

Human Microbiome: Your Body Is an Ecosystem

This StepRead is based on an article provided by the American Museum of Natural History.

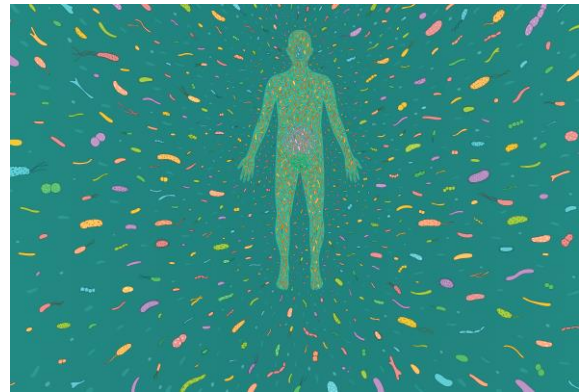
What Is an Ecosystem?

An ecosystem is a community of living things. The living things in an ecosystem interact with each other and with the non-living things around them. One example of an ecosystem is a forest. Every forest has a mix of living things, like plants and animals, and non-living things, like air, sunlight, rocks, and water. The mix of living and non-living things in each forest is unique. It is different from the mix of living and non-living things in any other ecosystem.

You Are an Ecosystem

The human body is also an ecosystem. There are trillions tiny organisms living in and on it. These organisms are known as microbes and include bacteria, viruses, and fungi. There are more of them living on just your skin right now than there are people on Earth. And there are a thousand times more than that in your gut!

All the microbes in and on the human body form communities. These communities are part of the ecosystem of the human body. Together, all of these communities are known as the human microbiome. No two human microbiomes are the same. Because of this, you are a *unique* ecosystem. There is no other ecosystem like your body.



The human body is an ecosystem. It is home to trillions of microbes.

Photo Credit: Gaby D'Alessandro/AMNH

Humans & Microbes

Microbes have been around for more than 3.5 billion years. That makes them the oldest form of life on Earth. For the past six million years they have been evolving together with humans. As they have changed over time, microbes and humans have formed complex relationships with each other. Humans need microbes to stay healthy, and microbes need the environments provided by the human body to survive.



Scientists study the human microbiome in a clean room so that other bacteria cannot come in.

Photo Credit: AMNH

Different species of microbes live in different places in and on the human body. Some live on the cool, dry skin of your knee. Others live in the warm, wet darkness inside your mouth. Wherever they are, they have evolved to live there.

Just like the plants and animals in a forest, the different kinds of microbes in and on your body interact with each other. They need these interactions in order to eat, grow, and reproduce. One way they interact is by competing. They compete with each other for space and resources, and some of this competition is helpful to us. For example, bacteria on our skin compete with the fungus that causes athlete's foot and keeps the fungus from infecting us. Microbes also keep other organisms from entering the human microbiome.

How Do Scientists Study the Human Microbiome?

How do scientists find out which organisms make up a human microbiome? They do experiments. Here is an example.

A scientist named James Meadow put people in a “clean room.” Microbes are *everywhere*, but this room was as free of microbes as possible. Scientists closed off the room and killed the microbes that were in it. They filtered the air to keep microbes from coming in from the outside. Then they divided the space into two rooms. One stayed empty. People entered the other room, one at a time. After each person left, the scientists took a sample of the air in the rooms. They repeated this experiment many times. They could tell not only which room had been occupied but also which person had been in the room. They would measure “clouds” of bacteria that had come off people's bodies in the room. They could identify different people by these “clouds” because every person's microbiome is unique.

Scientists are just beginning to understand what roles bacteria play in human health. Some kinds of bacteria benefit us, like gut bacteria that help us digest food. Others harm us, like bacteria that cause disease. Many do not benefit or harm us at all. In fact, most species are either harmless or beneficial to humans. If bacteria are harmless, scientists call them commensal. If they are beneficial, scientists call them mutualistic. Sometimes bacteria that are harmless or beneficial in one place can cause problems in another.



These bacteria can help protect our skin against fungi and yeast. But they can also cause infections and even deadly diseases.
Photo Credit: AMNH



This species of bacteria is usually found on human skin where it is harmless. But if it gets stuck in a hair follicle, it can cause acne.
Photo Credit: AMNH



***S. epidermis* is usually harmless, but it can cause infection if it gets into the body.**
Photo Credit: AMNH

The Human Microbiome and Antibiotics

Scientists are still learning about the balance among different bacterial communities as they study how microbes work in our bodies. One way they have learned about bacteria is by studying fungi. Fungi have been competing with bacteria for millions of years. During that time, fungi evolved the ability to produce chemicals that kill bacteria. By studying fungi, scientists learned how to make these antibacterial chemicals themselves and turn them into antibiotic drugs. These drugs have saved millions of lives by killing harmful bacteria. However, they also kill helpful bacteria. Products like antibacterial hand sanitizers have a similar effect on a patch of skin. They kill both the good and bad bacteria there. Studies suggest that the increasing use of antibiotics in the United States has made our microbiomes less diverse. There seem to be fewer kinds of bacteria living in them than there used to be.

Being Healthy Means Having a Balanced Microbiome

Scientists now understand that a diverse and balanced microbiome is important to a person's health. We need that diversity and balance for a strong immune system. Some scientists think that babies who do not have much contact with microbes get more allergies, asthma, eczema, and other health problems. Studies also suggest that the microbiome plays a role in obesity and depression. In fact, the microbiome is so important that it is like another organ. It is a part of the body that serves necessary functions, just as the skin and kidneys do.

Remember, the human body is an ecosystem. We need to preserve ecosystems in nature, and that includes our own. We need to preserve the human microbiome.