

وَقُلْ رَبِّ زِدْنِي عِلْمًا



PERIPHERAL NERVOUS SYSTEM



SUBJECT : Anatomy

LEC NO. : 9

DONE BY : Batool Alzubaidi + Hashem Ata

#كَلِينِيكَال_إِلَا_شَحْطَة



The Autonomic Nervous System

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The Autonomic Nervous System

- Concerned with the innervation and control of *visceral organs, smooth muscle* and *glands*.
- *Regulates* and *Coordinates* visceral functions: heart rate, blood pressure, respiration, digestion, urination & reproduction
- The majority of the activities of the autonomic system do *not impinge on consciousness*

■ *Sympathetic*

- Stress reaction
- Fight-or-flight
- Primes body for intense skeletal muscle activity



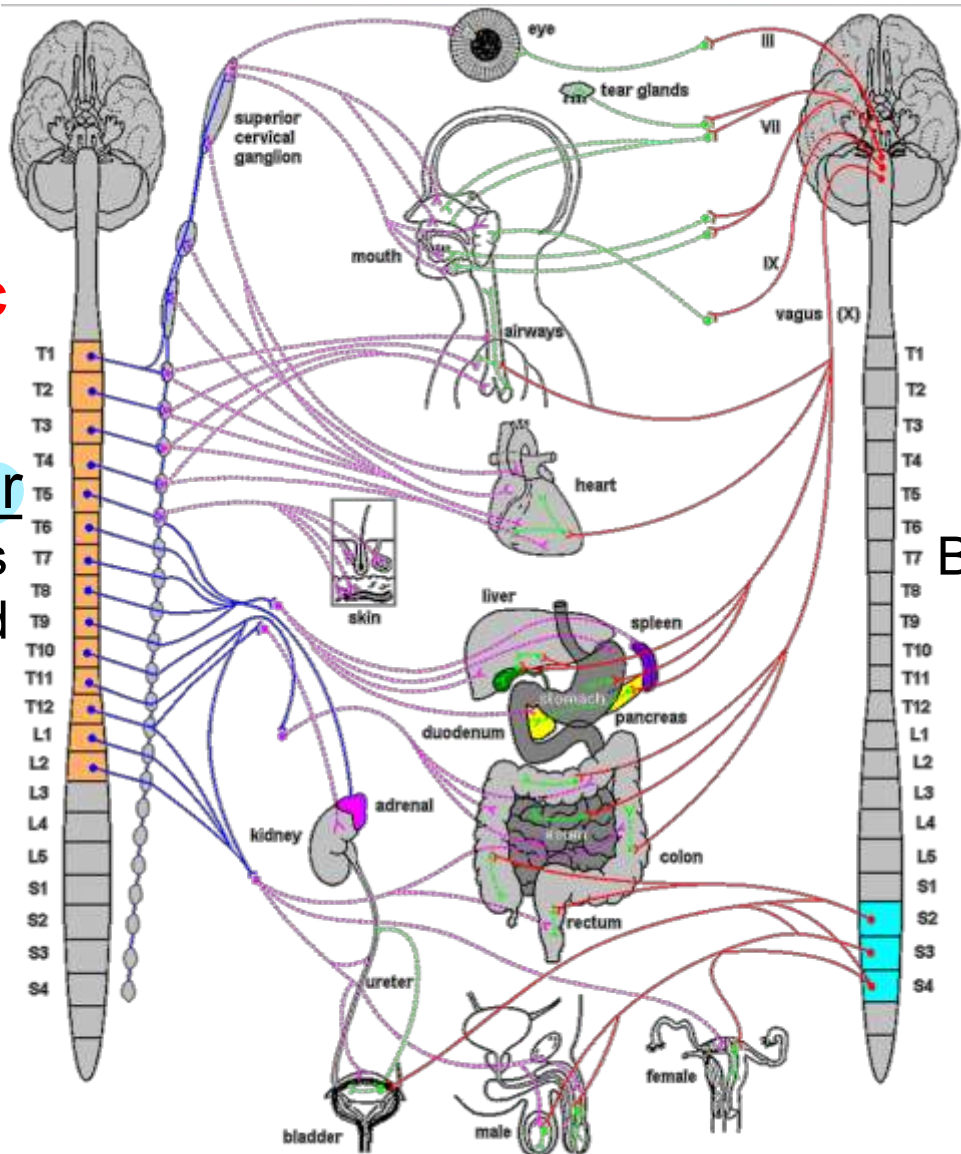
■ *Parasympathetic*

- Maintenance functions
- Rest-and-repair
- Counterbalances sympathetic function



Sympathetic

Parasympathetic



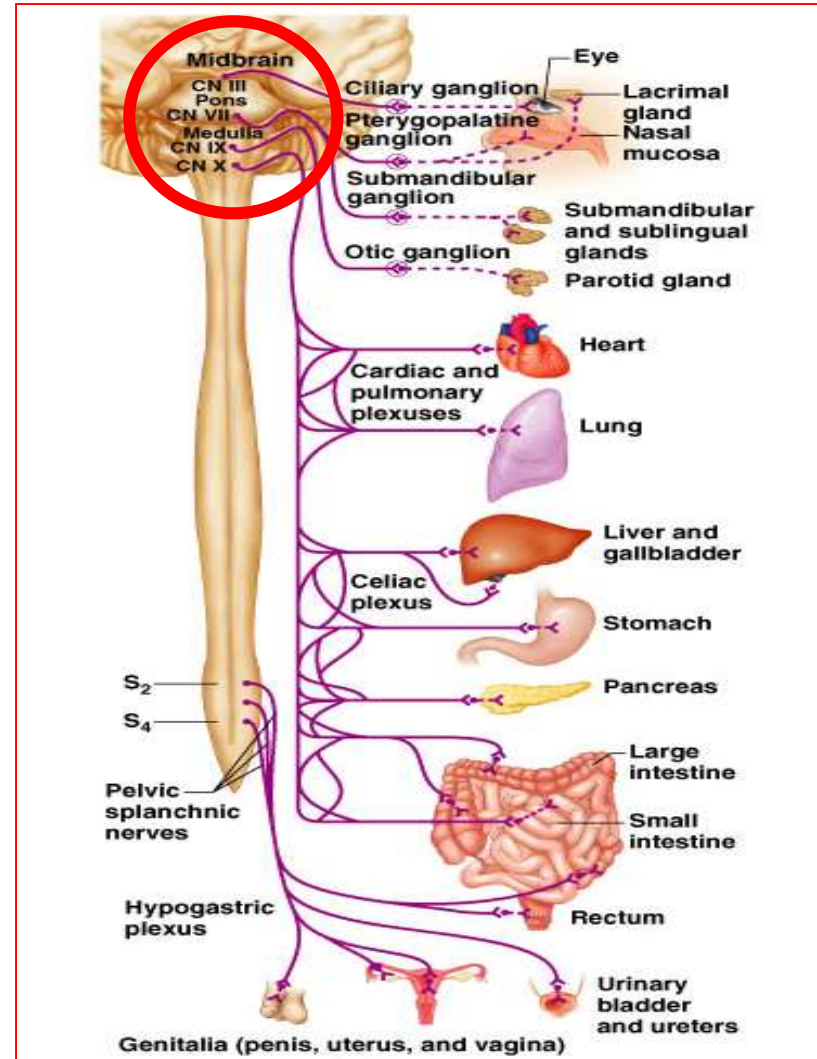
Thoracolumbar
T1 – L2/L3 levels
of the spinal cord

Craniosacral
Brain: CN III, VII, IX, X
Spinal cord: S2 – S4

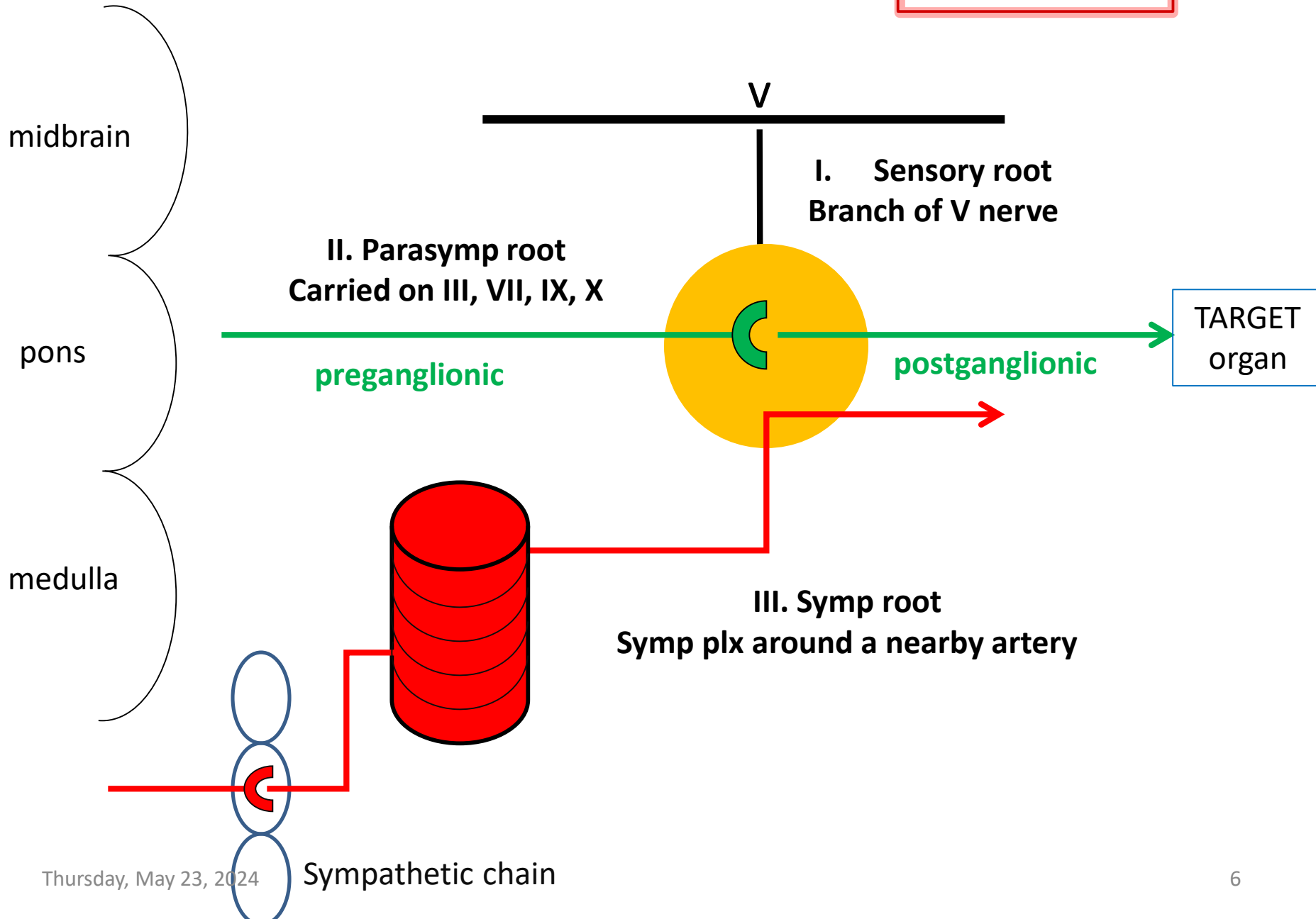
Parasympathetic Division

Cranial Outflow

Preganglionic fibers are carried by Occulomotor, Facial, Glossopharyngeal and Vagus nerve (3,7,9,10) and innervate organs of the head, neck, thorax, and abdomen ↴



تبعوا على النوتس تحت



ال trigeminal nerve الي هو ال 5th ما الـ دخل بال
 parasymphathetic هو بس بحمل ال ganglion يعني anatomically ال
 ganglion محمولة عليه suspended on it اما ال flow الي بروحها من
 ال brain يكون عن طريق ال nerves الي حكينا عنهم 3,7,9,10
 مش حكينا انه ال trigeminal مسؤول عن ال sensation of
 ال head and neck، ال ganglion هاي mainly parasymphathetic و
 لكن يكون معها sensory branches و احيانا sympathetic
 و ممكن احيانا motor branches

فلما يكون في sensory nerve معدي من خلالها حيكون
 جاي من وين؟ مدامها متعلقة على branch من ال trigeminal
 اذا اكيد لازم يكون جاي من ال branch الي متعلقة عليه هو الي
 راح يعطيها الجزء ال sensory

طيب ال sympathetic من وين بييجي؟ دايمما بييجي من ال
 nearby artery لانه ال sympathetic بحب ال arteries يكون
 لافف حوالهم ف اقرب ال artery لل ganglion ببعثها

بدنا ننتبه على شغلة حكينا انه ال ganglion هاي
parasympathetic شو يعني؟ يعني انها
preganglionic fibers و بتبع postganglionic
fibers و هاد الاشئ بس بالنسبة لل
.. parasympathetic part

لكن ال sensory nerve او ال nerve الي بيحي
من ال sympathetic root ما بعمل relay فيها
يعني ما بوقف فيها بس بعدي من خلالها و بكمل
يعني سواء motor, sensory, sympathetic راح
يعدي على ال ganglion و لكن لا يقف فيها

They're all suspended on branches of trigeminal nerve

PARASYMPATHETIC GANGLIA OF THE HEAD

They include :

1. CILIARY GANGLION

Suspended on naso-ciliary nerve
a branch of ophthalmic nerve

2. SUBMANDIBULAR GANGLION

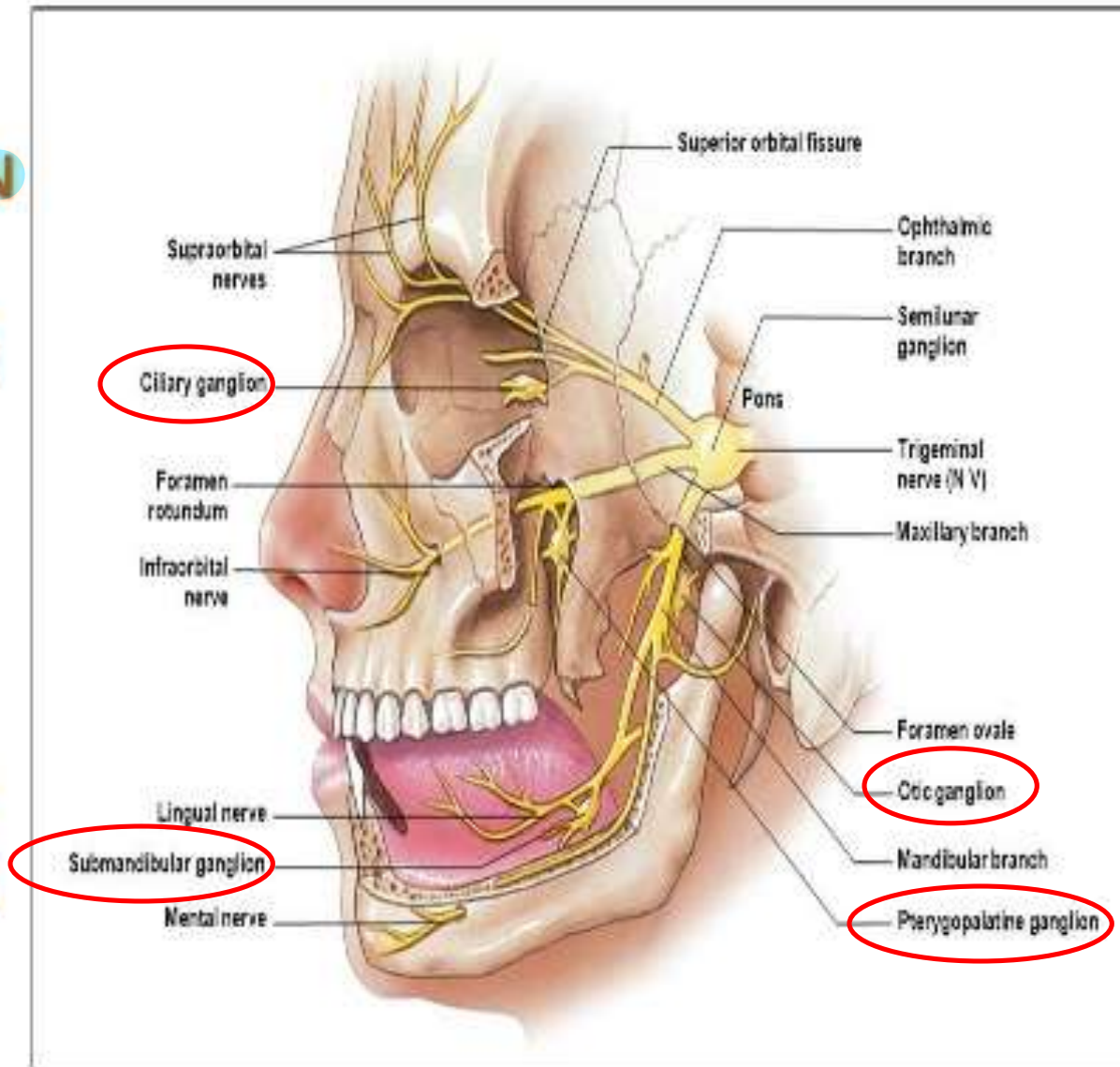
Suspended on lingual nerve a
branch of mandibular nerve

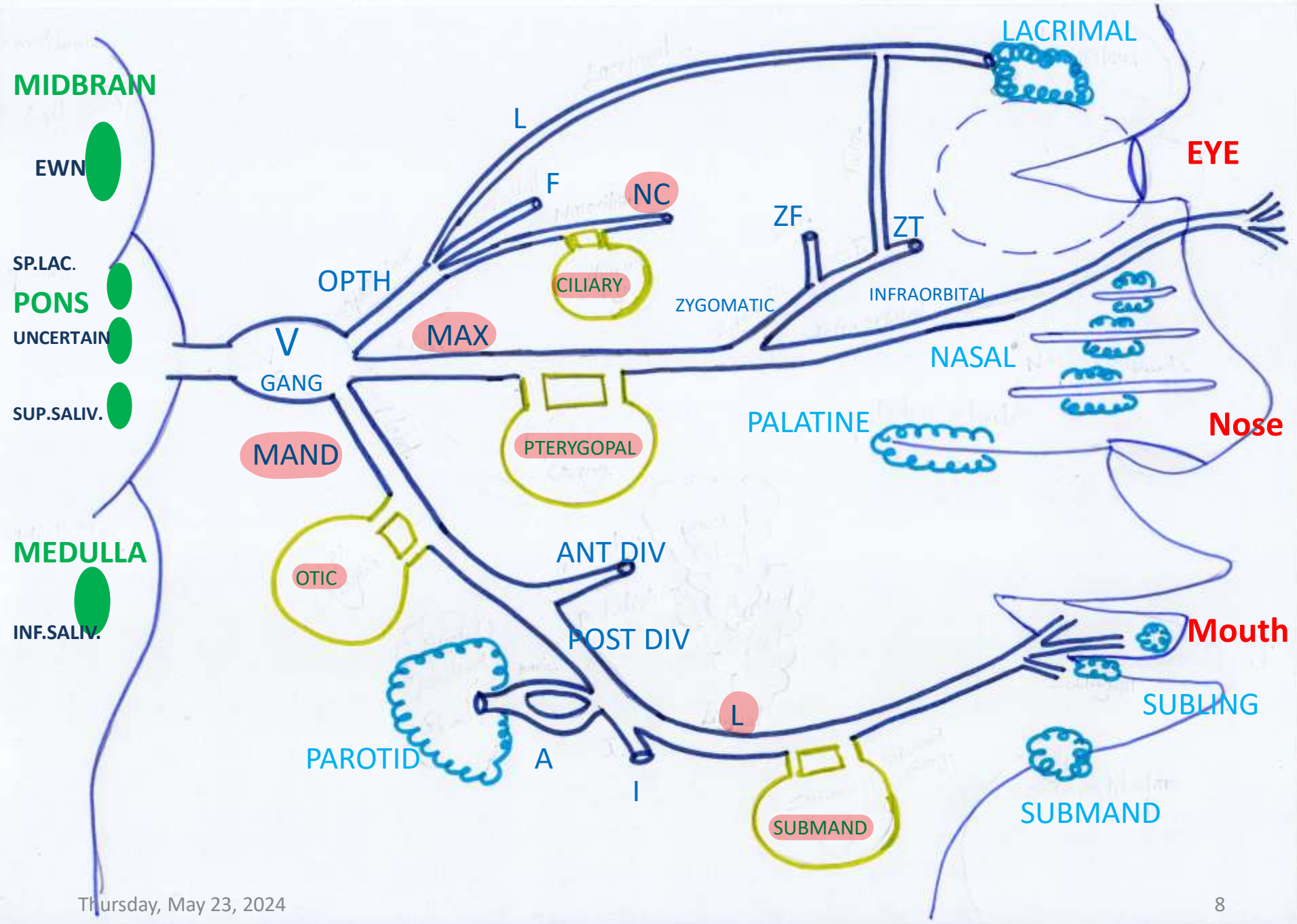
3. OTIC GANGLION

Suspended on mandibular nerve

4. SPHENOPALATINE (PTERYGOPALATINE) GANGLION

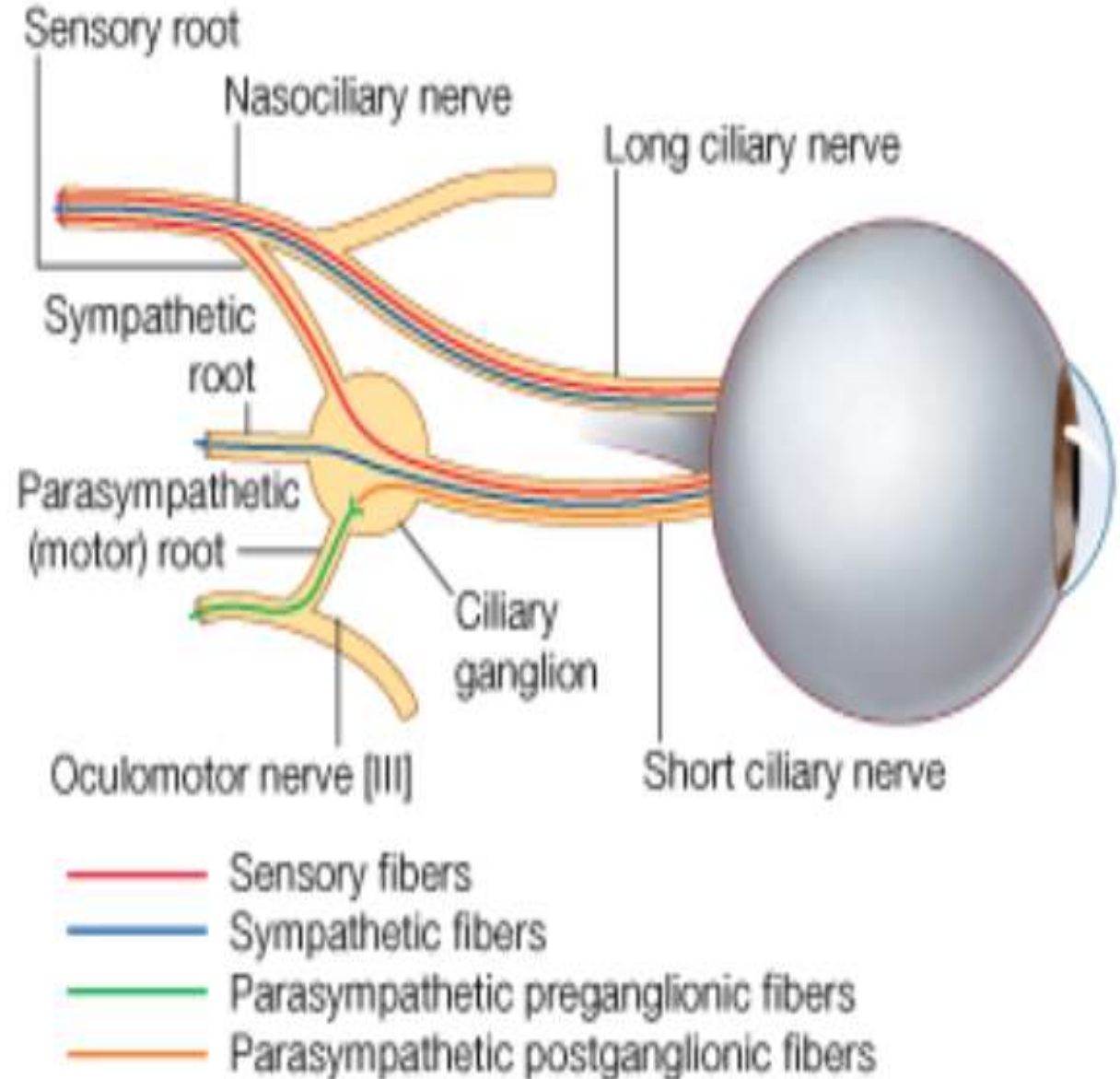
Suspended on maxillary nerve





Ciliary Ganglion

- lies near the apex of the orbit
- suspended from the nasociliary nerve



Ciliary ganglion

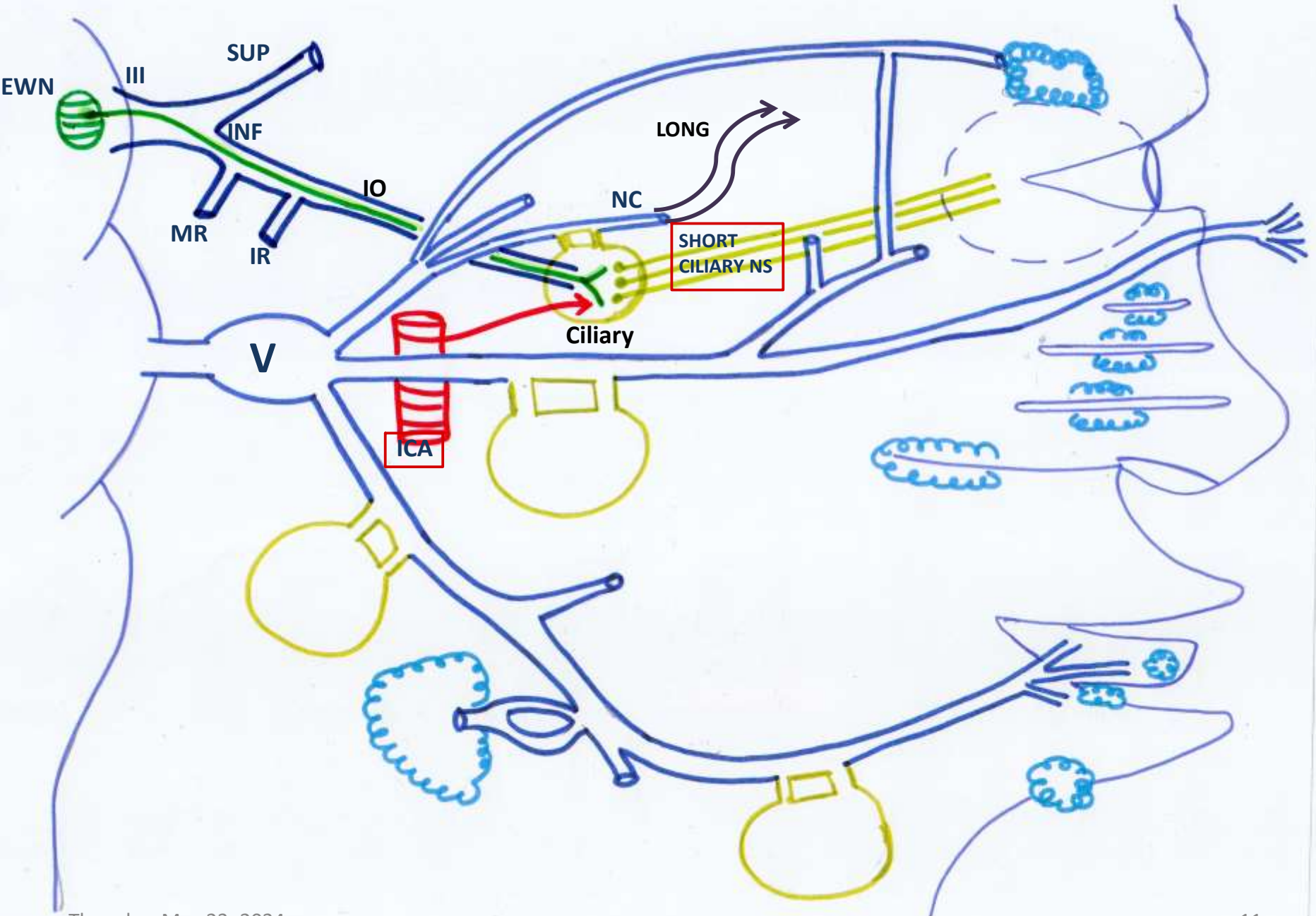
➤ **Roots:** It has 3 roots:

1. Sensory root: **Nasociliary nerve**.
2. Parasympathetic root: **Oculomotor nerve (3rd)** through the nerve to inferior oblique.
3. Sympathetic root: From the sympathetic plexus around the internal carotid artery.

➤ **Branches:** 12-15 short ciliary nerves which pierce the back of eyeball around the entrance of optic nerve. They contain the following fibers:

- a- Parasympathetic postganglionic fibers which supply the **ciliary and the sphincter pupillae muscles**.
- b- Sympathetic fibers supply the blood vessels of the eyeball.
- c- Sensory fibers: carry the sensation from the **eyeball**.

يعني لو هاي ال ganglion خربت او عملتها block ممكن تشتغل بعين المريض عادي بدون ما يحس ب اشئ او الم



Otic Ganglion

اول ما يطلع ال mandibular nerve من foramen oval
و يدخل ال infratemporal fossa راح يتعلق فيها

Small parasympathetic ganglion lying in the
intra-temporal fossa and is suspended on the
mandibular branch of the trigeminal nerve

Roots and branches of the ganglion:

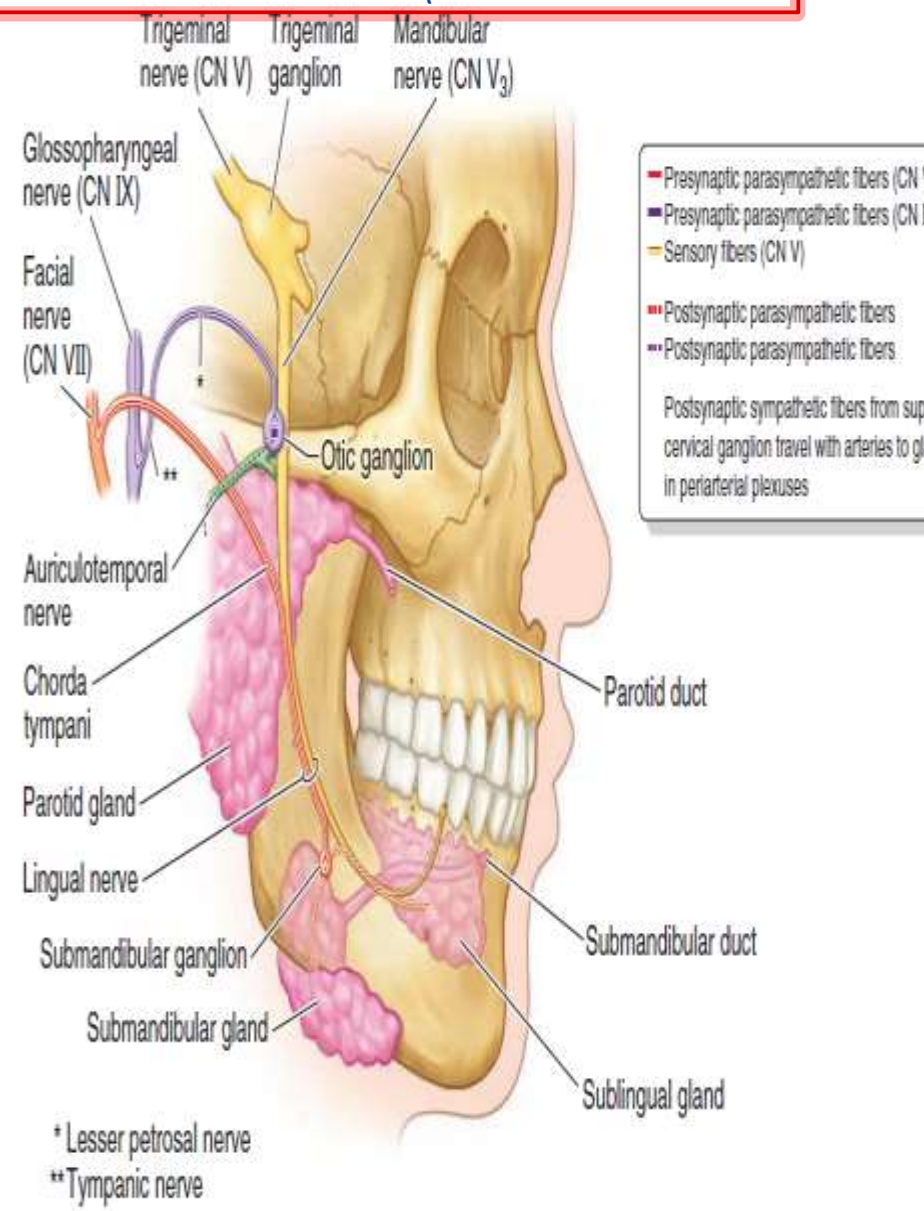
Parasympathetic root (Lesser petrosal nerve 9th Cr. N)

The postganglionic fibers join the auriculo-temporal nerve
to reach the parotid gland. Branch of mandibular

Sympathetic root: It arises from sympathetic plexus
around middle meningeal artery. join the auriculo-temporal
nerve which supplies the parotid gland.

Motor root: Two fibers arise from nerve to medial
pterygoid. They traverse the ganglion without relay to

Supply 2 muscles tensor palati and tensor tympani



Sphenopalatine Ganglion

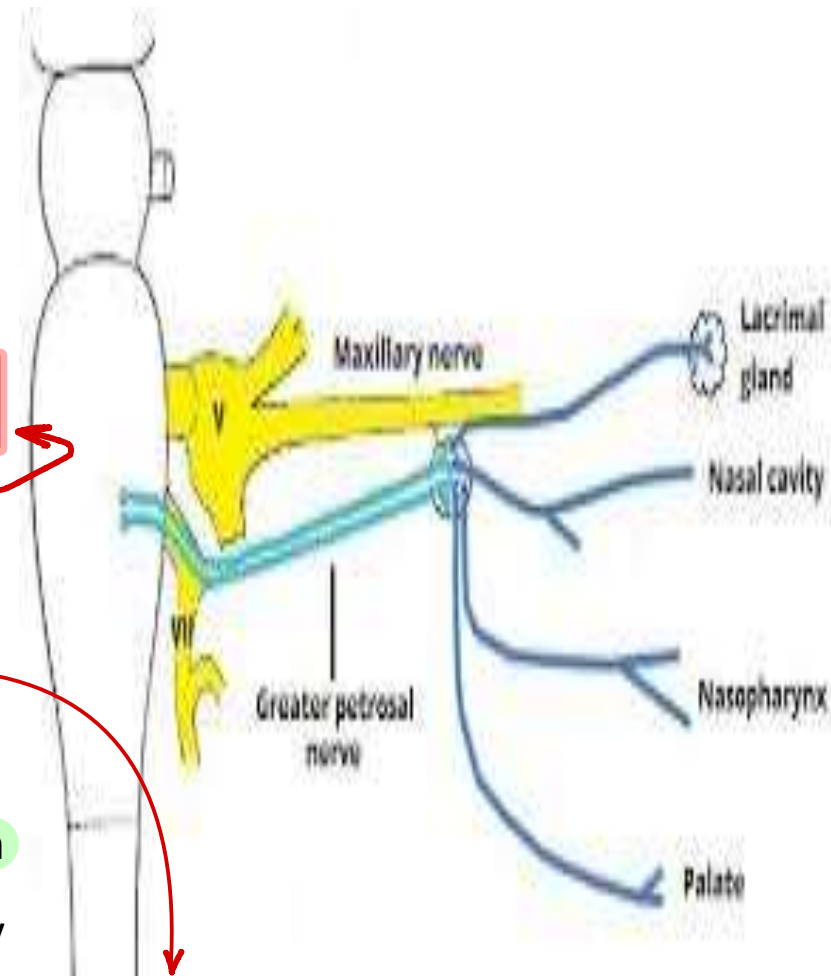
(pterygopalatine)

Small flattened parasympathetic ganglion that lies in the pterygopalatine fossa, suspended by 2 roots from maxillary nerve. (ganglia of hay fever)

Roots of the ganglion:

- ✓ **Parasympathetic root:** Greater petrosal nerve (7th Cr. N) relays in the ganglion.
- ✓ **Sympathetic root:** Deep petrosal nerve traverses the ganglion without relay.
- ✓ **sensory root:** Two ganglionic branches which connect the ganglion to the maxillary nerve. They contain sensory fibers from the orbit, nose, palate and nasopharynx which traverse the ganglion without relay.

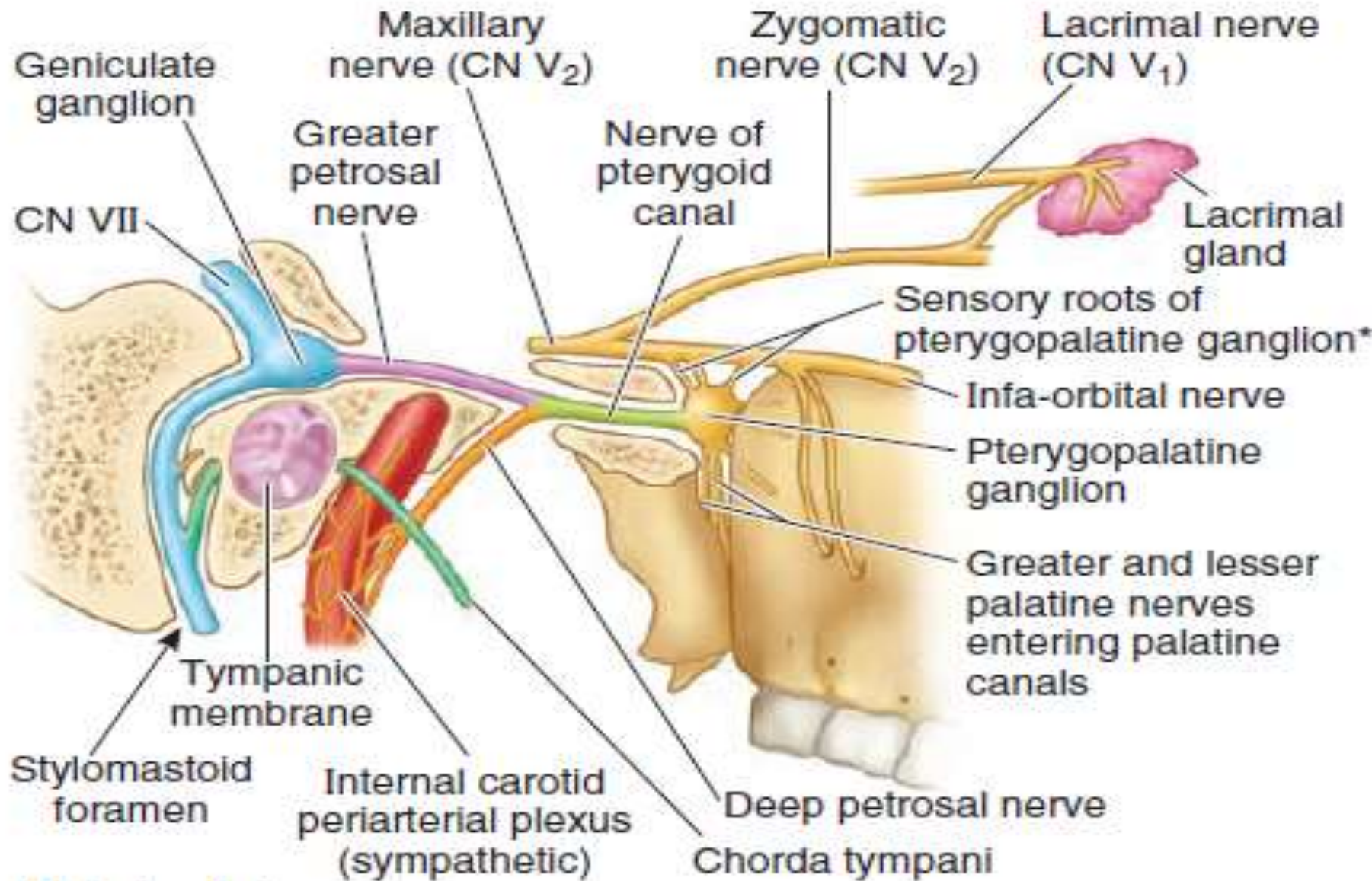
Geniculate ganglia

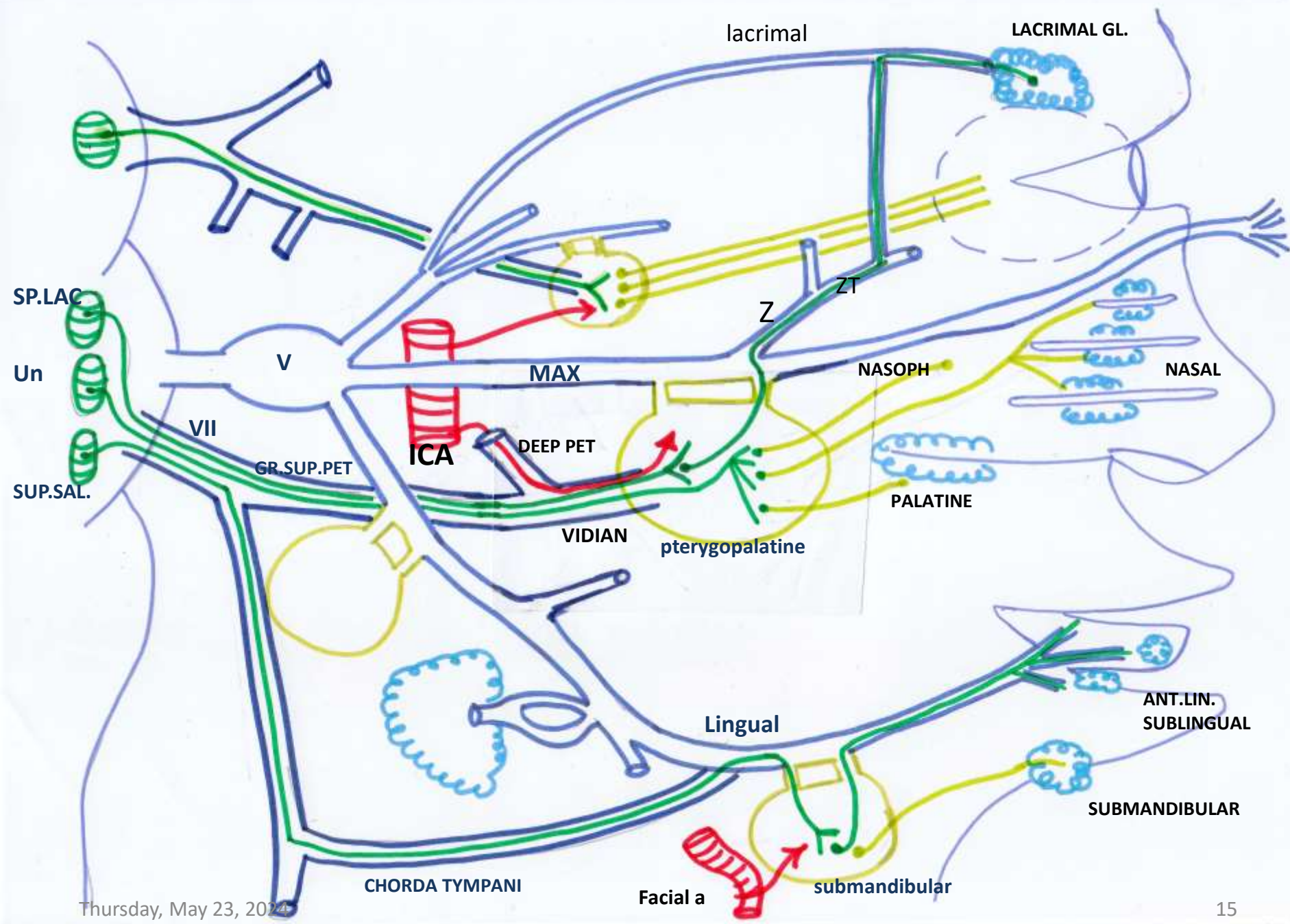


بتكون ماشية جوا ال petrous part of temporal
bone بتكون حوالين ال internal carotid

ال hay fever هي حمى القش هاي الي بصيرلها viral infection بحالة البرد او لو واحد عنده حساسية انفية allergic rhinitis .. الناس الي عندهم حساسية انفية يكون عندهم nasal secretion, lacrimation و يكون عندهم dry cough في sensation بال palate و ال pharynx و ال nasopharynx لانه هاي الي بصيرلها irritation

ال sensory root بعطي ال lacrimal gland كمان تاغت الدموع .. ال ciliary gland الي بتكون بال eye انها تكون هي المسؤولة عن lacrimation ولكن المسؤؤل عن ال lacrimation هي ال sphenopalatine عشان هي بصير للشخص lacrimation و بصيرله itching بعينه لما يكون عنده حساسية ال parasympathetic المسؤولة عن ال mucosa بال eye هي ال G pterygopalatine و ال parasympathetic المسؤولة عن ال ciliary muscles و ال sphincter pupillae هي ال ciliary G ← مهم



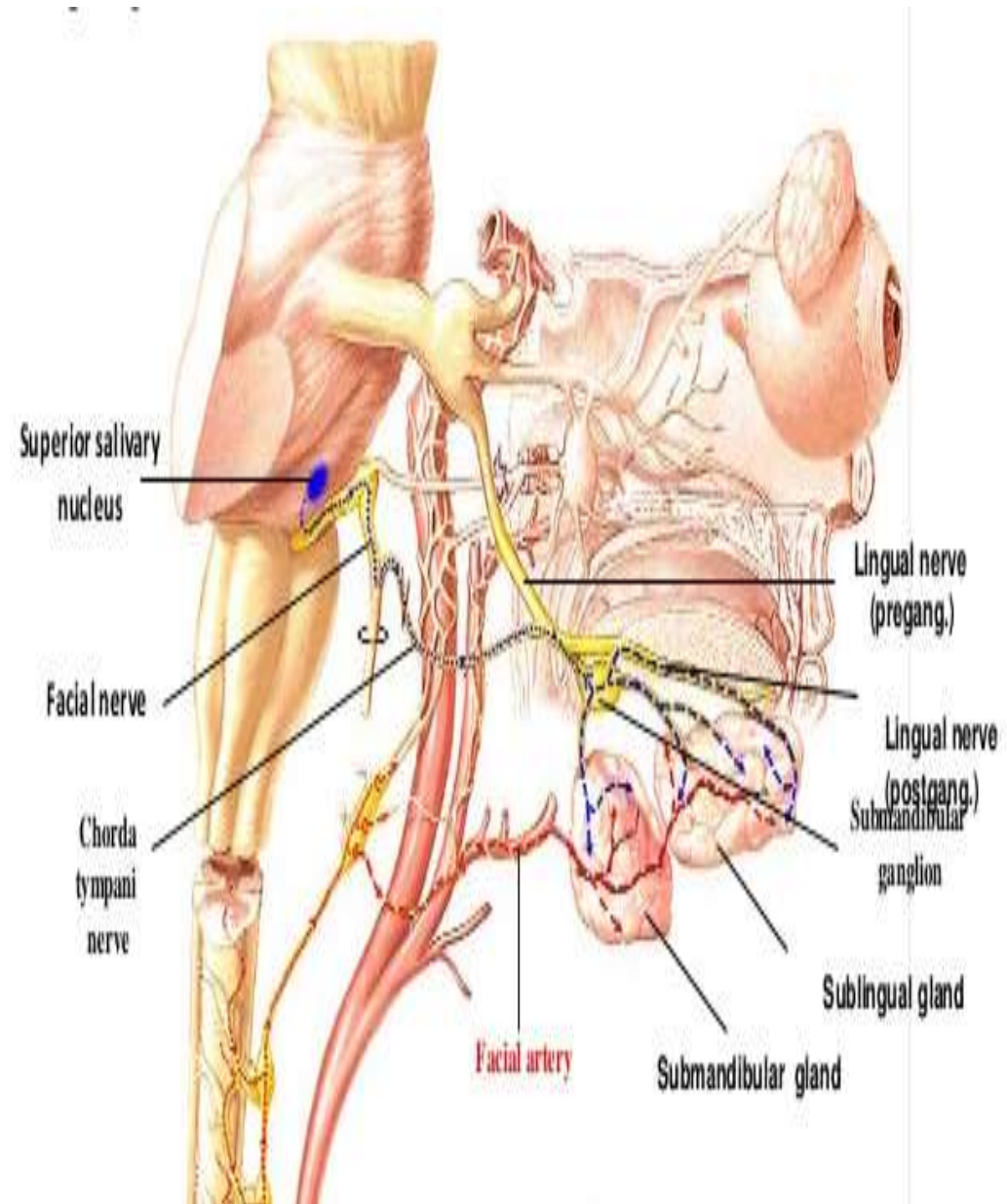


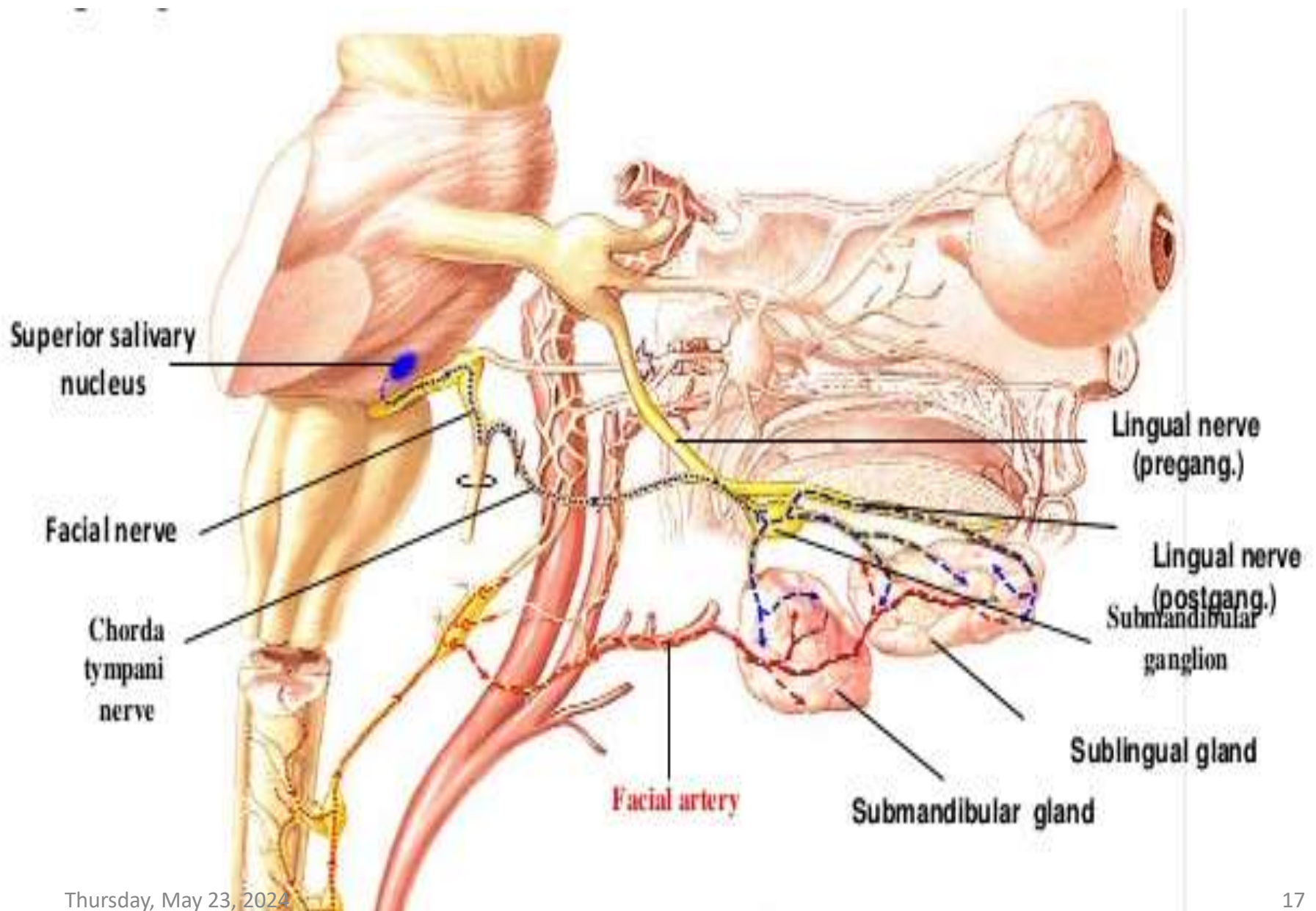
Submandibular ganglion

Small parasympathetic ganglion that lies in above the deep portion of the submandibular gland.

Roots of the ganglion:

- ✓ **Parasympathetic root:** preganglionic parasympathetic fibers from the chorda tympani (from facial N) relay in submandibular ganglion & postganglionic fibers carried by the lingual nerve
 - To submandibular salivary gland thru the brs of the ganglion itself or
 - To the sublingual via the lingual nerve.
- ✓ **Sympathetic root:** plexuses around facial artery
- ✓ **Sensory root:** lingual nerve



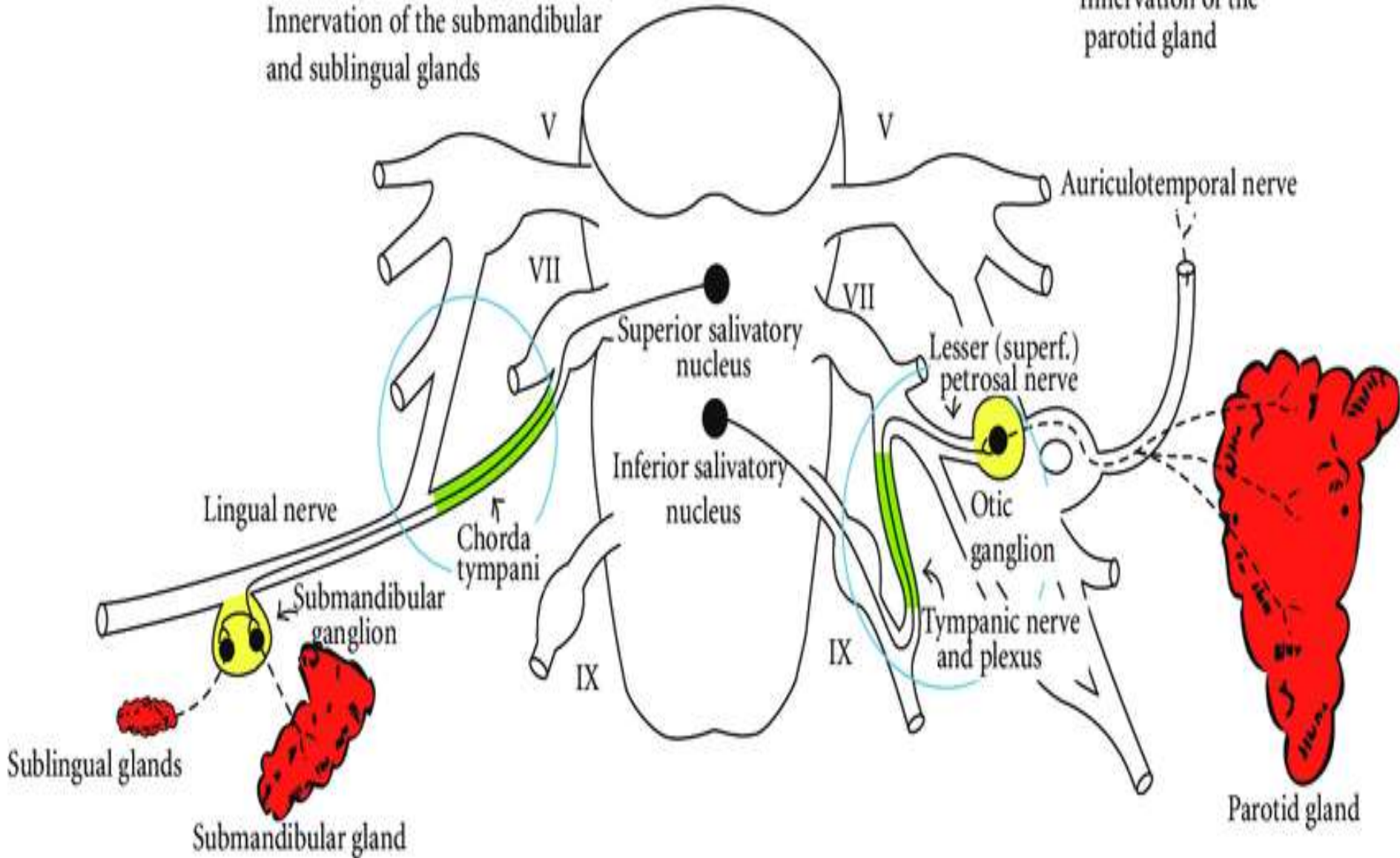


Salivary nuclei

شوفوا النوتس تحت

Innervation of the submandibular and sublingual glands

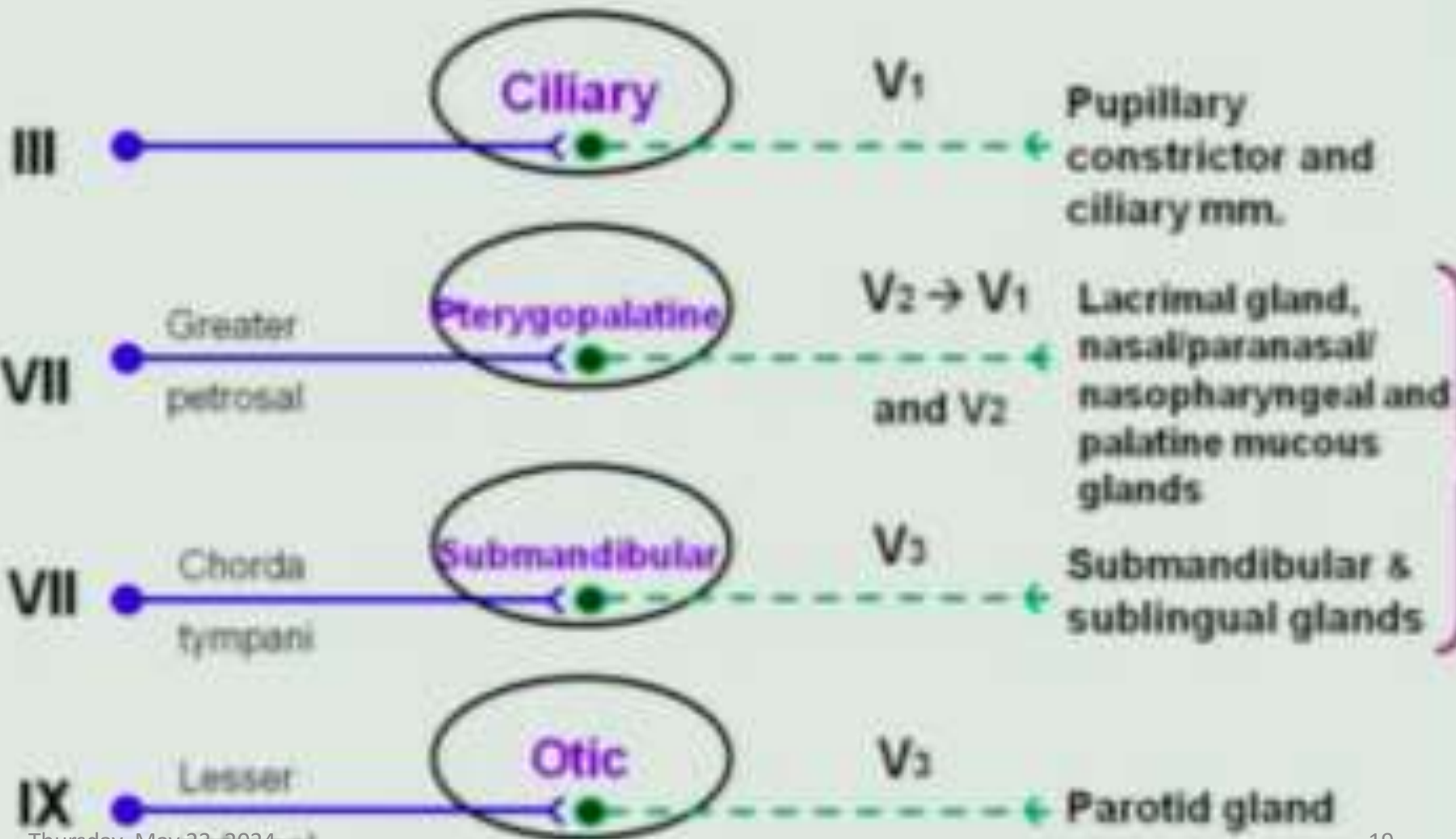
Innervation of the parotid gland



في بال pones and medulla تنتين nucleie ال
superior and inferior salivatory .. ال
submandibular ganglion الي بتعطي ال
submandibular and sublingual glands الي هم
superior salivatory nucleus من ال
الي بتعطي cranial nerve رقم ٧

inferior salivatory بتعطي cranial nerve ال
رقم ٩ الي يعطي otic ganglion الي يعطي ال
parotid gland اذا ال parotid gland مسؤول عنها ال
inferior مع ان ال parotid gland هي الي فوق ..

<u>Cranial nerve</u>	<u>Ganglion</u>	<u>Branch of V</u>	<u>Target tissue</u>
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C.N.	Ganglion	CN V Branch	Target
III	Ciliary	Ophthalmic	Intrinsic eye muscles
VII	Pterygopalatine	Maxillary	Lacrimal gland, Nasal cavity, Maxillary sinus, Palate
VII	Submandibular	Mandibular	Submandibular and sublingual glands
IX	Otic	Mandibular	Parotid gland

The sympathetic system

It is formed of: **thoracolumbar outflow**

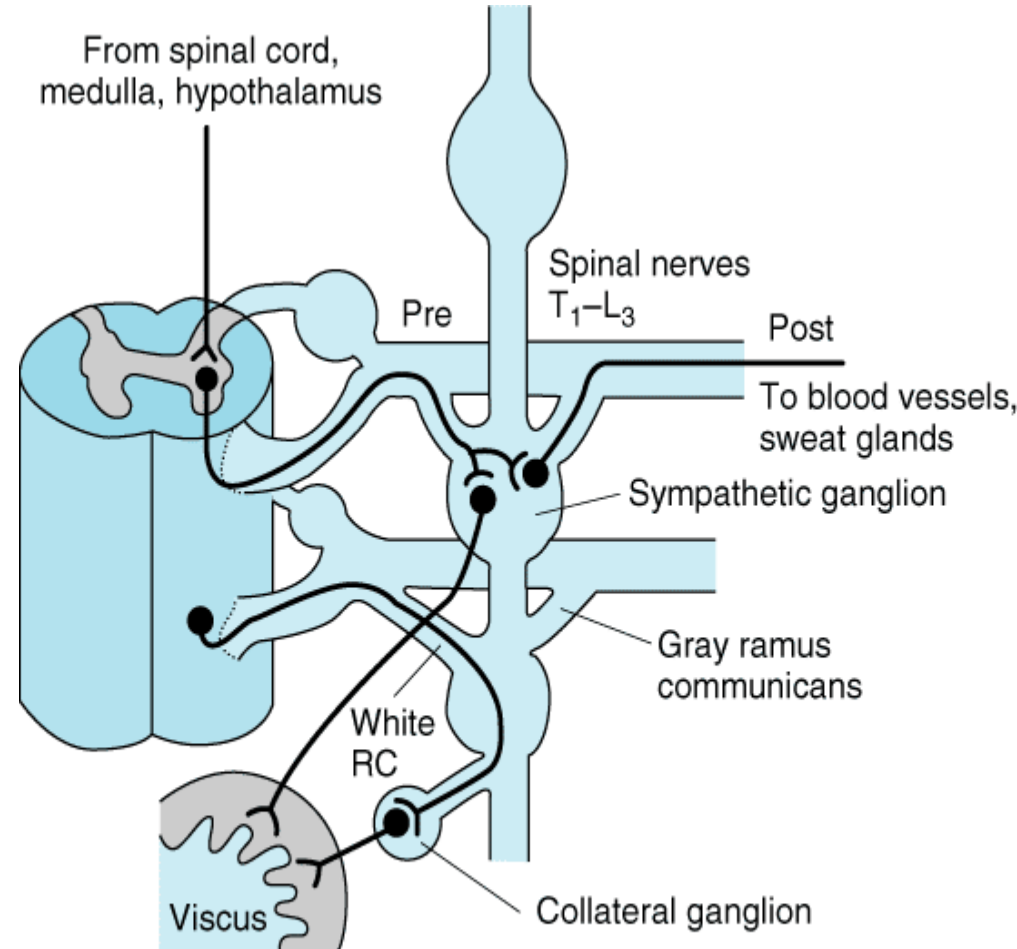
1. Preganglionic fibers: they arise from the neurons of the lateral horns of grey matter of the spinal cord in the following segments:

- a) all thoracic segments
- b) upper 2 lumbar segments

The fibers run in the ventral root, trunk, ventral ramus of corresponding spinal nerve.

Finally they leave the ventral ramus as **white ramus communicante** to reach the ganglia of the sympathetic chain which extends along side of the vertebral column.

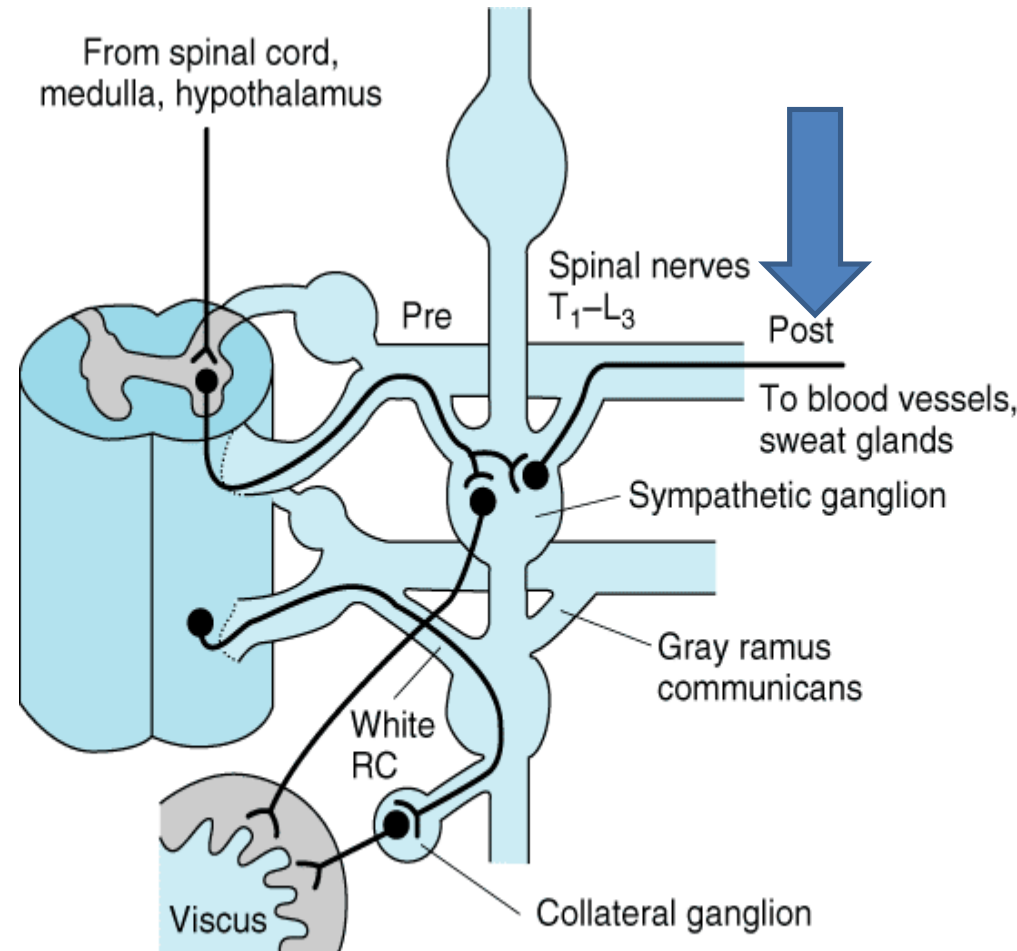
N.B. : A **ganglion** is a collection of neurons cell bodies outside the C.N.S.



Sympathetic division

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2. Postganglionic fibers: they are the axons of the cell bodies of the sympathetic ganglia. The fibers leave the ganglia as **grey rami communicantes** to be distributed to their target organs in close relations to the arteries.



Sympathetic division

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Cervical Sympathetic Chain

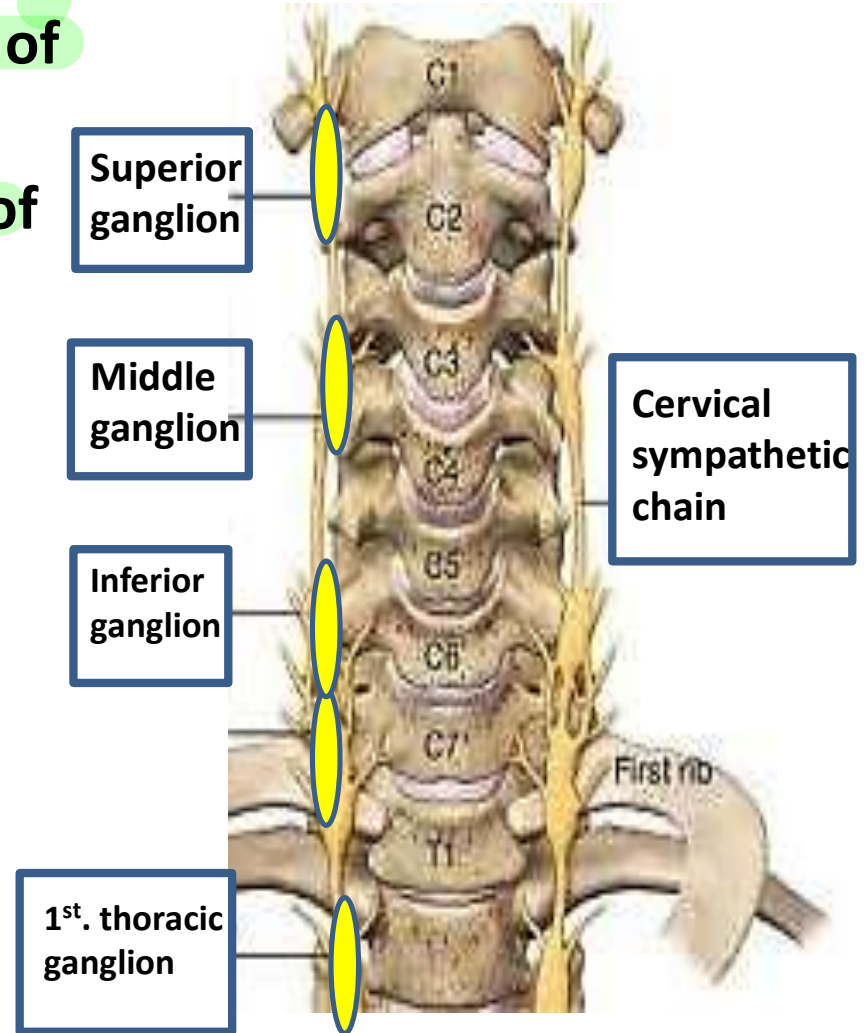
Cervical sympathetic chain

Extends from **base of skull** to neck of **the 1st rib**, where it becomes continuous with the thoracic part of the **sympathetic trunk**.

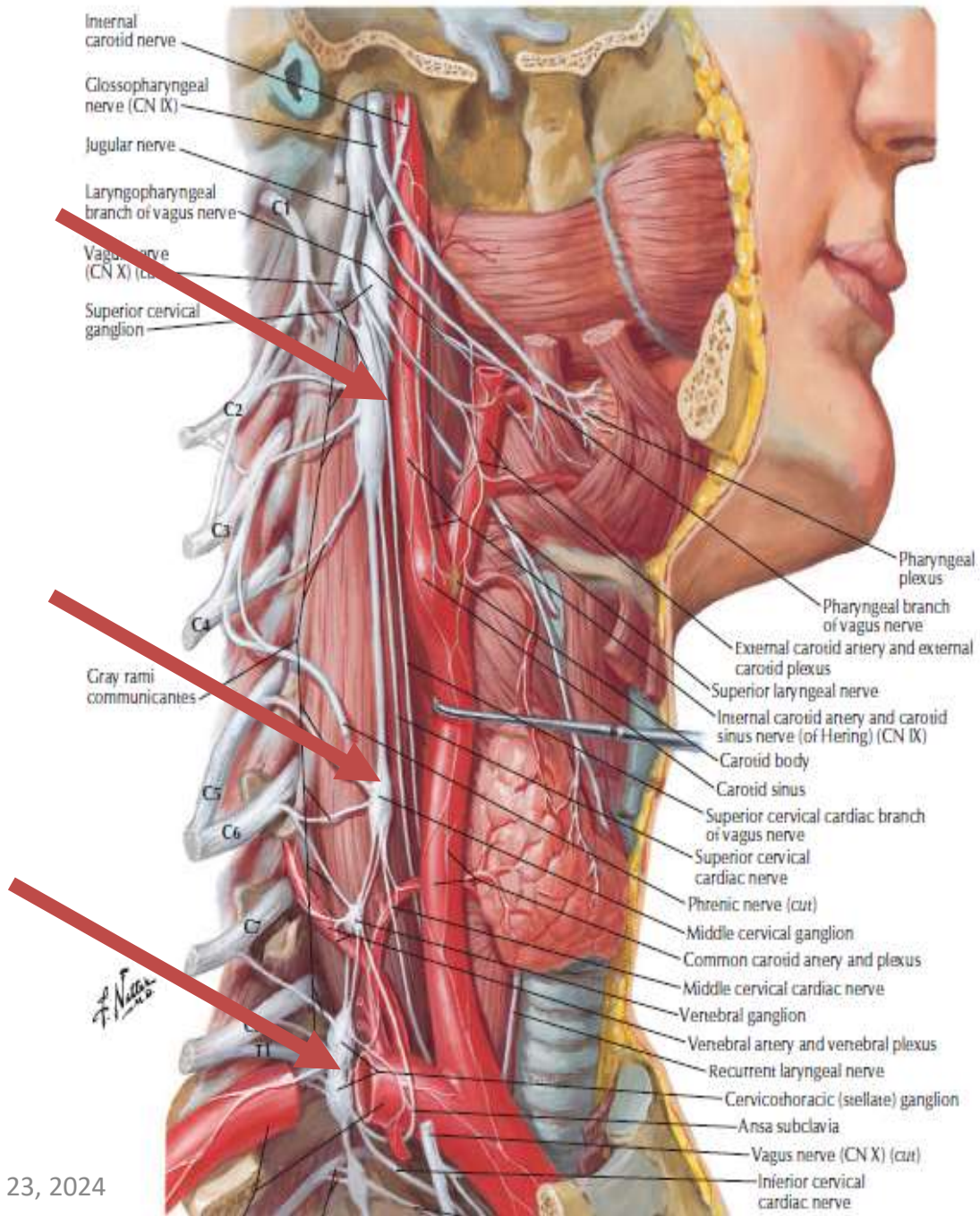
- It is embedded in deep fascia between the carotid sheath and the prevertebral layer of deep fascia.

يعني هي مش جوات ال carotid sheath

- It carries three ganglion
 - 1- superior
 - 2- middle
 - 3- inferior



(in most people it is fused with 1st thoracic ganglion to form stellate ganglion in front of neck of 1st Rib.



Branches of Sympathetic ganglia are divided into three groups:

1- Communicating..... To nearest nerve.

2- Vascular.....around nearest artery.

3- Visceral.....to nearest viscera.

Superior cervical ganglion:

1- Communicating

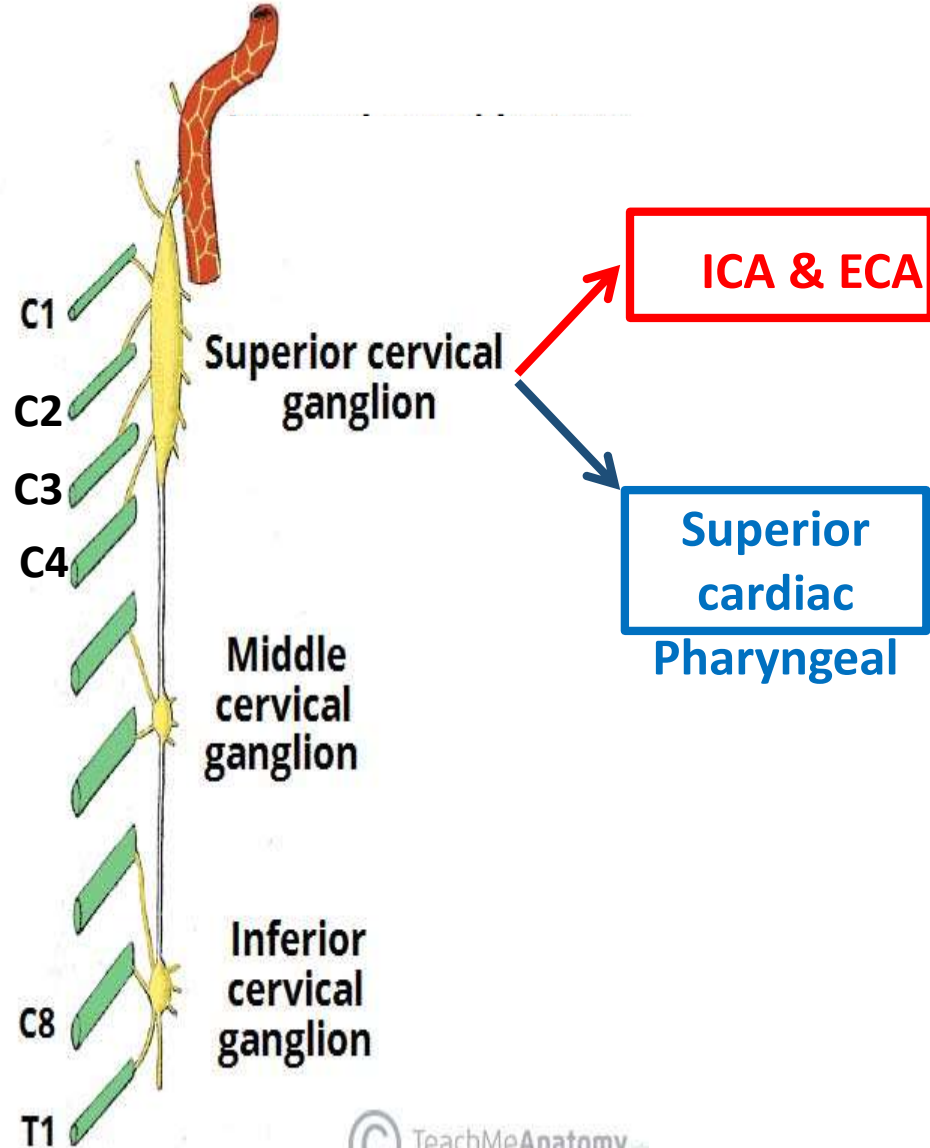
With upper 4 cervical spinal nerves
With 9, 10 & 12 cranial nerves.

2- Vascular

Around ICA & ECA

3- Visceral

- Superior cardiac
- Pharyngeal branches



Middle cervical ganglion:

1- Communicating

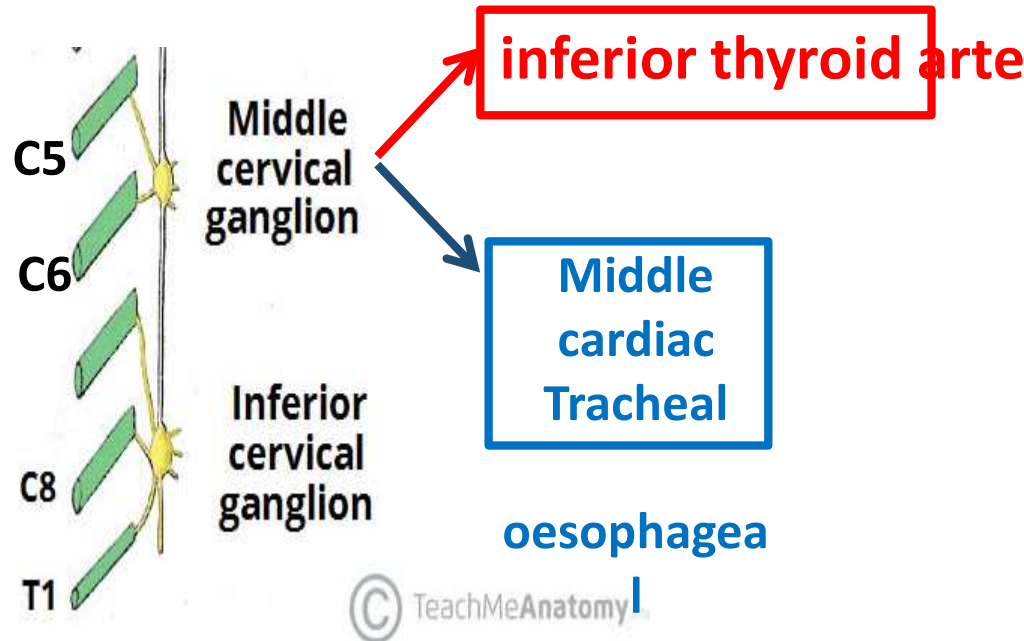
With C5,6 spinal nerves.

2- Vascular

Around inferior thyroid artery

3- Visceral

- Middle cardiac branches
- Tracheal & oesophageal branches



Inferior cervical ganglion:

1- Communicating

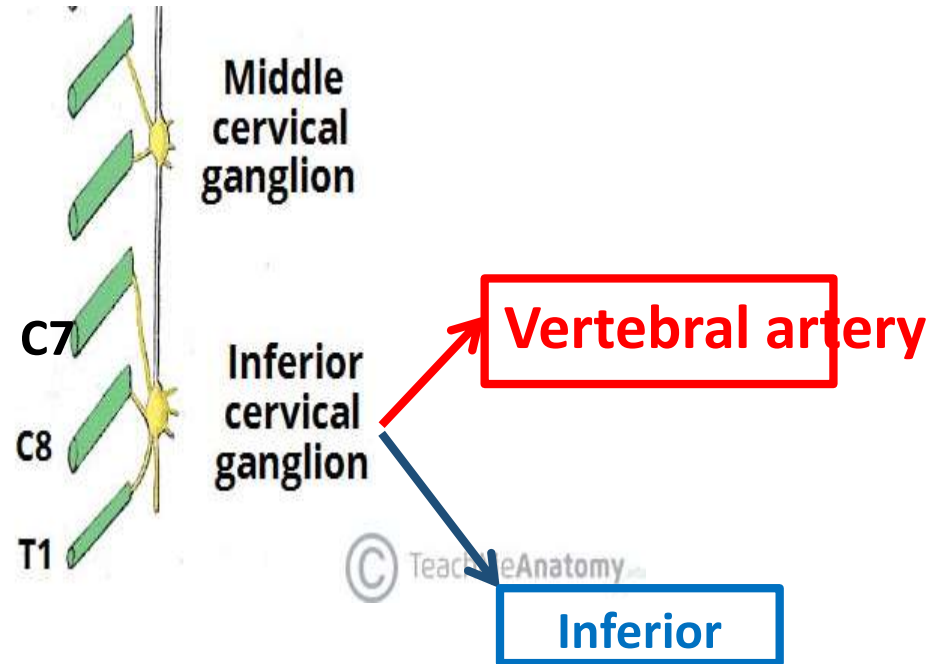
With C7,8 spinal nerves.

2- Vascular

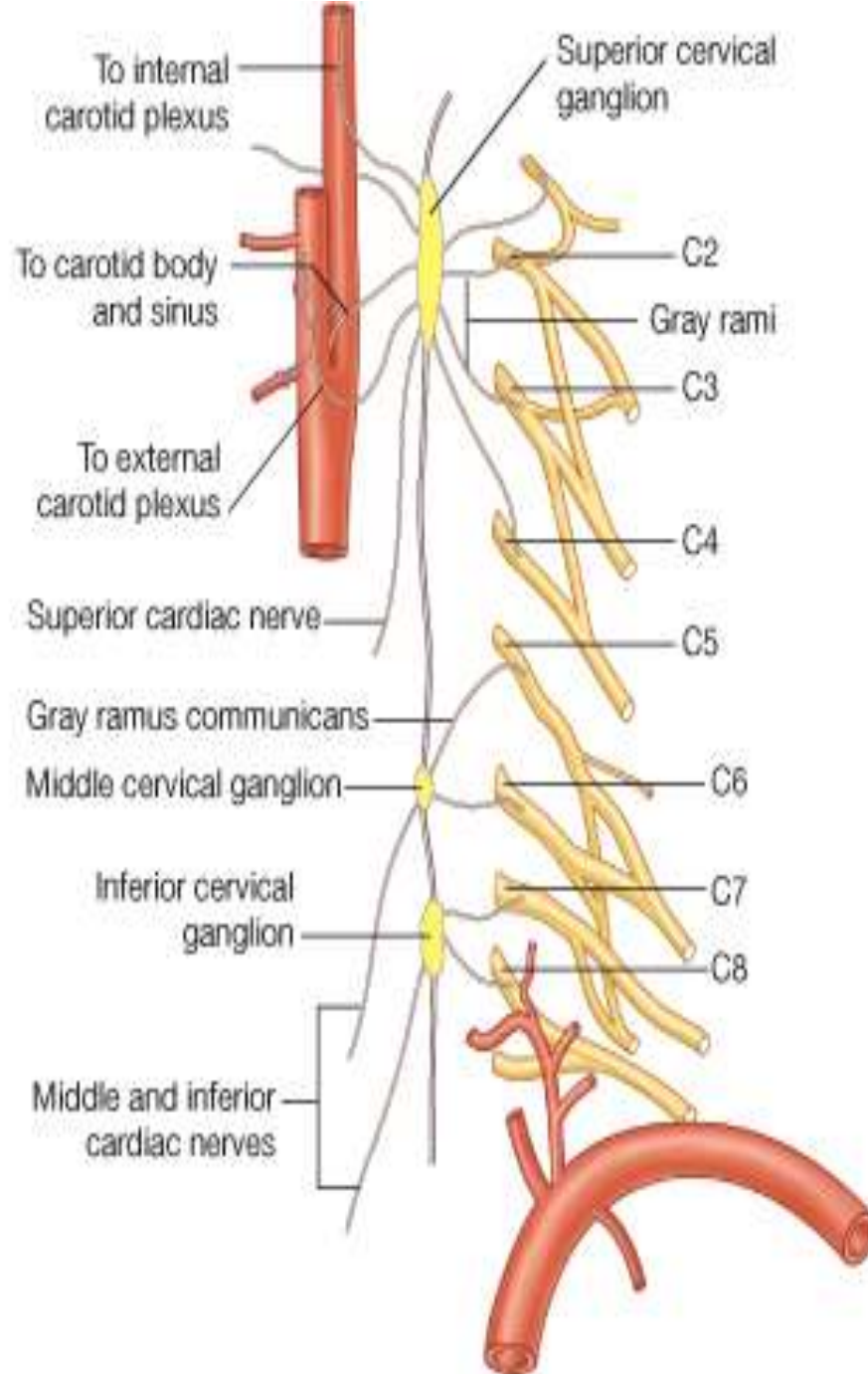
Around vertebral artery

3- Visceral

- Inferior cardiac branches



شوفنا فائدة كل هالكلام؟ ال cervical sympathetic هو المسؤول عن ال deep sensation ال visceral sensation ال
ال visceral pain .. فالمرضى الي عندهم terminal disease او cancer بنعمللهم اشفي اسمه pain therapy عن
طريق انه ينعمل block لل sympathetic supply الي بغذي المكان الي فيه الالم لانه ما بتقدر تضل ترفع ال
dose تاغت ال morphine مش بس لل terminal diseases برضه لل chronic disease الي بتاثر على ال
quality of life للمريض بسبب الالم الي بتعمله او لمريض كبير بالسن عنده ديسك مثلاً



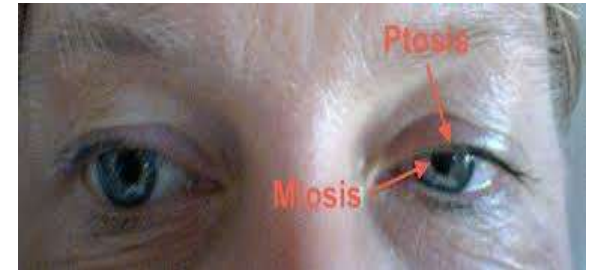
Pancoast syndrome, this apical lung tumor may spread to involve the sympathetic trunk, affect the lower portion of the brachial plexus (C8, T1, and T2),

This may lead to **Horner's syndrome** on the

affected side:

- **Miosis**: constricted pupil
- **Ptosis**: minor drooping of the upper eyelid
- **Anhidrosis**: lack of sweating
- **Flushing**: subcutaneous vasodilation

Molar muscle supplied by sympathetic will be affected



Traumatic injury to cervical sympathetic chain at root of neck

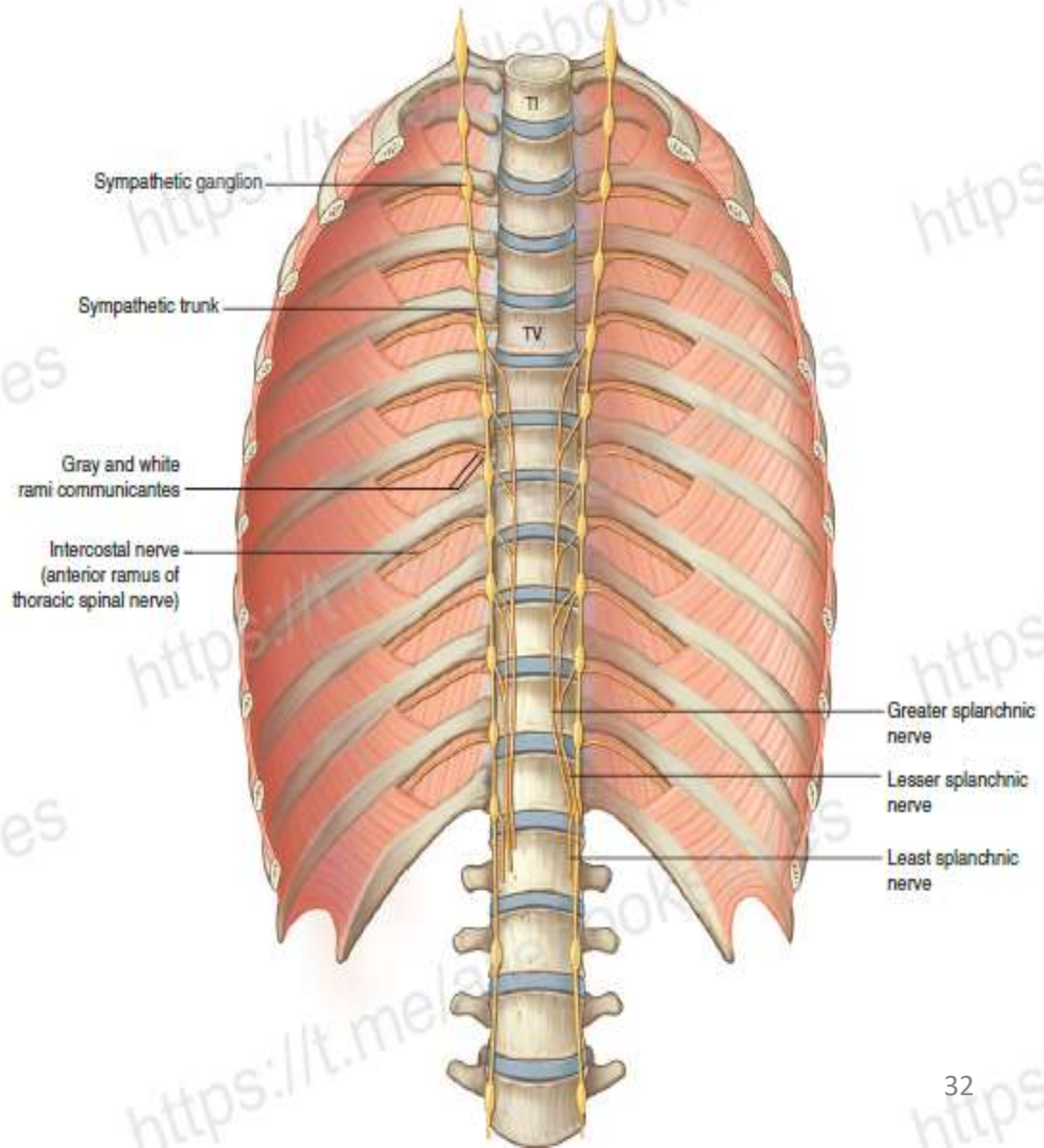
causes **Horner syndrome**????????

و بتكون ال upper limb على الجهة الي صاير فيها ال symptoms تعبانة لانه ال brachial plexus بتتاثر و هي الي بتعطي supply لل upper limbs .. اذا شكيت انه المريض عنده cervical lesion خصوصا بالجزء الي تحت من ال upper limb را ح يكون inferior cervical ganglion مع ال stellate ganglion لما يصير فيهم مشكلة بنضرب C8,T1,T2 و بالاخر بظهر اعراض ال horner مع flushing بال face و ال upper limb

Thoracic Sympathetic Chain

- In the posterior mediastinum
- 12 thoracic ganglia
- Connected to the adjacent thoracic spinal nerve by white rami communicantes

The upper 5 ganglia give postganglionic fibers to the thoracic viscera



Thoracic Sympathetic Chain

The lower 7 ganglia give **preganglionic fibers** to various abdominal and pelvic viscera through 3 nerves

Greater splanchnic

From the 5th to 9th ganglia

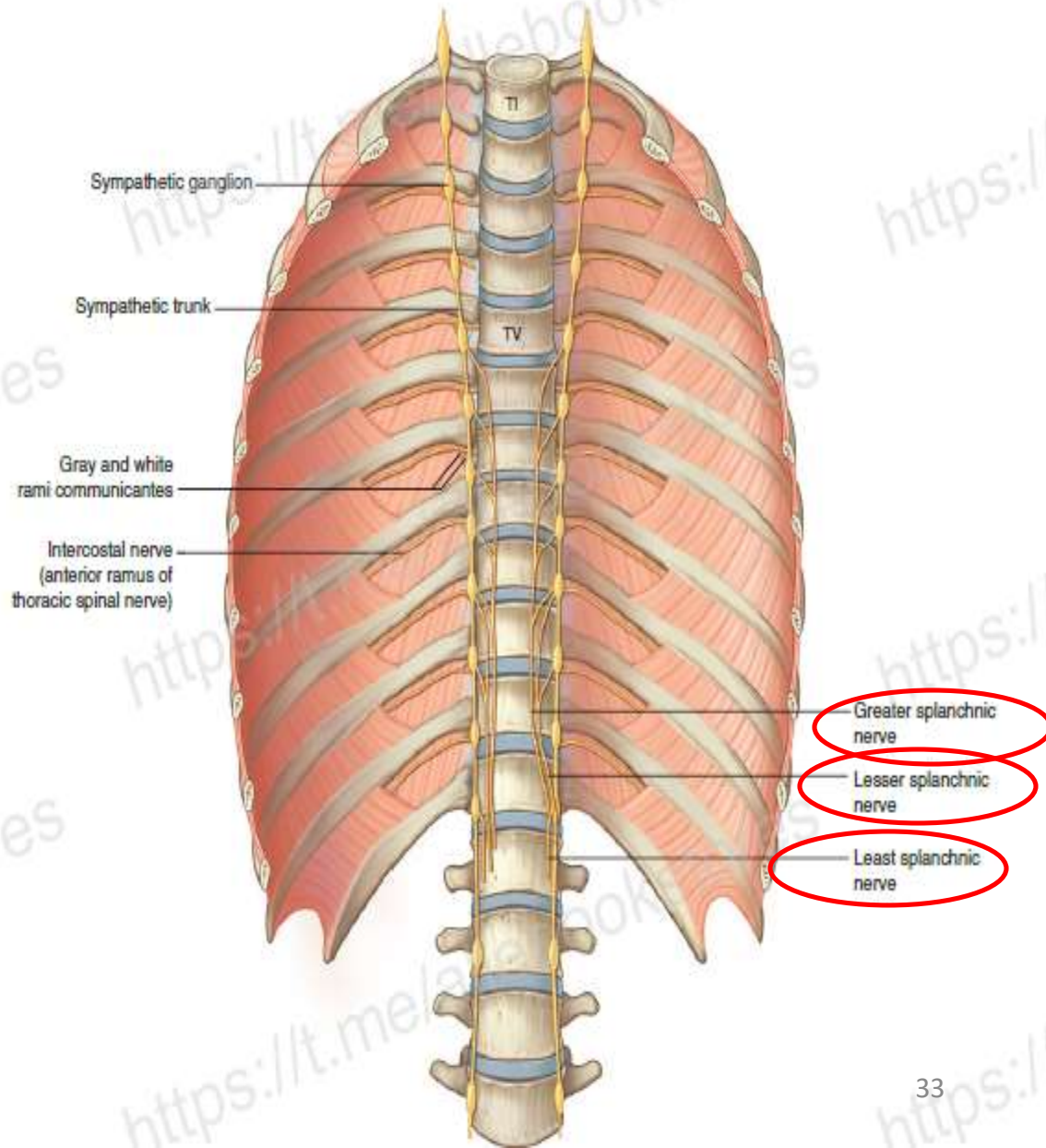
To the celiac ganglion

Lesser splanchnic

10th 11th to aortico renal ganglia

Least splanchnic

12th to renal plexus



The lumbar part of the sympathetic chain

continuous above with the thoracic part of the sympathetic trunk and pass into the abdomen behind the medial arcuate ligament to descend along the medial margin of the psoas major.



Thank you