



HFF Practitioner Training Presentation Module 2, Lesson 1

The gut and the brain. Where to begin with these massive topics? In previous lessons, we explored the nervous system and touched on the gastrointestinal tract (gut) and its importance in human health. Yet, there is much more to understand about these two organs and how they control and maintain bodily functions, affecting health in every capacity from physical health to mental and emotional health. What is more is that these two organs do not work in isolation. In fact, each has functions that were once thought to be the job of the other. The gut has now been dubbed the “second brain,” and our understanding of the role the microbiome plays in the functioning of the brain has exploded in the last 5 years. The nervous system, namely cranial nerve V, plays a major role in digestion, and the balance of specific microbes present in the GI tract directly affect mental health. In this lesson, we dive into these details as we also explore the current science around the gut/brain connection.

Training Presentation

The Plumbing Functional Gastroenterology

The gut has become a hot topic in the health and wellness arena as of late. Research by experts such as Dr. Martin Blaser, a scientist doing an amazing amount of research about the gut microbiome, and a myriad of authors writing



about the gut-brain connection, gut permeability and food sensitivities, reactivity, and inflammation have hit the mainstream, and for good reason.

Let's start with a quick and simplified explanation of digestion. Digestion is the process by which our bodies break apart whole foods, proteins, fats, and carbohydrates so that they can be used by the body as fuel.

Digestion begins even before we put the food into our mouths. At the first thought of food, we salivate and ready our bodies for the process. When we eat, we chew our food to break it into smaller parts, then we swallow. The food travels down through the esophagus and into the stomach where it is further broken down by our stomach acid and turned into chyme. This chyme then passes through the intestines where the broken-down particles are absorbed through the gut lining, and anything that is not needed by the body or is too big to pass through the gut wall is excreted through the colon as waste. There are several other organs involved in this process such as the small and large intestines and the pancreas and gall bladder and many processes that involve enzymes (which involves the pancreas and the brush boarder of the intestinal walls) and bile (which involves the gall bladder), and stomach acid (as was mentioned earlier). Digestion is a complicated process that requires full functionality at every step.

The process of breaking down food to use as fuel is called *assimilation*, and the process of separating out and excreting waste products and toxins from the body is called *elimination*.

Therefore, proper digestion requires that the pancreas and gall bladder are working properly; it requires ample stomach acid and a healthy gut lining with no large holes or damage.

Functional Gastroenterology

Functional gastroenterology is the study and treatment of chronic gastrointestinal symptoms (such as diarrhoea, bloating, constipation, and dyspepsia (indigestion), often put into wastebasket diagnoses such as Irritable Bowel Syndrome) that do not have an obvious or apparent causal factor or pathophysiology. Yet, I would argue that most, if not all, of these disorders do,



however, have physiological characteristics that can be identified if we know what to look for and how to assess them with an understanding of the chemical and physiological details regarding the gut-brain axis.

Intestinal Hyperpermeability

One such condition that can lead to mystery symptoms is intestinal permeability (leaky gut). Due to many issues that affect the integrity of the gut (intestinal) lining such as the consumption of gluten and other inflammatory foods (sugar, dairy, and chemical-laden foods are all inflammatory), alcohol, medications, mercury and other heavy metals, bacterial and parasitical infections, medications, the list goes on, many people develop a condition we call leaky gut, or more scientifically, *intestinal hyperpermeability*. The lining of the intestinal walls is meant to be intact to keep out larger particles of food as well as other toxins that are not usable by the body, yet allow for small particles of nutrients to pass through into the bloodstream. Everyone can experience damage to their gut linings when we ingest hard to digest food such as grains, but many people's bodies are able to quickly repair the damage, while others cannot depending on the person, their history, and the level and duration of the assault and or exposure.

We don't want the gut to be leaky. When the tight junctions in the gut are compromised, toxins, undigested food, and microbes can travel into the bloodstream causing an immune response and inflammation and, ultimately, symptoms. Intestinal hyperpermeability has also been recently identified as a prerequisite for autoimmunity.

Intestinal hyperpermeability can cause digestive issues such gas and bloating, mood problems, fatigue, brain fog, allergies, hormone imbalances, food sensitivities or intolerances, etc. Therefore, it is imperative to heal and maintain the gut lining.

Dysbiosis

We contain trillions of cells within our bodies, and the human body contains more bacteria than our own cells, about 2-6 pounds worth, and outnumber them 10 to 1. (source: <http://www.nih.gov/news/health/jun2012/nhgri-13.htm>). This colony of bacteria is called the human microbiome. There are many species living in and on the human body that serve many different functions that either *contribute to* or *extract from* our health. In an antiquated understanding of



bacteria, it was thought that all bacteria were harmful, and with the explosion of research and discovery in the last 5 years, this has been proven NOT to be the case. In fact, it is quite the contrary.

Human beings are designed to co-exist with a wide variety of bacteria, many of which are beneficial to our health. Some bacteria produce B vitamins and others help us to digest our food. According to Lita Proctor, Ph.D., NHGRI's HMP program manager: "Humans don't have all the enzymes we need to digest our own diet," and

Microbes in the gut break down many of the proteins, lipids, and carbohydrates in our diet into nutrients that we can then absorb. Moreover, the microbes produce beneficial compounds, like vitamins and anti-inflammatories that our genome cannot produce.
(<http://www.nih.gov/news/health/jun2012/nhgri-13.htm>)

The microbiome is also deeply involved in not only our physical health but mental health, as well, which we will get to in a minute. Potentially harmful bacteria always reside within the human body, but they are only harmful if the balance of harmful and beneficial bacteria becomes skewed. Medications and antibiotics can kill off beneficial bacteria, leaving room for the overgrowth of the not-so-desirable kind, making us vulnerable to bacterial and pathogenic infection. These organisms are *opportunistic* and can move in quite aggressively under the right circumstances. This is called dysbiosis, many many people have this imbalance, and a number of the symptoms are the same as one what might experience with other digestive issues such as gas and bloating, lactose intolerance, brain fog, weight gain, skin issues, and yeast and fungal infections.

Yeast

Yeast is an organism that, like bacteria, naturally resides in the human body without causing any problems if kept in check and in balance. However, if the terrain of the body is such that yeast is given the chance to over-populate, it can cause illness and debilitating symptoms such as brain fog, rashes, acne, and GI distress. Candida Albicans is a common fungal infection (overgrowth) and can exacerbate and prevent the healing of intestinal hyperpermeability. When candida is present, the yeast's fingerlike roots, or *hypha*, spread into the holes in the gut wall, keeping the gut permeable and perpetuating the problem. Once in the bloodstream, yeast can also penetrate organs such as the heart in the same



way. Therefore, if the goal is to address intestinal hyperpermeability, you must address any yeast overgrowth, as well.

Here are some ways in which poor digestive health can detrimentally affect overall health and create disease:

1. Diarrhoea lets food leave our bodies before we have a chance to extract their nutrients through assimilation, and constipation can leave the waste, such as used hormones and toxins, to sit in our bodies long enough to be reabsorbed. If there isn't enough fuel, you can't run the car. It is through digestion that the body receives the fuel it needs to function. Without proper digestion, it doesn't matter what you eat or how well you eat, the body will not function properly. In this way, a malfunctioning GI system can cause both toxicity *and* deficiency.

2. If there is any sort of dysbiosis in the GI tract, the brain, or on the skin, the body can become toxic with the waste products and body parts of bacteria and parasites that the opportunistic bacteria leave behind. Also, the body must function without the B vitamins, immune boosting, digestive aid, and other good things that the beneficial bacteria provide. Beneficial bacteria also prevent opportunistic microorganisms from invading.

3. Since the GI lining is the first line of defence in the immune system, if the lining of the GI tract is at all compromised, many other health issues can arise such as malabsorption and food sensitivities, which cause other hyper-immune responses like inflammatory conditions such as arthritis and other autoimmune conditions. If it is thrown into overdrive by stressors such as a leaky gut, the immune system can even begin to attack the body it was designed to protect. In fact, intestinal hyperpermeability has been implicated as being one of the three triggering factors for the onset of autoimmunity, where the body attacks and destroys its own tissue thinking it is a foreign invader, along with environmental triggers and genetic opportunity.

4. Neurotransmitters and hormones: The health of the gut even plays a role in our production of the neurotransmitter, serotonin, and can affect our hormone levels. More about this in a few minutes when we discuss the Gut-Brain Axis.

It is true what Hippocrates, the father of medicine, said:
"All disease begins in the gut."



The Brain

As everyone knows, the brain is one of the command centres of the body. It sends messages and signals to the rest of the body, commanding how, if, and when we do anything and everything from breathing, hearing, and seeing, to moving, assessing, and reacting. There are many factors that contribute to a healthy brain leading to a healthy body and mind including:

Ample bloodflow to carry oxygen and nutrients to the brain and toxins out of the brain

Adequate nutrients and fats (which will be discussed in the nutrition lesson)

Bloodsugar regulation (which will be discussed in the nutrition lesson)

A healthy glymphatic system (which will be discussed in the detoxification lesson)

A healthy microbiome

Proper and unimpeded communication between the brain and the rest of the body

In this lesson, we will be focusing on the last, but certainly not least, 2 items on the list, a healthy microbiome and proper and unimpeded communication between the brain and the rest of the body.

Functional Neurology

Functional neurology is an exciting discipline that is advancing the study of “neurology” by putting together the pieces of the brain/body connection, neuroplasticity, and the roles detoxification and the robustness of the immune system at play in brain health and function.

Traditionally, neurology tends to look at disease of the nervous system as black-and-white with one side being optimal neurologic function and the other being neurological disease such as tumors, strokes etc. Functional Neurology looks at dysfunction of the nervous system as different shades of gray looking for subtle changes in the nervous system before they become distinct pathologies. You will often hear it said by functional neurologist that neurons need fuel and activation in order to thrive and survive. Fuel can be defined as oxygen, glucose and essential nutrients.



Activation refers to stimulation of the nervous system, which causes changes in the structure and metabolism of the nerve cell. More recently, Functional Neurology Practitioners are also involved with eliminating possible negative effects on neurons such as toxins, infectious agents and immune responses. (<http://keystonechiropracticneurology.com/what-is-functional-neurology>)

Researchers and clinicians such as Drs. Datis Kharrazian and Brandon Brock are leading the charge on implementing the practice of functional neurology to address conditions ranging from classical neurodegenerative disorders such as Alzheimer's Disease, dementia, and cognitive decline to seemingly unrelated conditions such as autoimmunity, arthritis, and hypothyroidism, using both nutritional and lifestyle interventions and targeted brain exercises and stimulation. These practitioners recognize the starring role the brain plays in the disease and symptom onset and resolution.

Until recently, scientists used to believe that the brain was limited in development after a certain age and that, once damaged, it could not regenerate new cells nor recover from certain challenges. This belief has now been fully debunked, and we are reaching a new frontier in our understanding of the brain and the myriad of ways to nurture and regenerate it. This new understanding is called *neuroplasticity*. The human brain is, in fact, *plastic*. By applying the principles and therapies based on an understanding of neuroplasticity, we have yet another natural, safe, and powerful tool for healing from concussion, dementia, Alzheimer's Disease, and other neurodegenerative diseases and disorders. Even "natural" cognitive decline (like forgetting where you put your keys or having more "senior moments") thought to be due to aging can be effectively slowed, delayed, or even halted, giving people back their sharpness, memories, and even lives.

Dr. Titus Chu is also leading the charge in this field teaching both clients and clinicians simple techniques to exercise the brain and both regain and sharpen existing functionality. He calls his method *sensorygenomics*, which is the practice of using the senses to retrain the brain and manipulate genetic expression. Chu's goal is to turn on certain pathways in the brain as well as make new ones by stimulating the central nervous system through smell, sight, taste, touch, sound, and movement. Other functional neurologists also use eye and



vestibular exercises to garner similar results. We will dig into these details when we get to the section on functional physiology.

Psychoneuroimmunology and Psychobiotics: Where the Brain and Gut Intersect

Science direct defines psychoneuroimmunology as: “the study of the interactions among behavioral, neural and endocrine, and immune processes” (<https://www.sciencedirect.com/topics/neuroscience/psychoneuroimmunology>).

The gut and brain communicate through the gut-brain axis. Through this access, *The brain communicates with the immune system through autonomic nervous system and neuroendocrine activity. Both pathways generate signals that are perceived by the immune system via receptors on the surface of lymphocytes and other immune cells. Conversely, an activated immune system generates chemical signals (cytokines) that are perceived by the nervous system. Thus, bidirectional pathways connect the brain and the immune system and provide the foundation for behavioral influences on immune functions. Pavlovian conditioning can suppress or enhance immune responses and stressful life experiences and emotional states (e.g., depression) are generally immunosuppressive. These effects are biologically meaningful in that they appear to be implicated in altering the development and/or progression of immunologically mediated disease processes. The direction and/or magnitude of the effects of behavioral factors in modulating immune responses, however, depend upon the nature of the behavioral circumstances, the nature of the antigenic stimulation, and the temporal relationship between them; the immune response and when it is measured; a variety of host factors; and the interactions among these variables. Documentation of pathways and functional relationships between the brain and the immune system reinforces the hypothesis that immune changes could mediate some of the effects of psychosocial factors on health and disease.* (<https://www.sciencedirect.com/topics/neuroscience/psychoneuroimmunology>)

The body responds to environmental inputs and stressors through three steps: first, the nervous system responds by communicating to the rest of the body



through chemical messengers called neurotransmitters, then the immune system responds by communicating to the rest of the body through chemical messengers called cytokines, and finally, the endocrine system finally kicks in communicating to the rest of the body through hormones. We learned about all of these three systems in our previous lessons, and can now more fully understand how they work together in the Gut-Brain Axis.

Another piece of the puzzle to add here is further discussion about the intimate relationship between human health and the microbes that reside within and on us. In the preface of his book: *Psychobiotic Revolution: Mood, Food, and the New Science of the Gut-Brain Connection*, Scott C. Anderson asks:

*Are bacteria controlling your brain? It seems absurd! Bacteria are so ridiculously tiny that you could fit a thousand of them into a single human cell. And yet, microbes seem to have superpowers. Flesh-eating bacteria can mow a human down in mere days. The Black Death brought down entire civilizations. Could such a primitive creature take the reins of our exquisitely evolved human minds? The answer is yes. Just as scientists are learning more each day about the trillions of microbes living inside you, so they are also discovering that some of these microbes can actually commandeer your mind, control your tastes, and alter your moods. (Anderson, *Psychobiotic Revolution*, p9).*

“Not only can researchers now discern which strains of gut bacteria affect the nervous system, they can also map the exact pathways through which specific gut bacteria influence the brain”
(<https://www.psychologytoday.com/us/articles/201403/natures-bounty-the-psychobiotic-revolution>).

Ted Dinan coined the term *psychobiotics* to put a name to this colony of microbes that are “major players in the gut-brain axis” (Anderson, *Psychobiotic Revolution*, p9) and have a profound effect on mental health.

The Polyvagal Theory

We cannot leave the topic of the human brain and the Gut-Brain Axis until we touch on Stephen Porges’ Polyvagal Theory. In Module 1, Lesson 3, we



discussed stress and the central nervous system in great detail and based on a current, yet not quite complete, understanding of the nervous system. I say “not quite complete” because, although this theory was brought to the public and has been taught to body workers and therapists for many years now, many have yet to have heard about it or implement it into their practice and wheelhouse of understanding. Yet, the polyvagal theory just may be one of the most simple, yet powerful, points of access to the body’s natural healing process.

The vagus nerve is a major player in our physical, mental, and emotional wellbeing. In our current model of stress, we can be in either in a state of rest and relaxation (or breed and feed), which is the parasympathetic state, or in a state of fight or flight, which is the sympathetic state. In Module 1, Lesson 3, I mentioned “freeze” as another nervous system response and would like to elaborate here.

“Freeze” (or the depressive state) is the state of autonomic nervous system involvement that Porges speaks about when he says that humans experience more than one stress response. These responses are: “in addition to those of the ventral branch of the vagus nerve: the activity of the dorsal branch of the vagus nerve, and sympathetic activity from the spinal chain” (Stanley Rossenberg, *Accessing the Healing Power of the Vagus Nerve*, xxxiii). This whole system involves reducing stress responses by proper and appropriate communication and activation of the vagus nerve and five other cranial nerves to elicit a feeling of safety and social engagement. We need to feel safe in order to release old patterns, elevate depressive states, and settle hyper-arousal. With the vagus and other cranial nerves functioning properly, the body enters a state of healing that can alleviate symptoms such as migraines, back pain, poor digestion, depression, and even autistic behaviours. And it is through an understanding of how stress is a causal factor for all illness, it becomes apparent that it is most important to pay attention to the vagus nerve and to encourage its proper function as a foundational component of a complete and comprehensive healthcare and recovery plan.

Question for discussion:

What are some applications for the knowledge you have gained about the psychobiota and the Polyvagal Theory?



Let the discussion begin!

