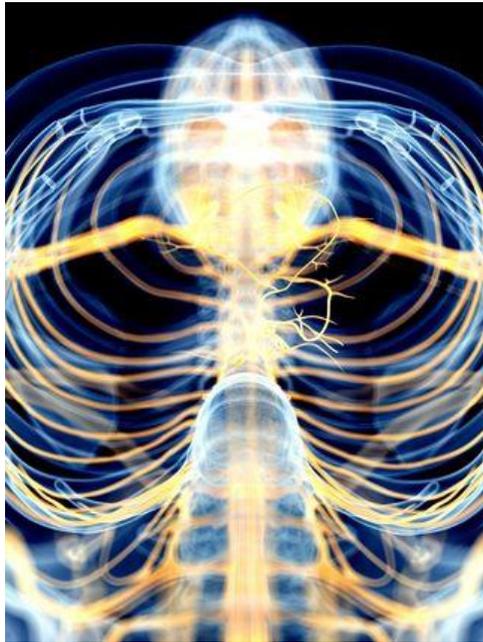


Vagus Nerve: Stimulation Dramatically Reduces Inflammation

Written by Heather Patton



Vagus nerve in yellow.

Source: Sebastian Kaulitzki/Shutterstock

Inflammatory responses play a central role in the development and persistence of many diseases and can lead to **DEBILITATING** (making a person weak) chronic pain. In many cases, inflammation is your body's response to stress. Therefore, reducing "fight-or-flight" responses in the nervous system and lowering biological markers for stress can also reduce inflammation.

Spell **DEBILITATING**.

What might be a cause of inflammation?

According to the title, what needs to happen to vagus nerve to reduce inflammation?

Typically, doctors prescribe medications to combat inflammation. However, there's growing evidence that another way to combat inflammation is by engaging the vagus nerve and improving "vagal tone." This can be achieved through daily habits such as yoga and meditation—or in more extreme cases of inflammation, such as **RHEUMATOID ARTHRITIS (RA)** (a chronic progressive disease causing inflammation in the joints and resulting in painful deformity and immobility) —by using an implanted device for vagus nerve stimulation (VNS).

What is the typical treatment for inflammation?

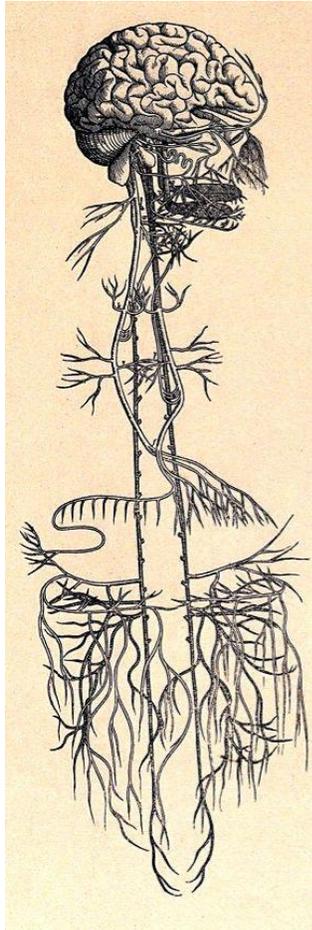
Name 2 things that can improve vagal tone.

Name the disease that is inflammation in the joints.

What does VNS stand for?

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The vagus nerve is known as the "wandering nerve" because it has multiple branches that diverge from two thick stems rooted in the cerebellum and brainstem that wander to the lowest viscera of your abdomen touching your heart and most major organs along the way. Vagus means "wandering" in Latin. The words vagabond, vague, and vagrant are all derived from the same Latin root.

Give the slang term for vagus nerve.

What does the vagus nerve touch?

Where is the vagus nerve rooted?

In 1921, a German physiologist named Otto Loewi discovered that stimulating the vagus nerve caused a reduction in heart rate by triggering the release of a substance he coined *Vagusstoff* (German for "Vagus Substance"). The "vagus substance" was later identified as acetylcholine and became the first NEUROTRANSMITTER (chemical messenger in the brain) ever identified by scientists.

What neurotransmitter is Vagusstoff?

How many years ago was the first neurotransmitter identified? (2018-1921= 97)

What is special about the discovery of the vagus substance?

Vagusstoff (acetylcholine) is like a tranquilizer (drug that reduces tension/anxiety) that you can self-administer simply by taking a few deep breaths with long exhales. Consciously tapping into the power of your vagus nerve can create a state of inner-calm while taming your inflammation reflex.

The vagus nerve is the prime component of the parasympathetic nervous system which regulates the "rest-and-digest" or "tend-and-befriend" responses. On the flip side, to maintain HOMEOSTASIS (stable state), the sympathetic nervous system drives the "fight-or-flight" response.

How does acetylcholine act in the body?

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What nervous system is the vagus nerve part of?

Which system is responsible for the primal fight or flight response?

Healthy Vagal Tone Is Part of a Feedback Loop Linked to Positive Emotions

Healthy vagal tone is indicated by a slight increase of heart rate when you inhale, and a decrease of heart rate when you exhale. Deep diaphragmatic breathing—with a long, slow exhale—is key to stimulating the vagus nerve and slowing heart rate and blood pressure, especially in times of performance anxiety.

A higher vagal tone index is linked to physical and psychological well-being. Conversely, a low vagal tone index is associated with inflammation depression, negative moods, loneliness, heart attacks, and stroke.

In healthy vagal tone, what happens to the heart rate in inhalation? _____

Upon exhaling? _____

What kind of breathing is the key to stimulating the vagus nerve?

What else is lowered with healthy vagal tone besides heart rate?

Watch video https://www.youtube.com/watch?v=v4b_SdLj6Wc

Now practice taking deep diaphragmatic breaths and slowing down the breathing.

A 2010 study, “How Positive Emotions Build Physical Health: Perceived Positive Social Connections Account for Upward Spiral Between Positive Emotions and Vagal Tone,” was published in *Psychological Science*. For this research, Barbara Fredrickson and Bethany Kok of the University of North Carolina at Chapel Hill honed in on the vagus nerve and discovered that a high vagal tone index was part of a feedback loop between positive emotions, physical health, and positive social connections.

Their research suggests that positive emotions, robust social connections, and physical health influence one another in a self-sustaining upward spiral dynamic and feedback loop that scientists are just beginning to understand.

How long ago was the study done on the link between vagal tone and emotions?
(current year-2010=8)

What college were the researchers associated with?

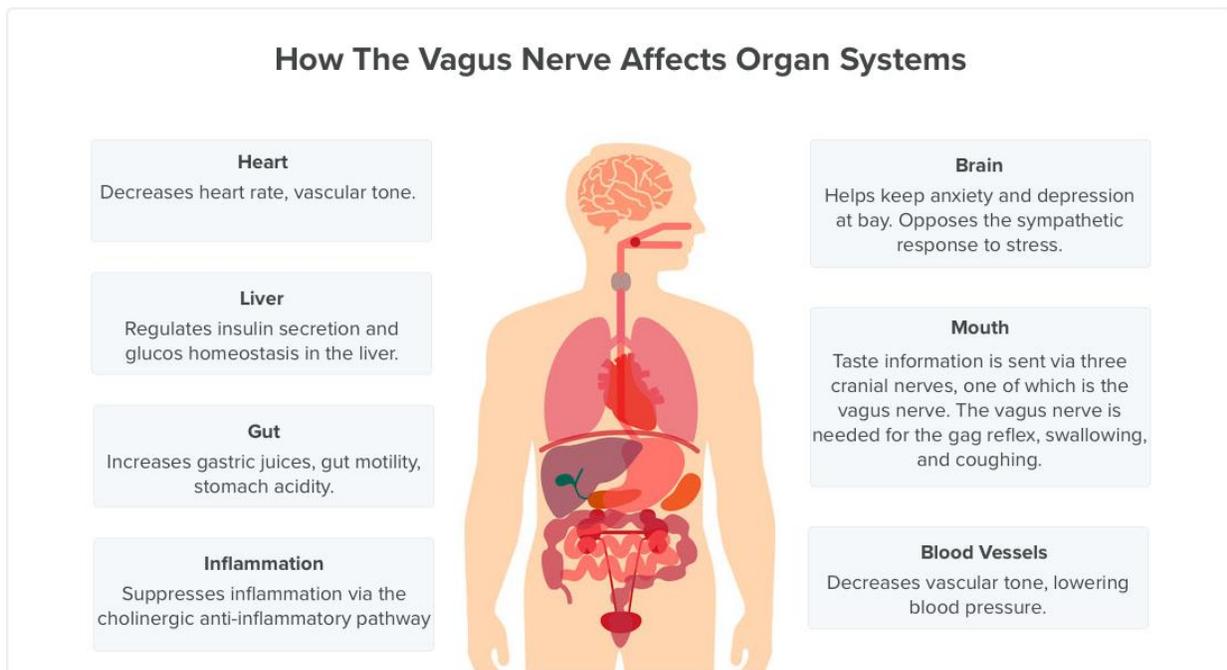
What 3 things are part of the vagal tone feedback loop?

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For this experiment, Frederickson and Kok used a Loving-Kindness Meditation (LKM) technique to help participants become better at self-generating positive emotions. However, they also found that simply reflecting on positive social connections and working to improve close-knit human bonds also caused improvements in vagal tone.

Let's work on our vagal tone. Name 1 positive thing you do (or want to do) for your physical health each day, name one positive emotion you had today and tell me about one positive social connection you had today.



Vagus nerve activity promotes relaxation, lowers heart rate, and helps keep anxiety and depression at bay. Conversely, impaired vagus nerve function increases heart rate, blood pressure, the stress response and impedes digestion.

What 2 activities did we learn previously that stimulate the vagus nerve? (yoga, meditation)

Define bidirectional. (functioning in two directions, flowing both ways)

Name 2 major organs not connected to the vagus nerve.

What kind of nerve is the vagus nerve? (parasympathetic)

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In the young and healthy, inflammation is a local event that resolves on its own. But the INNATE (natural, inborn) immune response can become disrupted resulting in continual pro-inflammatory cytokine activity. (**inflammatory cytokine** is a type of signaling molecule (a **CYTOKINE**) that is excreted from immune cells like helper T cells (Th) and MACROPHAGES (one type of cell that consumes dying or infected cells to maintain a healthy body), and certain other cell types that promote **inflammation**.) This state of chronic inflammations underpins a wide range of disease states, including sepsis, rheumatoid arthritis, inflammatory bowel disease, multiple sclerosis, and possibly even Alzheimer's disease.

The inflammatory reflex is a mechanism under the control of the vagus nerve. Parasympathetic outflows from the vagus nerve inhibit macrophage activation. Macrophages exposed to acetylcholine - which is main parasympathetic neurotransmitter - are disarmed.

What is a cytokine?

Name 2 diseases that relate to inflammation.

What does acetylcholine do to macrophages?

Define macrophages.



Source: Alila Medical Media/Shutterstock

Recently, an international team of researchers from Amsterdam and the United States conducted a clinical trial which demonstrates that stimulating the vagus nerve with a small implanted device significantly reduced inflammation and improved outcomes for patients with rheumatoid arthritis by inhibiting cytokine production.

RA is a chronic inflammatory disease that affects approximately 1.3 million people in the United States and costs tens of billions of dollars to treat each year, according to the researchers.

Name the 2 countries that had researchers participate in the study.

What did they do to stimulate the vagus nerve?

How many people in the US are affected by RA?

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The July 2016 study, "Vagus Nerve Stimulation Inhibits Cytokine Production and ATTENUATES (reduce force or effect) Disease Severity in Rheumatoid Arthritis," is the first human study designed to reduce symptoms of rheumatoid arthritis by stimulating the vagus nerve with a small implanted device which triggered a chain reaction that reduced cytokine levels and inflammation. Although this study focused on rheumatoid arthritis, the trial's results may have implications for patients suffering from other inflammatory diseases, including Parkinson's, Crohn's, and Alzheimers.

How recent was this study?

Name one other inflammatory disease.

What made this study unique?

What does the word ATTENUATE mean? (reduce force or effect)

In conclusion, co-author Kevin J. Tracey, president and CEO of the Feinstein Institute for Medical Research and the person who discovered the inflammatory reflex, said, "This is a real breakthrough in our ability to help people suffering from inflammatory diseases. I believe this study will change the way we see modern medicine, helping us understand that our nerves can, with a little help, make the drugs that we need to help our body heal itself."

Describe the benefits of VNS versus pharmaceuticals.

Vagus Nerve Stimulation is part of a burgeoning field called "BIOELECTRONICS" or "ELECTROCEUTICALS" that uses clinically-tested neuromodulation devices to "hack" into the body's nervous system to improve psychological and physical well-being. VNS therapy sends mild pulses to the vagus nerve at regular intervals throughout the day at a personalized dosage level of frequency and amplitude depending on the patient's specific needs. Stimulating the vagus nerve offers significant advantages to the use of drugs—such as lower cost and fewer side effects.

What is the nerve stimulation field known as?

What kind of device is used to stimulate the nerve?

Why do you suppose the nerve stimulation might improve psychological wellbeing?

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There are several types other types of brain stimulation therapies in addition to VNS, including electroconvulsive therapy (ECT), repetitive transcranial magnetic stimulation (rTMS), magnetic seizure therapy (MST), and deep brain stimulation (DBS).

Given all that you have learned about the vagus nerve and the stimulation of the nerve, what has been the most interesting to you?

What other type of brain stimulation or modern medical advance would you like to learn about?

Sources:

Christopher Bergland The Athlete's Way

<https://www.psychologytoday.com/blog/the-athletes-way/201607/vagus-nerve-stimulation-dramatically-reduces-inflammation>

The vagus nerve provides a BIDIRECTIONAL link between gut and brain and connects all major organs (excluding the thyroid and adrenal glands).

<https://www.psychologytoday.com/blog/the-athletes-way/201607/vagus-nerve-stimulation-dramatically-reducesinflammation>

<https://www.brainprotips.com/vagus-nerve-symptoms/>