

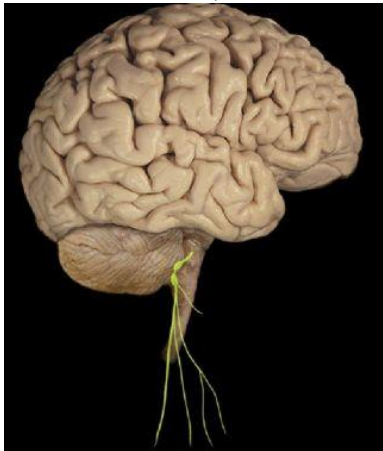
The Neurobiology of Grace Under Pressure

8 habits that stimulate your vagus nerve and keep you calm, cool, and collected.

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Vagus Nerve in Yellow

When was the last time that you had to perform gracefully in a high-pressure situation? How did you handle it? Did you choke or did you have grace under pressure? Researchers continue to confirm that daily habits of mindset and behavior can create a positive snowball effect through a feedback loop linked to stimulating your vagus nerve. In this entry I will show you 8 habits that stimulate healthy ‘vagal tone’ and allow you to harness the power of your vagus nerve to help you stay calm, cool, and collected in any storm.

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. A low vagal tone index is linked to inflammation, negative moods, loneliness, and heart attacks.

Heart disease is the number one killer in America. One way to improve your heart health is to focus on the vagus-friendly lifestyle habits I explore below. Well conditioned athletes have higher

vagal tone because aerobic breathing creates healthy vagal tone, which results in a lower resting heart rate. Healthy cardiac function is directly linked to stimulating the vagus nerve.

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: "Vagus Substance"). The "vagus substance" was later identified as acetylcholine and became the first neurotransmitter identified by scientists.

Vagusstuff is literally a tranquilizer that you can self-administer simply by taking a few deep breaths with long exhales. You can consciously tap the power of your vagus nerve to create inner-calm on demand. This knowledge alone should be enough to reduce the fear-of-fear-itself and give you grace under pressure next time you need it.

What exactly is the vagus nerve?

The word vagus means "wandering" in Latin. The words vagabond, vague, and vagrant come from the same root. 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.

The vagus nerve is constantly sending sensory information about the state of the body's organs "upstream" to your brain. In fact, 80-90% of the nerve fibers in the vagus nerve are dedicated to communicating the state of your viscera up to your brain. When people say "trust your gut" they are in many ways saying, "trust your vagus nerve." Visceral feelings and gut-instincts are literally emotional intuitions transferred up to your brain via the vagus nerve.

As with any mind-body feedback loop, messages also travel "downstream" from your conscious mind through the vagus nerve signaling your organs to create an inner-calm so you can "rest-and-digest" during times of safety or to prepare your body for "fight-or-flight" in dangerous situations.

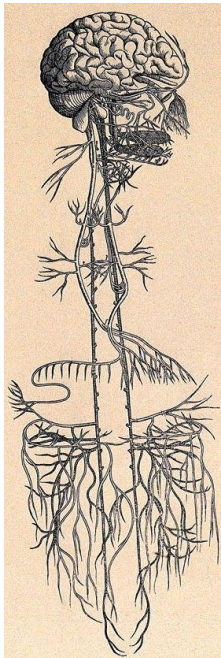
Your vagus nerve is the commander-in-chief when it comes to having grace under pressure. The autonomic nervous system is comprised of two polar opposite systems that create a complementary tug-of-war which allows your body to maintain homeostasis (inner-stability).

The sympathetic nervous system is geared to rev you up like the gas pedal in an automobile – it thrives on adrenaline and cortisol and is part of the fight-or-flight response. The parasympathetic nervous system is the polar opposite. The vagus nerve is command central for the function of your parasympathetic nervous system. It is geared to slow you down like the brakes on your car and uses neurotransmitters like acetylcholine and GABA to literally lower heart rate, blood pressure, and help your heart and organs slow down.

Unfortunately, the vagus nerve's reflexive responses can backfire and turn it from comrade into saboteur. Anytime you psyche yourself out before an important event, feel intimidated, or insecure your vagus nerve interprets that you are in real danger which exacerbates these negative responses.

All of the physical symptoms of performance anxiety—racing heart, sweaty palms, dry mouth, upset stomach, shakiness—are the result of your vagus nerve disengaging. Luckily, you have the power to harness your vagus nerve and keep it engaged to create grace under pressure. By understanding the incredible power of your vagus nerve you can begin practicing ways to flex its inhibitory strength to keep you mellow in times of distress.

8 habits that will stimulate your vagus nerve and give you grace under pressure.



Early anatomical drawing of the vagus nerve.

1. Visualize the Vagus Nerve.

Visualizing the vagus nerve as a wellspring of neurobiological ingredients that create mental and physical calmness will create a self-fulfilling prophecy. This is *not* just the placebo effect in action. Remember, anytime you take a deep breath and exhale you are triggering a biological release of vagusstuff that will lower heart rate and blood pressure.

In addition to visualizing my vagus nerve I literally talk to it in the third person like it is a separate entity. You can try this too the next time you have the butterflies or are shaky before a big presentation or challenge. I will literally say to my vagus nerve things like, "I thought we were in this together. I need you to work with me here. Come on! Don't let me down." Somehow this helps take my ego out of the situation, puts me at ease, and makes me feel like I have a loyal comrade on deck. Try this trick the next time you need grace under pressure and see if it works for you.

I include this narrow anatomical drawing to help you visualize what the vagus nerve actually looks like in your body and to illustrate how long it is from top to bottom.

2. Practice, Practice, Practice. In a *Psychology Today* blog entry called [No. 1 Reason Practice Makes Perfect](#), I wrote about the power of your cerebellum to store muscle memory and allow you to perform gracefully under pressure. Without extensive practice we are forced to rely too much on the 'executive function' of our prefrontal cortex. Anytime you 'over-think' your performance you are more likely to choke, fumble and drop the ball. Arthur Ashe called this "paralysis by analysis." Once the cerebellum is running the show your vagus nerve engages which helps create fluidity in your thoughts and actions.

3. Create Flow by balancing skill and challenge. The key to being in the 'zone' or creating a state of 'flow' is to find the sweet spot where your skill level perfectly matches the challenge. Get in the habit of continually nudging against your limits. By increasing the challenge gradually you become more skilled and comfortable with more difficult tasks.

Seek challenges that keep you nestled between anxiety and boredom. The key to peak performance is to have a heightened state of arousal but an inner sense of calm reflected in a perfect dynamic tension within the yin-yang of your autonomic nervous system. Although it is tempting to bite-off-more-than you can chew, your vagus nerve can betray you if it feels you're in uncharted territory. By consistently increasing your skills you will feel at ease as you take on bigger challenges. That said, if you ever do have the opportunity to leap frog to a high-stakes

challenge, use other techniques here to harness the vagus nerve and use it as an ally to get you through.

4. Reframe Priorities and Values. I strongly believe that friends, family, good health, and generosity of spirit matter more than any achievements that requires grace under pressure. In 2006, Geoffrey Cohen, a professor at the Stanford University School of Education, conducted a series of experiments designed to reduce test-taking pressures. In the experiment he asked students to write a paragraph about a topic unrelated to the exam such as: “relationships with friends and family,” “religious values,” “athletic ability,” and “being good at art” before being tested. This brief writing assignment significantly improved the grades of students.

Before you face any challenge or test that fills you with performance anxiety get in the habit of reframing the importance of the event by putting it in a broader perspective of other things that you're good at and what matters most to you. Even when the stakes are high, remember that every hurdle is an opportunity to learn. Mastery is a process. Overblown performance anxiety jacks up cortisol and adrenaline levels and makes you less likely to succeed.

5. Use neuroplasticity to re-wire habits of positive thinking. By generating positive emotions and a learned optimism you will 'fire-and-wire' together neural networks associated with a mindset that will give you grace under pressure. The vagus nerve picks up on signals coming from the 'top-down' and from the 'bottom-up' and uses these signals to re-wire your mind through neuroplasticity.

On January 28, 2013 researchers at the University of Glasgow in Scotland announced that they are hoping to help victims of stroke to overcome physical disabilities by helping their brains to 'rewire' themselves using a Vagal Nerve Stimulator (VNS). Lead researcher Dr Jesse Dawson, a stroke consultant and clinical senior lecturer in medicine, described the vagus nerve by saying, "That nerve is one of the major nerves that goes to the brain. By stimulating the nerves, you can cause upstream changes in the brain without having to go into the brain."

It is hoped that the device will stimulate release of the brain's own chemicals and help the brain form new neural connections which might improve participants' arm mobility. In 2005, the FDA approved the use of VNS for treatment-resistant depression, although it's use remains controversial... VNS is also used to treat epilepsy and tinnitus.

Dr Dawson added: "Evidence from animal studies suggests that vagus nerve stimulation could cause the release of neurotransmitters which help facilitate neural plasticity and help people re-learn how to use their arms after stroke, particularly if stimulation is paired with specific tasks." The link between vagus nerve stimulation and neuroplasticity is strong. By focusing on creating healthy vagal tone you can trigger similar neuroplastic changes from the bottom-up. Creating a mindset of grace under pressure can be reinforced through the powerful mind-body connection of the vagus nerve.

6. Seek Daily Physicality. Cardio-respiratory activity, strength training and yoga stimulate vagal tone and harmonize hormones and neurotransmitters linked to grace under pressure. Aerobic activity stimulates healthy vagal tone due to the inherent diaphragmatic breathing of rhythmic cardio-respiratory exercise. Strength training with an emphasis on a robust exhale as you push the weight will stimulate vagal tone.

Yoga increases vagal tone, too. In a 2012 article published in *Medical Hypotheses*, researchers from Boston University School of Medicine (BUSM), New York Medical College (NYMC), and the Columbia College of Physicians and Surgeons (CCPS) presented evidence that yoga may be effective in treating patients with stress-related psychological and medical conditions such as depression, anxiety, high blood pressure and cardiac disease.

The researchers hypothesize that stress causes an imbalance in the autonomic nervous system (parasympathetic under-activity and sympathetic over-activity) as well as under-activity of the inhibitory neurotransmitter GABA. According to the researchers, low GABA activity occurs in anxiety disorders, post-traumatic stress disorder, depression, epilepsy, and chronic pain. The hypothesis advanced in this paper could explain why vagal nerve stimulation (VNS) works to decrease both seizure frequency and the symptoms of depression.

"Western and Eastern medicine complement one another. Yoga is known to improve stress-related nervous system imbalances," said Chris Streeter, MD, associate professor of psychiatry at BUSM and Boston Medical Center, who is the study's lead author. Streeter believes that "This paper provides a theory, based on neurophysiology and neuroanatomy, to understand how yoga helps patients feel better by relieving symptoms in many common disorders."

7. Anxiety is contagious: Avoid anxious people. As a neurosurgeon, my father needed to have grace under pressure. He understood how delicate the sensors of his own vagus nerve

were and would ask anyone in the operating room to leave if he or she was emitting an uptight vibe.

I've learned to do the same in life—especially before an important event. Because anxiety is catching, I will remove myself from the vicinity of anyone who is negative, cynical or doubtful of my ability to hit-it-out-of-the-park in a high stakes situation. The vagus nerve picks up on people's vibe. Of course, none of us like to be around high strung people, but it is particularly important when you need to have grace under pressure.

If you are unable to remove yourself from anxious or nervous people (like in a waiting room for an audition or near the starting line of a race) I recommend using headphones with music that creates an appropriate mood and blocks the ability of others' anxiety to affect your vagal tone. You can also close your eyes and do mindfulness or meditation maneuvers to distance your vagal nerve from picking up the nervous vibe of people in your vicinity. Obviously, people who emit easy-going, warm, upbeat emotions are much better for your health, longevity, and ability to perform with grace under pressure. Seek these people out!

8. Foster Loving & Kindness. In order to maintain healthy vagal tone it's important to foster diverse and rewarding social connections. In a 2010 study published in *Psychological Science*, Barbara Frederickson and Bethany Kok of the University of North Carolina at Chapel Hill focused their attention on the vagus nerve.

Their article was titled: *How Positive Emotions Build Physical Health: Perceived Positive Social Connections Account for the Upward Spiral Between Positive Emotions and Vagal Tone*. They discovered that a high vagal tone index was part of a feedback loop between positive emotions, physical health and positive social connections.

Their research results suggests that positive emotions, positive social connections, and physical health influence one another in a self-sustaining upward spiral dynamic that scientists are just beginning to understand. Kok states that: "We propose here that people's ability to translate their own positive emotions into positive social connections with others may hold one of the keys to solving this mystery."

In the experiment Frederickson and Kok used a Loving-Kindness Meditation 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 them also caused improvements in vagal tone.

Conclusion: The Vagus Nerve and Ferocious Equanimity

Equanimity is a core tenet of many ancient philosophies and religions. Equanimity is defined as “Mental calmness, composure and evenness of temper, especially in a difficult situation.” Equanimity has its biological roots in the vagus nerve and is synonymous with grace under pressure.

Equanimity is not synonymous with passivity. As you strive to push yourself ever higher—and take on bigger challenges—do so with what I call “*Ferocious Equanimity*”. Use your vagus nerve to stay balanced and calm when the stakes are high. As you push against your limits remember that your vagus nerve is always there to keep you imperturbable and steady on the high-wire act of living your life to its fullest and maximizing your potential.

Hopefully the advice herein will give you some tools to utilize the incredible power of your vagus nerve and give you grace under pressure the next time you need it.