

SECTION 1 **Sorting It All Out**



California Science Standards

7.3.d

**BEFORE YOU READ**

After you read this section, you should be able to answer these questions:

- What is classification?
- How do scientists name organisms?
- How do scientists classify organisms?
- How does a branching diagram show how organisms are related?

**STUDY TIP**

**Organize** As you read, make a diagram to show the eight-level system of organization.

**Say It**

**Discuss** With a partner, describe some items at home that you have put into groups. Explain why you grouped them and what characteristics you used.

**Why Do We Classify Things?**

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? 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 ones might eat you. In other words, you need to study the organisms around you and put them into useful groups, or classify them.

Biologists use a *classification system* to group the millions of different organisms on Earth. **Classification** is putting things into groups based on characteristics the things share. Classification helps scientists answer several important questions:

- What are the defining characteristics of each species?
- When did the characteristics of an organism evolve?
- What are the relationships between different species?

**How Do Scientists Classify Organisms?**

What are some ways we can classify organisms? Perhaps we could group them by where they live or how they are useful to humans. Throughout history, people have classified organisms in many different ways.

In the 1700s, a Swedish scientist named Carolus Linnaeus created his own system. This system was based on the structure or characteristics of organisms. With his new system, Linnaeus founded modern taxonomy.

**Taxonomy** is the science of describing, classifying, and naming organisms. Classifying organisms by their characteristics is called *systematics*. ✓

**READING CHECK**

**1. Explain** How did Linnaeus classify organisms?

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**SECTION 1** Sorting It All Out *continued*

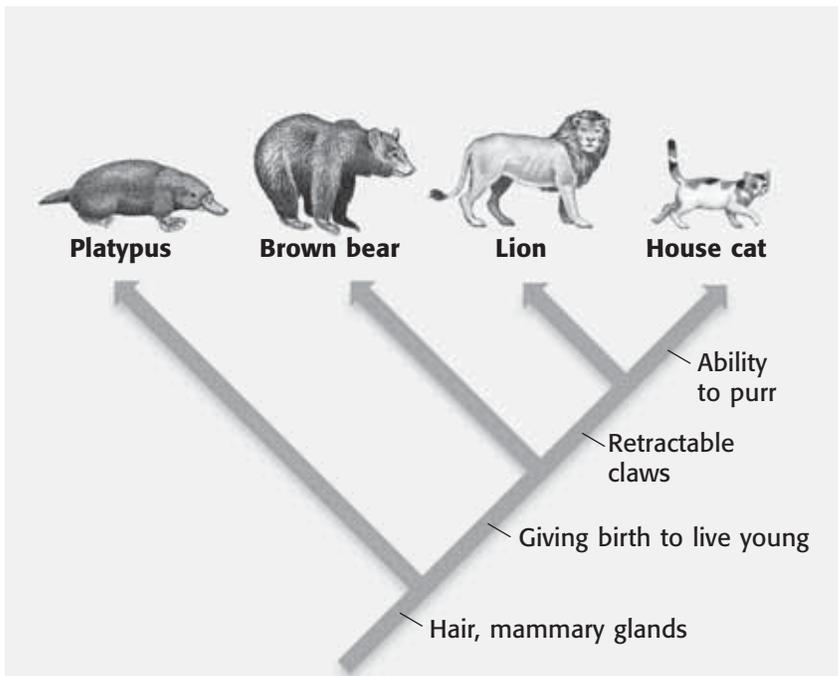
**SHARED DERIVED CHARACTERISTICS**

Taxonomists group organisms by their *shared derived characteristics*. Derived characteristics evolved in an ancestor of one group but not another. For example, both lions and house cats have retractable claws. This derived characteristic must have evolved in an ancestor of lions and house cats. Because these animals share these characteristics, they must be more closely related than those animals that do not.

**How Can Scientists Show How Organisms Are Related?**

Shared derived characteristics can be shown in a *branching diagram*. Each characteristic on the branching diagram is shared by only the animals above it. The characteristics found higher on the diagram evolved more recently than the characteristics below them.

In this diagram, all of the animals have hair and mammary glands. However, only the brown bear, lion, and house cat give birth to live young. More recent organisms are at the ends of branches high on the diagram. For example, according to the diagram, the house cat evolved more recently than the platypus. ✓



This branching diagram shows the similarities and differences between four kinds of mammals. The bottom of the diagram begins in the past, and the tips of the branches end in the present.

*Critical Thinking*

**2. Infer** What is the difference between organisms that share many derived characteristics and organisms that do not?

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**READING CHECK**

**3. Identify** On a branching diagram, where would you see the characteristics that evolved most recently?

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**SECTION 1** Sorting It All Out *continued*

## How Do Scientists Name Organisms?

We usually call organisms by common names. For example, “cat,” “dog,” and “human” are all common names. Most of the time, these names are useful. However, people who speak a language other than English have different names for a cat and dog. Sometimes, organisms are even called by different names in English. For example, a cougar, mountain lion, and a puma are three names for the same animal! ✓

**READING CHECK**

**4. List** What are two problems with common names?

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Scientists need to be sure they are all talking about the same organism. They give organisms *scientific names*. Scientific names are the same in all languages. An organism has only one scientific name.

Scientific names are based on the system created by Linnaeus. He gave each kind of organism a two-part name. The first part of the name is the *genus*, and the second part is the *species*. All genus names begin with a capital letter. All species names begin with a lowercase letter. Both words in a scientific name are underlined or italicized. For example, the scientific name for the Asian elephant is *Elephas maximus*. ✓

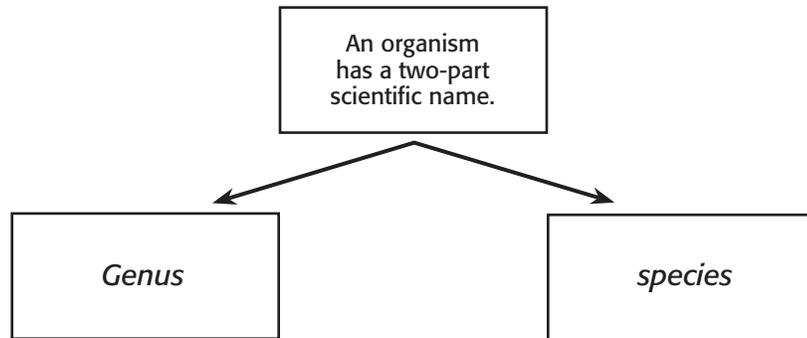
**READING CHECK**

**5. Identify** What are the two parts of a scientific name?

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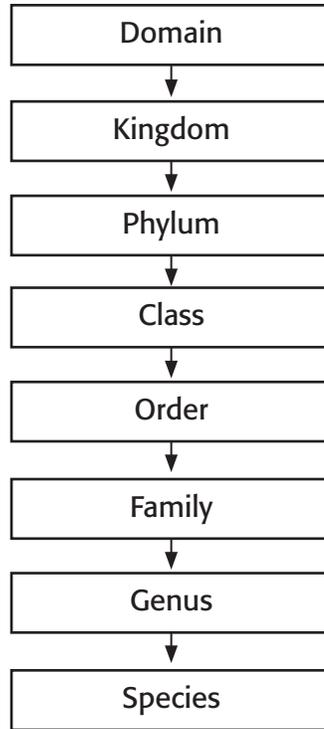


## What Are the Levels of Classification?

Scientists use shared derived characteristics to group organisms into eight levels of classification. At each level of classification, there are fewer organisms than in the level above. A domain is the largest, most general level of classification. Every living thing is classified into one of three domains.

Species is the smallest level of classification. A species is a group of organisms that can mate and produce fertile offspring. For example, dogs are all one species. They can mate with each other and have fertile offspring.

**SECTION 1** Sorting It All Out *continued*



**TAKE A LOOK**

**6. Identify** Which level contains organisms that are more closely related: a phylum or a class?

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This diagram shows the levels of classification of the house cat, in domain Eukarya.

Kingdom Animalia: All animals are in the kingdom Animalia.



Phylum Chordata: All animals in the phylum Chordata have a hollow nerve cord. Most have a backbone.



Class Mammalia: Animals in the class Mammalia have a backbone. They also nurse their young.



Order Carnivora: Animals in the order Carnivora have a backbone and nurse their young. They also have special teeth for tearing meat.



**SECTION 1** Sorting It All Out *continued*

Family Felidae: Animals in the family Felidae are cats. They have a backbone, nurse their young, have special teeth for tearing meat, and have retractable claws.



Genus *Felis*: Animals in the genus *Felis* share traits with other animals in the same family. However, these cats cannot roar; they can only purr.



Species *Felis catus*: The species *Felis catus* 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.



**TAKE A LOOK**

**7. Describe** How does the number of organisms change from the level of kingdom to the level of species?

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**What Do Branching Diagrams Show About Living and Extinct Organisms?**

Scientists learn about the characteristics of extinct organisms from fossils. Extinct organisms can be placed in a branching diagram along with living organisms. These diagrams show when the extinct organisms evolved and when they became extinct. The more characteristics an extinct organism shared with a living one, the more closely these organisms are related.

**TAKE A LOOK**

**8. Identify** Which genus that lived in the Miocene era evolved into the modern horse?

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**Critical Thinking**

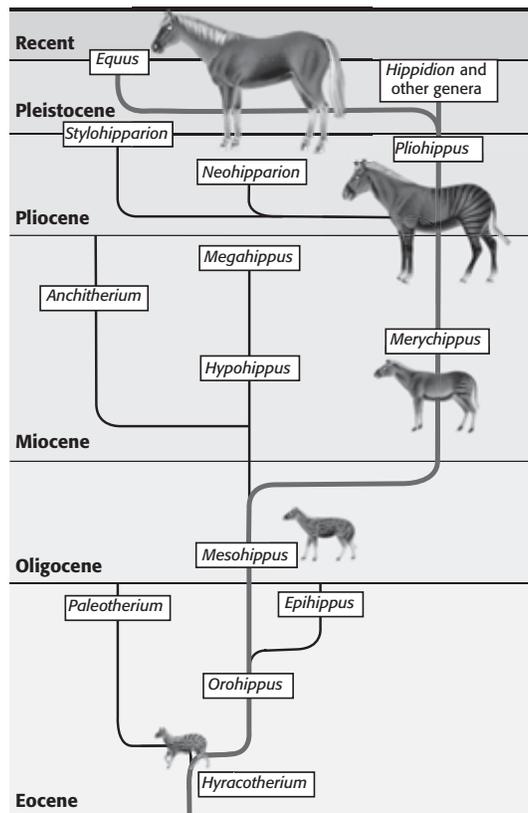
**9. Infer** Branches for some species never reach the top of the diagram. What do you think is the reason?

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This branching diagram shows the modern horse and the genera it is related to. The diagram also shows how the genera evolved from organisms that are now extinct.

# Section 1 Review

## SECTION VOCABULARY

<p><b>classification</b> the division of organisms into groups, or classes, based on specific characteristics</p>	<p><b>taxonomy</b> the science of describing, naming, and classifying organisms</p> <p><b>Wordwise</b> The root <i>tax</i> means “to arrange” or “to put in order.” The suffix <i>-nomy</i> means “the science of.”</p>
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**1. List** List the eight levels of classification from the largest to the smallest.

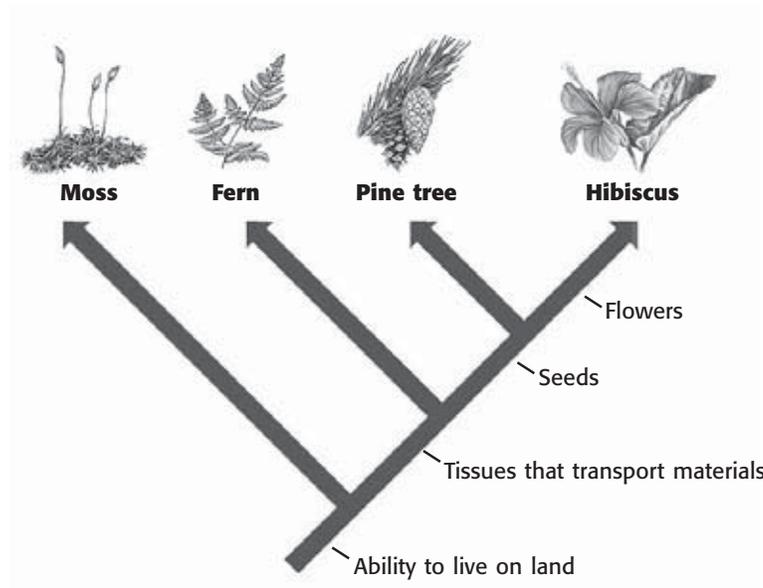
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**2. Identify** According to the branching diagram below, which characteristic do ferns have that mosses do not?

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**3. Organize** Construct a diagram similar to the one above. Use the following organisms: frog, snake, kangaroo, and rabbit. Include a change that happened before the first organism and changes that happened between the other organisms.