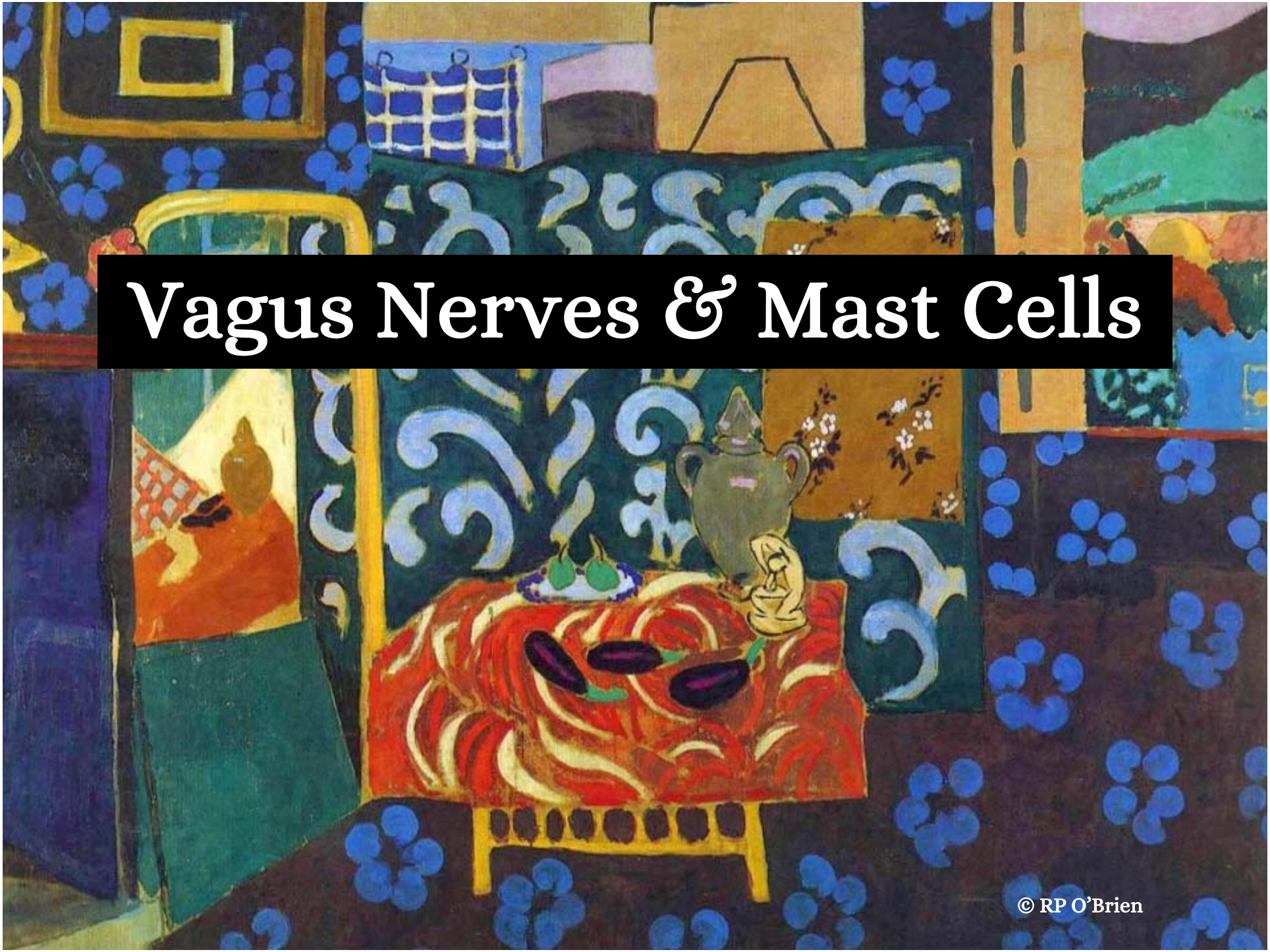
Vagus Nerves & Mast Cells
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About Me:

Roselle P. O'Brien,
LMHC, REAT, REACE, ICAT, LPN

Education:

- PhD in Psychology with focus on
  Mast Cell Disorders (MCD)
  Current Candidate

- MA in Clinical Mental Health Counseling
- MA in Education
- MFA in Creative Writing
- BA in Art/Fine Arts, Education
- Diploma Nursing

Licenses/Certification:

- Licensed Mental Health Counselor (LMHC)
- Licensed Clinical Mental Health Counselor (LCMHC)
- Licensed Educator
- Licensed Nurse
- Intermodal Creative Arts Therapist (ICAT)
- Intermodal Creative Arts Facilitator (ICAF)

About Me (cont'd):

Roselle P. O'Brien,
LMHC, REAT, REACE, ICAT, LPN

Licenses/Certification (cont'd):
- Registered Expressive Arts Therapist (REAT)
- Registered Expressive Arts Consultant/Educator (REACE)
- Certified Life Coach
- Certified Health & Nutrition Life Coach
- Certified Therapeutic Arts Life Coach
- Certified Group Life Coach

Certificates:
- Eco-Health Support: Medical Professional
- Eco-Health Support: Therapist

The Eco-Health Certificate Programs are for understanding and working with people who have Mast Cell Disorders (MCD) such as Mast Cell Activation Syndrome (MCAS), Post-/Long-COVID, being sensitive to multiple chemicals, chronic fatigue, brainfog, EDS, fibromyalgia, and more.

For more information: https://celacareonline.us

About the Work I Do:

Roselle P. O'Brien,
LMHC, REAT, REACE, ICAT, LPN

Health & Wellness · Therapy · Life Coach
Creative Arts for Health & Healing · Supporting You!

I am a mast cell specialist with over 13 years of experience working with and supporting individuals with MCAS and other mast cell activation related issues and disorders. Visit the websites and learn more:

CELACare Eco-Health, Inc.
https://celacareonline.us

The Counseling Center at CELA
https://counselingatcela.com

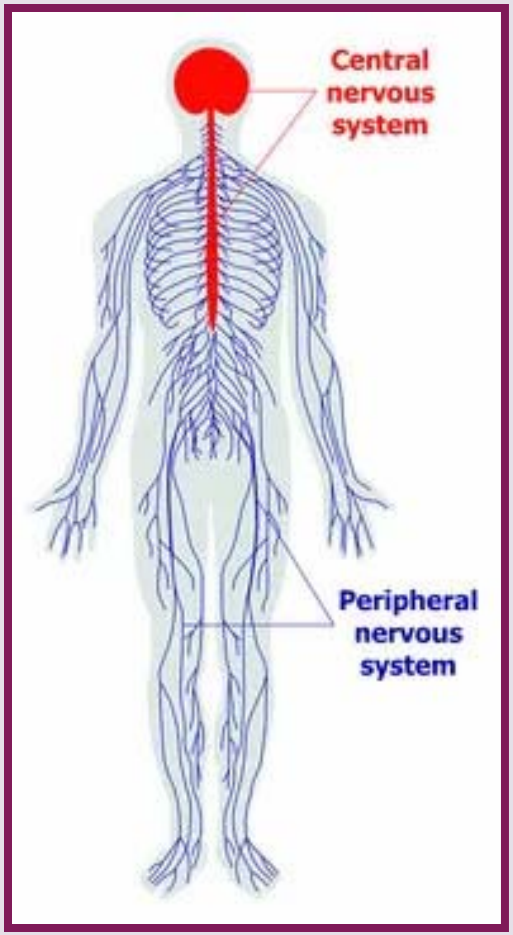
RoadMap:

- Biology 101: the Nervous System
- Cranial Nerves: What they Are, What they Do, How they do It
- Cranial Nerves Working Together
- Cells Communicate
- Enter Mast Cells
- Vagus Nerve & Mast Cells
- Food as Medicine
- Strategies

"I speak two languages, Body and English"

--- Mae West

Biology 101: the Nervous System



Our nervous system is in charge. It runs everything and allows us to do everything—move, eat, feel, think, digest, breathe, have memories and remember, sleep, sense and interpret what we see, hear, taste, touch. It responds to stress, stressors, and to stressful situations.

The nervous system is divided into two main parts:

- The Central Nervous System (CNS)
- The Peripheral Nervous System (PNS)

Biology 101: Autonomic Nervous System

The CNS is made up of the brain and the spinal cord. The brain and spinal cord are mainly responsible for processing and integrating sensory information and controlling the functions of our body.

- The brain: controls thinking, learning, movement, feelings
- The spinal cord carries messages between the brain and the rest of the body

The PNS is made up of everything else. It consists of nerves that connect the CNS to the rest of the body which enables communication between the brain and spinal cord and the body's organs, muscles, and senses.

The PNS is further divided into two systems/divisions:

- The Somatic Nervous System (SNS)
- The Autonomic Nervous System (ANS)

And the ANS is further divided into:

- The Sympathetic Nervous System
- The Parasympathetic Nervous System

Biology 101: the Nervous System

The Somatic Nervous System (SNS)

- Controls all of the body's *voluntary* muscular systems and *voluntary* movements (such as walking)
- Controls voluntary reflex arcs—the voluntary actions that involve conscious decision-making and are processes of the cerebral cortex
- Is responsible for our conscious perception of the environment and for our voluntary responses to that perception by means of our skeletal muscles

The Autonomic Nervous System (ANS)

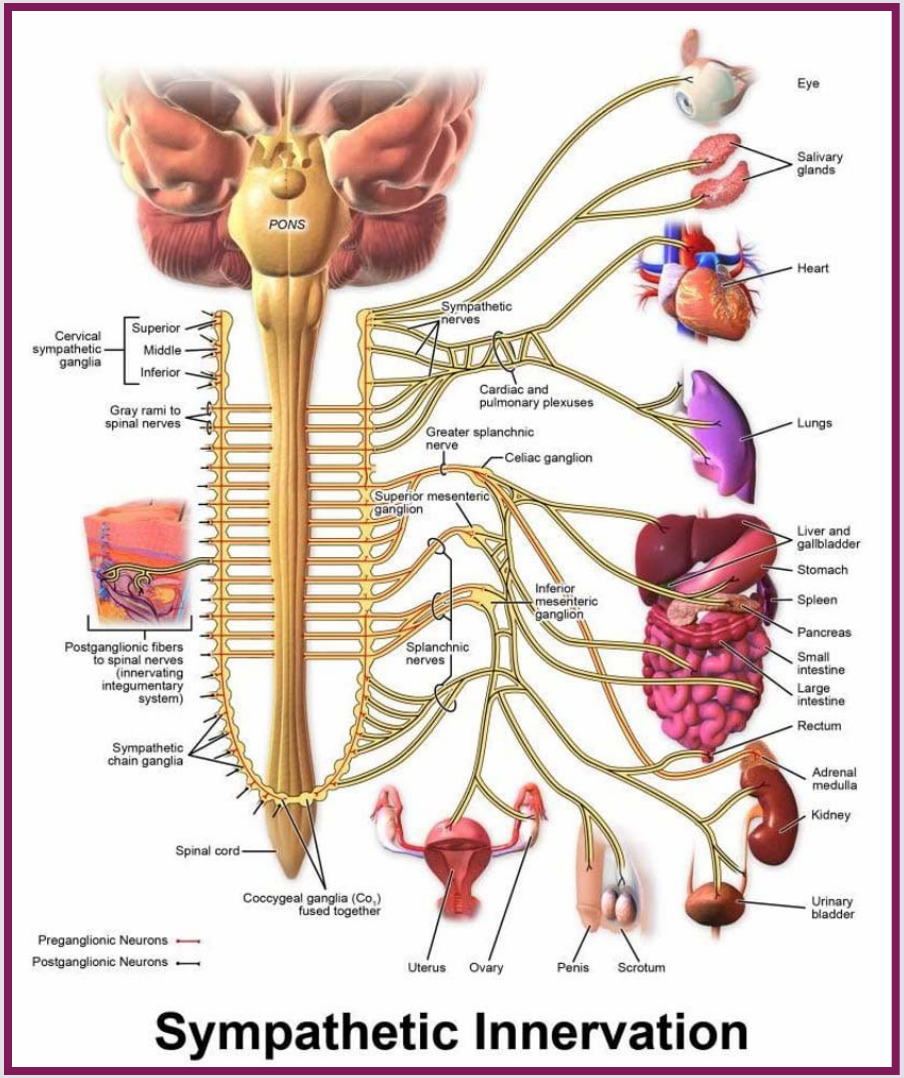
- Controls all of the body's *involuntary* functions (such as heart rate, digestion, breathing, blood pressure)
- Manages processes that happen without our conscious thought (such as certain states we call "rest and digest" or "fight or flight")
- Regulates internal organs and glands through neural pathways
- Maintains homeostasis in the body

The ANS further divides into the **sympathetic nervous system** and the **parasympathetic nervous system**

Biology 101: the Nervous System

Sympathetic Nervous System

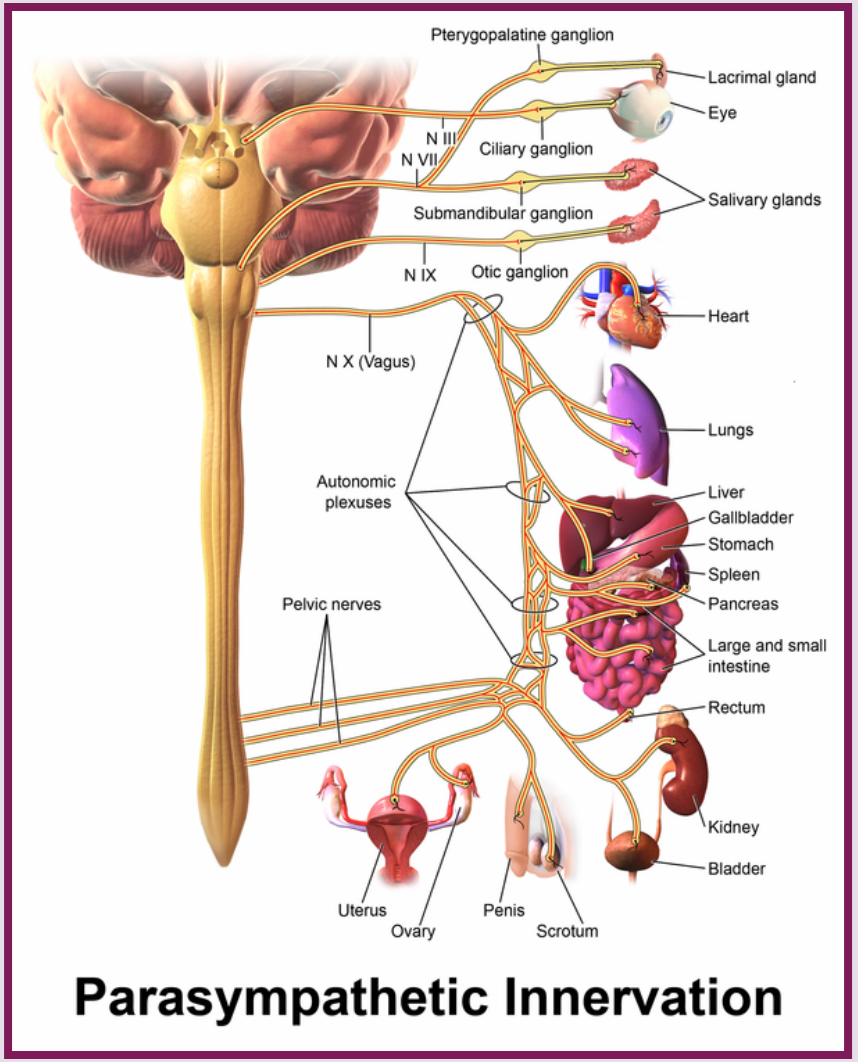
Often referred to as the “fight or flight” system because it prepares the body for action in response to a threatening or stressful situation. It increases the heart rate and blood pressure, slows digestion to maximize blood flow to muscles and to the brain allowing the body to respond to threats.



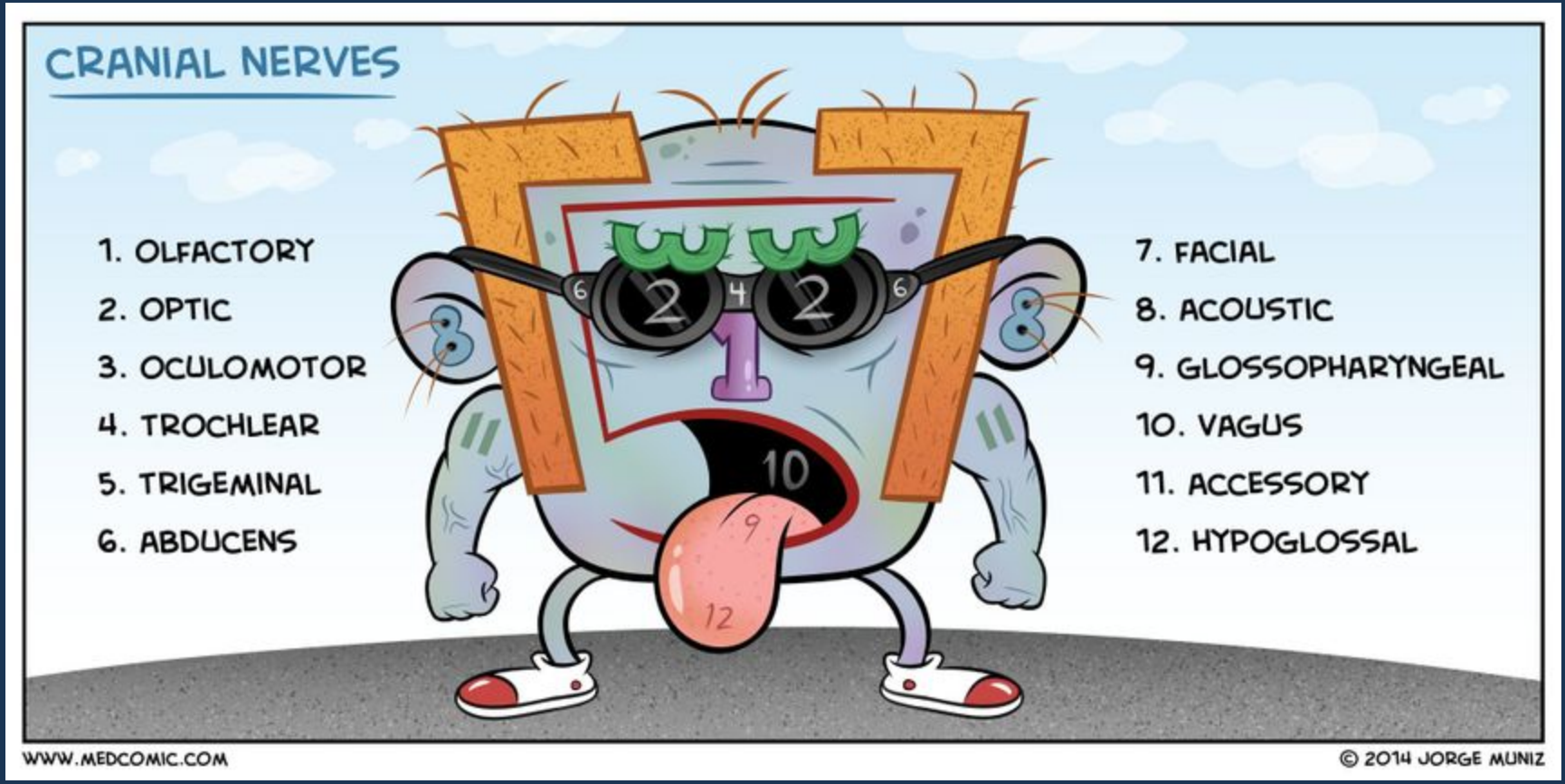
Biology 101: the Nervous System

Parasympathetic Nervous System

Is responsible for the “rest and digest” response. It slows the heart rate, stimulates digestion, and conserves energy by relaxing the body.



The Cranial Nerves



Cranial Nerves: What they Are

The cranial nerves are a set of twelve nerves that send electrical signals between the brain and different parts of the head, face, neck, and torso. Cranial nerves are a key part of the nervous system.

These signals help us to:

- See
- Smell
- Taste
- Hear
- Move our facial muscles
- Make facial expressions
- Blink our eyes
- Move our tongue
- Feel touch
- Sense pain
- Sense temperature

Our body parts—eyes, ears, nose, mouth---can't work properly without healthy cranial nerves.

Motor nerves play a role in controlling specific muscles. Some cranial nerves have both sensory and motor functions.

Cranial Nerves: Which do What

The cranial nerves are categorized based on the number each is given (usually a Roman numeral) and motor function.

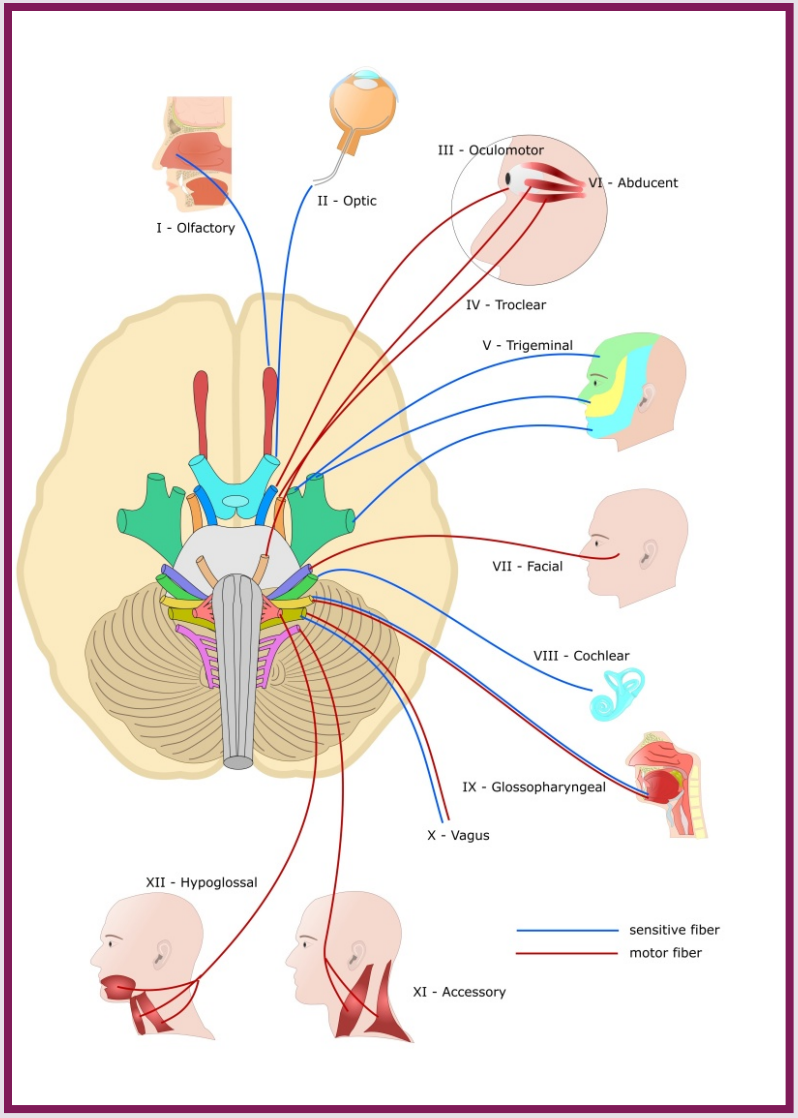
- **Olfactory nerve (CN I)** – provides sense of smell
- **Optic nerve (CN II)** – provides vision
- **Oculomotor nerve (CN III)** – opens and moves your eyes and adjusts eye pupil width
- **Trochlear nerve (CN IV)** – looking down and moving your eyes toward your nose or away from it
- **Trigeminal nerve (CN V)** – provides sensations in your eyes, most of your face, and inside your mouth. Also allows you to chew food
- **Abducens nerve (CN VI)** – moves your eyes from left to right

(cont'd)

Cranial Nerves: Which do What

- **Facial nerve (CN VII)** – controls several facial muscles to make facial expressions; provides the sense of taste in part of the tongue
- **Vestibulocochlear nerve (CN VIII)** – provides our sense of hearing and balance
- **Glossopharyngeal nerve (CN IX)** – provides taste sensations to part of the tongue; controls muscles for swallowing; has parasympathetic nerve fibers that play a role in blood pressure regulation and saliva production
- **Vagus nerve (CN X)** – regulates several automatic body processes including digestion, blood pressure, heart rate, breathing, mood, saliva production, and more. The vagus nerve runs from your brain to your large intestine, innervating several tissues along the way. It's the main nerve of the parasympathetic nervous system
- **Accessory nerve or spinal accessory nerve (CN XI)** – controls shoulder and neck movement
- **Hypoglossal nerve (CN XII)** – controls tongue movement, which plays a role in eating and swallowing

Cranial Nerves: Working Together



From: Neuroanatomy, Cranial Nerve

Working Together

Cranial nerves (CN) work together to coordinate specific body functions like sight, smell, taste, hearing with motor functions like facial expressions, eye movements, swallowing to allow for a seamless integration of sensory perception and physical response through direct connections to and communications with the brain.

They act as a communication network between the brain and various parts of the head and neck, with some nerves handling purely sensory functions and others controlling muscle movements.

Each cranial nerve has a specific function allowing for targeted control.

Cranial Nerves: Working Together

Key Points about how Cranial Nerves Work Together:

Specialized Functions
Each cranial nerve has specific function (e.g., optic nerve for vision, olfactory nerve for smell, facial nerve for facial expressions)

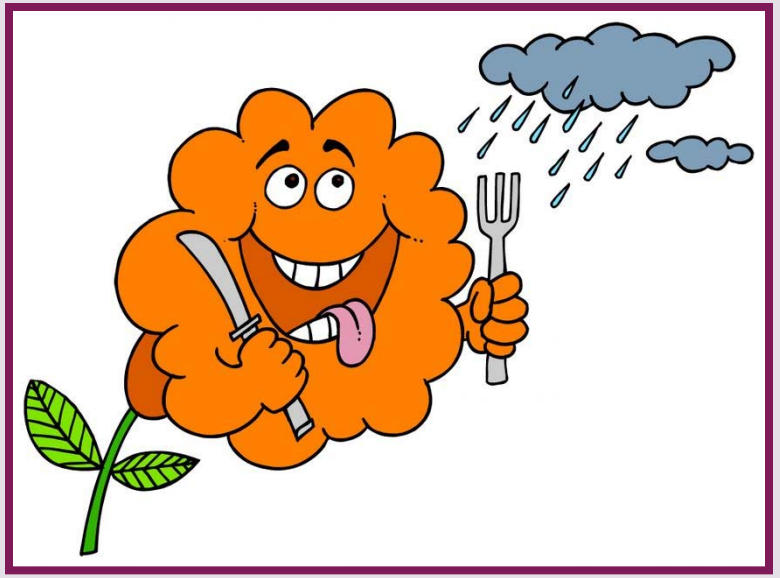
Integration in the Brainstem
Cranial nerves originate directly from the brainstem allowing for complex processing and coordination of sensory input and motor output

Sensory-Motor Integration
Some cranial nerves carry both sensory and motor information. This means that they can both receive sensory input/information and send motor commands to respond accordingly

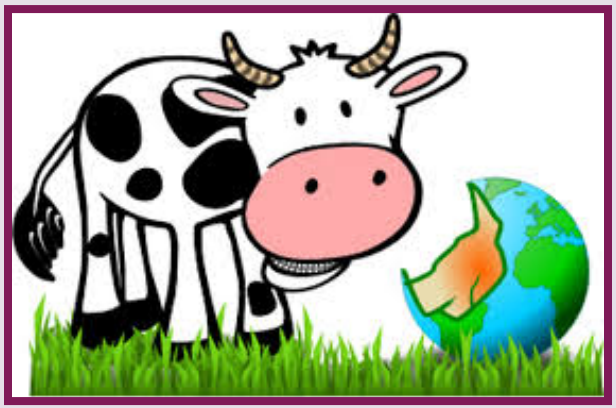
Cross-talk Between Nerves
While each pair of cranial nerves has a specific role, they can sometimes interact with each other to achieve coordinated functions such as the collaboration between the oculomotor nerve (eye movement) and the trochlear nerve (specific and targeted muscle control) for precise eye movements

Cranial Nerves: Working Together

Two Examples of Cranial Nerve Collaboration:



Chewing
When you bit down, the trigeminal nerve sends sensory information about the pressure on your teeth to the brain, which then sends motor signals via the same nerve to the muscles of mastication to initiate the chewing movement



Taste Perception
The facial nerve carries taste information from the front of the tongue, while the glossopharyngeal nerve handles taste from the back of the tongue, both sending signals to the brain for taste perception

Cranial Nerves: The Vagus Nerve

The left and right vagal nerves contain 75% of the parasympathetic nervous system fibers that send information between the brain, heart, and digestive system.

The vagal nerves play important roles in involuntary sensory and motor (movement) functions including:

- Digestion
- Heart rate
- Blood pressure
- Respiration (breathing)
- Immune system responses
- Mood
- Mucus and saliva production
- Skin and muscle sensations
- Speech
- Taste
- Urine output

Cranial Nerves: The Vagus Nerve

The left vagus nerve travels down the left side of the body. The right vagus nerve travels down the right side of the body.

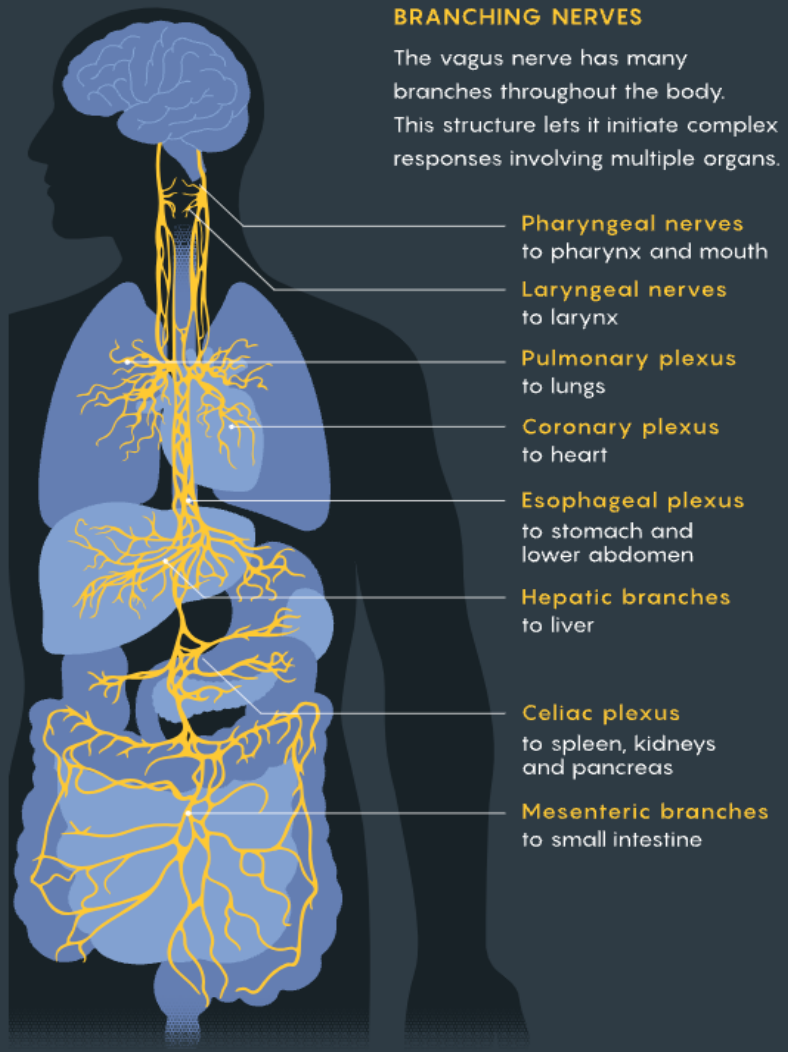
“Vagus” is the Latin word for wandering. The vagus nerves take a very winding path through the body from the brain to the large intestine. They exit from the medulla oblongata in the lower brainstem.

Then, the nerves pass through or connect with the:

- Neck (between carotid artery and jugular vein)
- Chest (thorax)
- Heart
- Lungs
- Abdomen and digestive tract

The Brain's Vital Connector

The vagus nerve connects the brainstem to the body's organs. It helps control autonomic functions such as heart rate, digestion and breathing, and can conduct physiological emotional responses such as fear and pleasure.



BRANCHING NERVES

The vagus nerve has many branches throughout the body. This structure lets it initiate complex responses involving multiple organs.

Pharyngeal nerves
to pharynx and mouth

Laryngeal nerves
to larynx

Pulmonary plexus
to lungs

Coronary plexus
to heart

Esophageal plexus
to stomach and lower abdomen

Hepatic branches
to liver

Celiac plexus
to spleen, kidneys and pancreas

Mesenteric branches
to small intestine

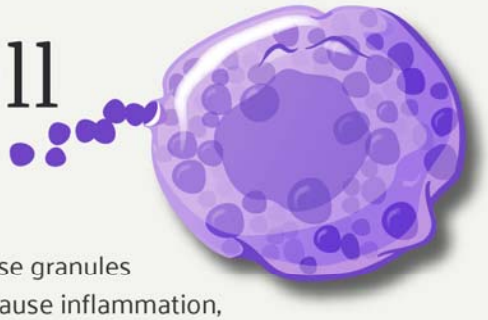
Cranial Nerves: Working Together

The Vagus Nerve and other Cranial Nerves:

- The vagus nerve has close communication and close coordination of activity with the accessory nerve and the glossopharyngeal nerve
- The vagus nerve receives sensory information from the pharynx and larynx, which is then integrated with sensory output from the glossopharyngeal nerve to fine-tune swallowing and speech functions
- The vagus nerve provides motor innervation to the muscles of the pharynx and larynx, while the accessory nerve contributes to the movement of the soft palate, and with their combined action they enable swallowing and vocalization
- The vagus nerve directly innervates the muscles that control vocal cord movement, and this function can be influenced by signals from other cranial nerves involved in speech production
- Damage to the vagus nerve can lead to difficulties with swallowing, speaking, and impaired taste perception – often presenting alongside dysfunction of other cranial nerves involved in head and neck functions

Enter Mast Cells

Mast Cell



White Blood Cell

Function: These cells release granules filled with chemicals that cause inflammation, such as histamine. Inflammation involves increased blood flow that allows more immune cells and other helpful particles in the blood to reach a site of infection or injury more easily.

Disease: The inflammatory chemicals released by mast cells can cause allergy symptoms when the immune system reacts inappropriately to an otherwise harmless substance–like proteins from house dust mites or a certain food. People can also experience persistent problems with inflammation if they are born with or develop too many mast cells in a rare condition called mastocytosis.

Location: Mast cells reside outside the bloodstream in the tissues, especially in skin, lung tissue, lymph nodes, the liver and the spleen. Basophils, another immune cell type that also plays a large role in allergies, are located in the blood.

NIH National Institute of Allergy and Infectious Diseases

- A type of white blood cell
- Found in the connective tissue throughout the body
- Found in every organ system including the brain
- Part of the body's immune response
- Part of the body's inflammatory response
- The body's 1st responders to perceived dangers and threats

Enter Mast Cells

Mast cells communicate with many different types of cells throughout the body, in addition to other mast cells, in the nervous, vascular, and immune systems.

The ways that they communicate vary, for example:

- Chemical signaling through the release of mediators such as histamine, proteases, cytokines, leukotrienes, prostaglandins
- By being physically in close proximity to other cells (called paracrine signaling)
- Brain to cell / cell to brain direct communications
- Through neurotransmitters (e.g., serotonin, dopamine, histamine)

Mast cells play a highly important role in the nervous system. The relationship between mast cells and the nervous system is bi-directional which means that mast cells influence neural function and neurons modulate mast cell activity.

Mast cells are present and communicate in the Central Nervous System (CNS) which is the brain and spinal cord, and in the Peripheral Nervous System (PNS) which is the network of nerves that extends throughout the body, connecting the CNS to the rest of the body including muscles and organs.

Vagus Nerve & Mast Cells

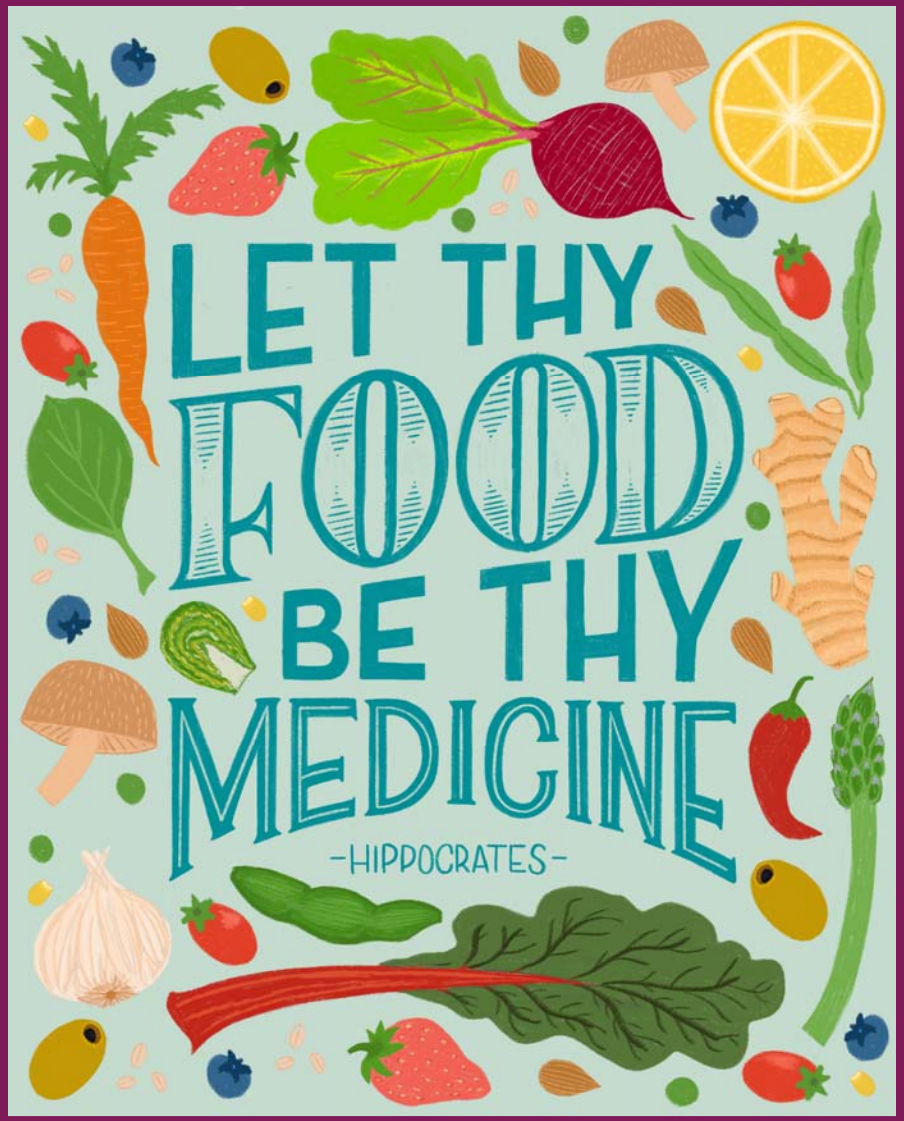
The vagus nerve plays a significant role in modulating mast cell activity. Vagus nerve stimulation has been shown to regulate mast cell degranulation, which can alleviate damage to the BBB and intestinal barrier following ischemic stroke. This modulation is part of the microbiota-gut-brain axis, indicating a complex interaction between the nervous system and the immune system.

The vagus nerve can influence mast cell behavior through the parasympathetic nervous system which is crucial for controlling inflammation and maintaining mast cell activity within a balanced state. This system helps to calm the body, allowing for rest and digestion, and is essential for managing the inflammatory response.

In MCAS, the vagus nerve influence is especially important. Dysfunction in the vagus nerve can lead to increased histamine production and other inflammatory mediators, contributing to symptoms such as digestive problems, anxiety, and sensitivity to cold.

Research indicates that vagus nerve stimulation can inhibit cardiac mast cell activation and improve myocardial atrophy after a stroke, further highlighting the interaction between mast cells and the vagus nerve in various physiological contexts.

The vagus nerve significantly influences mast cell activity through mechanisms that include direct stimulation and modulation of inflammatory responses, emphasizing the importance of this interaction for overall health and disease management.


LET THY
FOOD
BE THY
MEDICINE
-HIPPOCRATES-

Foods & Vagus Nerve Health

The vagus nerve is like a highway between the gut and the brain, and neurotransmitters, such as dopamine, serotonin, and norepinephrine that are produced in the gut, travel along the vagus nerve to the brain. These neurotransmitters affect appetite control, pain sensations, mood, memory, and more.

The vagus nerve also senses and tells the brain about inflammation that's happening in the body which can lead to release of cortisol (the stress hormone.) There are receptors on every mast cell for cortisol and when the cortisol hits those receptors, the mast cells degranulate—they crumble and release their mediators--bringing on reactions.

The vagus nerve not only senses inflammation, but also can inhibit inflammation in the body.

The vagus nerve's anti-inflammatory properties are part of the reason why it has become a therapeutic target for healing conditions such as irritable bowel syndrome, diabetes, rheumatoid arthritis through vagus nerve stimulation.

Foods & Vagus Nerve Health

Foods that support vagus nerve health include: choices that are high in fiber, prebiotics, choline, omega-3 fatty acids, vitamin B

Fiber
- Whole grains
- Fruits & vegetables (broccoli, peas, beans, skin-on potatoes, fruits)
- Prebiotic foods (garlic, onions, bananas, asparagus, chicory root, leeks, oats, barley)

Choline
- Animal foods (eggs, red meat, chicken, fish, sunflower seeds)

Omega-3 Fatty Acids
- Salmon, flaxseeds, walnuts

Vitamin B
- Soy beans, brown rice

Ginger
- Ginger root improves vagus nerve function

Tryptophan
- Amino acid that helps produce serotonin (spinach, seeds, nuts, bananas, poultry)

Foods & Vagus Nerve Health

Sodium Intake

A nonrandomized study (by McNeely JD, Windham BG, Anderson DE. Dietary sodium effects on heart rate variability in salt sensitivity of blood pressure. Psychophysiology. 2008 May;45(3):405–11. DOI: 10.1111/j.1469-8986.2007.00629.x. PMID: 18047481. PMCID: PMC2399901) found that low sodium intake was associated with decreased vagal tone and a high sodium intake increased vagal tone.

Sodium is an important electrolyte required for nerve impulses, muscle contraction, and water balance in the body. Check with your doctor to see if your sodium levels and intake might be too low.

Vitamin B12

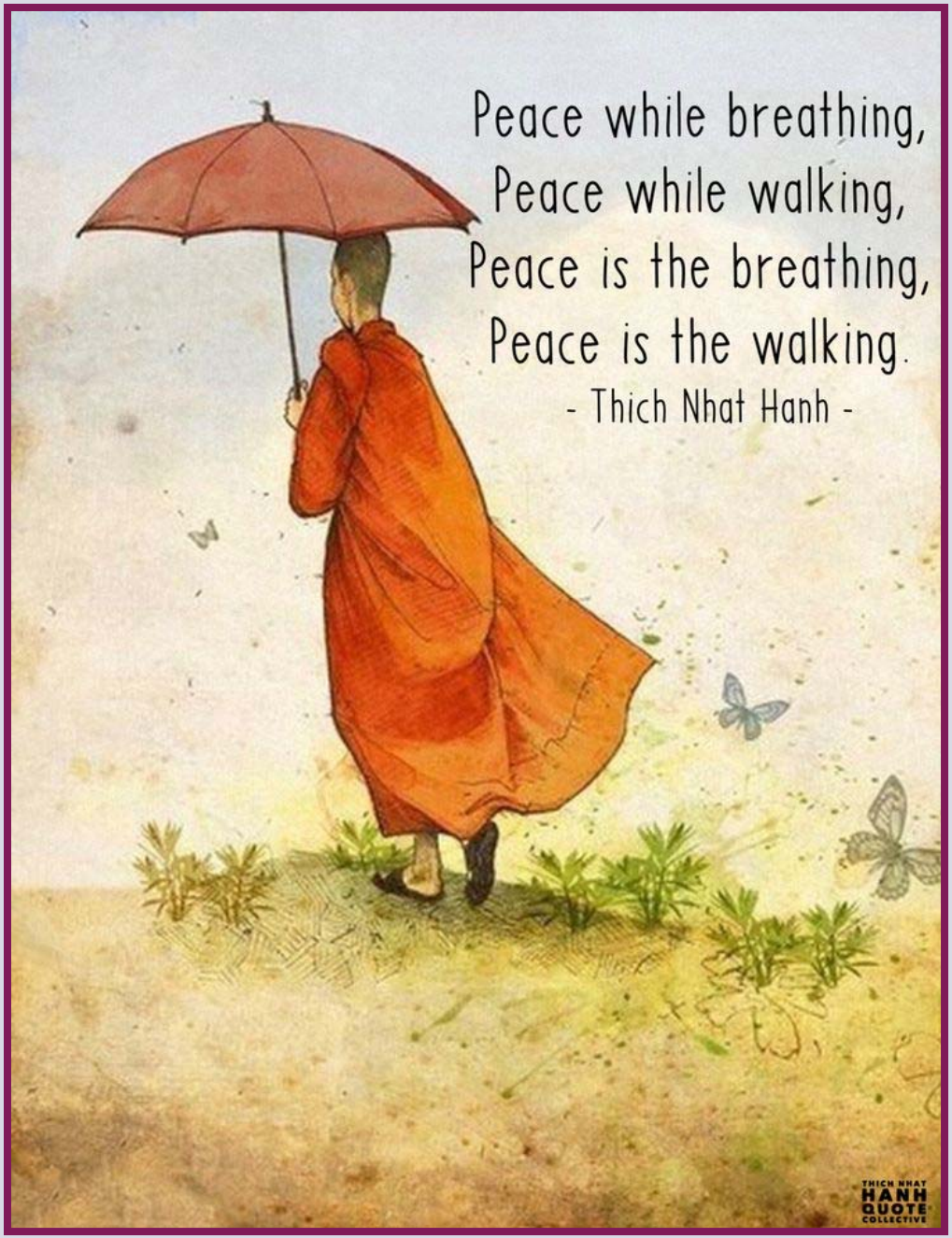
Helps build and maintain the myelin sheath that protects nerves

- Meat (beef, pork, chicken, lamb)
- Fish (salmon, tuna, sardines)
- Eggs
- Dairy (milk, cheese, yogurt)

Strategies

Add to your personal toolbox and don't forget to use what's in your toolbox!

- Vagus nerve focused breathing
- Facial nerve aware smiling
- Circadian rhythm awareness
- Retraining mast cells & brain cells
- Food as medicine: making informed choices
- Medications
- Sleep


Peace while breathing,
Peace while walking,
Peace is the breathing,
Peace is the walking.
- Thich Nhat Hanh -
THICH NHAT
HANH
QUOTE
COLLECTIVE

References:

Artwork:
Matisse - pgs 1, 5, 32, 33, 34

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Molderings, G. and Afrin, L., “A survey of the currently known mast cell mediators with potential relevance for therapy of mast cell induced symptoms” (27 May 2023).

Barbara, G., Wang, B., Stanghellini, S. et al “Mast cell dependent excitation of visceral nociceptive sensory neurons in irritable bowel syndrome” (2006).

Theoharides, T., Tslioni, I., Bawazeer, M., “Mast cells, neuroinflammation, and pain in fibromlagia syndrome” (2019).

https://vagusnervesupport.com/mast-cell-activation-syndrome/

Cleveland Clinic https://my.clevelandclinic.org/health/diseases/

van der Kleij, H.P.M., and Bienenstock, J., (2005) “Significance of conversation between mast cells and nerves”

Mittal, A., Sagi, V., Gupta, M., et al (2019) “Mast cell neural interactions in health and disease”

Kenny, B.J., (2022) “Neuroanatomy, Cranial Nerve 10 Vagus Nerve)” https://www.ncbi.nlm.nih.gov/books/NBK537171/

https://www.sciencedirect.com/science/article/pii/S092544391100130X

https://caringmedical.com/prolotherapy-news/mast-cell-activation-syndrome/

https://vagusnervesupport.com/mast-cell-activation-syndrome/

References: (cont'd)

https://my.clevelandclinic.org/health/body/23273-autonomic-nervous-system

https://my.clevelandclinic.org/health/body/23291-somatic-nervous-system

https://www.sciencedirect.com/science/article/pii/S1567576924012359/

https://pubmed.ncbi.nlm.nih.gov/38603861/

https://www.researchgate.net/publication/7277632_Vagal_influences_over_mast_cells

https://drruscio.com/vagus-nerve-diet/

https://pmc.ncbi.nlm.nih.gov/articles/PMC8128917/

https://nutritionsource.hsph.harvard.edu/vitamin-b12/#:~:text=Fish%2C%20shellfish,Enriched%20soy%20or%20rice%20milk

https://www.healthline.com/nutrition/vitamin-b12-foods#:~:text=The%20foods%20containing%20vitamin%20B12%20are%20primarily,with%20many%20essential%20functions%20in%20your%20body.

https://my.clevelandclinic.org/health/body/21998-cranial-nerves

https://onlinelibrary.wiley.com/doi/full/10.1111/jpi.12699

References: (cont'd)

https://medicine.uiowa.edu/iowaprotocols/cranial-nerve-anatomy-cranial-nerves#:~:text=Zygomatic%20nerve:%20*%20Course:%20from%20the%20pterygopalatine,of%20the%20lateral%20forehead%20and%20the%20cheek.

https://www.verywellhealth.com/cranial-nerves-anatomy-4780532#:~:text=Vagus%20Nerve%20(Cranial%20Nerve%2010)%20Your%20vagus,body%20to%20carry%20out%20functions%20of%20survival.

https://www.sciencedirect.com/science/article/pii/S0889159124007050#:~:text=Anatomy%20and%20function%20of%20vagus%20nerve&text=It%20relays%20sensory%20information%20from,Prescott%20and%20Liberles%2C%202022).

https://www.physio-pedia.com/Vagus_Nerve#:~:text=The%20large%20nerve%20originates%20in,and%20influencing%20your%20immune%20system./

https://www.merckmanuals.com/home/brain-spinal-cord-and-nerve-disorders/cranial-nerve-disorders/overview-of-the-cranial-nerves

https://caringmedical.com/prolotherapy-news/mast-cell-activation-syndrome/

https://my.clevelandclinic.org/health/articles/circadian-rhythm

https://www.mastattack.org/2015/04/circadian-rhythm-of-mast-cells/