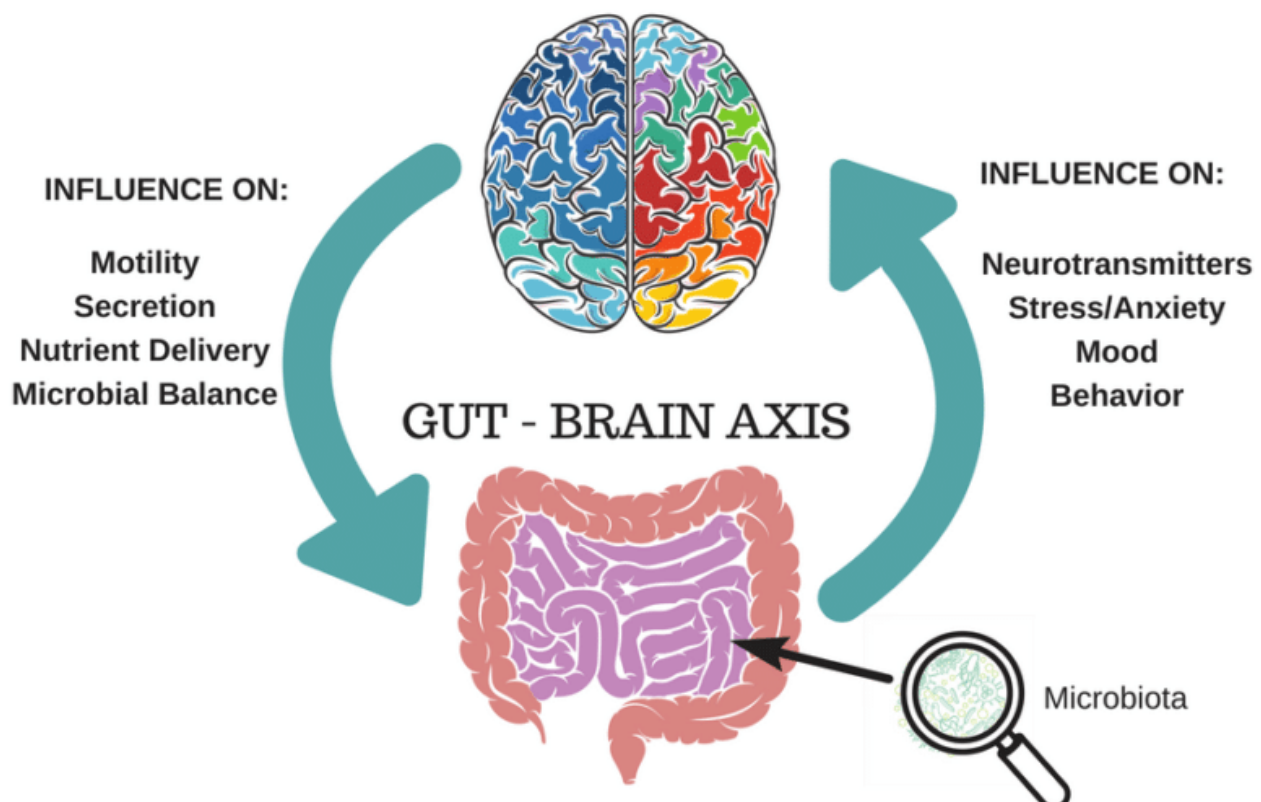


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Source: Healthline

The Gut-Brain Connection: How it Works and The Role of Nutrition



Have you ever had a gut feeling or butterflies in your stomach? These sensations emanating from your belly suggest that your brain and gut are connected.

What's more, recent studies show that your brain affects your gut health, and your gut may even affect your brain health.

The communication system between your gut and brain is called the gut-brain axis.

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The Vagus Nerve and the Nervous System

Neurons are cells found in your brain and central nervous system that tell your body how to behave. There are approximately 100 billion neurons in the human brain.

Interestingly, your gut contains 500 million neurons, which are connected to your brain through nerves in your nervous system.

The Vagus nerve is one of the biggest nerves connecting your gut and brain. It sends signals in both directions.

In animal studies, stress inhibits the signals sent through the Vagus nerve and also causes gastrointestinal problems. A study in humans found that people with irritable bowel syndrome (IBS) or Crohn's disease had reduced vagal tone, indicating a reduced function of the Vagus nerve.

Another study in mice found that feeding them a probiotic reduced the amount of stress hormone in their blood. However, when their Vagus nerve was cut, the probiotic had no effect. This suggests that the Vagus nerve is important in the gut-brain axis and its role in stress.

Neurotransmitters

Your gut and brain are also connected through chemicals called neurotransmitters. Neurotransmitters produced in the brain control feelings and emotions.

For example, the neurotransmitter serotonin contributes to feelings of happiness and also helps control your body clock.

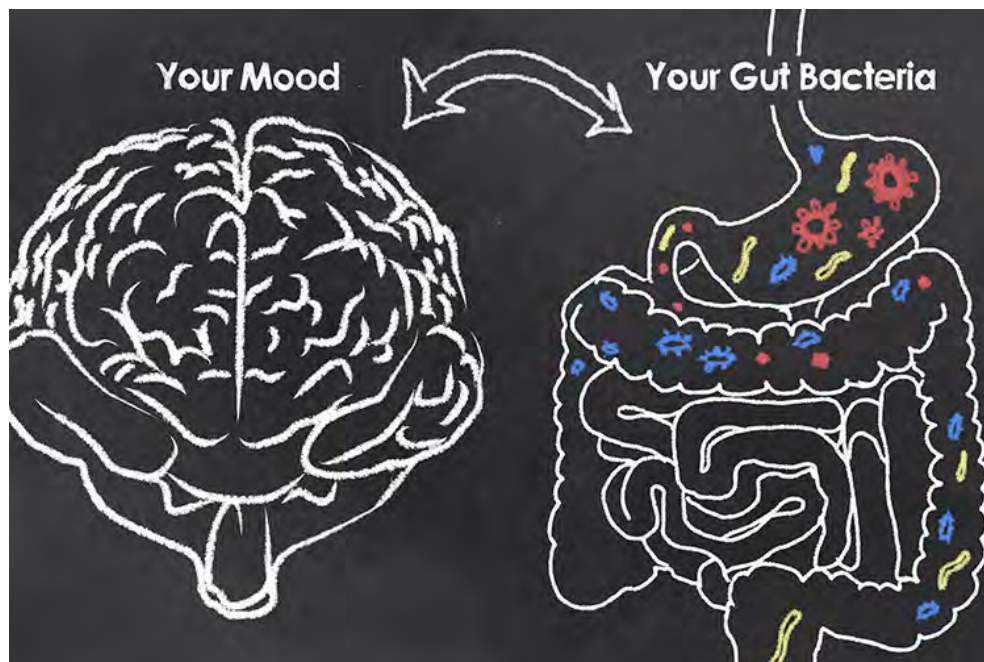
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Interestingly, many of these neurotransmitters are also produced by your gut cells and the trillions of microbes living there. A large proportion of serotonin is produced in the gut.

Your gut microbes also produce a neurotransmitter called gamma-aminobutyric acid (GABA), which helps control feelings of fear and anxiety.

Studies in laboratory mice have shown that certain probiotics can increase the production of GABA and reduce anxiety and depression-like behavior.



Gut Microbes Make Other Chemicals That Affect the Brain

The trillions of microbes that live in your gut also make other chemicals that affect how your brain works. Your gut microbes produce lots of short-chain fatty acids (SCFA) such as butyrate, propionate and acetate.

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They make SCFA by digesting fiber. SCFA affect brain function in a number of ways, such as reducing appetite.

One study found that consuming propionate can reduce food intake and reduce the activity in the brain related to reward from high-energy food.

Another SCFA, butyrate, and the microbes that produce it are also important for forming the barrier between the brain and the blood, which is called the blood-brain barrier.

Gut microbes also metabolize bile acids and amino acids to produce other chemicals that affect the brain. Bile acids are chemicals made by the liver that are normally involved in absorbing dietary fats. However, they may also affect the brain.

Two studies in mice found that stress and social disorders reduce the production of bile acids by gut bacteria and alter the genes involved in their production.



Gut Microbes Affect Inflammation

Your gut-brain axis is also connected through the immune system. Gut and gut microbes play an important role in your immune system and inflammation by controlling what is passed into the body and what is excreted.

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If your immune system is switched on for too long, it can lead to inflammation, which is associated with a number of brain disorders like depression and Alzheimer's disease.

Lipopolysaccharide (LPS) is an inflammatory toxin made by certain bacteria. It can cause inflammation if too much of it passes from the gut into the blood. This can happen when the gut barrier becomes leaky, which allows bacteria and LPS to cross over into the blood.

Inflammation and high LPS in the blood have been associated with a number of brain disorders including severe depression, dementia and schizophrenia.

Probiotics, Prebiotics, and the Gut-Brain Axis

Gut bacteria affect brain health, so changing your gut bacteria may improve your brain health. Probiotics are live bacteria that impart health benefits if eaten. However, not all probiotics are the same.

Probiotics that affect the brain are often referred to as “psychobiotics.”.

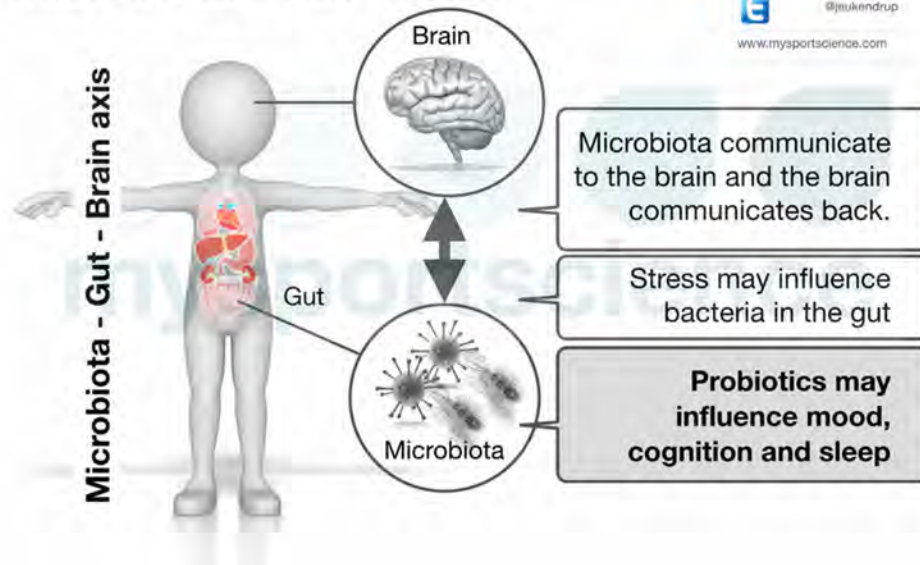
Some probiotics have been shown to improve symptoms of stress, anxiety and depression.

One small study of people with irritable bowel syndrome and mild-to-moderate anxiety or depression found that taking a probiotic called *Bifidobacterium longum* NCC3001 for six weeks significantly improved symptoms.

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Connections between Microbiota - Gut - Brain



Prebiotics, which are typically fibers that are fermented by your gut bacteria may also affect brain health.

One study found that taking a prebiotic called galactooligosaccharides for three weeks significantly reduced the amount of stress hormone in the body, called cortisol.

Foods that are specifically beneficial for the gut-brain axis.

Omega-3 fats: These fats are found in oily fish and also in high quantities in the human brain. Studies in humans and animals show that omega-3s can increase good bacteria in the gut and reduce risk of brain disorders.

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Fermented foods: Yogurt, kefir, sauerkraut and cheese all contain healthy microbes such as lactic acid bacteria. Fermented foods have been shown to alter brain activity.

High-fiber foods: Whole grains, nuts, seeds, fruits and vegetables all contain prebiotic fibers that are good for your gut bacteria. Prebiotics can reduce stress hormone in humans.

Polyphenol-rich foods: Cocoa, green tea, olive oil and coffee all contain polyphenols, which are plant chemicals that are digested by your gut bacteria. Polyphenols increase healthy gut bacteria and may improve cognition.



Tryptophan-rich foods: Tryptophan is an amino acid that is converted into the neurotransmitter serotonin. Foods that are high in tryptophan include turkey, eggs, and cheese.