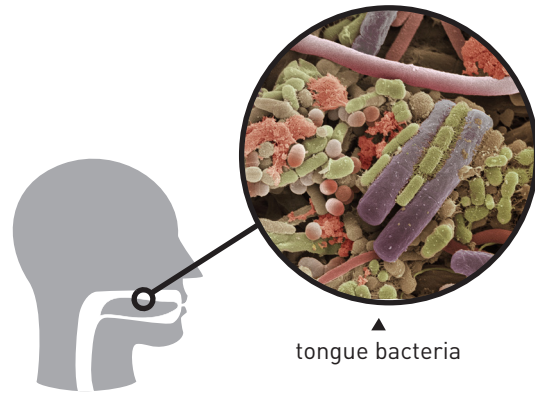


# The Human Microbiome

## *A World Inside You*

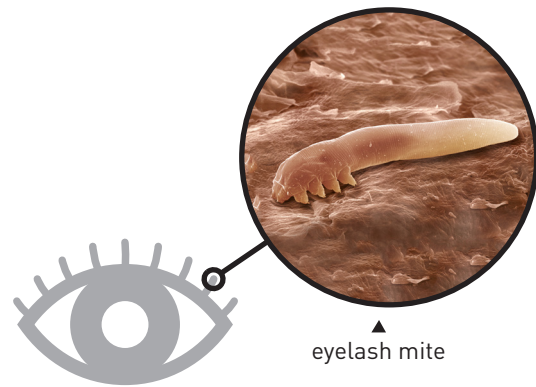
There's a world filled with strange creatures. The creatures of this world are invisible, and they're not human. Aliens sometimes threaten to invade the world these creatures call home. . .

This world is not a far-off planet: it's your body! The creatures are called **microorganisms**, and your body is home to more than 100 trillion of them. Microorganisms live on your skin, in your gut, in your nose and mouth, and pretty much everywhere else on and in your body.



tongue bacteria

Your tongue is covered with bacteria like the ones in this photo, taken through a microscope. Bacteria are some of the smallest microorganisms that live in and on your body: these bacteria are actually 10,000 times smaller than they look in this photo! The bacteria colored green in this photo are 1 micrometer long, about 100 times too small to see with the naked eye.



eyelash mite

This microorganism is an eyelash mite. It is harmless, and lives next to the roots of eyelashes. The photo was taken through a microscope, and shows the mite about 300 times larger than its actual size. This mite is about 210 micrometers in length. You might just barely be able to detect an eyelash mite with the naked eye in perfect conditions—if they weren't nearly transparent!

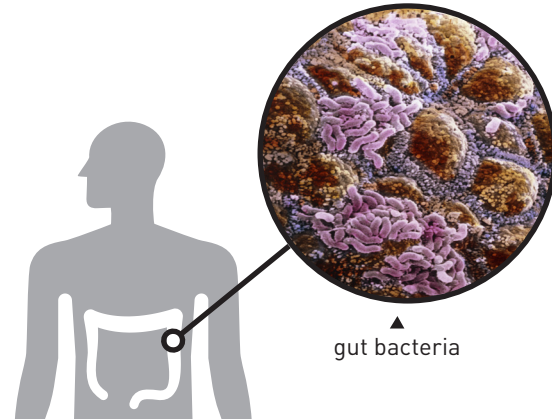
## Your Body: Home Sweet Home for Bacteria

The microorganisms living in and on your body range from fungus to eyelash mites, but most of them are **bacteria**. Bacteria are among the smallest microorganisms on Earth. Each one is made of a single **cell**—that’s the tiny structure that makes up all living things. However, bacteria are not all the same. They come in different shapes, use different things as food, and live in different places. Thousands of different kinds of bacteria live in your body.

Even though they are so tiny, bacteria are living things with the same basic needs that all living things share, such as food, warmth, and living space. The human body provides bacteria with all of these things, and that’s what makes our bodies such a good environment for bacteria. Another word for organisms living in an environment is *biome*, so we call the bacteria living in and on the human body the human **microbiome**. All together, the bacteria living in an average human’s microbiome weigh about 2 to 5 pounds. The number of bacteria in the microbiome of one human is millions of times greater than the number of people living on Earth!

### Helpful Bacteria and Alien Invaders

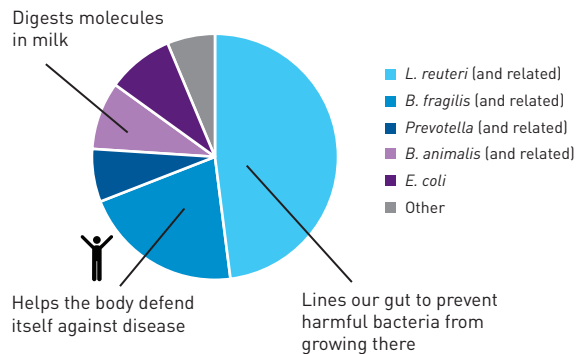
Most bacteria in the human microbiome are harmless. In fact, many bacteria do important jobs for the human body. For example, bacteria living in your gut (the stomach and intestines) help to break down food that your body can’t digest on its own. Other bacteria help protect your body from infection. In exchange for food and shelter, the bacteria of your microbiome do their part to keep you healthy. You depend on these bacteria, and they depend on you.



This microscope photo shows some bacteria in their natural environment: the human gut. The gut includes the intestines and stomach. In the photo, the bacteria appear 3,750 times larger than actual size. These bacteria are about 2 micrometers in length—nearly 50 times too small to even see, as even a speck.

### Chart 1: Bacteria in a Healthy Gut Microbiome

Total number of bacteria: about 90 trillion



This pie chart compares the relative amounts of different kinds of bacteria in the microbiome of a typical healthy human’s gut.

Unfortunately, not all bacteria are helpful. Harmful bacteria can invade the human microbiome through cuts, spoiled food, and even the air we breathe. An invasion of harmful bacteria is called an **infection**, and infections can make people very sick.

### Antibiotics and the Microbiome

Often, doctors treat infections with **antibiotics**. Antibiotics are medicines that kill bacteria. Antibiotics can stop dangerous infections, and they save millions of lives every year.

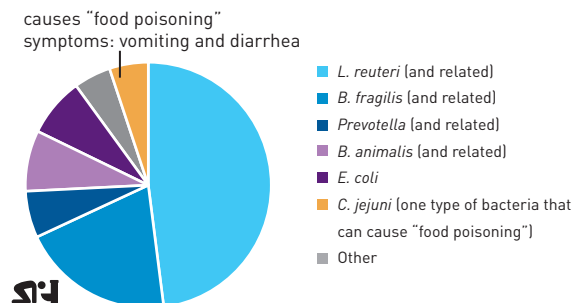
However, antibiotics don't just kill harmful bacteria—they kill helpful bacteria, too! A person who has just taken antibiotics has fewer bacteria than normal. Helpful bacteria will grow back in time, but often the bacteria that return are different from the ones that were there before. Taking antibiotics changes a person's microbiome.

### Your Own Little World

Your body is the whole world to the bacteria of your microbiome. It's their home and the environment that provides everything they need. What you do affects them, and they affect you too. Your body is a world in miniature—a microbiome.

**Chart 2: Gut Bacteria in a Person with a "Food Poisoning" Infection (*C. jejuni*)**

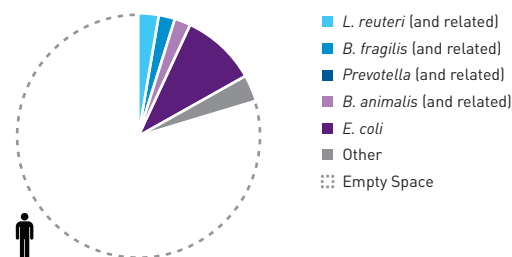
Total number of bacteria: about 90 trillion



What people call "food poisoning" isn't caused by poison: it's usually an infection with harmful bacteria such as *C. jejuni*.

**Chart 3: Reduced Gut Bacteria After Treatment with Antibiotics**

Reduced number of bacteria: ONLY about 5 trillion!



To treat harmful infections, antibiotics kill bacteria. After treatment with antibiotics, people have reduced numbers of bacteria in their microbiomes. In addition, they may have different types of bacteria than they did before.