

## **Bacteria Are Prokaryotes**

When scientists classify living things, they separate organisms into two groups. Eukaryotes are those organisms made up of eukaryotic cells. These complex cells have a cell nucleus that contains the DNA of the organism. They also have other organelles that perform various functions for the cell. Examples of eukaryotes include many of the living things you see around you, such as plants, animals, and fungi.

The second group is prokaryotes. Prokaryotes are made up of prokaryotic cells. These simple cells have DNA, but their DNA is not contained in a cell nucleus. The DNA strands are scattered throughout the cell, forming a loose tangle called a nucleoid. Rather than specialized organelles, their cells contain ribosomes. Most prokaryotes are bacteria.

## **The Smallest Organisms**

Bacteria are very tiny one-celled organisms. For many years, scientists did not even know these tiny organisms existed. However, the invention of the microscope changed that. Modern, powerful microscopes have allowed scientists to observe the structure and function of different types of bacteria.

Bacteria can have a variety of shapes, though most fall into one of three shape categories: rodlike, spherical, or spiral. They have a protective outer covering and a cell membrane that encloses the cell's cytoplasm. It is in this cytoplasm that the DNA and ribosomes float. Some bacteria have flagella—whiplike parts that help them move around.

## **Classifying Bacteria**

While scientists do use shape and motility (the ability to move) to differentiate one type of bacteria from another, they have also developed other ways to classify these microscopic organisms. One way is to classify them as gram-positive or gram-negative using a process called Gram's staining. In this process, bacteria



Bacteria come in a variety of shapes, including the rodlike appearance shown here, as well as spherical and spiral shapes.

cells are stained with a violet dye using a mixture of iodine and potassium iodide. Then a chemical decolorizer is added. Gram-negative bacteria will lose their color, while gram-positive bacteria remain violet. Red dye is then added, causing the decolorized cells to turn red, while the violet cells remain violet. The different reactions of bacteria to this process are due to the varied composition of their cell walls.

Another way bacteria are classified is by whether or not they require oxygen. Bacteria that need oxygen are *aerobic*. Bacteria that do not use oxygen are *anaerobic*. Some bacteria are *facultative anaerobes*, which means they use oxygen but can survive in conditions in which little or no free oxygen is available. The bacterium that causes salmonella, an infection people can get from undercooked eggs or poultry, is facultative.

### Helpful and Harmful Bacteria

Despite being the smallest of organisms, bacteria are very important. They are found in every environment and do an amazing variety of jobs. When you hear the word *bacteria*, you probably think of the small number of organisms that are harmful to humans—the kinds that give you a sore throat or an ear infection. Perhaps you think of the types of bacteria that cause milk or meat to spoil, or give people food poisoning. After all, bacteria cause cholera, tuberculosis, diphtheria, and some types of meningitis and pneumonia. However, the types of bacteria that people consider *pathogens*—harmful or disease-causing microorganisms—are not the only types of bacteria.

Many bacteria have important jobs in ecosystems. For example, some bacteria are decomposers. They consume dead organic matter in an environment, returning the nutrients to the environment for other organisms to use. Many of these bacteria live in the soil. Other bacteria live in plant



Bacteria in this compost pile will break down the dead plants. Nutrients from the dead plants will help other plants grow.

roots, helping the plants take up and use nitrogen—an essential nutrient for plants—from the soil.

How else do bacteria help us? We could not live without bacteria inside our bodies. Bacteria inside the digestive system help break down and digest food. Helpful bacteria are also used to produce many of the foods we love, including cheese, pickles, and yogurt. Scientists have even been developing special bacteria to clean up oil spills.

### **What Are Antibiotics?**

What happens when a harmful type of bacteria causes a health problem? For example, suppose you've been feeling bad for a few days, with a fever and a sore throat. You go to your doctor for a strep test. Your doctor does a throat culture—swabbing the inside of your throat to test for *Streptococcus*, the bacterium that causes strep throat.

If you test positive, your doctor may prescribe an antibiotic. These medicines only kill bacteria, so they won't help you fight a virus like the flu. Remember that a bacteria cell is a tiny organism. It has to perform certain functions to survive. Antibiotics work by blocking a bacteria cell's ability to perform essential life functions, such as releasing the energy in food. Individual antibiotics work in different ways because they block different functions and because every type of bacteria is different.



Cheese is one of the many foods that bacteria help us make.



Antibiotics may be prescribed in pill form or as a liquid suspension.