Sympathetic Overdrive: OMT for Stress Management and Self-Regulation Techniques

Amber Gruber, D.O.

Corewell Health Primary Care Conference

October 2024

I have no disclosures.

Objectives

- Review sympathetic and parasympathetic pathophysiology and anatomical access points
- Review common viscerosomatic responses and clinical scenarios
- Review concept of the Gut-Brain Axis
- Understand the concept of "sympathetic overdrive" as an imbalance of the autonomic nervous system
- Review breathing techniques to help reset and rebalance
- Discuss the role of mindful meditation in stress regulation
- Lab: Offer OMT treatment approaches for self and patients who suffer with sympathetic overdrive
  - Diaphragm, linea alba, rib release

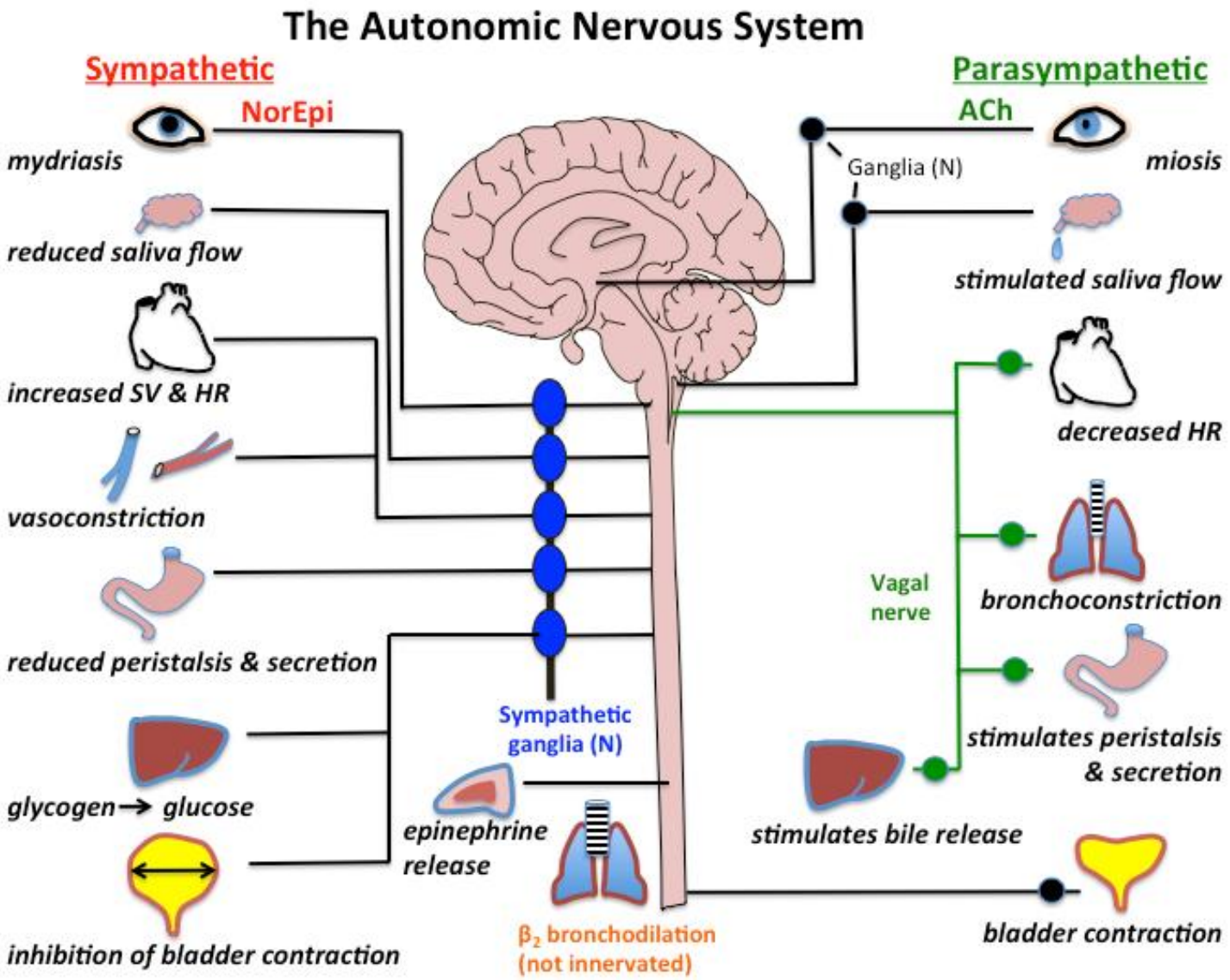
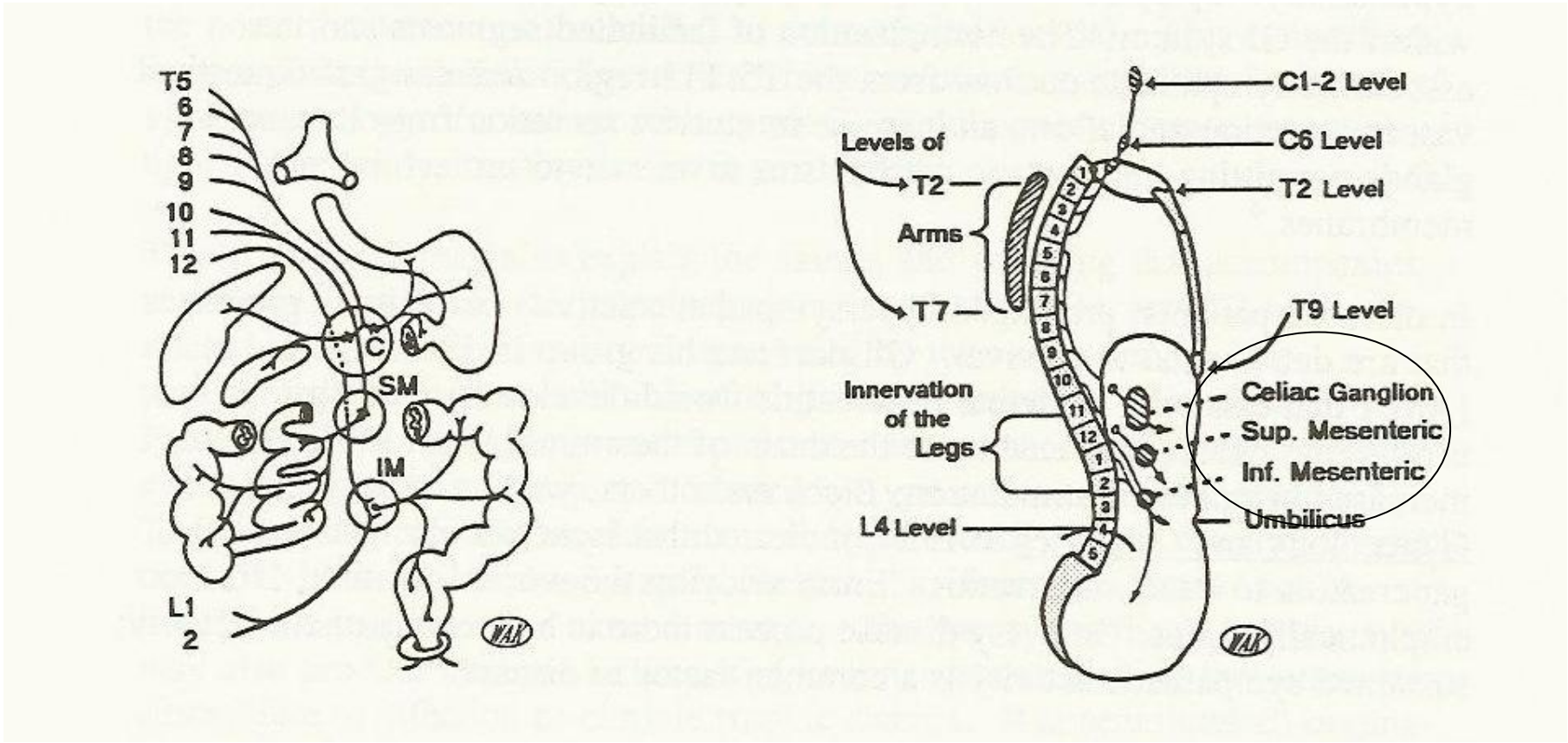


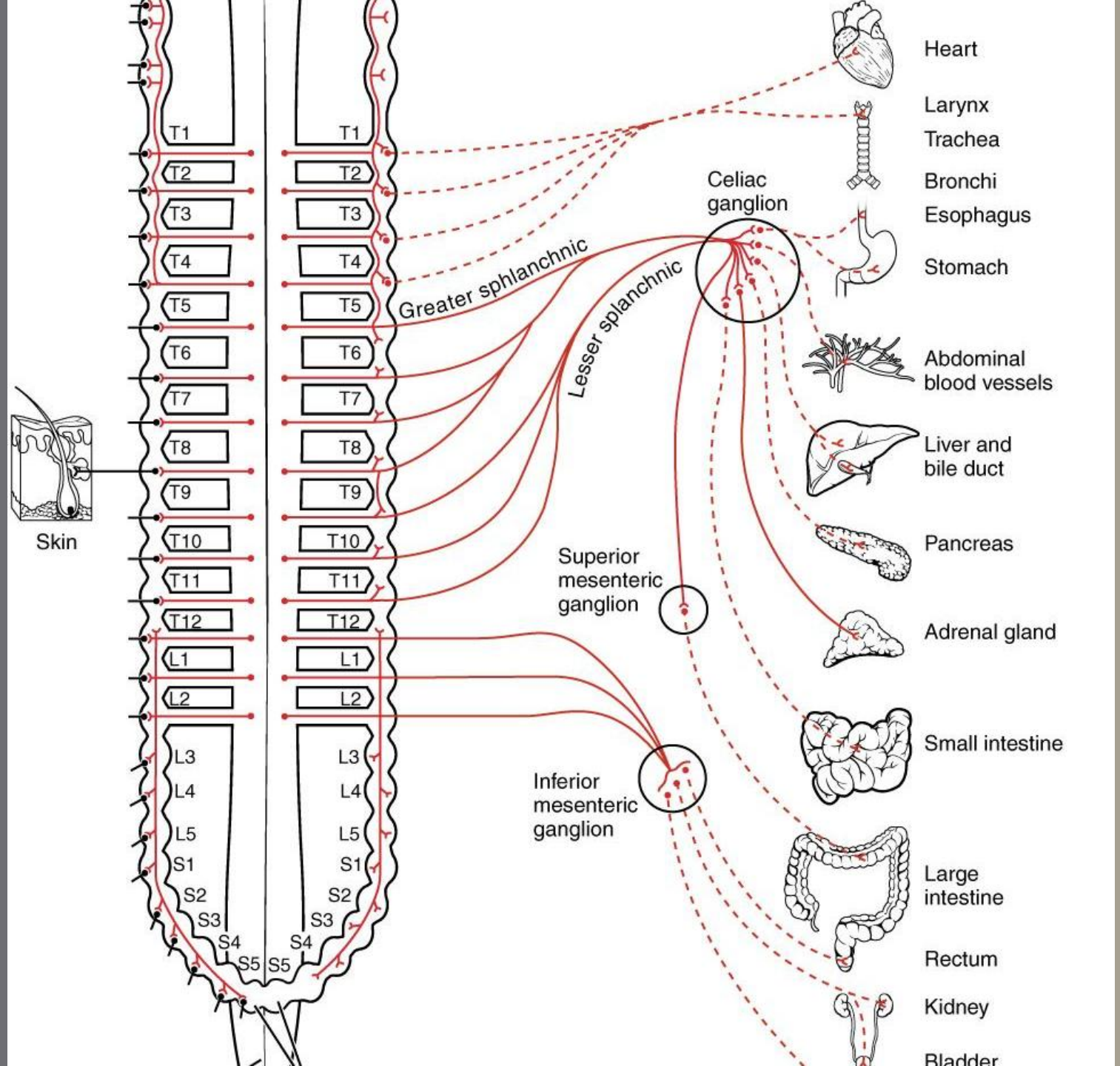
Table 9.1 visceral autonomics

Viscera	Spinal Cord Levels
Head and neck	T1-T4
Heart	T1-T5
Lungs	T2-T7
Esophagus	T2-T8
Upper GI Tract/Foregut (stomach, liver, gallbladder, spleen, pancreas, proximal duodenum)	T5-T9
Middle GI Tract/Midgut (distal duodenum, jejunum, ilium, ascending colon, proximal 2/3 of transverse colon)	T10-T11
Lower GI Tract/Hindgut (distal 1/3 of transverse colon, descending colon, sigmoid colon, rectum)	T12-L2
Appendix	T12
Kidneys	T10-T11
Adrenals	T10
Ureters	T10-L1
Bladder	T11-L2
Gonads	T10-T11
Uterus and cervix	T10-L2
Prostate	T12-L2

Table 9.2 Sympathetics

Sympathetics





Sympathetic Chain Ganglia

That's great. How do you apply this clinically?

How does a visceral organ affect T.A.R.T.?

Pathophysiology

- Pacinian corpuscles and free nerve endings are located in the wall of any given viscera
  - Found in anterior and lateral parietal peritoneum, the lesser omentum, mesentary, and mesocolon
  - Activated by spasm and stretch
    - Edema, pressure, torsion, traction, infiltration, bacterial toxins, enzymes or friction
  - Visceral afferents travel a course similar to the splanchnic nerves

Bath M, Owens J. Physiology, Viscerosomatic Reflexes. [Updated 2023 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK559218/

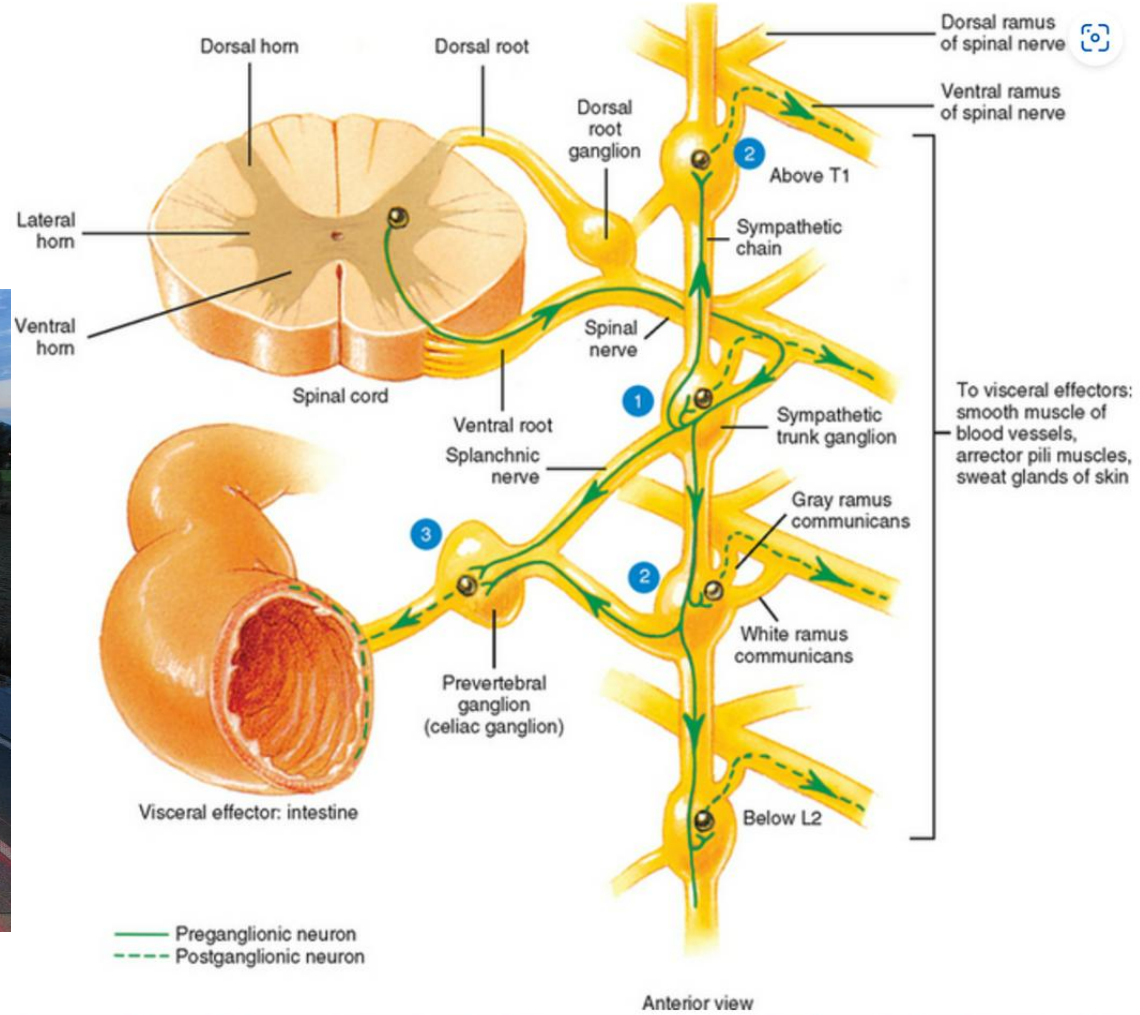
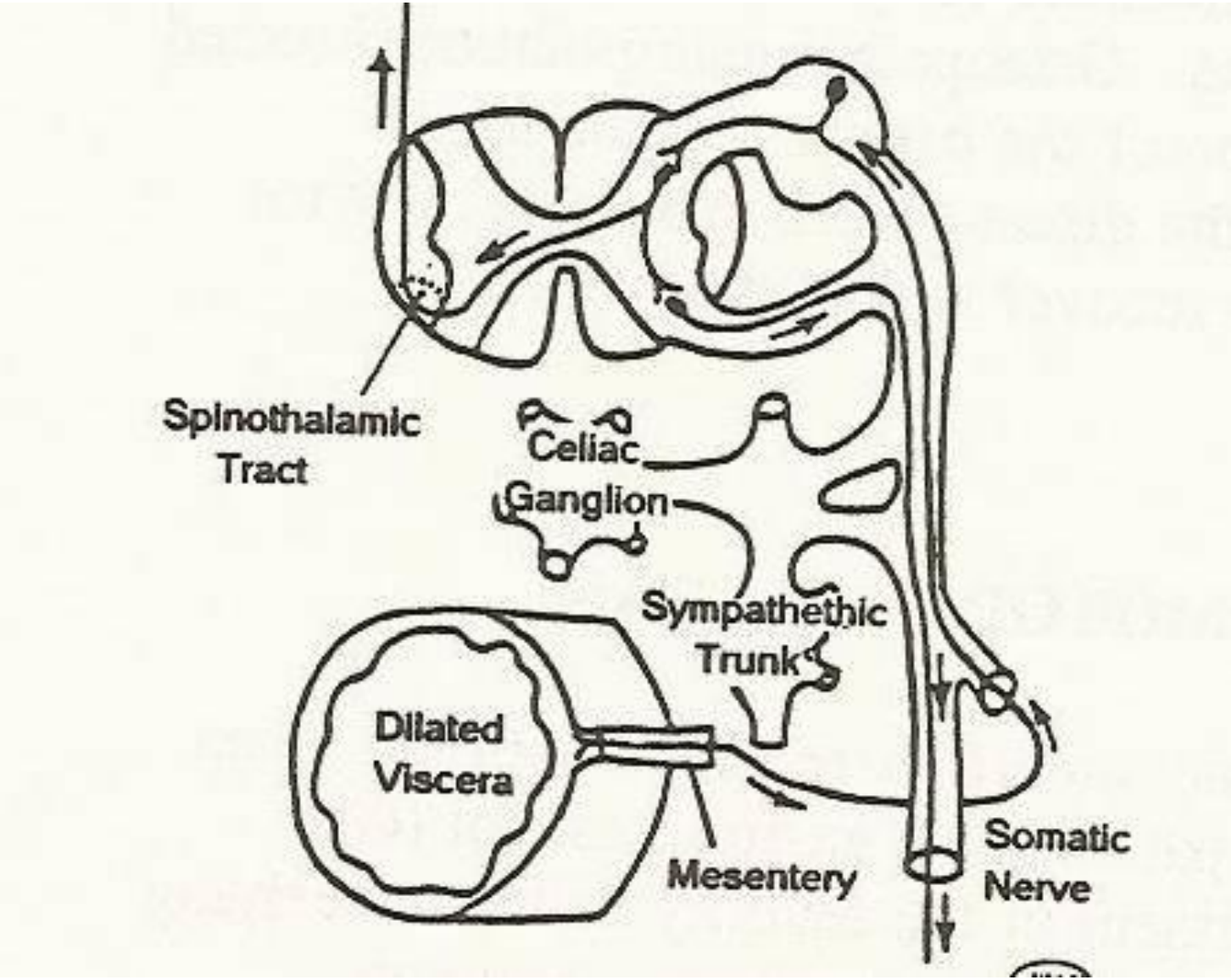


FIG. 10-6 Summary of synapses of sympathetic preganglionic and postganglionic neurons. *1,* Preganglionic fibers enter the chain via the white ramus communicans and may synapse at that level, ascend to a more superior ganglion and synapse, descend to a more inferior ganglion and synapse, or pass through the chain. *2,* Postganglionic fibers, destined to innervate peripheral effectors, exit the sympathetic chain via the gray ramus communicans (at least one for every spinal nerve) and enter into a ventral (anterior) ramus (they may enter a dorsal [posterior] ramus). *3,* Preganglionic fibers, destined to innervate viscera in the abdominal and pelvic cavities, exit the sympathetic chain without synapsing and travel to a prevertebral ganglion and synapse on postganglionic neurons.

(From Tortora GJ & Grabowski SR. [2003]. Principles of anatomy and physiology [10th ed.]. New York: John Wiley & Sons, Inc.]

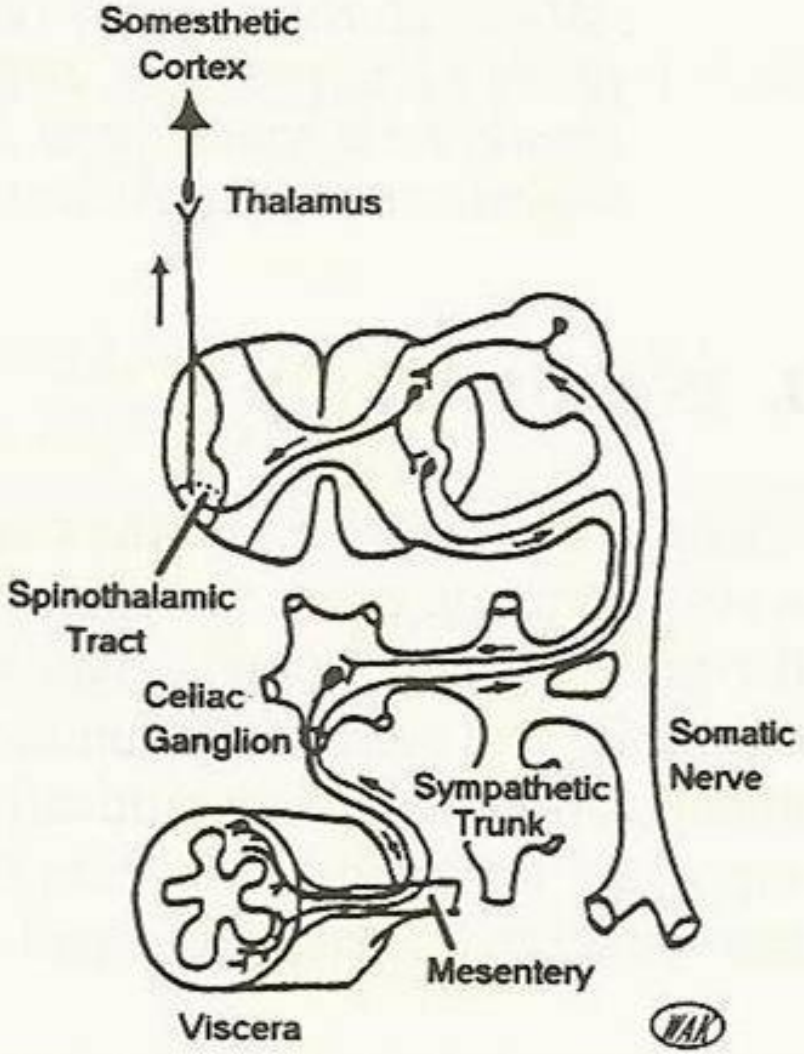


Viscerosensory Pain

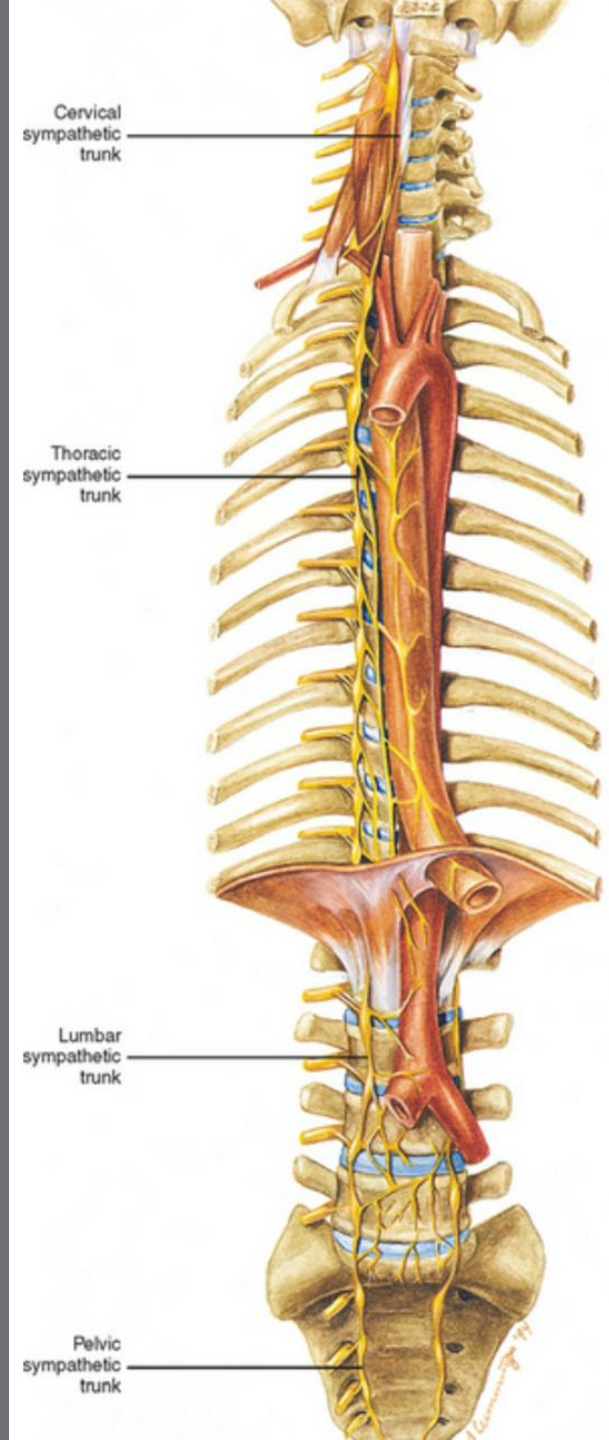
- Facilitated cord segments
- Paraspinal somatic changes
- Joint somatic dysfunction
- Dermatome hyperalgesia in areas related to the viscera's sympathetic origin

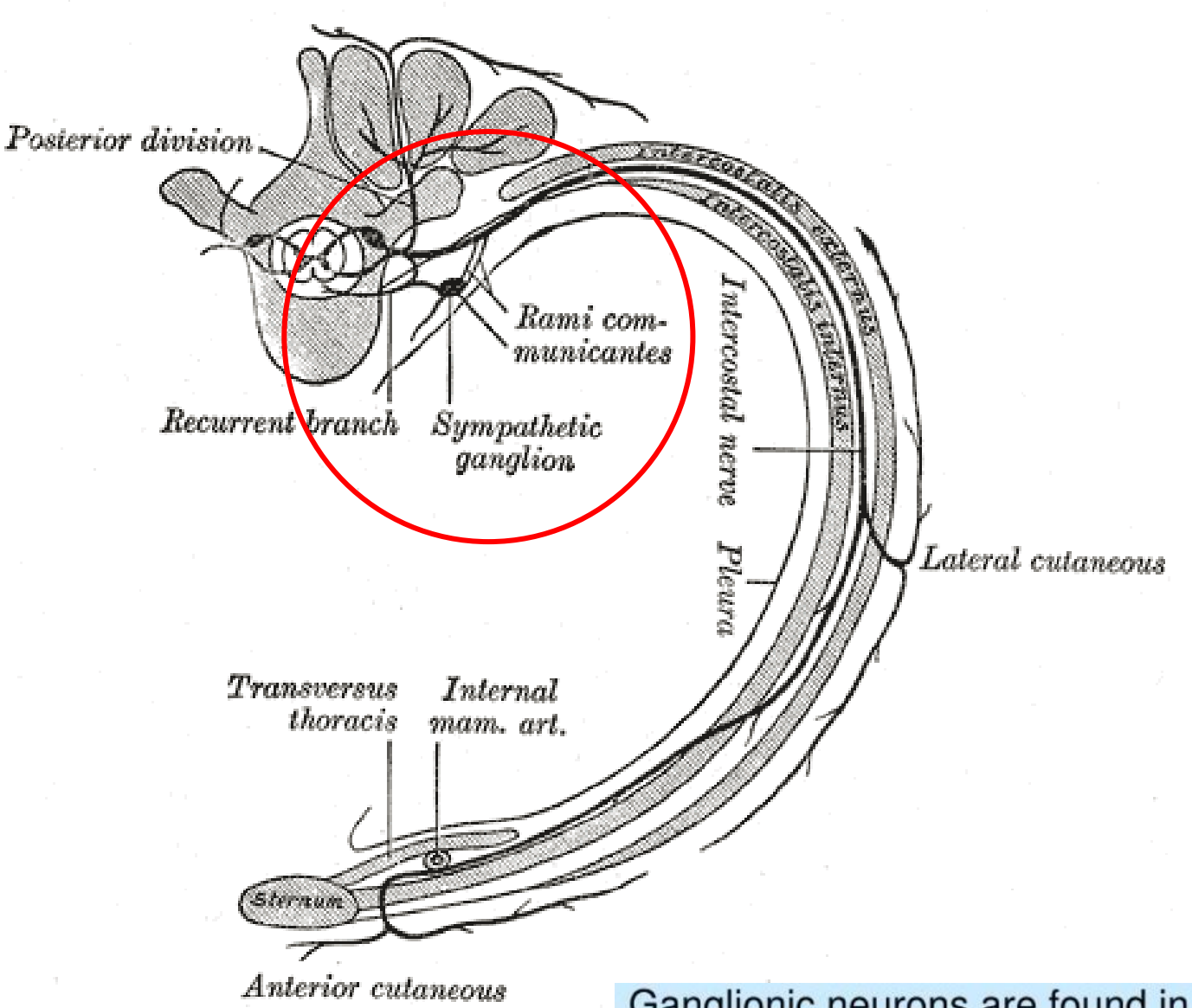
Pathophysiology

- No pain receptors in visceral peritoneum: the greater omentum and the spleen with its capsule are pain-*in*sensitive. An adjacent, pain-sensitive structure must be irritated to cause body awareness.



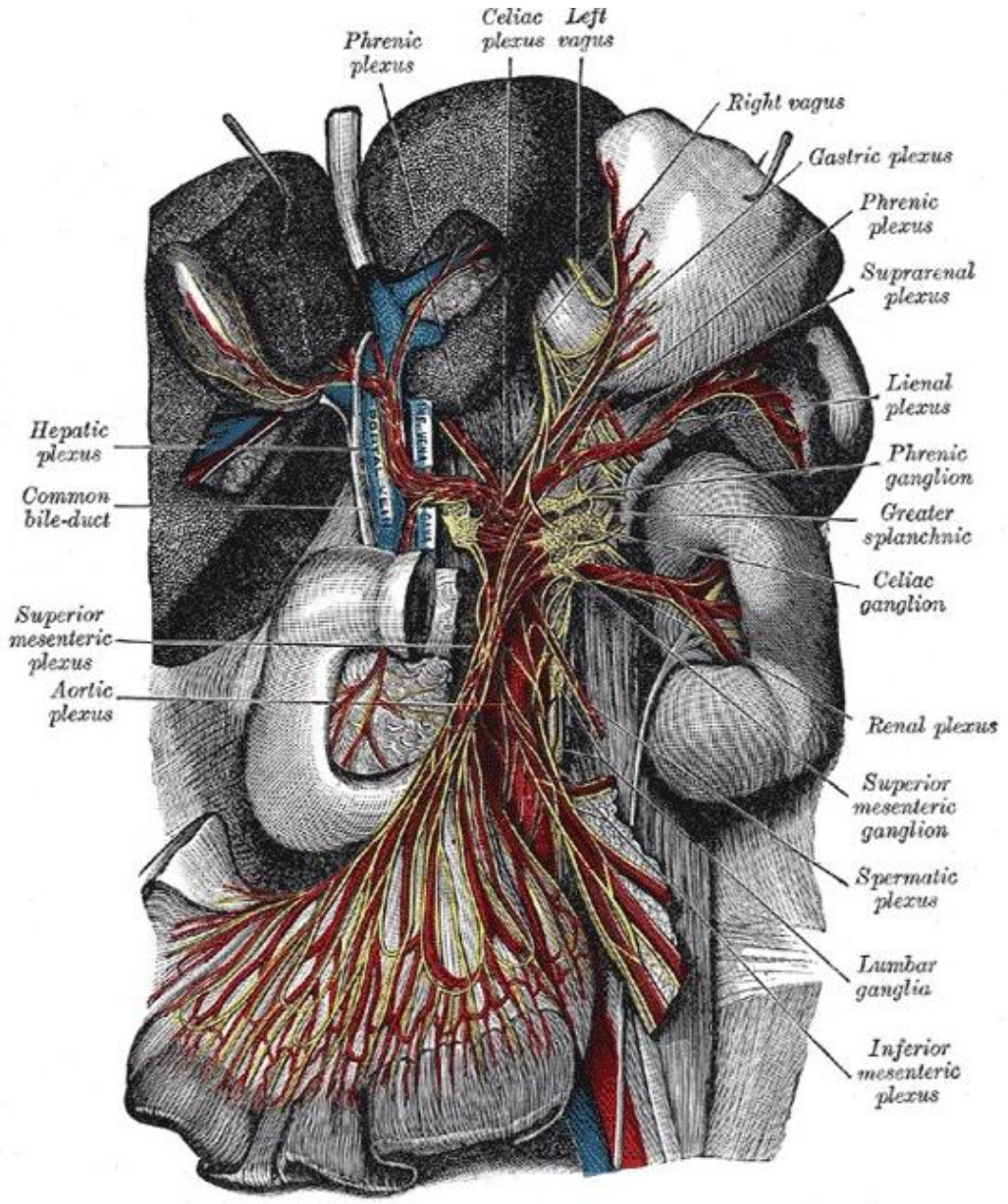
1. True visceral pain: This is early pain from irritation, stretching, contraction or exaggerated physiologic motor activity and dysfunction. It is midline pain, poorly localized and described as a vague, deep, diffuse burning ache.





Ganglionic neurons are found in either the

1. sympathetic chain ganglia near the spinal cord (paravertebral ganglia) or
2. collateral ganglia (prevertebral ganglia) that are anterior to the spinal cord

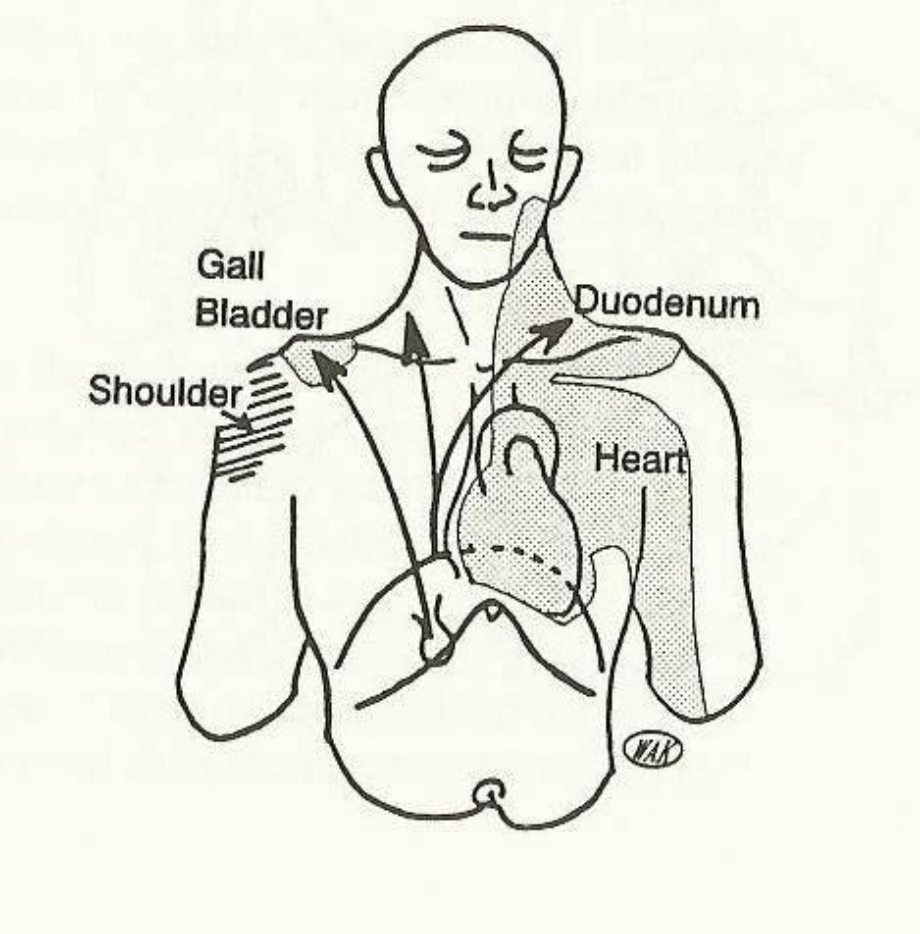


The Great Plexus of the Sympathetic System, The celiac ganglia with the sympathetic plexuses of the abdominal viscera radiating from the ganglia

Henry Vandyke Carter, Public Domain, via Wikimedia Commons

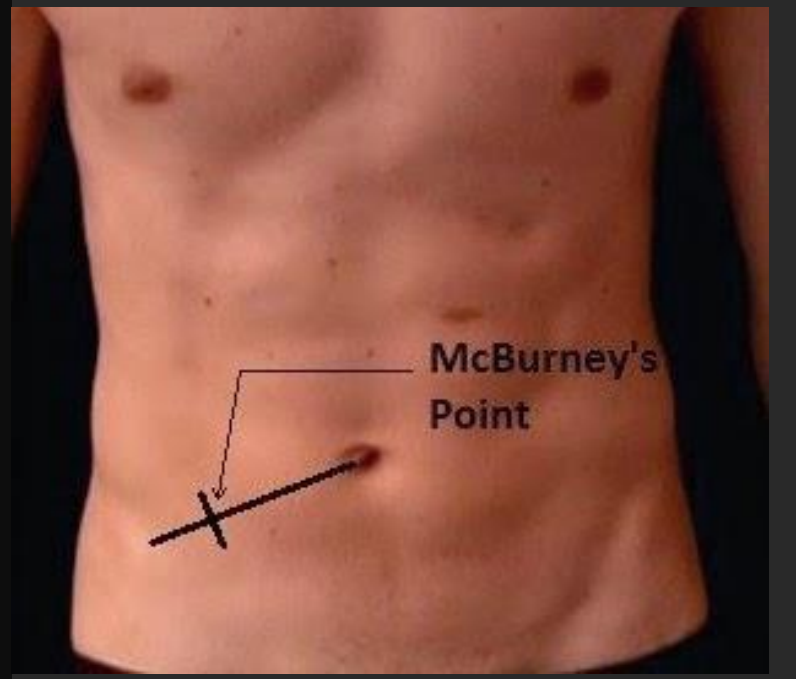
From: Anatomy, Abdomen and Pelvis: Celiac Ganglia

Abdominal Pain Classification



- Visceral – noxious stimuli affect abd viscus
  - Dull, vague (cramping, burning, gnawing)
  - Poorly localized to midline b/c innervation is centrally located and multi-segmental
  - Autonomic sx: diaphoresis, restlessness, pallor, nausea and vomiting

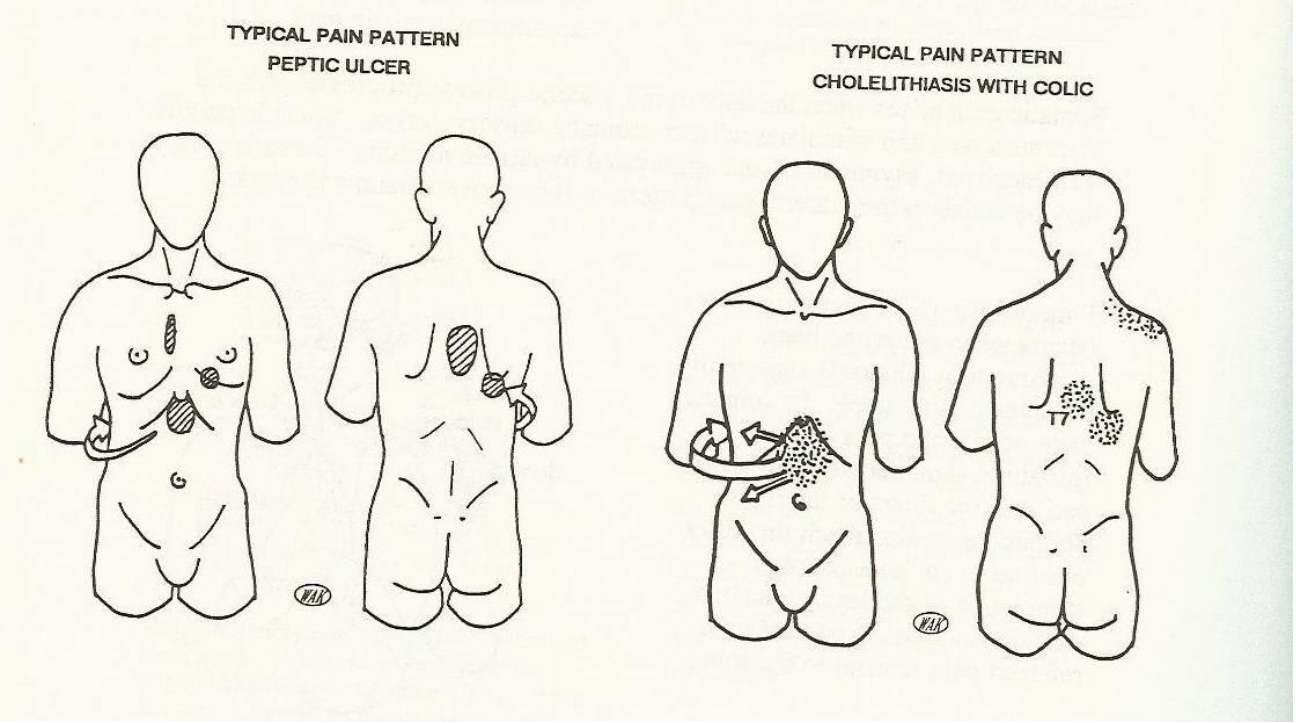
Abdominal Pain Classification



- Somatoparietal - noxious stimuli irritate the parietal peritoneum/adjacent somatic sensory nerves
- Pain results from irritation to the parietal peritoneal wall.
  - Intense and precisely localized on the side of the lesion.
  - Pain aggravated by coughing or jarring movement
  - Ie: McBurney's point

Abdominal Pain Classification

- Referred Pain – pain experienced in areas remote from site of injury
  - Remote pain site supplied by the same neurosegment as involved organ.
  - Ie: gallbladder pain to right scapula, pancreas referring to mid-thorax.



Gut-Brain Axis

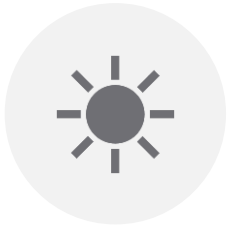
2-way communication between the brain and the gut microbiome

- Intricate interaction involving nutrients, hormones, and afferent/efferent regulation autonomous neuronal networks
- 70% of immune function is related to the gut
- Emerging research within the gut microbiome related to Neuro-inflammatory, neuro-degenerative, auto-immune diseases

Gut-brain interaction disorders associated with bloating and distension include

- **IBS**
- **chronic idiopathic constipation**
- **pelvic floor dysfunction**
- **functional dyspepsia**
- **functional bloating**
- Symptoms are amplified by factors such as anxiety, depression, somatization and hypervigilance

What causes Sympathetic Overdrive



STRESS AND OVERSTIMULATION

NOT ENOUGH SLEEP

AN UNBALANCED DIET

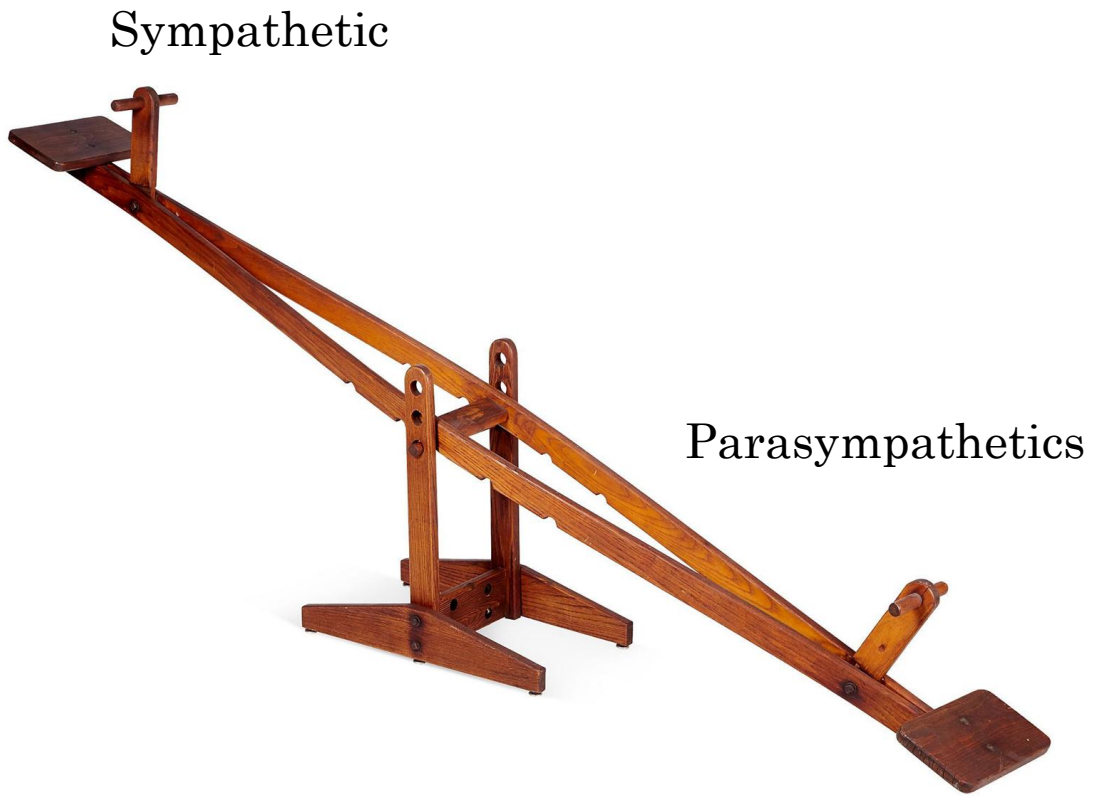
FREQUENT AILMENTS OR A CHRONIC CONDITION

UNKNOWN MEDICAL CONDITION

Cortisol, epinephrine and norepinephrine are overly exerted on various organs

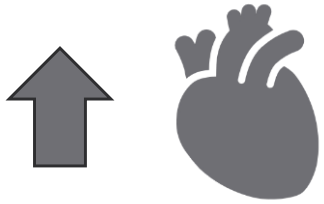
What symptoms would a person have?

- Sleep issues and insomnia
- Digestive issues and food sensitivities
- Fatigue and post-exertional malaise
- Chronic inflammation and chronic pain
- Heart palpatations and/or elevated resting heart rate
- Hormonal imbalances and development of related disorders
- Anxiety and panic disorders
- Cognitive disturbances and brain fog
- Sensory sensitivities (light, sound, touch, taste, smell)
- Overactivity of the immune system and development or worsening of auto-immune conditions



When sympathetics are unopposed:

Stimulation of the adrenal glands to release norepinephrine and epinephrine, which are responsible for the cascade of reactions associated with stress.



Increased heart rate and glucose release from liver, which results in an increased delivery of oxygen and nutrients to the brain and the muscles to prepare them for the stress.

Slowing down of digestive activity, which helps conserve your body's energy that can be used to defend itself against stress.

Food – Remember Gut/Brain Access?

Simple sugars are inflammatory

If we eat a lot of simple sugars, the body is constantly stimulated to remain in its active state.

Similarly, if we do not eat high quality foods, the overall inflammation increases

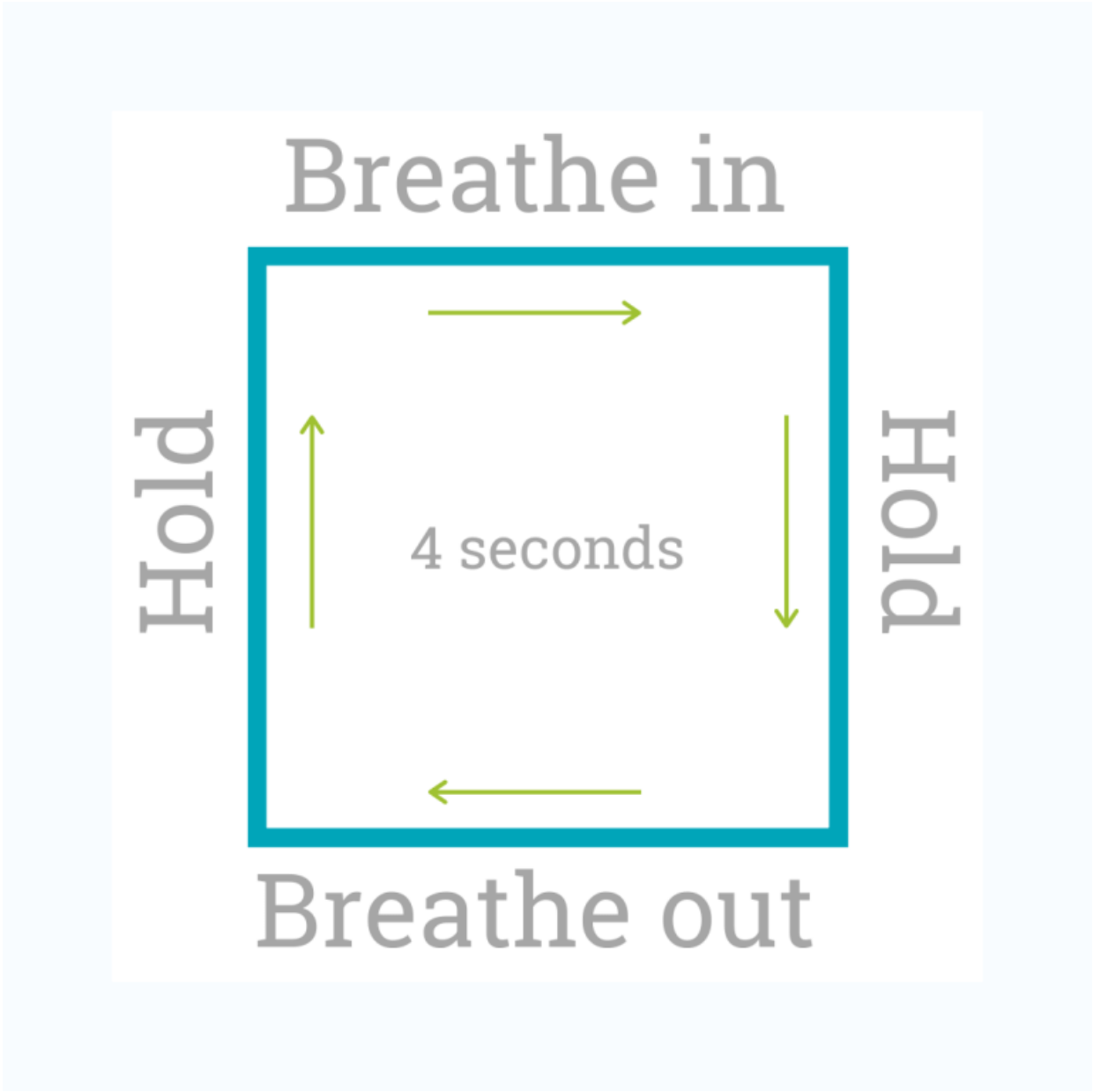
Aggravated inflammation stimulates the sympathetic nervous system as a form of defense mechanism.

Anxiety – Pain/Fear response

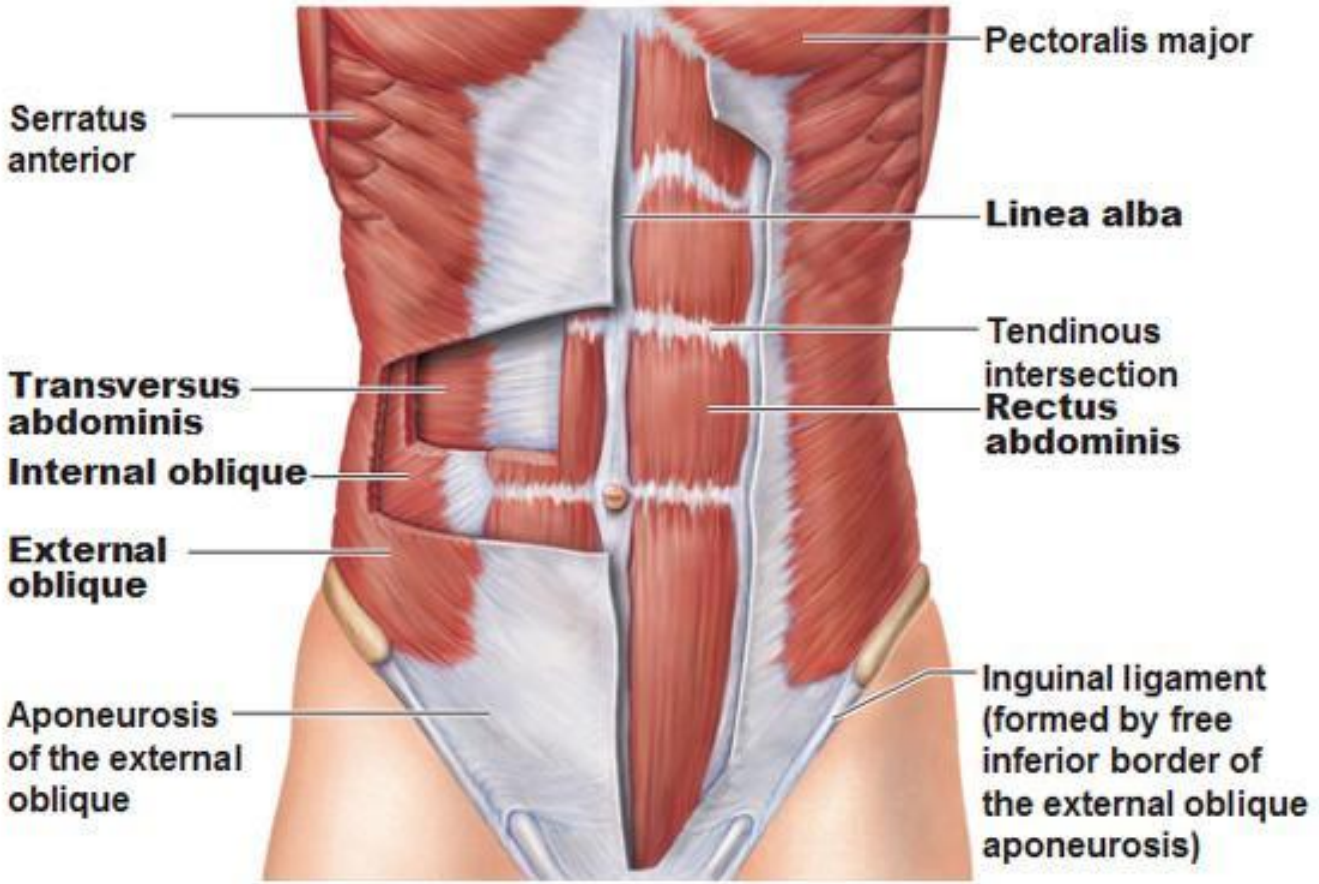
- Anxiety: Kerosine on the pain fire.
- CNS Hotwire
- Therapy – CBT/DBT
- Meditation
- Yoga

Standing Breathing Exercise

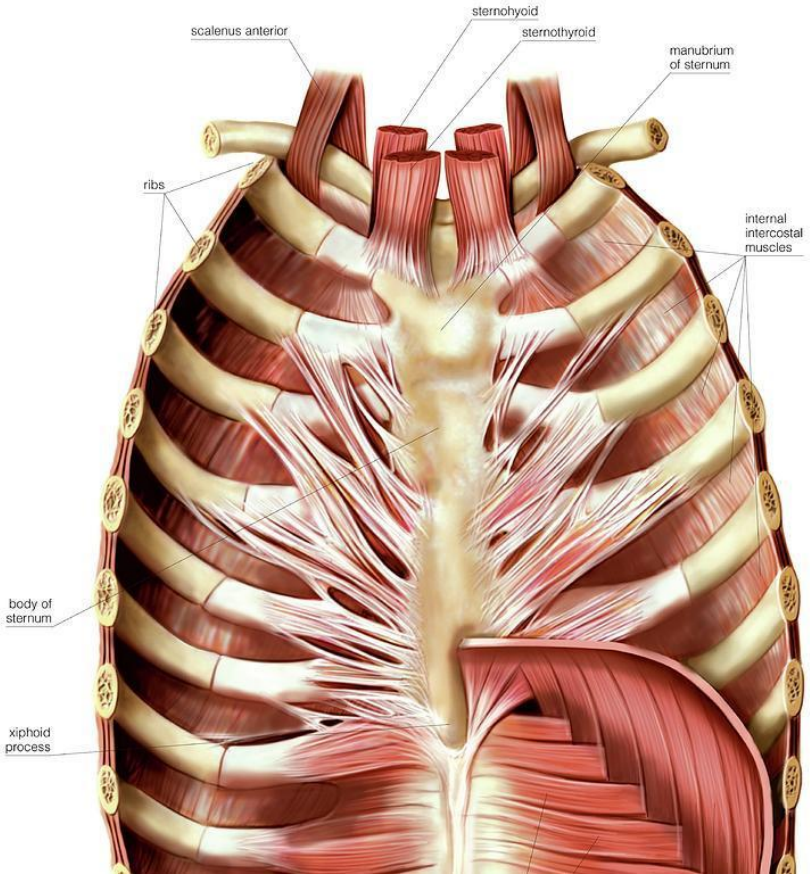
- Stand with good posture - shoulders back, chin tucked
- When you breathe in, pretend you are breathing into the back of your head
- Practice breathing into your lower abdomen
- Breathe into the upper abdomen
- Breathe into the chest
- Breathe into the upper back, picturing those ribs expanding, moving and massaging the nerve ganglia

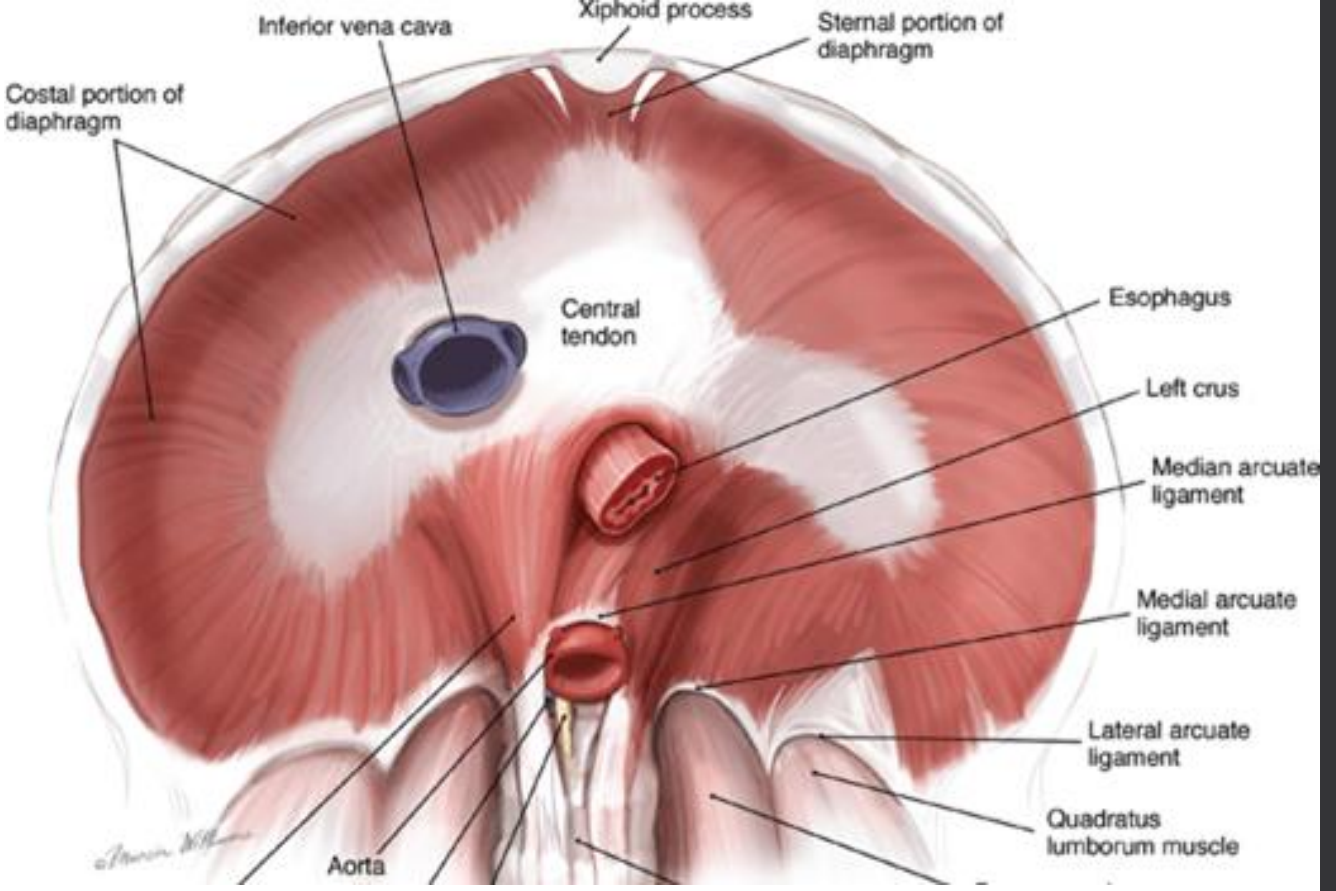


Box Breathing


Pectoralis major
Serratus anterior
Linea alba
Tendinous intersection
Transversus abdominis
Rectus abdominis
Internal oblique
External oblique
Aponeurosis of the external oblique
Inguinal ligament (formed by free inferior border of the external oblique aponeurosis)

Linea Alba


scalenus anterior
sternohyoid
sternothyroid
manubrium of sternum
ribs
internal intercostal muscles
body of sternum
xiphoid process

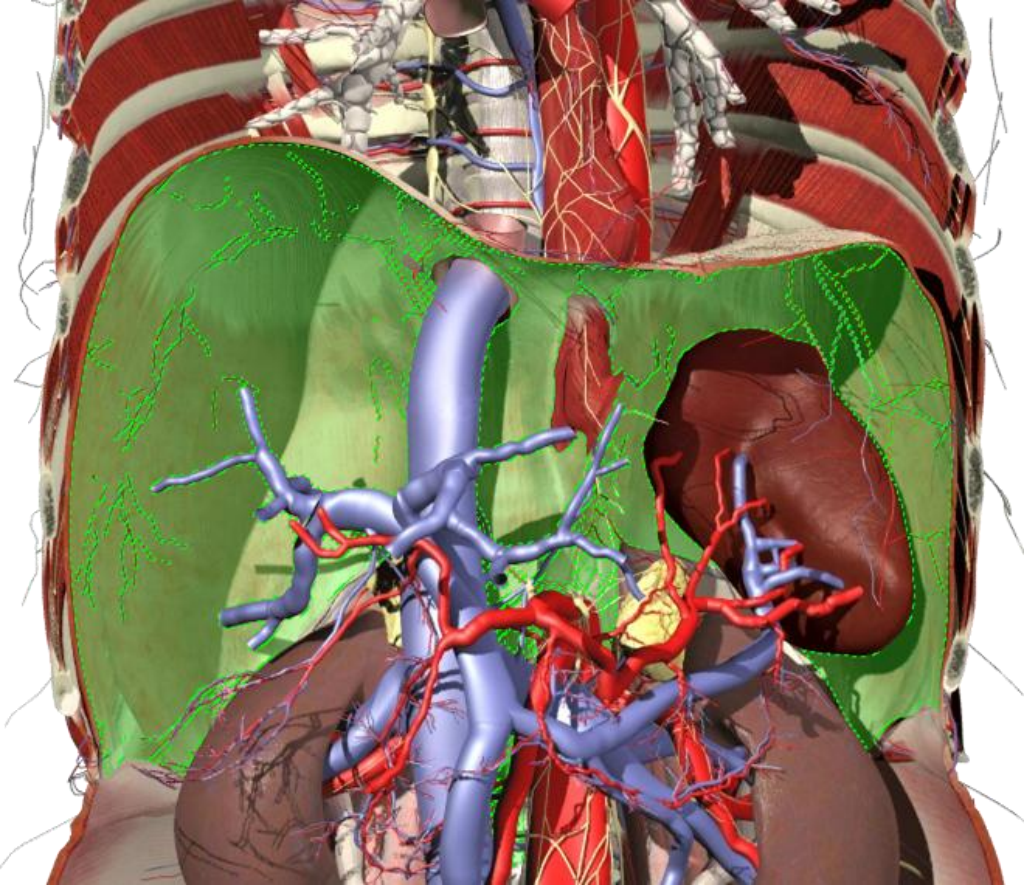

Inferior vena cava
Xiphoid process
Sternal portion of diaphragm
Costal portion of diaphragm
Central tendon
Esophagus
Left crus
Median arcuate ligament
Medial arcuate ligament
Lateral arcuate ligament
Quadratus lumborum muscle
Aorta

Diaphragm

Diaphragm

Attachments: xyphoid process, ribs 6-12 bilaterally, bodies of the intervertebral discs of L1-L3

Phrenic nerve: C3-5 “keeps the diaphragm alive”



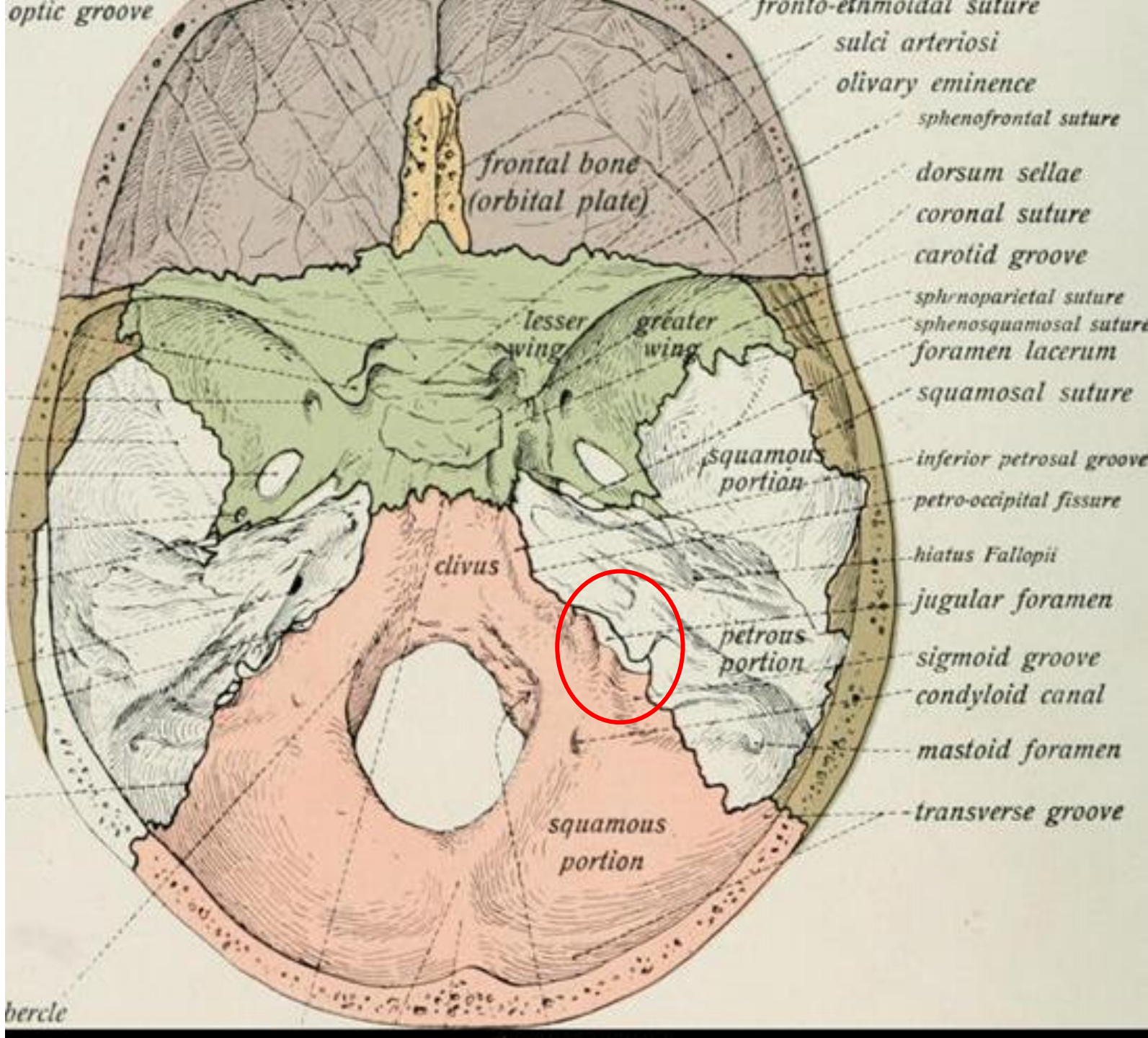
Diaphragm

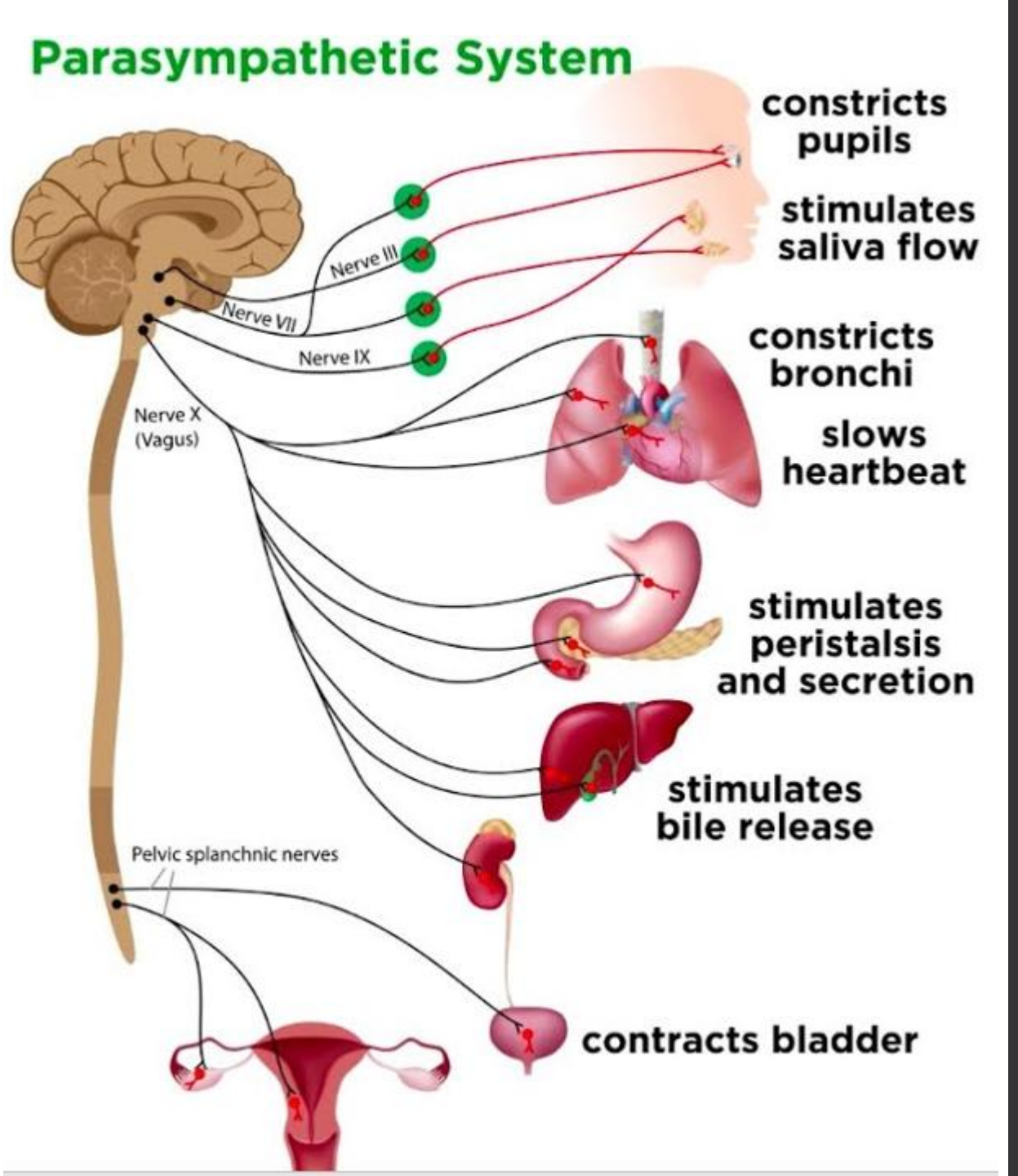
Parasympathetics

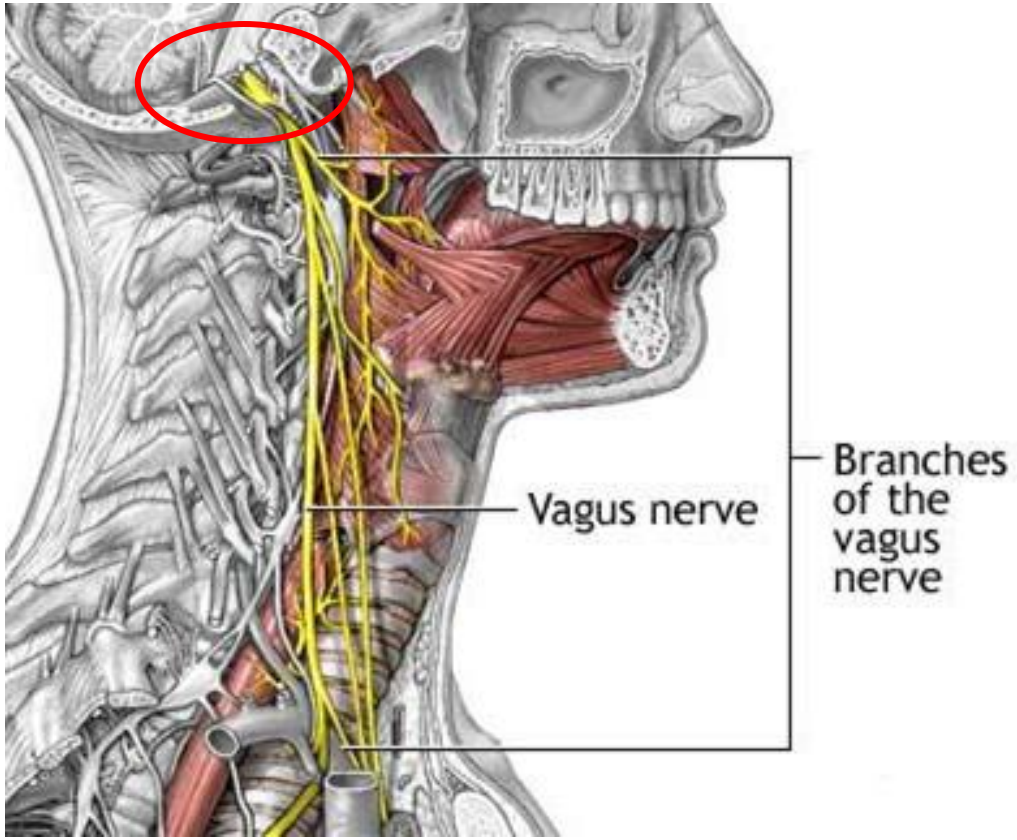
Vagus exits skull through jugular foramen (temp/occipital bones)

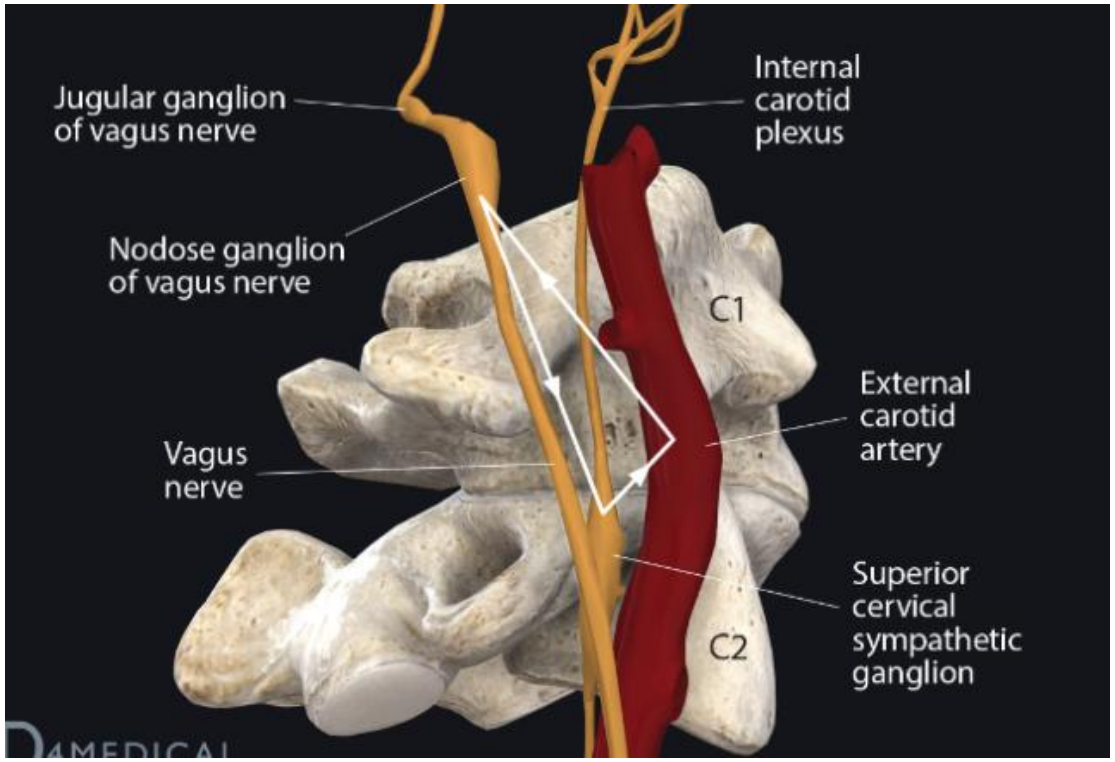
L vagus: greater curvature of stomach and extends to duodenum.

R vagus: Lesser curvature, small intestines, R colon and organs and glands up to mid transverse colon




Parasympathetic System
constricts pupils
stimulates saliva flow
Nerve III
Nerve VII
Nerve IX
Nerve X (Vagus)
constricts bronchi
slows heartbeat
stimulates peristalsis and secretion
stimulates bile release
Pelvic splanchnic nerves
contracts bladder

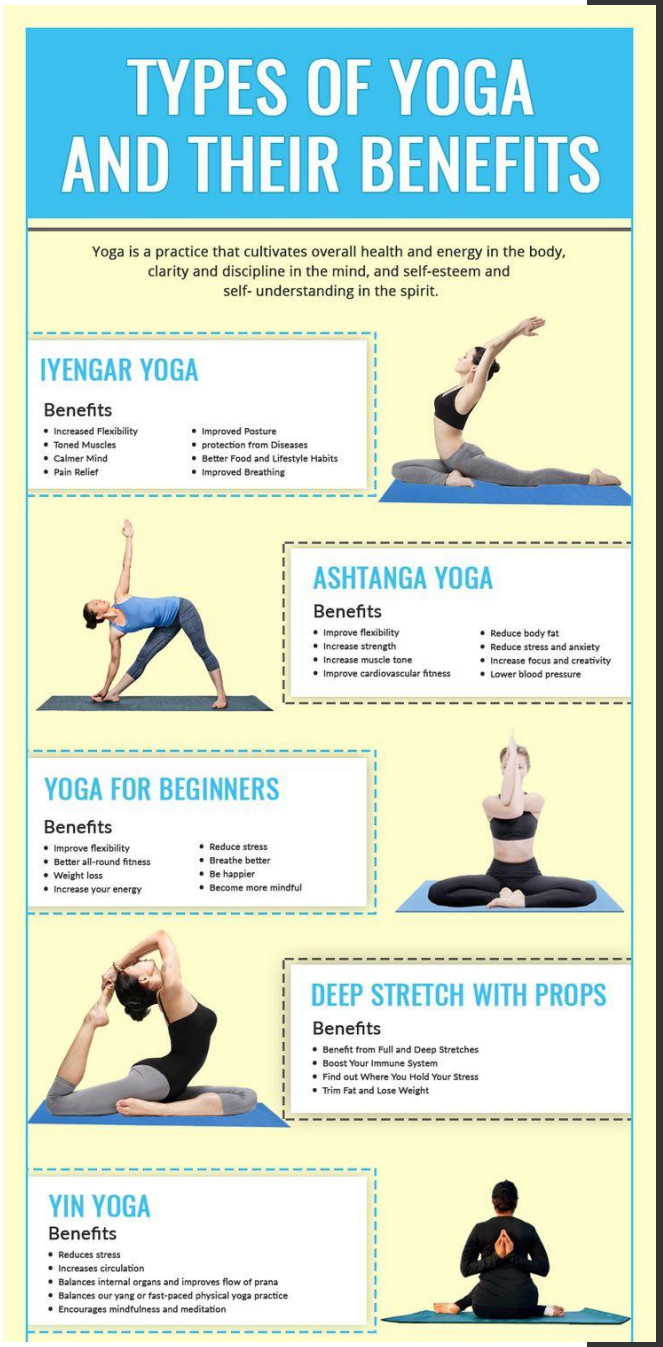




Vagus nerve Anatomy

Self-regulation techniques

- Mindful meditation
  - Pain management – "minds eye" direct visualization
- Insight timer
- Yin yoga
- Gratitude
- Regular exercise
- Time in Nature
- Social support



What's the evidence?

Various groups are doing research on the effects of biomarkers, vasodilation, heart rate variability, pulse ox

- Chiropractic
- Massage therapy
- Physiotherapy/PT
- Osteopathic

So many confounding variables:

Sham vs treatment

Technique based

Healthy vs sick patients

Many found that there is more of an affect on the parasympathetic nervous system, stimulating vagal tone thereby counterbalancing the sympathetic nervous system, if any effect

References

- Foundations of Osteopathic Medicine
- Kuchera and Kuchera, Osteopathic Considerations in Systemic Dysfunction
- Nelson,K. Somatic Dysfunction in Osteopathic Family Medicine, 2007 pp291-301
- Kovanur Sampath K, Tumilty S, Wooten L, Belcher S, Farrell G, Gisselman AS. Effectiveness of spinal manipulation in influencing the autonomic nervous system - a systematic review and meta-analysis. J Man Manip Ther. 2024 Feb;32(1):10-27. doi: 10.1080/10669817.2023.2285196. Epub 2024 Jan 16. PMID: 38044657; PMCID: PMC10795624.
- Guevarra, Christle C. and Seffinger, Michael A.. "Using Osteopathic Manipulative Therapy to Influence Autonomic Nervous System Activity" *Journal of Osteopathic Medicine*, vol. 116, no. 1, 2016, pp. 57-57. https://doi.org/10.7556/jaoa.2016.011
- Heineman, K. DO "An Osteopathic Manipulative Treatment (OMT) Evaluation and Treatment Protocol to Improve Gastrointestinal Function", *AAO Journal* (2022) 32 (2): 34-44, **https://doi.org/10.53702/2375-5717-32.2.34**
- Candal R, Reddy V, Samra NS. Anatomy, Abdomen and Pelvis: Celiac Ganglia. [Updated 2023 Aug 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK538129/
- Visceral Manipulation: A Manual Therapy Technique for Relieving Constipation - Gastroenterology Advisor
- Proper Breathing Brings Better Health | Scientific American
- https://comapp.nyit.edu/omm-center/omm-techniques-osteopathic-cranial-manipulative-medicine/
- Picchiottino M, Leboeuf-Yde C, Gagey O, Hallman DM. The acute effects of joint manipulative techniques on markers of autonomic nervous system activity: a systematic review and meta-analysis of randomized sham-controlled trials. Chropr Man Therap. 2019 Mar 12; 27;17
- Araujo, FX, Ferriera GE, Angellos RF, Stieven, FF, Plentz RDM, Silva MF. Autonomic Effects of spinal Manipulative Therapy: Systemic Review of Randomized controlled trials. J Manipulative Physiol Ther. 2019 Oct;42(8):623-34.
- Amatuzzi F, Gervazoni AC, Da Silva ML, Cipriano GF, et al. Acute and Time-Course Effects of Osteopathic Manipulative Treatment on Vascular and Autonomic Function in patients with heart failure: A Randomized Trial. J Manipulative Physiol. Ther. 2021. Jul-Aug; 44(6); 455-466