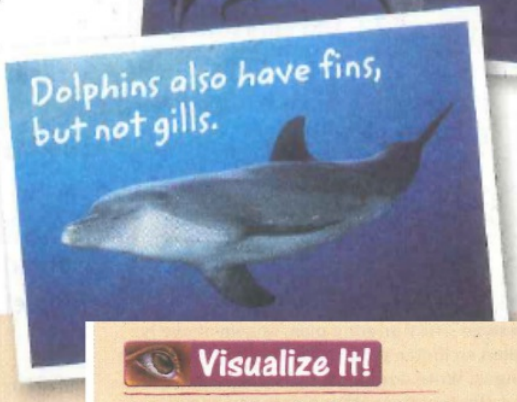
Sorting Things Out!

Why do we classify living things?

There are millions of living things on Earth. How do scientists keep all of these living things organized? Scientists *classify* living things based on characteristics that living things share. Classification helps scientists answer questions such as:

- How many kinds of living things are there?
- What characteristics define each kind of living thing?
- What are the relationships among living things?



Visualize It!

5 Analyze The photos below show two organisms. In the table, place a check mark in the box for each characteristic that the organisms have.

	Wings	Antennae	Beak	Feathers
Miami blue butterfly				
Scrub jay				

How do scientists know living things are related?

If two organisms look similar, are they related? To classify organisms, scientists compare physical characteristics. For example, they may look at size or bone structure. Scientists also compare the chemical characteristics of living things.

Active Reading

7 **Identify** As you read this page, underline the characteristics used to classify living things.

Physical Characteristics

How are chickens similar to dinosaurs? If you compare dinosaur fossils and chicken skeletons, you'll see that chickens and dinosaurs share many physical characteristics. Scientists look at physical characteristics, such as skeletal structure. They also study how organisms develop from an egg to an adult. Organisms that have similar skeletons and development may be related.

Chemical Characteristics

Scientists can identify the relationships among organisms by studying genetic material such as DNA and RNA. They use mutations and genetic similarities to find relationships among organisms. Organisms that have very similar gene sequences or have the same mutations are likely related. Other chemicals, such as proteins and hormones, can also be studied to learn how organisms are related.

What's in a Name?

How are living things named?

Early scientists used names as long as 12 words to identify living things, and they also used common names. So, classification was confusing. In the 1700s, a scientist named Carolus Linnaeus (KAR•uh•luhs lih•NEE•uhs) simplified the naming of living things. He gave each kind of living thing a two-part *scientific name*.

Scientific Names

Each species has its own scientific name. A **species** (SPEE•sheez) is a group of organisms that are very closely related. They can mate and produce fertile offspring. Consider the scientific name for a mountain lion: *Puma concolor*. The first part, *Puma,* is the genus name. A **genus** (JEE•nuhs; plural, *genera*) includes similar species. The second part, *concolor,* is the specific, or species, name. No other species is named *Puma concolor*.

A scientific name always includes the genus name followed by the specific name. The first letter of the genus name is capitalized, and the first letter of the specific name is lowercase. The entire scientific name is written either in italics or underlined.

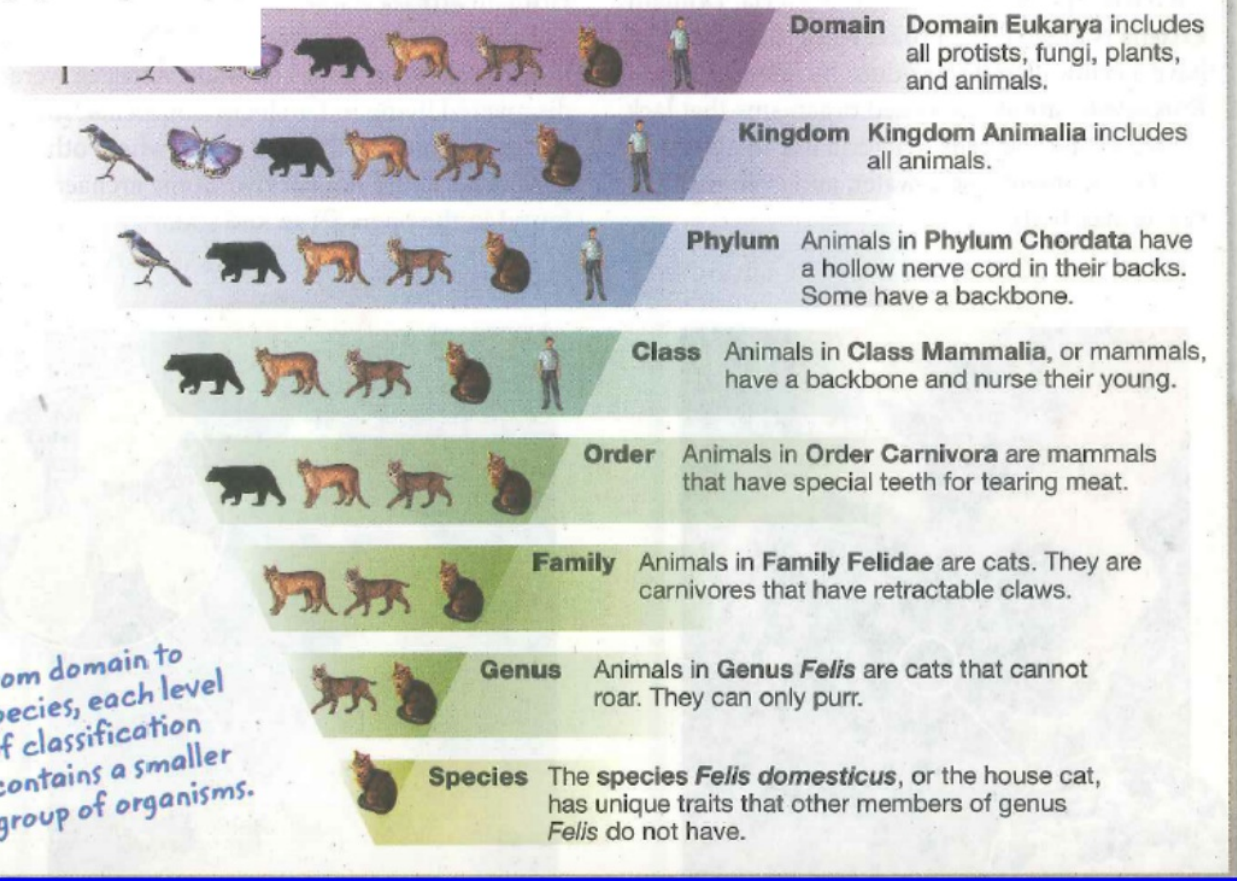
The A.K.A. Files

What are the levels of classification?

Linnaeus's ideas became the basis for modern taxonomy (tak•SAHN•uh•mee). *Taxonomy* is the science of describing, classifying, and naming living things. At first, many scientists sorted organisms into two groups: plants and animals. But many organisms did not fit into either group.

Today, scientists use an eight-level system to classify living things. Each level gets more definite. Therefore, it contains fewer kinds of living things than the level before it. Living things in the lower levels are more closely related to each other than they are to organisms in the higher levels. From most general to most definite, the levels of classification are domain, kingdom, phylum (plural, *phyla*), class, order, family, genus, and species.

Classifying Organisms



Bacteria

All bacteria belong to domain Bacteria. Domain **Bacteria** is made up of prokaryotes that usually have a cell wall and reproduce by cell division. *Prokaryotes* are single-celled organisms that lack a nucleus in their cells. Bacteria live in almost any environment—soil, water, and even inside the human body!

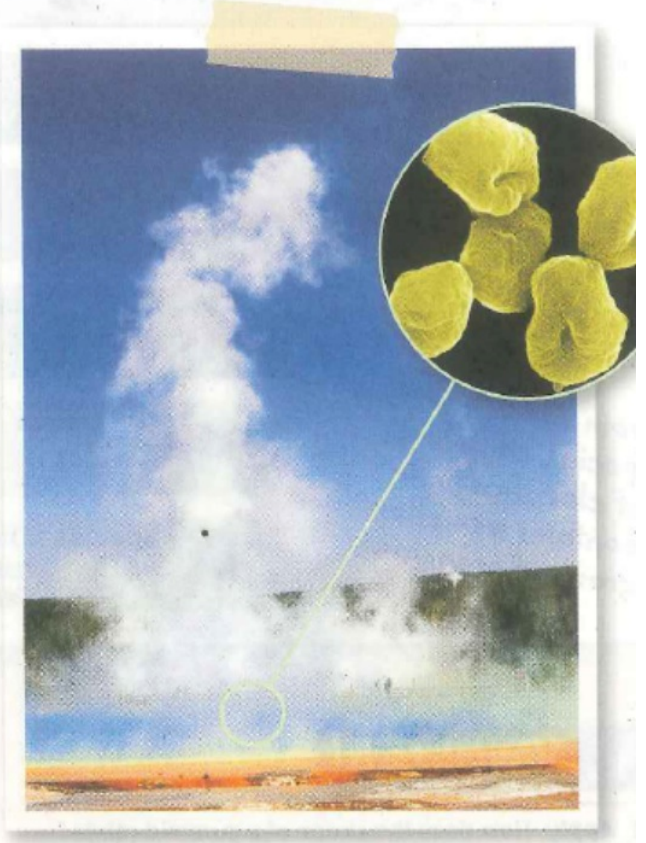
Archaea

Domain **Archaea** is also made up of prokaryotes. They differ from bacteria in their genetics and in the makeup of their cell walls. Archaea were discovered living in harsh environments, such as hot springs and thermal vents, where other organisms could not survive. Some archaea are found in the open ocean and soil.

What are the three domains?

Once, kingdoms were the highest level of classification. Scientists used a six-kingdom system. But scientists noticed that organisms in two of the kingdoms differed greatly from organisms in the other four kingdoms. So, scientists added a new classification level: domains. A **domain** represents the largest differences among organisms. The three domains are Bacteria (bak•TIR•ee•uh), Archaea (ar•KEE•uh), and Eukarya (yoo•KEHR•ee•uh).

Bacteria from the genus *Streptomyces* are commonly found in soil.



Archaea from genus *Sulfolobus* are found in hot springs.

Eukarya

What do algae, mushrooms, trees, and humans have in common? All of these organisms are *eukaryotes*. Eukaryotes are made up of cells that have a nucleus and membrane-bound organelles. The cells of eukaryotes are more complex than the cells of prokaryotes. For this reason, the cells of eukaryotes are usually larger than the cells of prokaryotes. Some eukaryotes, such as many protists and some fungi, are single-celled. Many eukaryotes are multicellular organisms. Some protists and many fungi, plants, and animals are multicellular eukaryotes. Domain **Eukarya** is made up of all eukaryotes.

It may look like a pinecone, but the pangolin is actually an animal from Africa. It is in domain Eukarya.

Kingdom Animalia

Kingdom **Animalia** contains multicellular organisms that lack cell walls, are usually able to move around, and have specialized sense organs. They eat other organisms for food. Birds, fish, reptiles, insects, and mammals are just a few examples of animals.

Kingdom Plantae

Kingdom **Plantae** consists of multicellular organisms that have cell walls, cannot move around, and make their own food. Plants are found on land and in water that light can pass through.

Kingdom Protista

Members of the kingdom **Protista**, called *protists*, are single-celled or simple multicellular organisms such as algae, protozoans, and slime molds. Protists are a very diverse group of organisms, with plantlike, animal-like, or funguslike characteristics.

Kingdom Fungi

The members of kingdom **Fungi** get energy by absorbing materials and have cells with cell walls but no chloroplasts. Fungi are single-celled or multicellular. Yeasts, molds, and mushrooms are fungi. Fungi use digestive juices to break down materials around them for food.

Visualize It!

14 Synthesize For which kingdom would you most likely need a magnifying lens or microscope to study the organisms?

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What kingdoms are in Eukarya?

Eukaryotes are found throughout the world. They vary in size from single-celled organisms, such as plankton, to multicellular organisms, such as blue whales. Currently, four kingdoms make up the domain Eukarya: Protista, Fungi, Plantae, and Animalia.