

Working with the Vagus Nerve (unabridged)

(An extended version of an article originally published in *Massage & Bodywork* magazine, 2017.)

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The vagus nerve is an extremely interesting structure. Much more than just a passive wire or cable, its afferent (sensory) and efferent (motor) neurons work together to actively regulate a long list of processes that span the boundary between the brain and body, biology and psychology, and health and dysfunction. And, since we can stimulate the vagus nerve with the right kinds of touch, could hands-on work beneficially affect the vagus' function?

Some of the many ways that the vagus (or cranial nerve X) actively influences our wellbeing include:

Stress Resilience and Recovery

When your sympathetic fight-or-flight reactions release cortisol and adrenaline into your blood, the vagus, as the main structure in the body's parasympathetic rest-and-repair system, counters these stress hormones by releasing the neurotransmitter acetylcholine (which was originally called "Vagusstoff," or vagus-substance).ⁱ The vagus' motor branches extend to multiple organs (Image 1), sending instructions to release other proteins and enzymes like oxytocin, prolactin, vasopressin, which dampen the sympathetic activation and help you manage and recover more quickly from stress.

Inflammatory and Immune Control

When the vagus' sensory branches sense inflammatory markers like cytokines or tumor necrosis factor (TNF), the vagus inhibits their inflammatory effects by signaling the release of anti-inflammatory neurotransmitters via cholinergic anti-inflammatory pathways, helping to control inflammation,ⁱⁱ which when unchecked, is involved in autoimmune conditions (such as rheumatoid arthritis), chronic pain, and more.

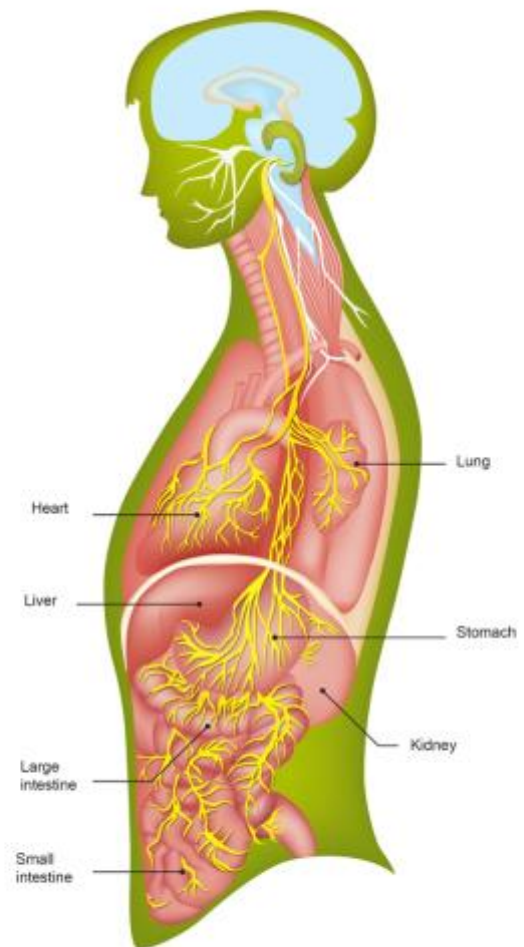


Image 1: The vagus nerve (yellow) is the body's main parasympathetic (rest and repair) structure. As the primary pathway between the brain and viscera's rich neuronal network (the enteric nervous system), it plays a crucial role in mood regulation, immune function, heart rate, and stress-recovery. Redrawn from De Witt; courtesy Advanced-Trainings.com.

The Viscera-Brain Connection

The vagus is the major communicator between the brain and the enteric nervous system—the rich neurology of your viscera. Your guts, with more than 100 million neurons, 30 neurotransmitters, and 95 percent of your body’s serotonin, send large quantities of information to the brain via the vagus nerve’s afferent fibers; this sets the mood or emotional backdrop for your brain’s mental processesⁱⁱⁱ.

Heart-Rate Variability

While looking for a way to research vagal effects in the 1980’s, neuroscientist Stephen Porges developed *vagal tone*, or Heart Rate Variability (HRV), a measure of the vagus’ responsiveness and its power on the heart.^{iv} Decreased HRV has since been associated with physical maladies like heart disease and diabetes; as well as emotional conditions like strain, time pressure,^v feeling worried or anxious,^{vi} depression, and PTSD.^{vii} On the other hand, if you have a stronger HRV, you are more likely to recover quickly after injury, stress, or illness,^{viii} and have better emotional regulation^{ix} (though it’s not always clear which of these are the results of a stronger vagal response, and which are its causes). Research into vagal HRV continues in many areas, and interestingly, several small studies over the last 30 years have shown that hands-on bodywork can have beneficial effects on vagal tone.^x

Vagal Stimulation

Vagal nerve stimulation (VNS) involves an implanted pacemaker-like device which electrically excites the vagus via an electrode wrapped around it in the neck. Though somewhat drastic-sounding, VNS first received approval about 20 years ago in both the US and Europe, and is used for treating a list of conditions including epilepsy, headaches, and treatment-resistant depression. VNS research continues for an even-broader range of complaints, including anxiety disorders, Alzheimer’s disease, migraines, fibromyalgia, obesity, and tinnitus.^{xi} Though benefits have been seen in some cases, not everyone responds to VNS; and there are clear risks (including infection, vocal hoarseness, breathing and swallowing problems), and the long-term side effects of VNS are unknown.^{xii} But especially for those with difficult and intractable conditions that haven’t responded to other treatments, VNS might offer welcome options.



Vagus nerve stimulation (VNS).

Source: Alila Medical Media/Shutterstock

Of course, there are other, less invasive and less risky ways to elicit the vagus nerve’s beneficial effects. Documented methods for improving vagal function include controlled breathing (especially longer exhalation); meditation; moving and relaxing the tongue, as well as singing, humming, and speaking (since the tongue and larynx are innervated by the vagus); animated conversation (since facial expression also seems to have a two-way relationship to vagal function);^{xiii} improving gut health; exercise and rest; as especially, reducing sources of physical, mental, and social stress.

But as hands-on practitioners, with our pragmatic perspective, our question is often, “That’s all interesting, but how can I touch it, and in what way, that might help?”

The Vagus in Your Ear

The ear is the only place where the vagus nerve reaches the surface of the body (via the auricular branch of the vagus nerve, also known as Alderman's or Arnold's nerve, Image 2).

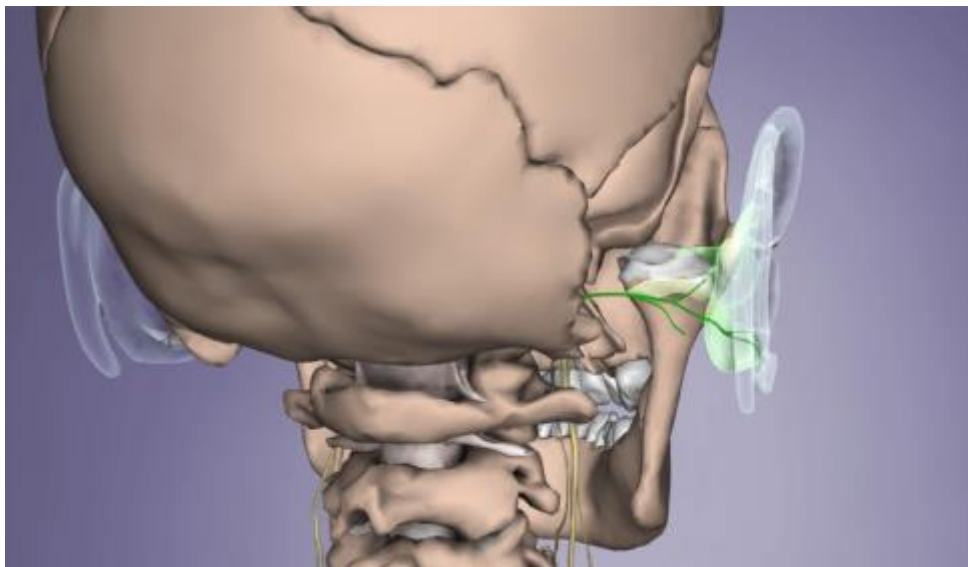
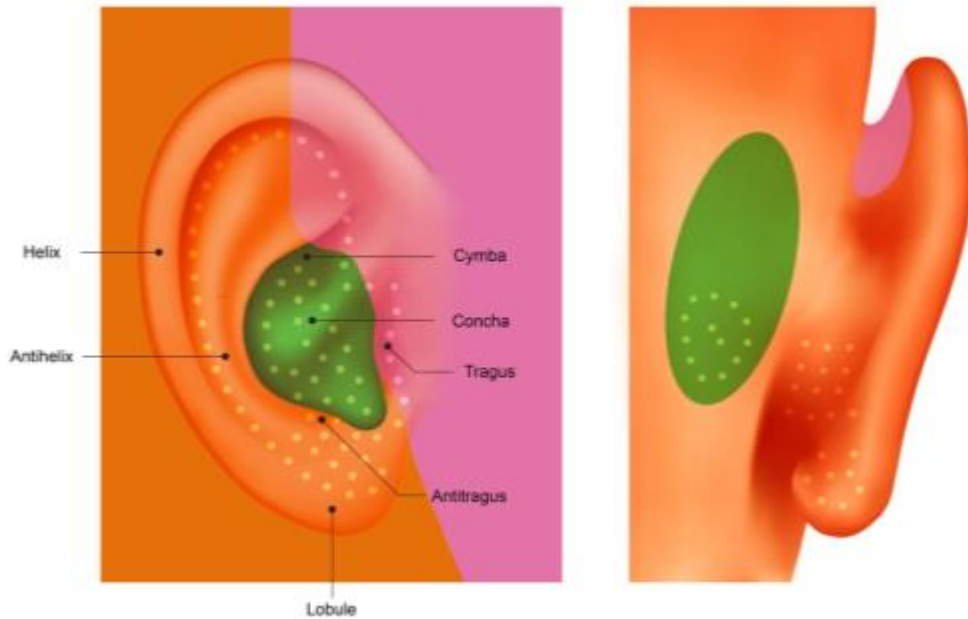


Image 2: The ear is the only place the vagus nerve reaches the surface of the body. Green: vagus nerve (X): auricular branch. Violet: mandibular nerve (V3): auriculotemporal branch. Orange: lesser occipital nerve (C2) and greater auricular nerve (C2, C3). White dots: facial nerve (VII): cutaneous fibers. Courtesy Advanced-Trainings.com.

Image 3: The auricular branch of the vagus nerve (dark green) and the ear structures it innervates (the concha and external auditory meatus; transparent green). Courtesy Primal Pictures, used by permission.

In fact, transcutaneous (via the skin) stimulation of this particular branch of the vagus is being studied as a treatment for numerous vagal-modulated conditions, and already has European clearance for treating epilepsy, depression, and chronic pain.^{xiv}

In our Advanced Myofascial Techniques series at Advanced-Trainings.com, we use several different ear techniques for addressing conditions like TMJ pain (the vagus nerve can be a powerful pain modulator via its neuroimmune effects), as well as for migraine and headache pain (see video link). Intriguingly, vagal stimulation has European clearance for treating cluster headaches, migraines, hemicrania continua, and medication overuse headache.^{xv}

The Vagus Nerve Technique

The vagus' auricular (ear) branch is made up of sensory neurons, which means that sensation stimulated in the vagal-innervated parts of the ear (Image 2) will excite vagal nerve activity. Specifically, the ear's concha (the deepest bowl of the external ear, particularly its *cymba* or upper recess), the external auditory meatus (the ear canal), and a small zone on the scalp just behind the ear, all have vagal innervation. Since in most cases our aim is also to calm and reassure the client's nervous system, a gentle, confident, and sensitive touch (Image 4) is usually most effective, with one study of babies showing that moderate pressure yielded greater vagal

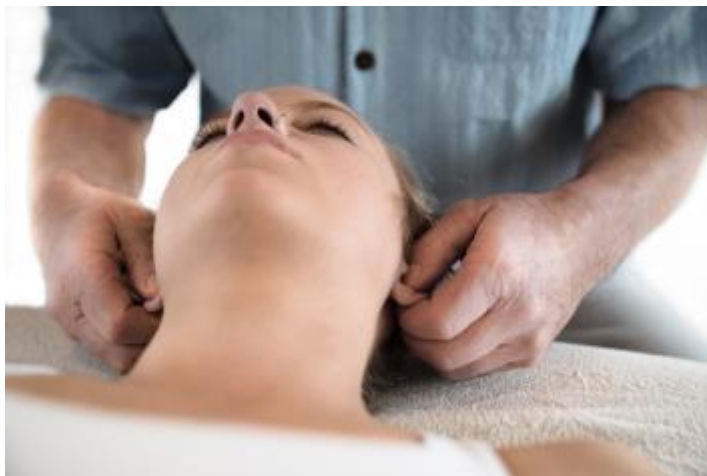


Image 4: The Vagus Nerve Technique involves stimulating sensation in the vagus nerve's auricular branches via moderate pressure, gentle traction, and active movement. Courtesy Advanced-Trainings.com.

Vagus Nerve Technique

Purpose

- Increase vagal nerve activity through gentle stimulation of sensation.

Indications

- Migraines and other headaches
- TMJ pain and TMJD
- Stress, anxiousness, or sympathetic ANS arousal
- May be helpful in a wide array of conditions mediated by the vagus nerve, such as tinnitus, mood issues, immune function and autoimmune conditions, epilepsy, pain, and others.

Instructions

- Use gentle touch, pressure, or light traction on the ear's concha (deepest bowl), ear canal, and the scalp just behind the ears, to gently stimulate sensation in the ear's vagus-innervated areas.
- For migraine or TMJ pain, look for areas that relieve pain, and for active movements of the jaw, eyes, face that evoke, relieve, or relate to the pain felt.

Movement Cues

- "Let your exhale be even slower, fuller, and longer."
- "Let your tongue rest in your mouth."
- "Let's hum a little tune...and meanwhile, let your neck and jaw stay relaxed."
- For migraines: "Look left and right with your eyes."
- For TMJ pain: "Gently, slide your jaw away from your ear."

For More Learning

- "TMJ" and "Migraines" in the Advanced Myofascial Techniques series of workshops and video courses.
- Advanced Myofascial Techniques, Volume 2 Chapters 15, 18. (Handspring 2016)



Image 5: Gentle touch on the scalp's vagus nerve-innervated zone, just behind the ear, where the auricular branch emerges from the cranial vault through a small hole

effects than light touch.^{xvi} Since many people are not accustomed to having their ears included in bodywork, be sure to ask permission first, and explain your purpose for proposing this work.

Could manual therapy with the ears be used to evoke some of the vagus' many beneficial effects? Clearly, touch would not be expected to have the same effects as direct electrical stimulation, and though a few small studies have shown that hands-on work can measurably affect vagus tone,^{xvii} others have had limited or mixed results,^{xviii} and a definitive answer would require more investigation. But understanding more about the vagus can certainly stimulate our therapeutic imagination and creativity. And practitioners have long known that careful work with the ears, as well as relieving specific complaints like headaches and TMJ pain, can be extremely calming, perhaps because of the vagus' power to soothe and relax both our body and mind.

Want to know more about the vagus nerve? A few good links:

Overview:

- Sarah Schwartz. (2016). Viva vagus: Wandering nerve could lead to range of therapies. Retrieved Sep 2017 from <https://www.sciencenews.org/article/viva-vagus-wandering-nerve-could-lead-range-therapies>

Vagal Nerve Stimulation:

- National Institute of Mental Health (2016). Brain Stimulation Therapies. Retrieved Sep 2017 from <https://www.nimh.nih.gov/health/topics/brain-stimulation-therapies/brain-stimulation-therapies.shtml>
- Gaia Vince. (2015). Hacking the nervous system. Retrieved Sep 2017 from <https://mosaicscience.com/story/hacking-nervous-system>
- National Headache Foundation. (2016). Vagus Nerve Stimulation Suppresses Brain Activity that Leads to Aura, Headache. Retrieved Sep 2017 from

<http://www.headaches.org/2016/03/04/vagus-nerve-stimulation-suppresses-brain-activity-that-leads-to-aura-headache/>

Heart Rate Variability:

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Notes

- ⁱ Bennett, M.R. (2000). "The concept of transmitter receptors: 100 years on". *Neuropharmacology*. 39 (4): 523–46.
- ⁱⁱ Oke SL, Tracey KJ. From CNI-1493 to the immunological homunculus: physiology of the inflammatory reflex. *J Leukoc Biol*. 2008 Mar;83(3):512-7.
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- ^{iv} Porges SW. (1992). Vagal Tone: A physiological marker of stress vulnerability. *Pediatrics* 90:498-504.
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- ^{vii} Hagit, C.; et al. (1998). "Analysis of heart rate variability in posttraumatic stress disorder patients in response to a trauma-related reminder". *Biological Psychiatry*. 44 (10): 1054–1059.
- ^{viii} Conder, R. L., & Conder, A. A. (2014). Heart rate variability interventions for concussion and rehabilitation. *Frontiers in Psychology*, 5, 890. <http://doi.org/10.3389/fpsyg.2014.00890>
- ^{ix} Aubert AE, Seps B, Beckers F. Heart rate variability in athletes. *Sports Med*. 2003;33(12):889-919.
- ^x Cottingham, J. Porges, S. and Richmond, K. Shifts in Pelvic Inclination Angle and Parasympathetic Tone Produced by Rolwing Soft Tissue Manipulation. *Physical Therapy*, Vol. 68, No. 9, p.1364-70, September 1988.
- ^{xi} Vagus nerve stimulation. (n.d.) In Wikipedia. Retrieved Sep 2017 from https://en.wikipedia.org/wiki/vagus_nerve_stimulation
- ^{xii} National Institute of Mental Health (2016). Brain Stimulation Therapies. Retrieved Sep 2017 from <https://www.nimh.nih.gov/health/topics/brain-stimulation-therapies/brain-stimulation-therapies.shtml>
- ^{xiii} Gothard, K. M. (2014). The amygdalo-motor pathways and the control of facial expressions. *Frontiers in Neuroscience*, 8, 43.
- ^{xiv} Howland, R. H. (2014). Vagus Nerve Stimulation. *Current Behavioral Neuroscience Reports*, 1(2), 64–73; and: electroCore LLC. (n.d.) Migraine and Cluster Headache, <http://www.electrocore.com/active-therapy-areas/migraine>.
- ^{xv} Howland, R. H. (2014). *Ibid*.
- ^{xvi} Field, T. et al. (2006). Moderate versus light pressure massage therapy leads to greater weight gain in preterm infants, In *Infant Behavior and Development*, Volume 29, Issue 4, 2006, Pages 574-578.

^{xvii} Cottingham, J. Porges, S. and Richmond, K. Shifts in Pelvic Inclination Angle and Parasympathetic Tone Produced by Rolwing Soft Tissue Manipulation. *Physical Therapy*, Vol. 68, No. 9, p.1364-70, September 1988. And, Cottingham, J. and J. Maitland (1997). "A Three Paradigm Treatment Model Using Soft Tissue Mobilization and Guided Movement-Awareness Techniques for a Patient with Chronic Low Back Pain: A Case Study," *Journal of Orthopedic Sports Physical Therapy* 26(3):154-167.

^{xviii} Paschoal Mário Augusto. (2016) Influence of classic massage on cardiac autonomic modulation. *Fisioter. mov.* 2016 Sep; 29(3): 487-496.