

# Scientists Find Direct Link Between Brain and Immune System

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Addendum by; Dr. Jewel Pookrum

By Dr. Mercola

A new discovery by a team of researchers from the University of Virginia (UVA) “may call for a reassessment of basic assumptions in neuroimmunology” (a field involved in the study of the nervous system and the immune system).<sup>1</sup>

A direct link between the brain and the immune system, via lymphatic vessels that were not previously known to exist, was found. Similar to blood vessels, which carry blood throughout your body, lymphatic vessels carry immune cells throughout your body.

However, it was long believed that such vessels stopped before reaching the brain. The new discovery, which detected lymphatic vessels beneath a mouse’s skull, could open new avenues for understanding autism, [multiple sclerosis](#), Alzheimer’s, and many other diseases.

It’s becoming increasingly clear that your brain, your immune system *and* your gut microbes are intricately linked. Autism, for instance, is associated with gastrointestinal problems and potentially an over-reaction in the immune system. As reported by *io9*:<sup>2</sup>

*“Moreover, neurological diseases like multiple sclerosis and Alzheimer’s have long been linked to changes in immune system function, and autoimmune diseases of the gut, like Crohn’s disease, correlate with psychiatric illness.”*

It wasn’t always clear how such connections occurred, but now both a gut-brain axis and a pathway from your immune system into your brain have been uncovered.

## ‘They’ll Have to Change the Textbooks’

This was the reaction of Kevin Lee, PhD, chairman of the UVA Department of Neuroscience, when he heard of the new finding.<sup>3</sup> The lymphatic vessels were detected in the meninges, the protective membranes that cover the brain, and found to closely follow blood vessels.

The study’s lead author, Jonathan Kipnis, a professor in UVA’s Department of Neurosciences and the director of UVA’s Center for Brain Immunology, highlighted the importance of the discovery:<sup>4</sup>

*“We believe that for every neurological disease that has an immune component to it, these vessels may play a major role. Hard to imagine that these vessels would not be involved in a [neurological] disease with an immune component...”*

*In Alzheimer’s [for example], there are accumulations of big protein chunks in the brain. We think they may be accumulating in the brain because they’re not being efficiently removed by these vessels.”*

It makes sense. Why *wouldn’t* your brain have a direct conduit to your immune system, after all? And there have been clues along the way. The brain was once considered to be free of normal immune surveillance, which was thought to be necessary, for starters, because swelling (a normal immune response) inside the brain can be deadly.

However, considering the brain “immune privileged” was overly simplistic. According to *io9*:<sup>5</sup>

*“Careful studies have shown that the brain does interact with the peripheral immune system, albeit in unique ways. Immune cells do, somehow, circulate through the brain, and antigens—which would normally stoke an immune response—do drain from the brain into the lymph nodes.”*

The newly discovered lymphatic vessels in the brain indeed suggest there’s an intimate and essential connection between the brain and the immune system that is only beginning to be uncovered.

## **Microbes in Your Gut Influence Your Brain, Too**

It’s not only your immune system that has a direct line to your brain. Your gut, which is teeming with microbial life, also communicates with your brain, via what’s known as the “gut-brain axis.”

In fact, in addition to the brain in your head, embedded in the wall of your gut is your enteric nervous system (ENS), which works both independently of and in conjunction with the brain in your head.

This communication between your “two brains” runs both ways and is the pathway for how foods affect your mood or why anxiety can make you sick to your stomach, for instance. However, this gut-brain connection is about far more than just comfort food or butterflies in your stomach. According to *Scientific American*:<sup>6</sup>

*“The gut-brain axis seems to be bidirectional—the brain acts on gastrointestinal and immune functions that help to shape the gut’s microbial makeup, and gut microbes make neuroactive compounds, including neurotransmitters and metabolites that also act on the brain.”*

This also explains why changes in your gut bacteria are linked to brain disorders and more, including depression. Jane Foster, PhD, an associate professor of psychiatry and behavioral

neurosciences at McMaster University, described to *Medicine Net* the multiple ways your [gut microbes](#) communicate with your brain:<sup>1</sup>

*“One is via the enteric nervous system, the part of the nervous system that governs the digestive tract. Also, gut bacteria can alter how the immune system works, which can affect the brain. The gut bacteria are involved in digestion, too, and the substances they make when they break down food can affect the brain.*

*And under certain conditions, such as stress or infection, potentially disease-causing gut bacteria, or bad bugs, can leak through the bowel wall and enter the bloodstream, enabling them and the chemicals they make to talk with the brain through cells in blood vessel walls.*

*Bacteria could also communicate directly with cells in certain regions of the brain, including those located near areas involved in stress and mood...”*

## **Altering Your Gut Bacteria May Influence Your Mood**

A study published in the peer-reviewed journal *Gastroenterology* enlisted 36 women between the ages of 18 and 55 who were divided into three groups:<sup>2</sup>

- 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 explained.<sup>2</sup>

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
- 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.

## ‘Psychobiotics’ for Better Mental Health?

The research is growing showing that your body’s brain and microbes are intricately linked. In December 2011, the *Journal of Neurogastroenterology and Motility* reported the novel finding that the probiotic known as *Bifidobacterium longum* NCC3001 may help normalize anxiety-like behavior in mice with infectious colitis.<sup>10</sup>

Separate research 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.<sup>11</sup>

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.

Psychobiotics or “bacteria for your brain” are even being used to successfully treat depression, [anxiety](#), and other psychiatric problems,<sup>12</sup> although more research is needed to determine which probiotics, and in what doses, work best for different mood disorders.

Currently, researchers are exploring so-called “magic bullet” antibiotics that are able to target specific “bad” bacteria while leaving good bugs unharmed. [Fecal transplants](#) are also being increasingly explored as a way to achieve a healthy microbial balance.

## The Inflammatory Connection Between Your Gut and Your Brain

Your gut is also the starting point for [inflammation](#)—it’s actually the gatekeeper for your inflammatory response. According to psychoneuroimmunologist Kelly Brogan, your gut’s microorganisms trigger the production of cytokines. Cytokines are involved in regulating your immune system’s response to inflammation and infection. Much like hormones, cytokines are signaling molecules that aid cell-to-cell communication, telling your cells where to go when your inflammatory response is initiated.

Most of the signals between your gut and your brain travel along your vagus nerve—about 90 percent of them.<sup>13</sup> Vagus is Latin for “wandering,” aptly named as this long nerve travels from your skull down through your chest and abdomen, branching to multiple organs. Cytokine

messengers produced in your gut cruise up to your brain along the “vagus nerve highway.” Once in your brain, the cytokines tell your microglia (the immune cells in your brain) to perform certain functions, such as producing neurochemicals.

Some of these have negative effects on your mitochondria, which can impact energy production and apoptosis (cell death), as well as adversely impacting the very sensitive feedback system that controls your stress hormones, including cortisol. So, this inflammatory response that *started in your gut* travels to your brain, which then builds on it and sends signals to the rest of your body in a complex feedback loop. The take-home message is this: your body’s parts are intricately connected, and the health of your *gut* is of utmost importance to the health of your brain *and* that of your immune system.

## ‘Nutritional Psychiatry’ for Your Brain Health

Coming back full-circle to your brain health, consuming naturally [fermented foods](#) is one of the best ways to optimize your microbiome, which in turn may optimize the health of your brain. Fermented foods are also a key component of the [GAPS](#) protocol, a diet designed to heal and seal your gut. Scientific studies have revealed a positive-feedback loop between the foods you crave and the composition of your microbiome, which depends on those nutrients for survival. So, if you’re craving sugar and refined carbohydrates, you may actually be feeding a voracious army of [Candida](#)!

Once you’ve begun eliminating foods that damage your beneficial flora, start incorporating fermented foods such as sauerkraut, naturally fermented pickles, miso, tempeh, and fermented dairy made from raw, unpasteurized grass-fed milk (yogurt, kefir, etc.). These probiotic-foods will help heal, repopulate, and “re-educate” your gut. An article in the *Journal of Physiological Anthropology* makes the case that properly controlled fermentation amplifies the specific nutrient and phytochemical content of foods, thereby improving brain health, both physical and mental. The authors wrote:<sup>14</sup>

*“The consumption of fermented foods may be particularly relevant to the emerging research linking traditional dietary practices and positive mental health. The extent to which traditional dietary items may mitigate inflammation and oxidative stress may be controlled, at least to some degree, by microbiota.”*

They go on to say that the microbes associated with fermented foods (for example, *Lactobacillus* and *Bifidobacteria* species) may also influence your brain health via direct and indirect pathways, which paves the way for new scientific investigations in the area of “nutritional psychiatry.” Developing a [healthy gut flora begins at birth](#). Childbirth and breastfeeding set the stage for what organisms are going to inhabit your baby’s body. Therefore, if you’re a mother-to-be, it’s important that you optimize your own microflora, as you will be passing it along to your child.

The good news is, [fermented vegetables](#) are easy to make in your own kitchen. They are also the most cost-effective way to get high-quality probiotics in your diet. Your goal should be to consume one-quarter to one-half cup of fermented veggies with each meal, but you may need to

work up to this amount. Consider starting with just a teaspoon or two a few times a day, and increase as tolerated.

If that is too much (perhaps your body is severely compromised), you can even begin by drinking a teaspoon of the brine from the fermented veggies, which is rich in the same beneficial microbes. You may also want to consider a [high-potency probiotic supplement](#), but realize that there is no substitute for the real food.

## **Addendum**

**Weak and persistent fluctuation of immune health within the Hueman population is one of most severe and chronic health conditions of these societies. Immune system dysfunction, to this day, continues to be inappropriately treated. The cause of chronic immune deficiency disorders in huemans is due to the incomplete development and total UNDER USE of the entire brain and its peripheral nervous system.**

**The environment created by modern technologically advanced societies, do not support full maturation and development of the brain and nervous systems of its members. This has occurred due to the intense insertion of artificial constructs into the social, religious, work, entertainment and political systems composing these societies. These constructs are imposed to regulate hueman behavior and thinking by mechanical mechanisms such as; clocks, error based calendars and prolonged inappropriate exposures to artificial wavelengths of light.**

**By the time a new born infant is reared in a modern industrial society and reaches 18-21 years of age; the Brain and nervous system has only matured by 5-10 percent of its capacity. In these modern societies it is well accepted by the adult population that adults functioning with the use of only 10-15% of their brain capacity is common and acceptable.**

**This is the salient and occult reason why industrial civilizations have the greatest amount of illnesses and chronic disease disorders of all types.**

**Change the brain and you will change your life and completely enhance the functionality of the immune system.**

**The observation of specific Sacred Geometric configurations will initiate, redesign, and complete the development and full integration of the hueman brain and its peripheral nervous system.**

**Please contact the J.E.W.E.L. University of Immortal Sciences for Immortal Living (JUIS).**

**[www.juis.education](http://www.juis.education)**

**Dr. Jewel Pookrum, Dean**

**J.U.I.S.College of Neuro Science & Neuro-redesign**