

Hypermobility 112: The Vagus Nerve

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Who Am I?

- Professor Emeritus, Physical Therapy Department, Clarkson University
- Retired PT, St. Lawrence Health System, Potsdam NY
 - Clinical specialties: hypermobility, fibromyalgia, headaches, temporomandibular disorders
- Member: Ehlers-Danlos Society Medical and Scientific Board
- Chair: The Allied Health Working Group of the International Consortium of Ehlers-Danlos Syndromes and Hypermobility Spectrum Disorders
- Frequent presenter to professional and patient groups at national and international conferences
- Author of multiple review and research articles on hypermobility
- Author: “Pain Mechanisms in HSD” in Di Bon, *The Integral Movement Method for Hypermobility Management*
- Author: “Chronic Pain” chapter in *Physical Rehabilitation* textbook for PT students
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**I do not have any
conflicts of interest to report**

Hypermobility Lecture Series Schedule

- HSD 101: Basics of HSD/hEDS and self-care
- HSD 102: POTS and POTS self-care, basics of MCAS
- HSD 103: Pain management in HSD/hEDS
- HSD 104: Safe exercise selection and progression with HSD/hEDS
- HSD 104 part 2: How to Modify Exercises for HSD & POTS – nuts and bolts.
- HSD 105: Posture and joint protection
- HSD 106: Gut issues in HSD/hEDS, POTS, MCAS
- HSD 107: Fatigue in HSD/hEDS and POTS
- HSD 108: Headaches, migraines, & TMJ pain associated with HSD, POTS and MCAS
- HSD 109: Breathing disorders in HSD
- HSD 110: Lumbar instability
- HSD 111: Conservative management of cervical instability
- HSD 112: The vagus nerve
- HSD 113: The role of fascia
- HSD 114: Hospitalization and surgery with HSD, POTS, MCAS
- HSD 115: Functional Neurological Disorder
- HSD 116: *NEW* Bleeding Disorders in HSD

I will refer to these if you want more info



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I will refer to these if you want more info

Relevant Handouts Available

- <https://webpace.clarkson.edu/~lrussek/research.html>
- **Self-Care Strategies**
 - **[Relaxation and vagus nerve activation.](#)** The vagus nerve stimulates relaxation, decreases inflammation, and improves other aspects of health
 - **[Self-Care Toolbox.](#)** A checklist to help you optimize your self-care toolbox.
 - **[Breathing.](#)** Breathing is an easy way to activate the vagus nerve.
 - **[Heart-rate variability biofeedback.](#)** Biofeedback to increase activation of your parasympathetic nervous system can help quiet sensitive nerves and decrease pain.
- **Pain Management**
 - **[Pain self-care plan.](#)** Create a pain self-care plan to improve your pain management.
 - **[Pain flare management plan - PDF version.](#)** Create a flare management plan so you know what works when you have a flare.
 - **[Free chronic pain management apps for teens](#)**
 - **[Chronic pain management app.](#)** Cognitive behavioral approaches to pain management. Contact Dr. Russek if you are interested in 6 weeks free access: Lrussek@clarkson.edu



Disclaimers

The information in this presentation is for general purposes, only, and may or may not apply to your situation.

Check with your health care provider before starting any new treatment approach to ensure that it is appropriate and safe for YOU.

I cannot provide personal diagnostic or treatment guidance.

Scientific evidence about the vagus nerve is evolving rapidly. This lecture attempts to use the most current available research.

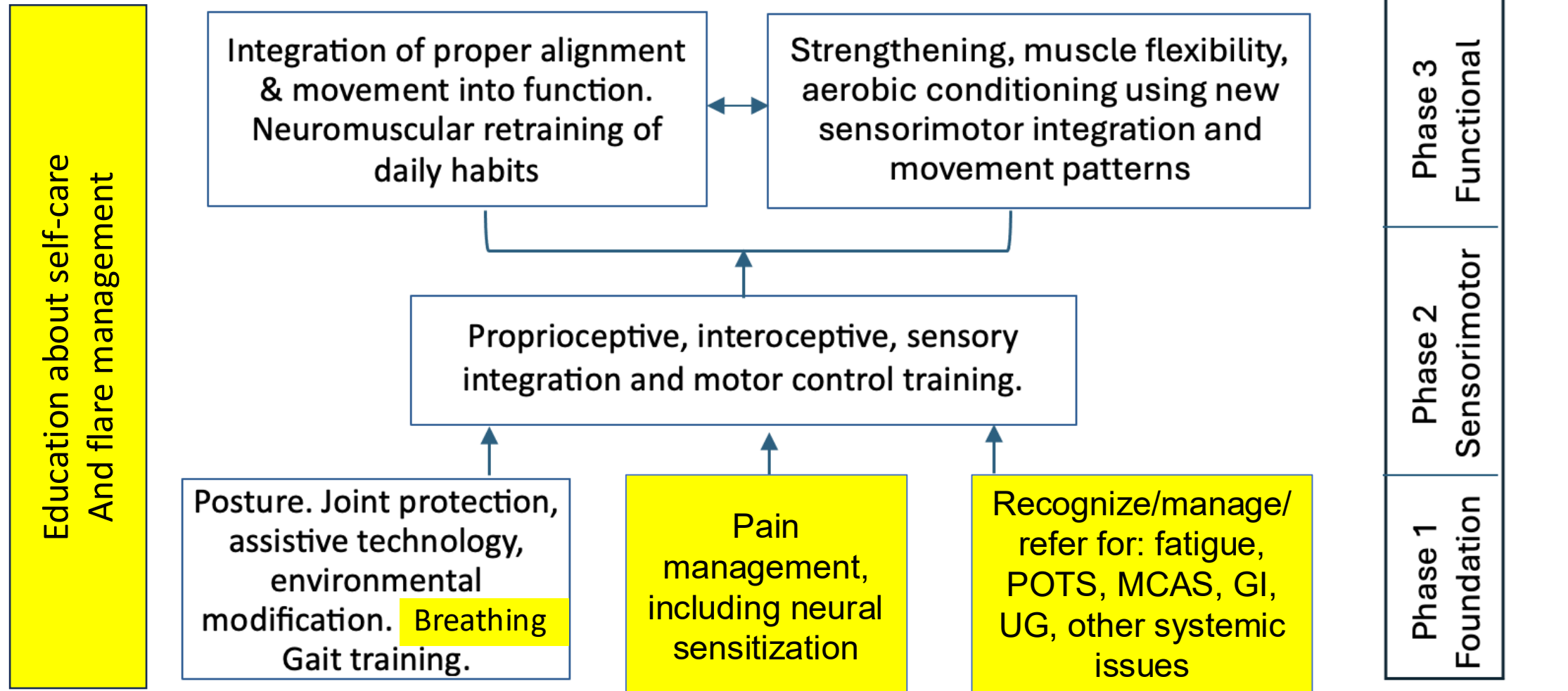


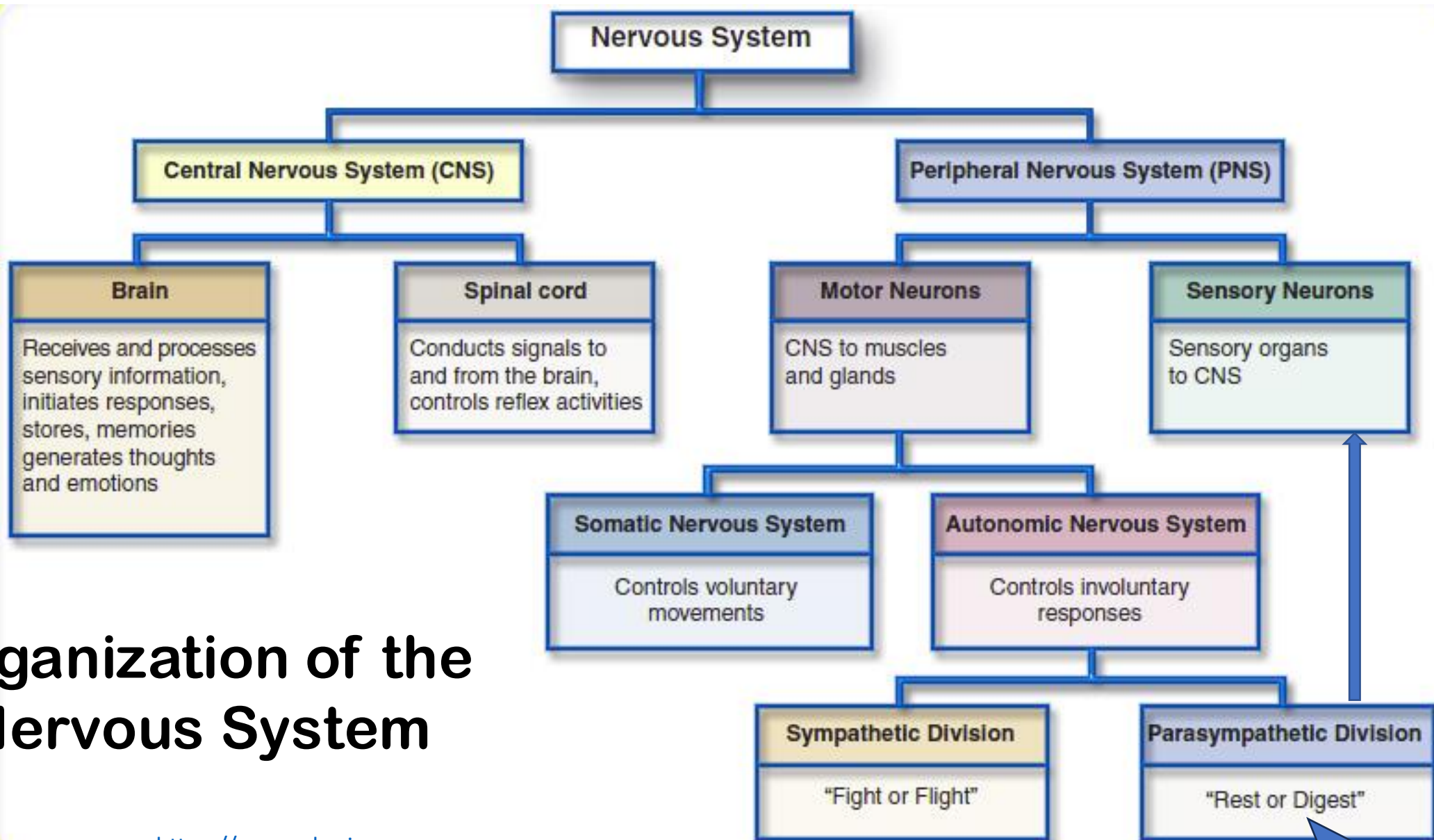
Objectives

By the end of this session, participants should be able to:

1. Describe the function of the vagus nerve (VN)
2. List some of the health consequences of vagus nerve dysfunction
3. Describe the basic concepts of 'Polyvagal Theory'
4. Describe how heart rate variability (HRV) can measure VN activity
5. Identify strategies for activating the vagus nerve
 - Relaxation strategies: e.g., slow breathing, chanting, ear massage, singing, etc.
 - Exercises: Aerobic exercise, The Basic Exercise
 - Transcutaneous electrical stimulation (vagus nerve stimulation – VNS)

PT Approach to Managing HSD





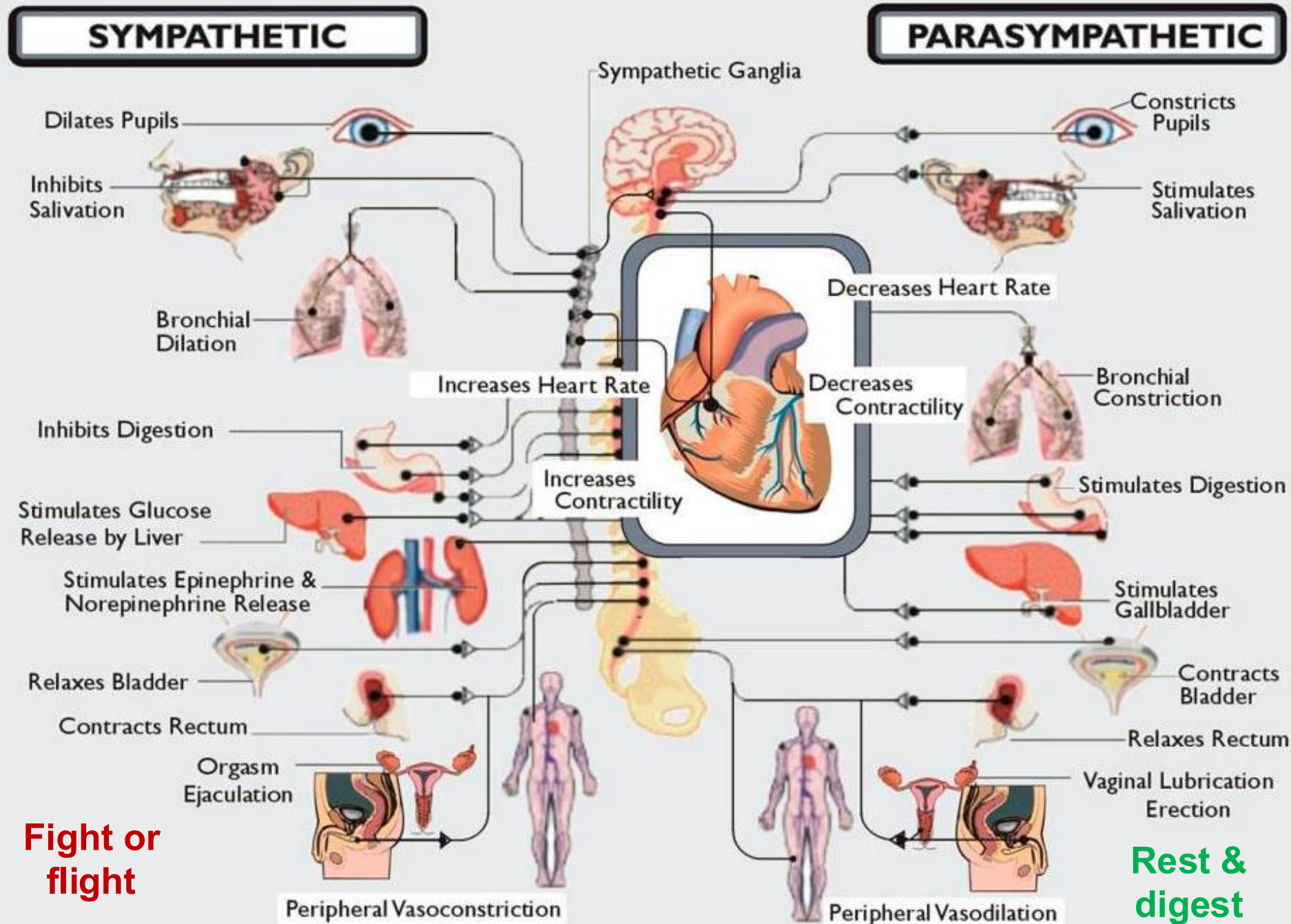
Organization of the Nervous System

https://www.physio-pedia.com/Introduction_to_Neuroanatomy

Vagus Nerve

The Autonomic Nervous System (ANS)

It is not actually a binary system as shown here

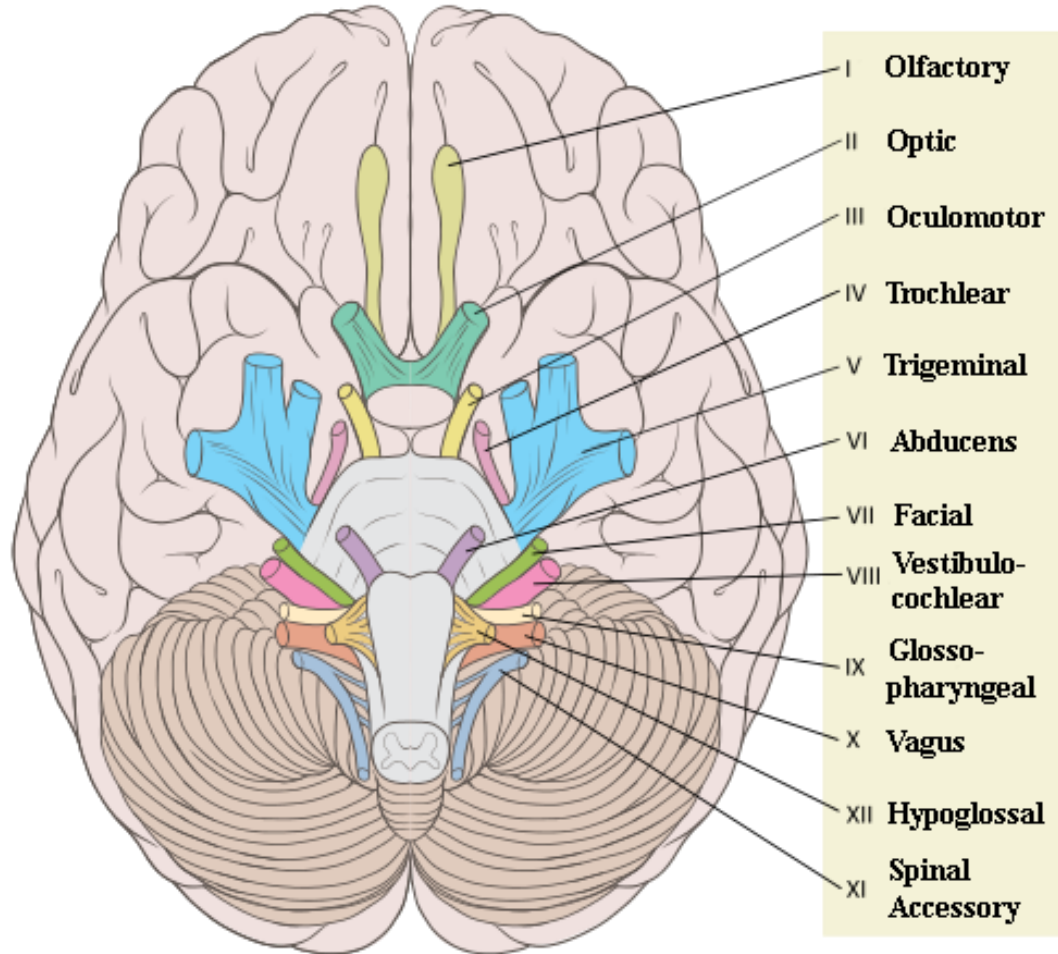


Sympathetic vs. Parasympathetic

- There is normally a balance between the sympathetic nervous system (SNS) and parasympathetic nervous system (PNS)
- The PNS drives the SNS
- Pain shifts the balance towards the SNS (and SNS increases pain)
 - SNS provides an emergency response to pain The hypothalamic-pituitary-adrenal axis (HPA) provides a slower response via release of cortisol
 - This is beneficial as response to acute pain/stress, but maladaptive as a response to chronic pain/stress
- The VN normally controls/decreases inflammation and cortisol



Cranial Nerves



- Cranial nerves (CN) come directly from the brain (not the spinal cord)
- Upper cervical instability can compress or stretch them
- CN III, VII, IX, X are most commonly affected by cervical instability

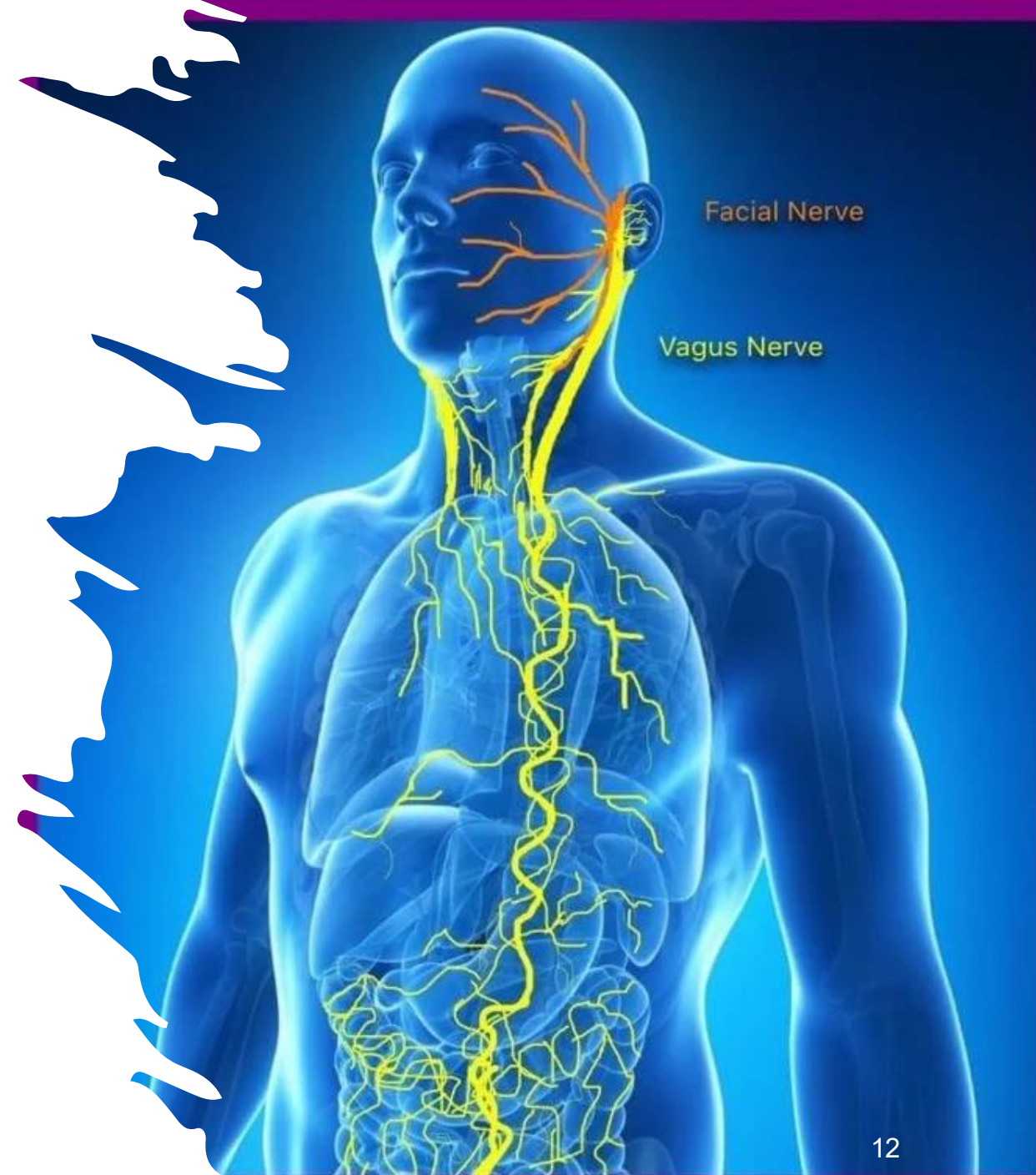
View of the brain from the bottom

<https://www.vestib.com/CN-anatomy.html>



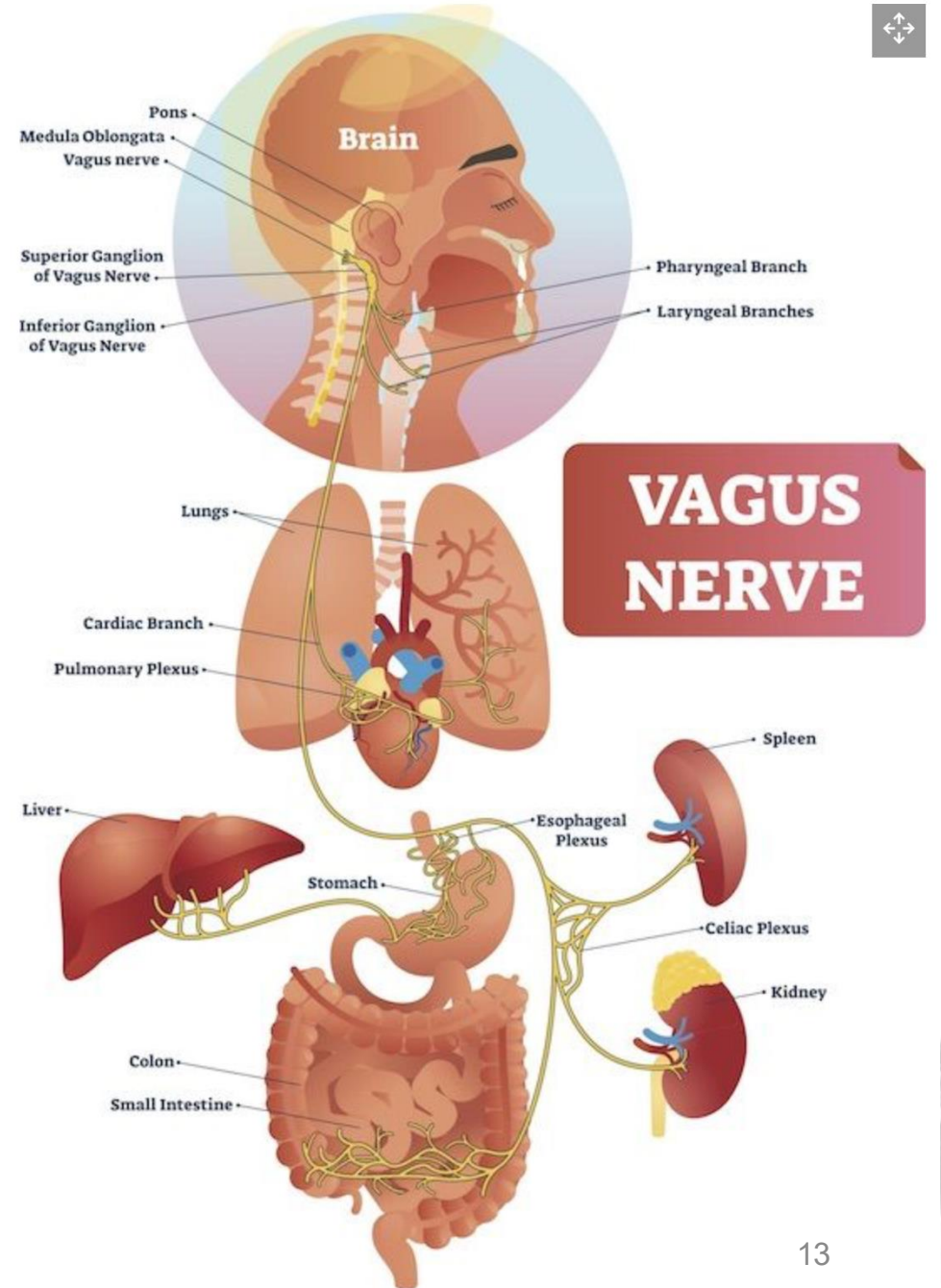
The Vagabond

- The Vagus Nerve (VN) is a cranial nerve: it comes directly from the brain
- It is the longest cranial nerve in the body: the “vagabond” or “traveler”
- It is the primary controller of parasympathetic function, hence of autonomic function

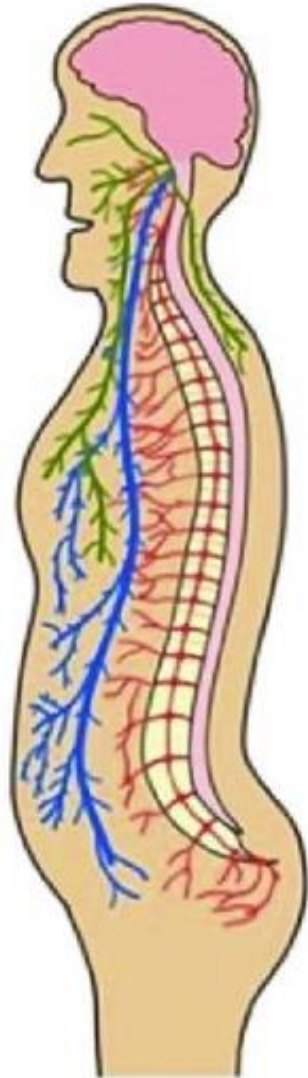


VN Anatomy/Function

- Cranial nerve: from brain via the skull
- Serves some structures in the head and throat, and most organs in the chest and abdominal regions
 - R VN controls most cardiac function
- Functions
 - Sensory: skin of outer ear, throat, heart and abdominal organs
 - Special sense: contributes to taste
 - Motor: some muscles of mouth and throat
 - Parasympathetic: trachea, lungs, gut, heart



Dorsal and Ventral Vagus Nerves?



- The right VN becomes the posterior (dorsal) branch and the left becomes the anterior (ventral) branch
 - Dorsal serves the gut and abdominal organs (primitive)
 - Ventral serves the heart, lungs, and vocal cords (only in animals that rear live young).
 - The ventral VN modulates the dorsal VN. When the ventral VN is underactive, the dorsal VN leads to a 'freeze' state

Porges, 2021; Porges, 2022

- However, scientists refute the biological premise of polyvagal theory

Grossman, 2023



Polyvagal Theory - An Intro

Ventral Vagal

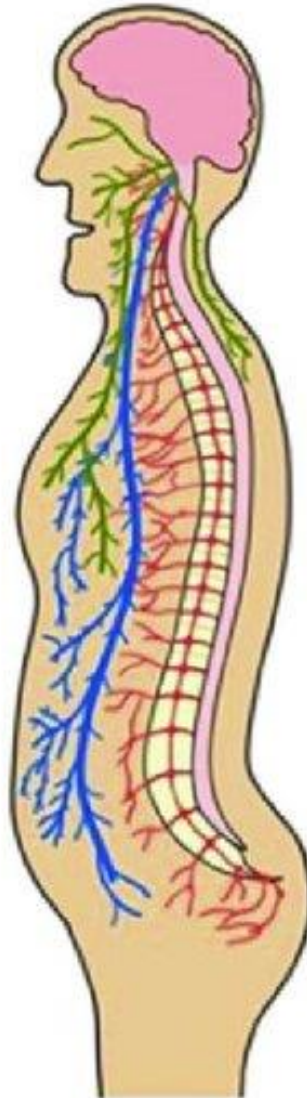
- Social Engagement Network
- Location: Face, throat, chest
- Ability to talk, engage, co-regulate, self-soothe and remain calm
- Top of the regulatory and evolutionary ladder

Sympathetic

- Fight & Flight (Mobilization)
- Location: Along the spinal cord
- Mobilize the body to fight, or run away from danger
- Increased heart rate, tense muscles, fast shallow breathing
- Middle of the regulatory and evolutionary ladder

Dorsal Vagal

- Freeze, Collapse, Dissociate (Immobilization)
- Location: Diaphragm, heart, gut
- Shut off from the threat, when can't fight or flight
- Decreased heart rate, low energy, depressed, numb, shut down
- Bottom of the regulatory and evolutionary ladder



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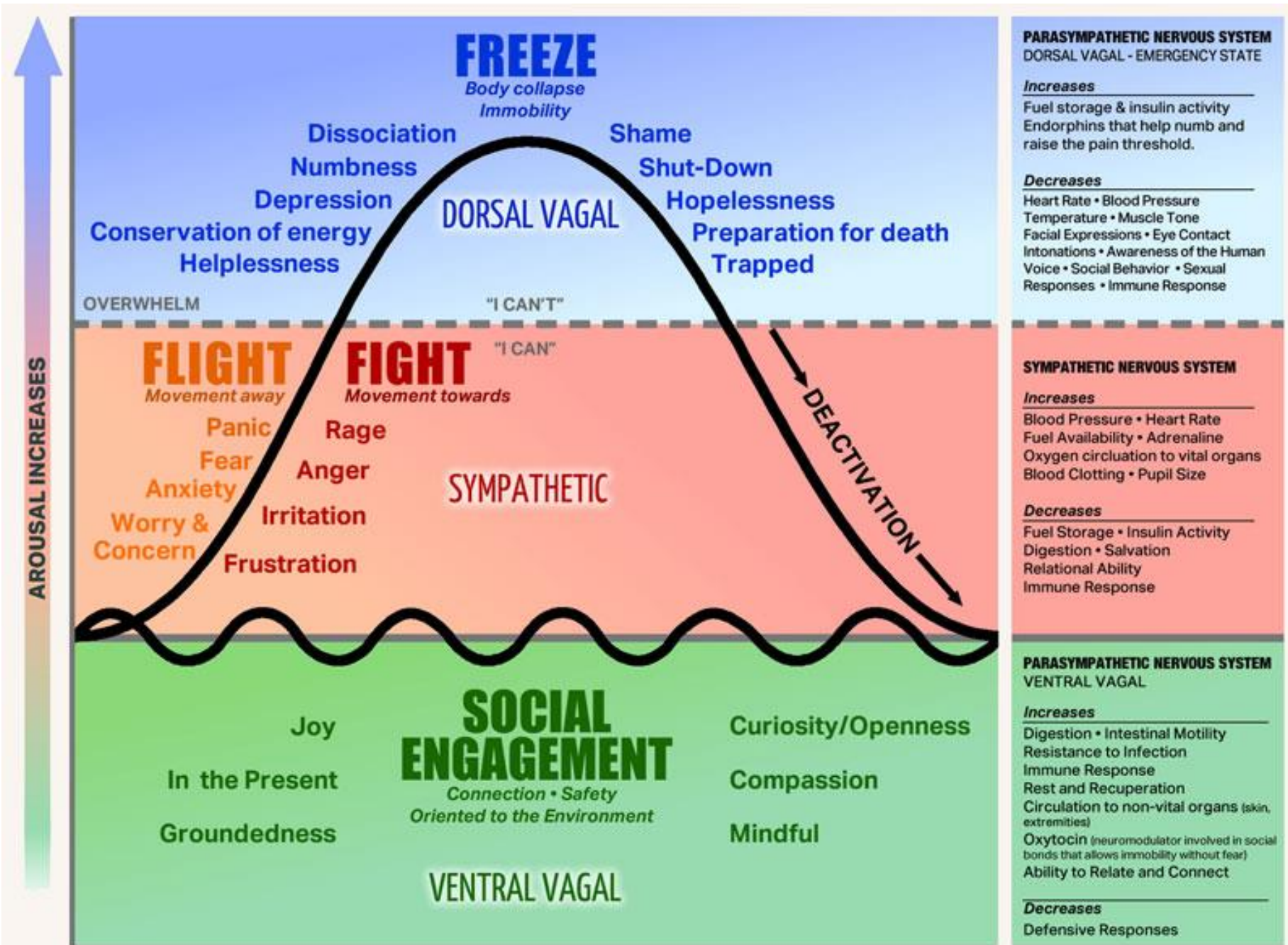
Polyvagal Theory

- We previously thought that the autonomic system was binary: sympathetic and parasympathetic.
- We now know that there are 2 parts to the parasympathetic system, hence “polyvagal”
- There is limited research supporting polyvagal theory

Porges, 2021; Porges, 2022

Diagram: Ayan Mukherjee -
therapyillustrated.com



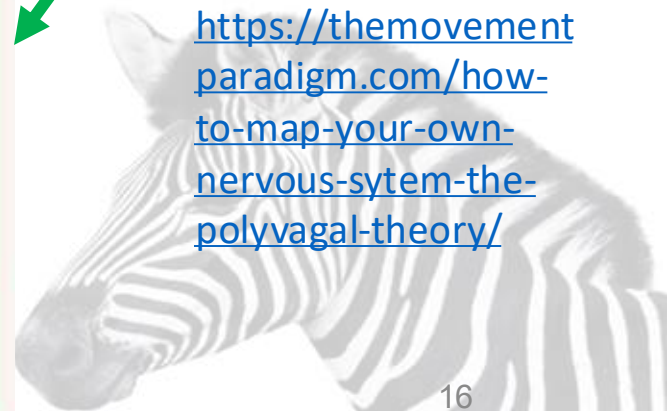


Parasympathetic:
Dorsal vagal

Sympathetic

Parasympathetic:
Ventral vagal

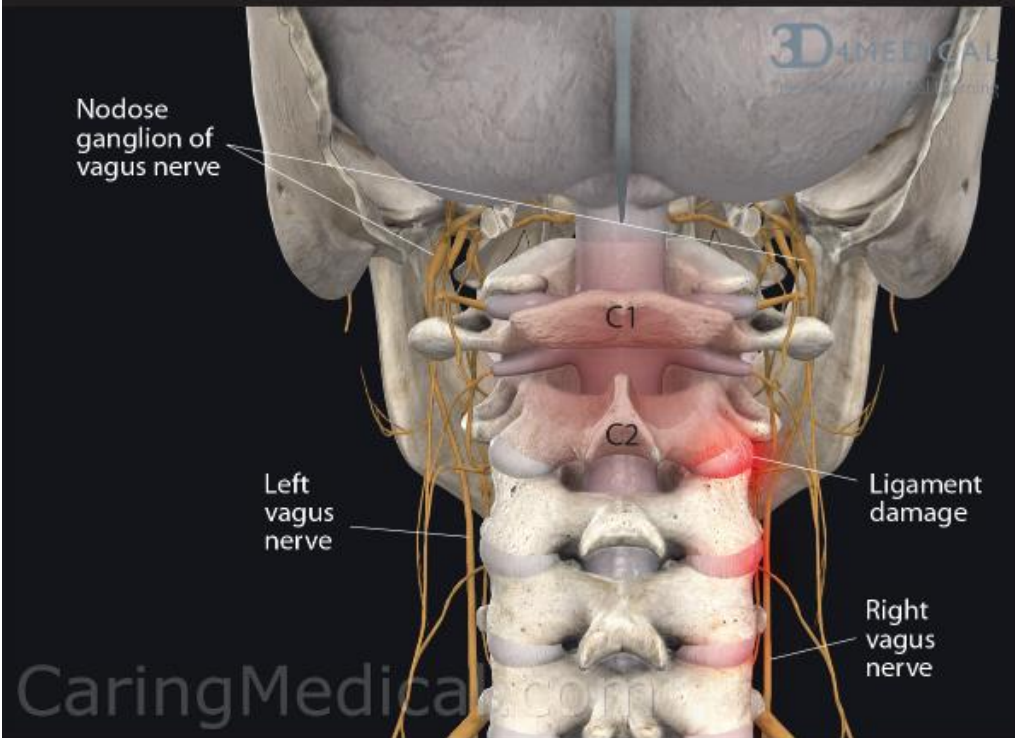
<https://thmovementparadigm.com/how-to-map-your-own-nervous-sytem-the-polyvagal-theory/>



VN and Cervical Instability

Upper Cervical Instability

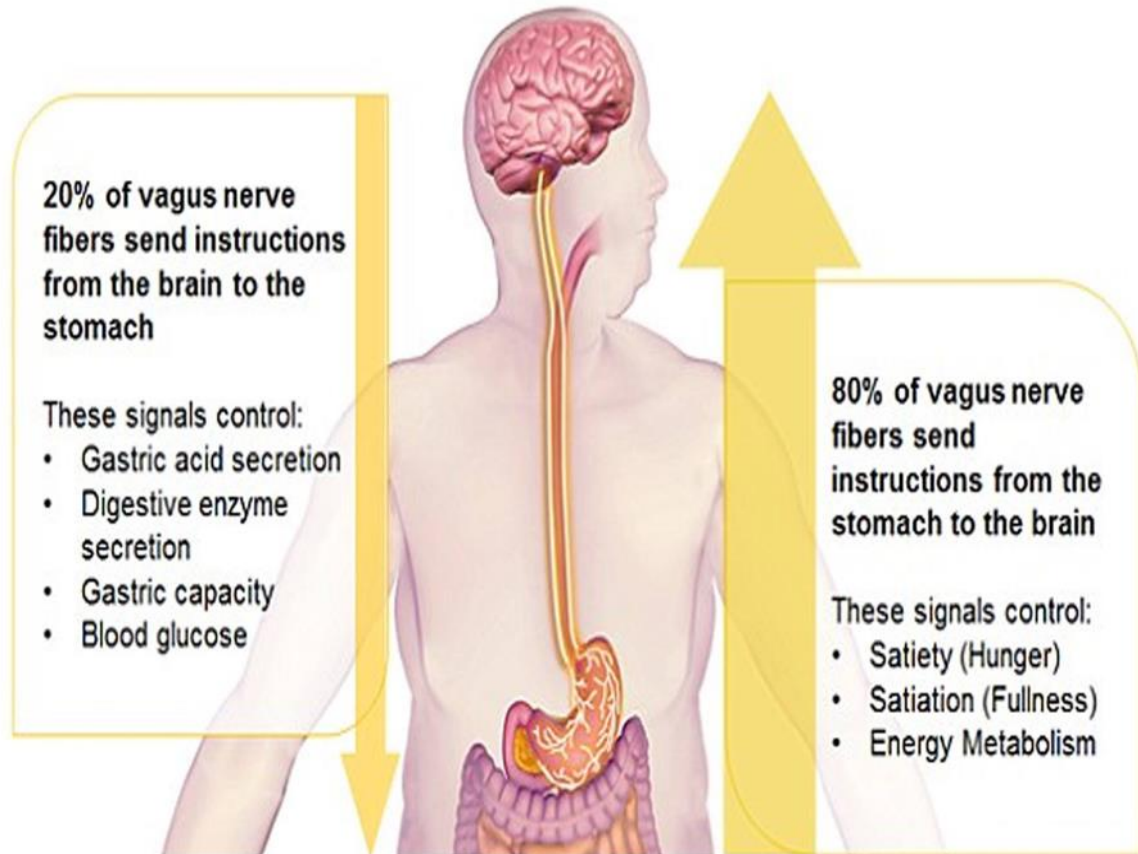
Upper cervical instability is the structural cause of vagus nerve destruction at the nodose ganglion.



- The VN travels very close to the top cervical vertebrae, C1 & C2
- Cervical instability likely compresses the VN, decreasing its activity
- This leads to increased SNS activity and may aggravate POTS
- It may also contribute to vaso-vagal syncope

<https://www.caringmedical.com/prolotherapy-news/vagus-nerve-compression-cervical-spine/>

VN: An Information Superhighway

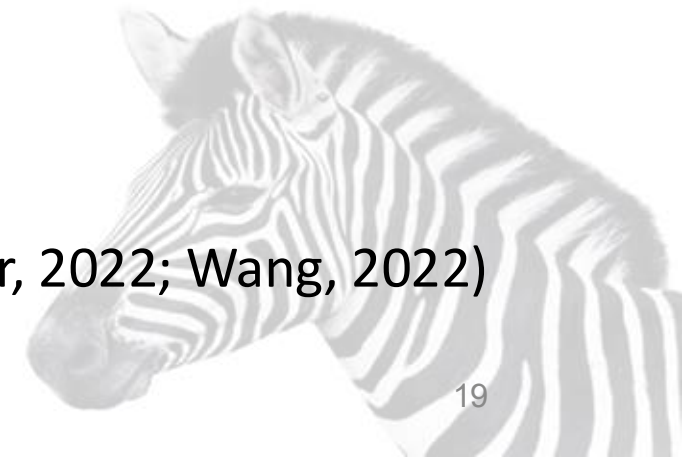


- Vagus nerve controls digestion, heart rate, immune function, mood and voice via the parasympathetic nervous system
- 80% of VN fibers communicate from the gut to the brain, telling the brain how the body is doing
- Sympathetic and parasympathetic activity are inversely related
- Vagus nerve function is disrupted in POTS (Anjum, 2018)

Conditions Involving VN Dysfunction

- Dysautonomia, POTS, orthostatic intolerance
- Epilepsy
- Rheumatoid arthritis and some other immune/autoimmune conditions
- Atherosclerosis, hypertension
- Migraine and other chronic pain conditions involving central sensitization
- Post-traumatic stress disorder, depression
- Diabetes, obesity
- Fainting (vasovagal syncope)
- May contribute to some cancers
- It may be involved in long COVID
- Crohn's disease, gastroparesis, constipation, irritable bowel...

(Gitler, 2022; Wang, 2022)

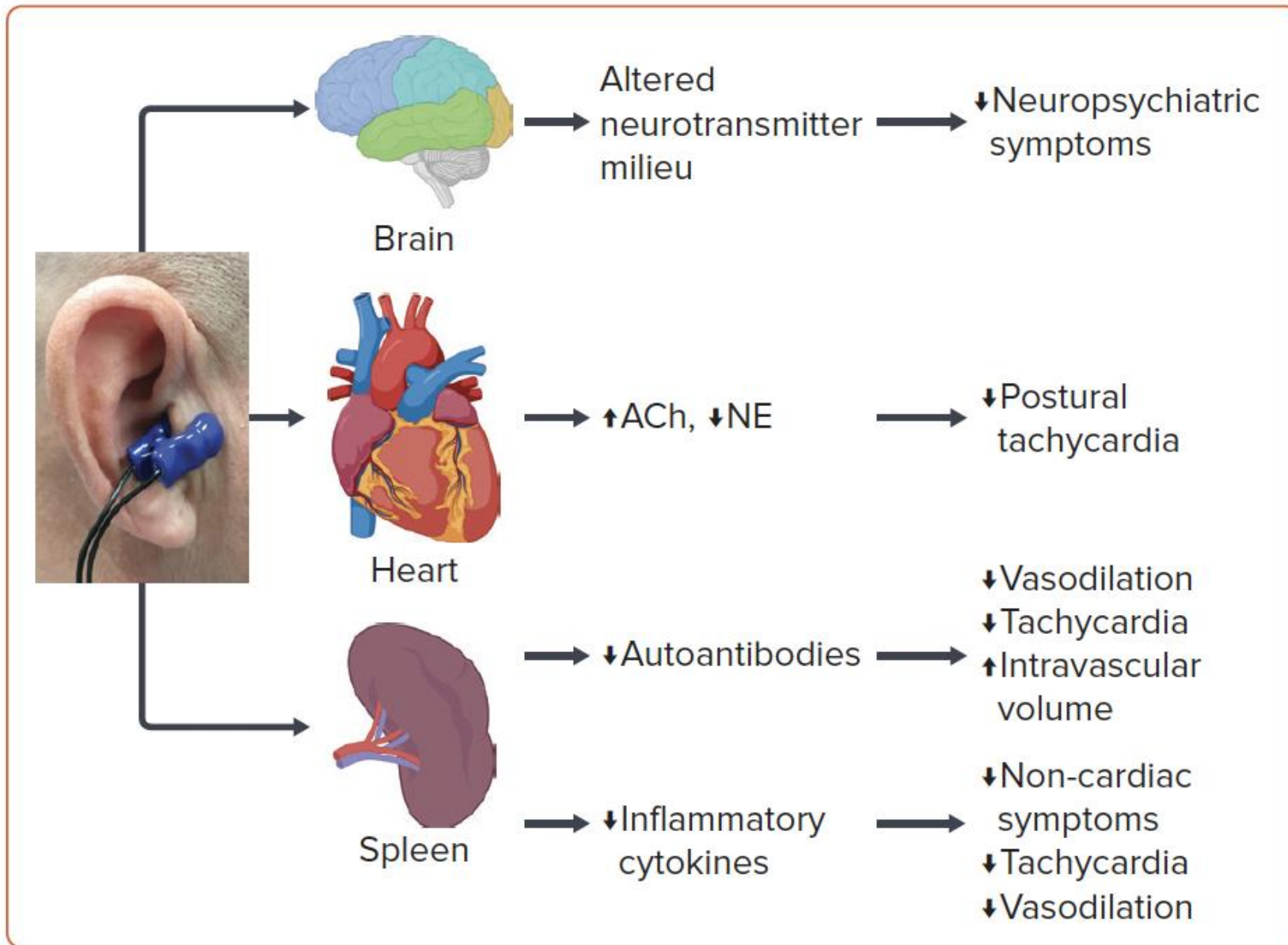


Gut-Brain Interaction

- “Functional gastrointestinal disorders” (FGD/FGID) have been renamed **“disorders of gut-brain interaction”** (DGBI) (Settembre, 2022)
- The bi-directional communication between the gut and central nervous system (brain)
- Mechanisms:
 - Vagus nerve sends signals between brain and gut
 - Immune system (organs, white blood cells, antibodies, chemicals that protect you from foreign invaders)
 - Endocrine system (set of glands that make & release hormones into blood to control)
 - Bacterial metabolites from the gut can pass through the blood-brain-barrier
- May be disrupted in multiple sclerosis, Alzheimer’s, Parkinson’s, depression and mood disorders (Rutsch, 2020)

VN and POTS

- The VN drives the parasympathetic branch of the ANS
- When the VN is not functioning well, dysautonomia results
 - Probably neuropathic POTS
- VN activity is decreased in chronic fatigue syndrome/myalgic encephalitis (CFS/ME) and does not rebound after exercise
- We are still learning how to use this to improve management of POTS
 - taVNS improves autonomic regulation and decreases systemic inflammation
 - Research shows improvement in POTS with 1 hr/day for 2 mo. (Chakraborty, 2023)
 - Aerobic physical exercise is one of the best ways to normalize VN activity



Physiology of VN Activation for POTS

(Chakraborty, 2023)

ACh = acetylcholine; NE = norepinephrine; POTS = postural orthostatic tachycardia syndrome; tVNS = transcutaneous vagus nerve stimulation. Source: Created with BioRender.com.



VN and Chronic Fatigue Syndrome

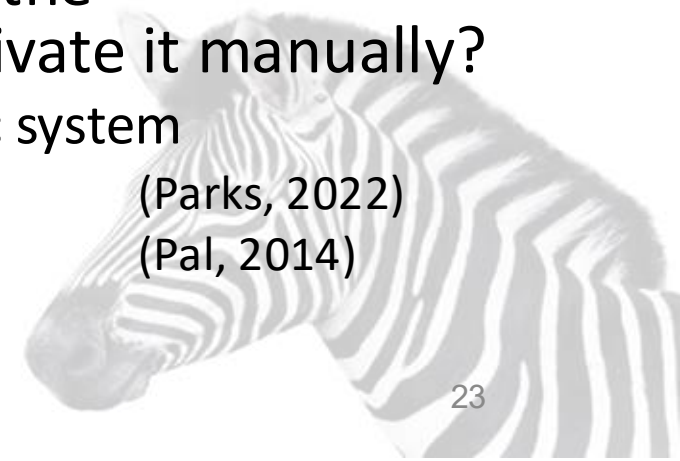
- People with dysautonomia/CFS are not able to regulate autonomic function during exercise
- Poor parasympathetic function is reflected in:
 - Higher resting heart rate (HRR)
 - Slower drop in HR after exercise
 - Lower HR variability (HRV)

(Gourine, 2018; Ladlow, 2021)

- If severe fatigue after exercise is associated with failure of the parasympathetic nervous system to reactivate, can we activate it manually?
 - Proposed strategies to activate the vagus nerve/parasympathetic system
 - Do a 'cool-down' after exercise
 - Slow, diaphragmatic breathing, left nostril breathing

(Parks, 2022)

(Pal, 2014)

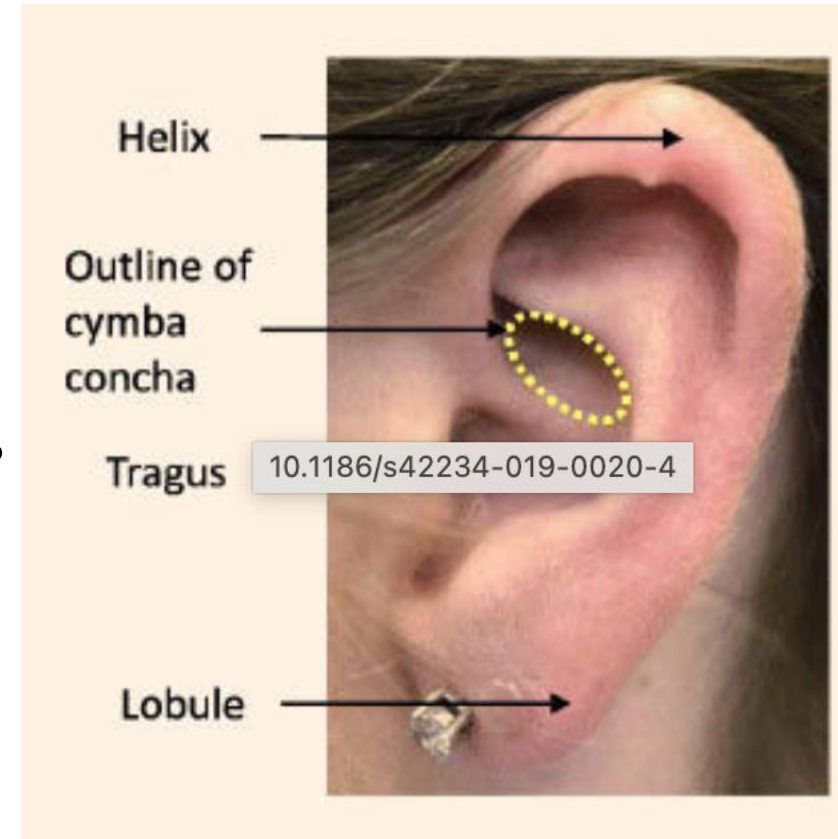


VN and Chronic Migraine

- VN afferents (sensory fibers) connect to portions of the brain involved in migraine (locus coeruleus and raphe nuclei)
 - These regions of the brain regulate noradrenaline and serotonin in other parts of the brain.
- VN stimulation: 30 minutes, 3x/week for 4 weeks (1 Hz, continuous) to left cymba concha
- Decreased number of migraine days and pain intensity
- Research showed change in brain connectivity

(Huong, 2023)

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VN and MCAS

- Mast cell activity influences nerve function, including the VN
- The VN stimulates anti-inflammatory activity, which influences mast cells
- VN directly connects to mast cells, e.g., in the gut, airways, etc. (Forsythe, 2015)
- Research does not yet show how to use this connection for MCAS.



VN and Feelings of Safety

- HSD, POTS and MCAS may all compromise feelings of safety
 - Feeling out of control
 - Not knowing why you have specific symptoms
 - Feeling like your body is vulnerable to injury
- Feelings of danger can trigger:
 - Sympathetic (fight or flight) response
 - Dorsal vagal (freeze) response
- Interventions should always be implemented slowly, carefully, with time to adapt and feel comfortable





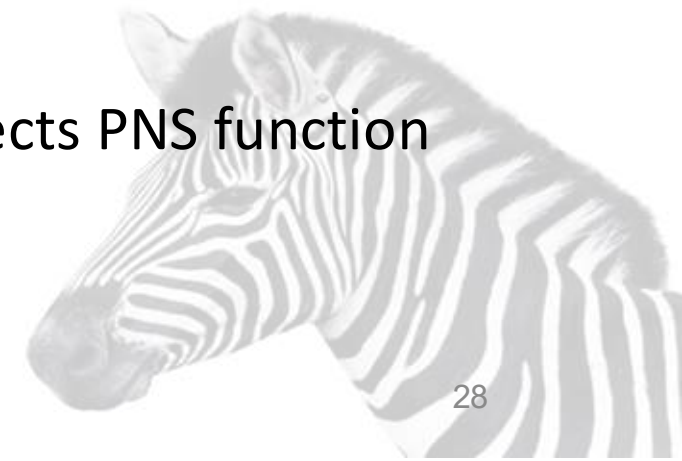
Questions?



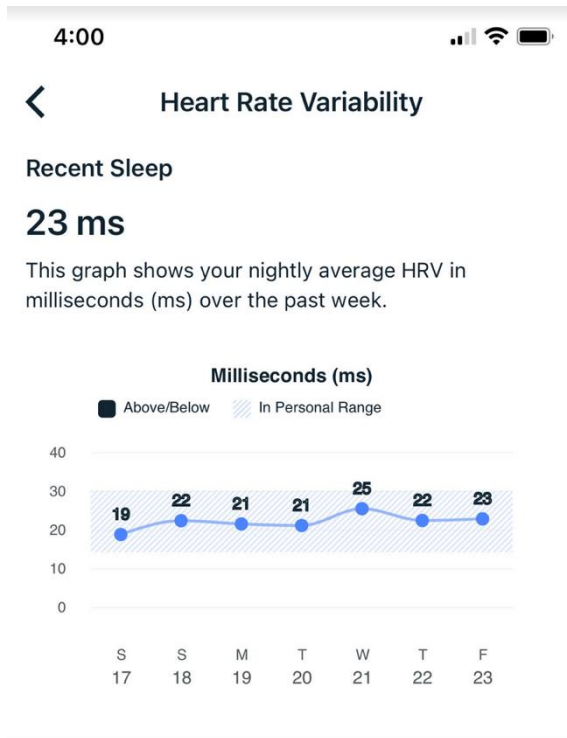
Measuring VN activity

HR Variability
Biofeedback

- “Heart rate variability” is a measure of PNS function (Gitler, 2022)
 - Higher HRV indicates higher parasympathetic function (good)
 - There are HRV biofeedback apps that use your smartphone camera to measure HRV: Smartscan™ is free and gives real-time feedback
 - Juva™ uses facial scans to measure HRV
 - Dedicated HRV biofeedback devices: Inner Balance™
- Resting HR also reflects PNS function, but depends on other things as well
 - HR response after exercise (parasympathetic recovery) reflects PNS function
- Tilt table test (same test as for POTS)

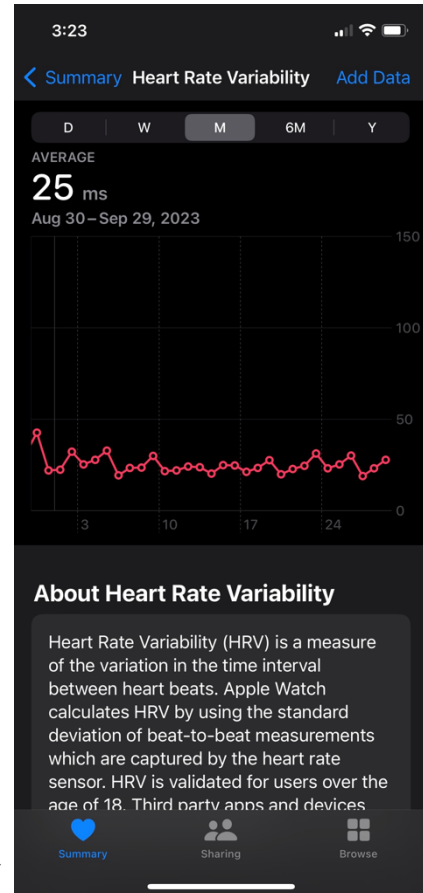


Many Wearables Track HRV



Fitbit↑

AppleWatch→

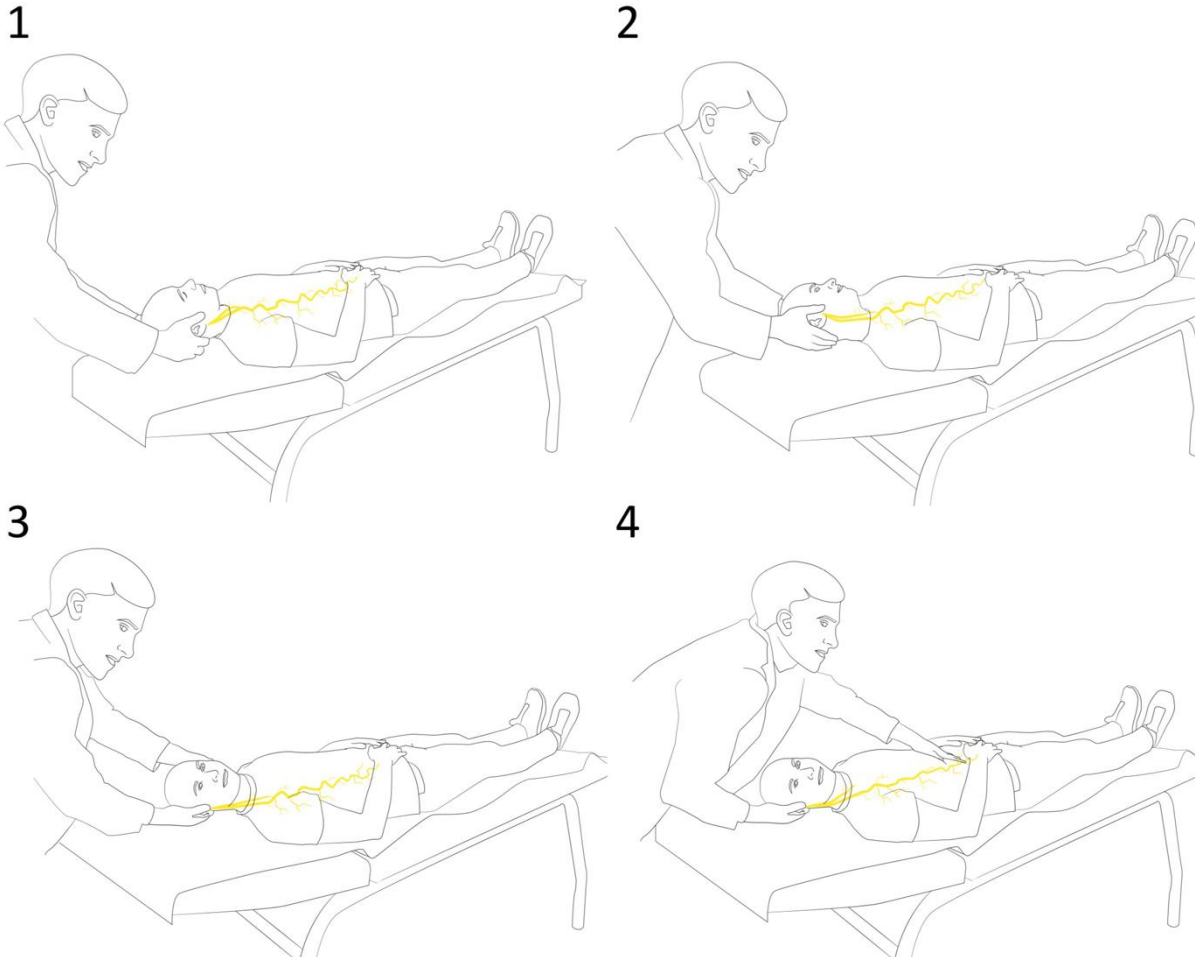


- You can use daily HRV to judge your daily resilience
 - If your HRV is higher than usual, your body is more resilient, and you can challenge yourself more
 - If your HRV is lower than usual, your body is stressed, and you should be more cautious



FYI: Vagus Neurodynamic Test

Info for
Clinicians



1. Starting position with upper cervical spine in flexion.
2. Contralateral lateral flexion.
3. Ipsilateral neck rotation.
4. End position, with gentle movements of the upper abdomen caudally and cranially as discrimination maneuverers.
5. (+) finding is mechanical allodynia in ipsilateral suboccipital region (predicts autonomic symptoms)
6. Causes HR decrease 8-12 BPM

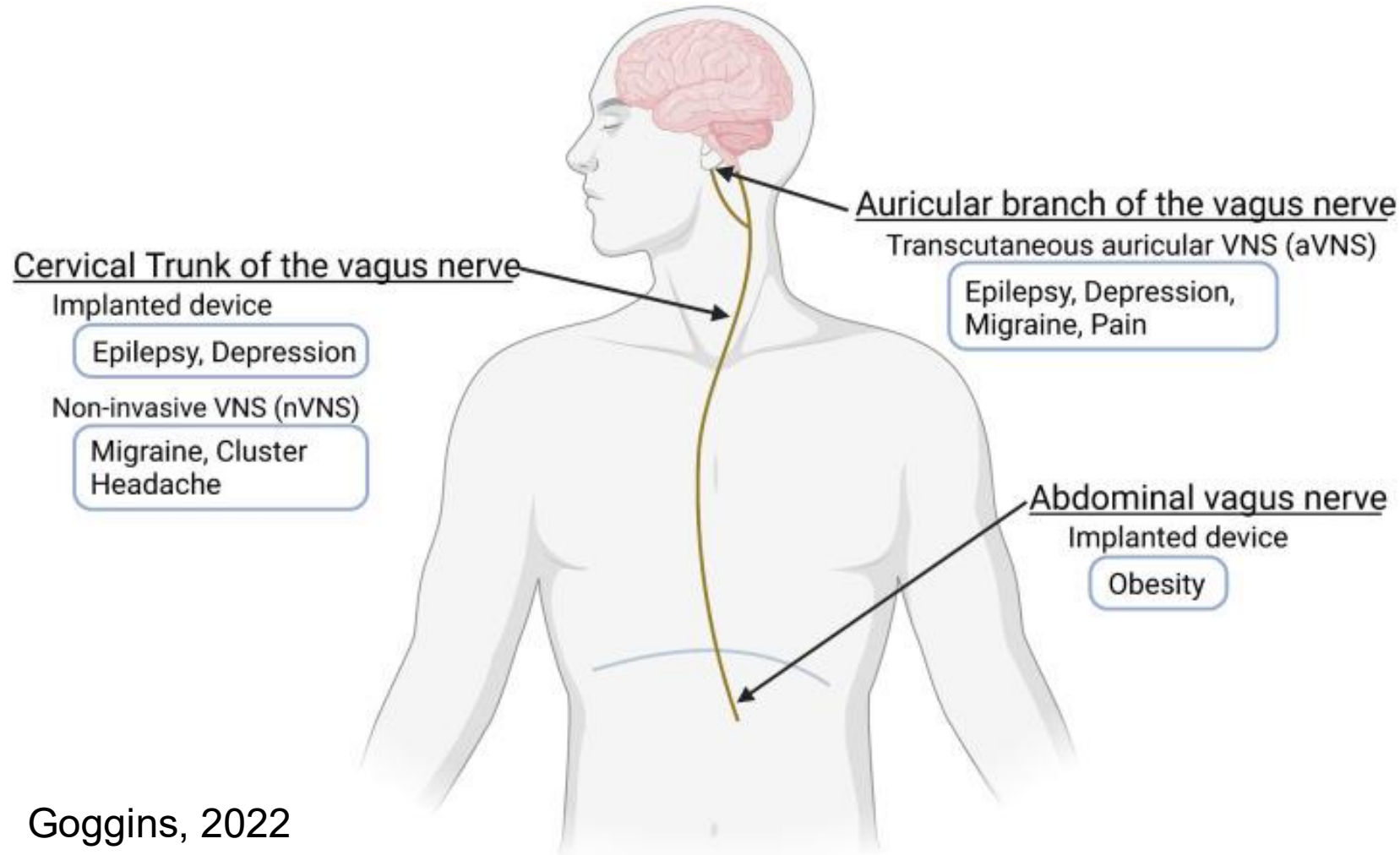
(Carta, 2021)

Activating the Vagus Nerve

- Electrical stimulation
- Stress reduction
 - Slow breathing, chanting, laughter
 - Mindfulness meditation
 - Relaxation biofeedback
 - Awe, exposure to nature, positive emotions, forgiveness
- Exercise
 - General (e.g., aerobic exercise, yoga, Pilates, etc.)
 - Vagus nerve specific
- Manual therapy
- Nutrition



Vagus Nerve Electrical Stimulation

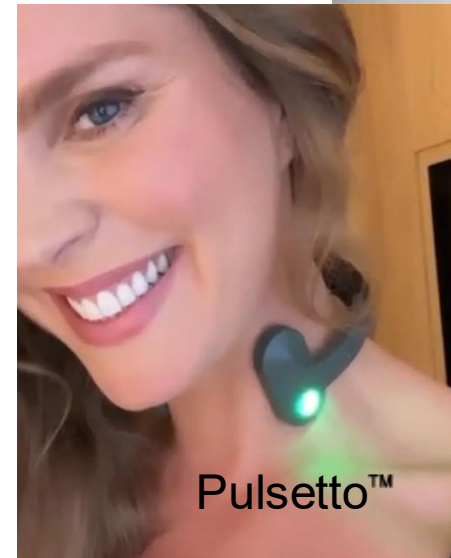
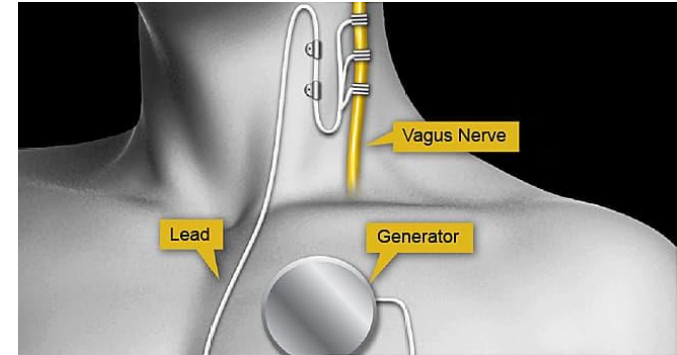


Goggins, 2022



Stimulating the VN at the Neck

- Implanted electrical VN stimulators
 - For intractable epilepsy or depression
 - Chronic inflammatory conditions: RA, Crohn's, asthma, fibromyalgia
- Transcutaneous electrical VN stimulators
 - For migraine/headaches
 - GammaCore™ available by prescription
 - Truvaga™
 - Pulsetto™
- Cervical VN stimulation has good research support, but commercial devices do not yet.

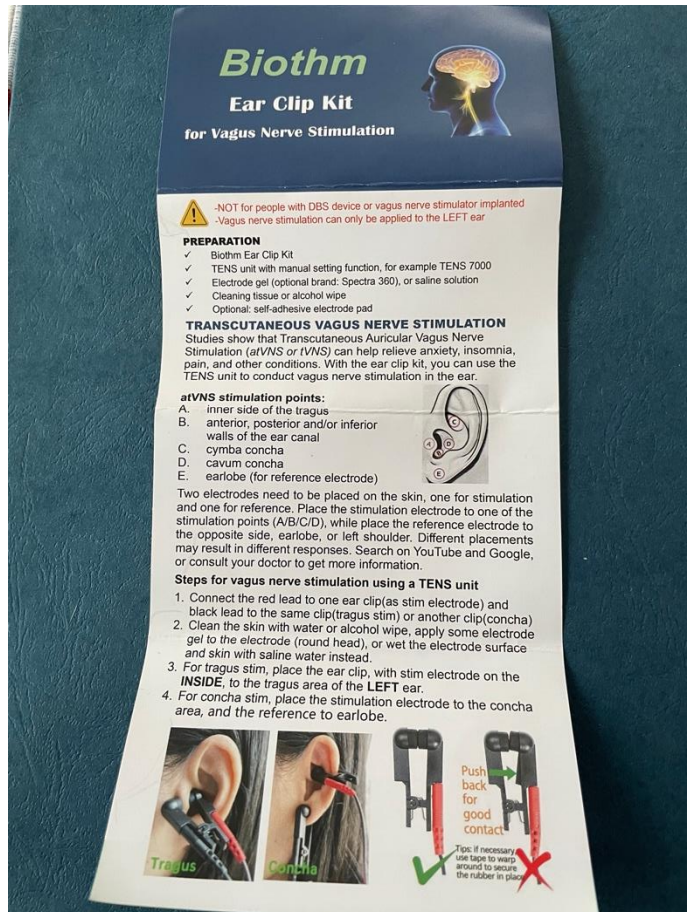


Stimulating the VN at the Ear

- Transcutaneous auricular VN stimulators (taVNS)
 - Also percutaneous aVNS using a small needle in the ear (Sant'Anna, 2023)
- Research shows benefit for: (Wang, 2022)
 - Pain/inflammation
 - Atrial fibrillation
 - Constipation & abdominal pain
 - Depression, anxiety, insomnia
 - Migraine
- Can use custom ear electrodes or clamp electrodes: LEFT cymba concha
- Parameters: (Wang, 2022)
 - “The pulse widths, 100 μ s, 200 μ s, 250 μ s, 200–300 μ s, 300 μ s, 450 μ s, and 1000 μ s, are often used during clinical research. The frequencies include 1 Hz, 1.5 Hz, 8 Hz, 20 Hz, 25 Hz, and 30 Hz. The intensities used in clinical research include 130 μ A, 0 μ A–600 μ A, 0.1 mA–5mA, 0.1 mA–10 mA, 0.25 mA–10 mA, 0.5 mA, 1 mA, 1.5 mA–3 mA, 4 mA–6 mA, 5 mA, 8 mA, 10 mA–50 mA, tingling threshold, pain threshold, or the threshold of maximum tolerable level.” (Wang, 2022)
 - That means – we don't know what parameters are best.
- No... I cannot recommend a specific device to purchase

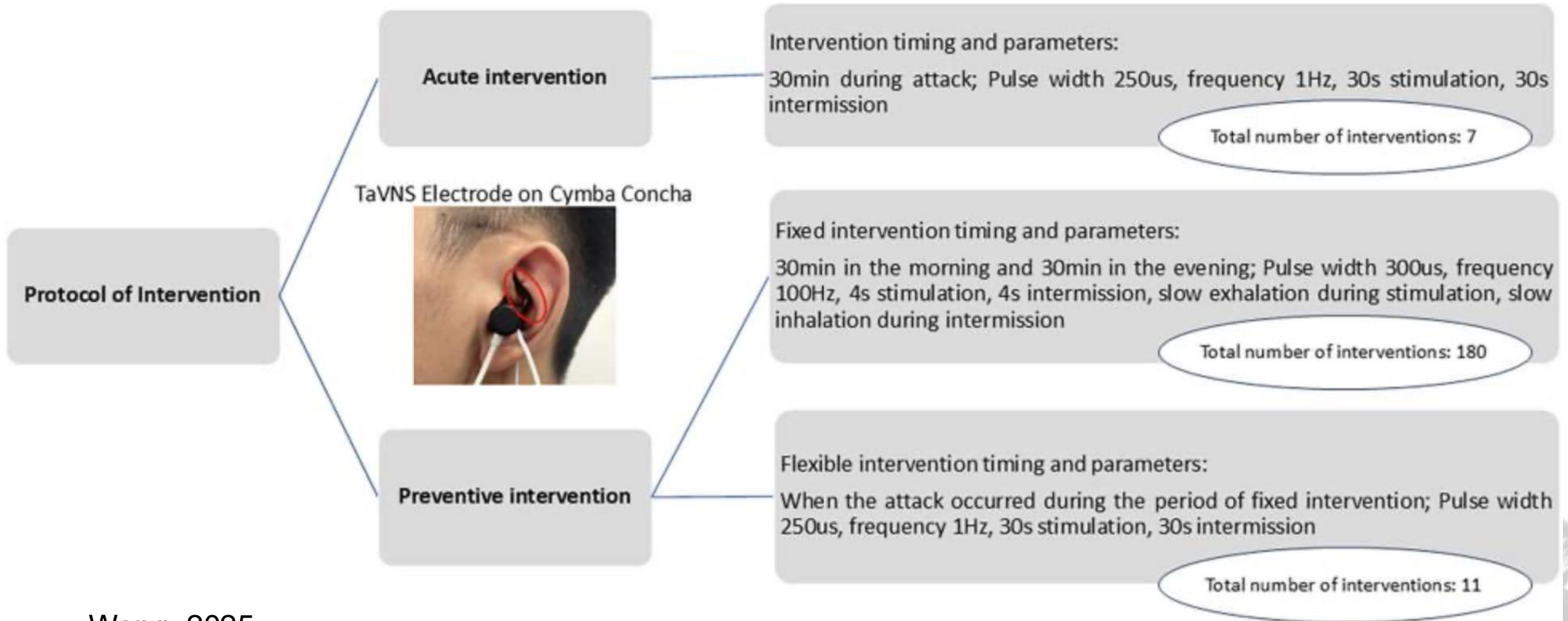


Auricular Stimulation Electrodes



- Get electrodes designed for stimulating the ear
- Get electrode gel
- Use a TENS machine that has appropriate settings:
 - Pulse width 200-300 microseconds (usually 200us)
 - Frequency 5-30 Hz (usually 25Hz)
 - Intensity just below uncomfortable
 - 15-30 minutes

But Recommended Parameters Vary



Weng, 2025

Safety of Electrical VN Stimulation

- Implanted electrodes are relatively high risk
- Transcutaneous VN stimulation is much safer
 - Cervical stimulation is considered safe
 - Ear (auricular) stimulation is very safe

(Lendvai, 2018)

(Kim, 2022)



“Low Tech” Approaches with Research

- Relaxation training
 - Slow breathing, chanting, laughter
 - Mindfulness meditation
 - Heart rate variability (HRV) biofeedback
- Exercise
 - Aerobic exercise (if not harmful/threatening)
 - Muscle stretching (in people who were tight), strength training
 - Yoga
- Nutrition
 - Omega-3 fatty acids
 - Probiotics
- Other
 - Massage: ear, abdominal, neck
 - Cold water facial immersion

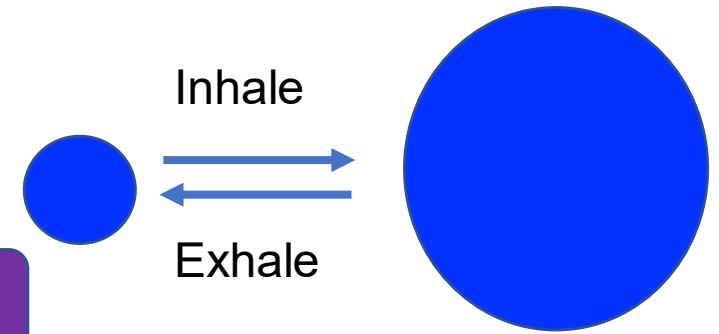
Yuen, 2017



Slow Breathing Practice

HSD109: Breathing

Breathing



- **Slow breathing**

- Research is very strong that slow breathing improves VN activity (Laborde, 2022)
- <https://youtu.be/PzwTAf2YLh4> has a 2-minute practice
- Apple Watch & Fitbit also have slow breathing functions

- **Extended exhale**

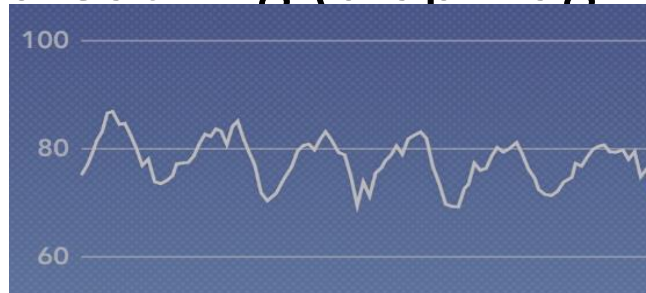
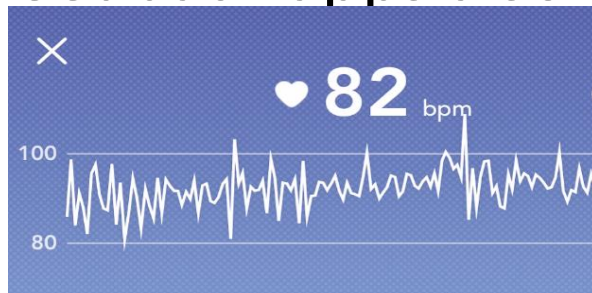
- **Exhale twice as long as inhale**
- E.g., 3 seconds in, 6 seconds out
- It is normal to feel a little light-headed or 'air-hungry' at first
 - Don't try to breathe quite so slowly if these symptoms are distressing
- It may take several weeks for the nervous system to reset



Biofeedback

- More information about biofeedback is available at:
<https://www.mayoclinic.org/tests-procedures/biofeedback/about/pac-20384664>
- HRV biofeedback provides feedback on vagus nerve activity (Gitler, 2022)
 - A smartphone with camera/flash can do HRV biofeedback, many apps available
 - StressScan™ has real-time feedback
 - Juva™ uses facial imaging to track HRV (<https://www.juvahealth.com>)
 - You can purchase a dedicated biofeedback unit with ear clip: more features
 - Inner Balance™
- Biofeedback apps also for breathing (diaphragmatic or slow)

Stressed



Relaxed



Humming, Chanting, Singing



- How we think it works:
 - The vagus nerve serves the vocal cords and throat; vibration may stimulate those nerves
- Evidence:
 - Chanting OM creates similar brain activation changes as seen with VNS
 - Deactivates the limbic system (decreases anxiety)
 - An 'sssss' sound does not have the same effects
- <https://youtu.be/QSAvPggQ2L0>

Kalyani, 2011; Inbaraj, 2022

Yoga and the Vagus Nerve

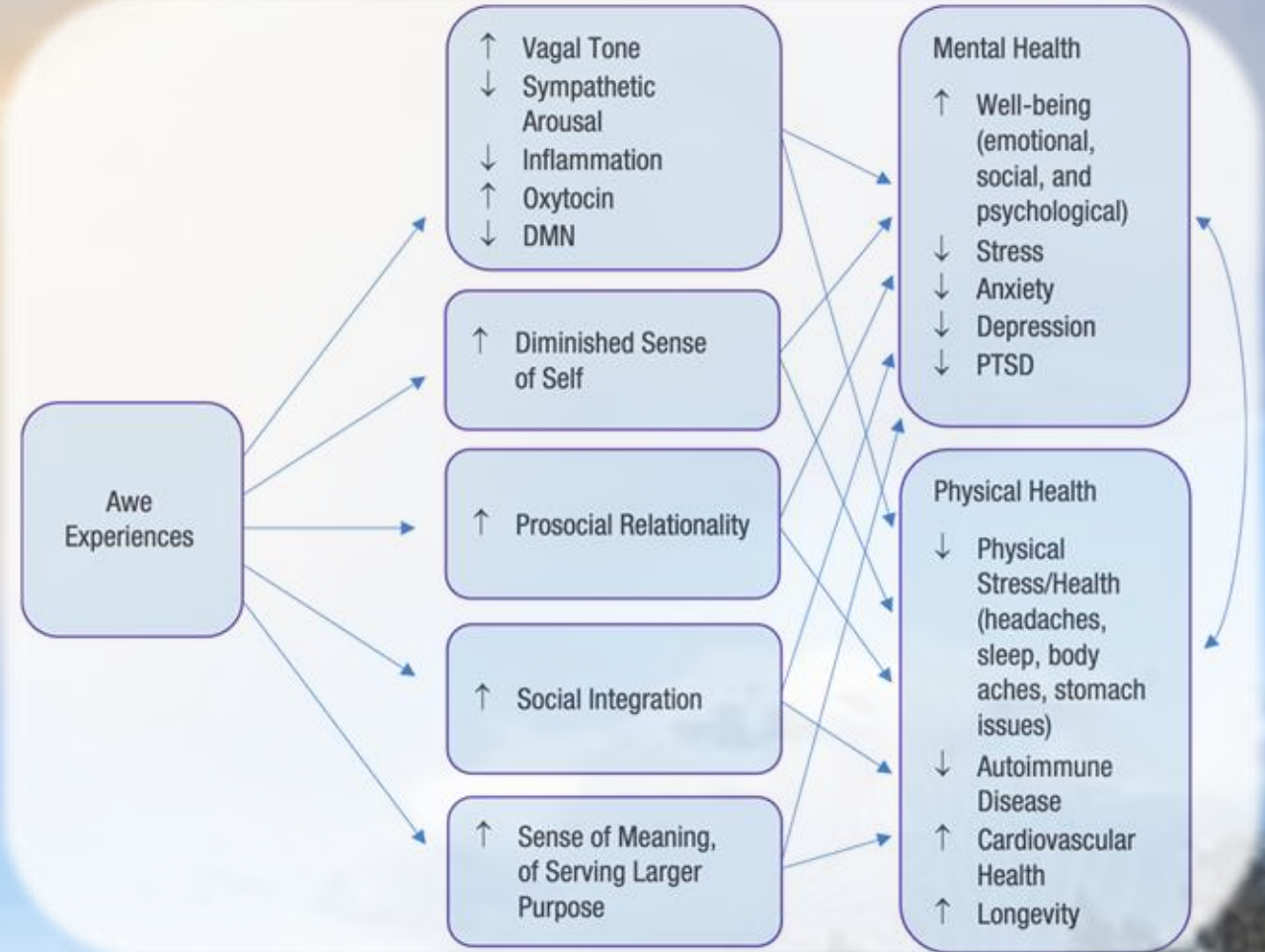
- Yoga is a form of neural exercise
 - Increases Heart Rate Variability and ventral vagal activity
- The mind-body connection is important
 - The sense of calm
- Controlled breathing is important
 - Chanting may also be helpful
- Slow, full body movements might improve VN mobility and health
- Pilates uses many similar approaches

Sullivan, 2018

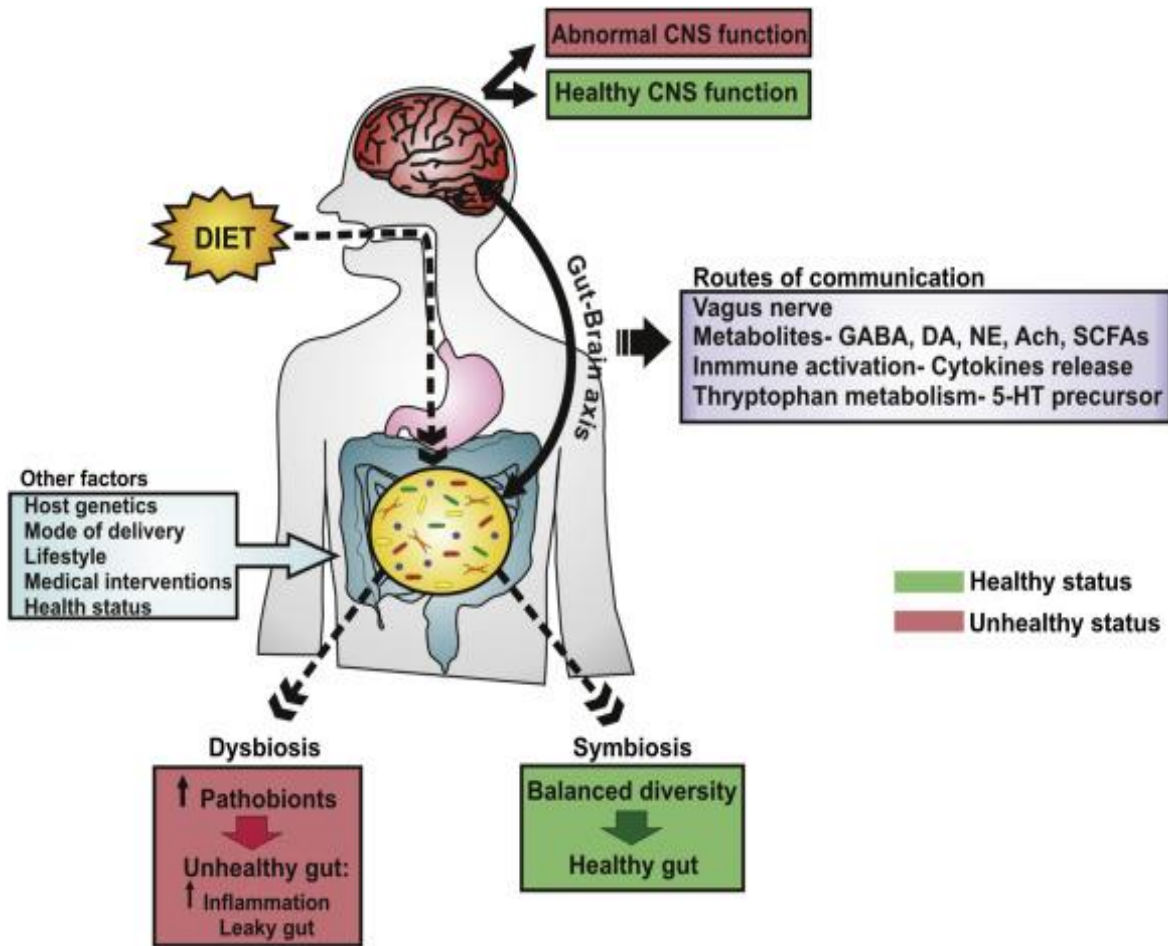


Psychological Approaches

- Listening to Mozart's music
- Positive emotions, 'loving-kindness' meditation, forgiveness
- Exposure to nature
- Experiencing positive awe
- Spirituality (Monroy, 2023)



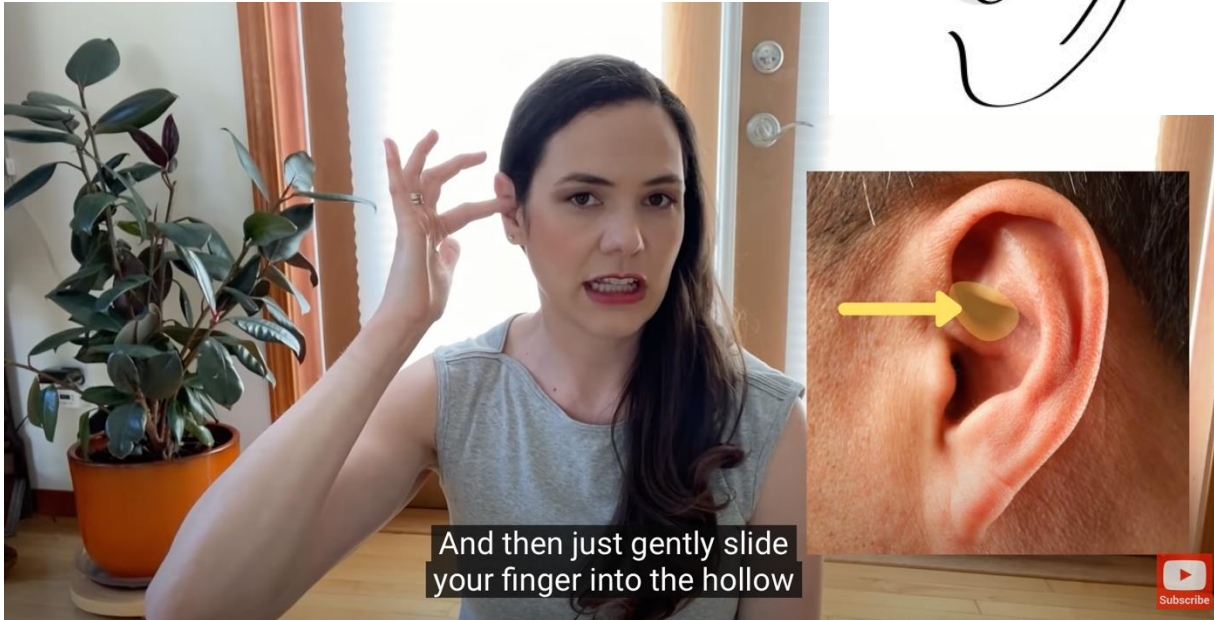
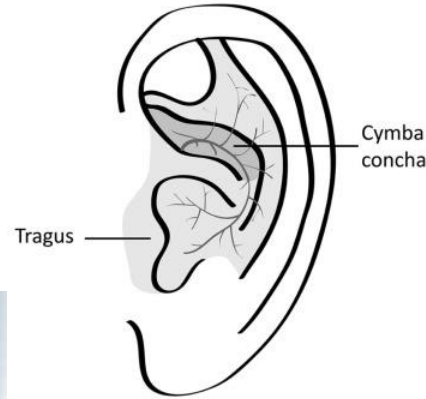
Role of Diet in VN Function



- Our diet influences our gut microbiome
- Gut microbiome communicates with the brain via the VN and circulating metabolites
- Diet influences brain function, and can lead to neuroinflammation and pain
- VN activation can decrease gut inflammation and leakiness

(Oriach, 2016; Bonaz, 2018)

Ear Massage

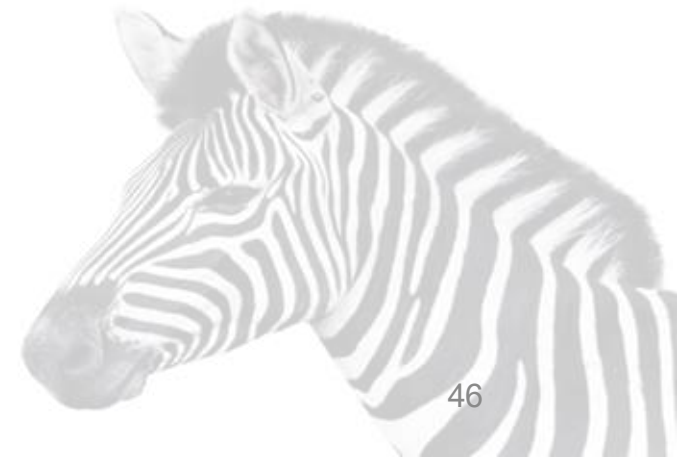


- Research is limited for ear massage
- How we think it works:
 - The vagus nerve supplies sensory nerves to a portion of the ear pinna (flap)
 - Sensory stimulation of this section of skin provides input to the vagus nerve
 - We think that massage can also stimulate the nerve more gently
 - <https://youtu.be/LnV3Q2xIb1U>



Manual Therapy to Sternocleidomastoid

- The vagus nerve lies behind the SCM muscle
- Tightness or spasm in the SCM may aggravate the VN
- Stay tuned for further information...

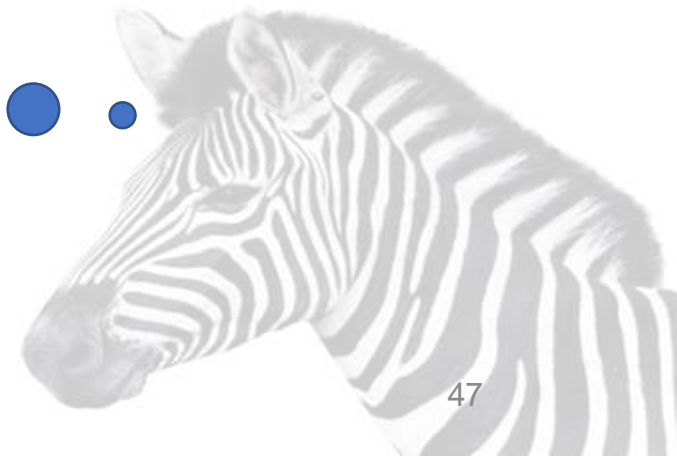


Other “Low Tech” Approaches

- Relaxation with salivation, think of sucking on a lemon
- Sleeping on R side

https://sass.uottawa.ca/sites/sass.uottawa.ca/files/how_to_stimulate_your_vagus_nerve_for_better_mental_health_1.pdf

These ‘low tech’ approaches have little or no research support, but are likely harmless to try



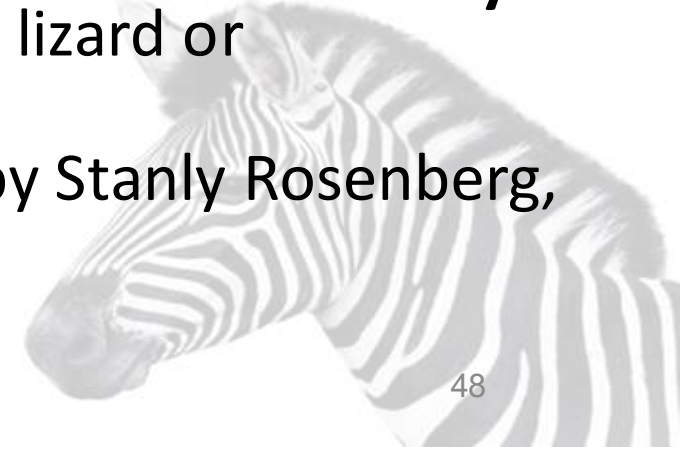
Vagus Nerve “Exercises”



- The Basic Exercise for activating the VN
 - (top picture)
 - Do it lying down (less chance of pulling on your neck/head)
 - A yawn shows it has ‘worked’
- **Caution if you have unstable shoulders,** or use pillows to support your arms
- YouTube video:
 - <https://youtu.be/-cbC2Tto2UM>
- **Caution if you have cervical instability:** some exercises (e.g., lizard or salamander)
- Exercises proposed by Stanly Rosenberg, PT (2017)



Russek: HSD112 Vagus Nerve



Vibration



- Research is limited for vibration
- Sensate™ :
 - <https://www.getsensate.com/pages/meet-sensate>
- Apollo Neuro™ :
 - <https://apolloneuro.com>
- These companies report research supporting benefits of improved HRV, sleep, relaxation, but not directly relating to VN

Listening to Special/Filtered Sounds



- How we think it works:
 - Activates VN through the hearing system, which is sensitive to sounds of threat and danger
 - Creators report research evidence, I could not find confirmation
- “Dreampad” pillow
- “Safe and Sound Protocol”
- <https://integratedlistening.com/ssp-safe-sound-protocol/>

Summary

- The VN is important for function in many ways
 - Controlling the ‘rest and digest’ organs
 - Managing inflammation, pain, recovery from exercise
 - Communicating from our gut to our brain: “gut feelings”
 - It may also contribute to ‘freeze’ states in trauma, depression, etc.
- There are many ways to improve VN function
 - Low tech: e.g., slow diaphragmatic breathing, chanting, biofeedback, etc.
 - Vagus nerve electrical stimulation (VNS) not widely available, but research and technology changing very fast
- We may be able to ‘hack’ our VN function to improve health



Caution!

- The VN is definitely important.
- But much of what you read about the VN on the internet or in popular books is not supported by research (at least, not yet).
- Many approaches may be harmless to try, but be cautious.



Natural Techniques For Stimulating The Vagus Nerve



Exercise

Exercise is good for your brain's cognitive faculties, your mental health and your gut flow, thanks to its ability to stimulate the vagus nerve.



Thoughtful meditation

You can improve your mood simply by silently repeating positive phrases about your friends and family.



Singing

Humming, chanting and singing are all exercises that increase heart rate variability (HRV). Higher HRV is linked with "reduced morbidity and mortality" and "improved psychological well-being and quality of life."

Singing also increases oxytocin, aka the love hormone, because it's an activity that brings people closer together.



Gargling

Gargling with water stimulates the muscles of the pallet and has been shown to improve working memory performance.



Deep, slow breathing

Breathing slowly and deeply activates your vagus nerve to send messages to your brain that help lower your blood pressure and heart rate.



Chill out

Exposure to cold dampens the fight or flight response and increases the rest and digest response, like taking a cold shower or drinking ice water.



Laughing

Laughter is a natural immune booster which, like singing, can increase HRV in a group setting.



Yoga

Disciplines like yoga increase vagus nerve activity to help keep you calm and are particularly effective for people suffering from anxiety or depression.



Resources

- Natural Techniques handout: <https://hypnosistrainingacademy.com/what-does-the-vagus-nerve-do/>

Books:

- Stanly Rosenberg: *Accessing the Healing Power of the Vagus Nerve: Self-Help Exercises for Anxiety, Depression, Trauma, and Autism* (2017)
- Stephen Porges: *Polyvagal Safety: Attachment, Communication, Self-Regulation* (2021)
- Stephen Porges: *The Pocket Guide to The Polyvagal Theory* (2017)

Web Resources

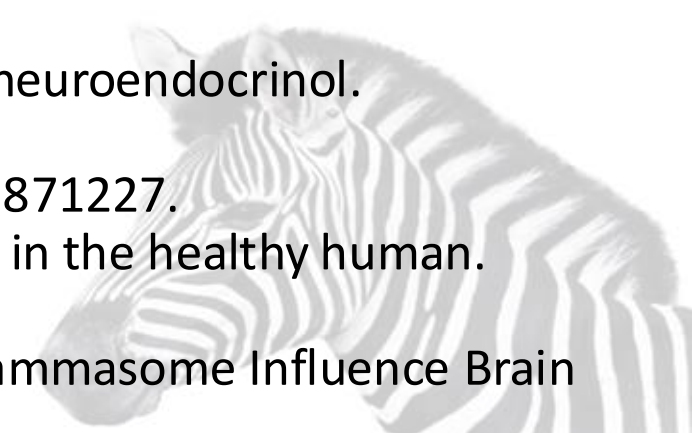
- Porges brief interview: <https://youtu.be/ec3AUMDjtKQ>
- Longer and simpler explanation: <https://youtu.be/OeokFxnHGQo>
- Web site with Polyvagal Theory resources: <https://integratedlistening.com/science-of-feeling-safe/>
- Good overview of self-care strategies:
https://sass.uottawa.ca/sites/sass.uottawa.ca/files/how_to_stimulate_your_vagus_nerve_for_better_mental_health_1.pdf
- YouTube ear self-massage: <https://youtu.be/LnV3Q2xlb1U>
- "The Basic Exercise" by Rosenberg: <https://youtu.be/-cbC2Tto2UM>
- Additional exercises (require neck movement, so do not do if you have neck instability):
<https://youtu.be/L1HCG3BGK8I>
- <https://www.rewiretherapy.net/vtp-240-official> (looks good, but costs \$ and I haven't tried it)
- Andre C. Proper Breathing Brings Better Health. Scientific American. Jan, 2019. Available at: <https://www.scientificamerican.com/article/proper-breathing-brings-better-health/> (popular science article)
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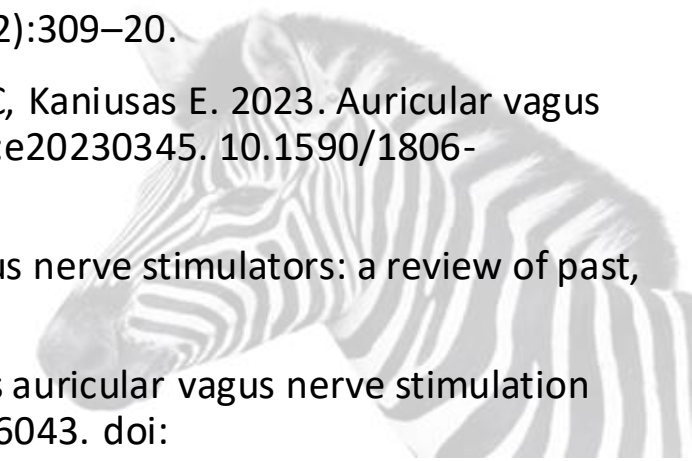
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Thank
You!





Questions?

