



# Healthy and Happy Monthly Newsletter

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#8 Crestwood Executive Center · St. Louis, Missouri 63126 Tel: 314-849-3123

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## The Brain-Gut-Axis:

### Think Again before You Dismiss that Gut Feeling; Because Two Brains are better than One.

From Olympians competing on the world stage, to a first date, and even a grade school child presenting a book report, most of us are familiar with feeling “butterflies” in the stomach. As it turns out, there are complex physiological explanations for this sensation, which is part of our evolution and survival. Herein lays the internal world of the brain-gut axis. Together the brain and gut are hard wired, and they communicate through a continuous bi-directional flow of information and feedback. In this sense, the body has two brains, one inside the skull and one lower down in the gut. Would you be interested to know that disruptions in the relationship between the brain and the gut can have a significant effect on the body, and manifest in physical, behavioral and emotional symptoms. If so, read on as we highlight the relationship between the brain and gut, and explore how our thoughts affect our gut health, and how our gut health affects our thoughts, and by extension, every organ, system, and function throughout the body.

Discussed in detail in last month’s newsletter on stress, the fight-or-flight response is associated with the sensation of “butterflies” when the brain perceives a potential threat to survival, increasing alertness, by raising heart rate, blood pressure and breathing rate. The central nervous system, the brain, signals the adrenal glands to release hormones including adrenaline or cortisol. This survival response creates muscle tension, especially in the stomach, the enteric nervous system, causing the stomach’s smooth muscles to be extra sensitive, which can explain the fluttery sensation. So, when you feel nervous before your next big exam or presentation, or if you get pulled over for speeding, understand that your brain is communicating that anxiety to your gut, which is why you can feel nauseous, and in some cases even begin to vomit.

The connection between the brain and the gut lies at the heart of many symptoms and illness that the human body develops in response to stress, improper digestion, and toxic thoughts. The sensation of “butterflies” is often harmless when experienced infrequently, but can turn problematic when it becomes a regular and unrelenting feeling day after day. So, what is it about the gut that can affect our happiness and influence our health and longevity? The answer lies with your gastrointestinal system, the secretions that it produces, and the bacteria that inhabit it.

In order for the body to function properly, it is necessary to provide it with the tools that it needs to perform. Life sustaining functions, like breathing, blood pressure, body temperature and heartbeat are performed by the autonomic nervous system. These involuntary or unconscious actions take place due to a complex network of nerves that extend from the brain to all the organs in the body. This network has two major divisions, the sympathetic nervous system and the parasympathetic nervous system. The sympathetic nervous system triggers the fight-or-flight response, and the parasympathetic nervous system calms the body down once the stressful situation has passed. Both of these systems interact with another, lesser known, part of the autonomic nervous system, the enteric nervous system.

The enteric nervous system regulates the digestion, nutrient absorption, and detoxification that take place in the gastrointestinal tract. The human gastrointestinal tract consists of the mouth, esophagus, stomach, small and large intestine, rectum and anus. The lower gastrointestinal tract comprises approximately 80% of the gastrointestinal immune system, and the upper G.I., the tongue, mouth and throat, account for the other 20%.



The gastrointestinal immune system is responsible for nutrient absorption, and along with the liver, is the body's main detoxification organ. The enteric nervous system relies on the same type of neurons and neurotransmitters that are found in the central nervous system, the brain and spinal cord. Aside from the brain, the gastrointestinal tract has a larger concentration of neurotransmitters than in any other area of the body, including the brainstem. In the field of clinical nutrition, it is for this reason that the gut is referred to as the "second brain".

When the gut senses that food has entered into it, the neuron saturated digestive tract signals the smooth muscle cells to begin a series of contractions that help to move the food further along, breaking it down into nutrients and waste. During this time the enteric nervous system communicates with the central nervous system to signal that it is satiated and can cease the sensation of hunger. The communications go beyond the "on/off" switch of consumption, and can help to explain the phenomenon of how social and psychological stress triggers unhealthy food cravings and disrupts digestion.

Stress can impact the gut in a number of ways that cause it to malfunction, including decreased nutrient absorption, decreased oxygenation in your gut, and decreased blood flow to the gut accompanied by decreased metabolism and enzyme production. These digestive problems can affect the brain and cause anxiety, brain fog, depression, increased stress, and more. Therefore, rather than viewing the enteric and central nervous system as exclusive networks, consider both systems to be intimately connected.

Your brain in your skull is responsible for communicating with and instructing the rest of your body on what to do and how to function. Your gut is responsible for performing various background tasks like nutrient absorption, energy and protein production, and detoxification. So, what does this have to do with social and psychological stress management, and the extent to which stress can reap havoc on the body in the form of inflammation, pain, anxiety, and depression? In short, everything.

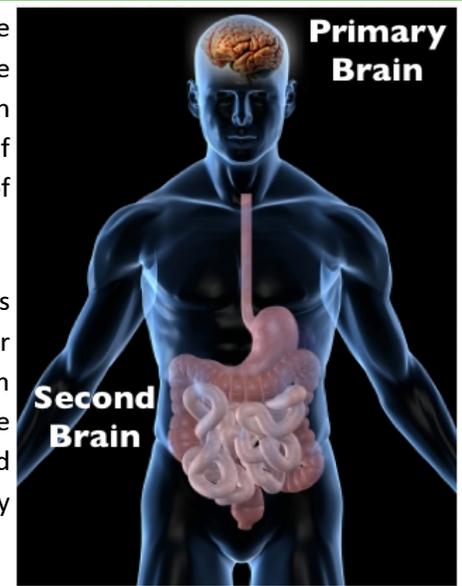
At birth the gastrointestinal tract is sterile. But, as the fetus passes through the birth canal and out into the external world for the first time it ingests vaginal mucus that contains several strains of live bacteria to jump start the colonization of healthy gut flora. Over time, everyone develops a distinct population of over 500 bacterial species in their gastrointestinal tract that number around 100 trillion. If the good bacteria in a healthy adult gastrointestinal system were entirely collected, it would weigh around ten pounds. The human body should have twenty times more good bacteria than cells to maintain a hardy gastrointestinal tract, a testament to the fact that maintaining proper gut bacteria is of great importance to help fight illness, prevent disease, and maintain a healthy body and mind.

The gastrointestinal tract maintains a unique balance of approximately 85% good and 15% bad bacteria, known as intestinal flora. Unfortunately, in many individuals the balance is inverted or grossly imbalanced, and leads to symptoms like irritable bowel syndrome (IBS), skin conditions like psoriasis and eczema, and ultimately disease and cancer due to the mineral and nutrient deficiencies that develop from disrupted absorption and detoxification.

The intestinal bacteria are important for sustaining life and play an integral role in regulating metabolism and digestion. They sort and make vitamins and other nutrients from the food that you eat, and help to support the gastrointestinal immune system. They help to maintain the structural stability of the gut wall which protects the body from opportunistic invaders like microbial parasites and a variety of other pathogens.

In addition to protecting the body, these beneficial bacteria produce hundreds of neurochemicals that the brain uses to regulate basic physiological and mental functions such as learning, memory, mood, pain sensitivity, and sense of well being. For example, more serotonin is produced in your gut than anywhere else in the body; approximately 95%. In addition, beneficial bacteria help to produce chemicals known as benzodiazepines, which are sent from the gut to the brain when a person is injured to relieve pain, relax the muscles, and in some cases even induce sedation.

Stress, diet, prescription and over the counter medications, climate, and even habitual toxic thought patterns synergistically contribute to the breakdown of healthy intestinal flora and create an environment by which bad pathogenic bacteria, parasites and fungi will grow and thrive. Conditions like auto-immune disorders, cancer, decreased immune response, diabetes, infection, obesity, inflammation and pain occur as a result of disrupted gut health over time. In truth, all of the factors mentioned here can fall under the category of stress on the gut, and mainstream research is now embracing the fact that stress induced changes in gut bacteria can in turn affect the brain and behavior. In other words, the gut's brain plays a major role in human happiness and misery.



A decreased presence of good intestinal bacteria will weaken the immune system and the natural production of enzymes that assist with nutrient absorption and detoxification. The presence of excessive harmful bacteria will interfere with the production of neurotransmitters, effect the communication of the brain-gut axis, and create symptoms of disease such as gas, bloating, constipation and diarrhea, along with depleting the body of chemicals, nutrients and minerals that are essential to life itself.

In recent years, the relationship between the digestive system and the nervous system has been studied extensively. Interestingly, the brain and gut are created out of the same piece of tissue. Shortly after conception in the embryo and throughout fetal development, one part turns into your central nervous system while the other turns into your enteric nervous system. These two systems are connected by the vagus nerve, the tenth cranial nerve that runs from your brainstem down to your abdomen. Today it is recognized that there is a constant exchange of chemicals and electrical messages between the two systems, which many scientists and clinicians now refer to as the brain-gut axis. Therefore, conditions that affect the gut will directly affect the brain.



Nearly every chemical that controls the brain is also located in the gastrointestinal system and stomach region. Gut bacteria both produce and respond to the same neurochemicals as the brain, including hormones and neurotransmitters like serotonin, glutamine, dopamine, GABA, and norepinephrine. The brain and spinal cord (central nervous system), along with the gut (enteric nervous system) play an important role in human emotions.

While the brain uses these neurochemicals to regulate mood and cognition, research indicates that it is likely the brain that adjusts its behavior to the feedback that it gets from the gut bacteria. Few people are aware that the gut is truly the body's second brain, and therefore gut health is overlooked. Often, symptoms from the two brains get confused, and just as the brain can upset the gut, the gut can also upset the brain.

While the brain interprets feedback from the gut, the brain communicates with the gut through the neurotransmitter pathways, helping to control the pattern of activity in the gut. There are neurons and cells in the gut that regulate the immune system response and the protection of the "blood brain barrier" to keep harmful substances away from the important neurons in the brain. The gut also has sensors for sugar, protein and acid that influence the progress of digestion and detoxification, and determines how the gut mixes and handles its contents.

There are also various chemicals in the stomach that work to break food down. They include digestive enzymes for metabolizing proteins, fat, and carbohydrates, but also the production of hydrochloric acid to create a suitable environment for the enzymes to function properly and assist in digestion. Without these digestive enzymes and hydrochloric acid being present in adequate amounts, the entire sequence can become compromised, disrupting optimal digestion, nutrient assimilation, and detoxification. When this occurs, our emotions and behavior begin to change as well. The body goes from feeling energetic to lethargic, from calm to anxious, from focus and concentration, to brain fog and impaired memory, from logic to irrational behavior.

The presence of hydrochloric acid also assists in the muscle contractions that push food through the intestines while destroying pathogenic bacteria, parasites, fungi, and other opportunistic invaders that are harmful to the body. Without sufficient acid, these harmful organisms can proliferate, raising the risk of gastrointestinal infections and autoimmune diseases. In addition, acid coming from the stomach signals the pancreas and gallbladder to release alkaline juices into the small intestine. Without the release of these juices, the body becomes systemically more acidic, increasing the risk of cardiovascular disease, diabetes and cancer. With the relationship of brain-gut axis, this increased acidity in the stomach adversely affects the brain, increasing anxiety, depression, and insomnia.

As research reveals more about the brain-gut-axis, it is becoming clearer why people behave the way that they do. The brain and gut are alike in so many ways; both go through 90 minute cycles while we are sleeping. At night when sleeping, the brain and gut work together to scavenge the body of free radicals, toxins, pathogenic bacteria, parasites, fungus, and other opportunistic invaders.

The brain goes through five stages of sleep. Usually when you are asleep, the body goes from stage one through four and finally REM, before starting over. For the brain, stage four, slow wave sleep, is interrupted by rapid eye movement sleep (REM), in which dreams occur. For each of the sleep cycles, the gut also goes through slow waves of muscle contractions. But during the REM sleep stage, the gut goes through short bursts of rapid muscle movement. This gut activity is even more interesting when you consider that REM sleep is characterized by arousal, and increased heart rate and blood pressure, where your eyes move rapidly and the rest of the body's muscles become immobile.

Sleep study findings reveal that patients with disrupted gut function tend to have abnormal sleep patterns, and dream infrequently or not at all. Poor sleep is often experienced by individuals with irritable bowel syndrome (IBS), and acid reflux. If this sounds like you, typically you will awake in the morning after a long night of sleep feeling brain fog, fatigue and exhaustion.

Just as the good gut bacteria communicate with the brain through the neurotransmitter pathways, so can the pathogenic bacteria send messages to the brain, and cause it to make choices that it will regret. For example, pathogenic bacteria know and remember that the gut and brain will go through the scavenging process during sleep each night, waging war against them on a quest to achieve homeostasis, or balance. These pathogens grow and thrive on sugar, and leading up to bedtime each night these bad bacteria will signal to the brain, "FEED US SUGAR, WE GROW AND THRIVE ON SUGAR!" This war cry often upsets both the gut and brain, which makes the body tense up and become unsettled. It is at this time that many people give in to the craving and often consume a bowl of ice cream or cereal, chocolate, cookies, potato chips, or anything that is rich in carbohydrates. Soon thereafter, the body calms down and can go to sleep; only now the bad bacteria are able to increase their ranks and offer strengthened resistance against the brain and gut, surviving to fight another day.

A good rule of thumb is to consider the situation described above and understand that the things that the body craves are often the things that it is most allergic to. Not only do the bad bacteria get the fuel that they need to grow and thrive, but the process by which blood sugar and blood pressure are supposed to decrease during sleep does not occur properly. Poor sleep disrupts your body's ability to regulate stress hormones like cortisol, and the body experiences restless sleep fraught often with tossing and turning, only to awake feeling un-refreshed and irritable.

Due to stress raising the levels of cortisol, when you wake up and throughout the day, your body will tend to crave foods high in carbohydrates, fat, and sugar and salt. This is because carbohydrates and sugars raise dopamine and serotonin levels and make us feel good in light of the stress that we experience. Also, studies indicate that salt may lower stress hormones and increase the level of oxytocin, the "love hormone", which helps to create bonds of love and social connections between friends, lovers or parents and children. So, on the surface, it appears that the consumption of comfort food helps us to combat the effects of stress, but below the surface, this could not be any farther from the truth, as it is actually an indicator that the brain-gut-axis is out of synch.

On the other end of the spectrum lay ideal gut health and the harmonious communication and feedback that can take place between the brain and gut if you give the body what it needs to perform. Instead of giving in to the bedtime hunger cravings, make a good choice for your body and take probiotics in supplement form each night on an empty stomach shortly before bedtime. Also, make sure to drink around six ounces of water before bedtime and sleep in complete darkness. Water is essential for nutrient absorption and detoxification and will assist your gut bacteria and brain to repair and replenish your body while you sleep. Darkness is necessary for the production of melatonin during sleep, which plays a calming role in the brain-gut-axis and has been shown to reduce inflammation in the gastrointestinal tract. By doing so you will be arming the brain and gut with the reinforcements that they need to fight the war against the unhealthy bacteria, weakening their pathogenic ranks, and restoring your gut flora to a more ideal equilibrium. Interestingly, the upper gastrointestinal tract shares the same good and pathogenic bacteria as the lower gastrointestinal tract, and so adding and mixing your probiotic supplement to a small amount of water, enough to comfortably swish, gargle, and swallow, will coat your mouth in good bacteria, promote gum and teeth health, and help to ensure proper enzyme production in the saliva, all of which lead to reduced mouth acidity, and a more comprehensive restoration of beneficial bacteria.

The payoff for exploring brain and gut interactions is extraordinary and awesome. Sadly, the truth is that most people today completely ignore gut health and simply address the symptoms of a disrupted brain-gut-axis without ever addressing the root cause. Fortunately, scientific and clinical research has yielded a comprehensive body of understanding which continues to evolve as time goes on. Much of the disease and disorder that people suffer and die from every day is preventable, and a result of prolonged disfunction of the brain-gut-axis. Can you imagine the dramatic improvement in our health as a society in just one generation if these concepts could be instilled in our youth from early on? The gut has long been a repository where good and bad feelings cause physical sensations. Understanding the brain-gut-axis makes the concept that emotional states from the head's brain are mirrored in the gut's brain and vice versa a reality, which can be felt by those who pay attention to it. Therefore, never forget that your body may have many parts, but like a symphony, each instrument must be playing in harmony to produce a melody that resonates with the soul.

