

# Your Gut Microbiome: How To Improve It, Its Effects on the Immune System, and More

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By Julie Grisham, Thursday, June 8, 2023



Dr. Marcel van den Brink is leading a number of different studies on how the gut microbiome affects health.

You may have heard the terms “gut microbiota” and “microbiome” and wondered what they mean and why they matter. Many researchers at Memorial Sloan Kettering Cancer Center (MSK) are studying how they influence the health of people with cancer and the general population, too.

Here, medical oncologist Marcel van den Brink, MD, PhD, answers common questions, including how your gut microbiota impacts your health, how to protect it, and the effect it has on diseases like cancer. Dr. van den Brink heads MSK’s Division of Hematologic Malignancies and holds the Alan N. Houghton Chair. He also leads a research lab in the Immunology Program of the Sloan Kettering Institute (SKI).

## What is the microbiota, and how is it different from the microbiome?

Your “microbiota” is the collection of all the microbes that live on and inside your body. These microbes include viruses, bacteria, and other microorganisms.

The “microbiome” refers to all the genes that make up those microorganisms. The microbiome is a more extensive system than you may realize. In fact, the number of genes in the microbiome is much greater than the number of genes from cells in your body.

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## How does the gut microbiota affect your immune system and overall health?

Those of us who study the gut microbiota often refer to it as the “forgotten organ.” It can have a huge impact on a person’s health. Some microbes are associated with disease. Others are important for good health.

Most microbiome research has focused on the microbiota in the gut, but some scientists are studying the microbiome in other parts of the body as well.

It’s an exciting time. Advances in DNA sequencing technology and computational biology over the past decade have dramatically boosted scientists’ ability to analyze and observe changes in the gut microbiota and the overall microbiome. This technology gives us a much better picture of what’s happening inside the body. And we are starting to look at how we may be able to build therapies around our understanding of the microbiota.

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## How does the microbiome affect the development of diseases, including cancer?

There is a strong connection between the microbiome and the immune system, our natural way of fighting disease. The microbiome plays a fundamental role in training the immune system, and likewise, the immune system keeps the microbiome in balance.

Inflammation triggered by the immune system is strongly linked to many common conditions, including heart disease, some neurological conditions, and certain types of cancer. That’s why it’s important to study the relationships between the microbiota and the immune system. Our findings could also help understand the causes of some autoimmune diseases as well as to learn how people respond to vaccines.

Some researchers are studying how the microbiota may directly influence the formation of cancer. We already know that certain microbes contribute to cancer. For example, the human papillomavirus (HPV) causes many cancers of the cervix, anus, and head and neck. The bacteria *Helicobacter pylori* (*H. pylori*) has been implicated in many stomach cancers. It’s possible there are other connections we don’t yet know about.

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## What does it mean to have a healthy gut microbiota?

We still have so much to learn about which microbial species are the most beneficial for health and how to repair a microbiota that’s been damaged. It’s a complicated system.

But we know that a healthy microbiota is one that is as diverse as the Amazon rainforest — it contains many, many different species. This diversity prevents the domination of certain species that are harmful, including *Clostridioides difficile* (*C. diff*) infections and antibiotic-resistant *Enterococcus* infections. When these species take over, it can be life-threatening.

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## How can you improve and maintain a healthy microbiome?

Eating a healthy diet can help improve your microbiota. This means eating a diet with lots of fruits, vegetables, and fiber. Fiber supports the growth of many beneficial species in the gut.

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## Can taking probiotics improve your microbiota?

Many stores sell probiotics that claim to heal or restore your microbiota. But we don’t know enough about the microbiota to know all the species that are needed for a healthy balance. Also, the over-the-counter probiotic supplements that are currently sold do not contain the types of strains that are the most important contributors to the gut microbiota, called anaerobic bacteria.

For people whose immune systems are suppressed, including those recovering from stem cell and bone marrow transplants (BMTs), these probiotic products may actually be harmful. You should always talk to your doctor before taking a probiotic.

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## How does the gut microbiota affect people with cancer?

I am a blood cancer doctor interested in improving the outcomes of my patients who are receiving BMTs. When these transplants use donor cells (known as allogeneic), sometimes those donor cells attack healthy tissues in the patient. This is called graft-versus-host disease (GVHD). My research has found that protecting the gut microbiota in transplant patients can prevent GVHD and therefore improve their health.

In 2009, we united a group of investigators from across MSK — including clinical researchers and scientists at SKI — to launch a project to collect stool samples from patients having transplants. These samples allow us to study connections between the food and medication that goes into a person’s body, how they change the microbiota, and whether they contribute to GVHD and other clinically relevant outcomes. We now have about 100 scientists working on this project and other microbiome studies at MSK.

In addition, part of the BMT process requires wiping out a patient’s immune cells, in order for them to be replaced by a new immune system from a donor. This process offers a unique window to observe how the microbiota and the immune system interact with each other.

We are now expanding this project to study how the gut microbiome impacts patients’ responses to treatments with immunotherapy, including CAR T therapy and immune checkpoint drugs.

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## What has MSK learned about protecting the gut microbiota of people who have cancer?

- Antibiotics should be prescribed carefully. Transplant patients receive a lot of antibiotics, which can damage the harmless species of microbes in their guts and lower the diversity of the microbiota overall, allowing more dangerous strains to take over. Our studies have shown that patients with a more diverse microbiota do better after their transplants and have lower rates of GVHD.
- Diet plays a role in your microbiome. One study in mice found that animals that consume lactose (a sugar that’s naturally found in milk and dairy products) have higher levels of the harmful bacteria *Enterococcus* in their guts, which resulted in an increased risk of GVHD.
- We are studying currently whether fecal microbiota transplants may help patients who have received bone marrow transplants.

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## Besides antibiotics, do other medications also affect the gut microbiome?

Yes. Other drugs affecting the microbiome include laxatives, medicines for nausea, and opioids, according to a study led by Chi Nguyen, a talented graduate student in my lab, that was published June 8, 2023, in *Cell*.

We found that people who received certain drugs had higher levels of harmful microbes like *Enterococcus*. They did not do as well after their transplants. This research is another reason why studying all the effects of common medications is important for improving patient outcomes after BMTs.

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## Should people who don’t have cancer be concerned about how antibiotics affect the gut microbiome?

We have learned that one of the most important things you can do to preserve the diversity of your gut flora is to avoid unnecessary antibiotics. That’s because antibiotics can kill off much of the essential or harmless bacteria living in your gut. However, transplant patients and people with cancer in general will sometimes need to be treated with broad-spectrum antibiotics, especially when they are immunocompromised. We are currently performing a study in transplant patients to compare broad-spectrum antibiotics and determine which do less or more damage to your healthy gut flora.

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