SECTION 1

Sorting It All Out

Imagine that you live in a tropical rain forest and must get your own food, shelter, and clothing from the forest. What do you need to know to survive in the forest?

To survive in the rain forest, you need to know which plants are safe to eat and which are not. You need to know which animals you can eat and which might eat you. In other words, you need to study the living things around you and organize them into categories, or classify them. **Classification** is putting things into orderly groups based on similar characteristics.

What You Will Learn

- Explain why and how organisms are classified.
- List the eight levels of classification.
- Explain scientific names.
- Describe how dichotomous keys help in identifying organisms.

Vocabulary

classification
taxonomy
dichotomous key

READING STRATEGY

Reading Organizer As you read this section, create an outline of the section. Use the headings from the section in your outline.

Why Classify?

For thousands of years, humans have classified living things based on usefulness. The Chácabo people of Bolivia know of 360 types of plants that grow in the forest where they live. Of these 360 plant types, 305 are useful to the Chácabo.

Some biologists, such as those shown in **Figure 1,** classify living and extinct organisms. Scientists classify organisms to help make sense and order of the many kinds of living things in the world. Biologists use a system to classify living things. This system groups organisms according to the characteristics they share. The classification of living things makes it easier for biologists to answer many important questions, such as the following:

- How many known species are there?
- What are the defining characteristics of each species?
- What are the relationships between these species?

classification the division of organisms into groups, or classes, based on specific characteristics

Reading Check **What are three questions that classifying organisms can help answer?** *(See the Appendix for answers to Reading Checks.)*

Figure 1 *These biologists are sorting rain-forest plant material.*

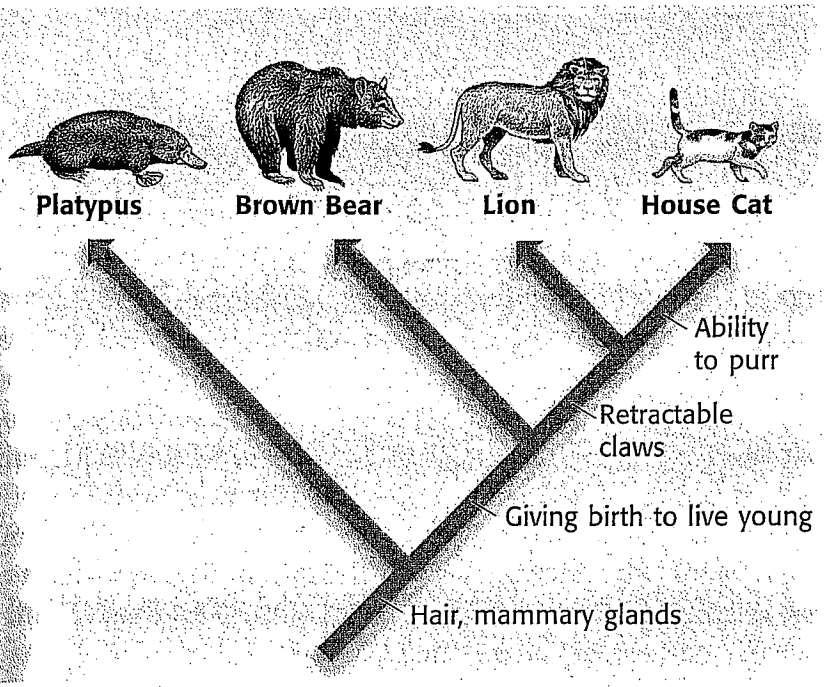


Figure 2 *This branching diagram shows the similarities and differences between four mammals.*

How Do Scientists Classify Organisms?

Before the 1600s, many scientists divided organisms into two groups: plants and animals. But as more organisms were discovered, some did not fit into either group. In the 1700s, Carolus Linnaeus (KAR uh luhs li NAY uhs), a Swedish scientist, founded modern taxonomy. **Taxonomy** (taks AHN uh mee) is the science of describing, classifying, and naming living things. Linnaeus tried to classify all living things based on their shape and structure. Today, scientists use a system of classification that is very similar to the one that Linnaeus developed.

taxonomy the science of describing, naming, and classifying organisms

Classification Today

Taxonomists use an eight-level system to classify living things based on shared characteristics. Scientists also use shared characteristics to hypothesize how closely related living things are. The more characteristics the organisms share, the more closely related the organisms may be. For example, the platypus, brown bear, lion, and house cat are thought to be related because they share many characteristics. These animals have hair and mammary glands, so they are grouped together as mammals. But they can be further classified into more-specific groups.

Branching Diagrams

Look at the branching diagram in **Figure 2.** Several characteristics are listed along the line that points to the right. Each characteristic is shared by the animals to the right of it. All of the animals shown have hair and mammary glands. But only the bear, lion, and house cat give birth to live young. The lion and the house cat have retractable claws, but the other animals do not. Thus, the lion and the house cat are more closely related to each other than to the other animals.

A Branching Diagram

1. Construct a diagram similar to the one in **Figure 2.**
2. Use a frog, a snake, a kangaroo, and a rabbit in your diagram.
3. Think of one major change that happened before the frog evolved.
4. For the last three organisms, think of a change that happened between one of these organisms and the other two. Write all of these changes in your diagram.

Two-Part Names

Linnaeus simplified the naming of living things by giving each species a two-part scientific name. For example, the scientific name for the Asian elephant is *Elephas maximus* (EL uh fuhs MAK suh muhs). The first part of the name, *Elephas,* is the genus name. The second part, *maximus,* is the specific name. No other species has the name *Elephas maximus*. Naming rules help scientists communicate clearly about living things.

All genus names begin with a capital letter. All specific names begin with a lowercase letter. Usually, both words are underlined or italicized. But if the surrounding text is italicized, the scientific name is not, as **Figure 4** shows. These printing styles show a reader which words are the scientific name.

Scientific names, which are usually in Latin or Greek, contain information about an organism. The name of the animal shown in **Figure 4** is *Tyrannosaurus rex*. *Tyrannosaurus* is a combination of two Greek words and means "tyrant lizard." The word *rex* is Latin for "king." The name tells you that this animal was probably not a passive grass eater! Sometimes, *Tyrannosaurus rex* is referred to as *T. rex*. To be correct, the scientific name must consist of the genus name (or its abbreviation) and the specific name.

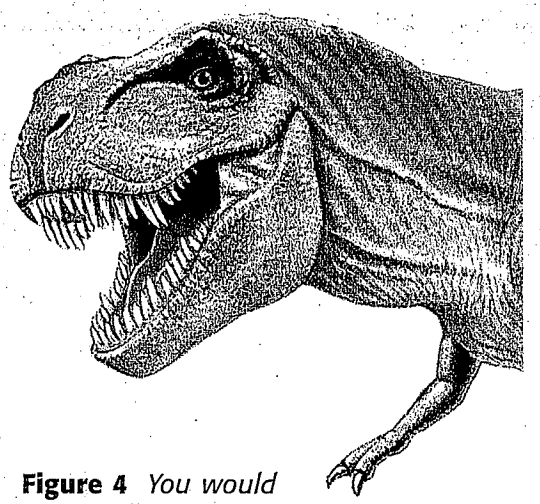
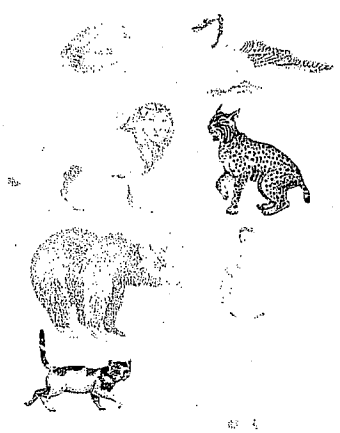
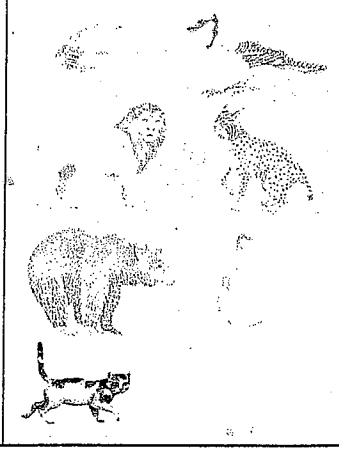


Figure 4 *You would never call* Tyrannosaurus rex *just* rex*!*

Reading Check What are the two parts of a scientific name?

Family Felidae	Genus *Felis*	Species *Felis domesticus*
Animals in the **family Felidae** are cats. They have a backbone, nurse their young, have special teeth for tearing meat, and have retractable claws.	Animals in the **genus *Felis*** have traits of other animals in the same family. However, these cats cannot roar; they can only purr.	The **species *Felis domesticus*** is the common house cat. The house cat shares traits with all of the organisms in the levels above the species level, but it also has unique traits.
		

Levels of Classification

Every living thing is classified into one of three domains. Domains are the largest and most general groups. All living things in a domain are sorted into kingdoms. The members of one kingdom are more like each other than they are like the members of another kingdom. All living things in a kingdom are further sorted into phyla (singular, *phylum*). The members of a phylum are sorted into classes. Each class includes one or more orders. Orders are separated into families. Families are broken into genera (singular, *genus*). And genera are sorted into species. A species is a group of organisms that are closely related and can mate to produce fertile offspring. **Figure 3** shows the classification of a house cat from the kingdom Animalia to the species *Felis domesticus*.

INTERNET ACTIVITY

For another activity related to this chapter, go to **go.hrw.com** and type in the keyword **HL5CLSW.**

Scientific Names

By classifying organisms, biologists can give organisms scientific names. A scientific name remains the same for a specific kind of organism even if the organism has many common names. Before Linnaeus's time, scholars used names that were as long as 12 words to identify species. This system was hard to work with because the names were so long. The system was also hard to use because individual scientists named organisms differently. So, an organism could have more than one name.

Figure 3 *The eight levels of classification are domain, kingdom, phylum, class, order, family, genus, and species.*

Kingdom Animalia	Phylum Chordata	Class Mammalia	Order Carnivora
All animals are in the **kingdom Animalia.**	All animals in the **phylum Chordata** have a hollow nerve cord. Most have a backbone.	Animals in the **class Mammalia** have a backbone. They also nurse their young.	Animals in the **order Carnivora** have a backbone and nurse their young. They also have special teeth for tearing meat.
			

Dichotomous Keys

dichotomous key an aid that is used to identify organisms and that consists of the answers to a series of questions

You might someday turn over a rock and find an organism that you don't recognize. How would you identify the organism? Taxonomists have developed special guides to help scientists identify organisms. A **dichotomous key** (die KAHT uh muhs KEE) is an identification aid that uses sequential pairs of descriptive statements. There are only two alternative responses for each statement. From each pair of statements, the person trying to identify the organism chooses the statement that describes the organism. Either the chosen statement identifies the organism or the person is directed to another pair of statements. By working through the statements in the key in order, the person can eventually identify the organism. Using the simple dichotomous key in **Figure 5,** try to identify the two animals shown.

Reading Check What is a dichotomous key?

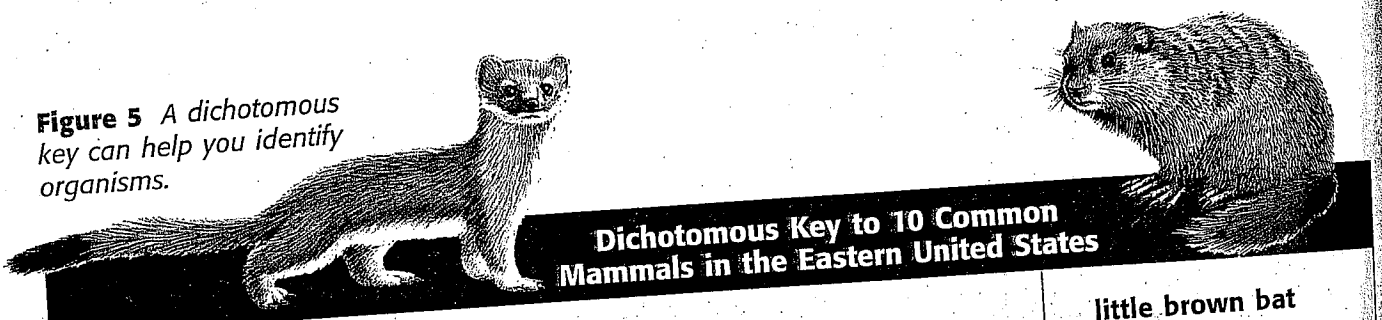


Figure 5 *A dichotomous key can help you identify organisms.*

Dichotomous Key to 10 Common Mammals in the Eastern United States

1. a. This mammal flies. Its "hand" forms a wing.	**little brown bat**
b. This mammal does not fly. It's "hand" does not form a wing.	**Go to step 2.**
2. a. This mammal has no hair on its tail.	**Go to step 3.**
b. This mammal has hair on its tail.	**Go to step 4.**
3. a. This mammal has a short, naked tail.	**eastern mole**
b. This mammal has a long, naked tail.	**Go to step 5.**
4. a. This mammal has a black mask across its face.	**raccoon**
b. This mammal does not have a black mask across its face.	**Go to step 6.**
5. a. This mammal has a tail that is flat and paddle shaped.	**beaver**
b. This mammal has a tail that is not flat or paddle shaped.	**opossum**
6. a. This mammal is brown and has a white underbelly.	**Go to step 7.**
b. This mammal is not brown and does not have a white underbelly.	**Go to step 8.**
7. a. This mammal has a long, furry tail that is black on the tip.	**longtail weasel**
b. This mammal has a long tail that has little fur.	**white-footed mouse**
8. a. This mammal is black and has a narrow white stripe on its forehead and broad white stripes on its back.	**striped skunk**
b. This mammal is not black and does not have white stripes.	**Go to step 9.**
9. a. This mammal has long ears and a short, cottony tail.	**eastern cottontail**
b. This mammal has short ears and a medium-length tail.	**woodchuck**

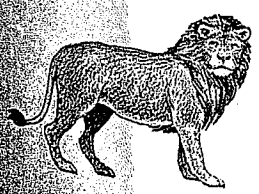
A Growing System

You may think that all of the organisms on Earth have already been classified. But people are still discovering and classifying organisms. Some newly discovered organisms fit into existing categories. But sometimes, someone discovers new evidence or an organism that is so different from other organisms that it does not fit existing categories. For example, in 1995, scientists studied an organism named *Symbion pandora* (SIM bee AHN pan DAWR uh). Scientists found *S. pandora* living on lobster lips! Scientists learned that *S. pandora* had some characteristics that no other known organism had. In fact, scientists trying to classify *S. pandora* found that it didn't fit in any existing phylum. So, taxonomists created a new phylum for *S. pandora*.

SECTION Review

Summary

- In classification, organisms are grouped according to the characteristics the organisms share. Classification lets scientists answer important questions about the relationships between organisms.
- The eight levels of classification are domain, kingdom, phylum, class, order, family, genus, and species.
- An organism has one two-part scientific name.
- A dichotomous key is a tool for identifying organisms that uses a series of paired descriptive statements.



Using Key Terms

1. In your own words, write a definition for each of the following terms: *classification* and *taxonomy*.

Understanding Key Ideas

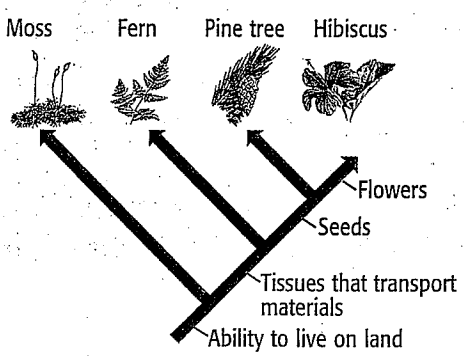
2. The two parts of a scientific name are the names of the genus and the
   - **a.** specific name.
   - **b.** phylum name.
   - **c.** family name.
   - **d.** order name.
3. Why do scientists use scientific names for organisms?
4. List the eight levels of classification.
5. Describe how a dichotomous key helps scientists identify organisms.

Critical Thinking

6. **Analyzing Processes** Biologists think that millions of species are not classified yet. Why do you think so many species have not been classified yet?
7. **Applying Concepts** Both dolphins and sharks have a tail and fins. How can you determine if dolphins and sharks are closely related?

Interpreting Graphics

Use the figure below to answer the questions that follow.



8. Which plant is most similar to the hibiscus?
9. Which plant is least similar to the hibiscus?