YOU HAVE A LOT OF NERVE

More specifically, you have a lot of vagus nerve. Not to be confused with the well-known city in Nevada. This vagus is spelled V A G U S and what happens in this vagus does not stay in vagus.

Your vagus nerve is your 10th and longest cranial nerve. It is a massive, meandering network of more than 100,000 nerve fibers that travel from nearly every internal organ to the base of the brain and back again. It derives its name from the Latin word for “wandering”. Your vagus nerve take a long, winding course through your body. Your left vagus nerve travels down the left side of your body. The right vagus nerve travels down the right side of your body. They exit from your medulla oblongata in your lower brainstem. Then, the nerves pass through or connect with your neck between your carotid artery and jugular vein; your chest (thorax); your heart; your lungs and finally your abdomen.

In the neck, the vagus nerve provides required innervation to most of the muscles of the pharynx and larynx, which are responsible for swallowing and vocalization. In the thorax, it provides the main parasympathetic supply of nerves to the heart and stimulates a reduction in the heart rate.

In the intestines, the vagus nerve regulates the contraction of smooth muscles and glandular secretions.

The vagus nerve is responsible for the regulation of internal organ functions, such as digestion, heart rate, and respiratory rate, as well as vasomotor activity, and certain reflex actions, such as coughing, sneezing, swallowing, and vomiting.

Its activation leads to the release of the neurotransmitter, acetylchonline, and binds to receptors that stimulate muscle contractions in the parasympathetic nervous system. The vagus nerve is the main contributor to the parasympathetic nervous system. 80% of the vagus nerve is comprised of sensory neurons that bring information from inner organs, such as gut, liver, heart and lungs, to the brain, while 20% of the vagus nerve is comprised of motor neurons that carry information from the brain to the organs. This suggests that the inner organs are major sources of sensory information to the brain. The gut is the largest organ surface towards the outside world and might, therefore, be a particularly important sensory organ. Historically, the vagus nerve has been studied as a motor nerve and as an antagonist of the sympathetic nervous system. However, together with the sympathetic nervous system, the parasympathetic

nervous system is responsible for the regulation of the involuntary functions by acting in opposition to each other.

For example, the parasympathetic signals a dilatation of blood vessels, bronchioles and salivary glands, as well as increased bowel motility and glandular secretions in the gastrointestinal tract. Basically, it relaxes things. Alternatively, the sympathetic stimulation results in dilation of blood vessels, bronchioles, increase in heart rate and constriction of the intestinal and urinary sphincters. This will result in slower intestinal activity due to a reduction of blood flow to the gut, allowing for a higher blood flow to the heart and muscles when the body is facing real or perceived stress.

To put this into a real life situation, let's say that you are going along just having a fine day. You feel good, calm and focused. Your vagus nerve is doing a good job of maintaining homeostasis. Suddenly you realize that you don't have your cell phone. You feel panic. The first thing that happens is your sympathetic nervous system signals your brain, activating the stress response. This signals the adrenal gland to release the hormone, epinephrine (adrenaline), as well as other hormones such as cortisol, into the bloodstream. The ephinephrine increases respiratory rate, blood pressure, and heart rate, redirects blood away from the digestive

tract to the muscles and speeds up reaction time. Your heart starts racing, your eyes dilate and you begin to breathe rapidly. Cortisol triggers the release of glucose from the liver for quick energy to the muscles and brain so you can stay on high alert. You rush here, you rush there, looking everywhere for your missing phone. You're out of your mind thinking about how your entire life is contained in that missing cell phone. You are now experiencing the "fight or flight" response, which is provided by the sympathetic nervous system.

Then, after running all over and worrying, you find your misplaced cell phone. You immediately feel relieved. The message travels from your brain via the vagus nerve, that all is well. Now the vagus nerve lets all of the organs know that they can relax by activating the secretion of feel good hormones, such as serotonin and oxytocin, to alleviate the stress response. Your breathing slows, your heart rate slows and you no longer feel like you've been kicked in the stomach. Blood supply is returned to the GI tract. Homeostasis is achieved once again. This is known as the "rest and digest" response provided by the parasympatheric nervous system via the vagus nerve.

But , consider what the effect of being in this stress mode indefinitely would be. Not only will it overwork your heart and increase your blood pressure with a continuous supply of stress hormones, but it will continue to redirect blood to your heart and muscles at the expense of supplying blood to your digestive system. Unrelenting periods of stress, or chronic stress, cause the continued presence of cortisol. Cortisol affects the immune system by preventing the production of inflammatory mediators. During chronic stress, cortisol is overproduced. This causes fewer receptors to be produced in immune cells which induces chronic inflammation. Stress induces chronic immune activation and can result in chronic inflammatory diseases. In addition, altered immune function can lead to exacerbated symptoms in existing physical and psychological illnesses.

Another way that chronic stress can impact your health is that it can affect the microbiota in your gut. Yes, stress can give you a belly ache.
The human microbiota that lives in your gut consists of over 100 trillion microbial cells, including bacteria, fungi and viruses, and plays a fundamental role in your overall health. Gut microbial alteration, also known as dysbiosis, is a condition associated not only with gastrointestinal disorders, but also with diseases affecting other distal organs.

Recently it became evident that the intestinal bacteria can affect the central nervous system physiology and neuroinflammation. The CNS and the GI systems are communicating through a bidirectional network of signaling pathways called the Gut-Brain Axis, which consists of multiple connections, including the vagus nerve, the immune system and bacterial metabolites. During dysbiosis these pathways are dysregulated and associated with altered permeability of the blood-brain barrier and brain inflammation.
In simpler terms, dysbiosis is an imbalance of the gut microbiota. Damage or disruption to the gut microbiota causes you to lose microbial diversity, and in the process see a higher proportion of inflammatory microbes emerge.

Stress affects gut health by inhibiting activity of the vagus nerve and has deleterious effects on the gastrointestinal tract and on the microbiota. It is involved in the pathophysiology of gastrointestinal disorders, such as irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD) which are both characterized by a dysbiosis. Low vagal activity has been described in IBD and IBS patients thus, favoring peripheral inflammation.

For the gut to host a healthy microbiome without an inappropriate or potentially damaging immune response, the intestinal tract has developed a specialized immunological environment. The vagus nerve makes a contribution to this anti-inflammatory environment not only by promoting intestinal integrity, but also by actively dampening the activation of immune cells at the gut. This anti-inflammatory effect of the vagus nerve is regulated, in part, by the hormonal stress response that is coordinated at the hypothalamus of the brain, and that is also affected by the microbiota.[7] Short-chain fatty acids are metabolites that intestinal bacteria produce from dietary fiber, and are particularly interesting in gut-brain-microbiome communication, as they may circulate in the blood or activate the vagus nerve directly. Therefore, the metabolites produced by intestinal bacteria, as a result of digesting the fiber we consume, may aid in the activation of the vagus nerve.

The health of your gut influences more than just your physiology. As Dr. Katerina Johnson explained: “There is growing interest in the way that our gut, and the microbes living in it, might be able to affect our mood and emotional states. We know that in animals the gut microbiome can affect emotional behavior via the vagus nerve.”

In spite of the nerve connections between the microbiome and the brain, it still seems staggering that experiments performed in mice indicate that the microbiome can affect our very behavior. Specifically, mice lacking a microbiome display changes in how they behave that can be described as 'anxiety-like' and 'depression-like'. Similar experiments have even shown that the microbiome affects the very development of the brain, with physical differences seen at the connections between neurons of mice that lack a microbiome.

As the authors of the research paper, "Gut Microbes and the Brain: Paradigm Shift in Neuroscience" state, *"The initial skepticism about reports suggesting a profound role of an intact gut microbiota in shaping brain neurochemistry and emotional behavior has given way to an unprecedented paradigm shift in the conceptualization of many psychiatric and neurological diseases".*

Corresponding with results collected using mice, patients diagnosed with IBS or IBS-associated disorders (such as chronic pelvic pain or overactive bladder) also presented with psychiatric problems such as depression more commonly than the wider population. Gastrointestinal problems and a disrupted microbiome also occur in individuals with autism spectrum

disorder, with gastrointestinal and autistic symptoms even appearing linked in severity. These observations suggest that mental health and behavior are linked to the gastrointestinal tract and the microbiome, not just by mouse experiments, but in humans also.

The gut-brain-microbiome axis is not only important in the development and function of the brain, but also in the death of neurons that occurs during neurodegenerative disease. Scientists have shown that patients with Parkinson's disease, and more recently Alzheimer's disease, also have an altered microbiome that signifies a link between neurodegenerative disease and the gastrointestinal tract. To Parkinson's patients, involvement of the gastrointestinal tract in their condition will be of little surprise, as Parkinson's can present with well-documented gastrointestinal symptoms; however, recent evidence suggests that the gastrointestinal tract and the gut-brain-microbiome axis may be more important to the condition than previously thought.

In the brain to gut direction, the anti-inflammatory and pro-intestinal integrity effect of vagal nerve stimulation may have potential in the

alleviation of intestinal inflammation and in inflammatory bowel disease through the restoration of a healthy balance of bacteria in the microbiome.

Vagal tone is the measurement of activity of vagus nerve. I like to think of it as the strength of the signal, similar to the signal of your cell phone. If the strength of the tone is low, it is difficult to communicate. A strong vagal tone improves the lines of communication between the brain and organs of the body.

We know that a vagus nerve overworked by chronic stress can cause digestive problems, inflammatory disease and a compromised immune system, as well as depression and mental dysfunction.

So, how do we improve our vagal tone for better health and well-being? Vagal tone can be improved by stimulation of the vagus nerve, either electronically or manually. Electronic stimulation is quite a bit more invasive and is used in primarily in more severe cases. However, manual stimulation of the vagus nerve can be accomplished by simple changes to your lifestyle

EXERCISES FOR IMPROVING VAGAL TONE

Deep breathing – deep inhalations and long, slow exhalations. This can be done on its own or as part of yoga or meditation practice.

Meditation - We know that meditation, over time, teaches the body and mind to relax. It often means you can react slower to the stress response, meaning you are less 'triggered' by external stimuli in both work and personal life.

Massage – neck and shoulder massages will stimulate the vagus nerve – That's why it feels so good!

Cold exposure – splash cold water on face, cold shower, ice swimming The immune system improves as the body learns to respond differently to cold water, which in turn teaches us to lessen our response to uncomfortable situations. Like putting ice on an injury, it slows inflammation.

Gut healthy diet – avoid inflammatory foods, i.e. sugar, processed foods, alcohol. Feed your gut microbes a good diet of probiotics, high fiber goods or supplements.

Singing, humming, and chanting – vibrations stimulate the vagus nerve in your vocal chords.

Outdoor activity – take a walk around your neighborhood or get out into nature. It's good for relieving stress and outdoor activities will expose you to more microbes.

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