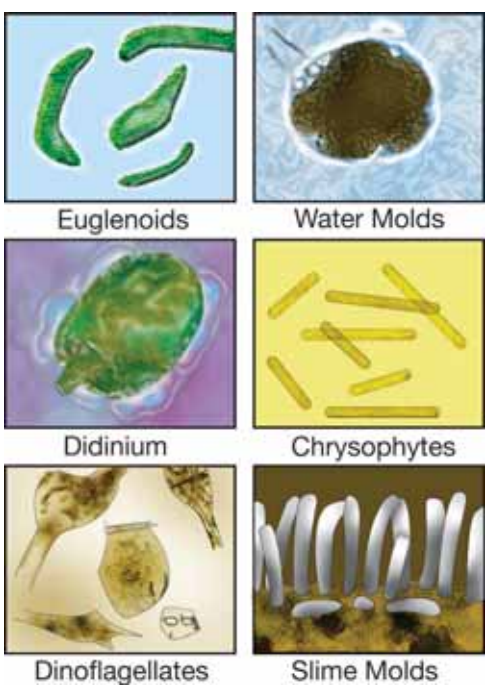


Figure 2.13: *These are just a few members of Kingdom Protista.*

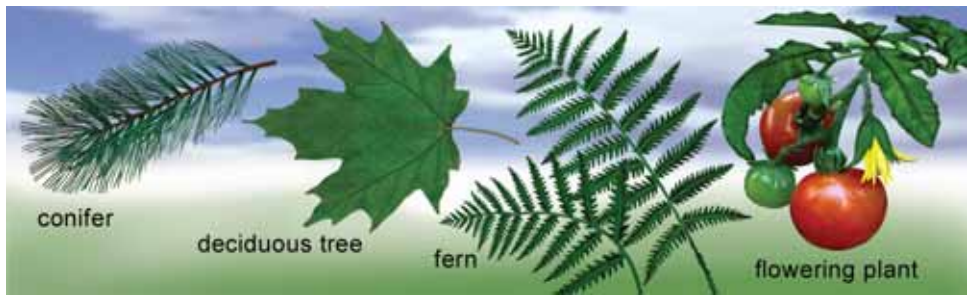
Kingdom Fungi

Kingdom Fungi includes the fungi, mushrooms, molds, and yeasts. You may have seen members of this kingdom growing on rotting logs in the woods. Fungi are important because they break down rotting things and return the nutrients to the soil. Fungi have eukaryotic cells and most (except yeasts) are multicellular. They get their energy by breaking down and absorbing dead organisms like trees. You'll learn more about fungi in Chapter 13.

Kingdoms Plantae and Animalia

Kingdom Plantae

The Kingdom Plantae is made up of multicellular organisms that have eukaryotic cells. In a process called *photosynthesis,* plants harness energy from the sun and store it in the form of molecules. When animals eat the plants, they use these molecules as energy to survive. Examples of plants include mosses, ferns, trees, and flowering plants. Figure 2.14 shows the characteristics of a typical plant. Plants are discussed in Chapter 14.



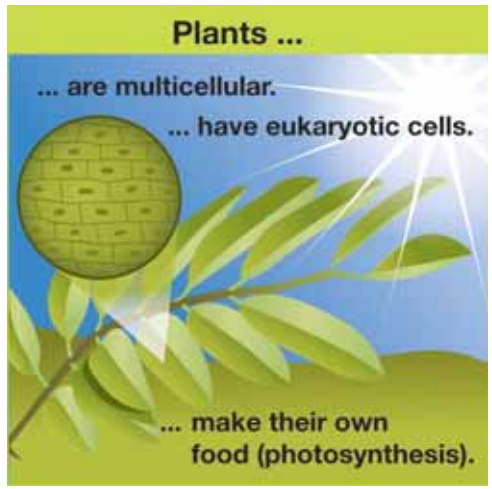
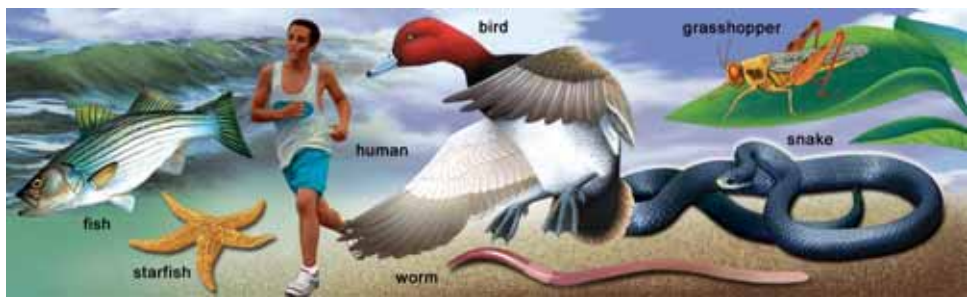


Figure 2.14: *The characteristics of a typical plant.*

Kingdom Animalia

Like plants, animals are multicellular organisms that have eukaryotic cells. Unlike plants, all animals need to eat other organisms to get their energy. Beetles, worms, snakes, and birds are animals. You are also an animal. Figure 2.15 shows the characteristics of a typical animal. Animals are discussed in Chapter 15.



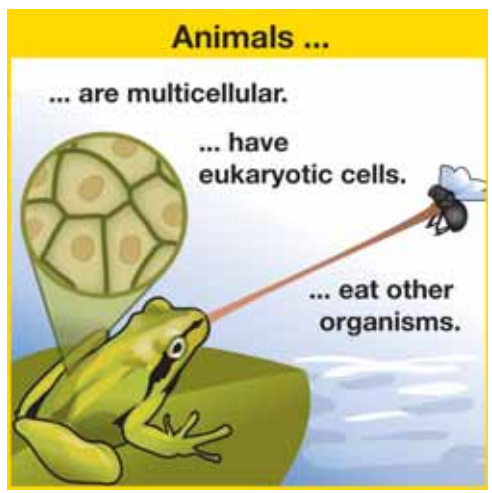


Figure 2.15: *The characteristics of a typical animal.*

Levels of classification

Taxonomy is the process of identifying and classifying living things. The Swedish scientist Carolus Linnaeus (1707–1778) developed this system for identifying and classifying living things. Taxonomy is based on the characteristics of organisms. Organisms with shared characteristics are grouped together.

For animals, the levels of classification are kingdom, phylum, class, order, family, genus, and species.

Levels of classification

For animals, the levels of classification are kingdom, phylum, class, order, family, genus, and species. Organisms belonging to the same kingdom are not necessarily very similar. As levels get smaller, organisms share more characteristics. Organisms in the same *order* share more characteristics than organisms in the same *class*. Organisms belonging to the same **species** are very similar and can produce offspring together. Table 2.1 shows the classification of some animals.

VOCABULARY

taxonomy - the process of identifying and classifying living things.

species - a group of similar organisms that can produce offspring.

MY JOURNAL

How many different species of organisms can you identify in your backyard or local park? Visit a local park or your backyard. List all of the different species of organisms you see.

Table 2.1: Classification of some common animals

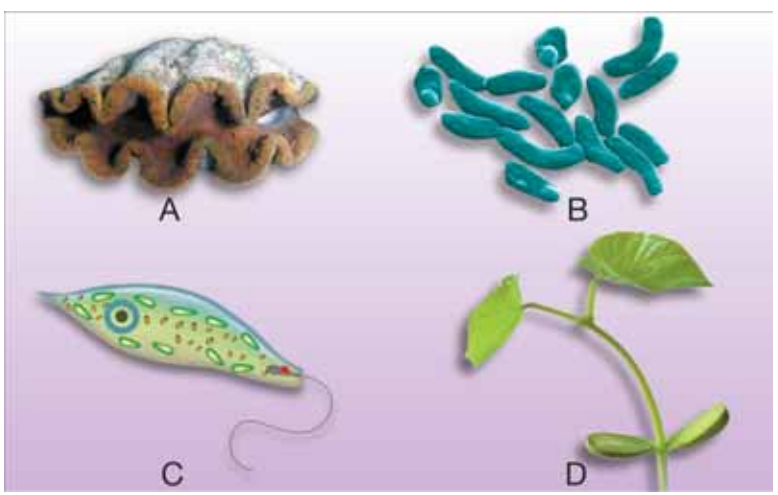
Level	Human	Dog	Bull frog	Brine shrimp
Kingdom	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Arthropoda
Class	Mammalia	Mammalia	Amphibia	Crustacea
Order	Primates	Carnivora	Anura	Brachiopoda
Family	Homonidae	Canidae	Ranidae	Anostraca
Genus	Homo	Canis	Rana	Artemia
Species	*Homo sapiens*	*Canis familiaris*	*Rana catesbeiana*	*Artemia gracillus*

2.3 Section Review

1. Why is it important to classify living things?
2. Complete the following table.

Kingdom	Prokaryotic or eukaryotic cells?	Single-celled or multicellular?	Producers or consumers?
Eubacteria			
Protista			
Fungi			
Plantae			
Animalia			

3. For each organism below, (a) name the kingdom; and (b) give a reason for your answer.



4. At which level of classification do a dog and a human get separated? What about a frog and a brine shrimp?

CHALLENGE

What IS this?

Euglenas are one-celled, eukaryotic organisms that live in ponds. They have the following characteristics:

- They are green and can make their own food.
- They have a whip-like structure called a flagella that they use to move around.
- They sometimes find food instead of making their own.

Answer the following questions:

1. To which Kingdom do Euglenas belong?
2. Before the invention of the microscope, scientists classified all organisms as either animals or plants. Explain why they needed to invent a new Kingdom when they discovered Euglenas.

ASTRONOMY CONNECTION

Is There Proof of Life on Mars?

Do you think there is life on other planets? Not long ago, most people would have said "no." The search for life on other planets switched from science fiction to real science during the last century. The search for life elsewhere has followed on the heels of our greater understanding of the universe itself.

We now know that the universe is huge. It contains billions of galaxies. Because the universe is so big, the chances of life existing beyond Earth are very good.

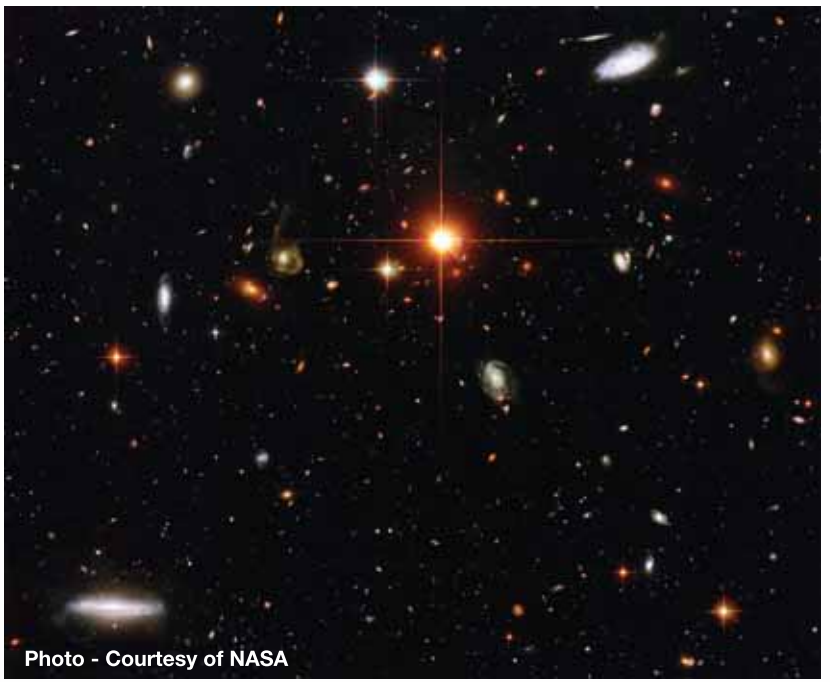


Photo - Courtesy of NASA

What do we mean by life when we talk about other parts of the universe? Definitions vary. We know that all living things on Earth are made of carbon compounds. We also know that all living things on Earth need water. Some scientists believe that if we find life elsewhere, it will have to be carbon-based. Other scientists think the universe is too vast to know this for sure. Our search for life beyond Earth starts with the search for evidence of water. If we find evidence of water, this suggests the existence of life.

Journeys to Mars

Our "near" neighbor Mars is the fourth planet from our sun. Mars is a little like our planet. It has long been the focus of our search for life beyond the Earth.

In the 1880s, better telescopes showed what seemed to be canals on Mars. Some even believed that people lived on Mars. These ideas lasted until the 1960s. At that point, improved techniques gave us a closer look at Mars. The "canals" were an optical illusion.

Photo - Courtesy of NASA

In 1976, the Viking mission landed on Mars. It found a thin atmosphere made mostly of carbon dioxide. Soil samples were tested. Viking found no signs of life or liquid water. Photos sent back revealed Mars as a barren place. Yet these images showed landforms that suggested liquid water might have existed on Mars long ago. Since then, scientists have tried to find out if Mars had water in the ancient past.

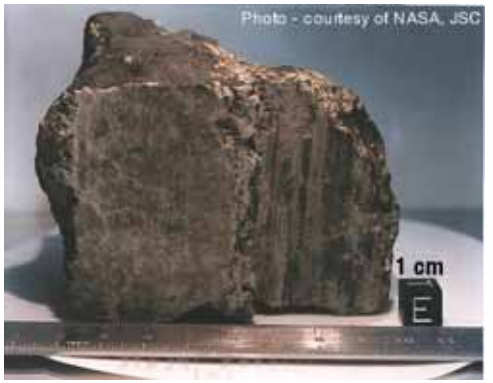
Proof from Earth?

In 1996, some scientists made a startling claim. They said that they had evidence suggesting that life existed on Mars more than 3 billion years ago. Perhaps most amazing of all, they found the evidence on Earth!

The evidence was found in a meteorite in Antarctica. You might wonder how can we know the meteorite came from Mars? Scientist discovered that the gases trapped in the meteorite match those found on Mars by Viking.

Here is what some scientists think may have happened. The rock was originally beneath the surface of Mars. About 3.6 billion years ago, meteorites hit Mars. The meteor impact cracked the rock. A liquid seeped into the cracks leaving mineral deposits behind. The deposits included carbon and iron compounds. These compounds are associated with some bacteria on Earth.

Then, about sixteen million years ago, an asteroid hit Mars. The rock was blasted into space. It finally fell to Earth in Antarctica about 13,000 years ago.



Scientists have studied the meteorite and found what might be fossils of ancient bacteria. Similar tiny bacteria have been found on Earth. These discoveries suggest that water once existed on Mars. This is just one conclusion from the evidence.

Other evidence

More evidence needs to be collected. Recent missions to Mars are looking for water. In 2003, the NASA rovers Spirit and Opportunity landed on Mars. They have sent back many amazing photographs.

Close-up images from Mars show textures that geologists recognize. Inside of some rocks, crystals form in salty water. Later the crystals dissolve. They leave marks on the rocks. Geologists see this on Earth. If the same process caused the textures on Mars, it would indicate the presents of water.

So far, we are not sure if water ever existed on Mars, much less if there are living things there now. Each new piece of evidence takes us a step closer to an answer.

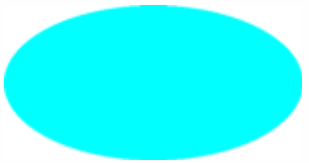
Questions:

1. How likely is it that life exists in other parts of the universe? Why?
2. What possible evidence of liquid water on Mars did Viking find?
3. What evidence of possible life on Mars was found on the Earth? Explain.

CHAPTER ACTIVITY Making a Key

Living organisms are classified into different groups to make it easier to understand the similarities and differences between these organisms. Scientists that study the characteristics of organisms and their relationships to other organisms are called *taxonomists*. One tool taxonomists use to identify unfamiliar organisms is called a *key*. A key asks a series of questions about an organism. As you answer each question, you are led to a different question depending on how you answered the first question. This continues until you are finally able to figure out what the organism is. Let's look at an example of a key used not for organisms, but for regular shapes.

Consider this shape:



1. Is the shape two-dimensional or three-dimensional?
   a. If two-dimensional, go to question 2.
   b. If three-dimensional, go to question 7.
2. Are all the edges of this two-dimensional shape all curved?
   a. If yes, go to question 3.
   b. If no, go to question 4.
3. If you place a point in the center of this shape, are all locations along the perimeter at an equal distance from the center point.
   a. If yes the shape is a circle.
   b. If no, the shape is an oval.

Get the idea? In this activity, you will create a key to identify some objects your teacher gives you.

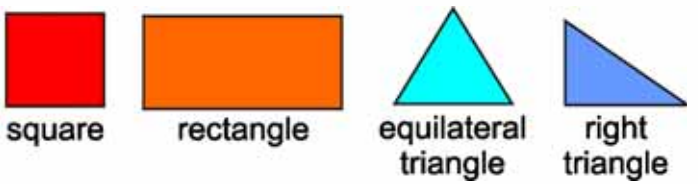
What you will do

1. Obtain a collection of objects from your teacher.
2. Give each item a silly name. The name should not be something that someone could easily guess.
3. Separate the objects into two groups based on some simple, easily observed difference between them. Write a question that when it is answered will determine the placement of an object into one group or the other. This question should be designed so that it only has two answers, for groups a and b.
4. Examine group a and repeat step 2 for this group. Keep repeating this for each group until the answer to a question leaves you with only one object. In this case, give the name of the object.

Applying your knowledge

a. Pair up with another group in the class. Randomly pick one of their objects. Draw a picture of this object. Use the key that your partner group wrote to try to correctly identify the chosen item and find out its silly name. What was the object's name? Did you get stuck at any steps? Is this group's key very different from yours?

b. You are a shape taxonomist. The key found in the introduction needs more work. You want people to be able to use this key to identify the shapes below. Write additional steps for the shape key so that it can be used to identify these shapes.



Chapter 2 Assessment

Vocabulary

Select the correct term to complete the sentences.

stimuli	energy	organ systems
species	tissues	homeostasis
organism	response	cells
taxonomy	organs	

Section 2.1

1. An ____ exhibits the characteristics of life.
2. Organisms react to environmental ____, such as heat, sunlight and nutrient availability.
3. An expected ____ to touching a hot stove is to flinch away from the heat.
4. All living things are made up of ____, the basic unit of life.
5. Life requires ____ in different forms to perform functions.

Section 2.2

6. ____ are groups of similar cells that are specialized to carry out a particular function.
7. ____ are groups of tissues that organize to perform a function.
8. Organs interact in groups called ____ to perform related tasks.
9. ____ is a process by which organisms maintain stable internal conditions suitable for life.

Section 2.3

10. The science of identifying and grouping organisms based on similarities is named ____.
11. Populations of interbreeding individuals who can produce fertile offspring are called a ____.

Concepts

Section 2.1

1. While hiking in the Sierra Nevada, you find an strange object. What steps are needed to determine if the object is alive?
2. During metamorphosis, tadpoles gradually lose their tail and form legs. This is an example of
   a. reproduction.
   b. growth and development.
   c. responding to the surrounding environment.
   d. evolving to the change in oxygen availability.
3. A world-class cyclist training for the Tour de France increases his respiration rate while pedaling up hills. What characteristic of life does this represent?
4. Zeedonks, animals that are the cross between a zebra and a donkey, cannot breed on their own. If zeedonks were isolated how would this affect their population? Using the zeedonk as an example, explain why reproduction is such an important characteristic of life?
5. Which is an example of chemical energy?
   a. The breakdown of large carbohydrate molecules into smaller glucose molecules.
   b. Solar powered space probes providing images of distant planets.
   c. Energy from the wind turns large turbines to provide electricity to homes and businesses.
   d. The splitting of uranium atoms to provide electricity for cities and towns

Section 2.2

6. Describe examples of how the human body is organized to perform life functions.

7. The liver is an example of:
   a. a tissue
   b. an organ system
   c. an organ
   d. none of the above
8. Paramecium have contractile vacuoles that pump water out their body cavities. This is an example of
   a. the organism maintaining homeostasis
   b. growth and development.
   c. an organism converting radiant energy into chemical energy.
   d. an organ system.

Section 2.3

9. Species from the kingdom Protista include:
   a. mushrooms b. bacteria
   c. algae d. starfish
10. Clams of the same order, must be classified in the same:
   a. genus b. species
   c. family d. class
11. Describe the major differences between plants and protists.
12. Carolus Linnaeus
   a. used DNA evidence identify relationships among species.
   b. strictly based his classification system on evolutionary relationships.
   c. created a classification system that identifies only multicellular organisms such as plants and animals.
   d. unified the science of taxonomy by identifying and classifying organisms based on structural and evolutionary relationships.

Math and Writing Skills

Section 2.1

1. Write a paragraph describing how your pet, or a friend's pet, meets the criteria of a living thing.

Section 2.2

2. Write a one page story about how you experience homeostasis each day.

Section 2.3

3. Suppose you discovered the creature shown here. Make up a scientific name for the creature and write a short story about a day in its life.

Chapter Project

Classification chart

The list below has scientific names for 12 different animals, most of which you could find at a zoo. Choose one of the scientific names. Create a chart and present it on a large poster, showing the correct classification of the animal, from kingdom to species. Find the common name too! Table 2.1 in this chapter shows an example classification chart. Include a correct photograph (printed from the internet, an actual camera photo, photocopied from a book, or cut from a magazine) and some interesting facts about the animal.

Scientific names (choose one for your project): *Bubo virginianus*, *Desmodus rotundus*, *Echinotriton andersoni*, *Ginglymostoma cirratum*, *Marelia boeleni*, *Pongo pygmaeus*, *Procyon lotor*, *Pygocentrus natterei*, *Sarcoramphus papa*, *Uncia uncia*, *Varanus komodoensis*, or *Zalophus californianus*.