

# The Vagus Nerve



CONVERSATION

## Workshop

Vagus Nerve Function

Immune, Gut and Hormone  
Connections

Conditions Related To Vagus Nerve

Stimulating the Vagus Nerve

Polyvagal Theory

Food and Nutrients

Exercises



# Vagus Nerve

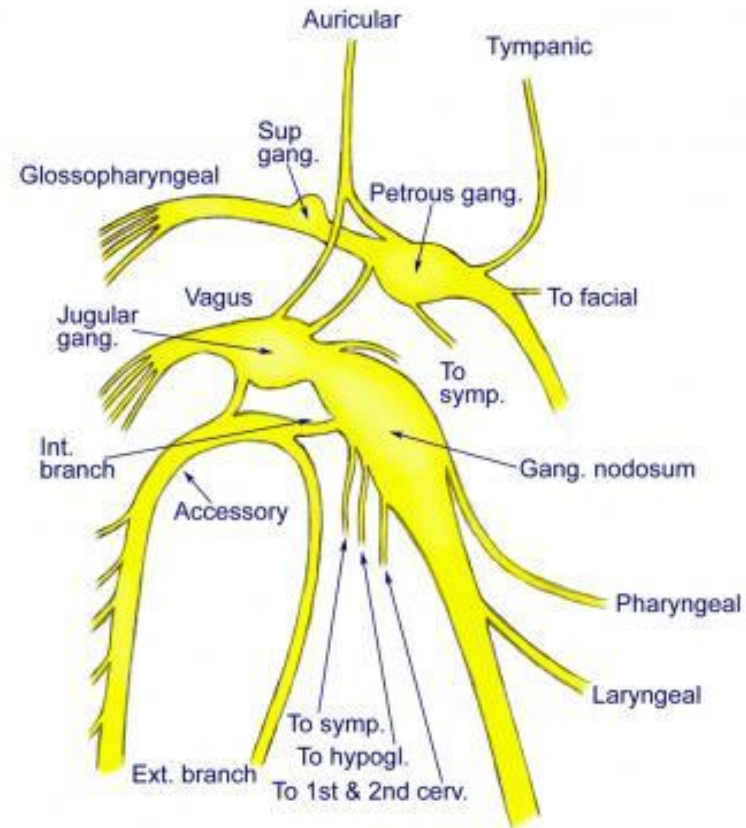
Considered the 10<sup>th</sup> cranial nerve

But it's more than one nerve

Main communication between the brain and the gut

Gut activating the vagus nerve can affect the brain and behavior

And signals from the brain can be sent to the gut via the vagus nerve

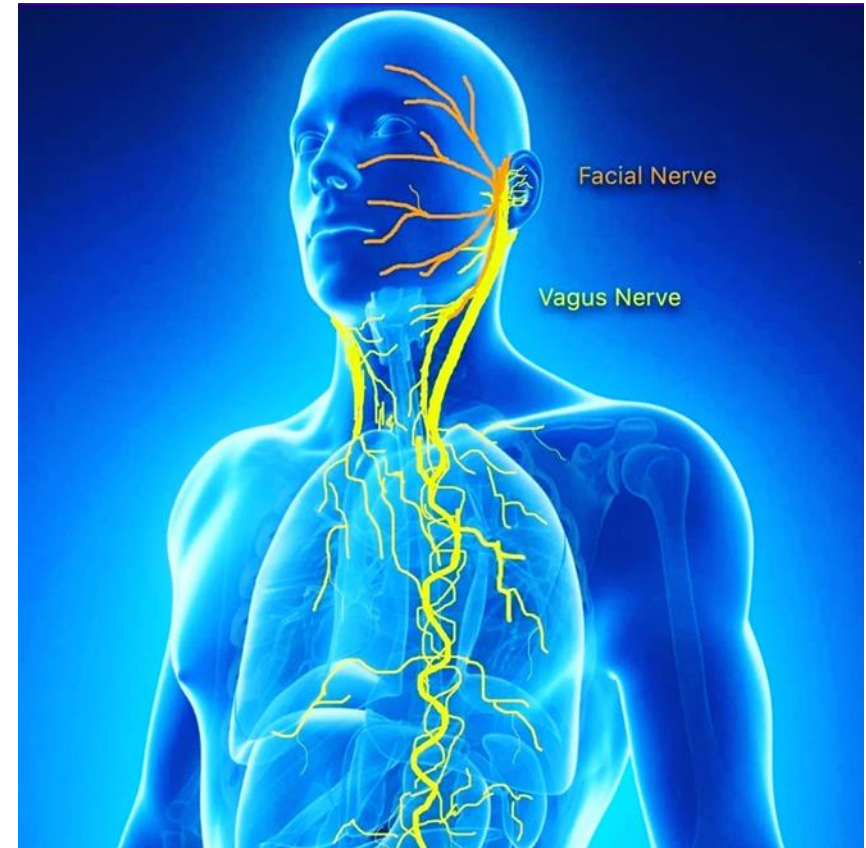


But this is just the beginning

The vagus nerve connects to multiple organs and functions in the body

Plays a role in metabolic disease, digestion, gut health, diabetes, obesity, inflammation, asthma, migraines, seizures, depression and more

It's complicated but the solutions don't have to be



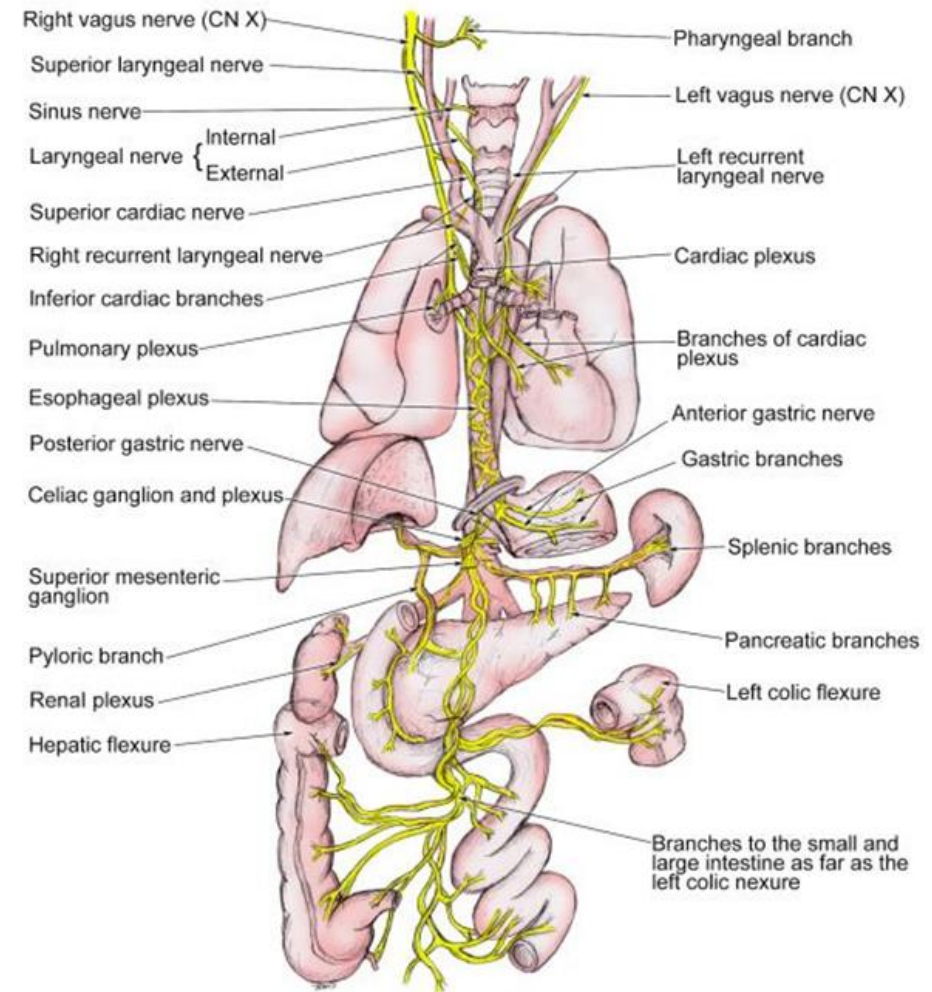


The vagus nerve represents the main component of the parasympathetic nervous system and was seen mainly as an antagonist to the sympathetic but we know now it does so much more

It oversees an array of the body's functions

This includes control of mood, immune response, digestion, and heart rate

It establishes one of the connections between the brain and the gastrointestinal tract

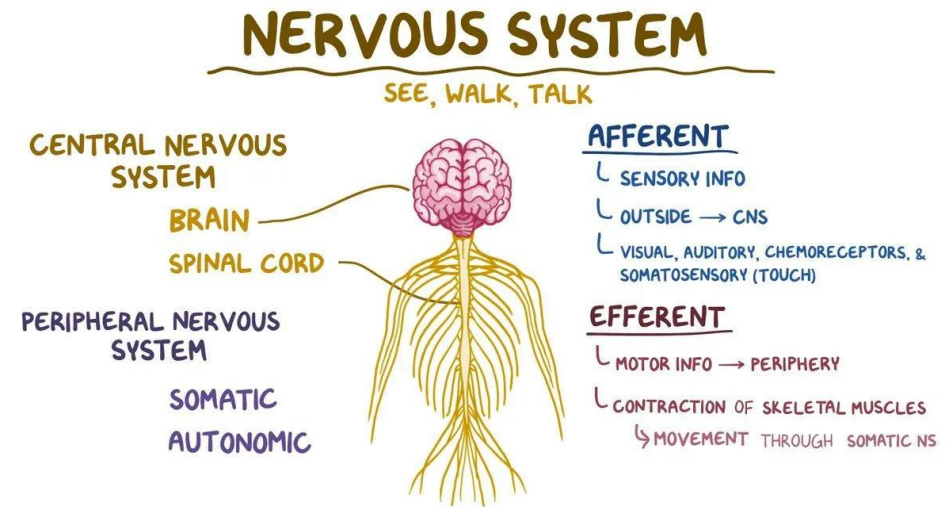


Sends information about the state of the inner organs to the brain via afferent fibers

But as the sympathetic nervous system increases, the vagus nerve slows down as does the parasympathetic nervous system

This affects how the body functions in different areas and can lead to health issues

There are many solutions to stimulate the vagus nerve but often more than one strategy is needed to see results to help health issues



|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nuclei               | <p>Dorsal nucleus - sends parasympathetic fibers to the intestines</p> <p>Nucleus ambiguus - sends efferent motor and parasympathetic fibers to the heart</p> <p>Solitary nucleus - receives special gustatory afferent from the tongue and visceral afferent fibers from organs</p> <p>Spinal trigeminal nucleus - receives general sensory afferent fibers</p>                                                                                                                     |
| Branches             | <p>In the jugular fossa: meningeal, auricular branches</p> <p>In the neck: pharyngeal, superior laryngeal, recurrent laryngeal nerves; superior cardiac branches</p> <p>In the thorax: inferior cardiac nerve, anterior bronchial branches, posterior bronchial branches, esophageal branches</p> <p>In the abdomen: gastric, celiac and hepatic branches</p>                                                                                                                        |
| Field of innervation | <p>General sensory afferent fibers - sensory information from larynx, auricle, external acoustic meatus, dura mater of the posterior cranial fossa</p> <p>General visceral afferent - information from the aortic body, esophagus, lungs, bronchi, heart, intestines</p> <p>Special afferent - information about taste</p> <p>General visceral efferent - parasympathetic division that simulates smooth muscle and glands of the pharynx, larynx, thoracic and abdominal organs</p> |
|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |



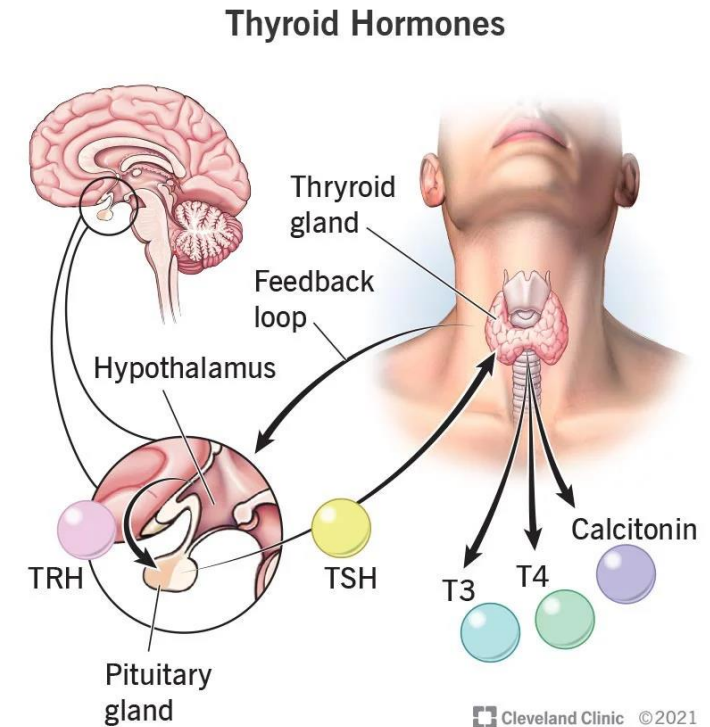
For clients on thyroid medication

In order for the vagus nerve to support HCL and enzymes, it requires TRH (thyrotropin-releasing hormone)

TRH is produced by neurons in the hypothalamus that stimulate the release of TSH (thyroid-stimulating hormone)

Being on a medication like Synthroid means this process for TRH and TSH does not happen

This reduces the ability of the vagus nerve to stimulate HCL and enzymes and to help gut motility





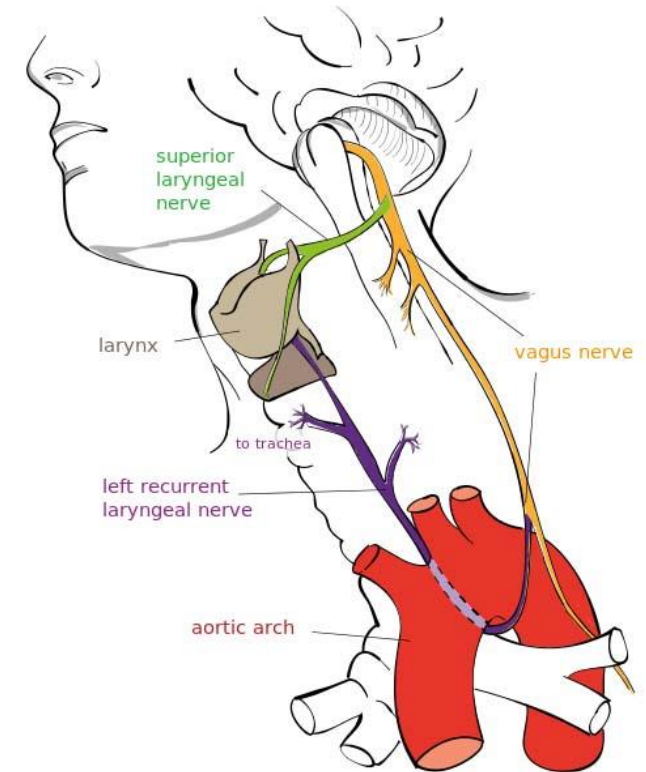
# The Vagus Nerve Connection To Immune & Inflammation

Vagus nerve is a bridge between the nervous system and the immune system, and it's bidirectional

When a client has a chronic condition, they can have multiple problems, including issues with brain function, GI function, dysregulation of the immune system, the presence of pathogens

And persistence of the inflammatory processes

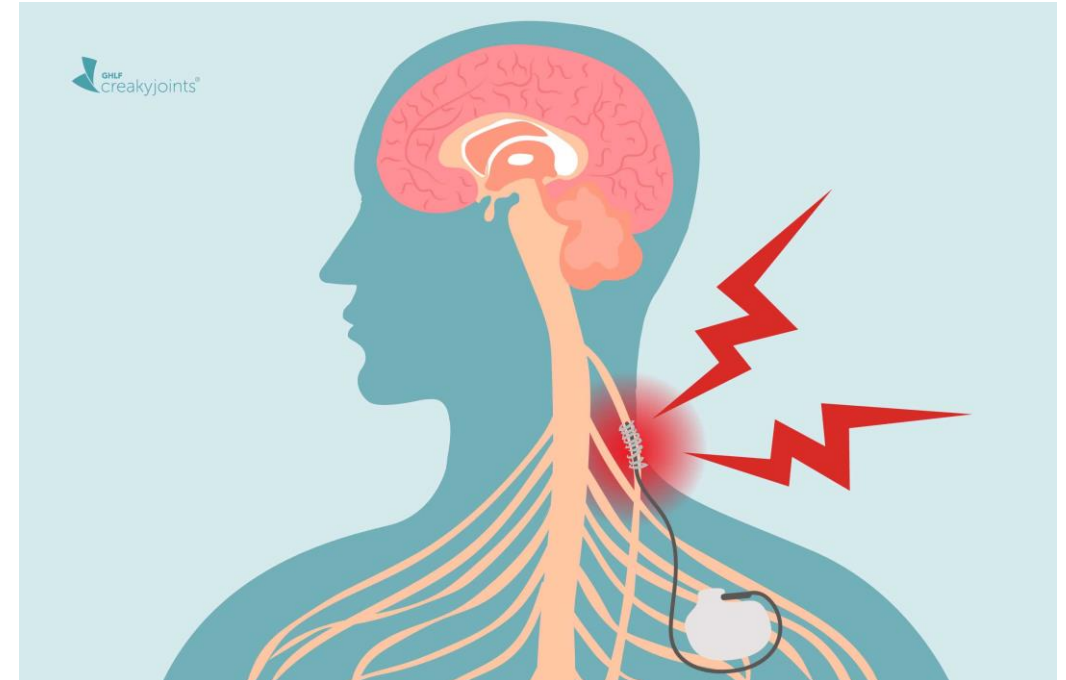
This means a client can have dysregulation in multiple areas and knowing where to start can be difficult



The vagus nerve can play a key role in shutting down the inflammatory process

The brain sends signals to the cortex, which in turn, stimulates normal function of the vagus nerve

The vagus nerve sends messages to the spleen to inhibit the production of inflammatory TNF-alpha and IL-1beta by spleen macrophages

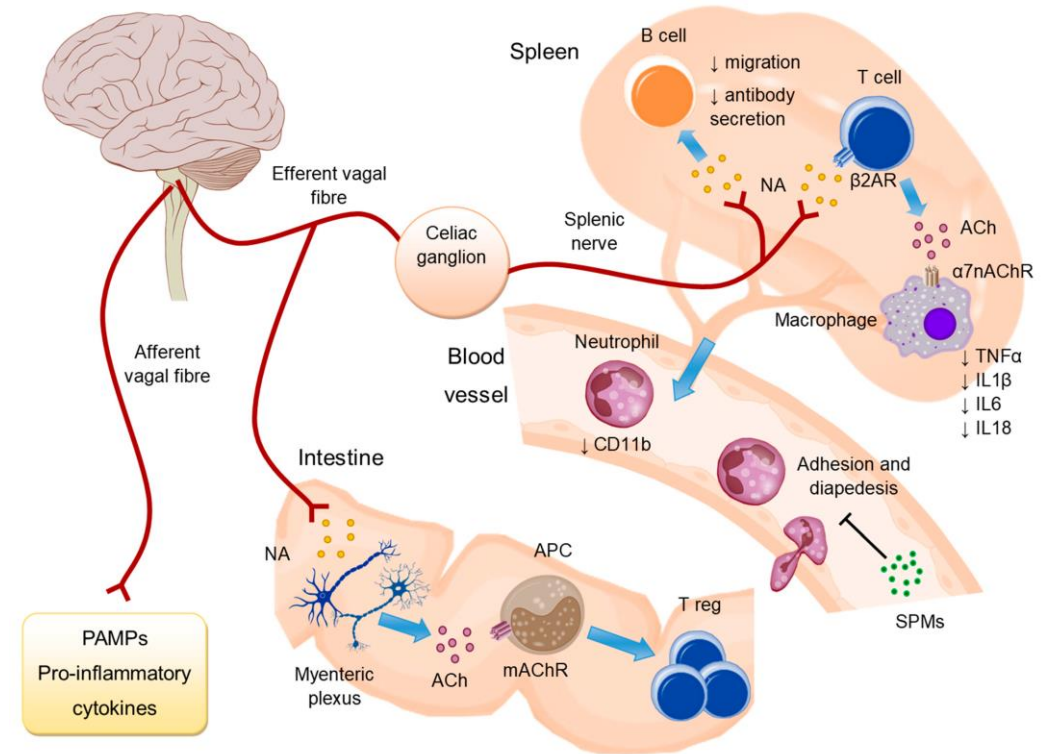


The vagus nerve also inhibits antibodies made by the macrophages

It does this with the neurotransmitter acetylcholine

It also sends messages to inhibit the activation of the sympathetic nervous system

And it promotes gut motility, HCl and digestive enzymes

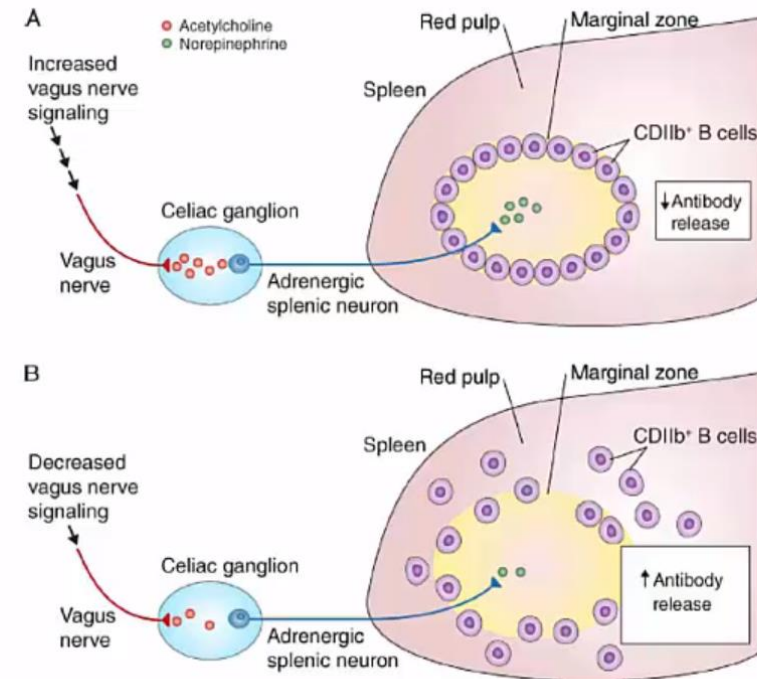




More HCL and enzymes means foods will be completely broken down and unrecognizable as a food antigen even if they were one previously

This prevents food sensitivities

All of this lowers inflammation in the GI tract

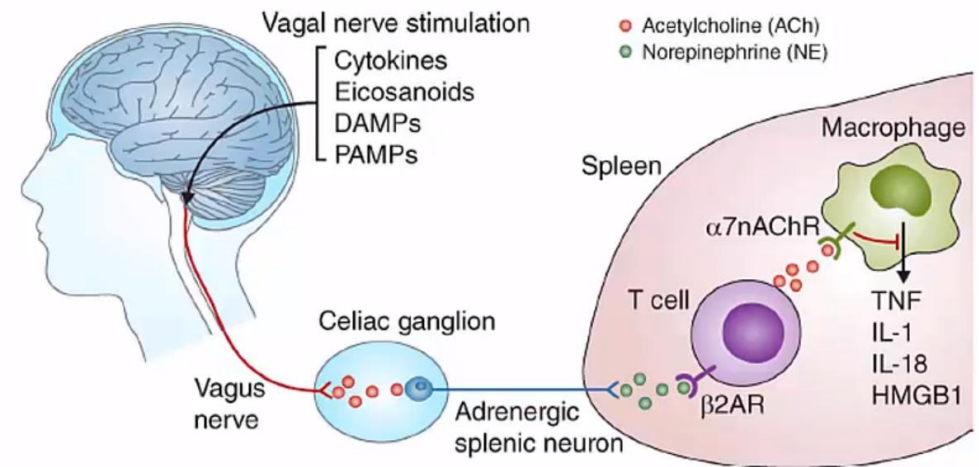


# What Goes Wrong

Body inflammation leads to brain inflammation

This will cause the person to have an inflammatory stimulation to the cortex

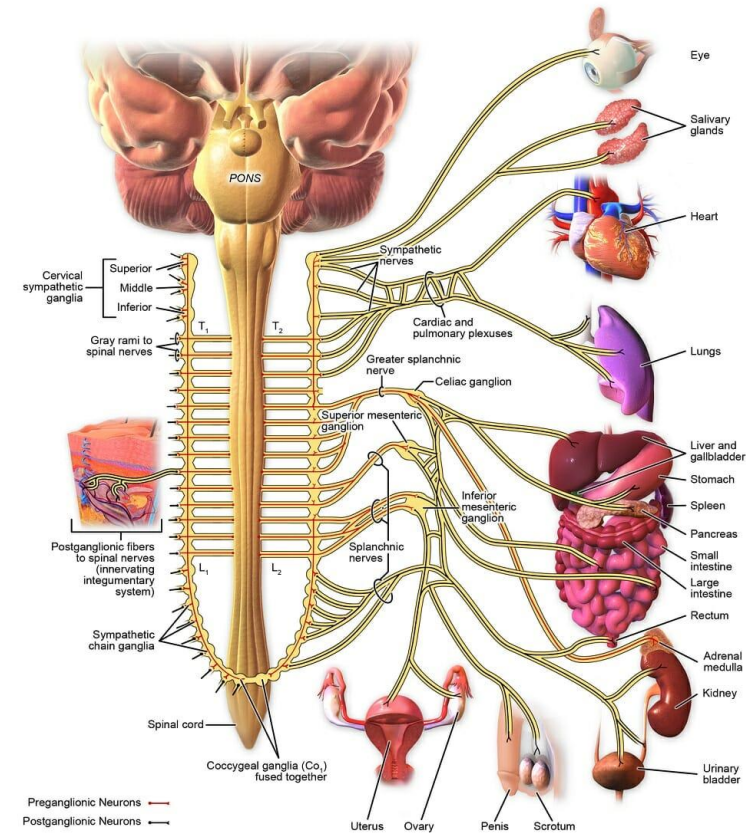
This lowers the frequency of the cortex to fire and reduces the vagal motor outflow, and the anti-inflammatory effect of the vagus nerve will be diminished



This means more inflammation, which is where this started in the first place, and the process is reinforced

The sympathetic nervous system will no longer be inhibited

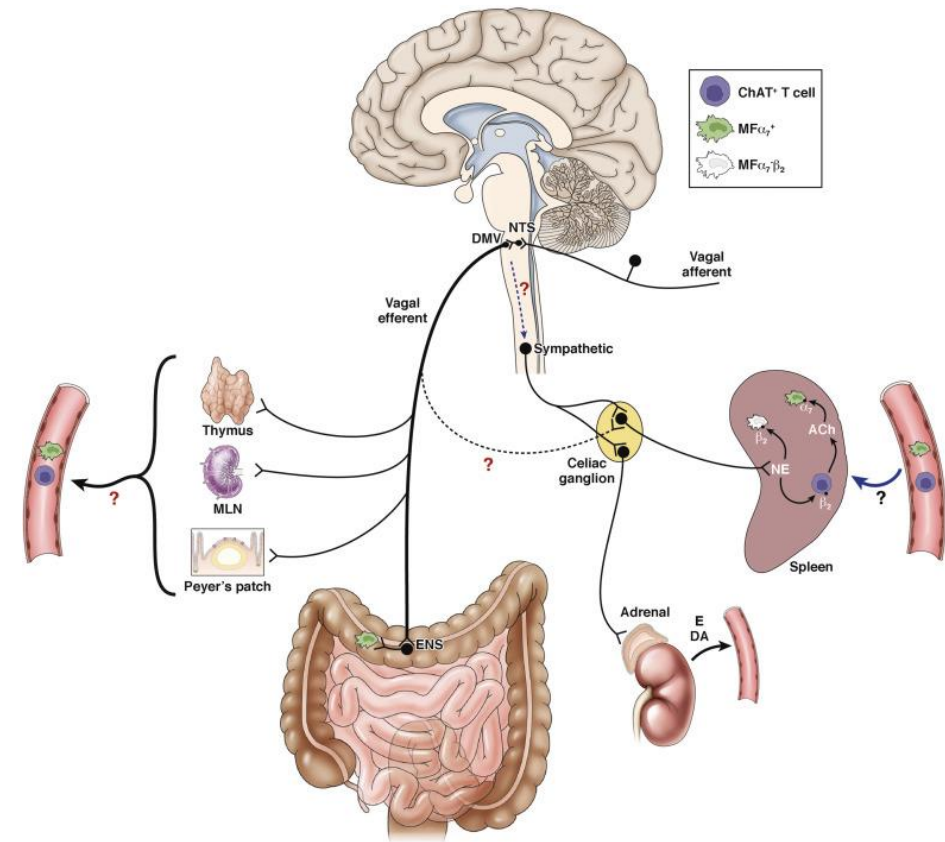
This means the stress response will be activated, and this also increases the inflammatory pathways



Also, gut motility will not be regulated properly

There will be insufficient HCL, and enzymes and food intolerances will increase and contribute to the inflammation process

This all happened because the body was inflamed to begin with which led to the brain inflammation



Where to look for initiation of the original body inflammation:

Gut problems and factors that cause them

Stress, lack of exercise and poor sleep

Injuries (including head injuries)

Poor nutrition and too much exposure to chemicals – drugs, environmental pollution





# The Gut & The Vagus Nerve

## Complicated relationship

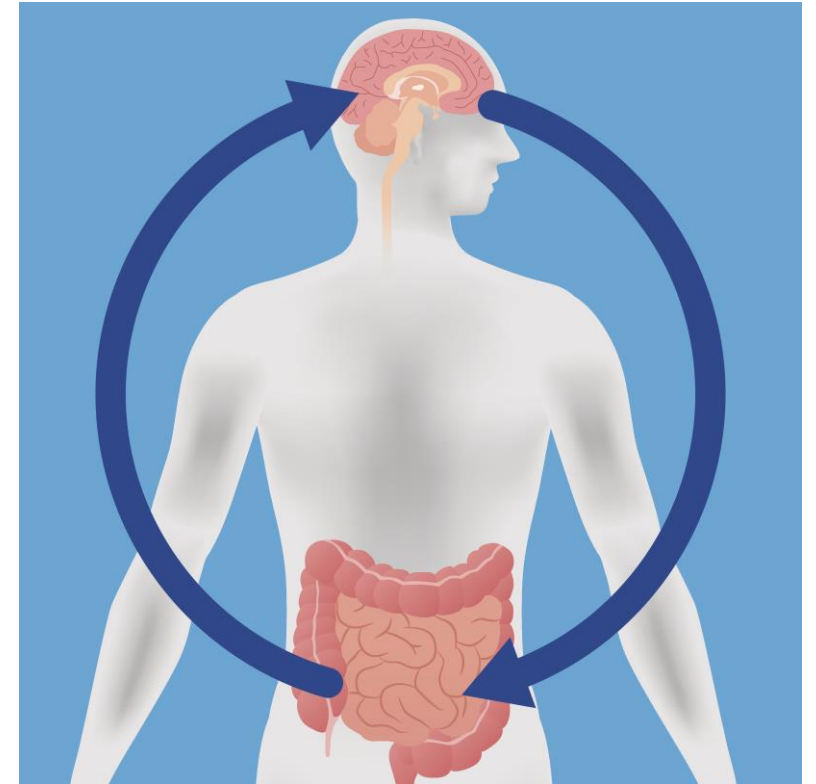
Vagus nerve sends signals to help a lot of GI tract function, especially the gut lining and mucus lining

Helps the tight junctions to help prevent leaky gut

Gut bacteria also can signal the vagus nerve:

1. By communicating with the brain which communicates with the vagus nerve
2. By affecting vagus nerve function directly

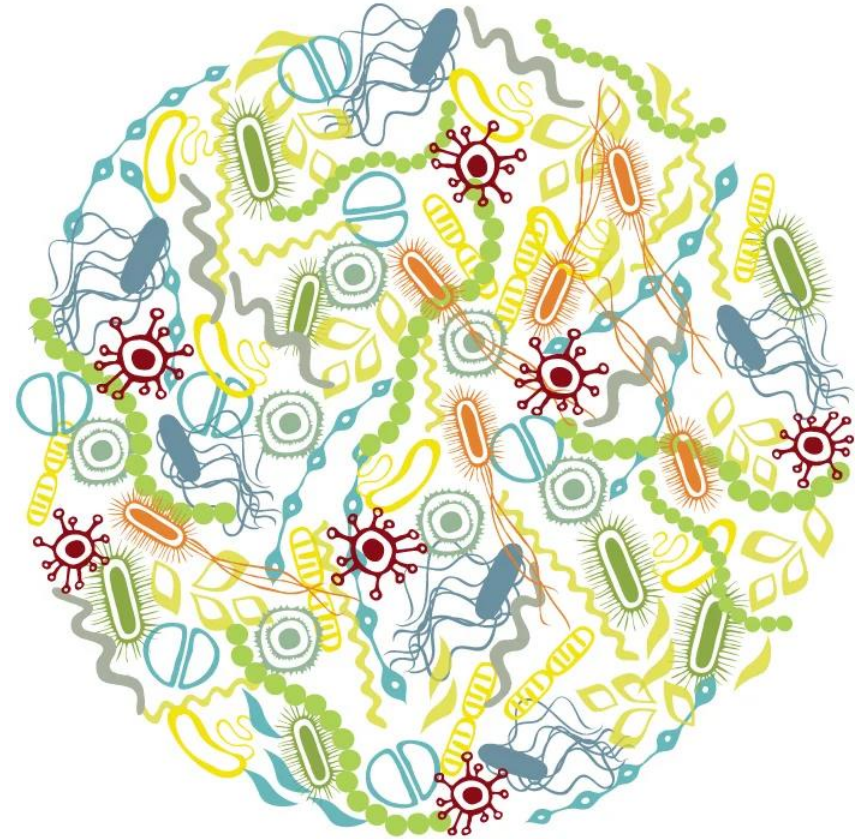
It all depends on what type of bacteria doing the communicating – good or bad



The vagus nerve also controls gut functions including motility, secretion, epithelial fluid maintenance, and mucosal immune response

This, in turn, can affect the microbial environment and influence the composition and activity of the microbes

Low vagus nerve function has been linked to intestinal disorders



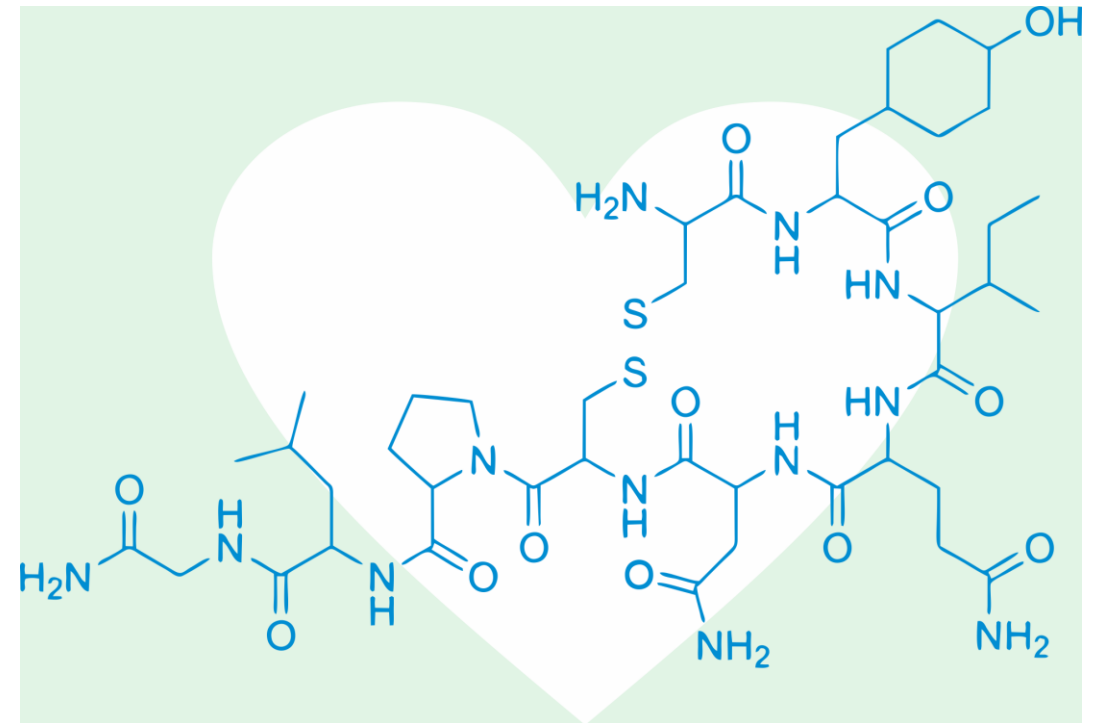
# Hormones

**Serotonin** is capable of activating the vagus nerve through various receptors:

**Oxytocin** may increase vagal nerve activity from the brain to the gut which induces relaxation and decreases appetite

**Thyroid hormones (T3)** increased appetite through activating the vagus nerve in rats

**Orexin neurons** are found in centers which control vagus nerve activation from the brain

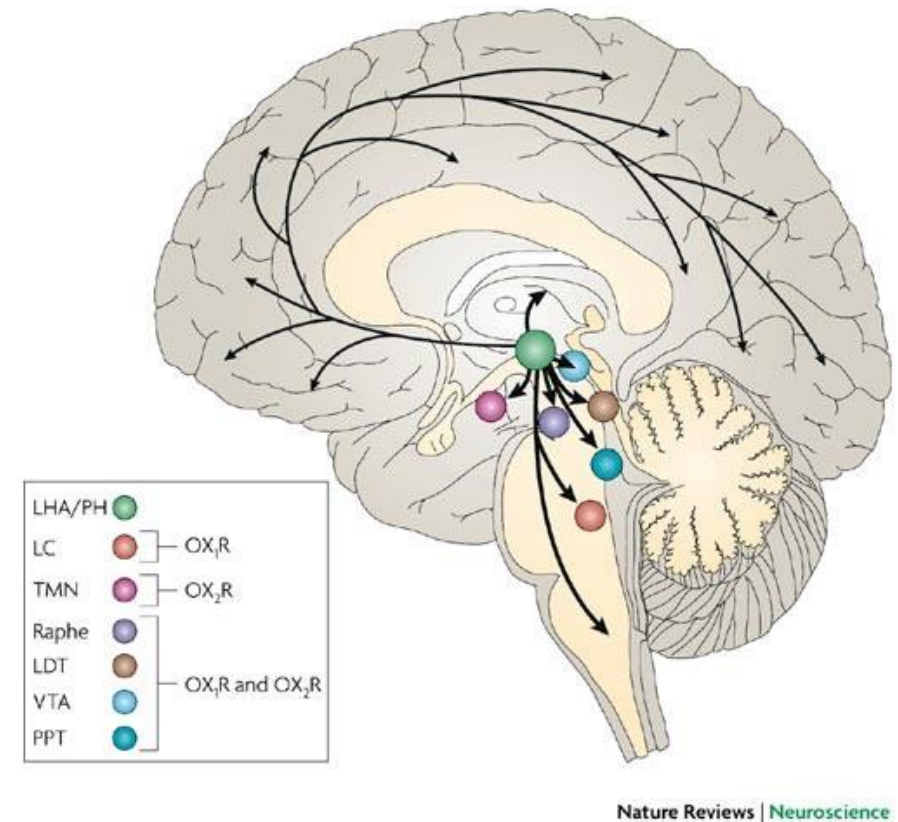




Orexin stimulates the vagus nerve from the brain, which promotes gut flow. It can stimulate the pancreas, too, according to an animal study

Also implicated in increasing glucose tolerance or insulin sensitivity via the liver vagus nerve

Orexin might inhibit the activation of the vagus nerve signals to the brain by competing with CCK (Cholecystokinin - triggers the gallbladder and pancreas to contract when fat or proteins enter the duodenum)



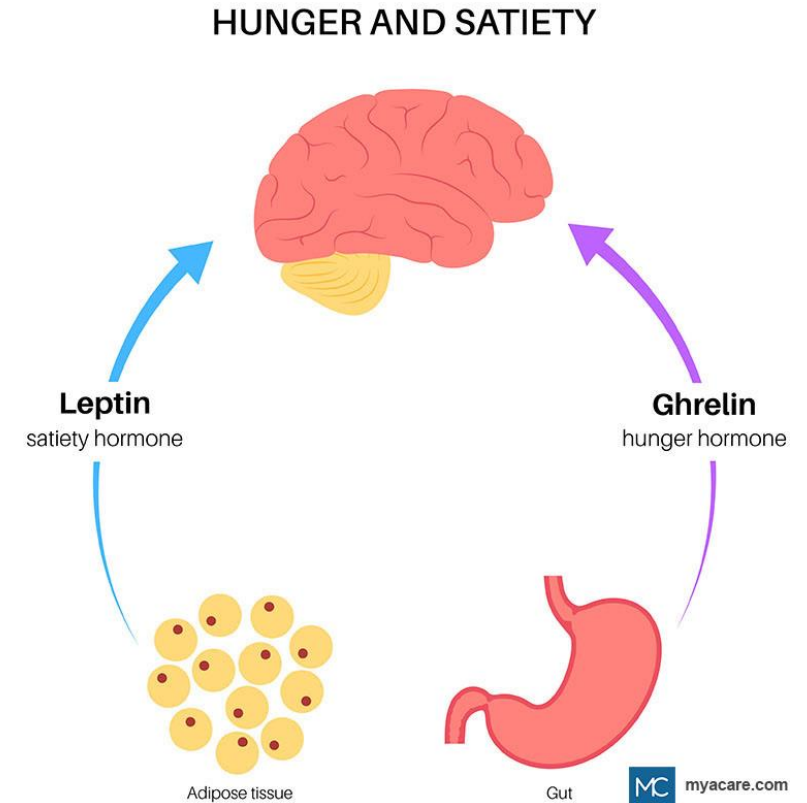
**Ghrelin** may increase growth hormone and hunger by stimulating the vagus nerve signal from the brain to the gut, capsaicin (in chili) can cancel this

Ghrelin may stimulate the pancreas from the brain via the vagus nerve

**Leptin** activates vagal impulses to the brain

May also potentiate the CCK-induced activation of the vagus nerve

But another study found that the leptin effect on the vagus nerve signal doesn't play a major role in food intake

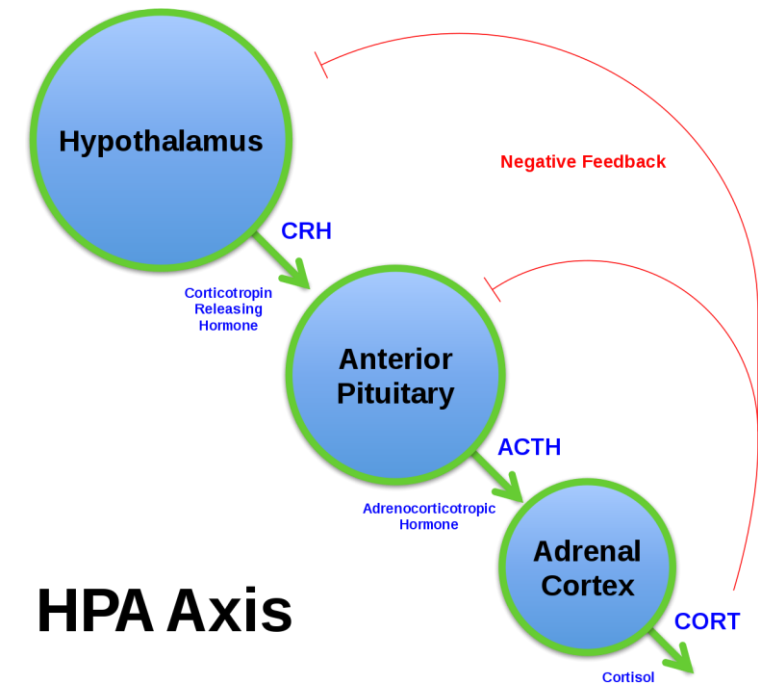


**CRH** (Corticotropin-releasing hormone from the hypothalamus) may decrease VN's activity from the brain to the heart. Vagus nerve activation will slow the heart rate, but CRH seems to inhibit this and increases heart rate—at least in animals

Also may increase VN communication from brain to the colon

Vagus nerve stimulation can normalize an overactive nervous system (HPA axis)

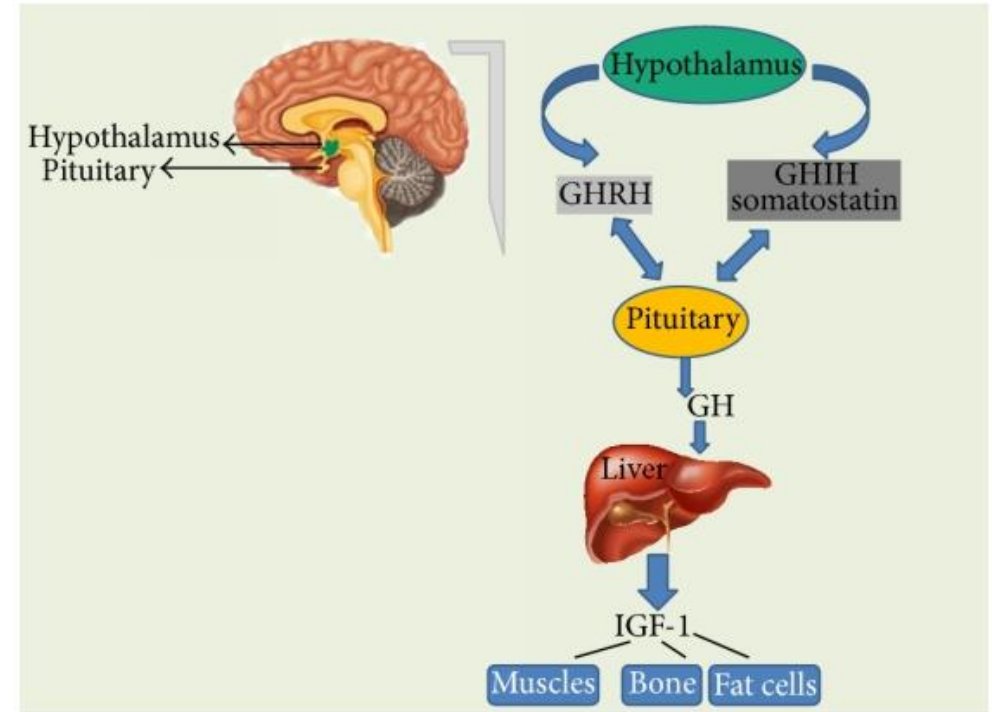
Vagus nerve can help reduce pain and this may be the mechanism used by estradiol which is believed to help reduce pain



Vagus nerve is thought to be important for releasing testosterone. Low T may be due to poor vagus nerve function

Proper functioning of the vagus nerve is important for the production of GHRH (growth hormone-releasing hormone) and IGF-1 in animals

Vagus nerve also activates the parathyroid hormone which helps convert Vitamin D to its active form



# Conditions Related To Vagus Nerve

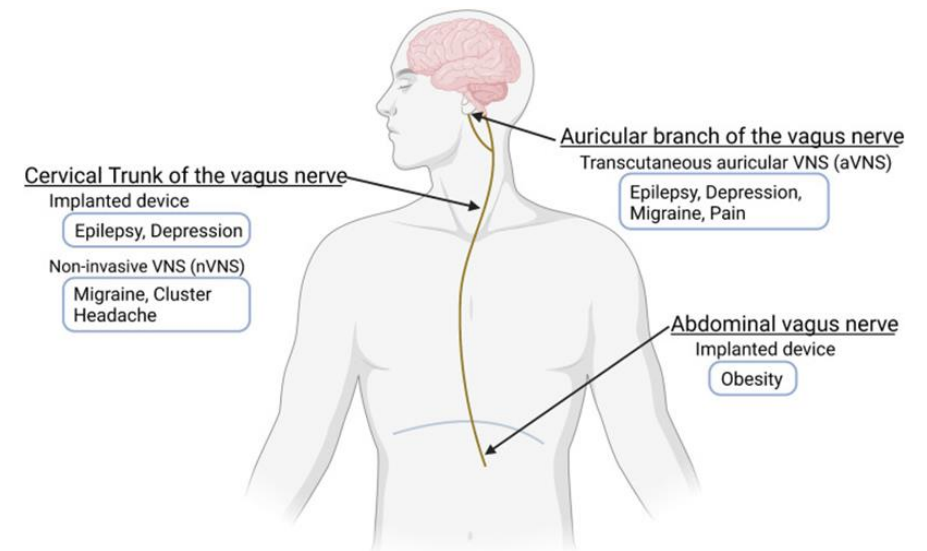
# Invasive VNS

VNS involves stimulating the left cervical vagus nerve by surgically implanting a pulse generator device.

The left, as opposed to the right cervical VN, is targeted to minimize cardiac effects including bradycardia (slow heart rate)

A lot of research for health issues uses this method to measure vagus nerve stimulation and includes positioning it in different areas of the VN

Auricular branch of the vagus nerve is better and less invasive (tragus)





# Cognitive Function

*“Activation of the nucleus of the solitary tract (NTS) in the brainstem by vagal afferent nerve fibers allows for modulation of various higher-order brain regions, including limbic and cerebral cortex structures”*

Different factors must be accounted for but “may allow for optimal VNS application to enhance memory”

[Vagus nerve stimulation: mechanisms and factors involved in memory enhancement - PMC \(nih.gov\)](#)



# Headaches

Both invasive and non-invasive methods of stimulating the vagus nerve have been shown to help with different types of headaches including cluster headaches and migraines

This is done by stimulating the carotid vagus nerve

Can be done with a hand-held device or massage  
(<https://www.gammacore.com/>)

Carotid sinus massage – done by a doctor

[How to Perform a Carotid Massage: 12 Steps \(with Pictures\) \(wikihow.com\)](#)

[Vagal Maneuvers: Safety, Efficacy, and How to Do Them \(healthline.com\)](#)

[Valsalva Maneuver: How to Do It and When to Use It \(webmd.com\)](#)



# Epilepsy

Sixty-seven patients were randomized to receive high or low VNS treatment with an implanted device for 14 weeks.

38.7% of patients receiving high VNS achieved at least 50% reduction in seizure frequency compared with 19.4% of patients receiving low VNS

Implantable VNS devices are used in the treatment of drug-resistant epilepsy for people who are not eligible for epilepsy surgery

6 months treatment to see optimal results



# Depression (and Anxiety)

VNS produced changes cerebral blood flow in multiple regions implicated in depression

This was seen areas such as in the bilateral orbitofrontal cortex, bilateral anterior cingulate cortex, and right superior and medial frontal cortex while decreases were seen in the bilateral temporal cortex and right parietal area

But this only lasted 30 weeks after treatment

VNS also improves noradrenaline and serotonin, also linked to lowering depression levels

May also help dopamine levels



# IBD

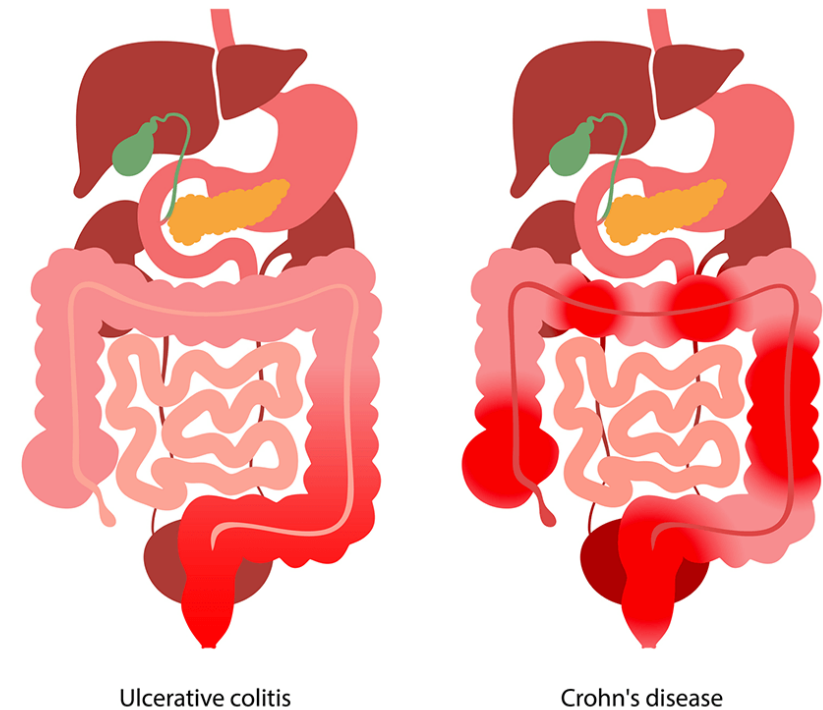
The VN connects the CNS to the digestive system through the brain–gut axis.

Vagus nerve receptors can detect the status of the GI tract and communicate with the CNS, which in turn can communicate back

Low vagal tone has been associated with higher levels of TNF-alpha (higher in those with IBD (includes Crohn's and colitis)

VNS lowered TNF-alpha

## INFLAMMATORY BOWEL DISEASE (IBD)



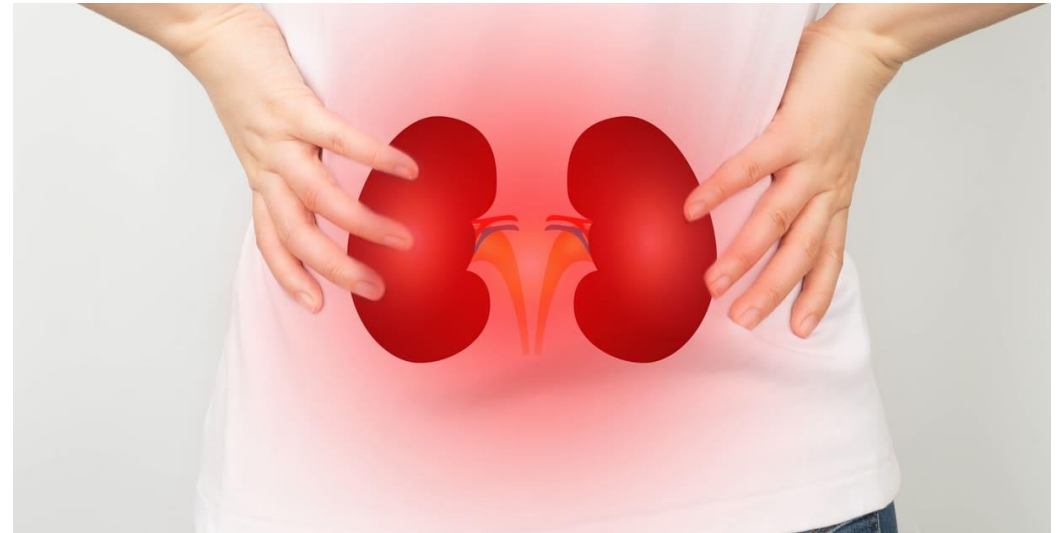
# Kidney Disease

VNS helped improve renal function in those with a kidney transplant

Have also been researching using this for dialysis to suppress inflammation

So far results have not been successful but the participants in the studies did not do VNS daily

Worthwhile teaching clients with kidney issues to support their vagus nerve





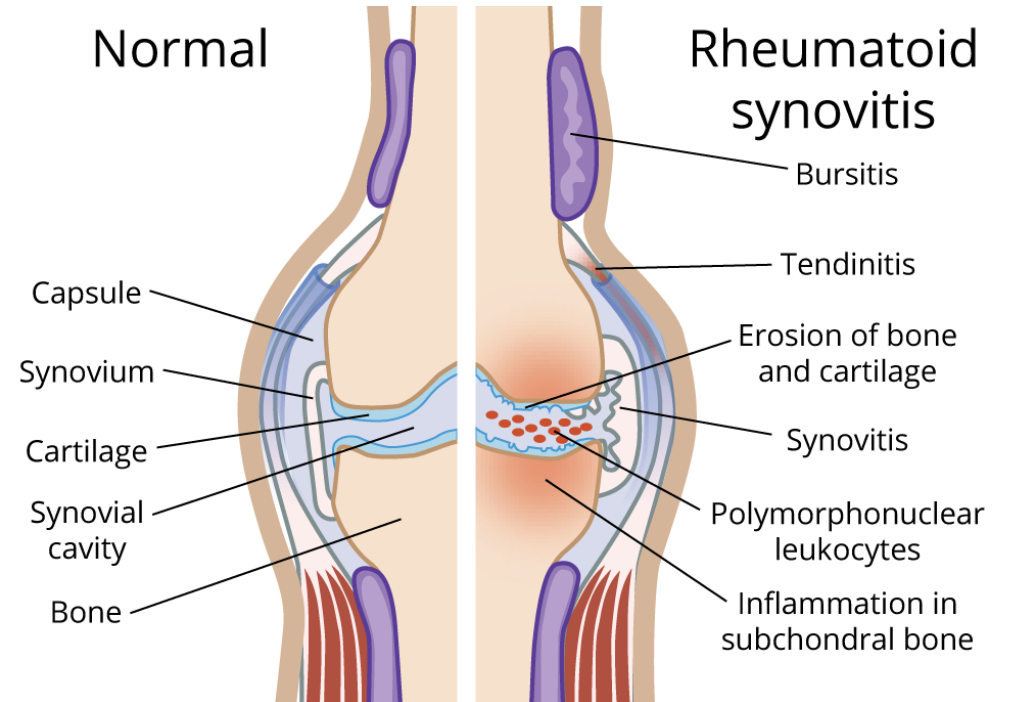
# Rheumatoid Arthritis

18 patients received VNS for 60 seconds up to four times daily.

Blood was collected on day 42 which showed a decrease in TNF-alpha levels with VNS

When stimulation was stopped for 14 days during which time TNF-alpha levels increased.

Shows consistency is required



# Stroke

Research is looking at using VNS for recovery

Specifically doing VNS while exercising during rehab

Human studies showed positive results – with the VNS groups improving more than non-VNS group – again an implant was used

In animal models this was successful but doing VNS after exercise was not

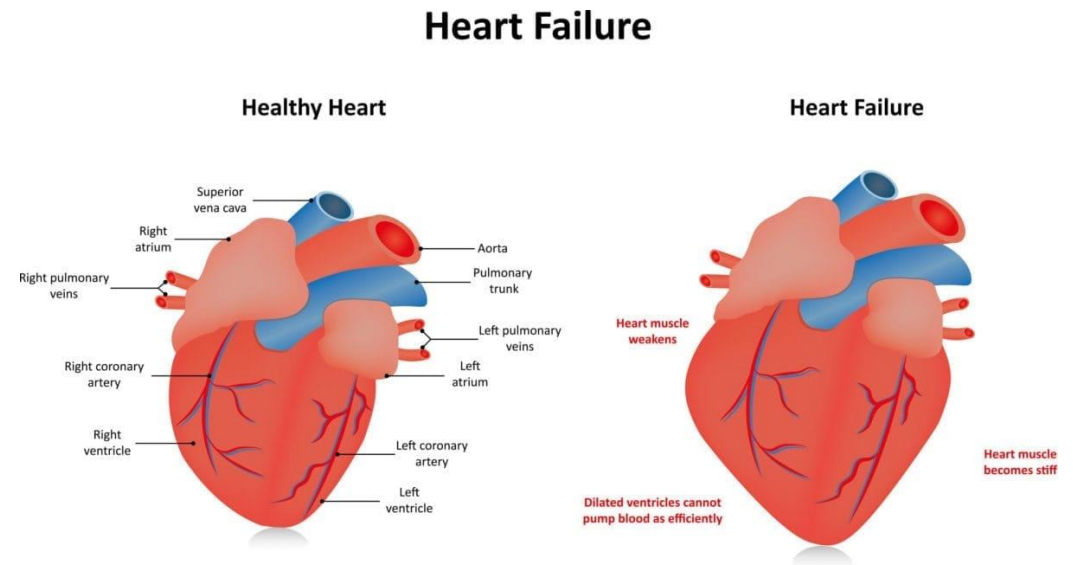


# Heart Failure

Study of patients with symptomatic heart failure

Wanted to see if VNS would reduce cardiac remodeling, improve cardiac function, and increase exercise capacity

Results showed benefits for quality of life but did not decrease heart failure incidences compared with controls



Current blood pressure studies  
(placebo-controlled) show that VNS  
can help in studies on healthy men

Has not been studied in older people  
with blood pressure issues

Rat study found that VNS improved  
cardiac structure, and increased heart  
weight but did not help fibrosis in  
hypertensive rats

Also increase longevity



# Diabetes

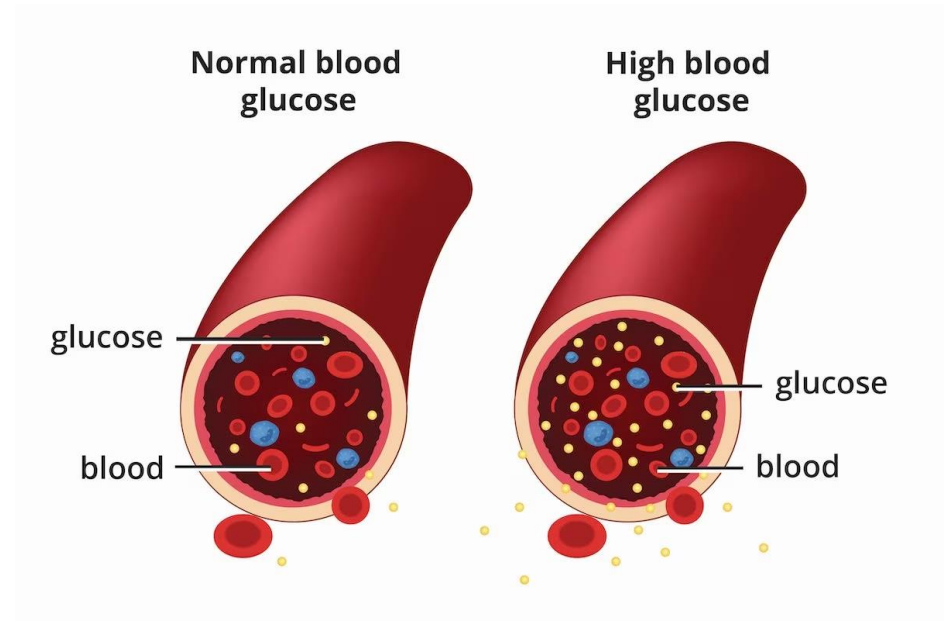
Vagus nerve has several ways to help with diabetes

By regulating inflammation it helps prevent insulin resistance

It helps lower stress which has been linked with developing diabetes

VNS has been shown to help lower high blood sugar in animal studies

VNS regulates energy metabolism, glucagon and insulin secretions



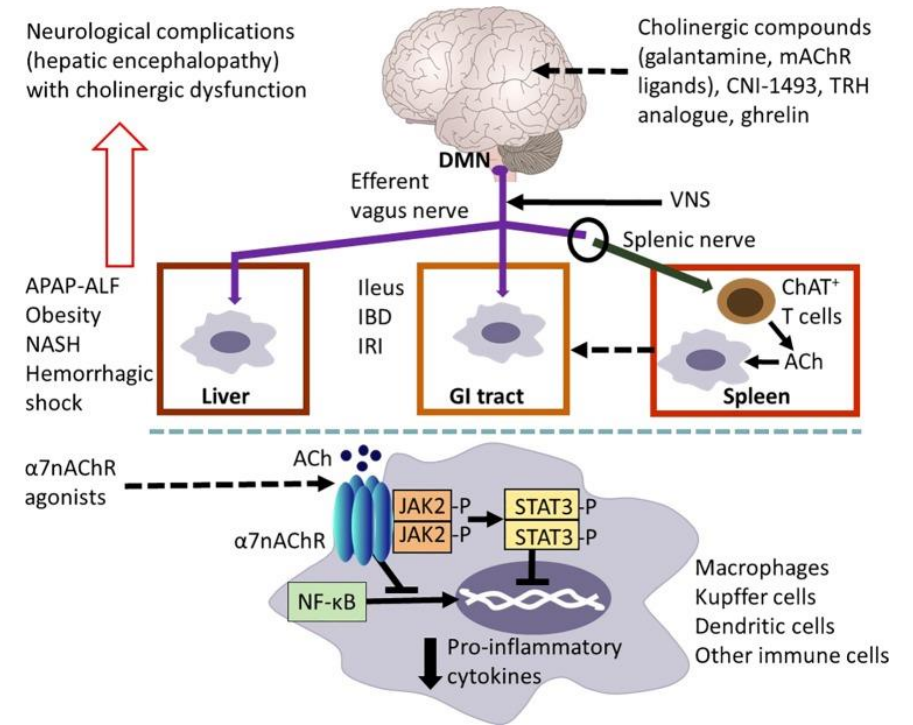
# Liver Disease

Many liver conditions have an inflammatory component

Cervical VN stimulation lowers LPS-induced TNF-alpha production in the liver

This happens with acetylcholine (cholinergic) acting as a neurotransmitter to signal the vagus nerve

Cholinergic – vagus nerve research is currently looking at fibrosis, primary biliary cirrhosis, chronic autoimmune hepatitis, and primary sclerosing cholangitis (scarred bile ducts)





# Cancer

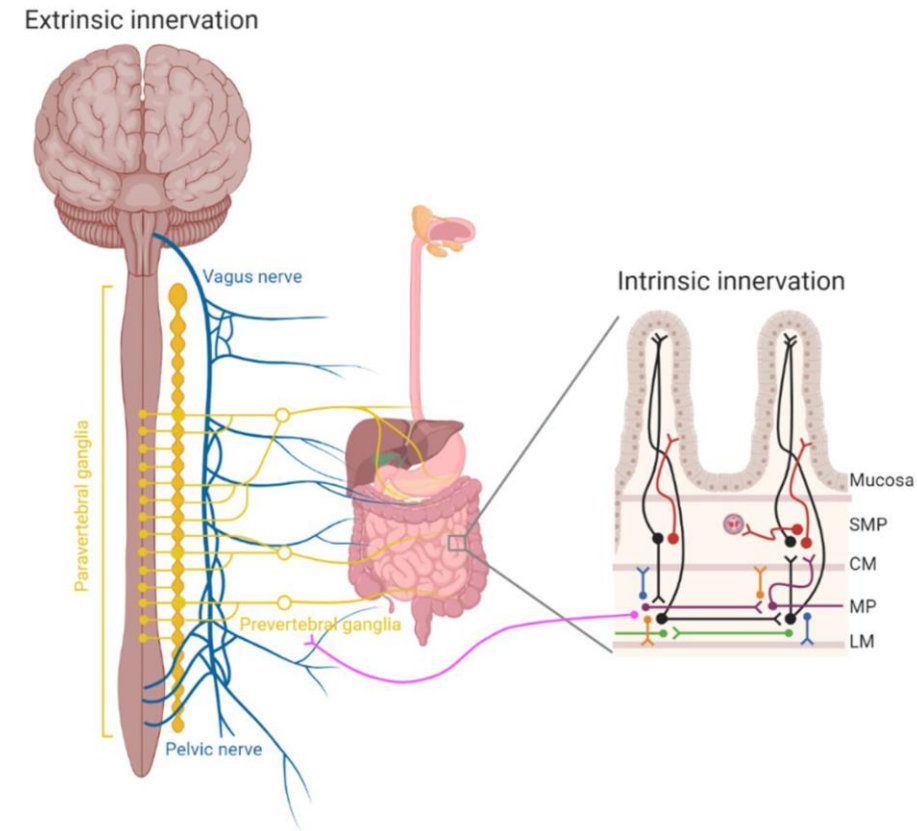
Three main factors for the onset and progression of tumors

1. Inflammation
2. Oxidative stress
3. Excessive sympathetic activity

High vagus nerve activity can inhibit all three

Even if cancer is present, high vagus function leads to slower progression

There's a protective role of the vagus nerve in cancer and specifically in the metastatic stage.





# Obesity

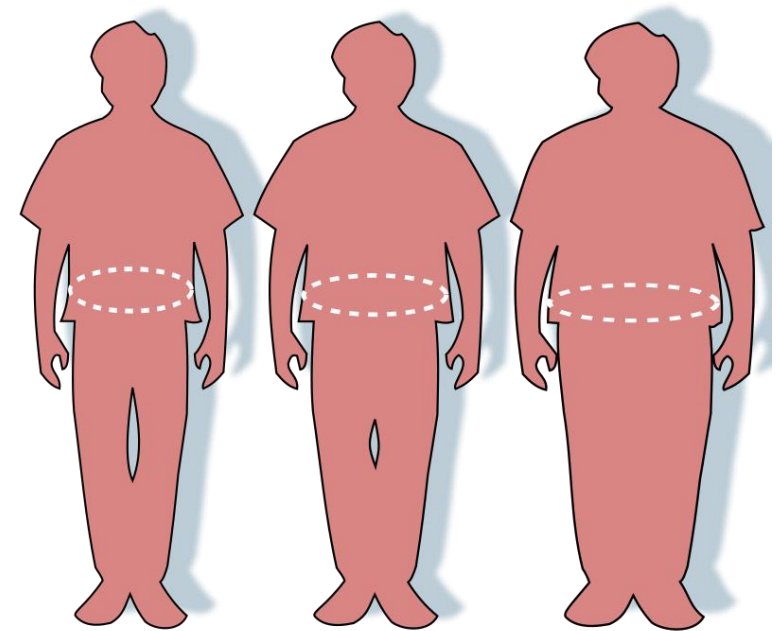
Weight loss was observed in epilepsy and depression studies with VNS

Animal models looking at obesity alone found VNS can delay gastric emptying and less food was consumed

FDA approved the use of VNS device in the treatment of obesity

A 12-month human study found the device helped weight loss but it was less than 10% weight reduction

Participants did sustain this loss for 18 months



# Technical Solutions

## TENS machine

In a randomized triple-blind trial, 150 obese participants will receive either active TENS, at 25 Hz, three to four times a day for 10 min, 30 min before the main meals, or sham stimulation, for 6 months

Changes in percentage of body fat, BMI, and waist circumference were observed



There are non-food/nutrient suggestions for stimulating the vagus nerve

More than one suggestion can be made to create a vagus nerve protocol

A TENS + EMS machine has been studied to stimulate the vagus nerve

It stimulates the cortex to then stimulate the vagus nerve to have normal function



# Study

Stimulating the tragus (left ear side) is known as transcutaneous auricular vagus nerve stimulation (taVNS)

18 healthy volunteers used a TENS + EMS machine with an ear clip at 500  $\mu$ s 25 HZ for 60 sec (repeated 3 times over 6 min) on either the tragus or the earlobe (as a control)

Conclusion: Stimulation of the tragus activates the brain impulses to the vagal nerve pathway



For more information about TENS + EMS machines for the vagus nerve:

[Best TENS Unit for Vagus Nerve Stimulation \(2023\) - Optimize Health 365](#)

<https://www.youtube.com/watch?v=hVUd2a3Hawg>

[Ten minute routine for stimulating the vagus nerve](#)



Clients may be too sensitive for nutrients, foods and supplements, including those for the vagus nerve

Vagus nerve stimulation may be the place to start

And transcutaneous vagus nerve stimulation may be the way to go





# Safe & Sound Protocol

A listening therapy based on Polyvagal Theory that promotes automatic state regulation, social engagement, sensory processing, and mental health.

Involves listening to specially filtered music to stimulate the vagus nerve and improve social engagement and emotional and physical well-being.

[SSP Safe & Sound Protocol](#)

Jenny Yoon, RHN [www.sensitivitycare.com](http://www.sensitivitycare.com)



Can help all people who experience challenges related to communication, social engagement, regulation, and sensory processing including people with autism, ADHD, trauma, anxiety, and other related conditions.

Ongoing research is investigating the benefits of SSP for adults with Chronic pain and fatigue, older adults with Parkinson's Disease, and young adults and adolescents with Ehler Danlos Syndrome (EDS), stroke, Mild Traumatic Brain Injury, and other conditions.



# Somatic Therapy

Instead of just talking about problems, somatic therapists guide patients to focus on their underlying physical sensations

Can combine several techniques including mind-body exercises may include breath work, meditation, visualization, massage, grounding, dance, and/or sensation awareness work



**Sensorimotor psychotherapy:** Uses the body as both a source of information and where to target intervention

**The Hakomi Method:** Combines scientific, psychological, and spiritual work. The four core concepts are gentleness, nonviolence, compassion, and mindfulness.

**Bioenergetic analysis:** An energy work form of psychotherapy that combines body, analysis and relationship work

**Biodynamic psychotherapy:** A combination of allopathic and holistic therapy modalities that include physical massage by the practitioner

**Brainspotting:** Combines mind and bodywork including eye positioning to retrain emotional reactions.

Much of the work for somatic therapy focuses on helping to relieve trauma

But the strategies are helping to stimulate the vagus nerve

If unsuccessful, then they weren't the right strategies for the vagus nerve to play a role in reducing the emotional issues

Drumming is a somatic therapy method that can help relieve trauma

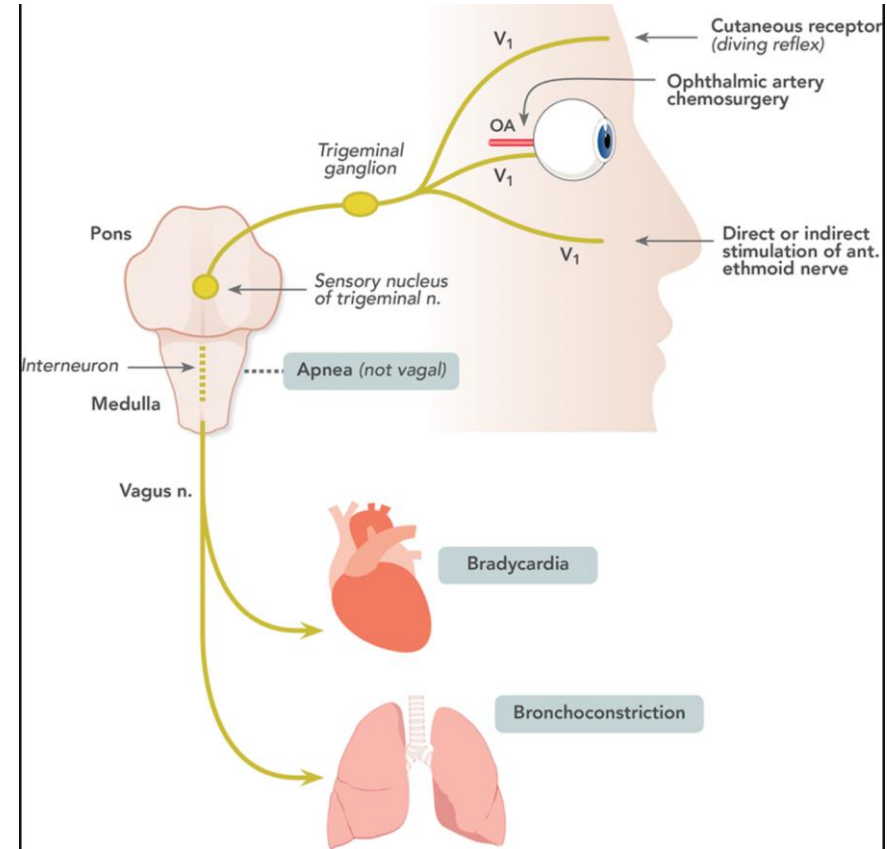
Its rhythmic nature along with dancing, swaying etc. helps stimulate the vagus nerve



Diving reflex is an innate multi-system physiologic response present in all vertebrates that functions to preserve oxygen stores during times of water immersion

Splashing cold water or immersing the face in cold water triggers sends a message from the trigeminal nerves in the face to the vagus nerve

This slows heart rate and preserves oxygen for the heart and brain



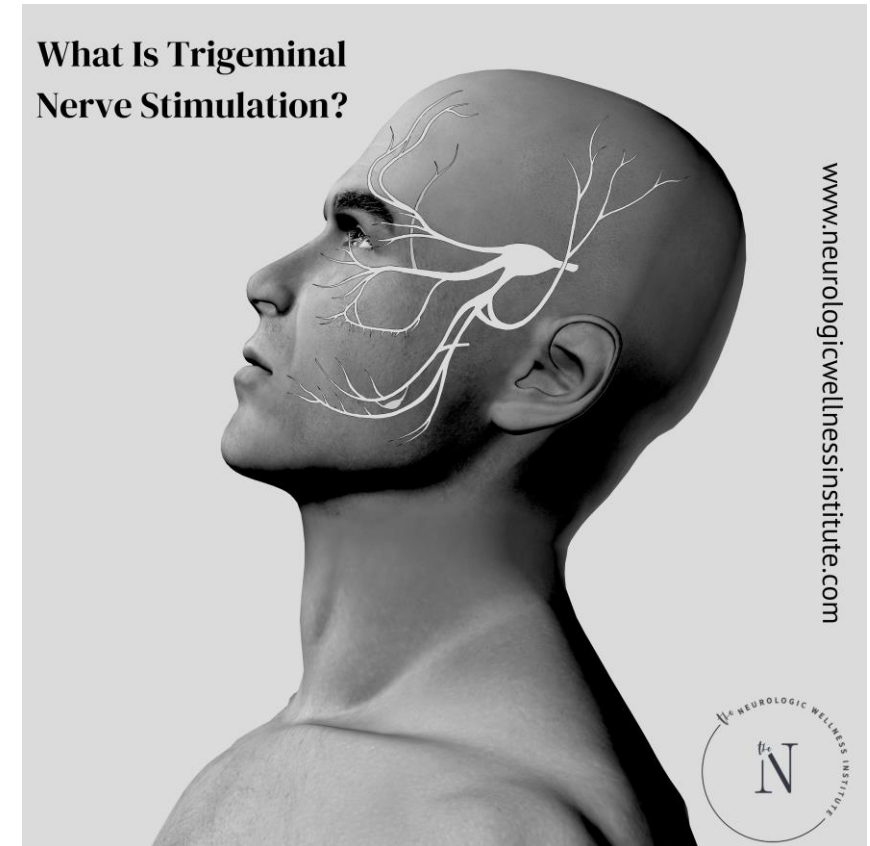


# Trigeminal Nerve Stimulation

Sends signals directly to the brain  
which signals the vagus nerve

But it can also go directly to the vagus  
nerve for heart and lung benefits and  
either stimulate fight or flight or calm a  
person down

Trigeminal nerves can be stimulated by  
gentle light therapy, slow rhythmic  
chewing, cold water





# Other Ways

Massage and physiotherapy can manipulate the vagus nerve

Reflexology and acupuncture – can stimulate the parasympathetic nervous system

Humming, speaking, singing – vocal cords connected to the vagus nerve

Breathing, meditation etc. – Peg will explain further

Cold therapy – shifts the attention away from worries and activates parasympathetic nervous system



Exercise: High-intensity exercise was shown to improve vagal tone better than moderate-intensity exercise in people with chronic heart failure

However, even light exercise like walking has been shown to help

Too much high-intensity exercise without proper recovery time will impede improvement and could cause injury – activating inflammatory pathways



The key to these strategies is to understand they need to be repeated throughout the day

Can't just hum once a day

Or as an alternative, do a combination of strategies throughout the day

Share all the strategies with a client to help them create a plan

This can be an important part of reducing their chronic issues

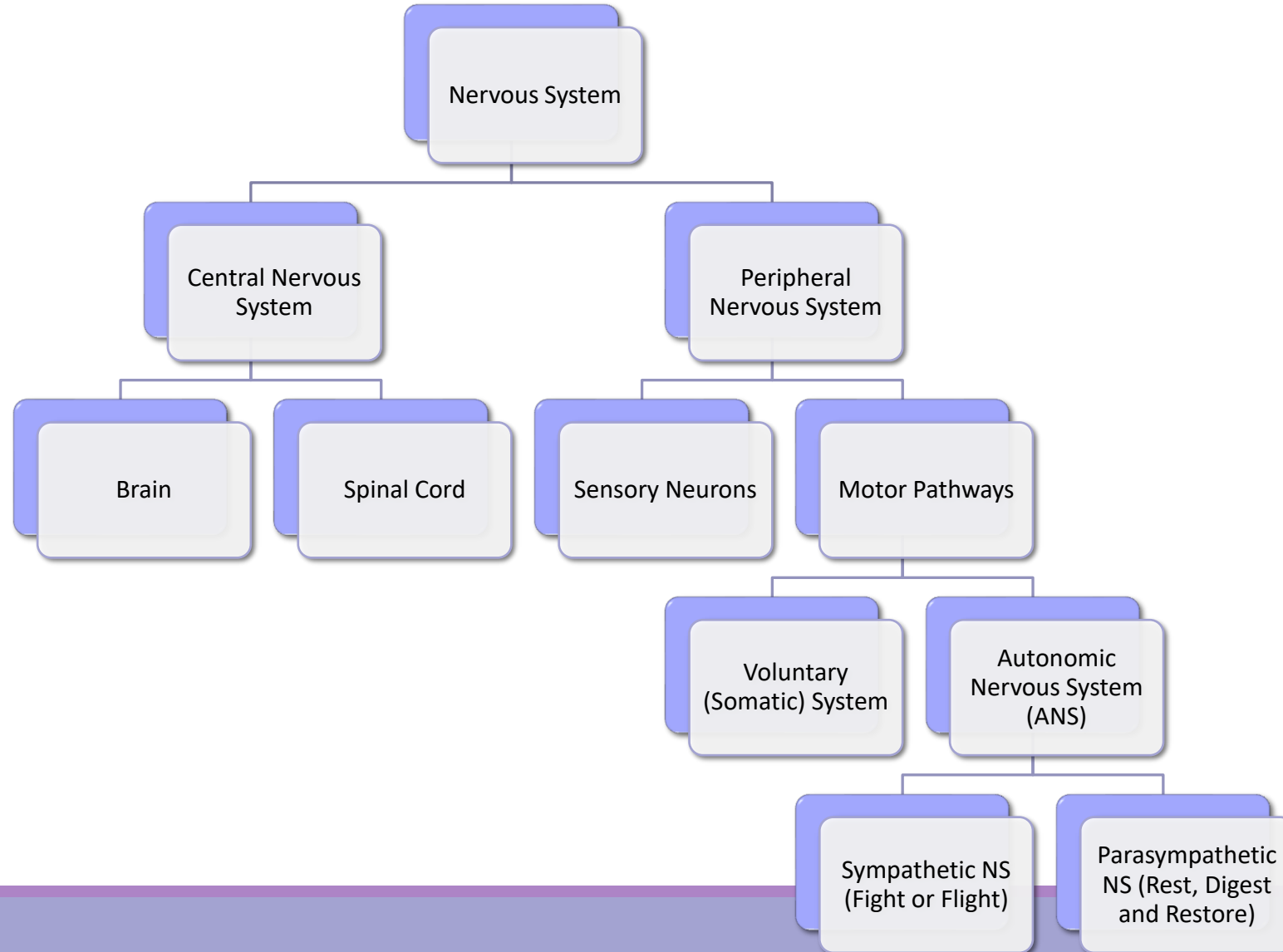


# Mammalian Nervous System

The mammalian nervous system is a complex biological organ consisting of a network of cells that reach every organ and part of the body, to conduct impulses back and forth to control essential physiological responses to internal and external stimuli.

It is divided into the central nervous system (CNS) and the peripheral nervous system (PNS), with the PNS controlling both voluntary (somatic NS) and what were presumed to be involuntary (autonomic NS) behaviours.

# Mammalian Nervous System



# Autonomic Nervous System

The part of the nervous system responsible for functions usually not consciously directed such as breathing, heartbeat, digestion.

***Historically, it was pictured as a two-part antagonistic system:*** when the **Sympathetic** is activated, the PNS is not; when we can turn on **Parasympathetic** calming there is less Sympathetic activation.

One of the benefits of Restorative Yoga is to turn off the SNS and turn on the PNS.

| Autonomic Nervous System                                                                                                                                   |                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Sympathetic NS</b> <ul style="list-style-type: none"><li>- Fight or Flight</li><li>- The body's ON switch, supporting mobilization for action</li></ul> | <b>Parasympathetic NS</b> <ul style="list-style-type: none"><li>- Rest, Digest &amp; Restore</li><li>- The body's OFF switch, supporting relaxation</li></ul> |

# The Vagus Nerve

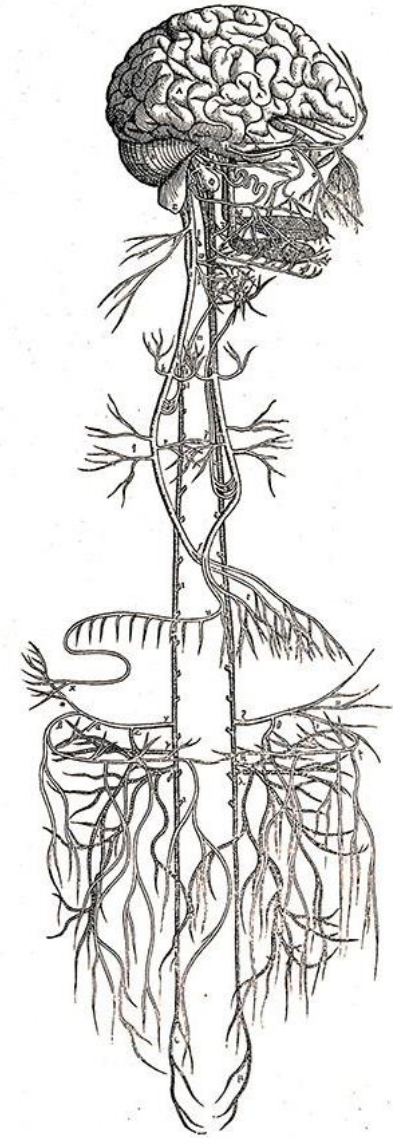
The vagus is the tenth cranial nerve, originating in the brain stem and travelling through the face, neck, lungs, heart, diaphragm, and abdomen, including the stomach, spleen, intestines, colon, liver, and kidneys.

Vagus is Latin for “wanderer,” an appropriate name for the longest cranial nerve in the body.

The vagus nerve is intricately connected to mood, immune response, digestion, and heart rate.

The vagus nerve has more than 100,00 nerve fibres and communicates bi-directionally between the brain and the body: 80% body to brain, 20% brain to body.

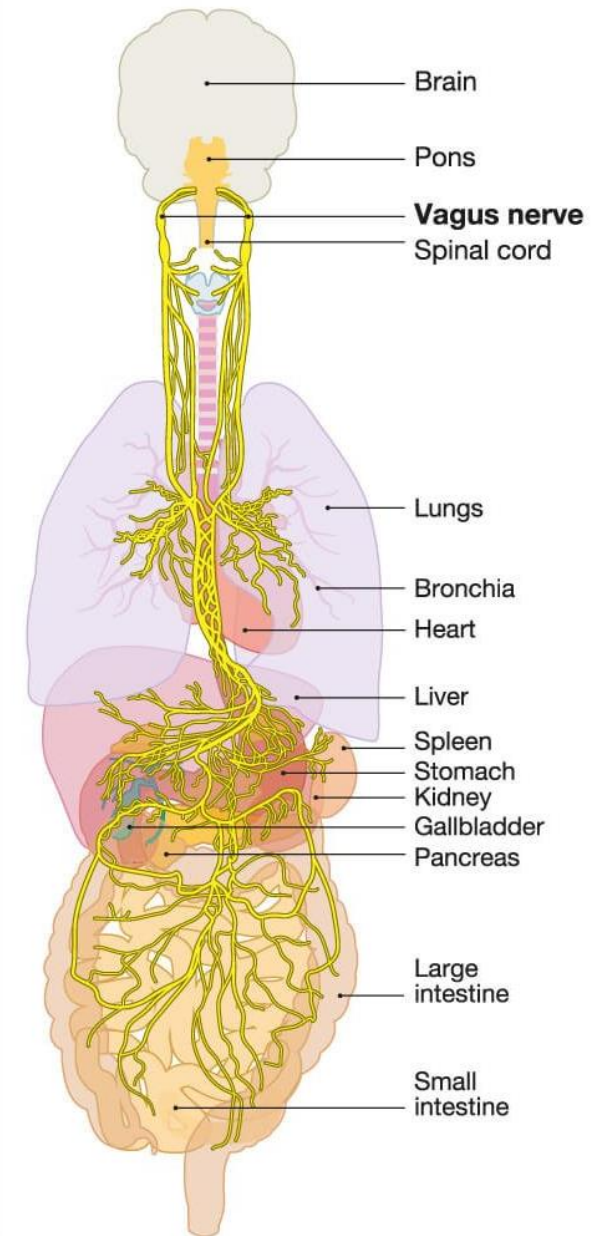
Source of your “gut feelings,” so pay attention!traveling





# Polyvagal Theory

A new theory, coined the Polyvagal Theory by Stephen Porges, identifies a third type of nervous system response that Porges calls the “social engagement system” that operates out of the Vagus Nerve, which controls a mixture of activation and calming. Rather than being in balance, the three systems **respond sequentially** to circumstances, both safe environments and perceived threats.



# Autonomic Nervous System

The three systems act sequentially to perceived threats:

| Autonomic Nervous System                                                                 |                                                                                           |                                                                                                         |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Sympathetic                                                                              | Parasympathetic                                                                           |                                                                                                         |
|                                                                                          | Dorsal Vagal                                                                              | Ventral Vagal                                                                                           |
| <ul style="list-style-type: none"><li>- Mobilization</li><li>- Fight or Flight</li></ul> | <ul style="list-style-type: none"><li>-Immobilization</li><li>- Freeze or Faint</li></ul> | <ul style="list-style-type: none"><li>-Rest, Digest &amp; Restore</li><li>- Social Engagement</li></ul> |

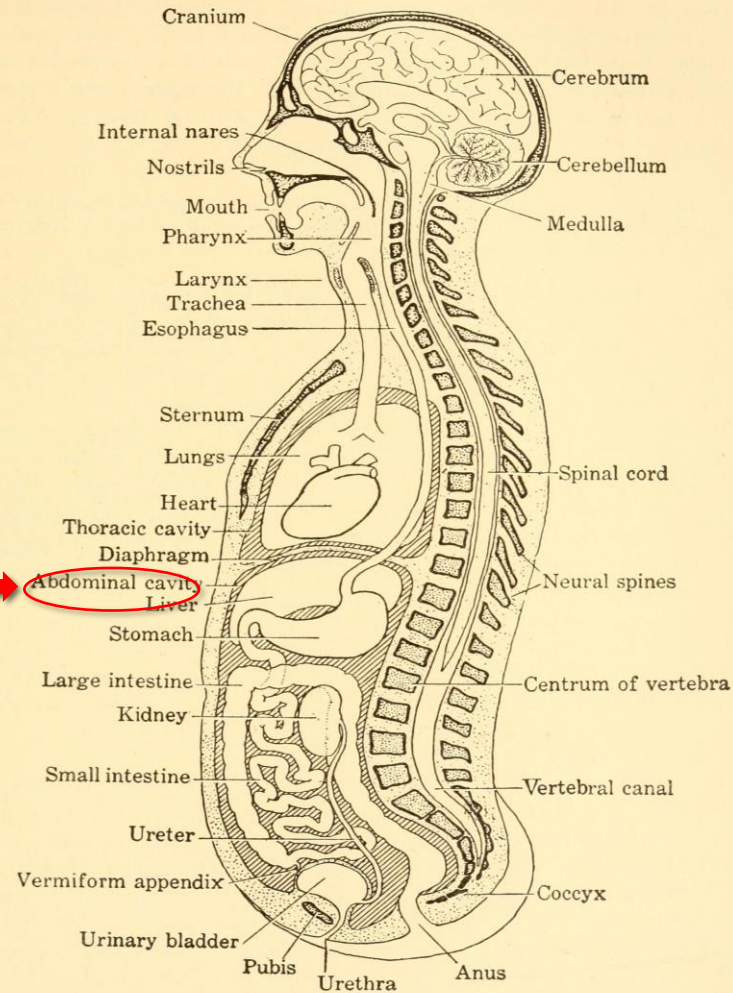


FIG. 109. — Diagrammatic median section of the human body.

# The Diaphragm

The **Diaphragm** is a thin muscle found in the chest cavity that separates the abdomen (belly) from the upper chest.

The **Ventral Vagal PNS** is found *above the diaphragm*, and controls organs and systems in this area including facial muscles, as well as the heart and lungs.

The **Dorsal Vagal PNS** is found *below the diaphragm*, and controls organs in this area.

- Ventral Vagal Nerve - Above the diaphragm
  - Formed as we evolved from ancient reptiles to mammals out of a need to nurture our young - more Evolved
  - Myelinated (has a covering for both protection and to increase speed of nerve transmission)
  - Primary regulator of heart rate and muscles in the face and neck, including nerves to control facial expression
  - Social Engagement necessary to coexist and work in communities
  - Must be in a safe environment to be activated

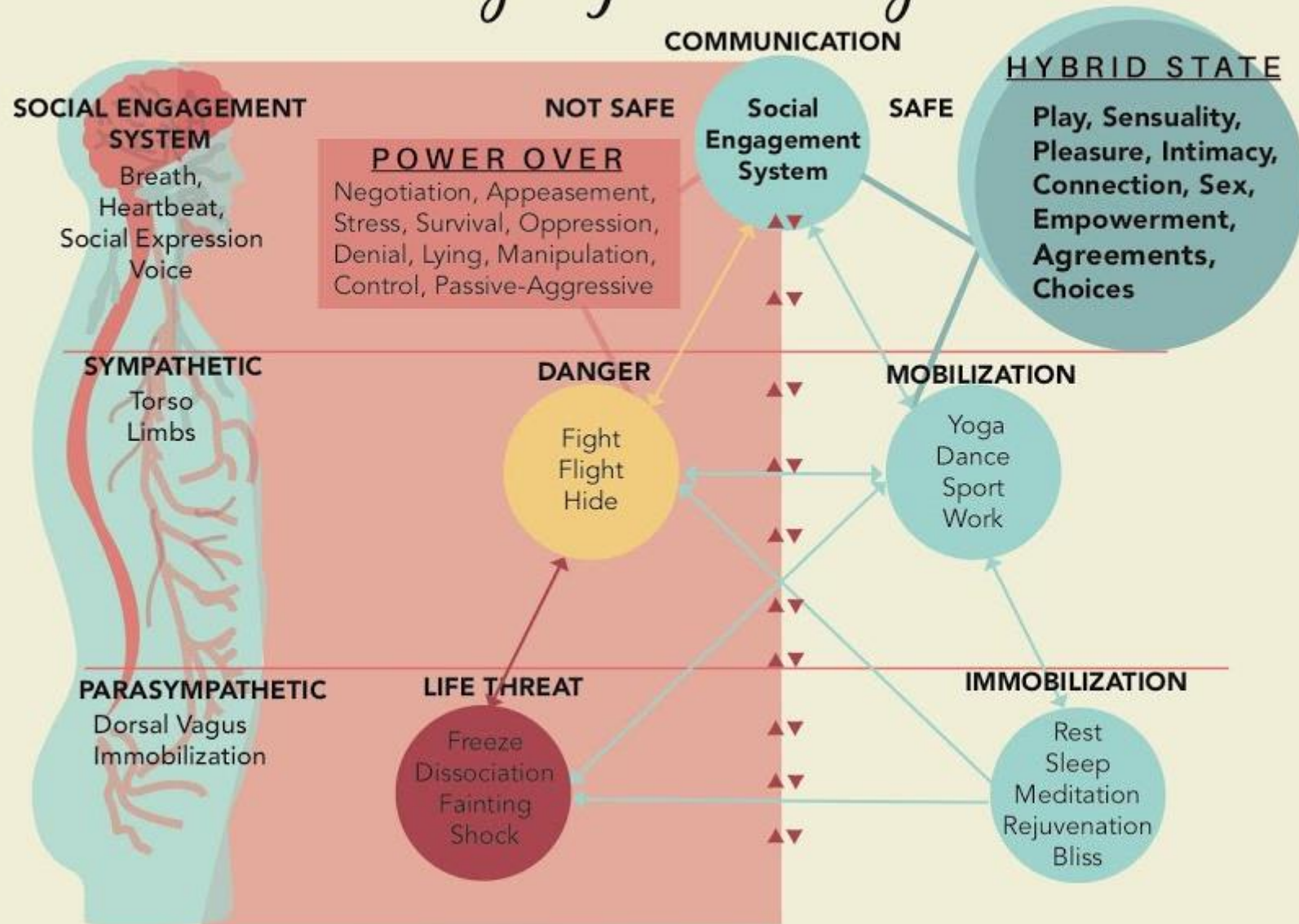
- Dorsal Vagal Nerve - Below the diaphragm
  - Oldest system, found in both reptiles and mammals, reflecting the need for survival
  - Supplies nerves to the visceral organs below the diaphragm including the stomach, liver, spleen, kidneys, gallbladder, urinary bladder, small intestines, pancreas and the ascending and transverse parts of the colon.
  - Nerve is non-myelinated (no protective covering)
  - Immobilization - feigning death

As Stephen Porges says: “When we are challenged, we start moving down the evolutionary ladder and in evolutionary stages we move from this safety engagement with the face, and with the myelinated vagus. We move to a more defensive system of the sympathetic nervous system.”

|                                          |                                                                  |                                |
|------------------------------------------|------------------------------------------------------------------|--------------------------------|
| <b>Level of Perceived Safety</b><br>High | SOCIAL ENGAGEMENT<br>→ Rest and Restore                          | Ventral Vagus<br>(myelinated)  |
|                                          | Worry, Anxiety, Detect Risk<br>MOBILIZATION<br>→ Fight or Flight | Sympathetic                    |
| Low                                      | IMMOBILIZATION<br>→ Shutdown                                     | Dorsal Vagus<br>(unmyelinated) |



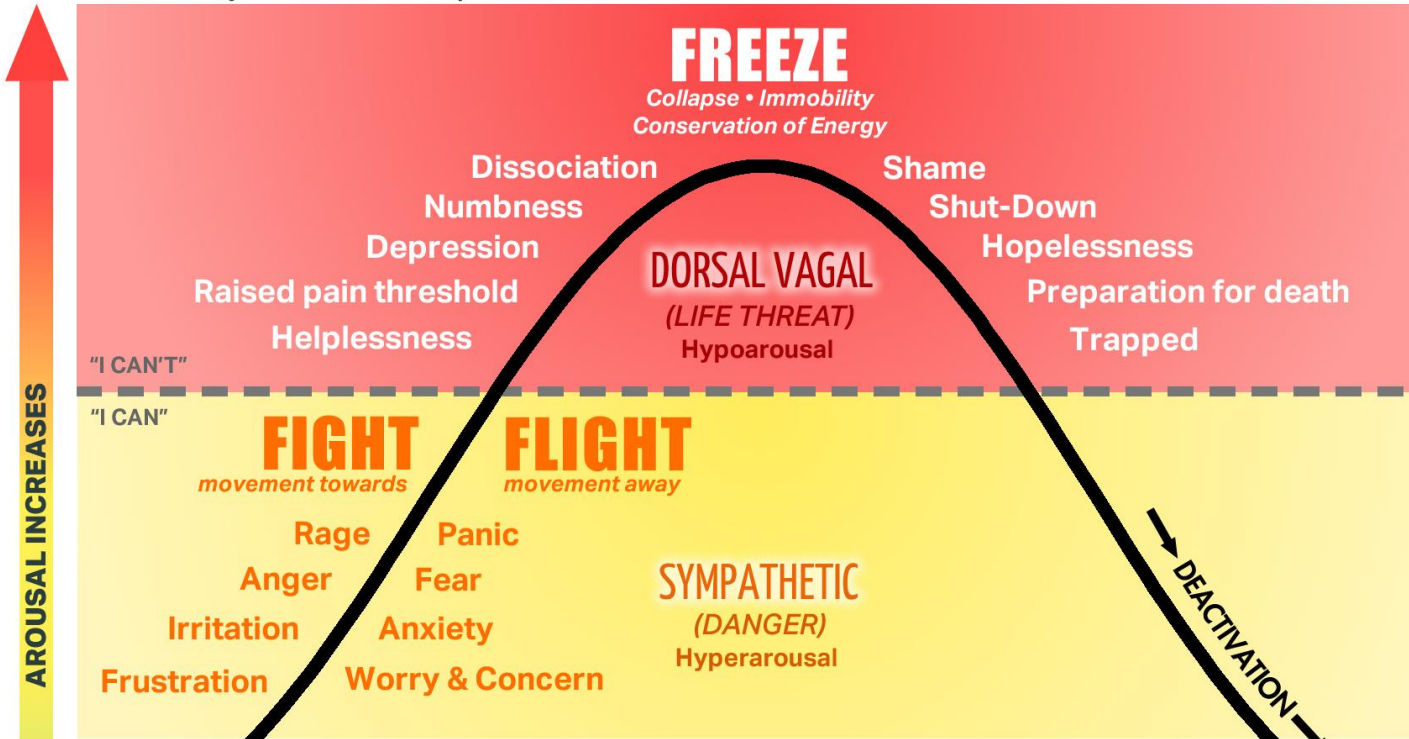
# Polyvagal Theory





# POLYVAGAL CHART

The nervous system with a neuroception of threat:



## PARASYMPATHETIC NERVOUS SYSTEM

DORSAL VAGAL COMPLEX

### Increases

Fuel storage & insulin activity • Immobilization behavior (with fear)  
Endorphins that help numb and raise the pain threshold  
Conservation of metabolic resources

### Decreases

Heart Rate • Blood Pressure • Temperature • Muscle Tone  
Facial Expressions & Eye Contact • Depth of Breath • Social Behavior  
Attunement to Human Voice • Sexual Responses • Immune Response

## SYMPATHETIC NERVOUS SYSTEM

### Increases

Blood Pressure • Heart Rate • Fuel Availability • Adrenaline  
Oxygen Circulation to Vital Organs • Blood Clotting • Pupil Size  
Dilation of Bronchi • Defensive Responses

### Decreases

Fuel Storage • Insulin Activity • Digestion • Salivation  
Relational Ability • Immune Response

The nervous system with a neuroception of safety:



## PARASYMPATHETIC NERVOUS SYSTEM

VENTRAL VAGAL COMPLEX

### Increases

Digestion • Intestinal Motility • Resistance to Infection  
Immune Response • Rest and Recuperation • Health & Vitality  
Circulation to non-vital organs (skin, extremities)  
Oxytocin (neuromodulator involved in social bonds that allows immobility without fear) • Ability to Relate and Connect  
Movement in eyes and head turning • Prosody in voice • Breath

### Decreases

Defensive Responses

# Polyvagal Theory: Pros

- Polyvagal theory provides a nuanced and comprehensive understanding of the autonomic nervous system, going beyond the traditional sympathetic and parasympathetic division.
- The theory has been influential in various fields, including psychology, psychiatry, and therapy. It has informed therapeutic approaches, especially in trauma treatment, **by emphasizing the importance of regulating the nervous system to promote healing.**
- Polyvagal theory highlights the link between the autonomic nervous system and social behaviour, and explains how the physiological state of the body is connected to social engagement, fight-flight responses, and shutdown behaviors.
- The theory is particularly useful in understanding how the ANS responds to stress and trauma. It offers insights into why individuals may have different responses to similar situations and how trauma can impact the nervous system.
- Polyvagal theory has generated a significant amount of research, and some empirical studies support its key concepts. This ongoing research contributes to the refinement and validation of the theory.

# Polyvagal Theory: Cons

- Critics argue that Polyvagal theory oversimplifies the complexity of the autonomic nervous system. While it introduces a third branch (ventral vagal), some researchers assert that the reality may be more nuanced and less hierarchical.
- Some critics argue that much of the research supporting Polyvagal theory has been conducted in Western cultures, raising questions about its universality. The theory may need further validation across diverse populations to determine its generalization.
- While Polyvagal theory has influenced clinical practice, there are challenges in applying it universally. Tailoring interventions based on individual nervous system responses requires a deep understanding and skill, which may be challenging for some practitioners.

In summary, Polyvagal theory has made significant contributions to our understanding of the autonomic nervous system and its role in social behavior and mental health. However the theory is still evolving, and its concepts may be refined or expanded as more research emerges. This ongoing development means that some aspects of the theory may be subject to change or adjustment.

# How the Human Brain Evolved:

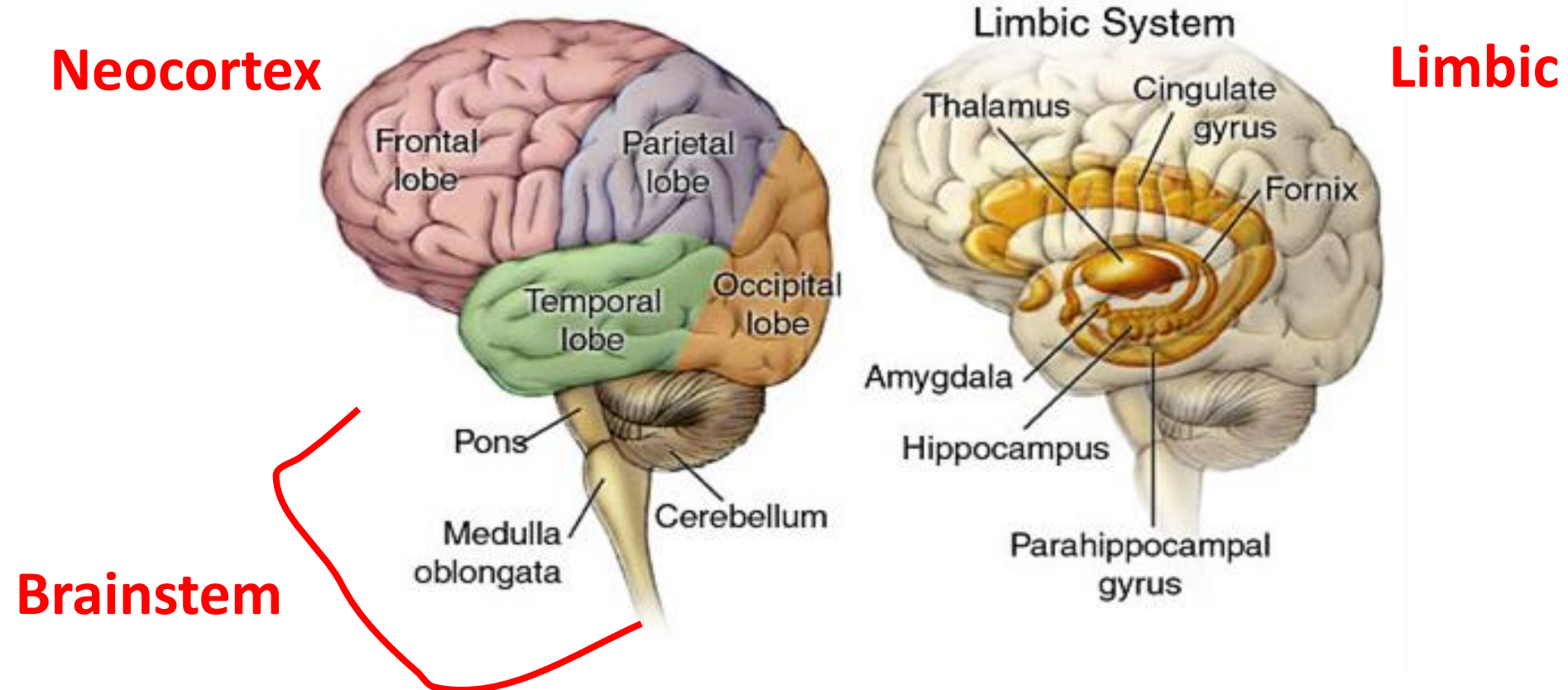
## Anatomy of the Brain

Different areas of the brain developed over different evolutionary eras, as the animals and the needs of their brains became more complex:

- Reptiles – Brainstem, the oldest system
- Mammals – Limbic System
- Primates – Neocortex

# Anatomy of the Brain

## Anatomy of the Brain





# How the Human Brain Evolved

| Evolution | Brain area    | Autonomic Nervous System | Effects                                                      |
|-----------|---------------|--------------------------|--------------------------------------------------------------|
| Reptilian | Brainstem     | Dorsal Vagal             | IMMOBILIZATION<br>Shutdown, Depression, PTSD                 |
| Mammalian | Limbic System | Sympatho-Adrenal         | MOBILIZATION<br>Anxiety, Panic                               |
| Primate   | Neocortex     | Ventral Vagal            | SOCIAL ENGAGEMENT<br>Emotional Regulation<br>Neuroprotection |

# Training the Human Brain

| Brain Area                | Contemplative Practice | Benefits   |
|---------------------------|------------------------|------------|
| Reptilian - Brainstem     | Embodied Practices     | Resilience |
| Mammalian – Limbic System | Compassion Training    | Resonance  |
| Primate - Neocortex       | Mindfulness Training   | Presence   |



# What Is Mindfulness?

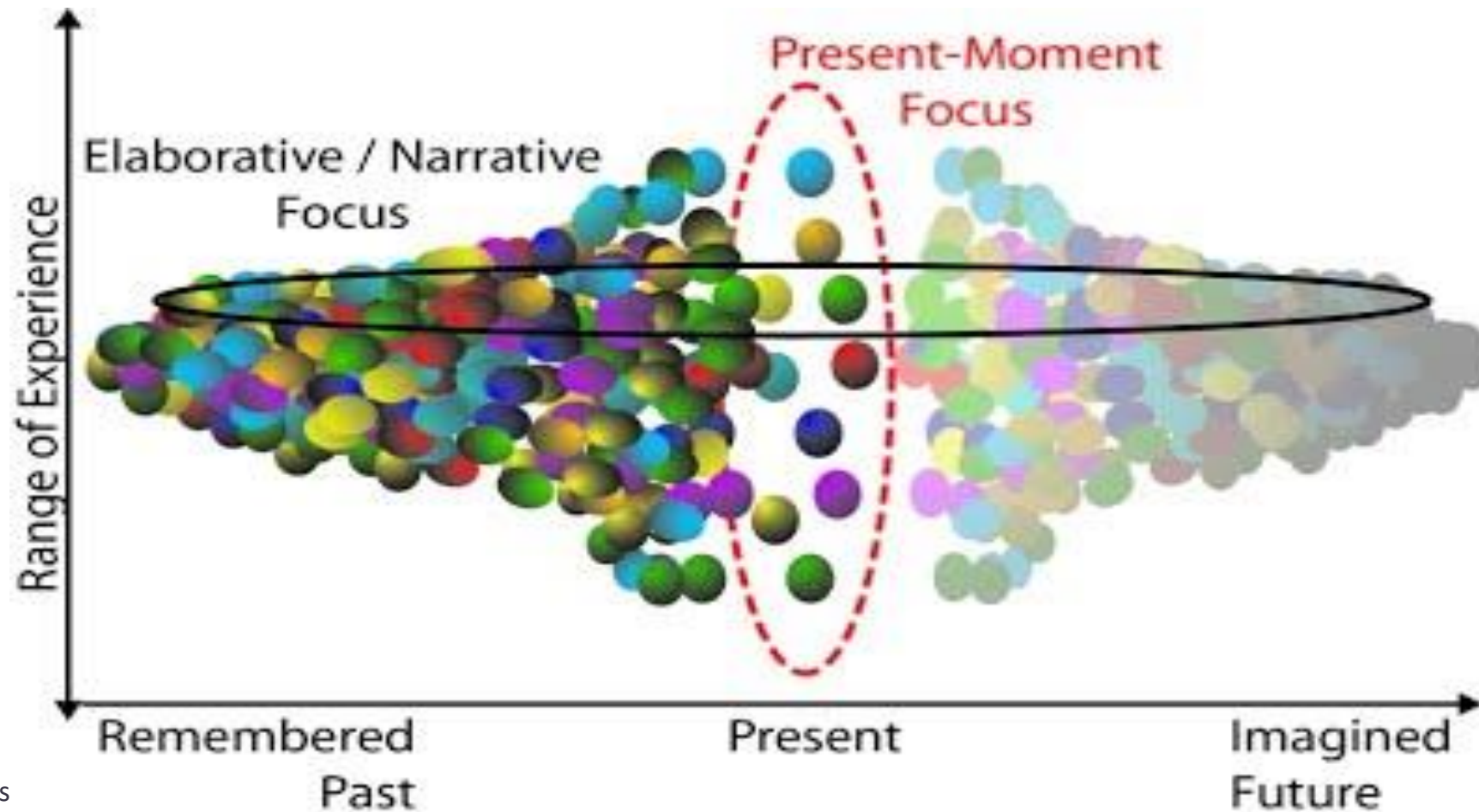
- Directing your attention to your experience in the **present moment**
- This can be assisted by **being aware of the breath and the body**, doing ones best to minimize any other distractions
- Notice and become aware of “what’s happening now” — without judgment or attachment
- Mindfulness studies have shown that this practice can:
  - Increase prefrontal activation, thereby increasing attention and working memory
  - Enhance prefrontal mood regulation
  - Decrease stress and amygdalar volume
  - Increase gray matter and thickness/activation in certain areas of the brain

# Norm Farb on Present Moment Awareness

- Norm Farb is a Neuroscience researcher at the University of Toronto, studying Present Moment Awareness
- He looked at the MRI results showing location of firing of neurons before and after an 8 week Mindfulness Meditation program, noting that **different areas of the brain will firing depending on whether the person is focusing on the past, the present or the future.**

<source: [www.normanfarb.com/research](http://www.normanfarb.com/research)>

# Norm Farb on Present Moment Awareness



# A Neuroscientific Model of Embodiment

Farb found that with 8 weeks of mindfulness training, participants were able to spend more time in the Present Moment, and were also more aware of where they were and were able to bring themselves back to the present.

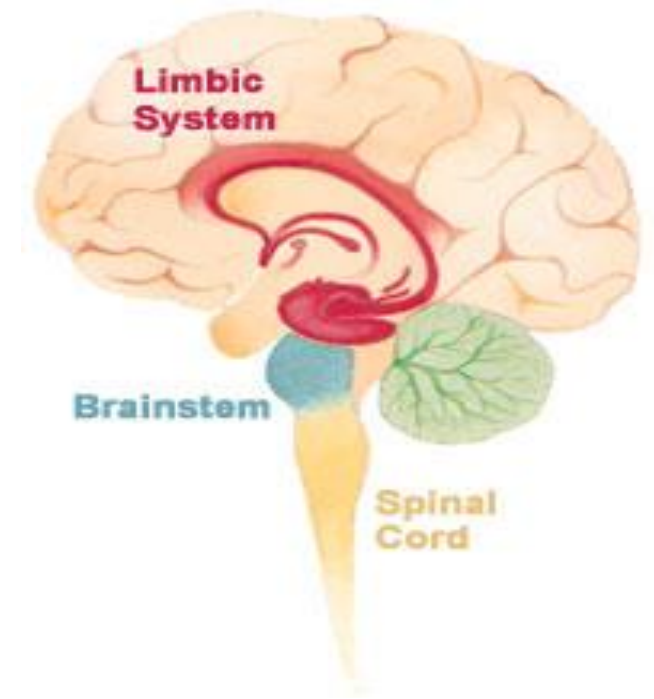
And he found that “a central mechanism of mindfulness training appears to be the use of **momentary bodily sensation as an anchor to focus attention on the present.** ... Awareness of changing body sensation may be especially important when responding to problems that are created or perpetuated through negative thinking.”

# What Is Compassion Training?

- Start with **awareness or mindfulness** of what's ailing you, here and now
- **Accept** your suffering as human, without shame or blame
- Investigate your suffering to reveal root causes and conditions
- Gradually widen your circle of care to mentors, friends, strangers, critics → Loving Kindness Meditation, sending love and well-being to self, others, strangers, all living beings, mother earth

# Benefits of Compassion Training

- Proactive Compassion
  - Other-related emotion
  - Positive feelings: e.g., love
  - Good health & well-being
  - Approach & prosocial motivation



# What are Embodied Practices?

- Embodied practices such as Yoga and Yoga Therapy are a way of facilitating a process by which practitioners can embrace Present Centered Awareness using their Body as opposed to their Mind.



- By using movement, awareness of body and breath, they are able to focus on noticing whatever comes up in the present moment.



# Julian Walker: Changes in Neural Structure

- “Neurons fire and wire preferentially and maximally with regard to whatever is in the field of focused attention” — this tells us that whatever we spend time and focus on **will determine the strength of that neural network.**
- For people wanting to make transformative change, this means pulling our attention away from what no longer serves and accentuating the positive.
- And to do this, mindfulness or related contemplative training is vital for improving therapeutic outcomes — the changes are *physical*.

<Source: Julian Walker, Tarka Issue #12>

- The brain is particularly vulnerable to changing for the worse through negative experiences. There are some vicious cycle dynamics we are increasingly aware of, one of which involves cortisol, a stress hormone ... It sensitizes the amygdala ... and weakens the hippocampus.
- There are MRI findings or other hard evidence showing that skillful mental activity, repeated over time, leads to lasting beneficial changes in neural structure or function.
- In other words, we have hard evidence that developing a regular (as close to daily as possible) meditative or contemplative practice, shining the attention on what we want in our life, will actually work over time to create that change.

# Conclusion

- From neuroscience research, we now know that practices such as mindfulness and self-compassion can train your brain to increase and preserve your cognitive capabilities, and stimulate the vagus nerve.
- It is the repeated, consistent patterns created by new experience that change the brain and this explains why daily practice and the repetition of desired habits is so essential.

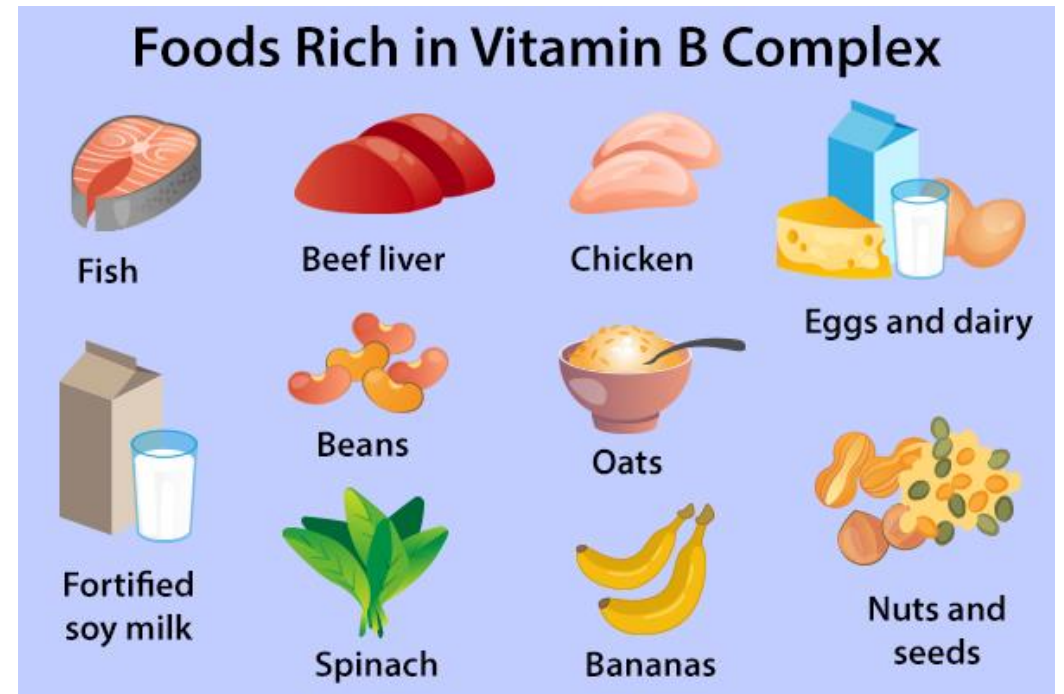


# Nutrients & Foods

B vitamins especially:

B12 (Cobalamin): Important for nerve function and the maintenance of the myelin sheath Food: Animal products, meat, fish, and dairy,

B6 (Pyridoxine): Involved in the production of neurotransmitters Food: Bananas, poultry, fish, and potatoes



Vitamin C: Has antioxidant properties that may help protect nerves from oxidative stress Food: Citrus fruits, strawberries, and bell peppers

Vitamin E: Acts as an antioxidant. Food: Nuts, seeds, and vegetable oils

Magnesium: Involved in nerve function and may have a calming effect on the nervous system Foods: Nuts, seeds, and leafy green vegetables





Zinc: Important for neurotransmitter regulation and may support overall nerve function. Food: meat, nuts, and seeds

Probiotics: Support gut health which is essential for the gut-brain connection  
Food yogurt, kefir, sauerkraut, kombucha, kimchi





**Polyphenols:** Have antioxidant and anti-inflammatory properties that may support nerve health. Food: Berries, green tea, and dark chocolate

**Acetyl-L-Carnitine:** An amino acid found in meat and dairy products, acetyl-L-carnitine may have neuroprotective effects and support nerve function.

**Choline:** A precursor to acetylcholine, a neurotransmitter that plays a role in nerve signaling Food: Eggs, meat, and certain vegetables,



Phospholipids: Are essential components of cell membranes, including those in nerve cells, and they play a crucial role in maintaining the integrity and function of these membranes.

Specific types of phospholipids may not be exclusively targeted at the vagus nerve, certain phospholipids are known to support overall nerve health, including the vagus nerve.



Phosphatidylcholine (PC): A major component of cell membranes and is particularly abundant in the brain. Food: Eggs, soybeans, sunflower seeds, and certain nuts.

Phosphatidylcholine: A precursor to acetylcholine, a neurotransmitter that plays a crucial role in nerve signaling.

Phosphatidylserine (PS): Phosphatidylserine is another phospholipid found in high concentrations in the brain. Helps maintain the structure and function of cell membranes and helps cognitive function Food: Fish, meat, and certain plant-based sources.



Phosphatidylinositol (PI): A minor but important component of cell membranes involved in cell signaling and plays a role in the transmission of signals within nerve cells. Food: Soybeans, sunflower seeds, and nuts.

Phosphatidylethanolamine (PE): Found in cell membranes and is involved in membrane fluidity. Food: Eggs, soybeans, and nuts

Lecithin: Is a mixture of phospholipids and has been studied for its potential benefits in supporting nerve function. Food: egg yolks, soy, chocolate (added as an emulsifier)



# GABA

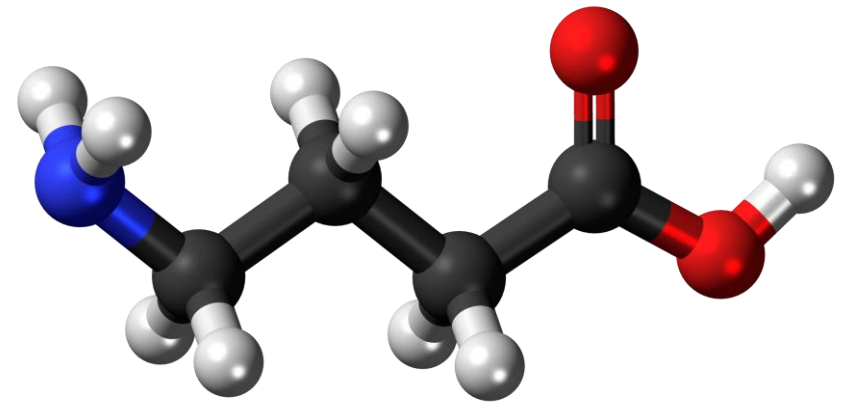
Lowers anxiety

Many antianxiety drugs work to stimulate GABA levels

A stimulated vagus nerve can signal the production of GABA

GABA-producing microbes:

Lactobacillus rhamnosus, L. brevis  
Bifidobacterium dentium DPC6333,  
Bifidobacterium infantis UCC35624  
and Bifidobacterium adolescentis DPC6044  
(all human-derived strains)





Bidirectional – raising GABA in the brain can calm the sympathetic and support the vagus nerve

Vagus nerve stimulation can signal the brain as we discussed

Cannabis is supposed to raise GABA levels but it may be due to cannabinoid receptors in the vagus nerve

CBD can stimulate the parasympathetic nervous system and therefore support the vagus nerve



# Other Nervous System Nutrients

**Tryptophan:** A precursor to serotonin, a neurotransmitter that plays a role in mood regulation  
**Food:** turkey, chicken, and dairy

**Tyrosine:** A precursor to dopamine, a neurotransmitter associated with pleasure and reward.  
**Food:** dairy products, meats, and nuts,

**Iron:** Important for the formation of hemoglobin, which carries oxygen to the brain.  
**Food:** Red meat, poultry, and fortified cereals





Potassium: Essential for nerve function

Sodium: Essential for nerve impulse transmission, muscle contractions, and maintaining electrolyte balance

Calcium deserves a mention –aids the ability of nerves to send messages

Low-level VN stimulation helps regulate calcium-handling in heart function – essential for pumping blood through the heart



# Essential Oils

Several studies on the effect on the nervous system – without naming the vagus nerve specifically

Topically, apply near earlobe (tragus)

Can also inhale – olfactory system goes to the brain – sends signals to the vagus nerve

Basil, lavender, peppermint oil, citrus oils (limonene), chamomile

Look for oils that are known for stress reduction and lowering anxiety – most likely will help the vagus nerve



# How to Activate the Ventral Vagal System

Must create a safe environment:

- make eye contact
- use pleasant facial expressions
- soothing human voice
- familiar people and surroundings
- develop relationships





# Reversing the stress response

- When you experience stressful thoughts, your body triggers the **sympathetic branch** of the nervous system to activate **the fight-flight-freeze** response, giving you a burst of energy to respond to the perceived danger.
- Your breathing becomes shallow and rapid, and you primarily breathe from the chest and not the lower lungs.
- This can make you feel short of breath, which is a common symptom when you feel anxious or frustrated.
- At the same time, **your body produces a surge of hormones such as cortisol and epinephrine (also known as adrenaline), which increase your blood pressure and pulse rate and put you in a revved-up state of high alert.** This can be helpful during times of actual threat but may be harmful if left chronically in this state.  
activate



# Reversing the stress response

- Pranayama/Breathwork is a practice that activates the **parasympathetic nervous system**.
- When you breathe deeply and slowly, it enables you to **downshift from the dominant sympathetic system to the parasympathetic system**, which is the body's **rest and digest system**.
- The parasympathetic branch helps you feel calm, centered, and grounded. It reverses the stress response.
- Pranayama also helps to strengthen our **digestive power**, or **agni**.
- It does this through **activation of the parasympathetic nervous system which optimizes the digestive process**.



# Practices to Stimulate the Vagus Nerve: Chanting

Vocal activities produce a **vibration in the neck**, which stimulates the vagus nerve in a beneficial way.

Chanting, such as “Om”

Humming

Singing

Gargling

Playing a wind instrument



Om Symbol



# Pranayama/Breathwork

- Pranayama is the practice of **consciously using the breath** to enhance our physical, emotional, and spiritual well-being.
- The word pranayama comes from two Sanskrit terms: **prana** and **ayama**.
- **Prana** is the vital life force or energy that flows through our body and animates all living beings.
- It is the cosmic intelligence within every cell, tissue, and organ.
- The word **ayama** means “to extend” or “draw out.”
- In pranayama, **we use our breath to extend or expand our life-force energy and improve the communication between all parts of our mind/body system.**



# Benefits of Pranayama

Improved cognitive functions

Increased mindful awareness

Reduced anxiety and depression

Lower/stabilized blood pressure

Increased energy levels

Muscle relaxation

Decreased feelings of stress and overwhelm

There are studies that show breathwork can help treat depression, anxiety, and PTSD by **reducing activity in stress parts of the brain and increasing activity in parts of the brain that regulate emotions.**

**Reprogram your nervous system** and experience both immediate and long-term benefits



# Diaphragmatic Warmup

Take your arms up overhead and breathe as deeply as you can through your nose

Release the breath and lower your arms – repeat 10X

Then 10 side stretches with breath to each side, feeling the stretch on each side

As you do this your rib cage will move up and your diaphragm will lower, loosening the attachments and creating more flexibility



# Deep Diaphragmatic Breathing

- Breathe through your nose, **inhaling deeply** into your belly and exhaling slowly. **Control your exhale so that it lasts longer than the inhale.**
- The movement of the diaphragm during this breath cycle massages the vagus nerve—and during the exhale, the diaphragm releases around the vagus nerve, improving its functioning.





# Coherence Breathing

Coherence Breathing is a very simple breathing technique in which the length of your inhalations and exhalations will follow a set ratio.

**Whatever the length of your inhale, your exhale is just a little bit longer.**

This pranayama technique has been shown to offer a variety of healing benefits, including:

- Reduced inflammation
- Strengthened immune system
- Decreased anxiety and depression
- Improved sleep
- Increased resilience



# Kapalabhati

- Use your abdominal muscles to exhale, driving prana into the head
- Called the skull cleansing technique.
- Breathe in through your nose and then you use your abdominal muscles to push the air out, then pause and your body will naturally inhale
- Put your hand on your belly and use your abdominal muscles to breathe out like a little burst of air.
- This will force cerebrospinal fluid to force a wave of detoxification to your brain.
- Begin with only a few breaths, stop if you feel lightheaded, increase over time.
- Kapalabhati lowers blood sugar, reduces abdominal fat, increases liver lipase, lowers cholesterol, increases ATP energy, mitochondrial energy in your body, and it boosts immunity.





## Bhramari (Humming)

- Plug your ears and hum.
- When you plug your ears, the humming feels really loud in your head and then you're going to feel a vibration head and your heart.



- Then as you're humming take the tongue to the roof of your mouth and all of a sudden you'll feel the energy go up to your head and you'll bring that bliss from your heart to your head.

# Ujjayi pranayama

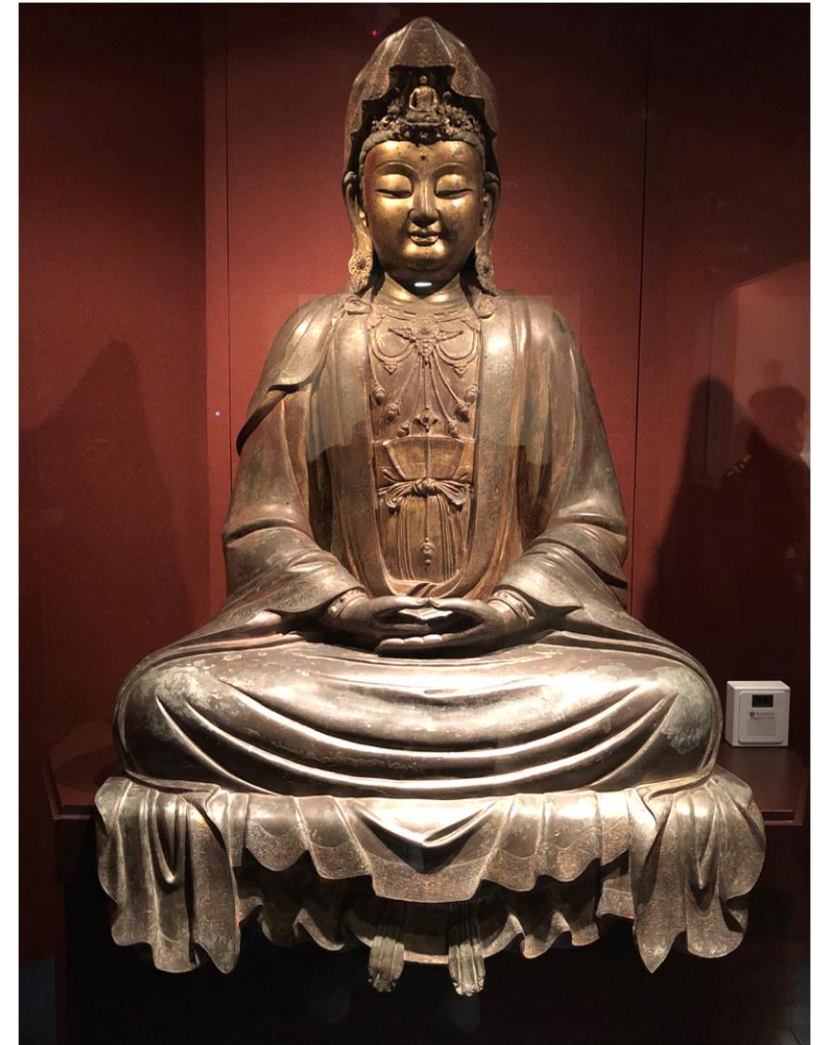
Ujjayi means “to be victorious” or “to gain mastery.”

**This gentle, rhythmic breath produces a pleasant, soothing sound—similar to the sound of the ocean waves rolling in and out.**

Think of exhaling forcefully onto your glasses to clean them—now do the same thing with your mouth closed!

The benefits of Ujjayi include:

- Calms and relaxes the mind
- Heats the core of the body
- Helps release feelings of irritation or frustration
- Stabilizes the cardiorespiratory system
- Balances the nervous system by toning the vagus nerve
- Helps coordinate breath with movement during asana practice



# Meditation

- Meditation is a **journey from activity to silence**. It is a technique that allows you to settle into quieter and quieter levels of awareness until you experience the pure silence within.
- All types of meditation are good for the vagus nerve. For example — compassionate or “Loving Kindness” meditation. Rather than letting your mind wander, you direct your good thoughts to other people. “May all beings be happy, healthy, loved and safe”
- As positive emotions increase, so does your vagal tone.
- In the process of going within, you start to purify the body, **releasing stress, fatigue, and toxins**.
- When you’re beginning, it can be helpful to use a recording or an app (such as Calm or Insight Timer) can



# Physical Benefits

The stimulation of the body's self-repair mechanisms and self-regulation

Lowered blood pressure and heart rate

Decreased inflammation

Increased levels of the enzyme telomerase to help slow the aging process

Better sleep

Improved immune function

Downregulation (turning off) of genes that contribute to diseases such as diabetes, Alzheimer's, autoimmune illnesses, and some types of cancer

Upregulation (turning on) of genes that are responsible for good health

Increased production of rejuvenating hormones such as DHEA and growth hormones

Reverses some of the brain changes that are associated with aging





# Mental and Emotional Benefits

- Decreased stress and anxiety and increased feelings of relaxation and peace
- Expanded experience of healing emotions such as love, compassion, joy, equanimity, and gratitude
- Decreased experience of painful emotions that constrict awareness, including anger, hostility, guilt, fear, anxiety, shame, and depression
- The ability to respond consciously rather than reacting in a conditioned, melodramatic way
- Increased focus, memory, and ability to learn
- Decreased addictive behaviour

The benefits of meditation are both immediate and long-term. You can begin to experience benefits the first time you sit down to meditate and in the first few days of daily practice. **The benefits that are noted will become more sustained with a regular practice.**



# Yoga

The practice of yoga incorporates diaphragmatic breathing, chanting, and meditation, all of which stimulate the vagus nerve and activate the parasympathetic nervous system to help reduce stress.





# Yoga Nidra

Yoga Nidra, a Sanskrit term meaning yogic sleep, is a meditation technique that aims to induce complete physical, mental and emotional relaxation by shifting awareness away from the external world to one's inner realm.



The physiological effects are related to the activation of the PNS.

# Your Home Practices this week:

## Preparation:

Set up a physical space for breathwork and meditation, away from distractions

Take a look at your schedule, and decide when “sitting in silence” for 5 to 10 minutes will work for you, such as:

- upon rising
- late afternoon, before dinner
- before bed

Let everyone know you are not available at this time!

Start any of these practises gently, for a few breaths, or a few minutes, and build up over time as you become accustomed to them.



## Your Home Practice this week:

1. Start with the Diaphragmatic Warm Up before any breathing practice, for greatest effect.
2. A few deep breaths through the nose.
3. Kapalabhati: 10-30 respirations followed by breath hold after last exhalation. 3-5 sets
4. Brahmari (humming breath with ears plugged) 30 respirations
5. Slow Ujjayi (ocean breath) 5-10 second count for each inhale and exhale. 5-10 minutes
6. Meditation 10-20 minutes



Try to build up a consistent practice—without judgment!  
Remember, a regular practice will increase the benefits