

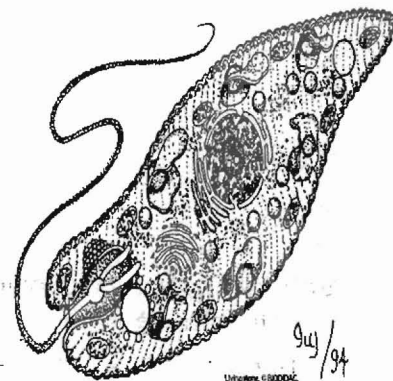
Domains

Scientists have divided living creatures into three main groups called Domains. Each Domain consists of groups of life forms that are related to each other and have characteristics in common. The domains describe the characteristics of every living creature that we know of.

Domains and Kingdoms

What do you call an organism that is green, makes its own food, lives in pond water, and moves? Is it a plant, an animal, or something in between?

For hundreds of years, all living things were classified as either plants or animals. But over time, scientists discovered species that did not fit easily into these two kingdoms. For example, an organism of the genus *Euglena*, such as the one shown to the right, has characteristics of both plants and animals. How would you classify such an organism?



What is it? Organisms are classified by their characteristics. For example, euglenoids which include members of the genus *Euglena* have the following characteristics:

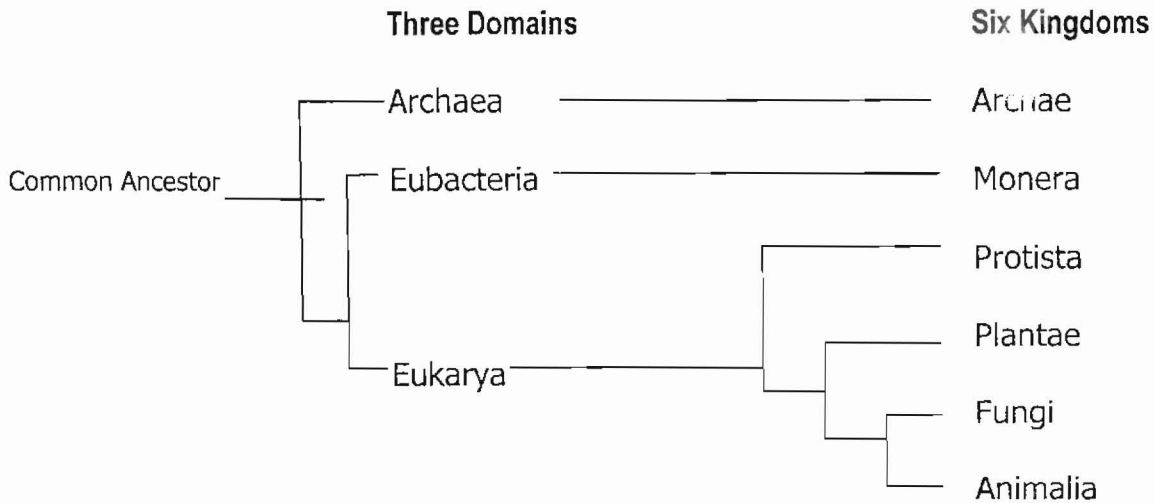
- Euglenoids are single celled and live in pond water.
- Euglenoids are green and make their own food by photosynthesis.

These characteristics might lead you to conclude that euglenoids are plants. However, you should consider the following characteristics of euglenoids:

- Euglenoids move by whipping their "tails," which are called flagella.
- Euglenoids can feed on other organisms.

Plants do not move around and usually do not eat other organisms. So, are euglenoids animals? As you can see, euglenoids do not fit into plant or animal categories. Scientists solved this classification problem by adding another kingdom-Kingdom Protista to classify organisms such as euglenoids.

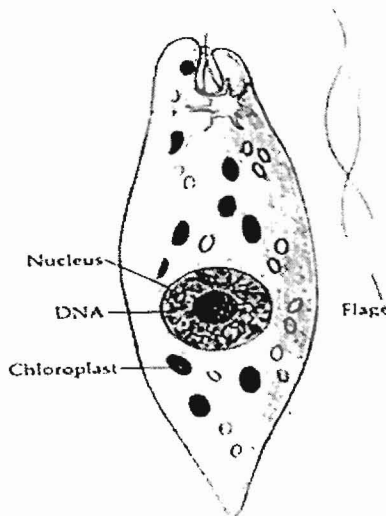
As scientists learned more about living things, they changed the classification system. Today, there are three domains in the classification system. **Domains** represent the largest differences between organisms. There are three Domains. These domains are divided into several **Kingdoms** which are the second largest division in the classification system.



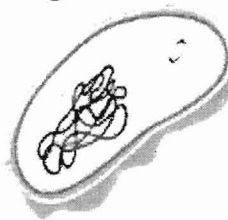
Domain # 1 Archaea

The Domain Archaea is made up entirely of ancient organisms that belong to the Kingdom Archae. Archae are one of two kinds of prokaryotes. **Prokaryotes** are single-celled organisms that do not have a nucleus. Archae are **anaerobic** organisms or anaerobes; they are organisms that do not require oxygen for growth. **Methanogens** are archaea that produce a gas called methane. Methanogens are rapidly killed in the presence of oxygen. Archae were first discovered living in extreme environments, where other organisms could not survive, therefore giving them the name

extremophiles. Some archae can also be found in moderate environments such as the open ocean. Some archae are called thermophiles. **Thermophiles** are heat lovers. Many are found in hot springs where temperatures range from 70 to 110°C. They can also be found near deep sea vents where hot water comes from underwater volcanoes. Other archae are called **Halophiles**. These are the salt lovers. They live in waters that have 15-20% salt; sea water only has a 3% salt content. The Great Salt Lake has many halophiles.



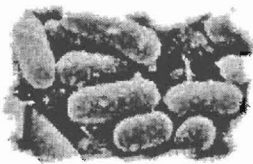
Eukaryote



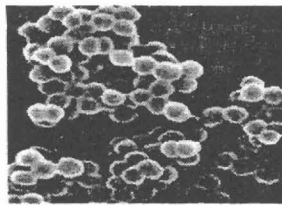
Prokaryote
(Single celled with no true nucleus)

Domain #2: Eubacteria

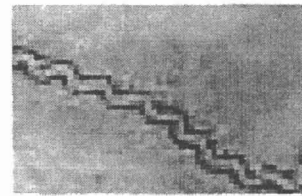
There is one Kingdom in this Domain, Kingdom Monera. Bacteria are another kind of **prokaryote** (single celled with no true nucleus and no membrane bound organelles). They are microscopic and can be either anaerobic or **aerobic** (An aerobic organism or aerobe is an organism that uses oxygen to obtain energy). Bacteria can be found in soil, water and even on and inside the human body! For example, *Escherichia coli* (known as E-coli), are present in large numbers in human intestines, where it produces vitamin K. One kind of bacterium converts milk into yogurt. Some bacteria cause diseases, such as pneumonia. Other bacteria make chemicals that help humans fight disease-causing bacteria. Monerans come in one of three shapes; spherical, rod shaped, or spiral. Spherical monerans are called **cocci**; rod shaped monerans are called **bacilli**; and spiral monerans are called **spirilli**. Some monerans cluster together; others form chains or filaments. The prefix staphylo- is used to describe cells that form clusters. Therefore a cluster of spherical moneran cells is called a staphylococcus. The prefix strepto- is used to describe cells that form filaments. Therefore a filament or rod shaped moneran cells is called a streptobacillus. The prefix diplo- means pair.



Bacilli: rod shaped



Cocci: spherical



Spirilli: spiral shaped

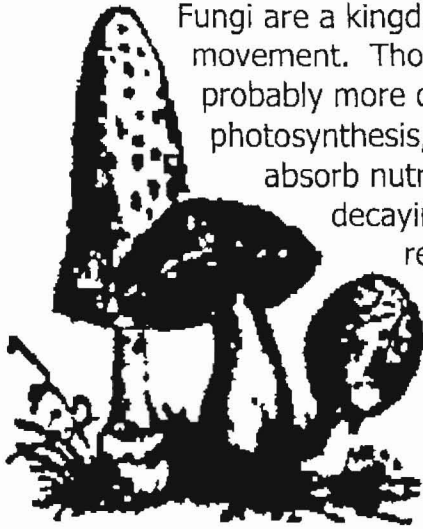
Domain #3: Eukarya

The Domain **Eukarya** contains all organisms whose cells have a nucleus and membrane-bound organelles. The organisms in this domain are therefore called **eukaryotes**. The eukaryotes include both single-celled (**unicellular**) and many celled (**multi-cellular**) organisms. Four kingdoms currently make up the domain Eukarya: Protista, Fungi, Plantae, and Animalia.

#1: Kingdom Protista

Members of the Kingdom Protista are the simplest of the eukaryotes. **Protists** are mostly one-celled and are different from plants, animals, bacteria, and fungi. Protists are an unusual group of organisms that were put together because they do not really seem to belong to any other group. Some protists perform photosynthesis like plants while others move around and act like animals, but protists are neither plants nor animals. They're not fungi either. Scientists think that the first protists evolved from ancient bacteria about 2 billion years ago. Eventually, ancient protists gave rise to fungi, plants, and animals. The Kingdom Protista contains many kinds of organisms. Protists include slime molds, and euglenoids.

#2: Kingdom Fungi



Fungi are a kingdom of non-green eukaryotic organisms that have no means of movement. Though the appearance of many fungi may resemble plants, they are probably more closely related to animals. Fungi are not capable of carrying out photosynthesis, so must get their nourishment from other sources. Many fungi absorb nutrients directly from the soil. Many others feed on dead and decaying organisms and therefore have an important role in the recycling of nutrients in natural systems. Still others feed on living organisms. Athlete's foot is a common fungus which feeds on a living host-you! When you think of fungi you probably think of mushrooms we can buy in the supermarket or hunt for in the woods, but most fungi is found underground.

Fungi comes in a wide variety of sizes and forms, and many are of great importance. Tiny, one celled yeasts are important for baking breads and fermenting wines, beers and vinegars. Many medicines are produced with the help of fungi, most notably, the antibiotic, Penicillin. If you leave your bread on the counter for too long, you'll be able to observe a relative of the *Penicillium* mold for yourself.

#3: Kingdom Plantae

Although plants vary remarkably in size and form, most people easily recognize the members of the Kingdom Plantae. Plantae consist of organisms that are eukaryotic, have cell walls, and make food through photosynthesis. For photosynthesis to occur, plants must be exposed to sunlight. Plants can therefore be found on land and in water that light can penetrate.



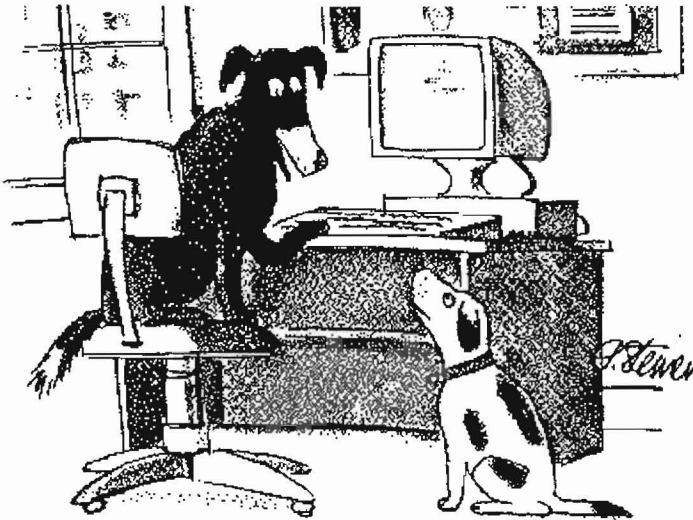
The food that plants make is important not only for the plants but for the organisms that get nutrients from plants. Most life on Earth is dependent on plants. For example, some fungi, protists and bacteria consume plants. When these organisms digest the plant material, they get energy and nutrients made by plants.

Plants also provide habitat for other organisms. The giant sequoias and flowering plants provide birds, insects, and other animals with a place to live.

#4: Kingdom Animalia

The kingdom Animalia contains complex, multi-cellular organisms that don't have cell walls, are usually able to move around, and have specialized sense organs. These sense organs help most animals quickly respond to their environment. Organisms in the Kingdom Animalia are commonly called animals. You probably recognize many organisms in the Kingdom Animalia.

With over 2 million species, Kingdom Animalia is the largest of the kingdoms in terms of species diversity. But when you think of an "animal", what image comes to mind? While mammals, birds, reptiles, fish, and amphibians are the most familiar to us, over half of all the animal species belong to a group called arthropods. Arthropods include animals such as centipedes, crabs, insects, and spiders. And with over a million species of arthropods, this means that the majority of animal species come from a group of critters that give most folks the creeps.



So, what exactly is an animal? With so much diversity among different animal species, it's difficult to imagine what they all might have in common. First, animals are "multicellular". In most animals, these cells are organized into tissues that make up different organs and organ systems. Second, all animals must get their food by eating other organisms. In addition, all animals require oxygen for their metabolism, can sense and respond to their environment, and have the capacity to reproduce sexually. During their development from a fertilized egg to adult,

all animals pass through a series of embryonic stages as part of their normal life cycle. Though frogs and humans don't look very much alike, we share many features in common during our embryonic phase.

Strange Organisms

Classifying organisms is often not easy. Like animals, some plants can eat other organisms to obtain nutrients. Some protists can use photosynthesis as plants do and can move around as animals do. The kingdom Animalia also includes members that might surprise you, such as worms, insect, and corals. Sponges are usually considered the simplest animals. They lack sense organs, and most of them cannot move. Scientists used to classify sponges as plants. But sponges cannot make their own food. They must eat other organisms to get nutrients, which is one reason that sponges are classified as animals.