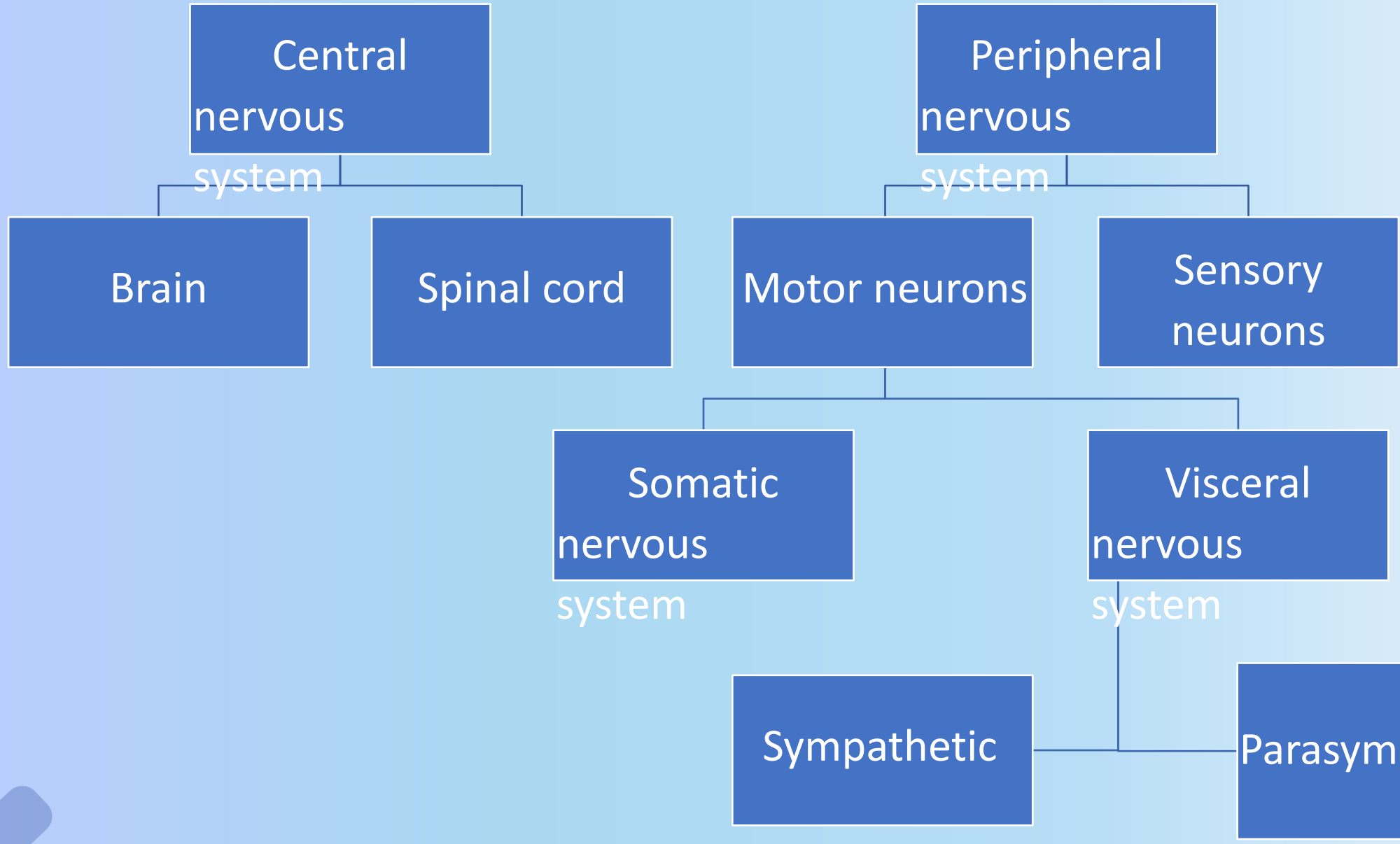
Parasympathetic and sympathetic ganglia

Sai Voleti

Table of contents


Central nervous system
Peripheral nervous system
Brain
Spinal cord
Motor neurons
Sensory neurons
Somatic nervous system
Visceral nervous system
Sympathetic
Parasympathetic

- Autonomic nervous system supply smooth muscle cells and glands

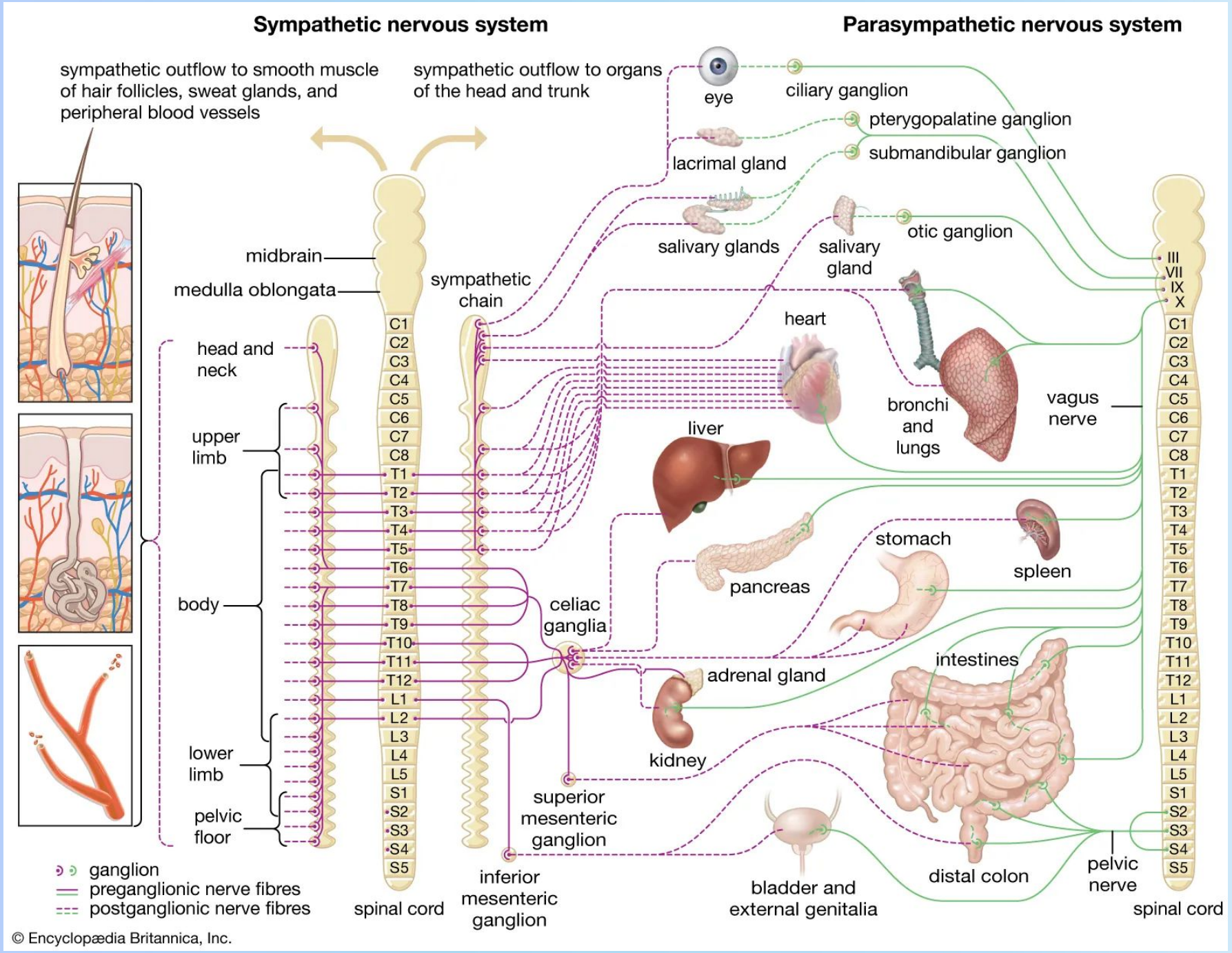
Both affect the viscera! (Internal organs)

Parasympathetic

1. Originates in the cranial and sacral region
2. Long presynaptic neuron
3. Postsynaptic neuron releases acetylcholine
4. Produces saliva, constricts the pupil (miosis), and decreases heart rate

Sympathetic

1. Originates in the thoracolumbar region (sympathetic chain)
2. Short presynaptic neuron
3. Postsynaptic neuron releases norepinephrine
4. Inhibits saliva, dilates pupil (mydriasis), increases heart rate


Sympathetic nervous system
Parasympathetic nervous system
sympathetic outflow to smooth muscle of hair follicles, sweat glands, and peripheral blood vessels
sympathetic outflow to organs of the head and trunk
midbrain
medulla oblongata
sympathetic chain
head and neck
upper limb
body
lower limb
pelvic floor
C1
C2
C3
C4
C5
C6
C7
C8
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
S2
S3
S4
S5
celiac ganglia
superior mesenteric ganglion
inferior mesenteric ganglion
spinal cord
eye
ciliary ganglion
pterygopalatine ganglion
submandibular ganglion
lacrimal gland
salivary glands
salivary gland
otic ganglion
III
VII
IX
X
heart
bronchi and lungs
vagus nerve
liver
pancreas
stomach
spleen
adrenal gland
kidney
intestines
distal colon
bladder and external genitalia
pelvic nerve
spinal cord
ganglion
preganglionic nerve fibres
postganglionic nerve fibres
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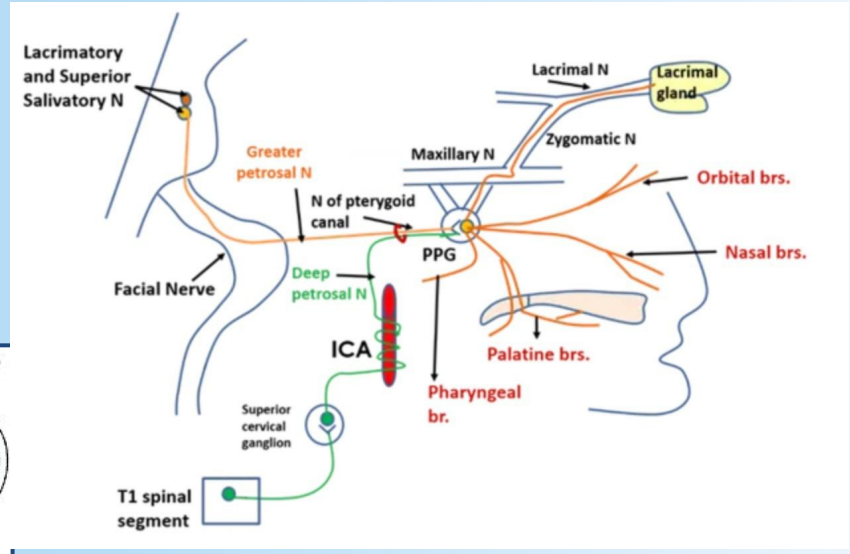
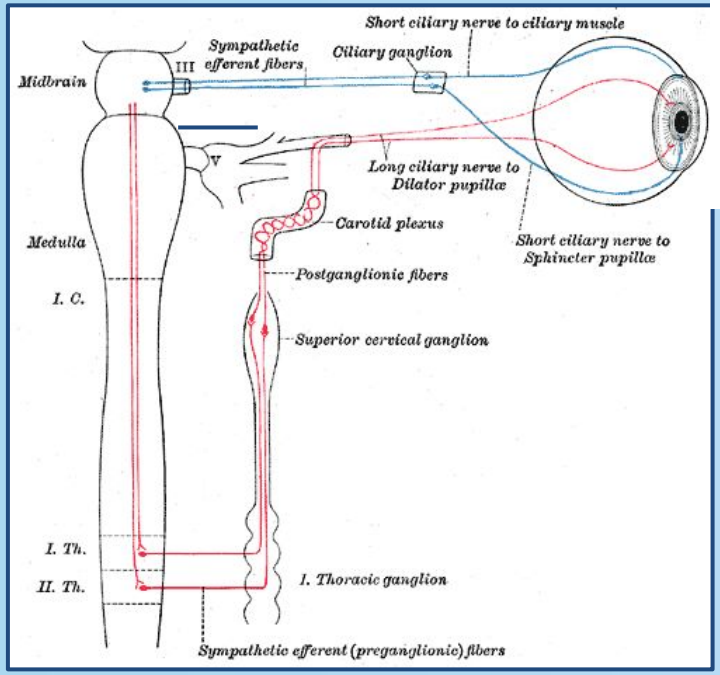
Sympathetic ganglia of head and neck

Sympathetic trunk (aka Chain) (HIGH YIELD)

What is it:

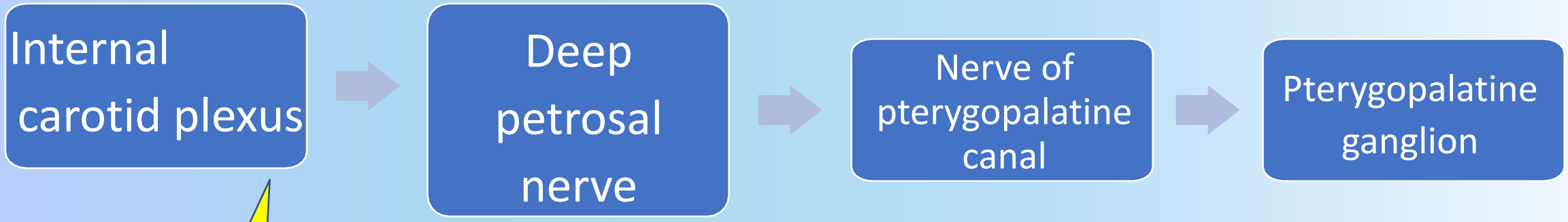
- Nerve fibers + ganglia
- Paired
- T1- L2/3
- Superiorly -- 1. superior cervical ganglion -- 2. carotid canal -- 3. ICA plexus -- eye, lacrimal gland, mucous membranes of mouth, nose pharynx etc, blood vessels in head





Superior cervical ganglion

1. ALL presynaptic sympathetic nerves to the head & neck synapse here, and they NEVER synapse before reaching the target!
2. Originate in T1-T6 enter the sympathetic trunk and ascend
3. Postsynaptic hitchhike with the carotids
4. Sympathetic trunk is located posterior to CCA, follow the trunk superior until it dilates in the region of ICA.



Horner syndrome

Classic triad of:

- Ptosis (partial)
- Miosis
- Anhidrosis from ½ of the face

But also:

- Enophthalmos (not real)

Sympathetic trunk X

Ipsilateral

There are a lot of nerve types

Types of nerves

- General visceral afferent
- General visceral efferent
- General somatic afferent
- ~~General somatic efferent~~

- ~~Special visceral afferent~~
- ~~Special visceral efferent~~
- Special somatic afferent

ALL GANGLIA HAVE THREE ROOTS

1. Parasympathetic (GVE)
2. Sympathetic (GVE)
3. Sensory (GSA)

"Autonomic"

Autonomic

Normal sensory

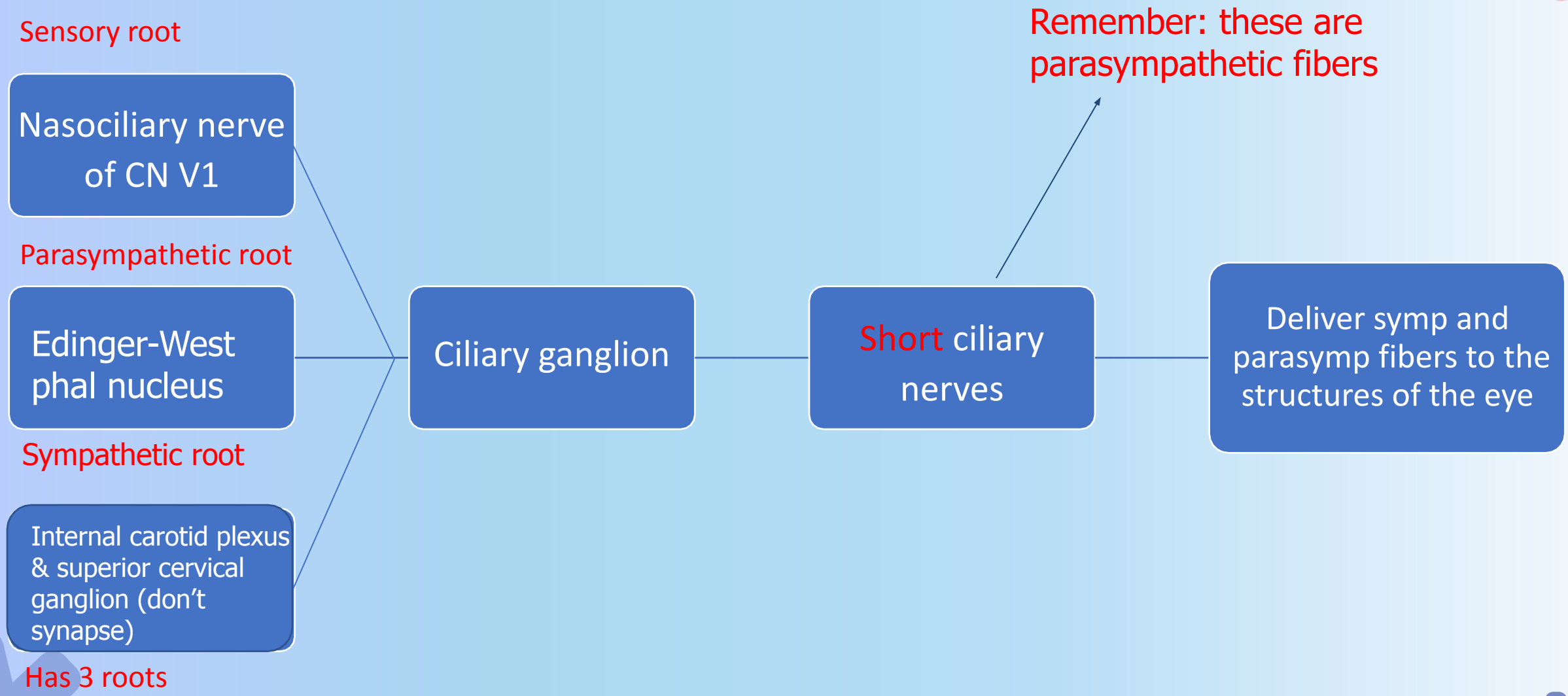
Normal motor

Type		Effect
General visceral afferent	CN VII, IX, X	Send sensory impulses from internal (visceral) organs to the CNS
General visceral efferent	CN III, VII, IX, X	Send motor impulses to smooth muscle, cardiac muscle, and glandular tissue
General somatic afferent		Transmit pain, temperature, touch, and proprioception from the body to the CNS
General somatic efferent		Send motor impulses to the skeletal (voluntary) muscles of the body
Special visceral afferent		Transmit smell and taste to the CNS
Special visceral efferent		Send motor impulses to the muscles developing from the pharyngeal arches
Special somatic afferent		Send signals of vision, hearing and balance to the CNS

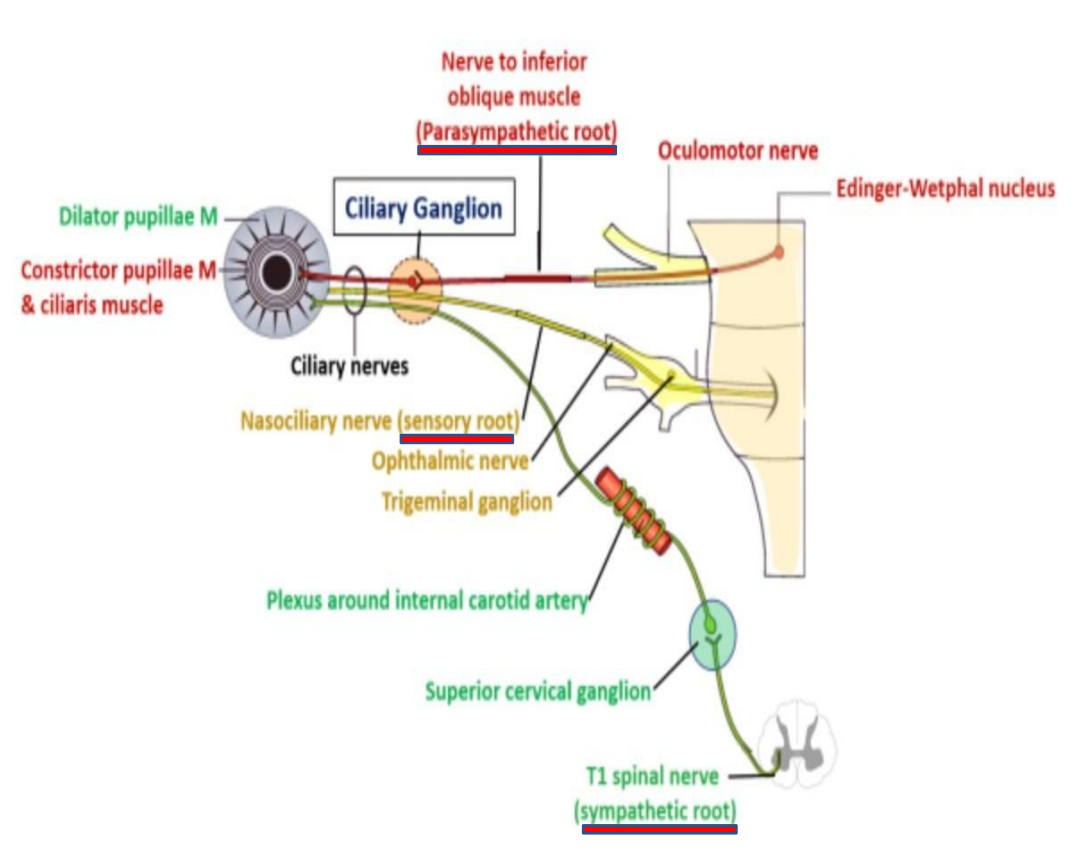
All parasympathetic ganglia of head and neck

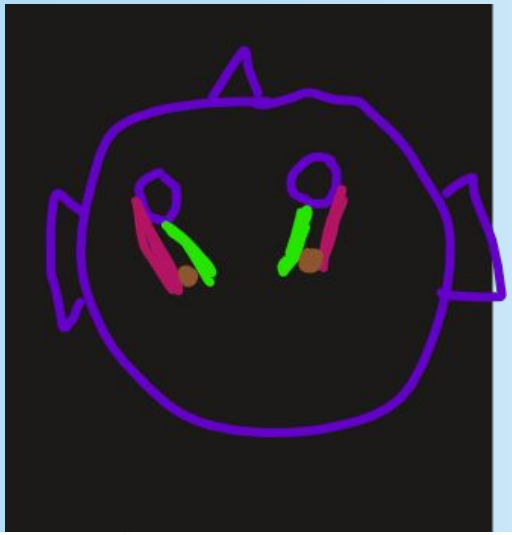
1. Superior cervical ganglion
2. Ciliary ganglion
3. Pterygopalatine ganglion
4. Submandibular ganglion
5. Otic ganglion

Ciliary ganglion



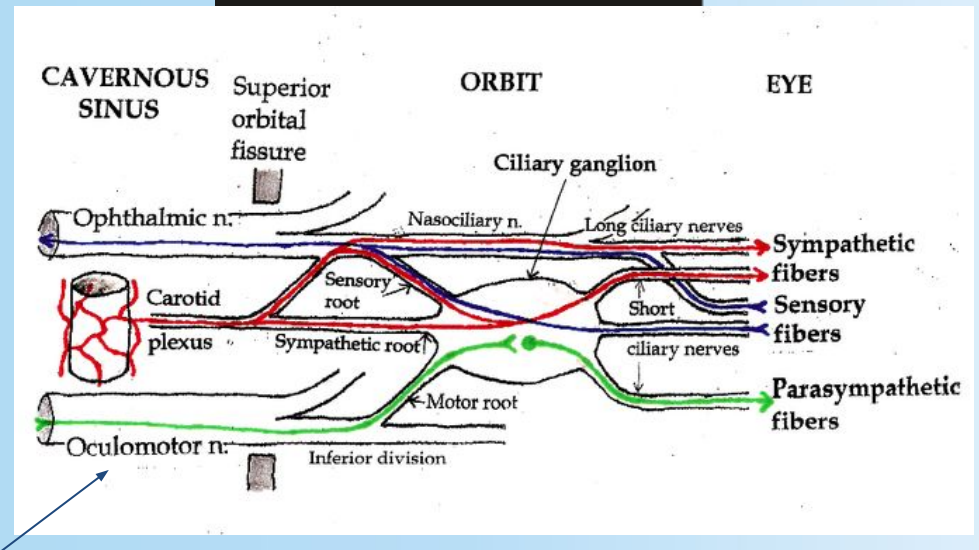
Roots and connections of ciliary ggl





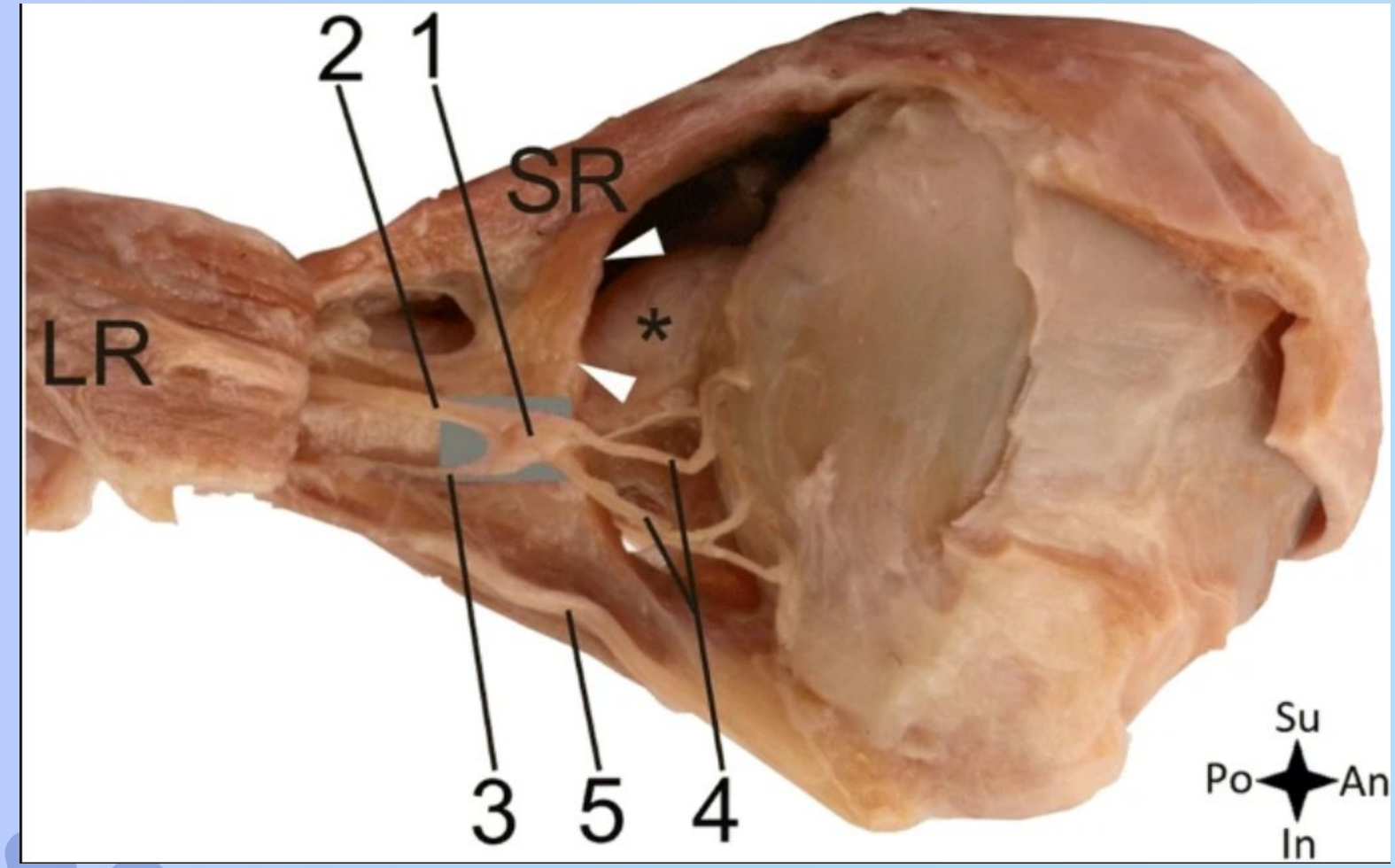
HIGH YIELD: The ciliary is present between the lateral rectus (LR) and optic nerve

LR (pink/purple)
Optic nerve (green)
Ciliary ganglion (brown)



HIGH YIELD: originate from Edinger-Westphal nucleus

Ciliary ganglion (dissection)



1. Ciliary ganglion
2. Sensory root
3. Parasympathetic root
4. Short ciliary nerves
5. Nerve to the inferior oblique

Pterygopalatine ganglion

Remember: lies in the pterygopalatine fossa, in front of the pterygoid canal

Sensory root

Pterygopalatine nerve of V3

Pterygopalatine ganglion

Greater- and lesser palatine nerve, nasopalatine nerve

Deliver symp and parasymp fibers to:

Lacrimal gland, paranasal sinuses, glands of nasal cavity, pharynx and gingiva

Parasympathetic root

Nerve of pterygoid canal

Greater petrosal nerve

Facial nerve

Nervus intermedius

Deep petrosal nerve

Internal carotid plexus

Superior cervical ganglion

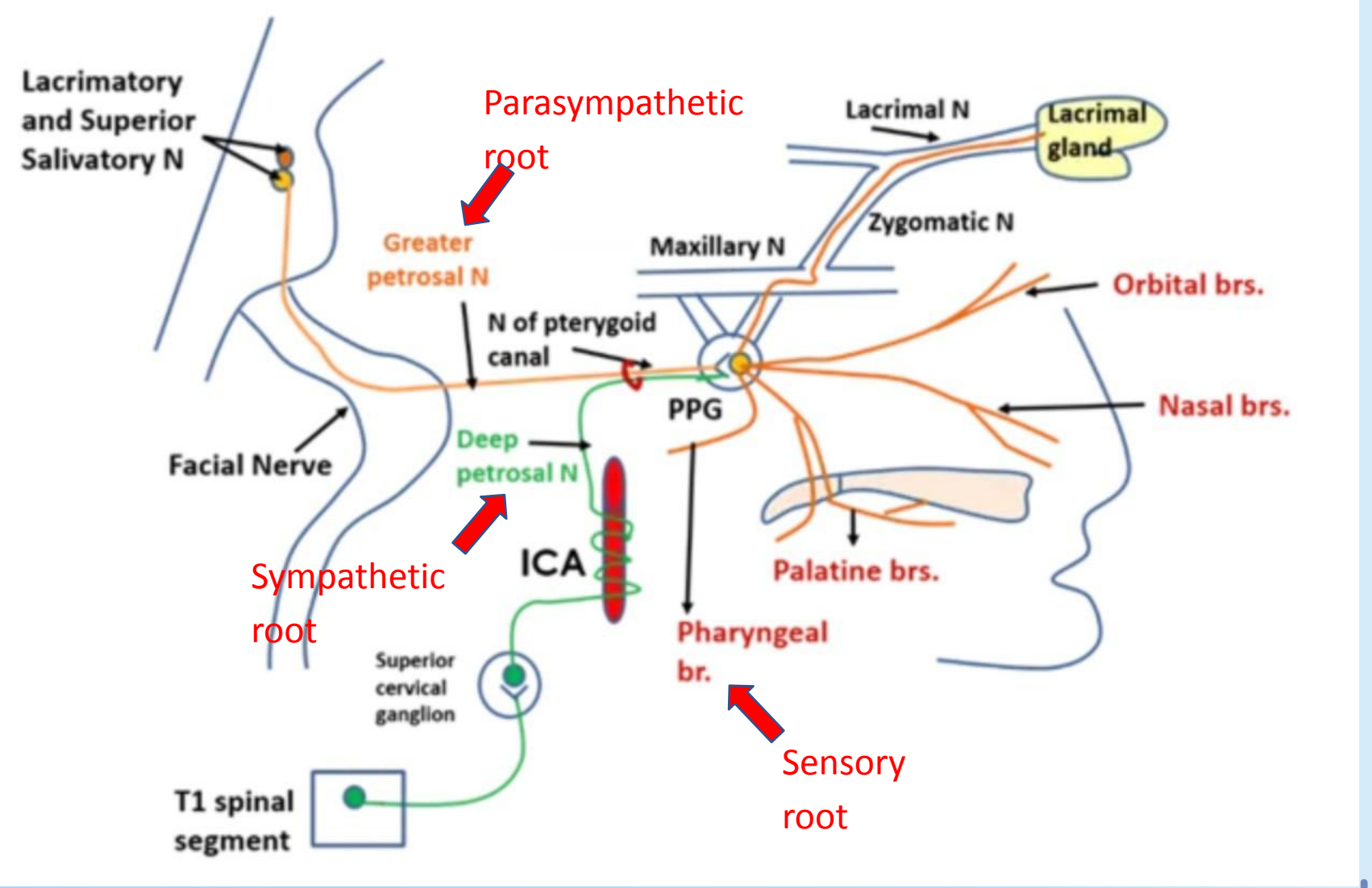
Sympathetic root

Never synapse after SCG

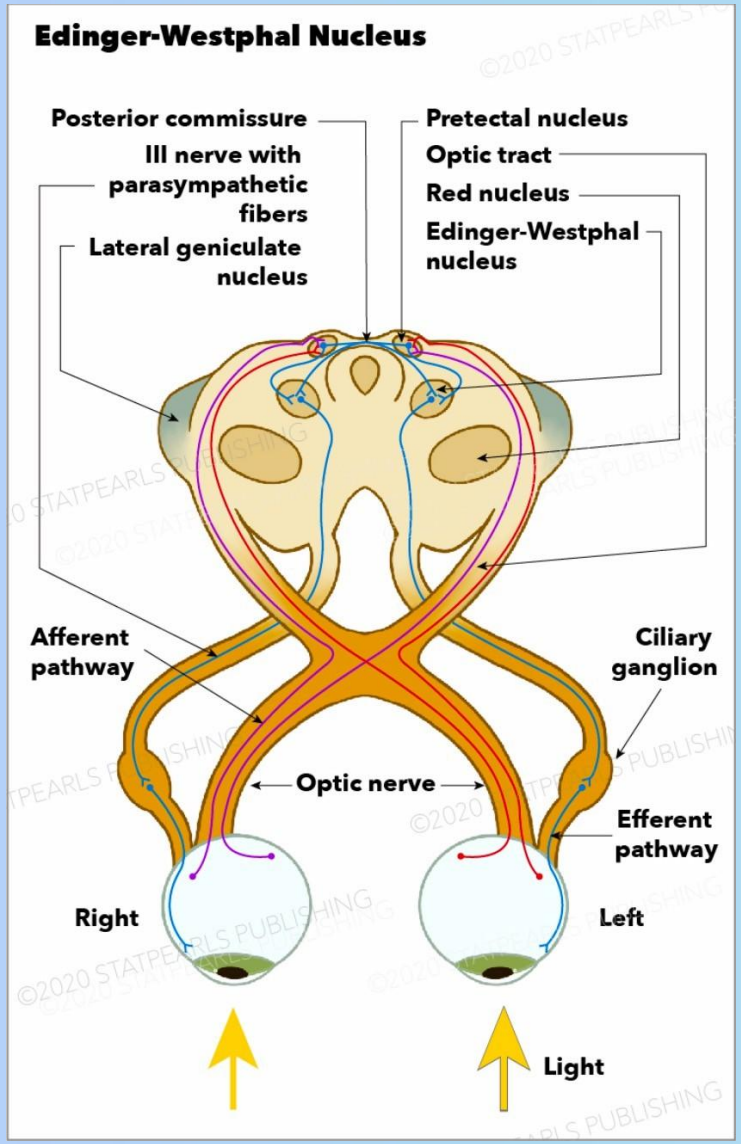
Artery in this case: ICA

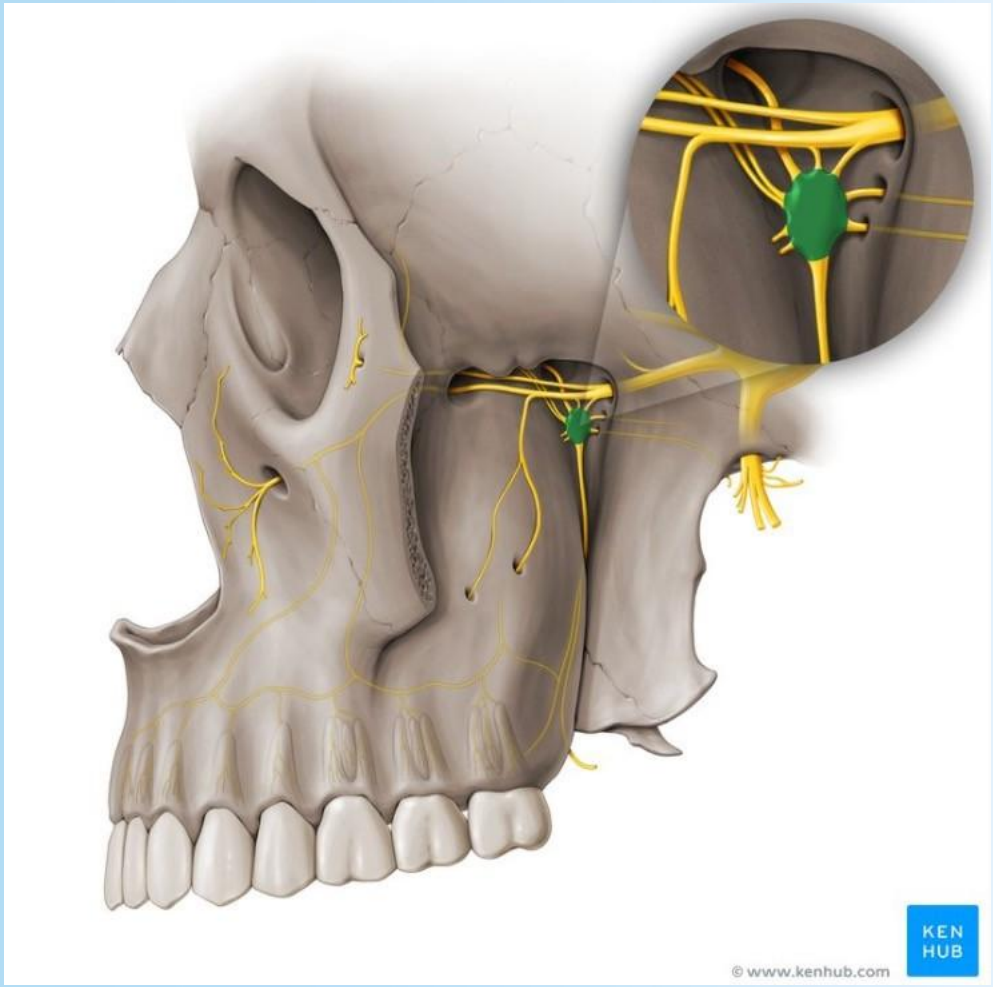
studyaid

Roots and connections of pterygopalatine ggl



Ciliary- and pterygopalatine ganglion





Submandibular ganglion

Sensory root

Lingual nerve of CN V3

Parasympathetic root

Chorda tympani – CN VII – sup. Salivatory nucleus

Sympathetic root

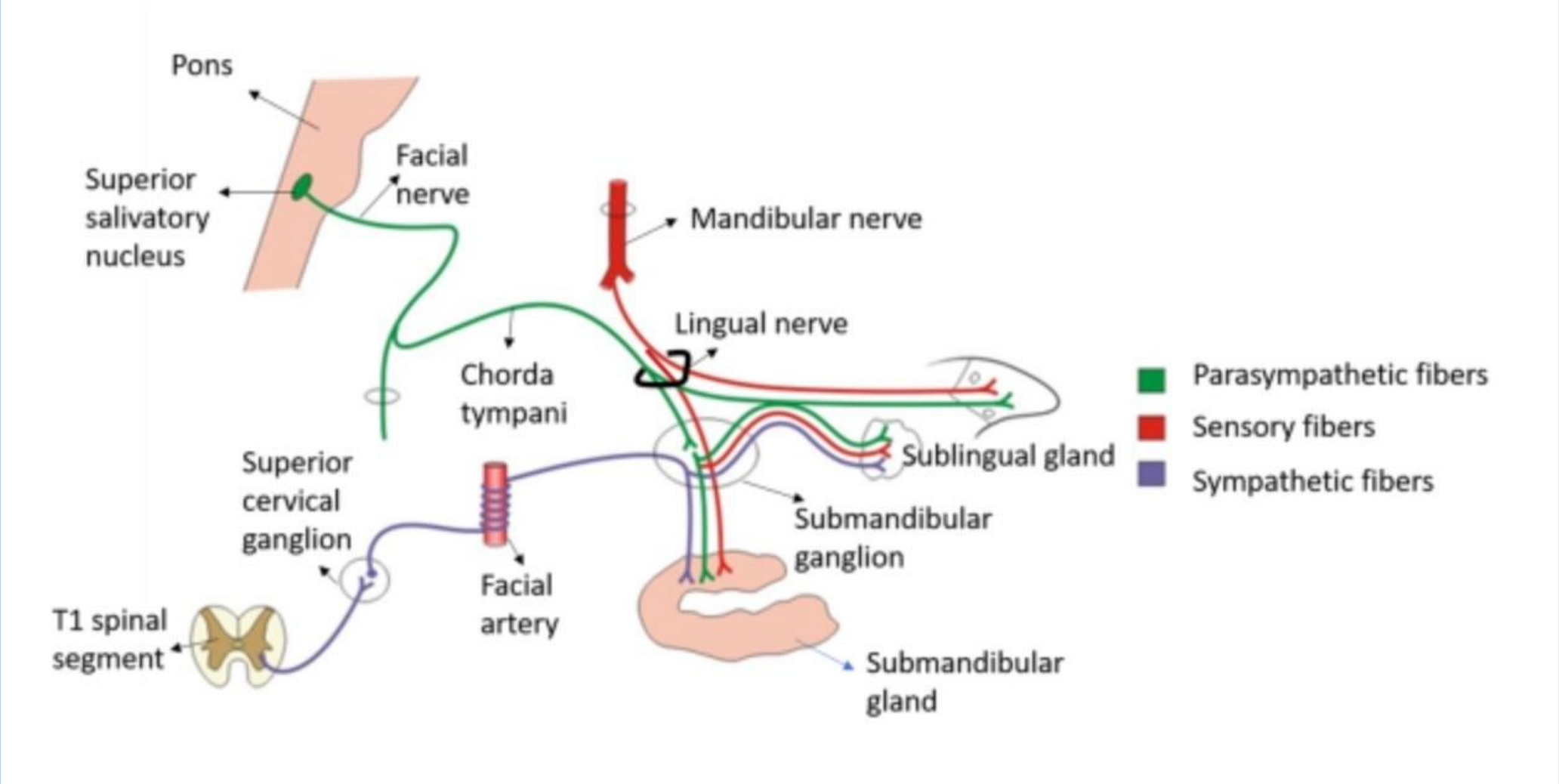
Deep petrosal nerve - Superior cervical ganglion

Submandibular ganglion

Deliver symp and parasymp fibers to the submandibular and sublingual gland

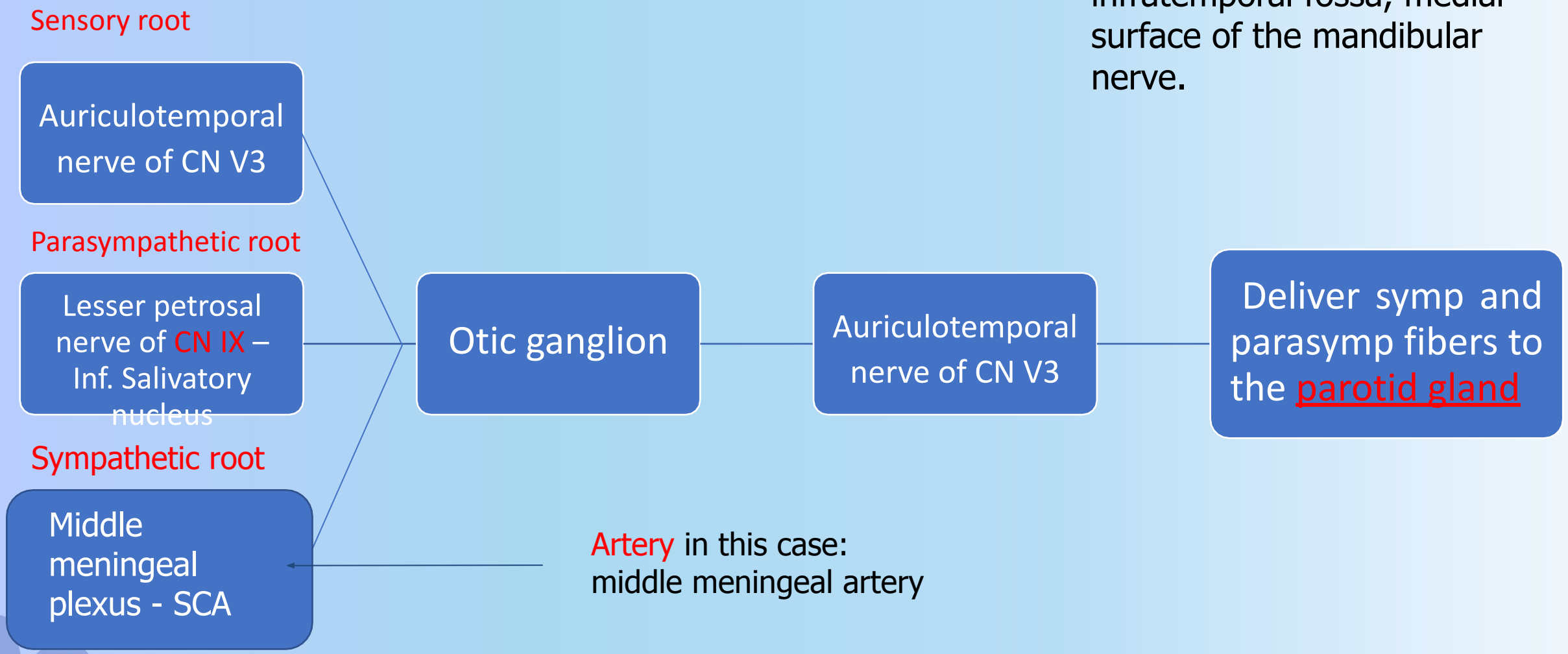
Artery in this case: facial artery

Roots and connections of submandibular ggl

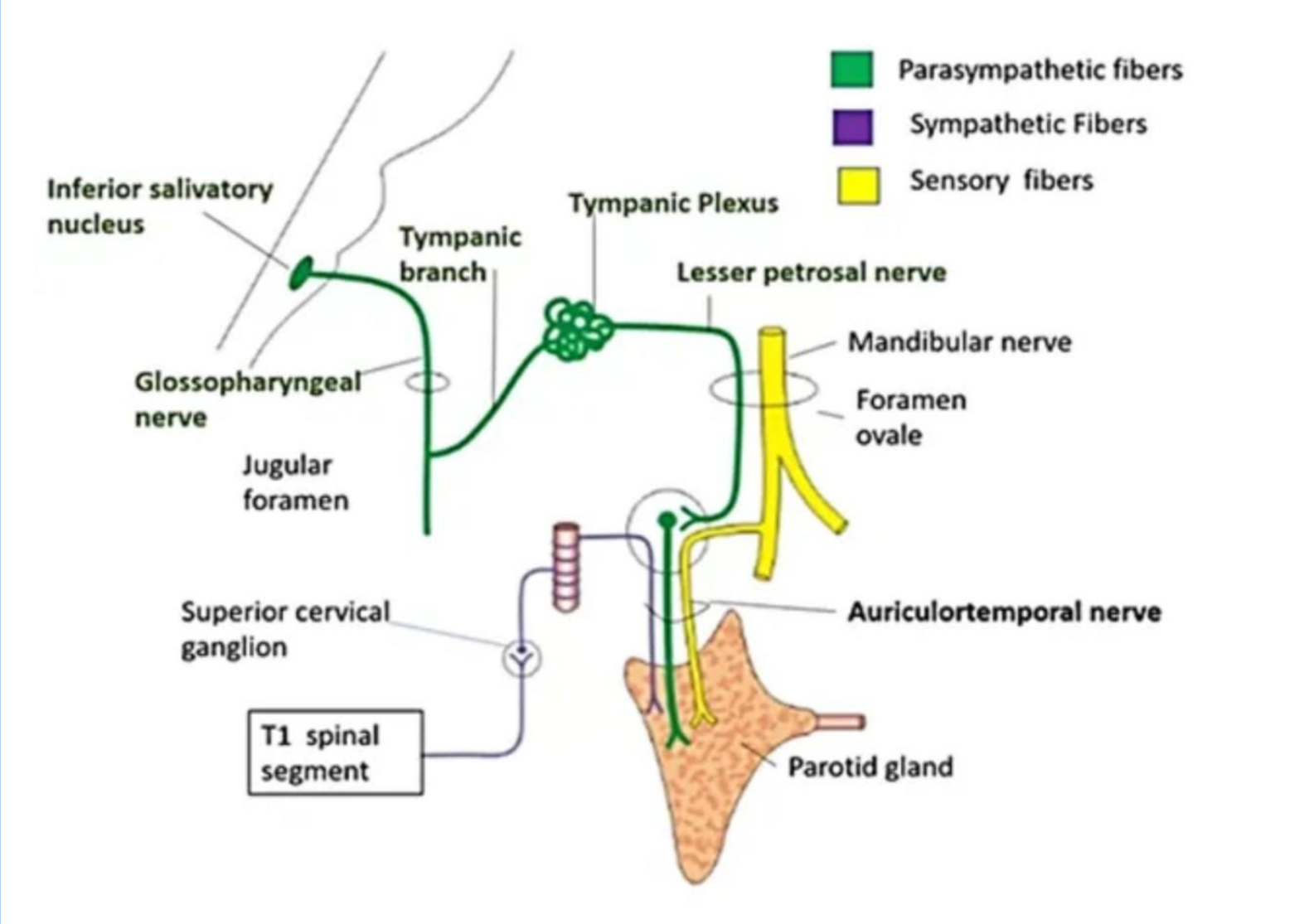


Otic ganglion

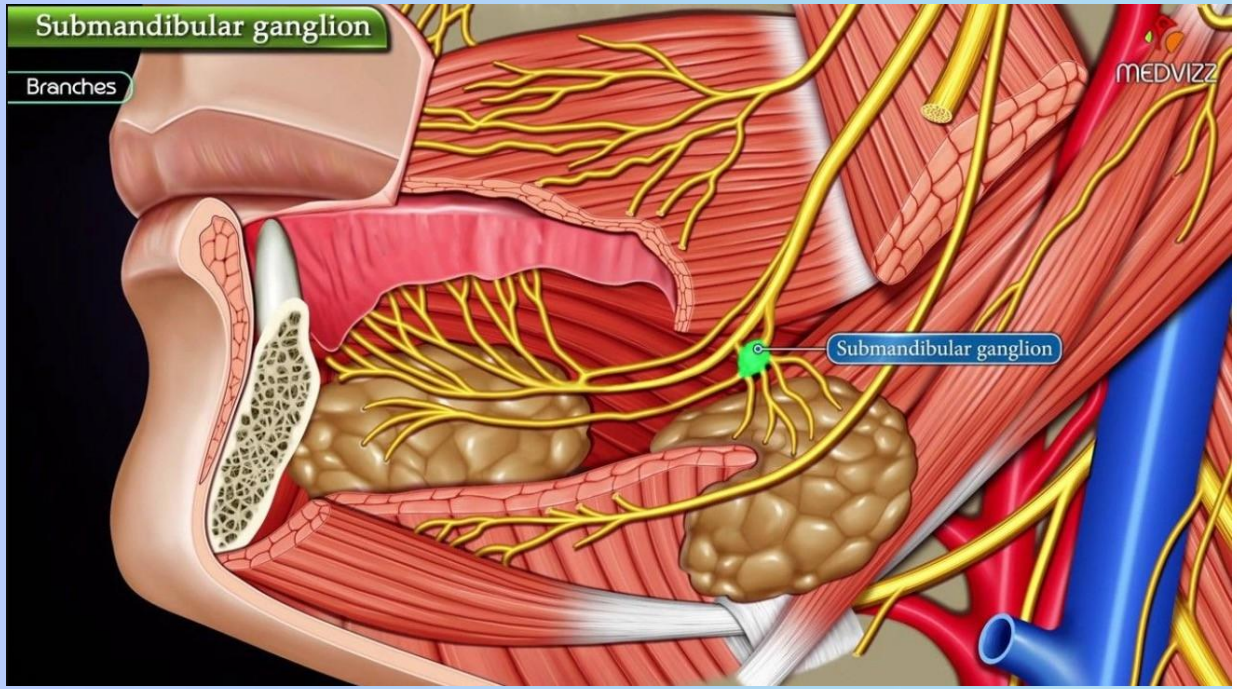
UWAGA: lies below the foramen ovale in the infratemporal fossa, medial surface of the mandibular nerve.

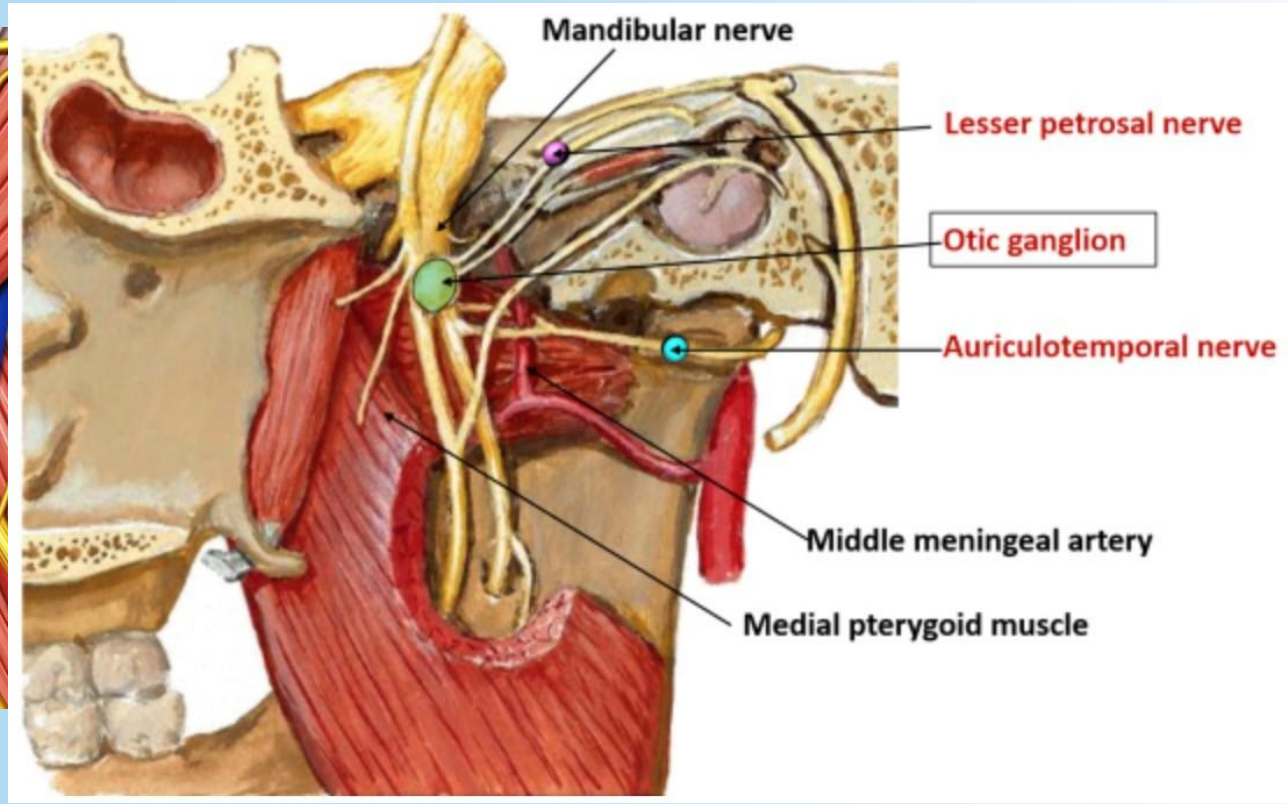


Roots and connections of otic ganglion



Submandibular- and otic ganglion





	Ciliary ganglion	Pterygopalatine ganglion	Submandibular ganglion	Otic ganglion
Sensory root	Nasociliary nerve of CN V1	Pterygopalatine nerve of V2	Lingual nerve of CN V3	Auriculotemporal nerve of CN V3
Parasympathetic ganglion	CN III – Edinger Westphal nucleus	Vidian nerve of CN VII – sup. Salivatory nucleus	Chorda tympani of CN VII – sup. Salivatory nucleus	Lesser petrosal nerve of CN IX – Inf. Salivatory nucleus
Sympathetic ganglion	Internal carotid plexus – sup. Cervical ganglion	Vidian nerve of CN VII – sup. Cervical ganglion	Deep petrosal nerve – sup. Cervical ganglion	Middle meningeal plexus – sup. Cervical ganglion

(+) Deep petrosal (Symp)
(-) Greater petrosal (Para)
= Vidian nerve