**Your Gut Bacteria Affects Your Brain Function, Study Confirms**

* The secret to improving your mood and brain health is in your gut, as unhealthy gut flora can impact your mental health, potentially leading to issues like anxiety, depression, autism and more
* A recent proof-of-concept study found that women who regularly ate yogurt containing beneficial bacteria had altered brain function compared to those who did not consume probiotics
* Just as you have neurons in your brain, you also have neurons in your gut -- including neurons that produce neurotransmitters like serotonin, which is also found in your brain and is linked to mood
* Limiting sugar, eating traditionally fermented foods, and taking a probiotic supplement are among the best ways to optimize your gut flora and subsequently support your brain health and normalize your mood

The bacteria, fungi, viruses and other microorganisms that comprise your body’s microflora actually outnumber your body’s cells 10 to 1, and it’s now becoming increasingly clear that these tiny organisms play a MAJOR role in your health—both physical and mental.

The impact of your [microflora](http://articles.mercola.com/sites/articles/archive/2012/10/01/gut-bacteria-on-fat-absorption.aspx) on your brain function has again been confirmed by UCLA researchers who, in a proof-of-concept study, found that probiotics (beneficial bacteria) indeed altered the brain function in the participants.

As reported by UCLA:[1](http://articles.mercola.com/sites/articles/archive/2013/06/20/gut-brain-connection.aspx?e_cid=20130620_DNL_ProdTest2_art_1&utm_source=dnl&utm_medium=email&utm_content=art1&utm_campaign=20130620ProdTest2#_edn1)

*"Researchers have known that the brain sends signals to your gut, which is why stress and other emotions can contribute to gastrointestinal symptoms. This study shows what has been suspected but until now had been proved only in animal studies: that signals travel the opposite way as well.*

*'Time and time again, we hear from patients that they never felt depressed or anxious until they started experiencing problems with their gut,' [Dr. Kirsten]* *Tillisch said. 'Our study shows that the gut–brain connection is a two-way street.'"*

The study, published in the peer-reviewed journal *Gastroenterology,*[2](http://articles.mercola.com/sites/articles/archive/2013/06/20/gut-brain-connection.aspx?e_cid=20130620_DNL_ProdTest2_art_1&utm_source=dnl&utm_medium=email&utm_content=art1&utm_campaign=20130620ProdTest2#_edn2) claims the discovery “carries significant implications for future research that could point the way toward dietary or drug interventions to improve brain function.” Naturally, I urge you to embrace dietary changes here, opposed to waiting for some “miracle drug” to do the work for you...

**Yes, Your Diet Affects Your Brain Function**

The study enlisted 36 women between the ages of 18 and 55 who were divided into three groups:

* The treatment group ate yogurt containing several probiotics thought to have a beneficial impact on intestinal health, twice a day for one month
* Another group ate a “sham” product that looked and tasted like the yogurt but contained no probiotics
* Control group ate no product at all

Before and after the four-week study, participants’ underwent functional magnetic resonance imaging (fMRI) scans, both while in a state of rest, and in response to an “emotion-recognition task.” For the latter, the women were shown a series of pictures of people with angry or frightened faces, which they had to match to other faces showing the same emotions.

*“This task, designed to measure the engagement of affective and cognitive brain regions in response to a visual stimulus, was chosen because previous research in animals had linked changes in gut flora to changes in affective behaviors,”* UCLA explains.

Interestingly, compared to the controls, the women who consumed probiotic yogurt had decreased activity in two brain regions that control central processing of emotion and sensation:

* The insular cortex (insula), which plays a role in functions typically linked to emotion (including perception, motor control, self-awareness, cognitive functioning, and interpersonal experience) and the regulation of your body's homeostasis, and
* The somatosensory cortex, which plays a role in your body’s ability to interpret a wide variety of sensations

During the resting brain scan, the treatment group also showed greater connectivity between a region known as the “periaqueductal grey” and areas of the prefrontal cortex associated with cognition. In contrast, the control group showed greater connectivity of the periaqueductal grey to emotion- and sensation-related regions. According to UCLA:

*“'The researchers were surprised to find that the brain effects could be seen in many areas, including those involved in sensory processing and not merely those associated with emotion,' Tillisch said...*

*'There are studies showing that what we eat can alter the composition and products of the gut flora — in particular, that people with high-vegetable, fiber-based diets have a different composition of their microbiota, or gut environment, than people who eat the more typical Western diet that is high in fat and carbohydrates,' [senior author Dr. Emeran] Mayer said. 'Now we know that this has an effect not only on the metabolism but also affects brain function.'"*

What is really remarkable to me is that this study showed any improvement at all, since they used commercial yogurt preparations that are notoriously unhealthy foods loaded with [artificial sweeteners](http://articles.mercola.com/sites/articles/archive/2009/10/13/artificial-sweeteners-more-dangerous-than-you-ever-imagined.aspx), colors, flavorings, and sugar. Most importantly the vast majority have virtually clinically insignificant levels of beneficial bacteria. Clearly, you would be far better off making your own yogurt from [raw milk](http://www.mercola.com/forms/raw_milk_cow_sharing.htm).

**Your Gut May Hold the Key to Better Brain Health**

You may not be aware that you actually have two nervous systems:

* Central nervous system, composed of your brain and spinal cord
* Enteric nervous system, which is the intrinsic nervous system of your gastrointestinal tract

Both are created from identical tissue during fetal development—one part turns into your central nervous system while the other develops into your enteric nervous system. These two systems are connected via the vagus nerve, the tenth cranial nerve that runs from your brain stem down to your abdomen. It is now well established that the vagus nerve is the primary route your gut bacteria use to transmit information to your brain.

While many think of their brain as the organ in charge, your gut actually sends far more information to your brain than your brain sends to your gut... To put this into more concrete terms, you've probably experienced the visceral sensation of butterflies in your stomach when you're nervous, or had an upset stomach when you were very angry or stressed. The flip side is also true, in that problems in your gut can directly impact your mental health, leading to issues like anxiety and depression.

For instance, in December 2011, the *Journal of Neurogastroenterology and Motility*[3](http://articles.mercola.com/sites/articles/archive/2013/06/20/gut-brain-connection.aspx?e_cid=20130620_DNL_ProdTest2_art_1&utm_source=dnl&utm_medium=email&utm_content=art1&utm_campaign=20130620ProdTest2#_edn3) reported the novel finding that the probiotic (good bacteria) known as Bifidobacterium longum NCC3001 has been shown to help normalize anxiety-like behavior in mice with infectious colitis. Separate research[4](http://articles.mercola.com/sites/articles/archive/2013/06/20/gut-brain-connection.aspx?e_cid=20130620_DNL_ProdTest2_art_1&utm_source=dnl&utm_medium=email&utm_content=art1&utm_campaign=20130620ProdTest2#_edn4) also found the probiotic Lactobacillus rhamnosus had a marked effect on GABA (an inhibitory neurotransmitter that is significantly involved in regulating many physiological and psychological processes) levels in certain brain regions and lowered the stress-induced hormone corticosterone, resulting in reduced anxiety- and depression-related behavior.

Just as you have neurons in your brain, you also have neurons in your gut -- including neurons that produce neurotransmitters like serotonin, which is also found in your brain. In fact, the greatest concentration of serotonin, which is involved in mood control, depression and aggression, is found in your *intestines*, not your brain. It’s quite possible that this might be one reason why [antidepressants](http://articles.mercola.com/sites/articles/archive/2011/03/07/reversing-depression-without-antidepressants.aspx), which raise serotonin levels in your *brain*, are often ineffective in treating depression, whereas proper dietary changes often help...

**Your Gut Microbes Can Affect Your Health in Numerous Ways**

In recent years, it’s become increasingly clear that the microbes in your gut play a much more vital role in your health than previously thought possible. In fact, probiotics, along with a host of other gut microorganisms, are so crucial to your health that researchers have compared them to "a newly recognized organ." Besides research implicating gut bacteria in mental health and behavior, other research has shown that your microbiota also has an impact on:

1. **Immune system function:** Biologist Sarkis Mazmanian[5](http://articles.mercola.com/sites/articles/archive/2013/06/20/gut-brain-connection.aspx?e_cid=20130620_DNL_ProdTest2_art_1&utm_source=dnl&utm_medium=email&utm_content=art1&utm_campaign=20130620ProdTest2#_edn5) believes bacteria can train your immune system to distinguish between "foreign" microbes and those originating in your body. His work is laying the groundwork for new therapies using probiotics to treat a variety of diseases, particularly autoimmune diseases such as multiple sclerosis and Alzheimer's.

Mazmanian and colleagues were recently awarded the MacArthur Foundation "genius grant" for identifying an organism that originates in the human body (opposed to a fermented food) that has demonstrable health benefits in both animal and human cells. The organism has been named *Bacteroides fragillis*, and is found in 15-20 percent of humans. His group hopes to one day be able to test this body-originated bacteria in human clinical trials.

1. **Gene expression:** Researchers have discovered that the absence or presence of gut microorganisms during infancy permanently alters gene expression. Through gene profiling, they were able to discern that absence of gut bacteria altered genes and signaling pathways involved in learning, memory, and motor control. This suggests that gut bacteria are closely tied to early brain development and subsequent behavior. These behavioral changes could be reversed as long as the mice were exposed to normal microorganisms early in life. But once the germ-free mice had reached adulthood, colonizing them with bacteria did not influence their behavior.

In a similar way, [probiotics](http://articles.mercola.com/sites/articles/archive/2010/10/11/probiotics-healing-power-impresses-researchers.aspx) have also been found to influence the activity of hundreds of your genes, helping them to express in a positive, disease-fighting manner.

1. **Diabetes:** Bacterial populations in the gut of diabetics[6](http://articles.mercola.com/sites/articles/archive/2013/06/20/gut-brain-connection.aspx?e_cid=20130620_DNL_ProdTest2_art_1&utm_source=dnl&utm_medium=email&utm_content=art1&utm_campaign=20130620ProdTest2#_edn6) differ from non-diabetics, according to a study from Denmark. In particular, diabetics had fewer Firmicutes and more plentiful amounts of Bacteroidetes and Proteobacteria, compared to non-diabetics. The study also found a positive correlation for the ratios of Bacteroidetes to Firmicutes and reduced glucose tolerance. The researchers concluded:

*"The results of this study indicate that type 2 diabetes in humans is associated with compositional changes in intestinal microbiota."*

1. **Obesity:** The make-up of gut bacteria tends to differ in lean vs. obese people. This is one of the strongest areas of probiotic research to date, and you can read about a handful of such studies [here](http://articles.mercola.com/sites/articles/archive/2011/06/18/good-gut-bacteria-may-help-fight-obesity.aspx). The bottom line is that restoring your gut flora should be an important consideration if you're struggling to lose weight.
2. **Autism:** Establishment of normal gut flora in the first 20 days or so of life plays a crucial role in appropriate maturation of your baby's immune system. Hence, babies who develop abnormal gut flora are left with compromised immune systems and are particularly at risk for developing such disorders as ADHD, learning disabilities and autism, particularly if they are vaccinated *before* restoring balance to their gut flora.

To get a solid understanding of just how this connection works, I highly recommend reviewing the information shared by [Dr. Natasha Campbell-McBride in this previous interview](http://articles.mercola.com/sites/articles/archive/2011/07/31/dr-natasha-campbell-mcbride-on-gaps-nutritional-program.aspx).