THE VAGUS NERVE
It’s 10 p.m. Do you know where your vagus nerve is?

The vagus nerve...sounds vaguely familiar, right? What is it and why should you care? The vagus nerve is the primary communicator of the brain to the parasympathetic nervous system, responsible for the relaxation response, and to the sympathetic nervous system, the fight, flight, or freeze response. And the vagus nerve is emerging as one of the key components in the science of how yoga works.

A team at Boston University School of Medicine recently published a report hypothesizing that yoga works by regulating the nervous system, specifically the vagus nerve. The tonality of the vagus nerve affects how we take in, process, and make sense of our experiences. By increasing vagal tone, we change how the body responds to stress.

The vagus nerve is the largest cranial nerve in the body, beginning at the base of the skull and extending throughout the body, regulating all major bodily functions.

The vagus nerve and its associated systems

We take the vagus nerve for granted when we’re feeling balanced; it’s when it’s not functioning that we notice the effects: feelings of depletion, sluggish digestion, increased heart rate, erratic moods. A poorly functioning vagus nerve can be part of depression, PTSD, chronic pain, and epilepsy.

New studies are suggesting that the vagus might work with oxytocin receptors, the neotransmitter of bonding feelings. People with higher levels of oxytocin are prone to feeling emotions that promote altruism – compassion, gratitude, love, and happiness. A happy vagus is a happy human; a happy human is a happy world.

The great news is that it’s easy to stimulate the vagus nerve. Just breathe! When you take a deep, conscious breath and expand your diaphragm, it stimulates your vagus system. You instantly turn on your parasympathetic nervous system, cortisol (the stress hormone) levels drop, and your body relaxes.

Various yoga asana will also help stimulate the vagus, as you can see all the related organs that would be worked through postures.

TO DO:
Tone Up Your Vagus Nerve!

- Breathe slowly in and out through the nose. Gradually slow the pace down, especially the pace of the out-breath (very slightly at first – not everyone likes th or responds well to it. RB)

- Practice asana - many yoga postures stimulate the VN.

- Practice (gentle – RB) resistance breathing, such as niyayi (ocean breathing). Breathing this way increases th relaxation response but also helps with heart rate variability (resilience).

- Chanting (e.g. “om” or “aum”) out loud increased vagal tone, according to one study.

- Placing an eye pillow on the forehead can help to stimulate the vagus nerve in restorative yoga.

http://spirittrail.wordpress.com/2012/12/15/its-10pm-do-you-know-where-your-vagus-nerve-is/vagus-nerve-2/
The Vagus Nerve – its many roles and functions

The Vagus Nerve interacts with all of the organs that it touches – bringing healing acetylcholine.

Research has found that the neurotransmitter acetylcholine acts as a brake on inflammation in the body[4]. Stimulating your vagus nerve sends acetylcholine throughout your body, not only making you feel relaxed, but also putting out the fires of inflammation – something that happens in response to stress[1].

Further to this, acetylcholine is also responsible for learning and memory. You can’t learn or heal though, if you stay in stress mode.

The vagus nerve is the 10th cranial nerve in your body. It is a very long nerve running from the hypothalamus area of your brain, chest, diaphragm, and to your intestines. It wraps around your heart and core area (Hara point and solar plexus centre) – areas traditionally considered to be the seat of intuition and compassion.

The vagus nerve activates the parasympathetic nervous system (PNS), which manages your relaxation response, and in turn, helps you to control the health of your immune cells, organs and tissues, and even your stem cells. Twenty percent of the fibres of the vagus nerve control the organs which ‘maintain’ your body (the heart, digestion, breathing, glands). The other 80 percent of its fibres send information from your gut to your brain. (We will be writing more about the gut-brain relationship in another blog article).

One of the key roles that the vagus nerve plays, is acting as the “reset” button after your internal alarm system has been set off – i.e., in response to some type of perceived threat (a stress response). This nerve then communicates with the rest of your body to tell you that the threat is gone and that all of your bodily functions can now return to normal, healing mode.

Research has linked the vagus nerve to improved neurogenesis (creation of new brain or neuronal cells), and increased brain-derived neurotrophic factor (BDNF) factor. BDNF is like a fabulous super-food for your brain cells. It helps with repair of brain tissue, actual regeneration throughout the whole body.

These[5] and other researchers have found that stem cell growth is directly connected to vagus nerve activity. Activating the vagus nerve can stimulate stem cells to produce new cells and even repair and rebuild your organs.

In the third installment of this blog, we will discuss further how the sympathetic and parasympathetic nervous systems work.

For now, it is important to know that if you are living in stress mode, your body is unable to heal itself. The hormones that are triggered by stress actively block the healing and resting response of the body. Stress can create a number of negative effects including: depression, anxiety, insomnia, anger; difficulty with decision making, violence, difficulty with thinking and attention.

Fortunately, there are many ways to activate the vagus nerve and turn your relaxation response back on. An easy, inexpensive way to do this is to just breathe. When you take a deep inhalation through the mouth, relax and expand your diaphragm, your vagus system kicks in, and your parasympathetic nervous system is activated. Then exhale via the nose and feel the stress leaving your body. The result? Your cortisol levels are reduced, and your brain heals.

Activating the Vagus Nerve

For more than 15 years, stimulation of the vagus nerve has been used as a treatment for epilepsy and depression. The Canadian Health Protection Branch approved Vagus Nerve Stimulation (VNS) in March 1997, with special focus on epilepsy patients over the age of 12 whose partial onset seizures are not well controlled by medication. The U.S. Federal Drug Administration has also approved VNS for the treatment of both epilepsy and depression. It appears that depression is a condition that is common amongst people with epilepsy. The February 2000 issue of Annals of Neurology reported that older adults who are clinically depressed are six times as likely to have a seizure as their peers. This suggests that a common factor may be underlying both the cause of depression and seizures. (Interestingly, the ‘diet to stop seizures’ is the ‘ketogenic diet’ and this same diet seems to be implicated in treating concussion, and even serious mood disorders such as schizophrenia).
In the October 2005 the *Annals of Neurology*, Columbia University researchers found that depression and suicide attempts may be due to underlying neurochemical pathways common to epilepsy development.

**What are the benefits of stimulating the Vagus Nerve?**

The vagal nerve is the main instrument of the parasympathetic nervous system. Its branches begin in the medulla oblongata and travel deep into the body sending signals to, but mostly from the organs (especially the gut).

There are several locations where the vagal nerve comes out to accessible zones for stimulation:

- Muscle that constricts the pharynx (rami pharyngei)
- Behind the eye balls (radix oculomotoria)
- Hard and soft palate (nervus palatinus)
- In the surface of the ear canal and lobe (ramus auricularis)
- Tongue (ramus lingualis)[i]

When properly stimulated the Vagus Nerve can:

- Turn on neurogenesis, helping our brains sprout new brain cells.
- Rapidly turn off the stress, hyper-arousal, and flight/flight via the relaxation response.
- Sharpen our memories.
- Fight inflammatory disease.
- Help you resist high blood pressure.
- Block the hormone cortisol and other oxidizing agents that age and deteriorate the brain and body.
- Block systemic (body-wide) inflammation – a major factor behind aging and poor health.
- Help us overcome depression and anxiety.
- Help us sleep better.
- Raise levels of human growth hormone.
- Help us overcome insulin resistance.
- Turn down allergic responses.
- Lower chances of getting stress and tension headaches.

- Help spare and grow our mitochondria- this is a key to maintaining optimal energy levels and not harming our DNA an RNA.
- Affect our overall ability to live longer, healthier, and more energetic lives.

**Activating the Vagus Nerve**

Vagus nerve stimulation can be turned on easily though a number of breathing and relaxation techniques:

- Deep/slow belly breathing.
- ‘OM’ Chanting
- Cold water face immersion after exercise
- Filling the mouth with saliva and submerging your tongue to trigger a hyper-relaxing vagal response.

**Deep Breathing**

To practice deep breathing, inhale through your nose and exhale through your mouth. Remember to:

- Breathe slowly.
- Breathe deeply, from the belly.
- Exhale longer than you inhale. *(again, this is not right for everyone - always experiment very gently, never forcing! – numeric guidelines for breathing patterns should be taken with a big grain of salt..practice lightly whenever changing your breathing patterns - RB)*

You can proceed as follows: take a deep inhalation into your belly (i.e. expanding your diaphragm) to the count of five, pause, and then exhale slowly through a small hole in your mouth. While at rest most people take about 10 to 14 breaths per minute. To get into parasympathetic/relaxation/healing mode it is ideal to reduce your breath to 5 to 7 times per minute. Exhaling through your mouth instead of nose makes your breathing more of a conscious process, and helps you to observe your breath more easily.[ii]

As you reduce your breaths per minute and get into parasympathetic mode your muscles will relax, dropping your worries and anxieties. The oxygen supply to your body’s cells increases and this helps produce endorphins, the body’s feel-good hormones.

Tibetan monks have been practicing ‘conscious breathing’ for decades, but there is nothing mysterious about it. You can enhance your experience by imagining that you inhale IN love, and exhale OUT gratitude.
These ancient techniques also will improve memory, fight depression, lower blood pressure, or heart rate, and boost your immune systems — and it’s free!

‘OM’ Chanting
An interesting study was performed by the International Journal of Yoga in 2011, where ‘OM’ chanting was compared with pronunciation of ‘SSS’ as well as a rest state to determine if chanting is more stimulatory to the vagus nerve. The study found that the chanting actually was more effective than either the ‘sss’ pronunciation or the rest state.

Effective ‘OM’ chanting is associated with the experience of a vibration sensation around the ears and throughout the body. It is expected that such a sensation is also transmitted through the auricular branch of the vagus nerve and will produce limbic (HPA axis) deactivation.[[iii]]

How to chant?
Hold the vowel (o) part of the ‘OM’ for 5 seconds then continue into the consonant (m) part for the next 10 seconds. Continue chanting for 10 minutes. Conclude with some deep breathing and end with gratitude.

Cold Water
Physical exercise causes an increase in sympathetic activity (HPA axis – fight/flight, stress response), along with parasympathetic withdrawal (resting, digesting, healing, immune system), resulting in higher heart rates (HR). Studies have found that cold water face immersion appears to be a simple and efficient means of immediately accelerating post-exercise parasympathetic reactivation via the vagus nerve, stimulating the reduction of heart rate, motility of the intestines, and turns on the immune system. It is also effective in a non-exercise environment to activate the vagus nerve.

In cold-water face immersion, subjects remained seated and bend their head forward into a basin of cold water. The face is immersed so that the forehead, eyes, and at least two-thirds of both cheeks were submerged. Water temperature was kept at 10–12°C.[[iv]]

A variation on this technique, called The Dive Reflex, has been developed by Steve Mensing and many people online have found it very valuable for relieving stress and depression. Here are the details:

Increased Salivation
The calmer the mind and the deeper the relaxation, the easier the stimulitic of salivation is. When the mouth is able to produce copious amounts of saliva, you know that the Vagus Nerve has been stimulated and your body is in the parasympathetic mode.

To stimulate salivation, try relaxing and reclining in a chair and imagine a juicy lemon. As your mouth fills with saliva, just rest your tongue in this bath (if this doesn’t happen, just fill your mouth with a small amount of warm water and rest your tongue in this bath. Just the practice of relaxing will stimulate the secretion of saliva). Now relax further, and feel your hands, feet, hips, back of the neck and head all relaxing. Breathe deeply into this feeling and stay here as long as you can.

There are many other ways to stimulate the vagus nerve and transfer your body into the healing, digesting and resting phase. Start with these suggestions and you may find that it becomes much easier to rest and relax!

References
[[ii]] https://site.google.com/site/stanleyguansite/health/health-tips/breathe-deeply-to-activate-vagus-nerve

The Autonomic Nervous System
Your body’s ability to deal with stress is regulated by the autonomic nervous system (ANS). This system monitors the environmental signals, interprets them, and organizes appropriate automatic behavioural responses. It is composed of a specialized group of neurons that regulate cardiac muscle (t heart), smooth muscles (walls of the visceral organs and blood vessels) and glands.

The autonomic nervous system has two components that balance each other – Protection – the sympathetic nervous system (SNS) and Growth – the parasympathetic nervous system (PNS). What is important to know is that both systems CANNOT operate optimally at the same time. We unavoidably restrict our growth behaviours when we shift into protective mode (stress...
Protection – the HPA axis and the Immune system

The sympathetic nervous system (SNS) turns UP your nervous system. It helps us handle what we perceive to be emergencies or threatening situations (can include emotional upset as well as physical stress) and is in charge of the flight-or-fight response. The SNS has two systems to protect the body: the Hypothalamus – Pituitary – Adrenals axis (HPA Axis) which responds to perceived external threats, and the Immune system which protects us from threats originating underneath the skin (like attack by virus or bacteria).

1. HPA axis
   - When the body perceives that there are no external threats, the HPA axis is inactive and growth flourishes.
   - When brain’s hypothalamus perceives an environmental threat, it engages the HPA axis by sending a chemical signal (CRE) to the pituitary gland.
   - The pituitary gland (master gland) is responsible for organizing the body to deal with the impending threat.
   - The pituitary gland sends a chemical signal (via ACTH) to the adrenals informing them to coordinate the body’s “fight or flight” response via stress hormones.
   - HPA axis interferes with both the immune system (protection) and growth systems:
     - HPA axis also interferes with our ability to think clearly
       - The processing of information in the forebrain (the center of executive reasoning and logic) is significantly slower than the reflex activity controlled by the hind brain
       - Adrenal stress hormones constrict the blood vessels in the forebrain reducing its ability to function
       - Stress hormones also repress activity in the brain’s prefrontal cortex (the center of conscious, volitional action)
       - In an emergency, the vascular flow and hormones serve to activate the hindbrain (source of reflexes)
       - Stress hormones inhibit neuronal growth, leading to depression. In chronically depressed people the hippocampus and prefrontal cortex are physically shrunken.
       - When the brain’s stress machinery goes into overdrive, it leads to depression.

2. Immune system
   - When the immune system is mobilized, it can consume much of the body’s energy supply.
   - Adrenal hormones secreted by the HPA axis actively repress the action of the immune system

Growth – the Vagus Nerve

The parasympathetic nervous system turns DOWN the nervous system and helps us to be calm. It is most active when the body is at rest and not threatened in any way. This division is sometimes called the ‘resting-and-digesting’ system since it is chiefly concerned with promoting normal digestion, with elimination of feces and urine, and with conserving body energy.

It promotes relaxation, rest, sleep, and drowsiness by slowing our heart rate, slowing our breathing, constrains the pupils of our eyes, increases the productivity of saliva in our mouth, and allows us to digest our food and grow.

The vagus nerve is the key instrument of the parasympathetic system. Beginning in the medulla oblongata, the nerve travels to all of the organs of the body sending signals to and from the brain. The two previous posts provide lots of information about the vagus nerve and how to activate the relaxation response. Post 1 – The Vagus Nerve, Post 2 – Activating the Vagus Nerve.

Importance of sleep

A recent survey found that more people are sleeping less than six hours a night and are having difficulties sleeping (because they are unable to turn off their HPA axis). Chronic sleep loss can contribute to health problems such as weigh gain, high blood pressure, and a decrease in the immune system’s power, reports the Harvard Women’s Health Watch.[i]

Some important tips for getting a good night’s sleep and allowing the PNS time to heal and relax are:

1. Keep a regular sleep schedule – set a regular time to go to sleep, and to wake up. After dinner, when you are relaxing on the sofa, try not to fall asleep and then wake up late in the night, get up and do something mildly stimulating. On the weekend, catch up on your sleep with naps.
2. Naturally regulate your light/dark cycles – increase light exposure during the day by taking walks outside in the light, use a light therapy box in the winter to offset SAD symptoms.
3. In the evening, turn off the television and electronic devices in your bedroom and close the blinds so outside lights don’t disturb you.
4. Create a relaxing bedtime routine – keep noise down, keep the temperature cool (adjust your thermostat to automatically drop several degrees during the night), and sleep in a comfortable bed.
5. *Eat right and get regular exercise* – stay away from really heavy meals late at night, avoid alcohol before bed, cut down on caffeine and avoid drinking too much liquid before bed. Having fruit several hours after dinner or before bed puts the system into ‘detox and cleanse mode’ which turns on the pancreas and liver and may keep you awake. If you are hungry before bed, try a light snack of a small piece of turkey or chicken breast, or avocado, or some soaked nuts with some plain yogurt.

6. *Get anxiety and stress in check* – try the activation of vagus nerve techniques in the previous post to turn on the PNS.

Today, we live in a stressed-out world and an increasing body of research suggests that our hyper-vigilant lifestyle is severely impacting the health of our bodies. Daily stressors and emotional upsets are constantly activating the HPA axis causing emotional and physical disharmony that cause major illness such as cardiovascular issues, depression, digestive issues, glucose/insulin resistance. Further, these stressors are not released from the body (as they would be in a fight or flight situation) and can build up to become chronic fears and concerns.

A dynamic balance needs to exist between the two divisions of the autonomic nervous system, so that they can continuously make fine adjustments. As a society we need to find new ways to release our fears and stressors and add relaxation time and techniques to our daily life.

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<tr>
<th>ORGAN</th>
<th>Sympathetic Stimulation/Stress</th>
<th>Parasympathetic Stimulation/Relax</th>
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<tbody>
<tr>
<td>HEART</td>
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<tr>
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<td>Increased rate and force of heartbeat</td>
<td>Decreases rate; slow and steady</td>
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<td>Dilates bronchioles</td>
<td>Constricts bronchioles</td>
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<td>GI TRACT</td>
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<tr>
<td>Motility</td>
<td>Decreased activity of digestive system</td>
<td>Increased slow muscles mobility (peristalsis) and amount of secretion by digestive system</td>
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<tr>
<td>SPHINCTERS (CLOSING)</td>
<td>Constriction</td>
<td>Relaxation</td>
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<td>Contracted</td>
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<td>Relaxes sphincters (allows voiding)</td>
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**Footnotes**


**Additional References**