Pranayama

Teachers Training
Level 1 2023

The Cranial Nerves &

The Vagal Nerve Complex

Yoga Education Collective

ॐ ॐ ॐ

श्री गुरुभ्यो नमः हरिः ॐ

Om Om Om

Sri Gurubhyo Namah Harih Om

Salutations to the Gurus!

ॐ सह नाववतु ।
सह नौ भुनक्तु ।
सह वीर्यं करवावहै ।
तेजस्वि नावधीतमस्तु मा विद्विषावहै ।
ॐ शान्तिः शान्तिः शान्तिः ॥

oṃ saha nāvavatu saha nau bhunaktu
saha vīryaṃ karavāvahai
tejasvi nāvadhītam astu mā vidviṣāvahai
oṃ śāntiḥ śāntiḥ śāntiḥ

May that Brahman protect us together. May it nourish us together. May we both gain great vitality. May our learning be brilliant. May we never argue. Om peace, peace, peace.

The Vagal Nerve Complex

"A recognized fact which goes back to the earliest times is that every living organism is not the sum of a multitude of unitary processes, but is, by virtue of interrelationships and of higher and lower levels of control, an unbroken unity. When research, in the efforts of bringing understanding, as a rule examines isolated processes and studies them, these must of necessity be removed from their context. In fact, quantitative findings of any material and energy changes preserve their full context only through their being seen and understood as parts of a natural order…

The Vagal Nerve Complex

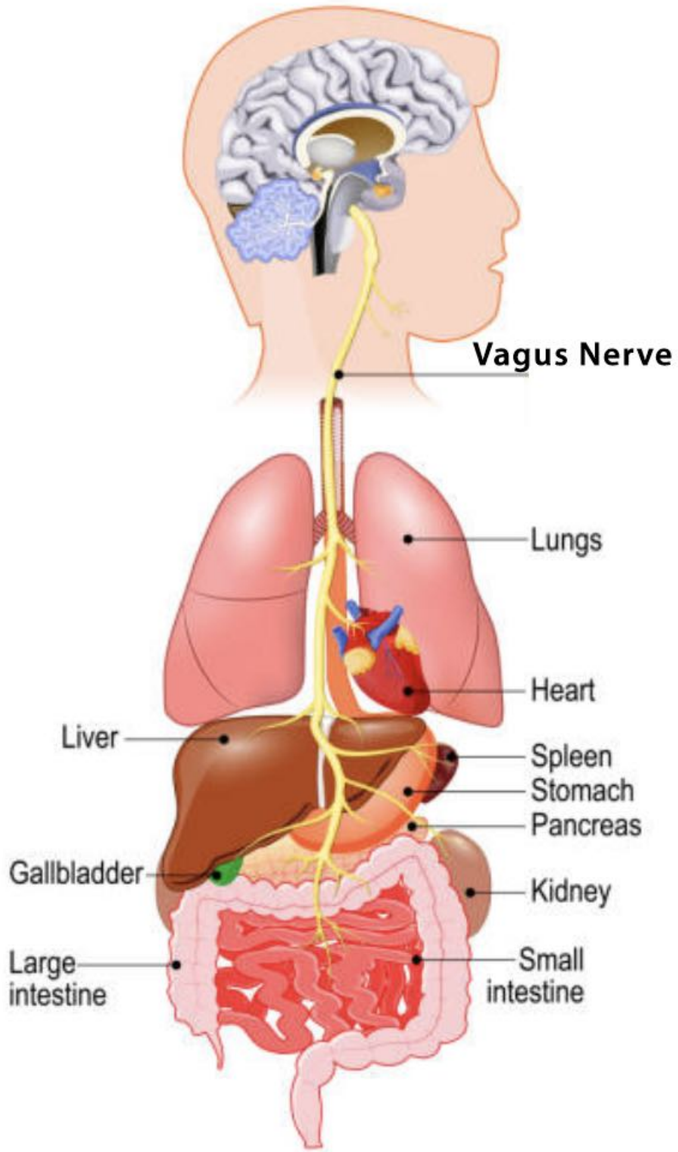
… This implies that the laws governing organic cohesion, the organization leading from the part to the whole, represent a biological uncertainty, indeed an uncertainty of the first order. In particular it deals with the neural mechanisms by which the activity of the internal organs is adapted to constantly changing conditions, and by which they are adjusted to one another, in the sense of interrelated systems of functions. It only remains to be added that broadening of our knowledge in these respects is of benefit not only with regard to the human compulsion to understand, but also to the practical healing art."

—W.R. Hess, Nobel Prize in Physiology address, 1949

Our Nervous System is an organized system of communication

The vagus nerve complex is the key information pathway connecting our brain to our:

1. Ears
2. Mouth
3. Throat
4. Vocal cords
5. Lungs
6. Heart
7. Stomach
8. Liver
9. Spleen
10. Pancreas
11. Intestines

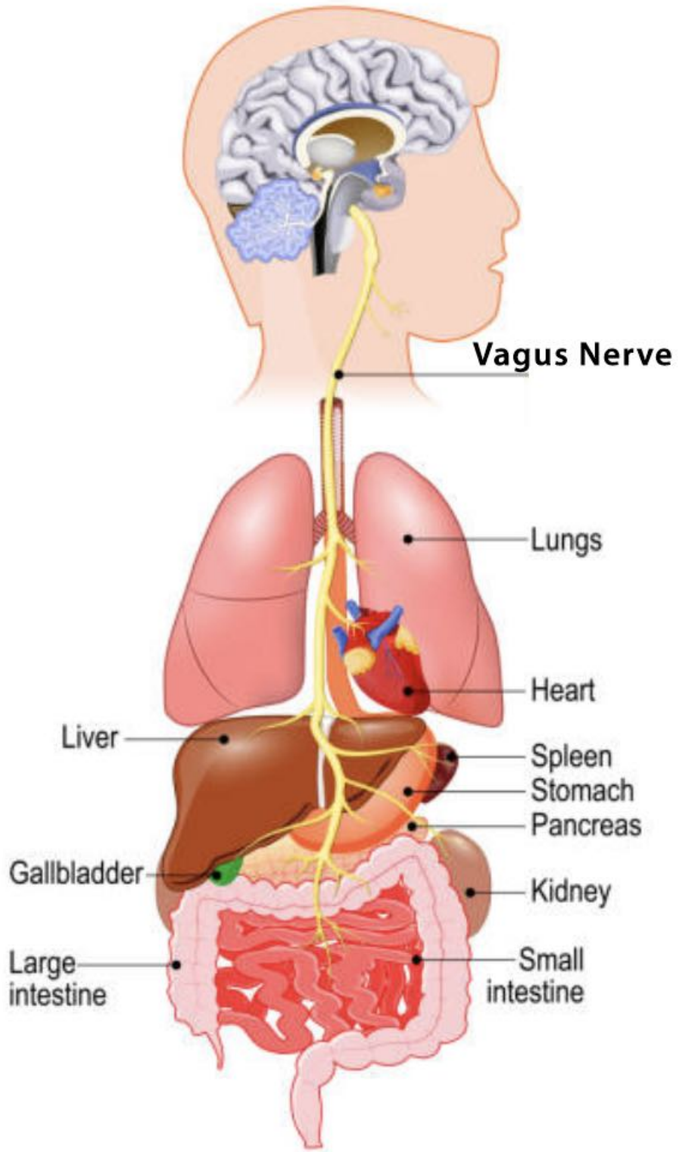


Our Nervous System is an organized system of communication

Put most simplistically, information comes “in” and is received by the brain, decisions are made, and activity is sent out

The nervous system organizes both of these information and activity flows through its various branches

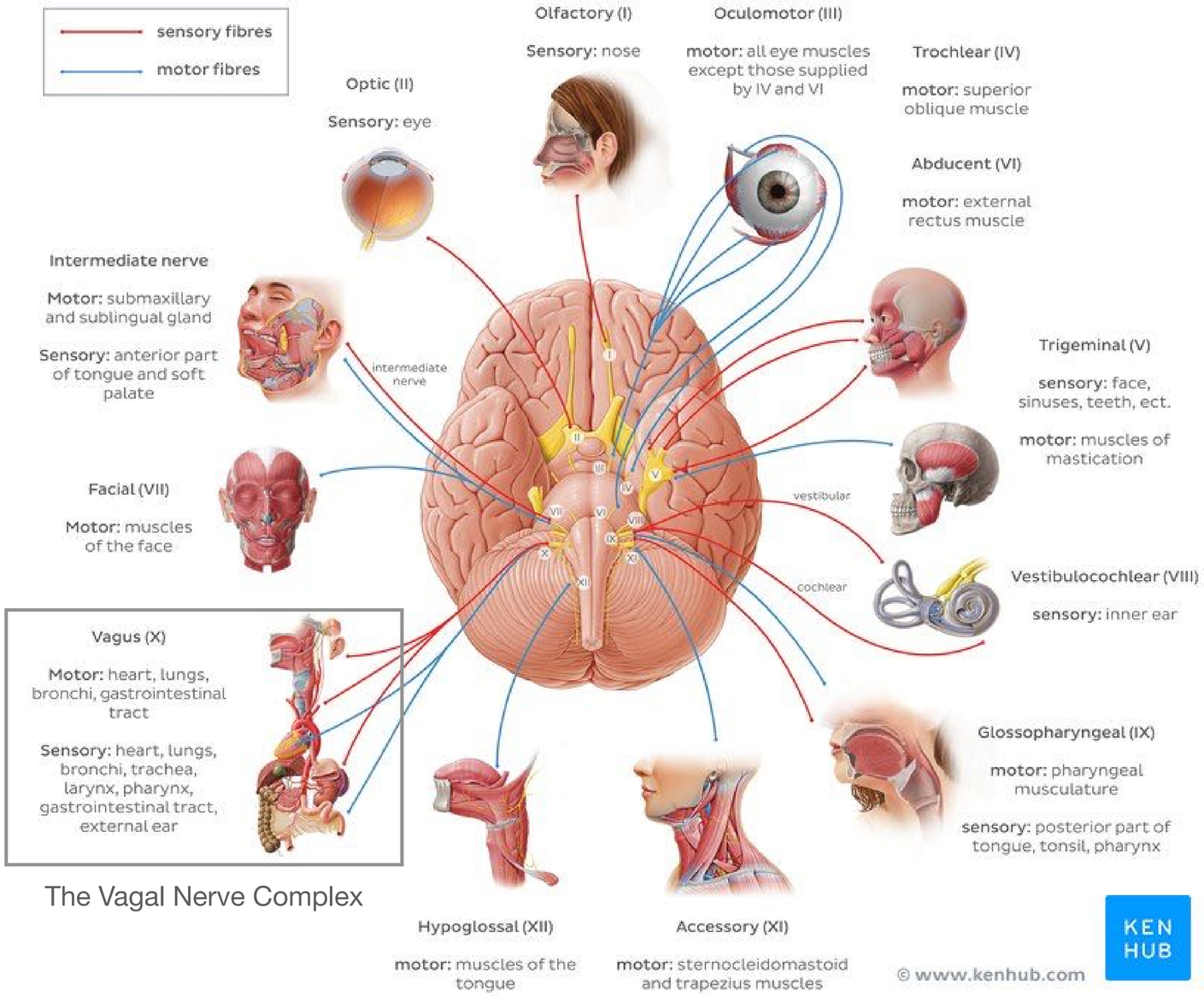
These activities include everything from our heart beat to mood fluctuations



The Cranial Nerves

Cranial Nerves are sensory and motor, and are sympathetic, parasympathetic, or mixed pathways

1. Twelve
2. Paired
3. Sensory (information in)
4. Motor (movement out)



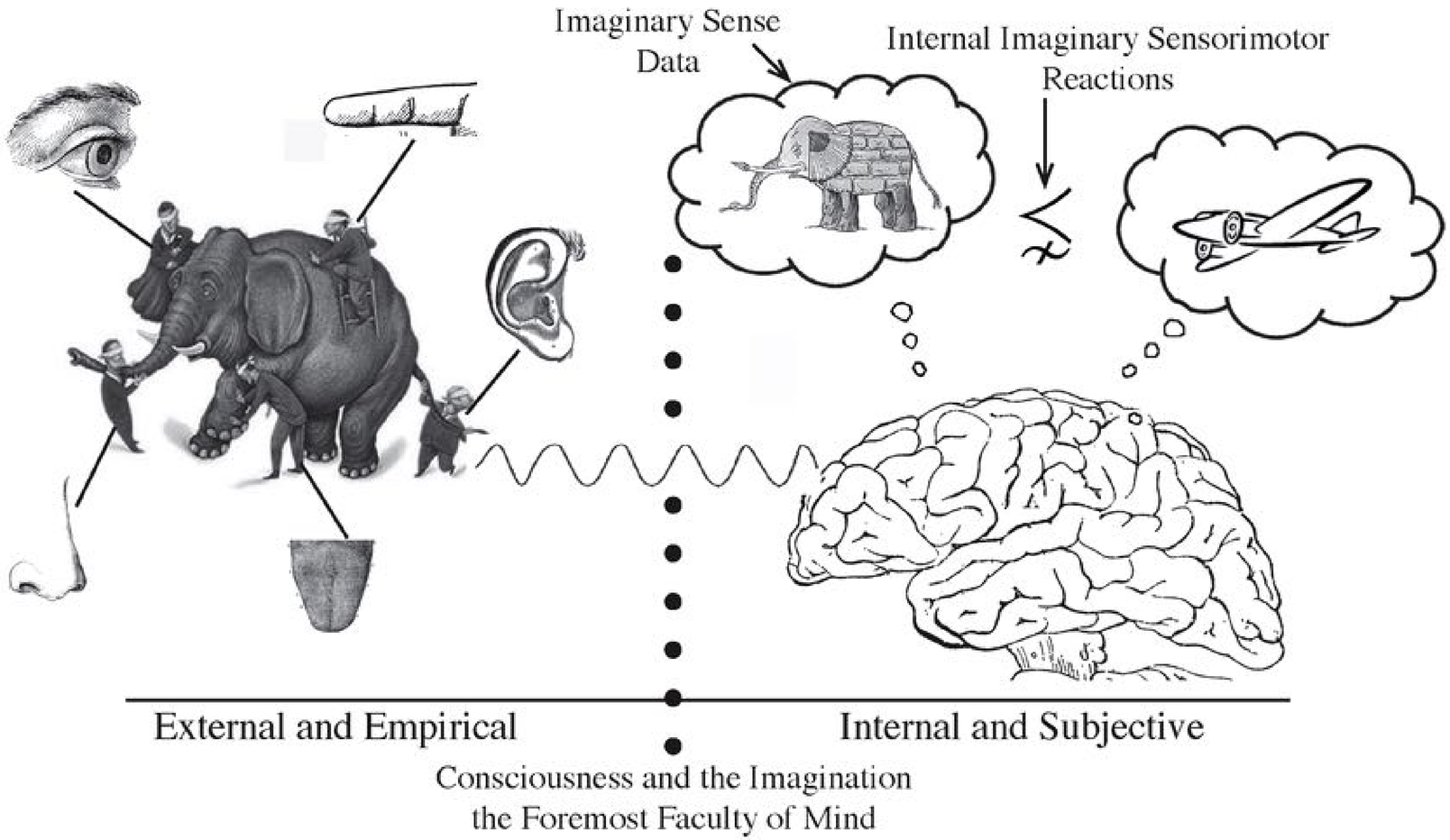
The Vagal Nerve Complex

Pratyahara

Pratyahara is the sense organs giving up identity with objects and taking the form of citta

svaviṣayāsaṃprayoge
cittasvarūpānukāra
ivendriyāṇāṃ pratyāhāraḥ
Yoga Sutras 2.54

Pratyahara prepares citta to have the fitness for dharana



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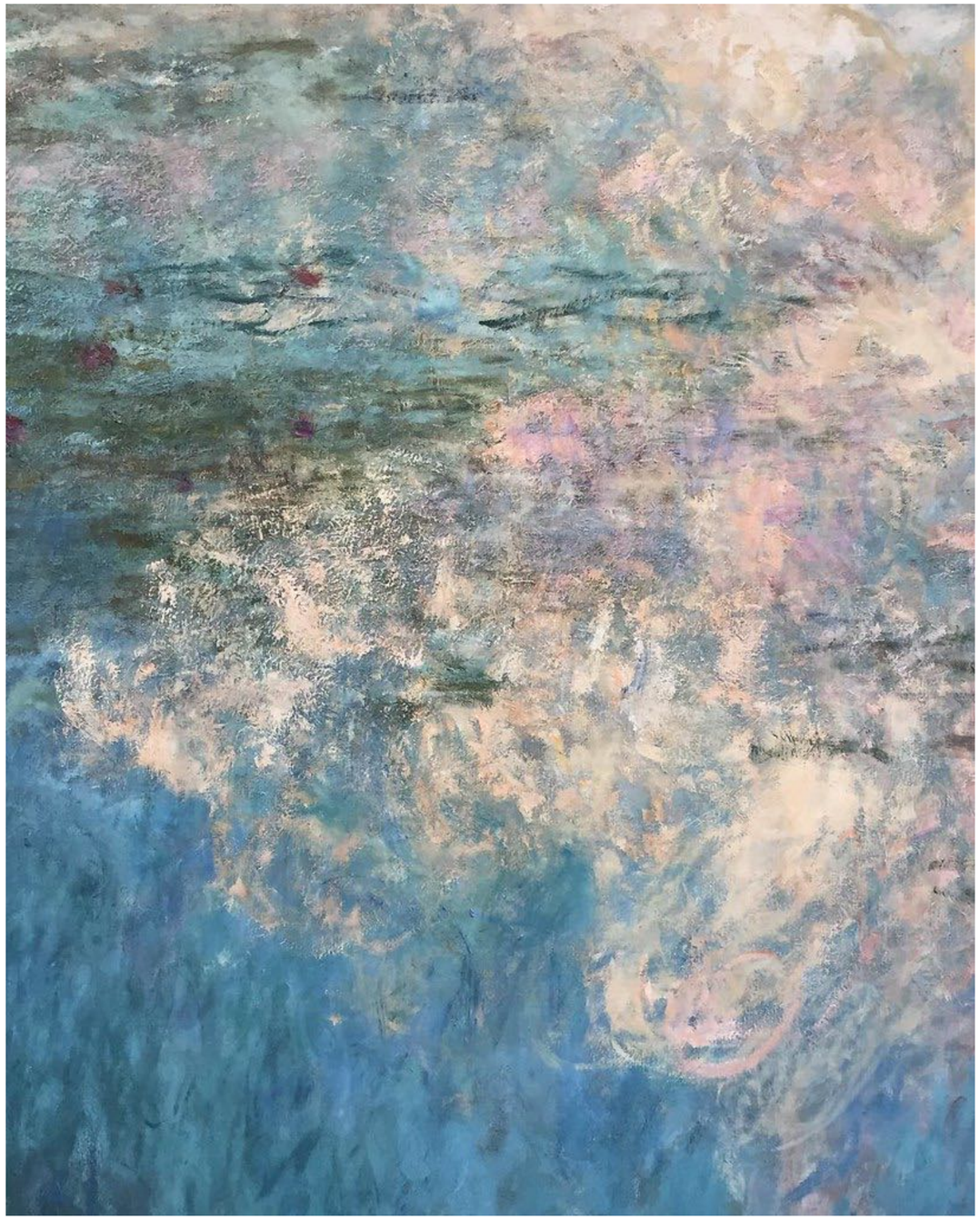


Claude Monet

Renato Muccillo

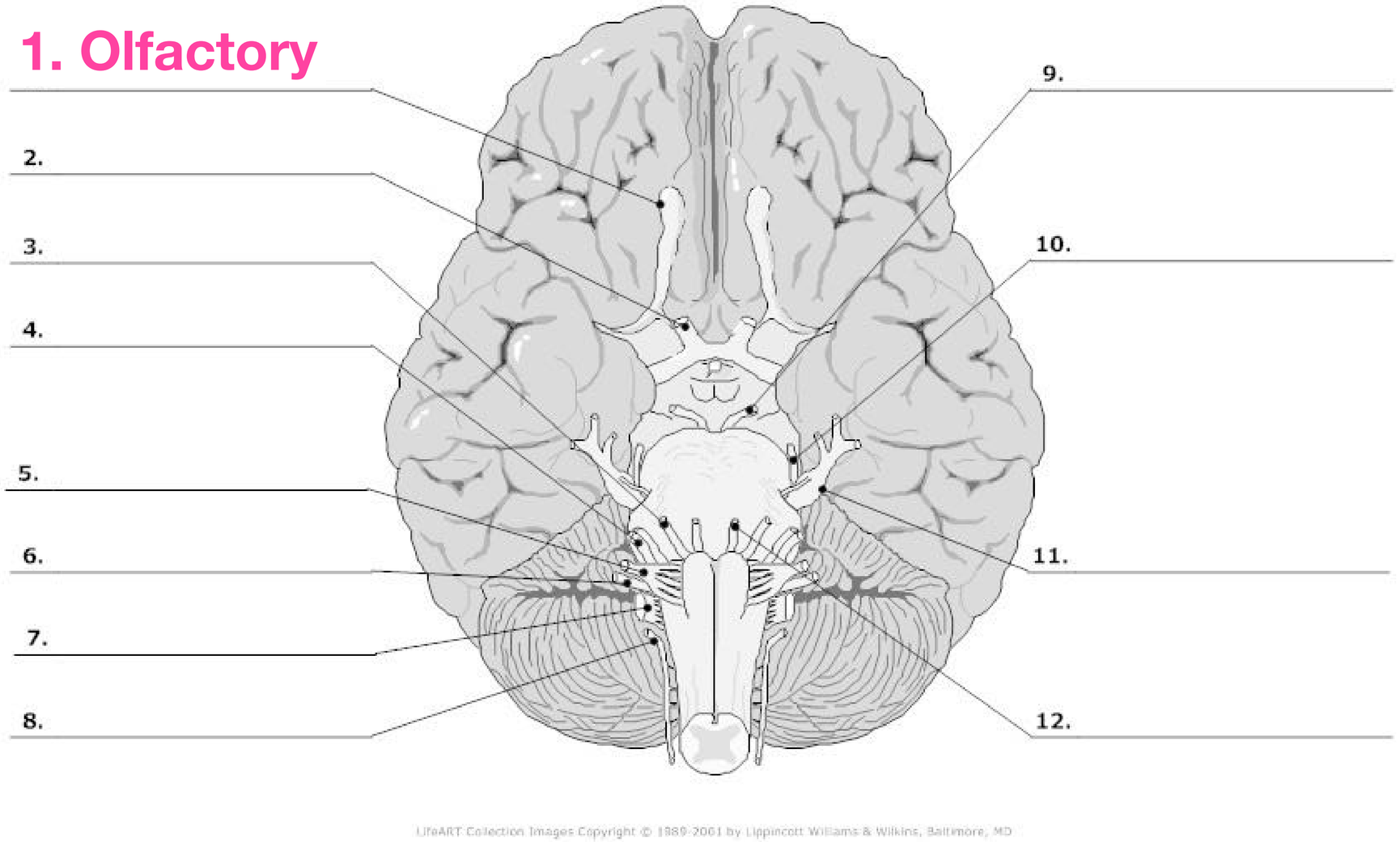
Pratyahara

1. **Pratyahara** is ceasing of contact of objects with the sense of perception
2. Not really control of the *sense organs*
3. It is control of **prana**
4. We lose prana through the motor action of the sense organs
5. We also lose prana through information coming “in”
6. If information comes in, but it is not interpreted as an object with substance, then no prana is lost
7. **Pranayama is the key practice that leads to pratyahara**
8. **The vagus nerve is the principle pathway that pranayama works on in the physical body**

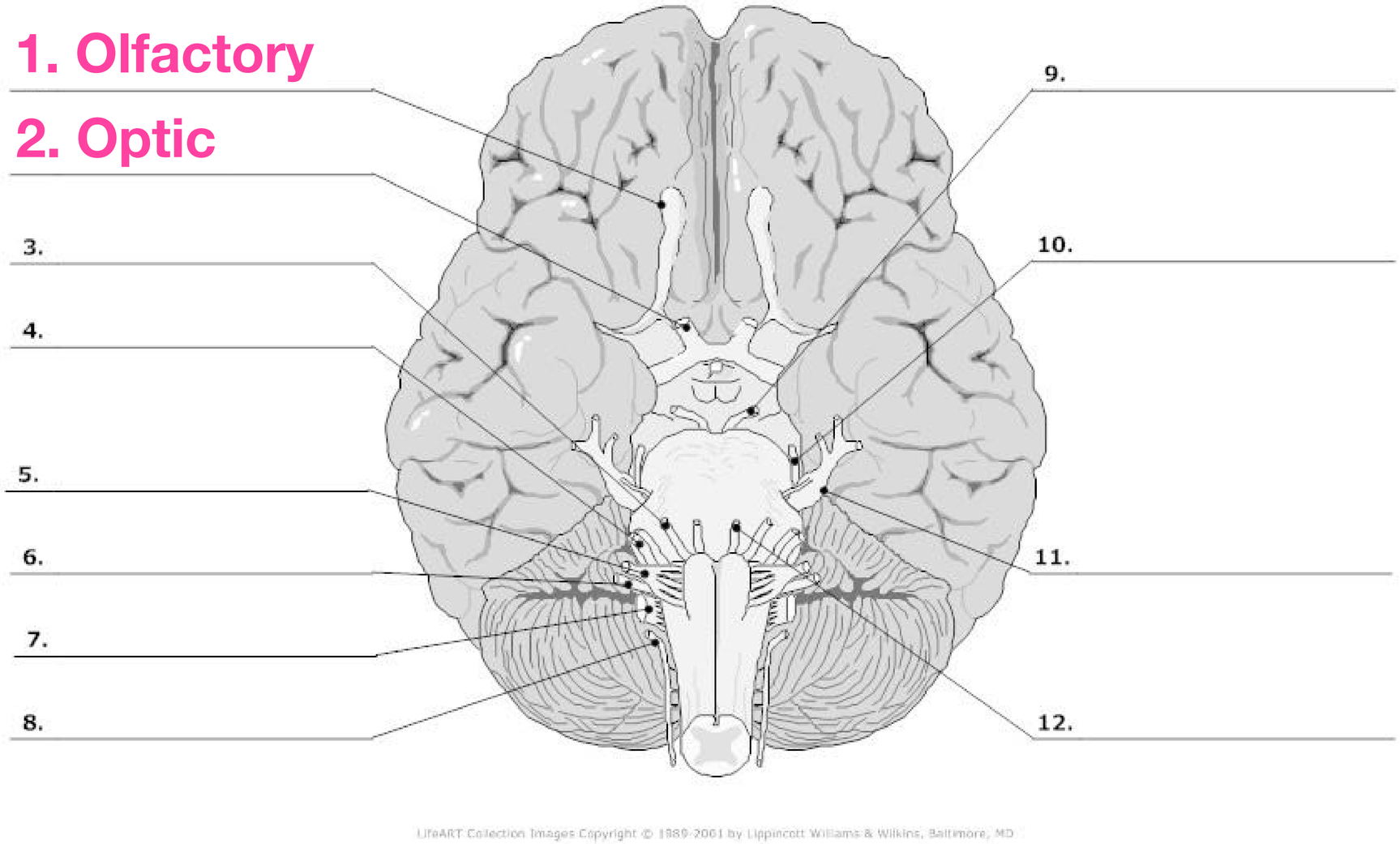
A quick look at **The Cranial Nerves**

Olfactory nerve: Sense of smell.
Optic nerve: Ability to see.
Oculomotor nerve: Ability to move and blink your eyes.
Trochlear nerve: Ability to move your eyes up and down or back and forth.
Trigeminal nerve: Sensations in your face and cheeks, taste, jaw movements.
Abducens nerve: Ability to move your eyes.
Facial nerve: Facial expressions and sense of taste.
Auditory/vestibular nerve: Sense of hearing and balance.
Glossopharyngeal nerve: Ability to taste and swallow.
Vagus nerve: Wandering nerve
Accessory nerve: Shoulder and neck muscle movement.
Hypoglossal nerve: Ability to move your tongue.

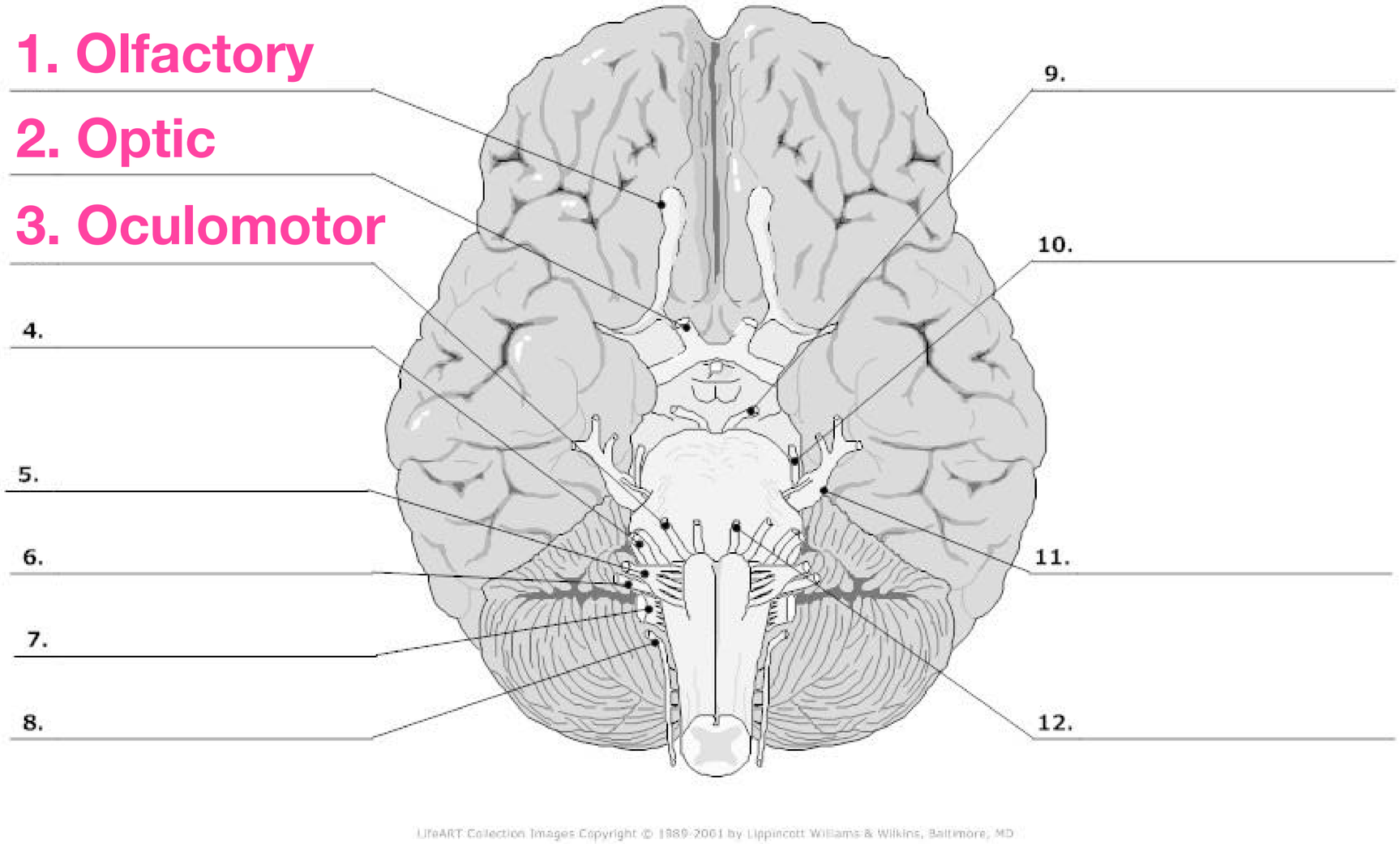
A quick look at **The Cranial Nerves,** which control sensory information pathways of the head, neck, chest and abdomen



The Cranial Nerves



The Cranial Nerves



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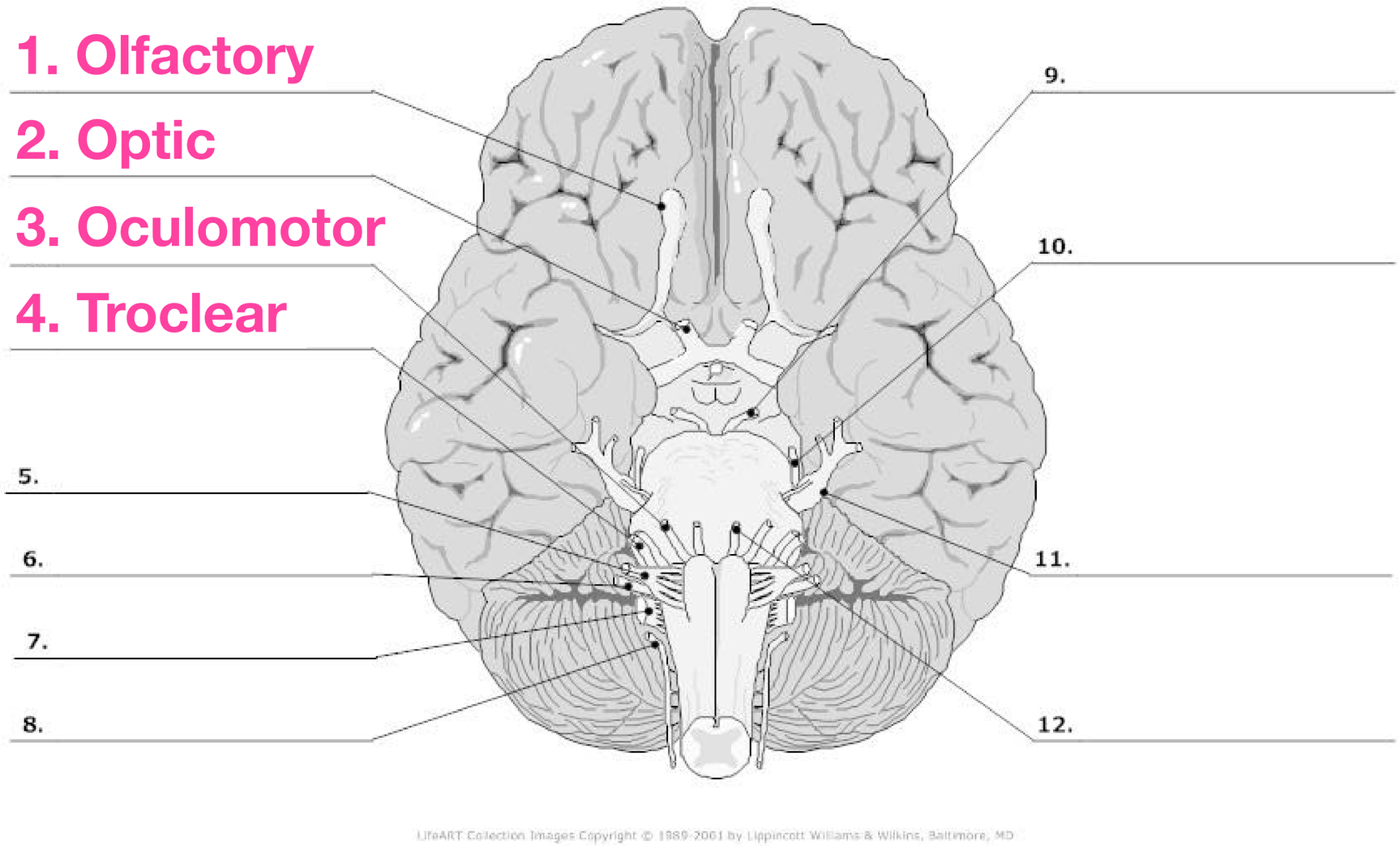
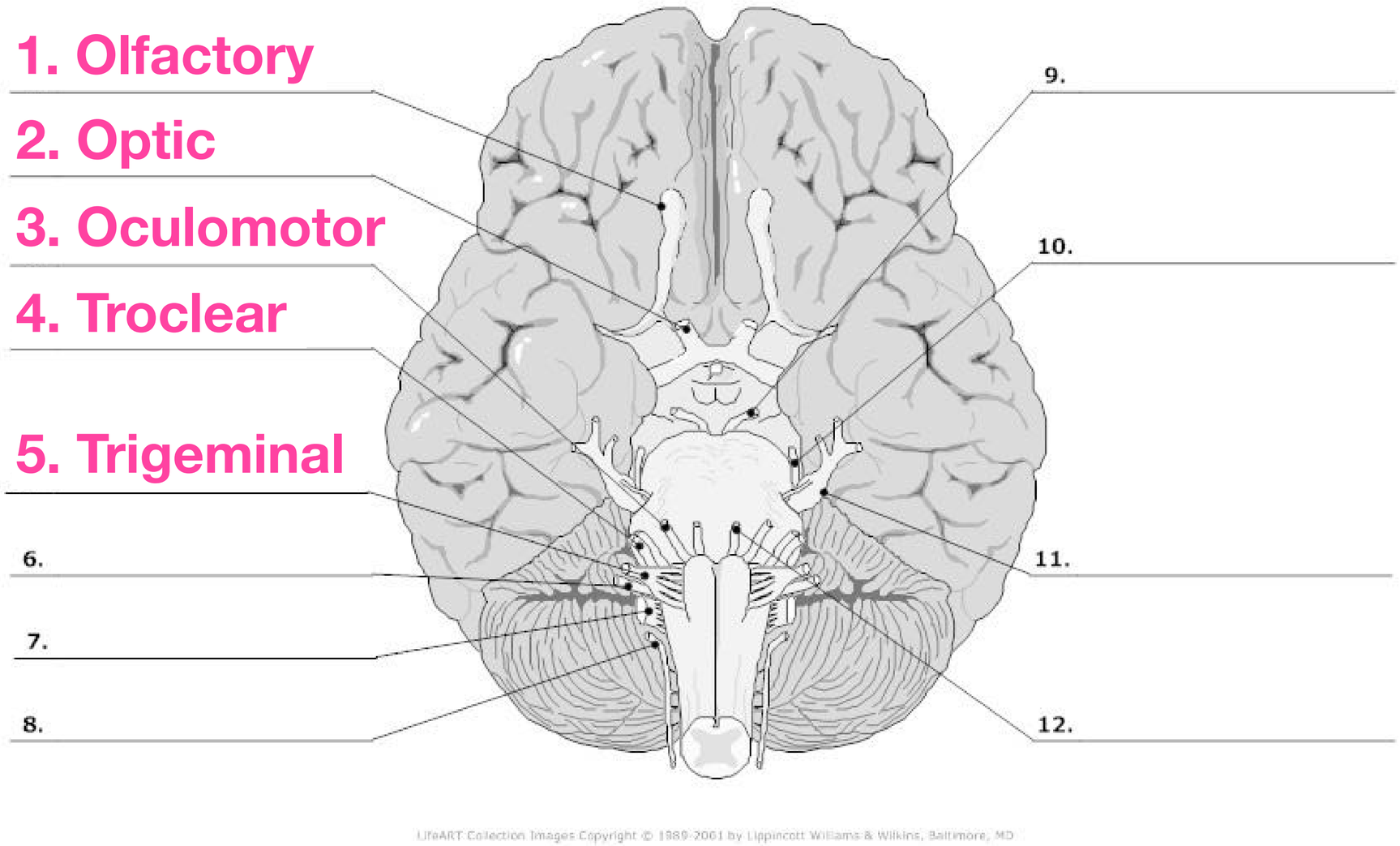
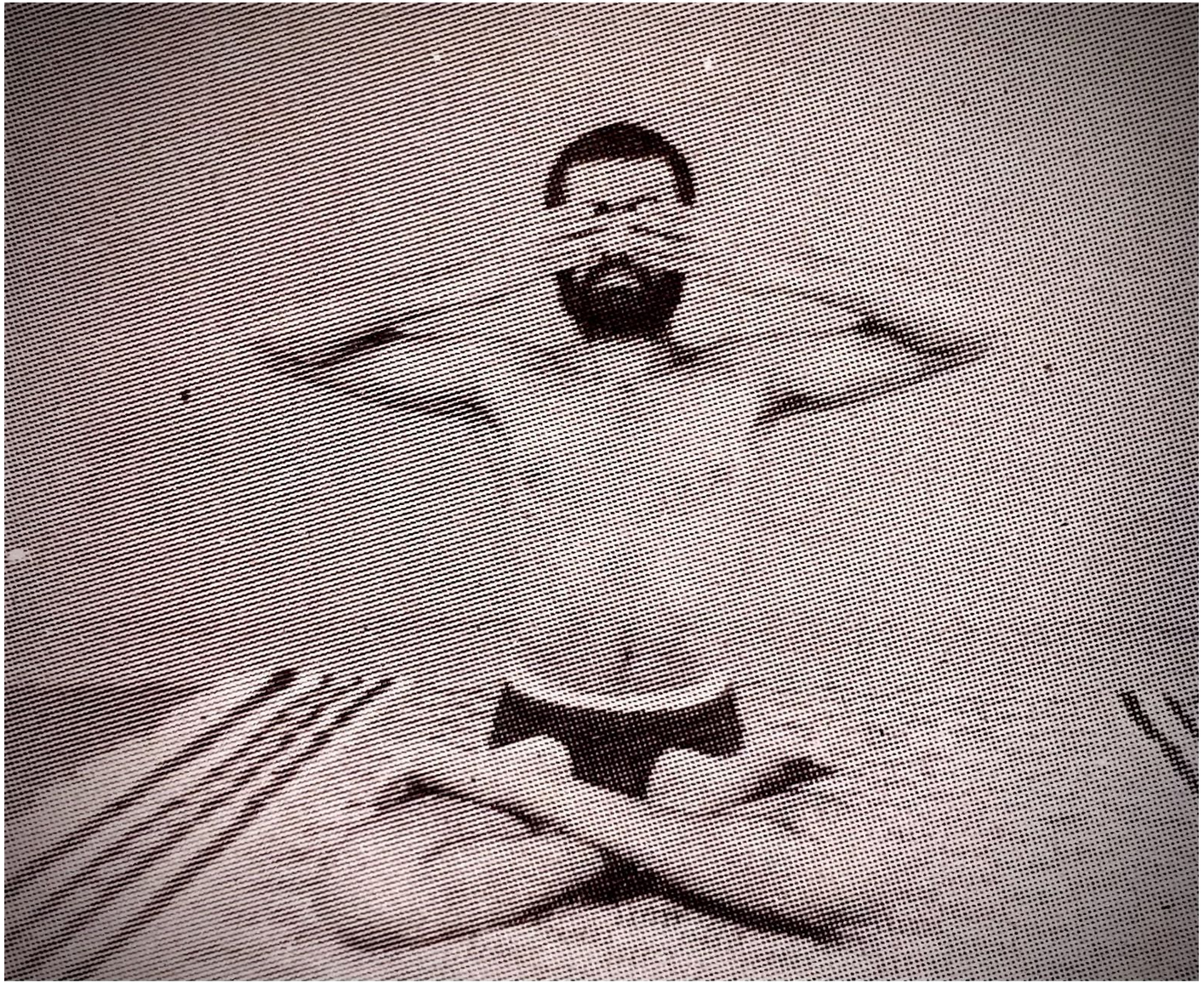


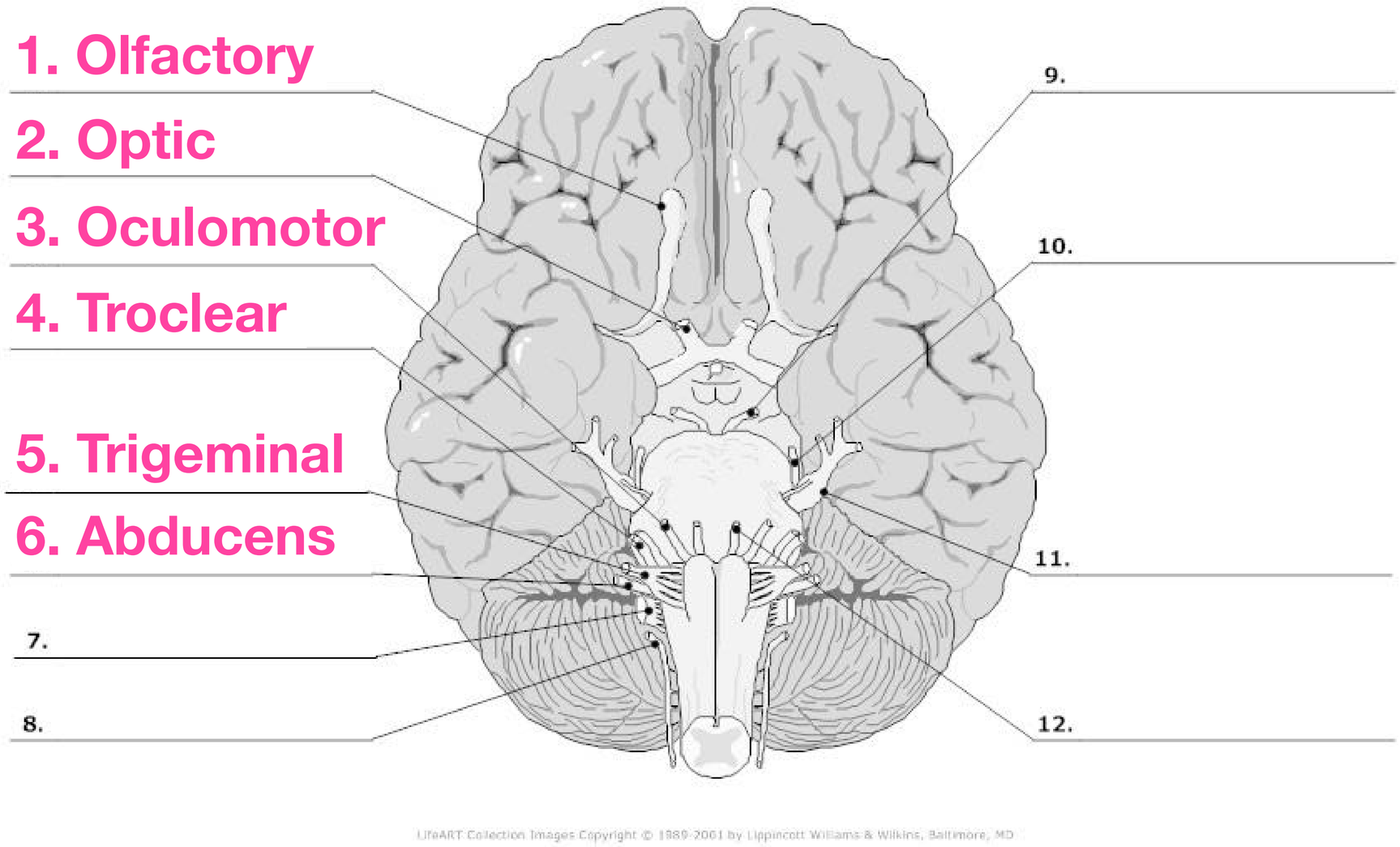
The Cranial Nerves



Shanmukhi Mudra

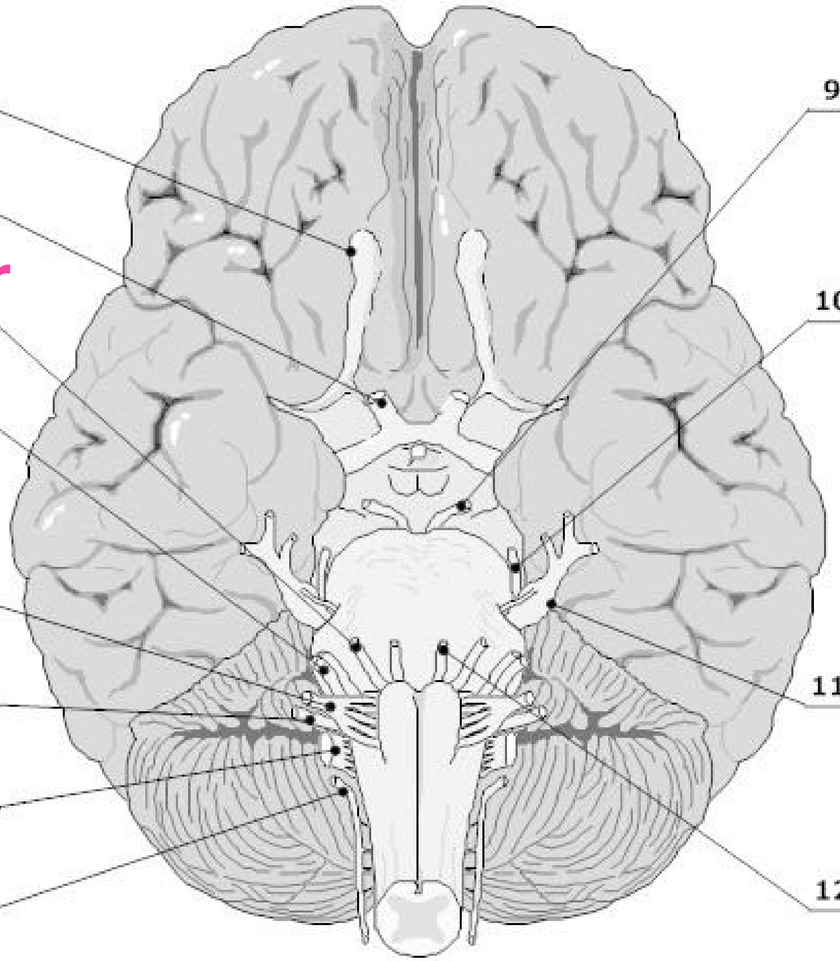


The Cranial Nerves



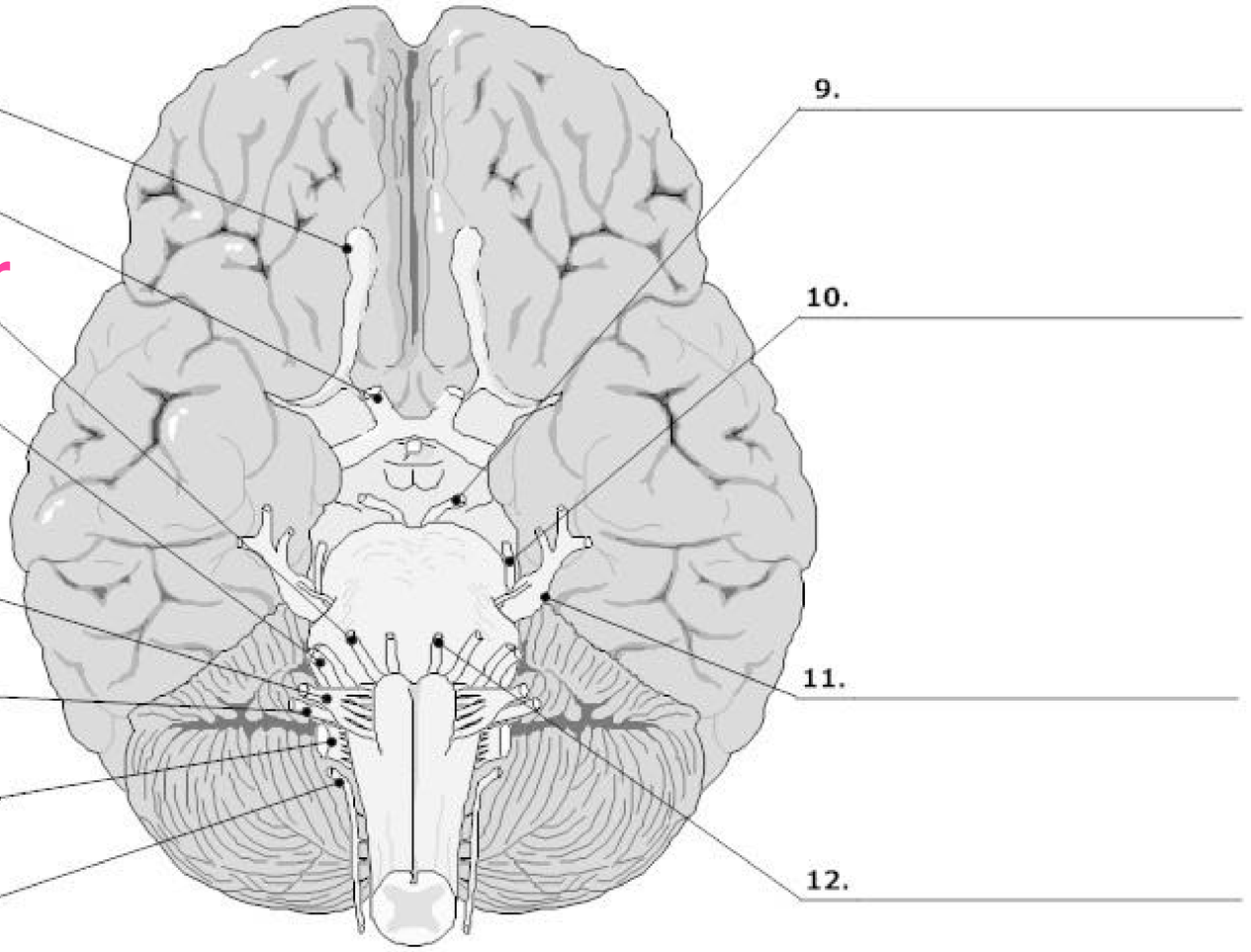
The Cranial Nerves

1. Olfactory
2. Optic
3. Oculomotor
4. Trochlear
5. Trigeminal
6. Abducens
7. Facial
8.
9.
10.
11.
12.



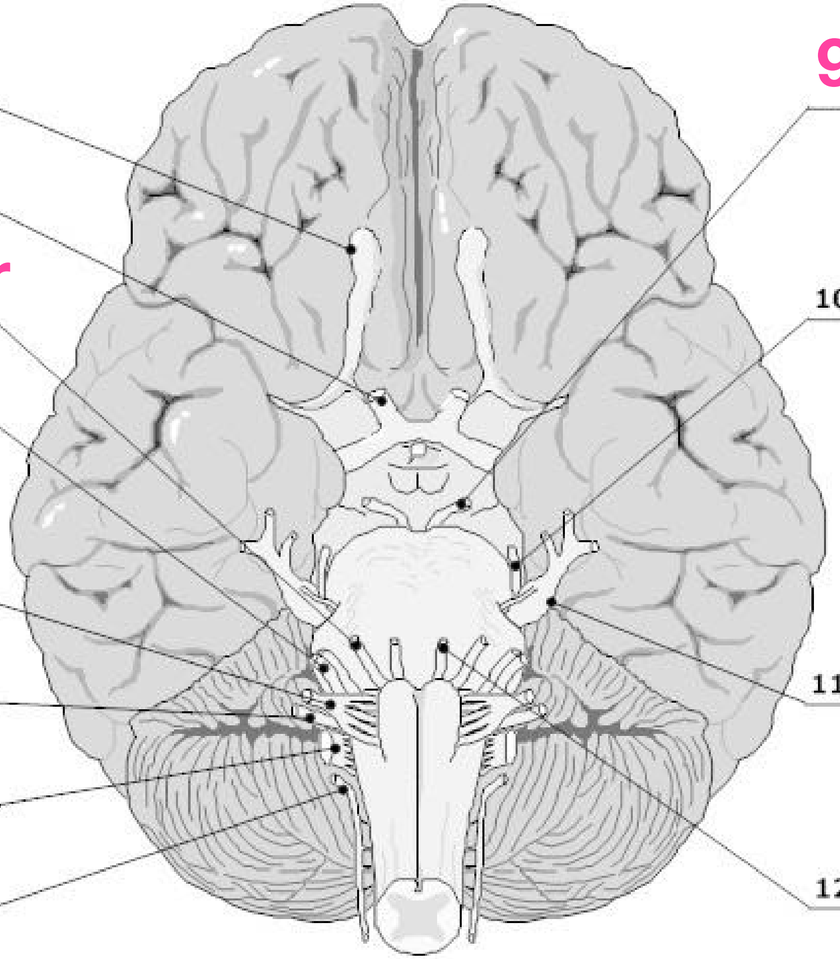
The Cranial Nerves

1. Olfactory
2. Optic
3. Oculomotor
4. Trochlear
5. Trigeminal
6. Abducens
7. Facial
8. Vastibulocochlear



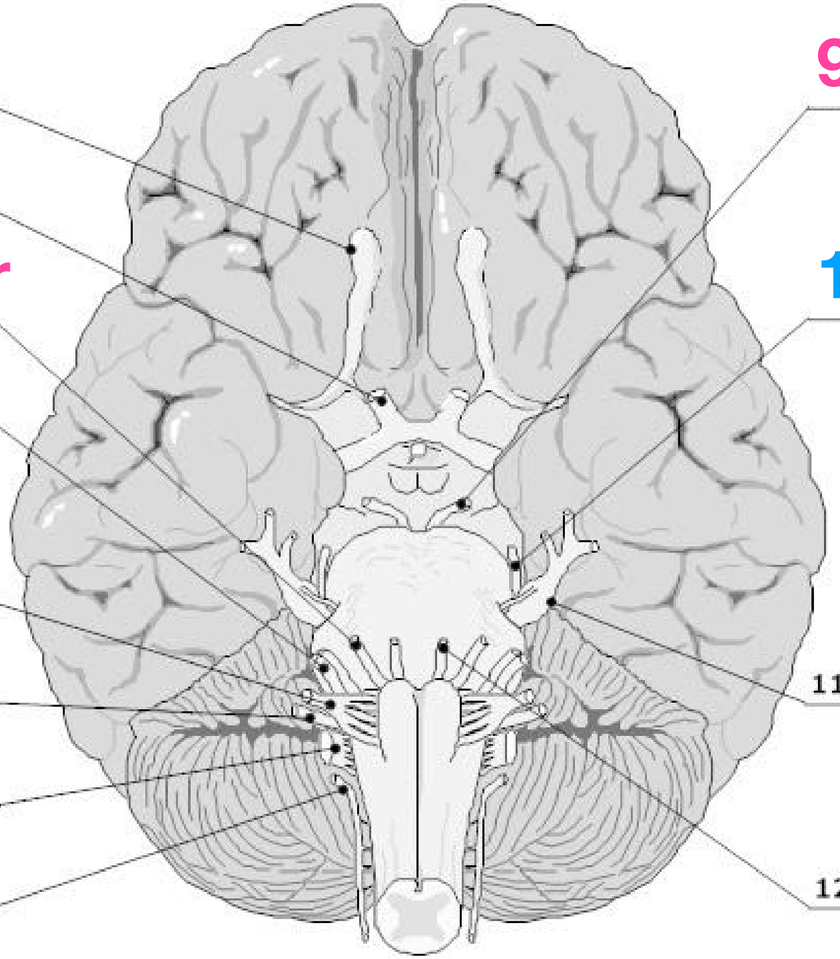
The Cranial Nerves

1. Olfactory
2. Optic
3. Oculomotor
4. Trochlear
5. Trigeminal
6. Abducens
7. Facial
8. Vastibulocochlear
9. Glossophayrngeal
10.
11.
12.



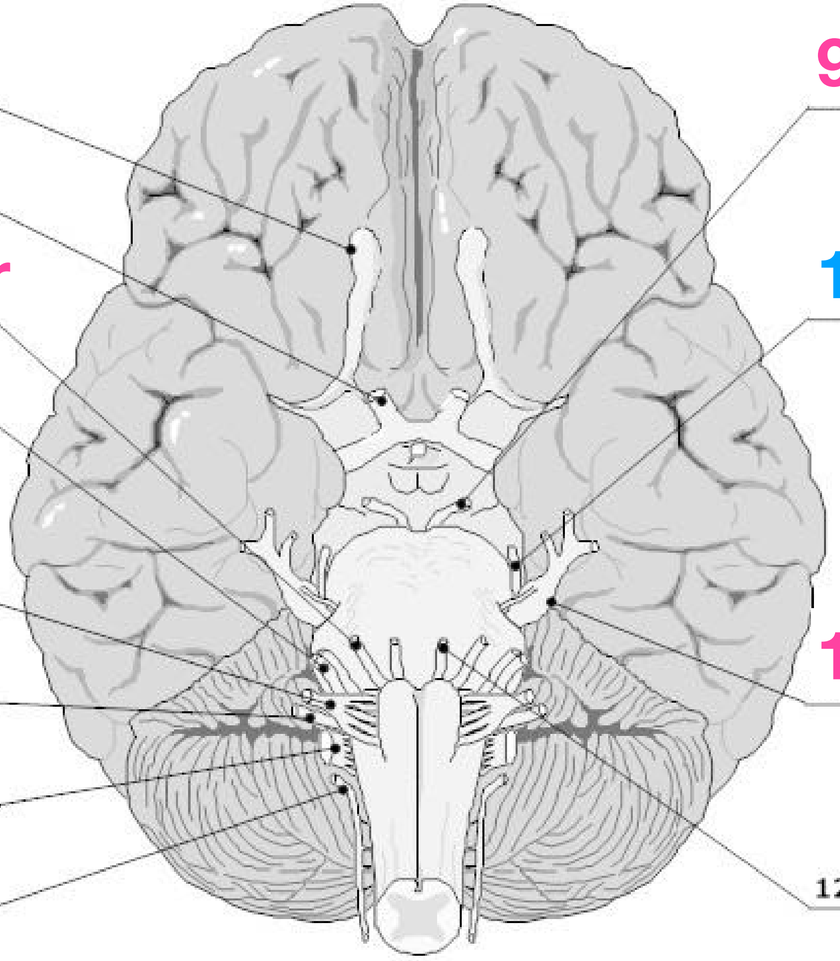
The Cranial Nerves

1. Olfactory
2. Optic
3. Oculomotor
4. Trochlear
5. Trigeminal
6. Abducens
7. Facial
8. Vastibulocochlear
9. Glossophayrngeal
10. Vagus Nerve
11.
12.

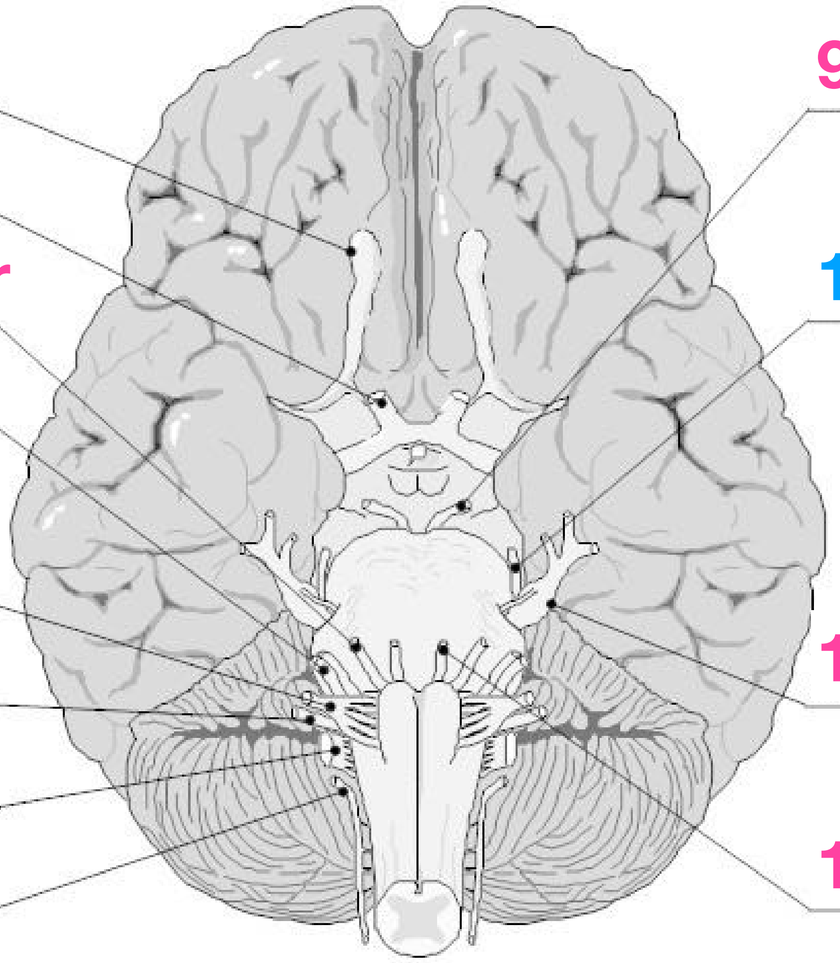


The Cranial Nerves

1. Olfactory
2. Optic
3. Oculomotor
4. Trochlear
5. Trigeminal
6. Abducens
7. Facial
8. Vastibulocochlear
9. Glossophayrngeal
10. Vagus Nerve
11. Accessory
12.



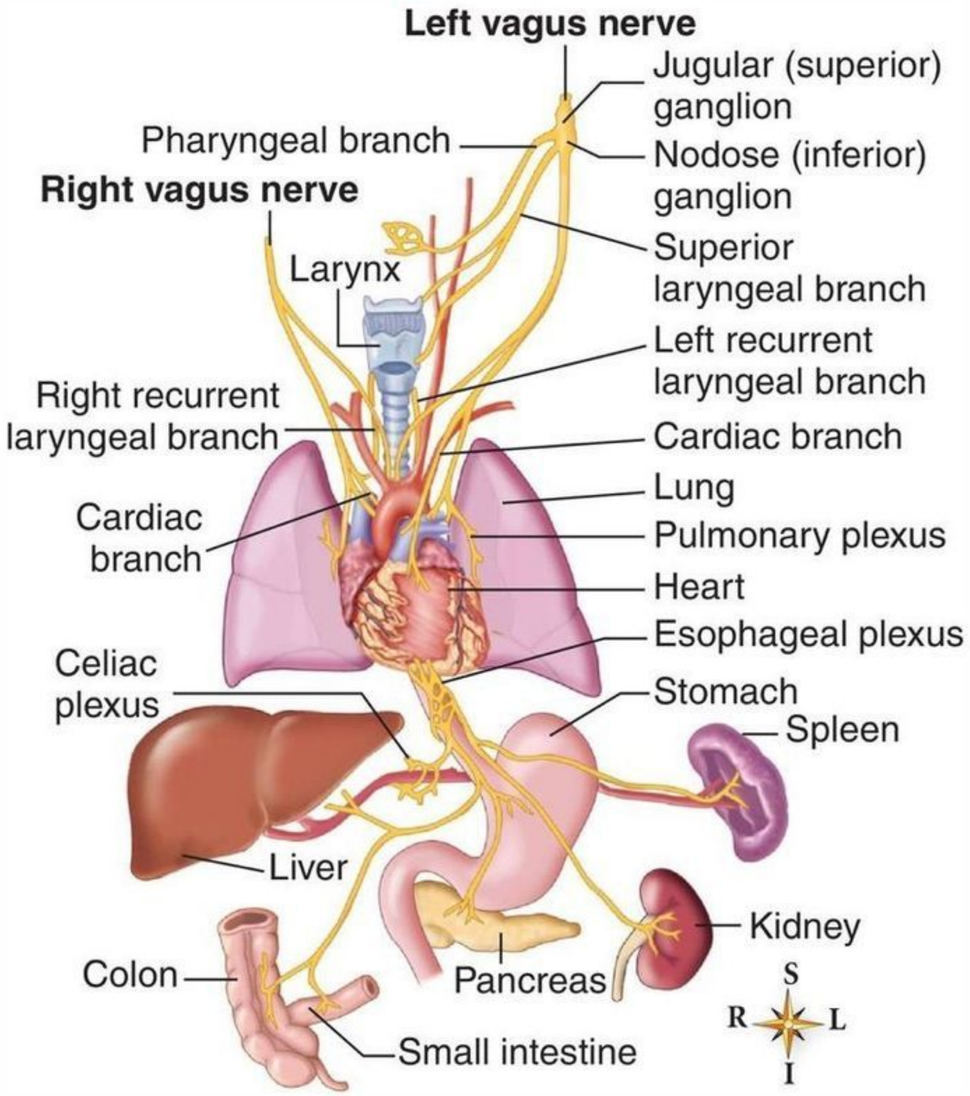
The Cranial Nerves



1. Olfactory
2. Optic
3. Oculomotor
4. Troclear
5. Trigeminal
6. Abducens
7. Facial
8. Vastibulocochlear
9. Glossophayrngeal
10. Vagus Nerve
11. Accessory
12. Hypoglossal

Overview of the basic anatomy & functions of the vagal nerve complex

1. **10th** of 12 cranial nerves
2. **Mix** of sensory and motor fibers
3. **Life-maintaining bodily functions**
    1. Heart rate
    2. Blood pressure
    3. Digestion
    4. Immune response
    5. Sexual reproduction
4. Modulates mood and emotional responses
5. Regulates stress response
6. Unique in thoracic and abdominal distribution



Mosby's Medical Dictionary, 9th edition. © 2009, Elsevier.

Overview of the basic anatomy & functions of the vagal nerve complex

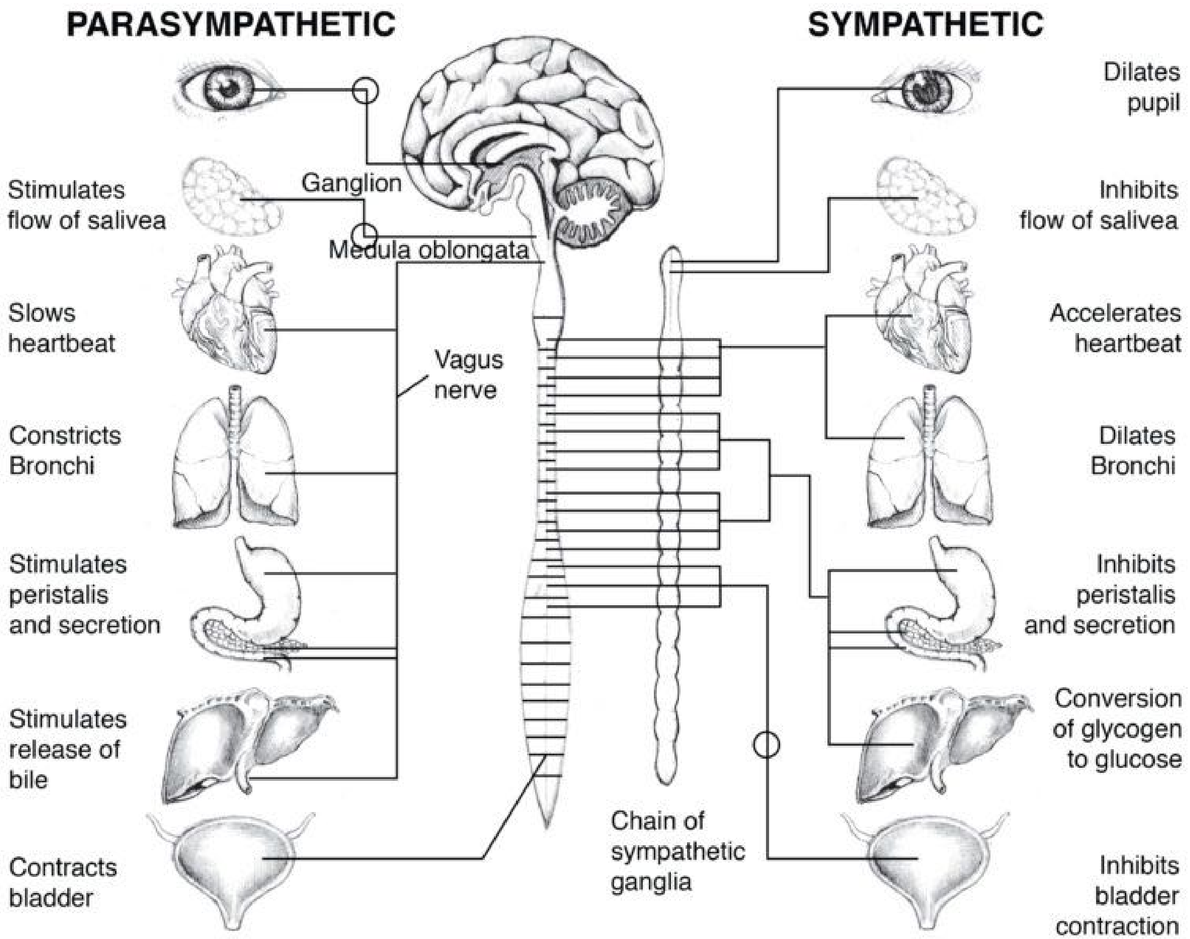
1. Most important functions are **afferent**, meaning carrying messages from the internal organs (including intestines, heart, liver, pancreas, lungs) to the brain
2. This suggests that the internal organs are a major source of sensory information for the brain – especially the “gut brain”
3. We usually limit our ideas of the sense organs to the eyes, ears, nose, mouth, and skin. However, these sense organs are the end organs of nervous system endings; they are portals of entry
4. The internal organs are as much a source of sensory information as our eyes or ears. To have an internal sense of the messages they are sending is called interoception

There are three branches of the Autonomic Nervous System

1. **Sympathetic** (activity, speed)
2. **Parasympathetic** (relaxation, repair)
3. **Enteric** (gastrointestinal behavior)

The vagus nerve complex is the main contributor to Parasympathetic Nervous System (PSNS) function – approximately 80-90% of it's makeup

The Enteric nervous system communicates with the brain through the vagus nerve (gut-brain axis)



The Vagal Nerve Complex

1. The vagus nerve is an **anatomical** pathway
2. It carries electrical messages to stimulate **hormone** production
3. The hormones act on end organs or tissues
4. The organs or tissues then respond with behavior change
5. The hormone carried or stimulated by the vagus nerve is **acetylcholine**
6. Acetylcholine was discovered in 1913 by Henry Dale
7. The hormone stimulated by the sympathetic nervous system is **noradrenaline**
8. The vagus carries messages through five different mixed fibers

Two important terms

1. **Adrenergic** relating to noradrenaline
2. **Cholinergic** relating to acetylcholine

This nomenclature designates the nature of the actual nerve fiber and the type of neurotransmitter used rather than the anatomical classification (such as sympathetic and parasympathetic)

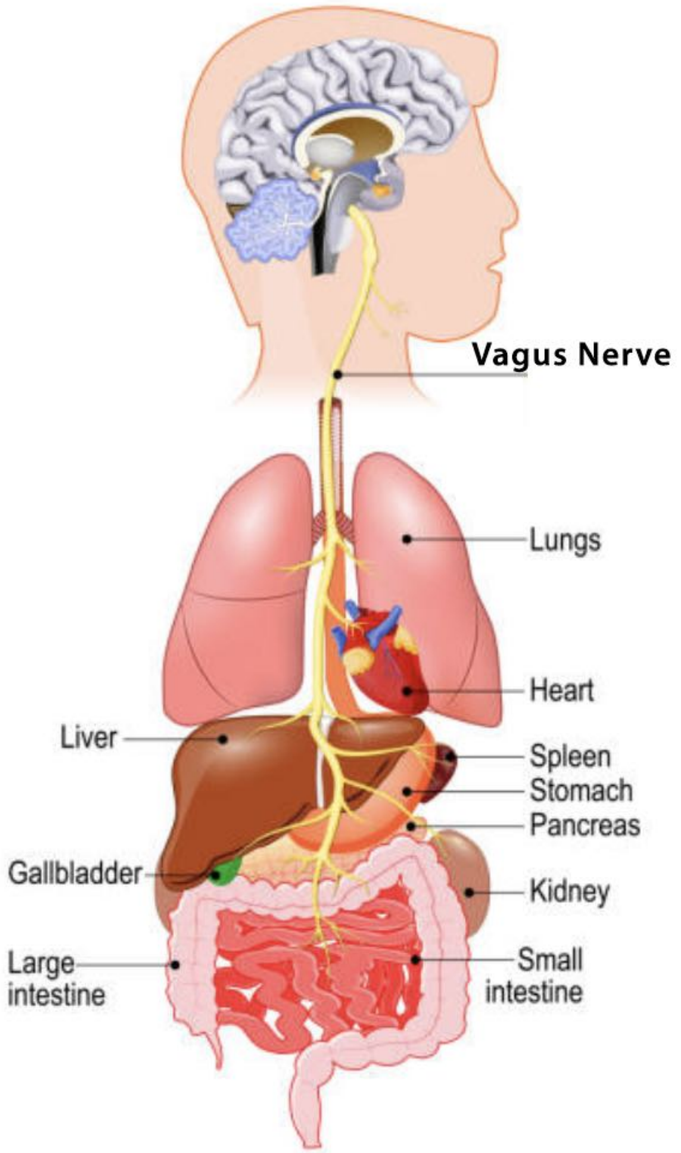
The cholinergic system is an **anti-inflammatory** system

The vagus nerve complex plays a dual role in modulating inflammation

Vagal Nerve Complex

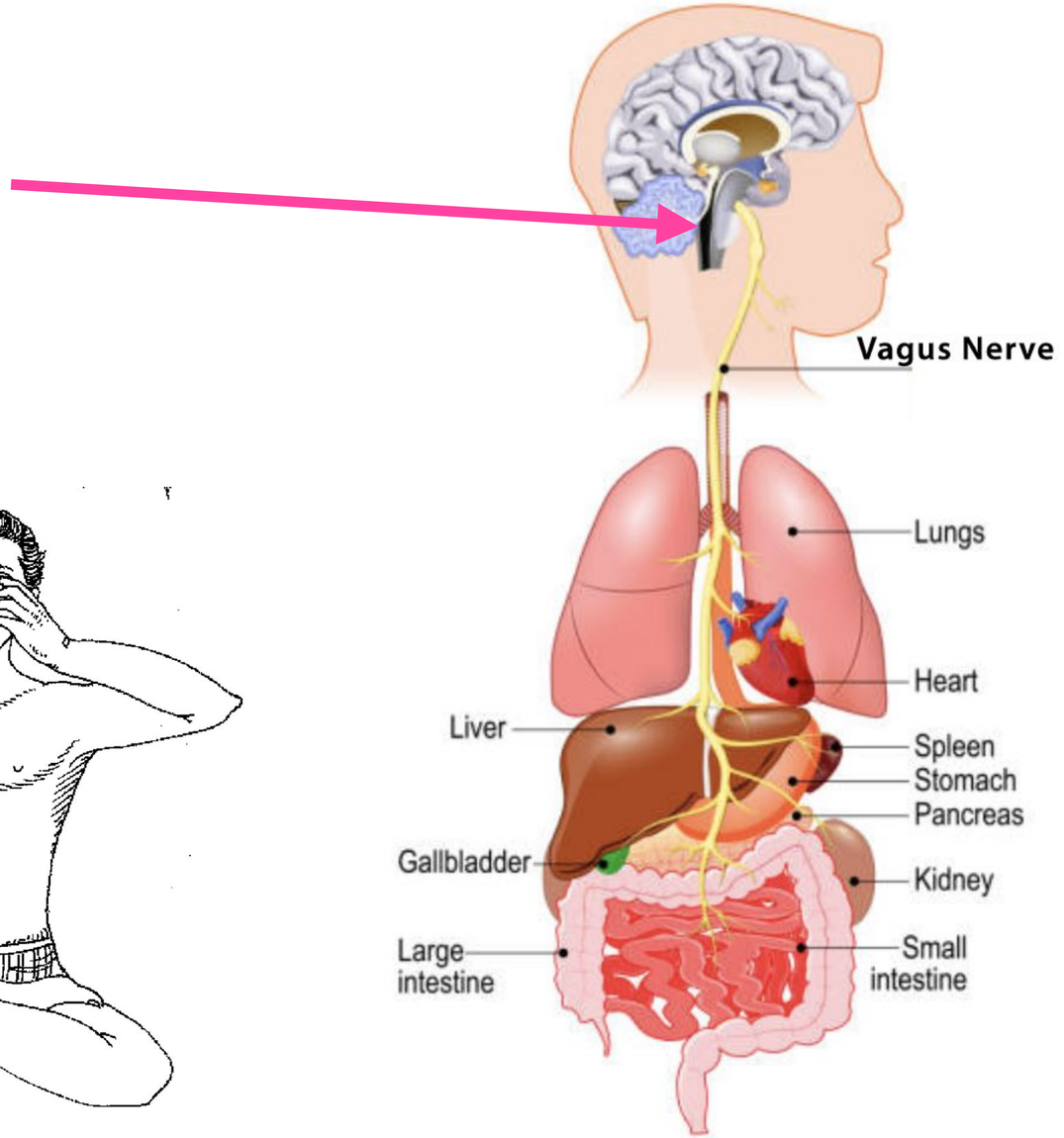
The vagal nerves are paired nerves that exit the brain from the Medulla Oblongata (brain stem), the control center for homeostasis and all Autonomic Nervous System (ANS) functions. They travel to the ears, throat, thorax, and abdomen, unlike any other cranial nerve.

One of the purposes of Yoga is to coordinate harmonious signaling through the body-mind-spirit complex, and the vagal nerve complex *seems* to be an anatomical structure that is mediating facets of this harmony .

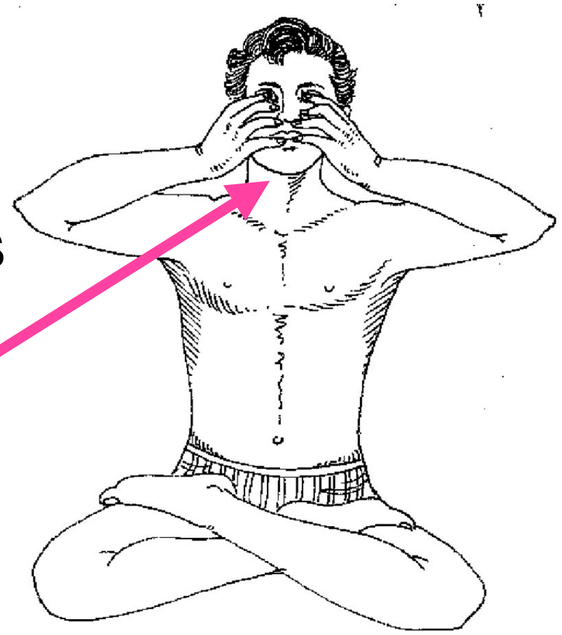


Mixed fibers of the Vagal Nerve Complex

General Somatic Afferents general sensations from the skin of the ear and auricular branch, as well as touch, pain, temperature (sensory)



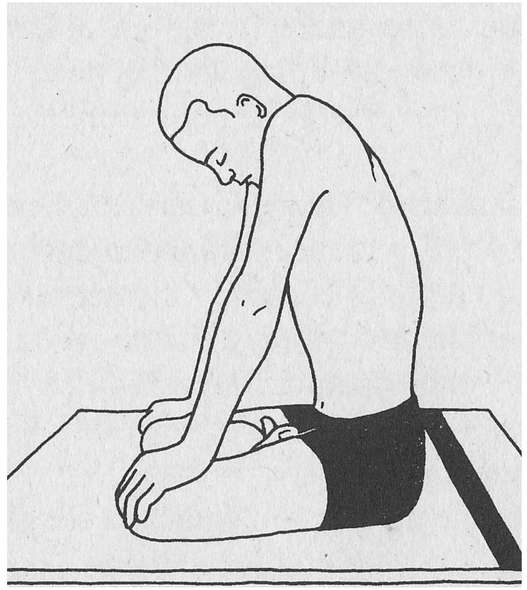
Shanmukhi mudra stimulates the vagal afferents of the ear, and trigeminal afferents at the lips, eyes, and nose



Mixed fibers of the Vagal Nerve Complex

The throat, providing motor functions to innervate the larynx and pharynx, which are responsible for swallowing and vocalization, and receive signals from the baroreceptors (blood pressure). Also provides pressure at the vocal cords for phonation.

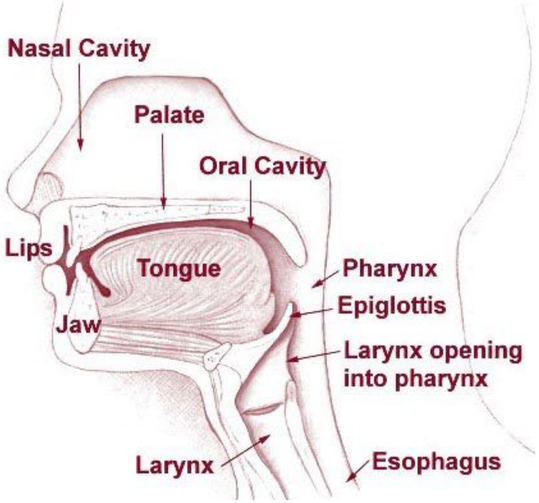
Jalandhara bandha



Special Visceral Afferents sensation of taste from back of the tongue and epiglottis (sensory)

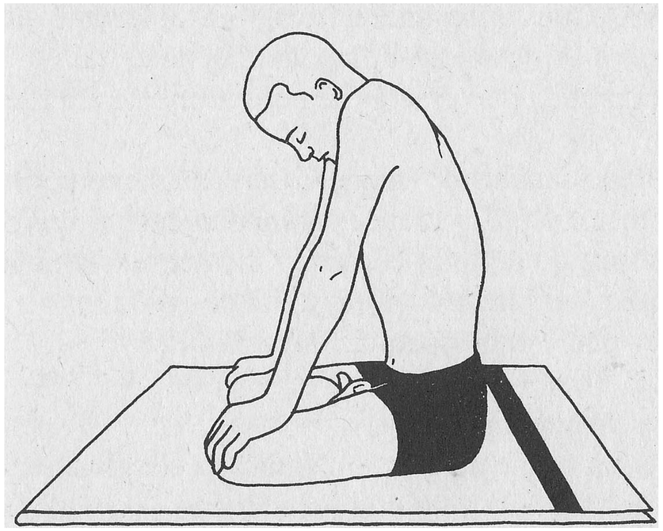
Special Visceral Efferents striated muscles of the larynx and soft palate, skeletal muscles of pharyngeal arches (motor)

Jihva bandha

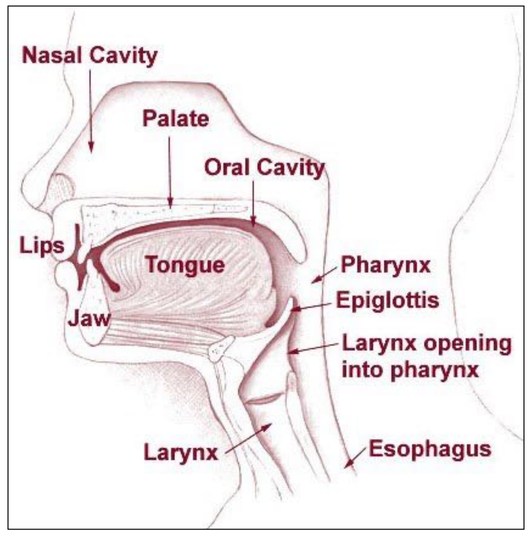


Mixed fibers of the Vagal Nerve Complex

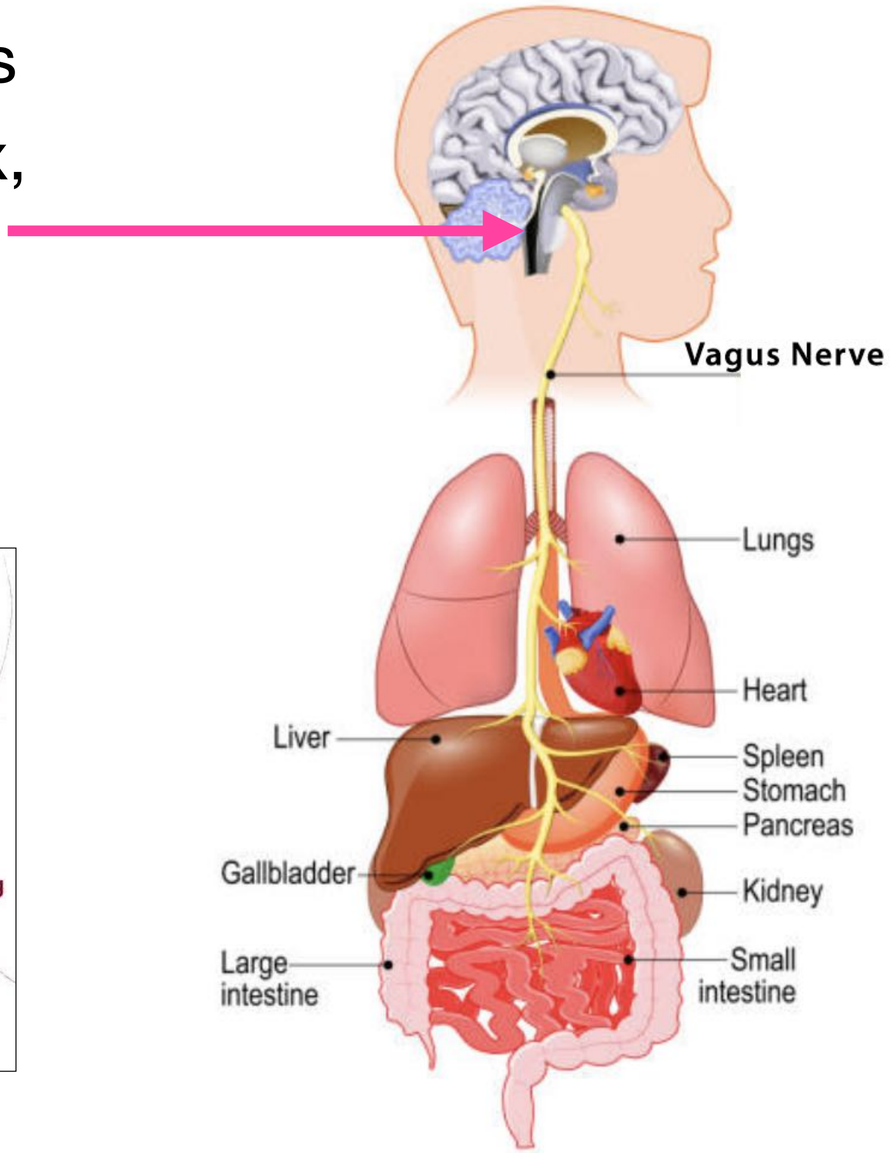
General Visceral Afferents general sensations from mucous membrane of the pharynx, larynx, trachea, thoracic vicera, baro- and chemo-receptors and carotid artery (sensory)



Jalandhara bandha



Jihva bandha

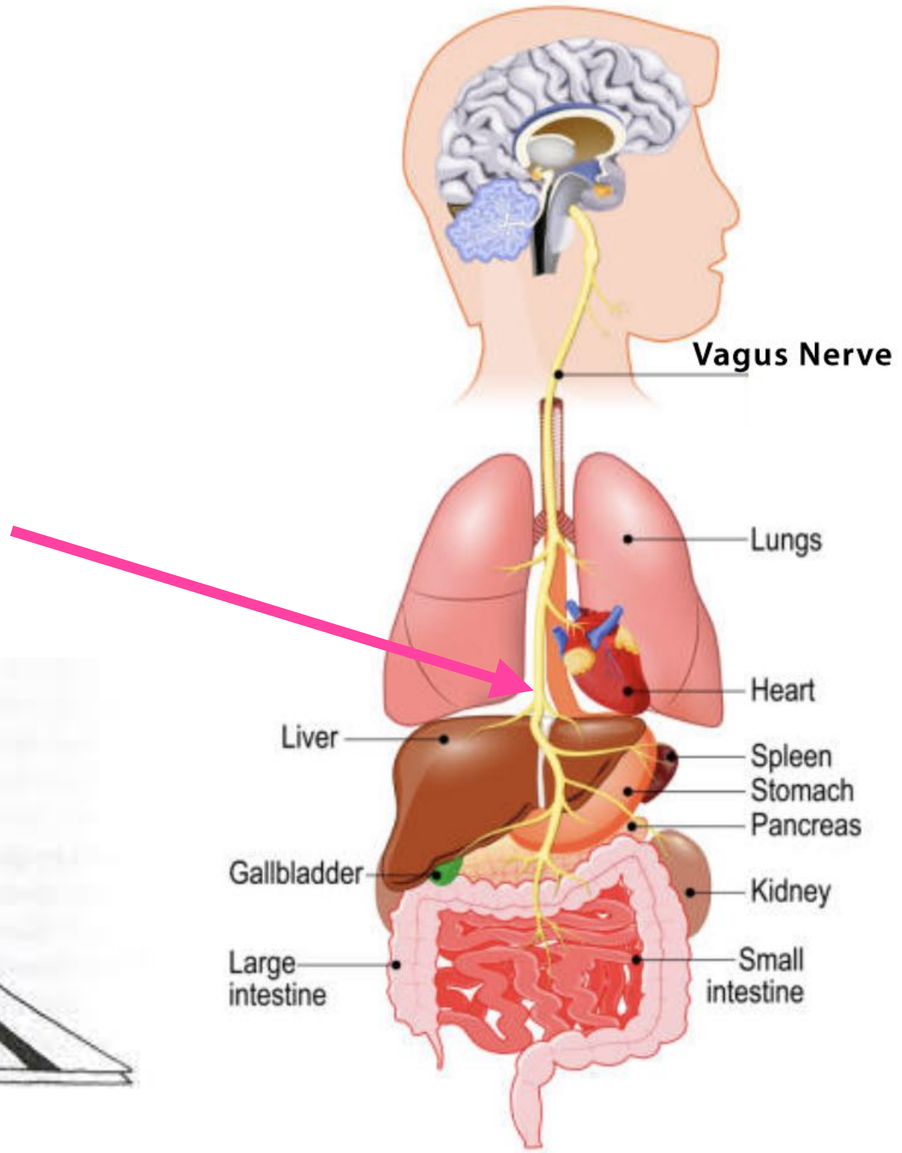


Mixed fibers of the Vagal Nerve Complex

The thorax, providing the main PSNS supply to the heart (stimulating heart rate reduction), diaphragm, and lungs

General Visceral Efferents motor innervation of the lungs and heart, innervation of the abdomen, gut brain, muscles of viscera and glands (motor)

Uddiyana bandha

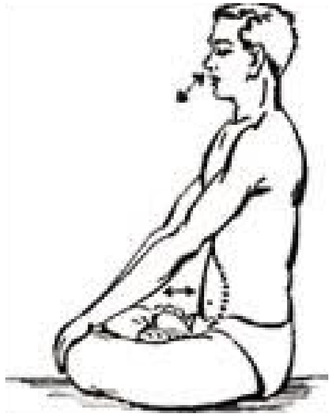


Mixed fibers of the Vagal Nerve Complex

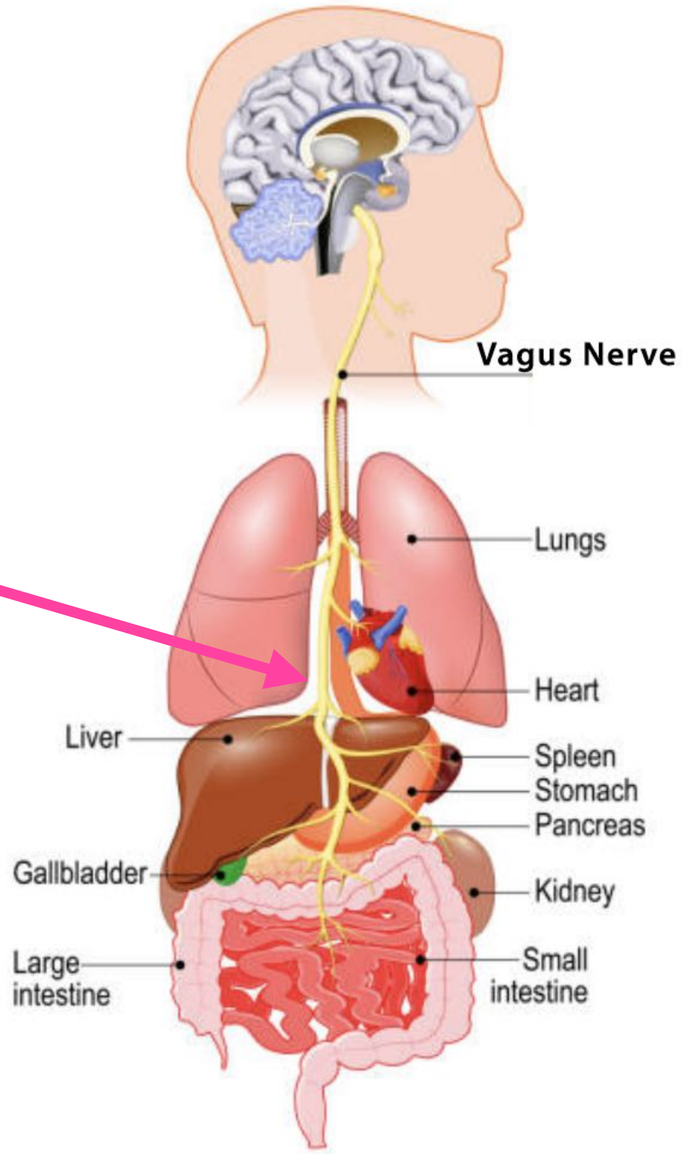
In the intestines, regulates contraction of smooth muscles (and thus directly related to digestion) and glandular secretions (hormones), till the midgut (transverse intestines)

The **abdominal vagal afferents** reach the esophagus, stomach, parts of the intestines, liver, and pancreas

Uddiyana bandha

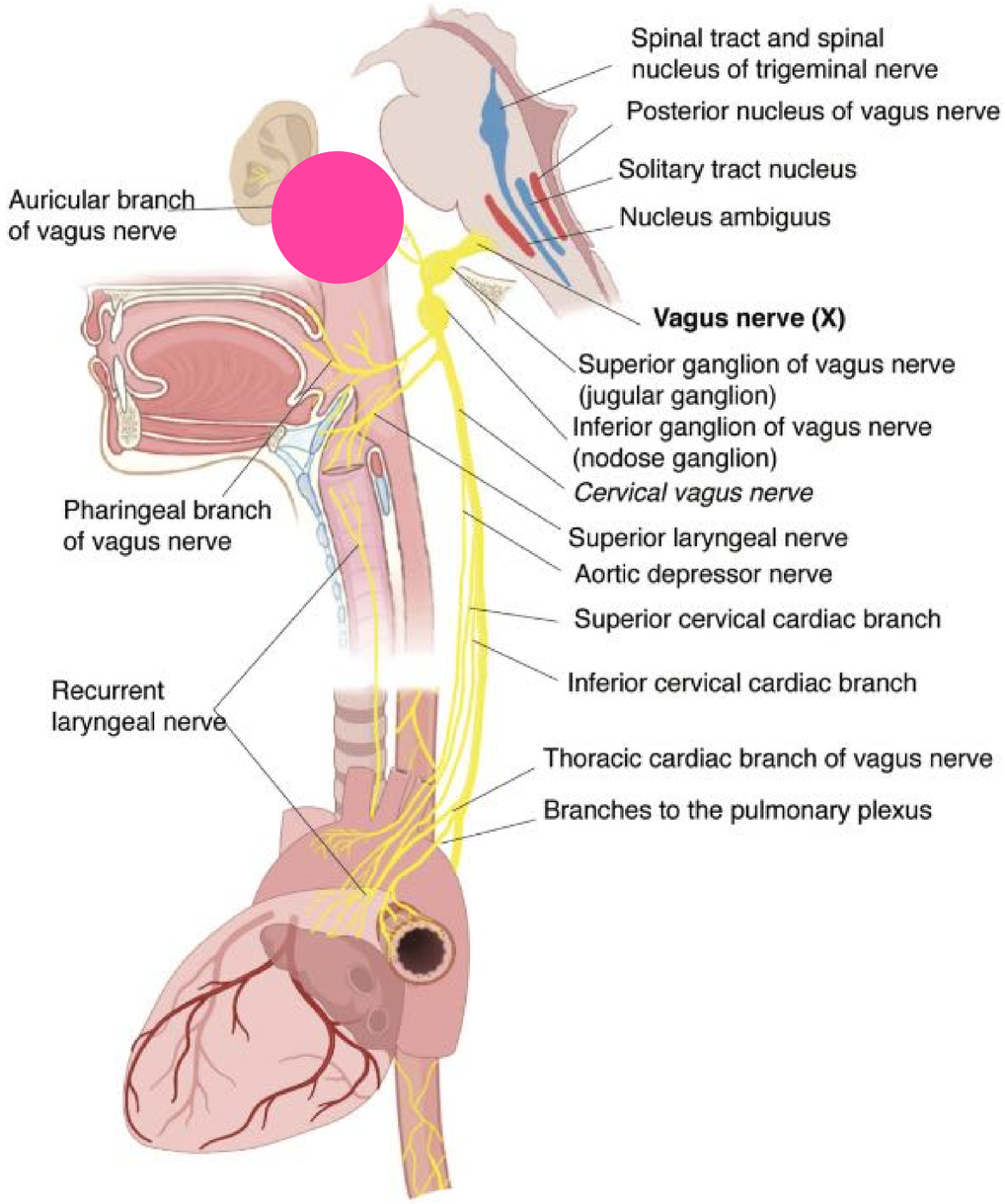


Kapalabhati



Ear

1. Touch
2. Pain
3. Temperature
4. Supplies areas of the inner ear
5. Patch of skin behind the ear
6. Meninges
7. Tympanic membrane (ear drum)

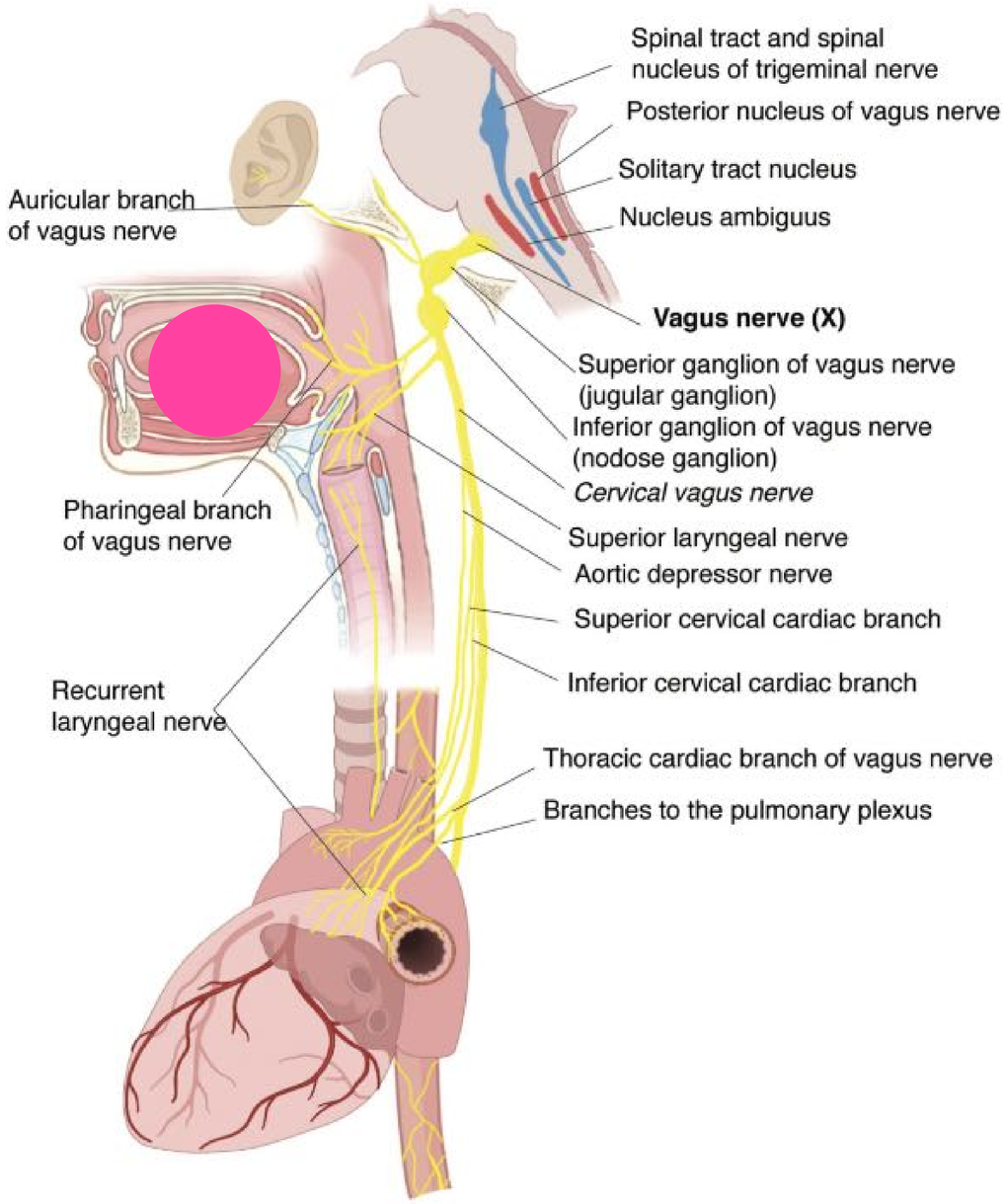


Taste, Epiglottis, and Pharynx

1. Taste buds on glottis, epiglottis, and pharynx

2. All six tastes are picked up here as well as on the tongue

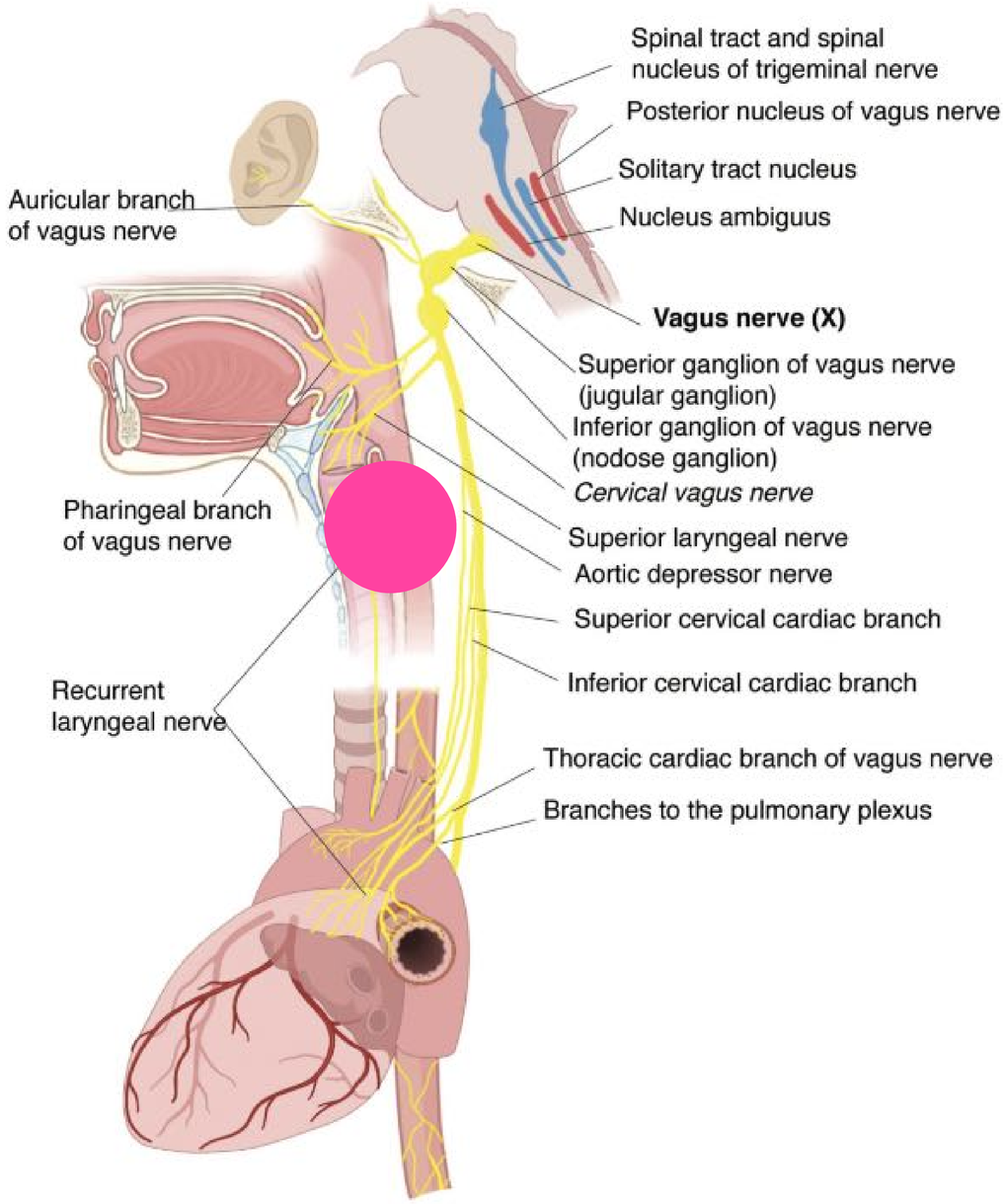
3. Supplies muscles that lift tongue up to the palate



Throat

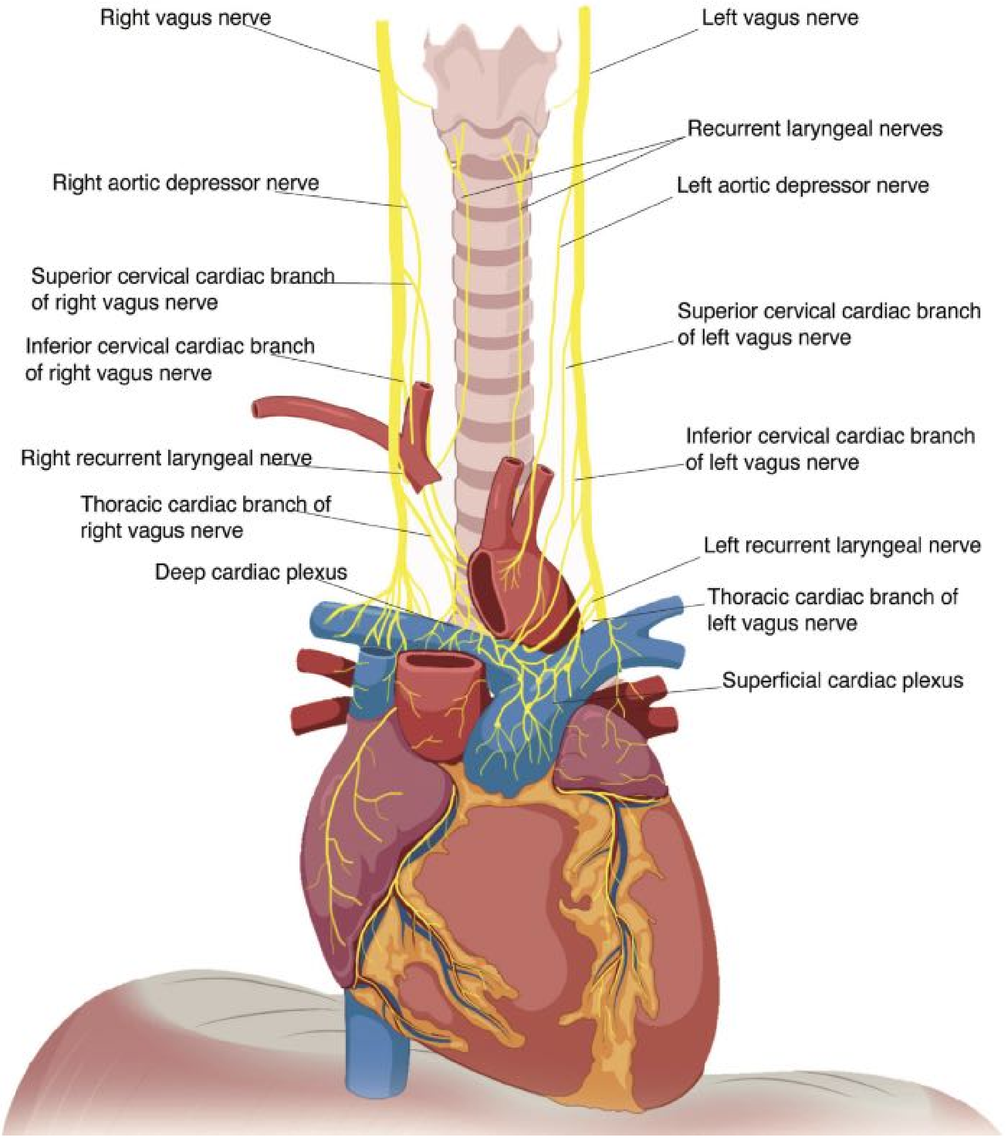
1. Supplies muscles of the larynx that are involved with phonation (speech)

3. The laryngeal nerves along with several groups of muscles pull the vocal cords tight so that when air moves against them they vibrate to make sounds



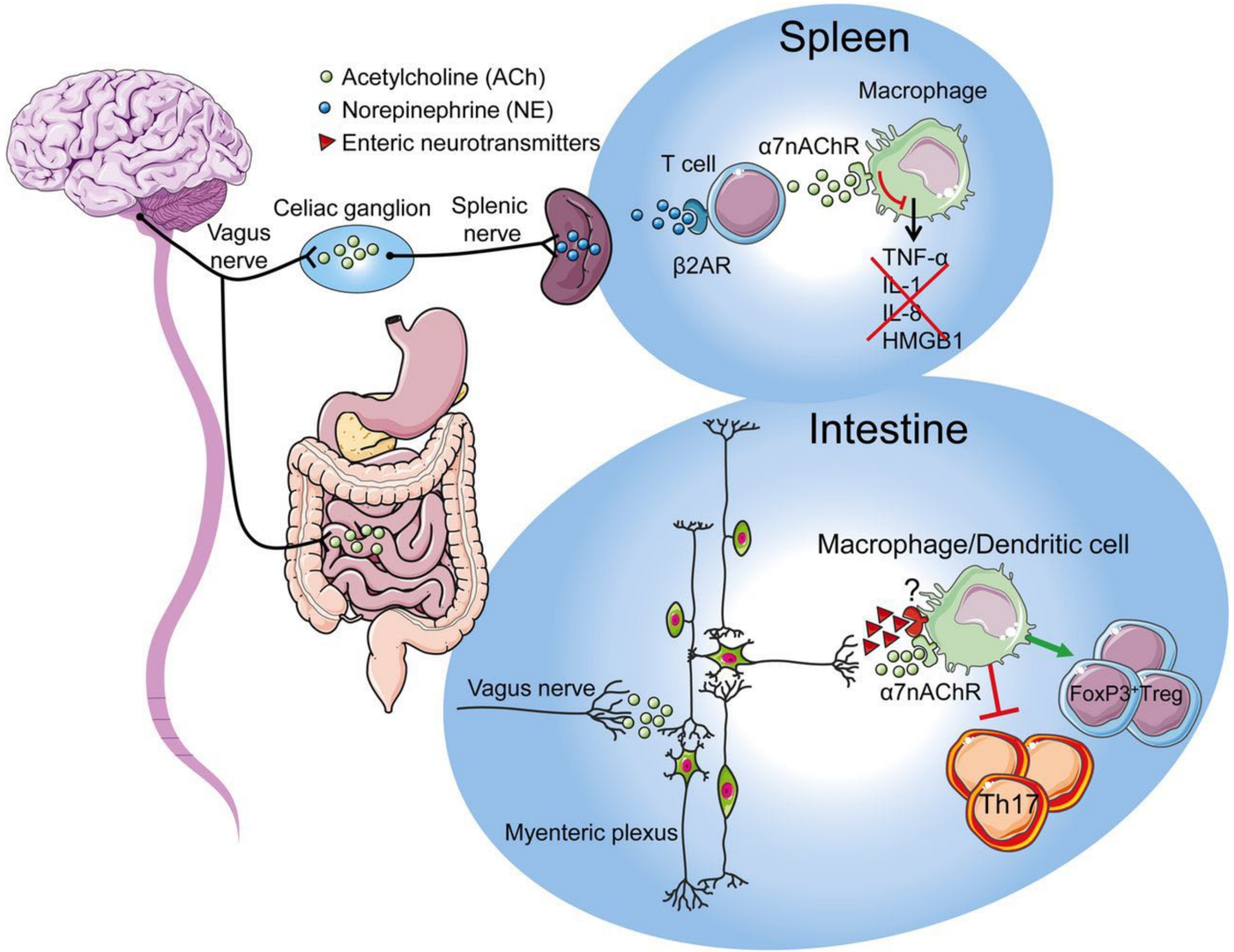
Thorax

1. **Regulates** normal breathing
2. **Constricts** bronchii
3. **Innervates** stress and irritant receptors of the trachea
4. **Heart:** slows the heart rate. Sino Atrial (SA) node (initiator of the heart beat) is innervated by the right vagus, Atrial Ventricular node (passes on the transmission of the SA node and coordinates signaling through the other chambers of the heart) is innervated by the left vagus. Slowing the breath slows the signals to the heart, thus slowing the heart rate



Gut Brain Axis

1. Controls mood, levels of anxiety, states of mind
2. Microbiome communicates through vagus nerve ending in the intestines
3. Abundance of emerging research on how the gut microbiome regulates neurotransmitters and their effect on mood, psychiatric disorders, and health
4. Signals levels of fullness, satiety, hunger
5. A shared mechanism of mood and appetite involves the vagus nerve



Features of the Vagal Nerve Complex

1. Control of mood, immune response, digestion, and heart rate
2. It establishes one of the connections between the brain and the gastrointestinal tract and sends information about the state of the inner organs to the brain *via* afferent fibers.
3. Vagal tone is correlated with capacity to regulate stress responses and can be influenced by breathing.
4. Meditation and yoga likely contribute to resilience and the mitigation of mood and anxiety symptoms.
5. Connects emotional and cognitive areas of the brain with gut functions
6. In the neck, the vagus nerve provides required innervation to most of the muscles of the pharynx and larynx, which are responsible for swallowing and vocalization.
7. In the thorax, it provides the main parasympathetic supply to the heart & stimulates a reduction in the heart rate.
8. In the intestines, the vagus nerve regulates the contraction of smooth muscles and glandular secretion.
9. The abdominal vagal afferents include mucosal mechanoreceptors, chemoreceptors, and tension receptors in the esophagus, stomach, and proximal small intestine, and sensory endings in the liver and pancreas (which means that it picks up pressure stress signal changes from these organs and sends them to the brain).
10. The vagus nerve is responsible for the regulation of internal organ functions, such as digestion, heart rate, and respiratory rate, as well as vasomotor activity (related to pancha pranas).
11. Certain reflex actions, such as coughing, sneezing, swallowing, and vomiting (related to the pancha upa pranas)

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5859128/#B140

Features of the Vagal Nerve Complex

“The most important function of the vagus nerve is afferent, bringing information of the inner organs, such as gut, liver, heart, and lungs to the brain. This suggests that the inner organs are major sources of sensory information to the brain. The gut has the largest surface toward the outer world and might, therefore, be a particularly important sensory organ.”

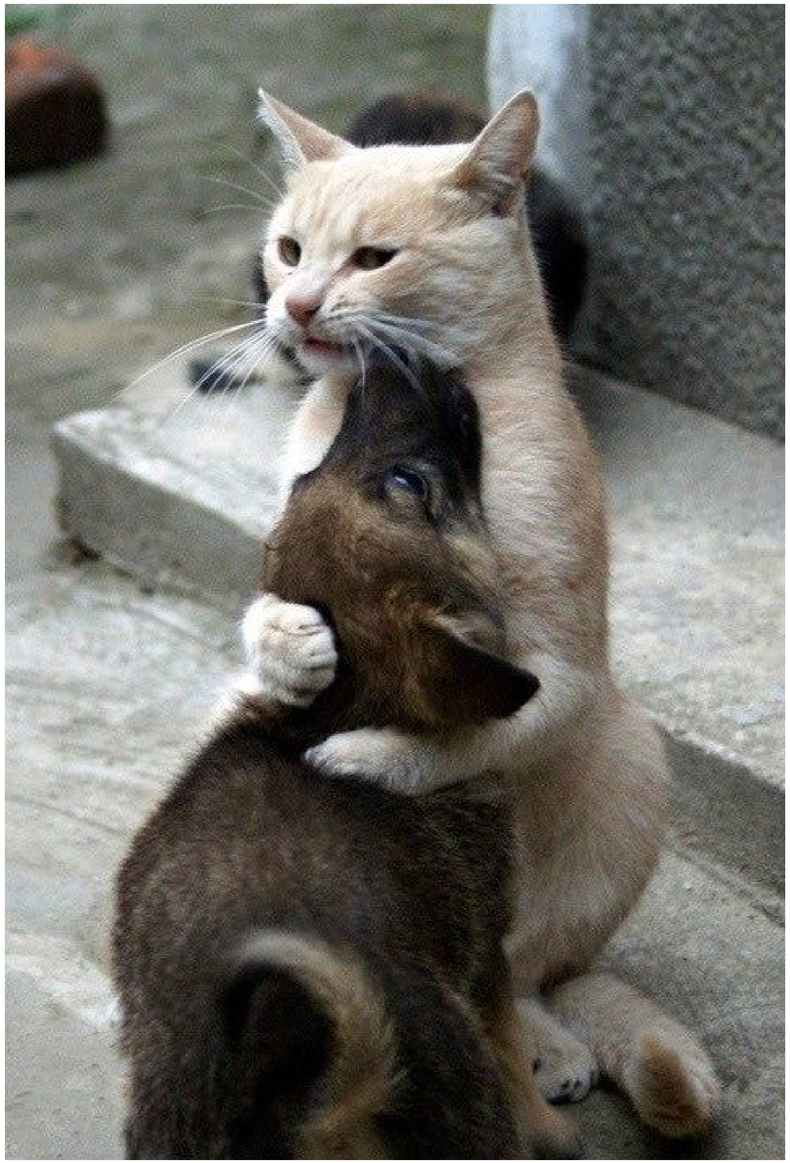
'It has been shown that self-generated positive emotions *via* loving-kindness meditation lead to an increase in positive emotions relative to [a] control group, an effect moderated by baseline vagal tone. In turn, increased positive emotions produced increases in vagal tone, which is probably mediated by increased perceptions of social connections.”

"Some yoga practices can directly stimulate the vagus nerve by increasing the vagal tone, leading to an improvement of autonomic regulation, cognitive functions, and mood and stress coping. The proposed neurophysiological mechanisms for the success of yoga-based therapies in alleviating depressive symptoms suggest that yoga breathing induces increased vagal tone.”

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5859128/#B140

How we can increase Vagal Tone

1. Be kind to people
2. Hold positive thoughts in our minds about ourselves and others
3. Practice yoga with awareness
4. Resonance breathing
5. Pranayama
6. Chant mantras and sing
7. Experience joy and pleasure in your practices
8. Meditation
9. Massage the carotid arteries
10. Cold showers, baths, dips or face wash
11. Laugh



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ॐ सर्वे भवन्तु सुखिनः
सर्वे सन्तु निरामयाः ।
सर्वे भद्राणि पश्यन्तु
मा कश्चिद्दुःखभाग्भवेत् ।
ॐ शान्तिः शान्तिः शान्तिः ॥

oṃ sarve bhavantu sukhinaḥ
sarve santu nirāmayāḥ
sarve bhadrāṇi paśyantu
mā kaścid duḥkha bhāgbhavet
oṃ śāntiḥ śāntiḥ śāntiḥ

May all be happy, may all be free from disease, may all see goodness,
may none suffer from sorrow.

ॐ असतो मा सद्गमय ।
तमसो मा ज्योतिर्गमय ।
मृत्योर्मा अमृतं गमय ।
ॐ शान्तिः शान्तिः शान्तिः ॥ हरिः ॐ तत्सत् ॥

asato mā sadgamaya
tamasomā jyotir gamaya
mrityormāāmritam gamaya
Oṁ śhānti śhānti śhāntiḥ harih om tat sat

Lead me from changing existence to unchanging being,
lead me from the darkness of tamas to the light of knowledge,
lead me from death to immortality. Harih om that is truth.