Cranial Nerves Review

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Cranial Nerve Overview

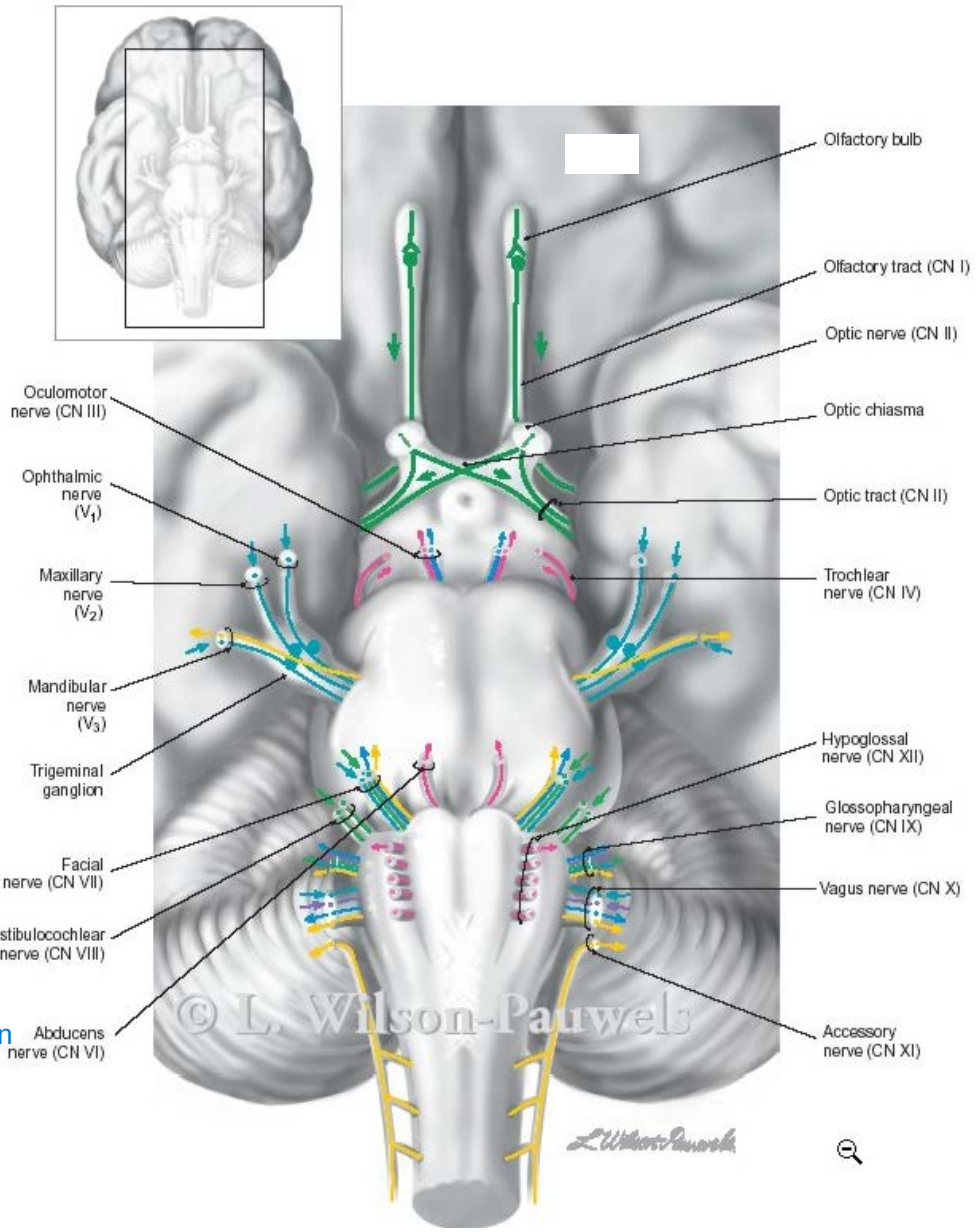
A cranial nerve is any nerve that is entering or exiting the cranium.

cranial vault/skull

There are 12 pairs of cranial nerves numbered I – XII from anterior to posterior.

Some cranial nerves carry many modalities such as:
special sensory, general sensory, visceral motor etc…

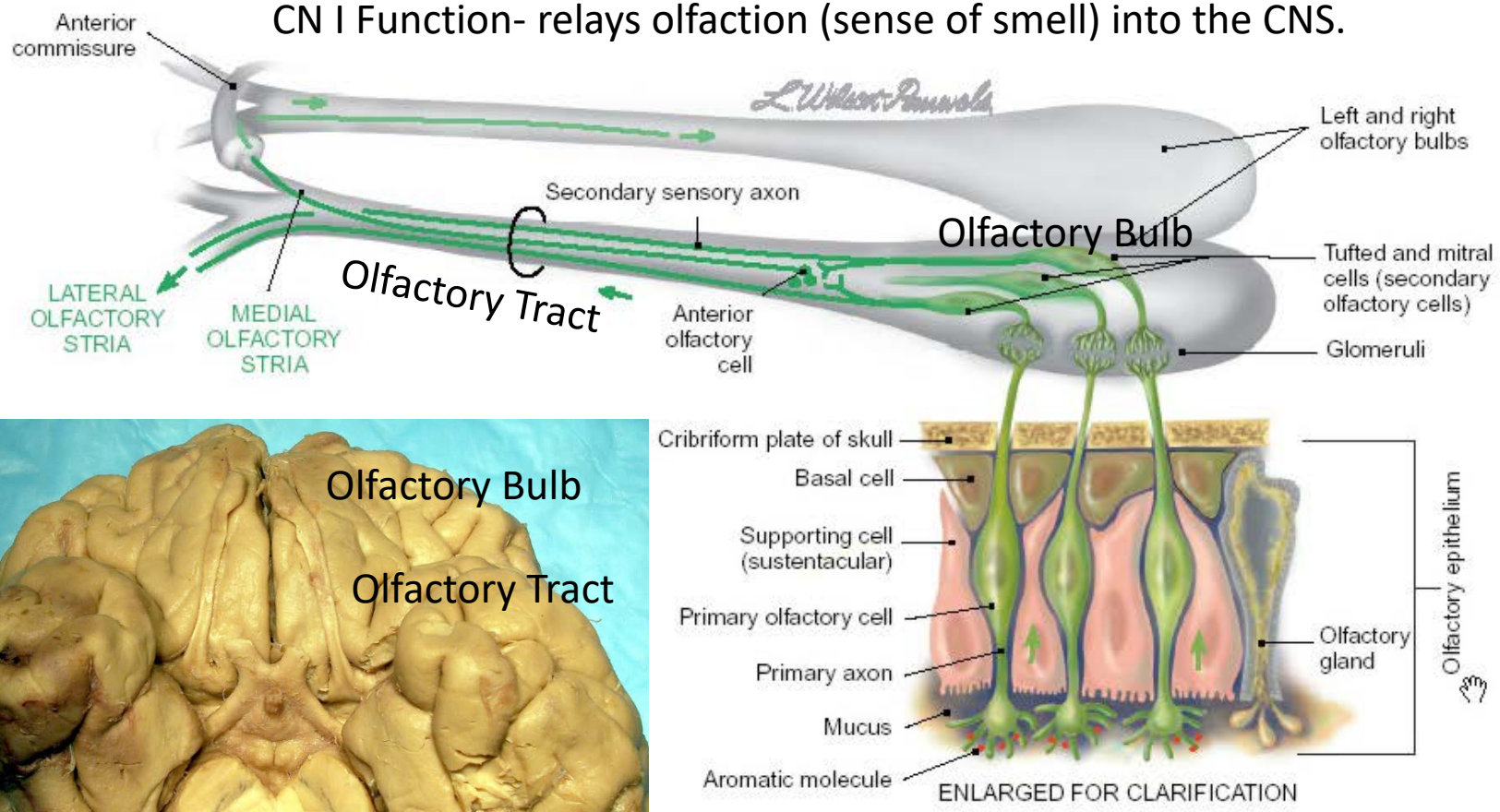
Cranial nerves are part of pathways.
If the cranial nerve is part of a sensory pathway, the cranial nerve is usually the 1st order neuron.
If the cranial nerve is part of a somatic motor pathway, it is the lower motor neuron. generally the first order neuron
If the cranial nerve is part of the ANS (Visceral motor pathway), it is the preganglionic neuron.



Cranial Nerve I = Olfactory nerve

nasal epithelium do not see on brain bc synapses to olfactory bulb

CN I Function- relays olfaction (sense of smell) into the CNS.



Nasal Epithelium

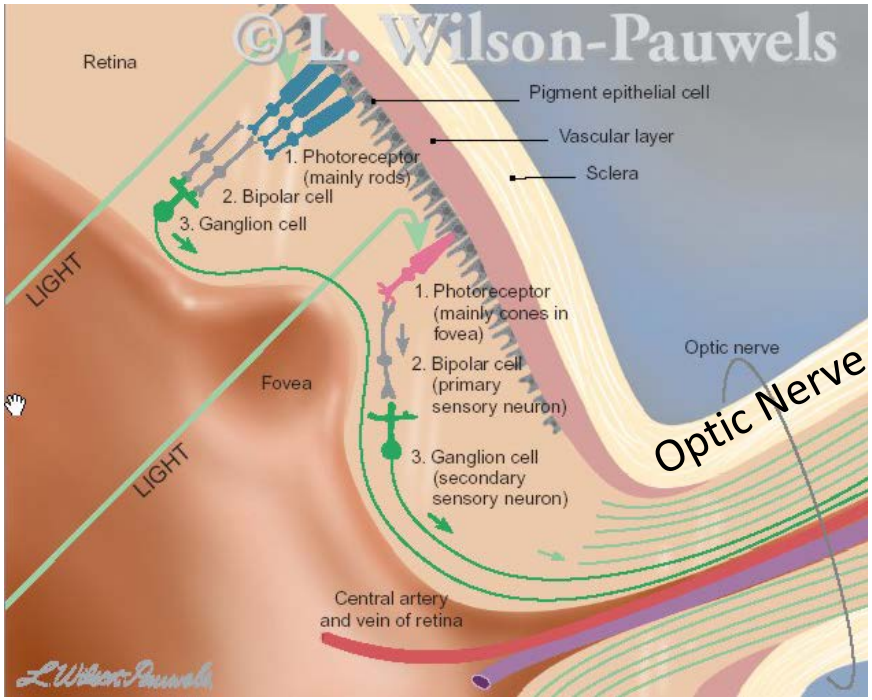
Lesion to CN I = Ipsilateral Anosmia

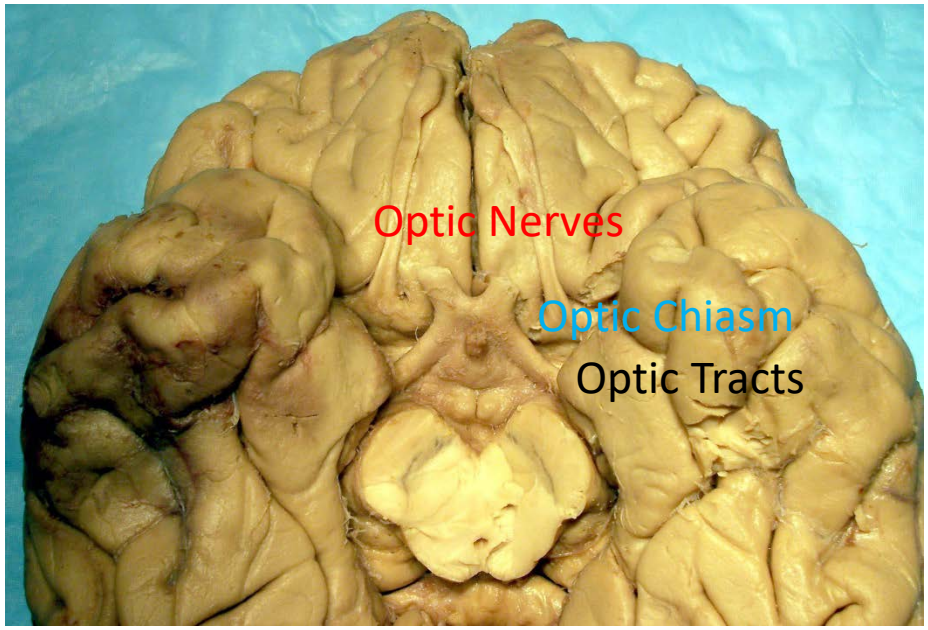
Lesion to Olfactory bulb and tract = Ipsilateral Anosmia

Cranial Nerve II = Optic Nerve

CN II function – relay visual information into the CNS

rods and cones that transduce visual information





cross at optic chiasm

CN II is the 2nd order neuron in the visual pathway.
(The 1st order neuron is the bipolar cell in the retina with its rods/cones.)

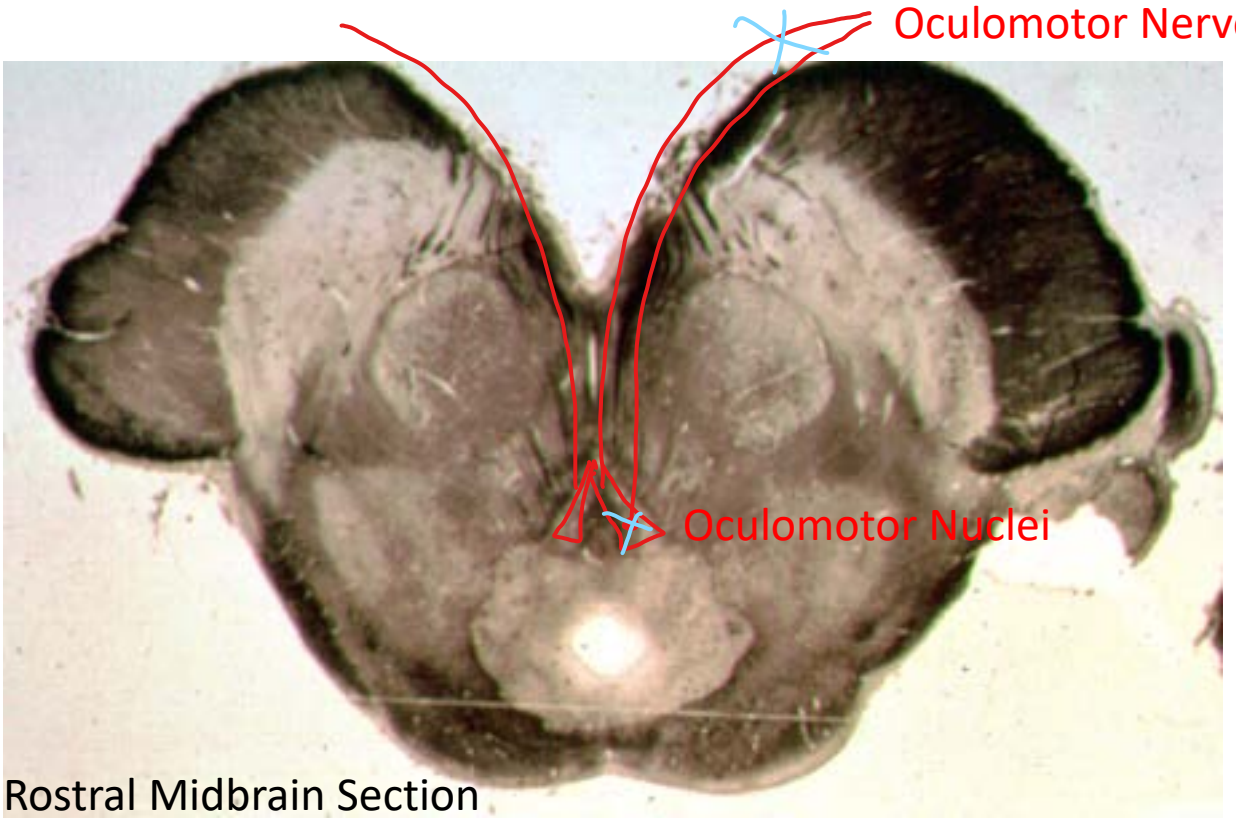
Lesion to Optic Nerve (on 1 side) = Ipsilateral loss of vision

Lesion to the Optic Chiasm = Bitemporal Hemianopia

Lesion to Optic tracts on 1 side = Contralateral Homonymous Hemianopia

Cranial Nerve III = Oculomotor nerve

CN III function- Lower motor neurons innervating 4 of 6 eye muscles and upper eyelid muscle;
Parasympathetic Preganglionic to cause pupil constriction and accommodation on the lens



Rostral Midbrain Section

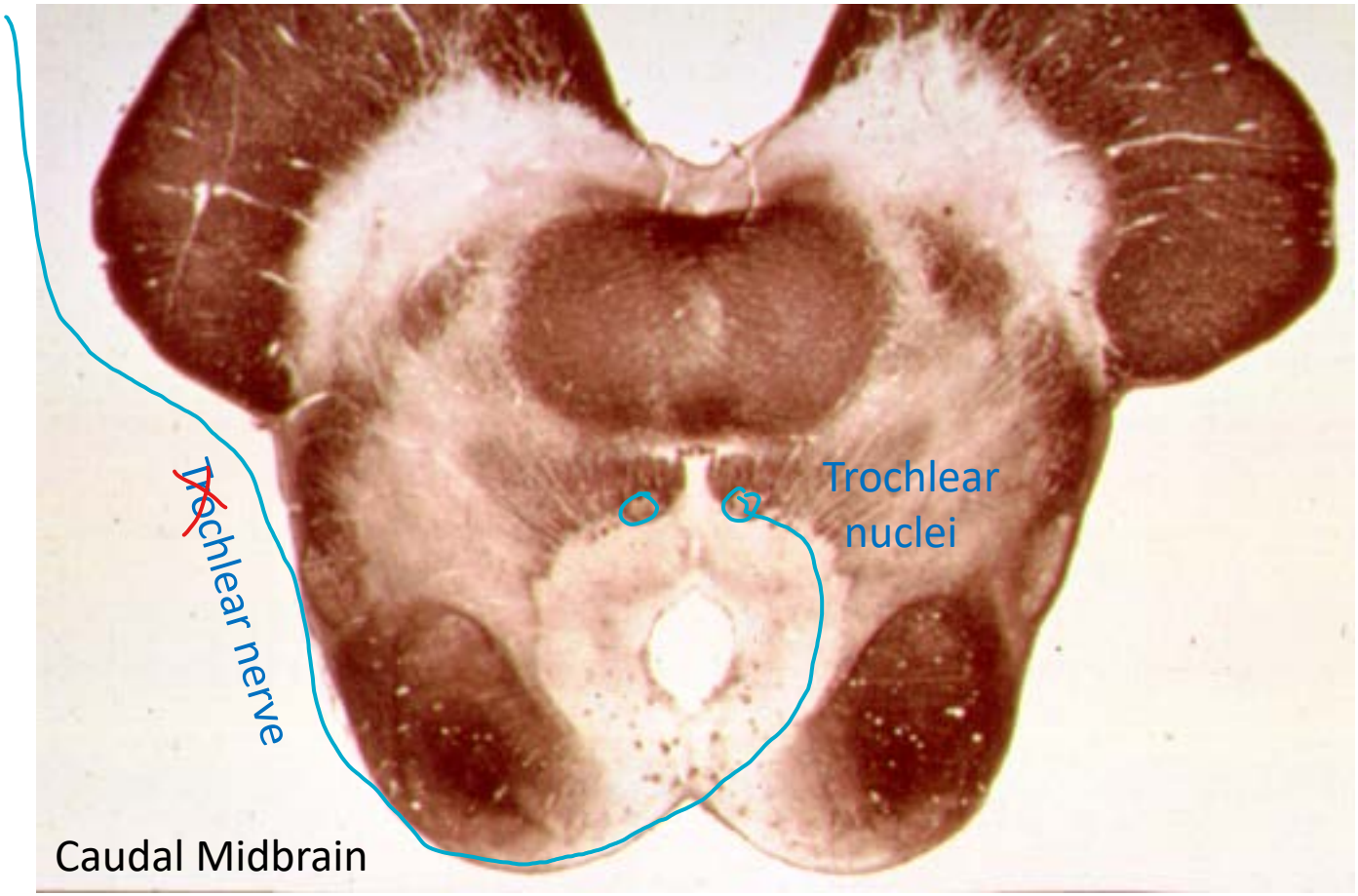
upper mickey mouse

Lesion to the Edinger-Westphal nucleus =
Dilated pupil on ipsilateral side (blown pupil) and
loss of accommodation on ipsilateral side

Lesion to the oculomotor nucleus or nerve = Ipsilateral flaccid paralysis of 4 of the 6 eye muscles and superior eyelid muscle.
Ipsilateral eye will deviate laterally (ipsilateral lateral strabismus)
Ptosis = drooping superior eyelid on ipsilateral side

Cranial Nerve IV = Trochlear Nerve

CN IV function – Lower motor neuron that innervates the superior oblique eye muscle (eye movement needed for walking down a flight of stairs)



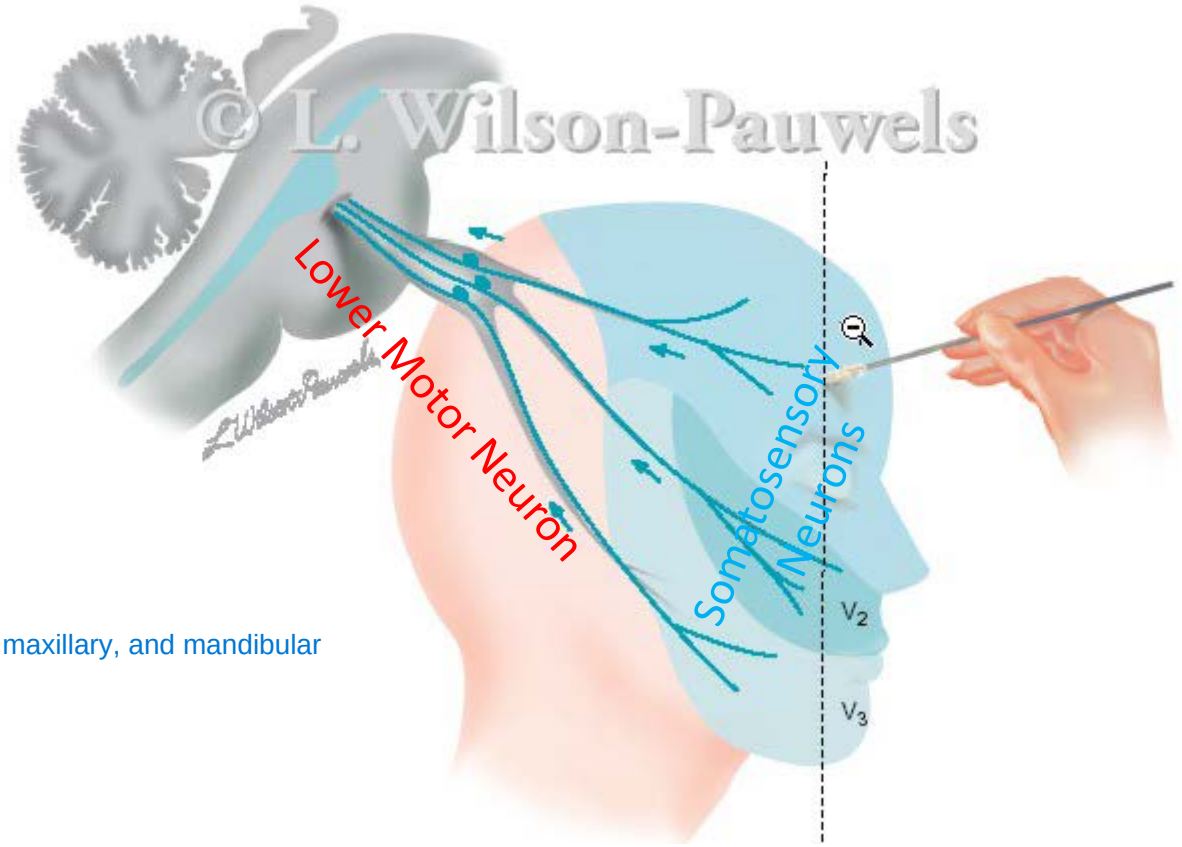
eye mvmt to walk down the stairs eye moves in and down

Lesion to trochlear nerve = Ipsilateral flaccid paralysis of the superior oblique eye muscle
Ipsilateral eye will deviate up and out

Cranial Nerve V = Trigeminal Nerve

Relays somatosensation from the face (from V1, V2, V3 nerves)
Lower motor neuron to muscles of mastication (V3 only)

cell bodies in the brainstem



ophthalmic, maxillary, and mandibular

Trigeminal Pathways

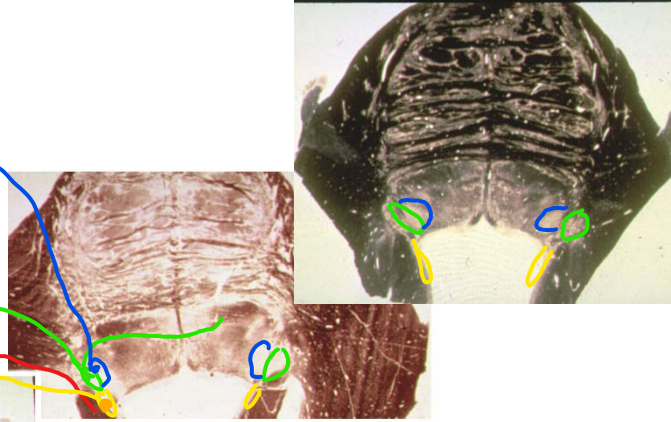
V3 only synapses on muscles of mastication (Lower motor neuron)

descends before ascends

Discriminative Touch, Vibration from Ipsilateral face (V1, V2, V3)

Pain and Temperature sensation from Ipsilateral face (V1, V2, V3)

Proprioception from the Ipsilateral face



Principle Sensory Nuclei

Trigeminal Motor Nuclei

Mesencephalic Nuclei and Tracts

Spinal Trigeminal Nuclei and Tracts

Lesion Principle Sensory Nucleus = Ipsilateral loss of discriminative touch and vibration from the face

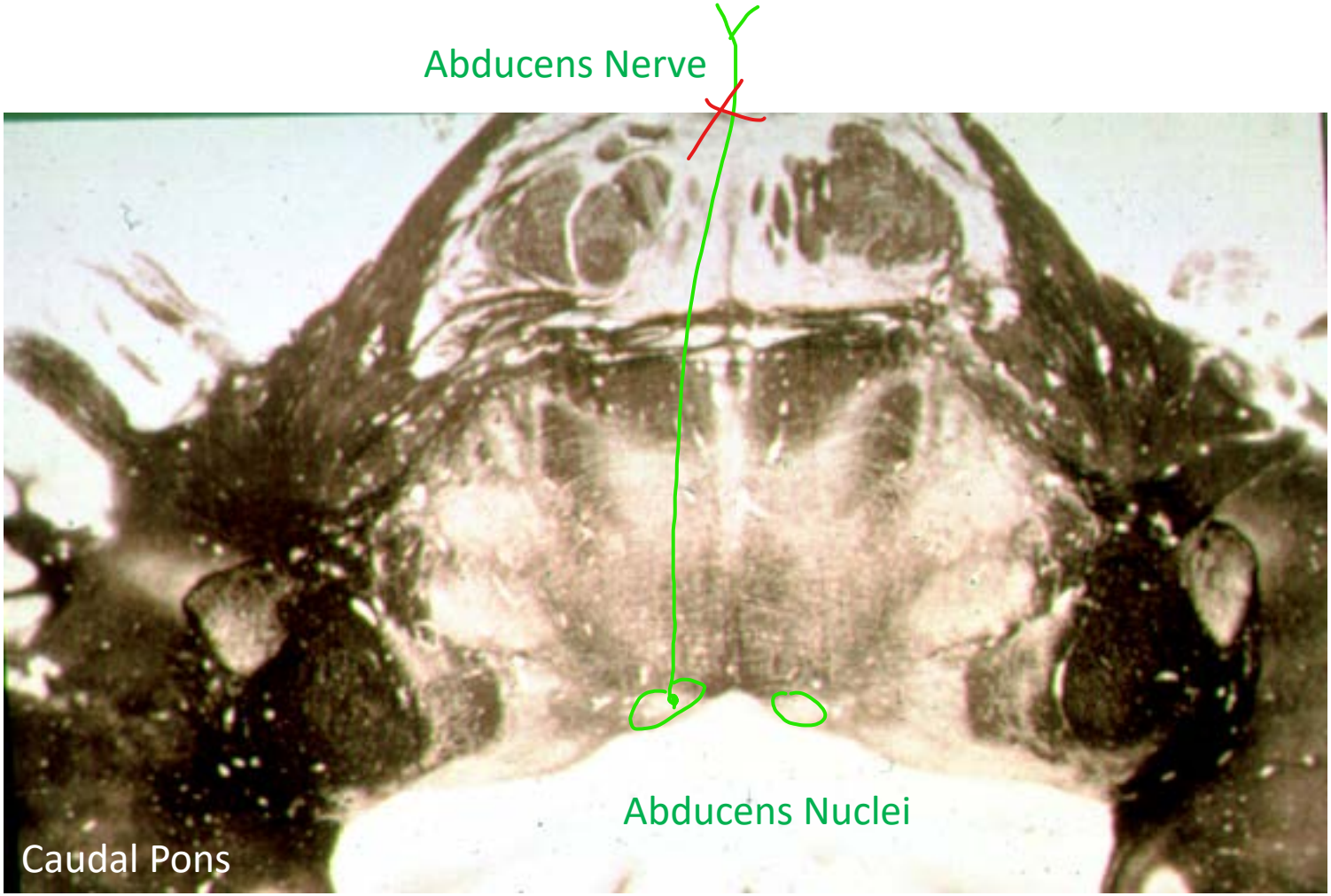
Lesion Trigeminal Motor Nucleus = Ipsilateral flaccid paralysis of the muscles of mastication

Lesion to Mesencephalic Nucleus and Tract = Ipsilateral loss of proprioception from the face

Lesion Spinal Trigeminal Nucleus and Tract = Ipsilateral loss of pain and temperature from the face

Cranial Nerve VI = Abducens Nerve

Lower motor neuron that innervates the ipsilateral lateral rectus muscle of the eye



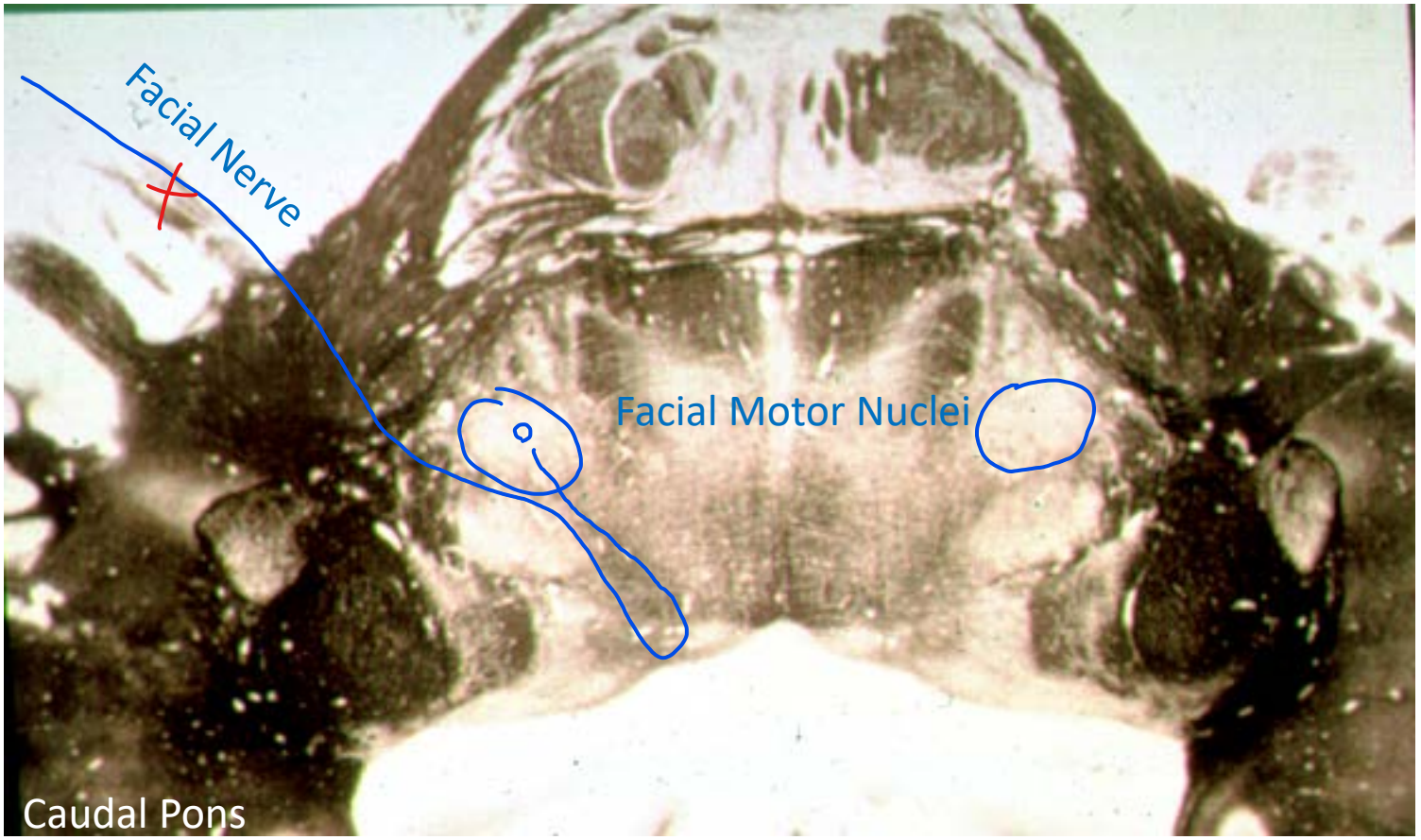
Lesion to the Abducens nerve = Ipsilateral flaccid paralysis of the lateral rectus eye muscle
Ipsilateral eye will deviate medially (Ipsilateral Medial Strabismus)

lose 6 and 3 wins and pulls it medially

Cranial Nerve VII = Facial Nerve

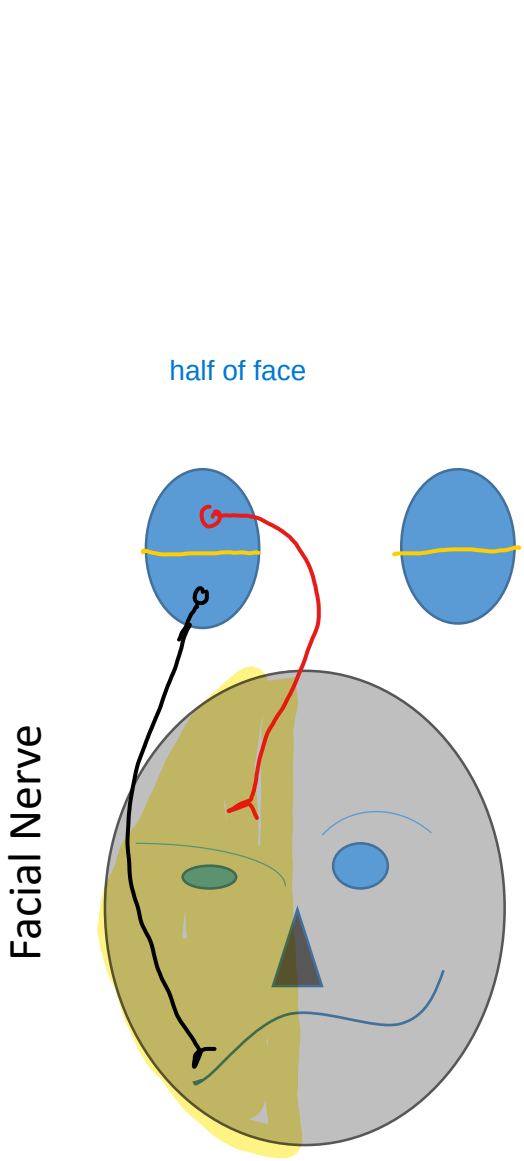
Main clinical function – Lower motor neuron innervation to muscles of facial expression

Relays taste sensation from anterior 2/3 of ipsilateral tongue
Parasympathetic preganglionic to ipsilateral glands of the face



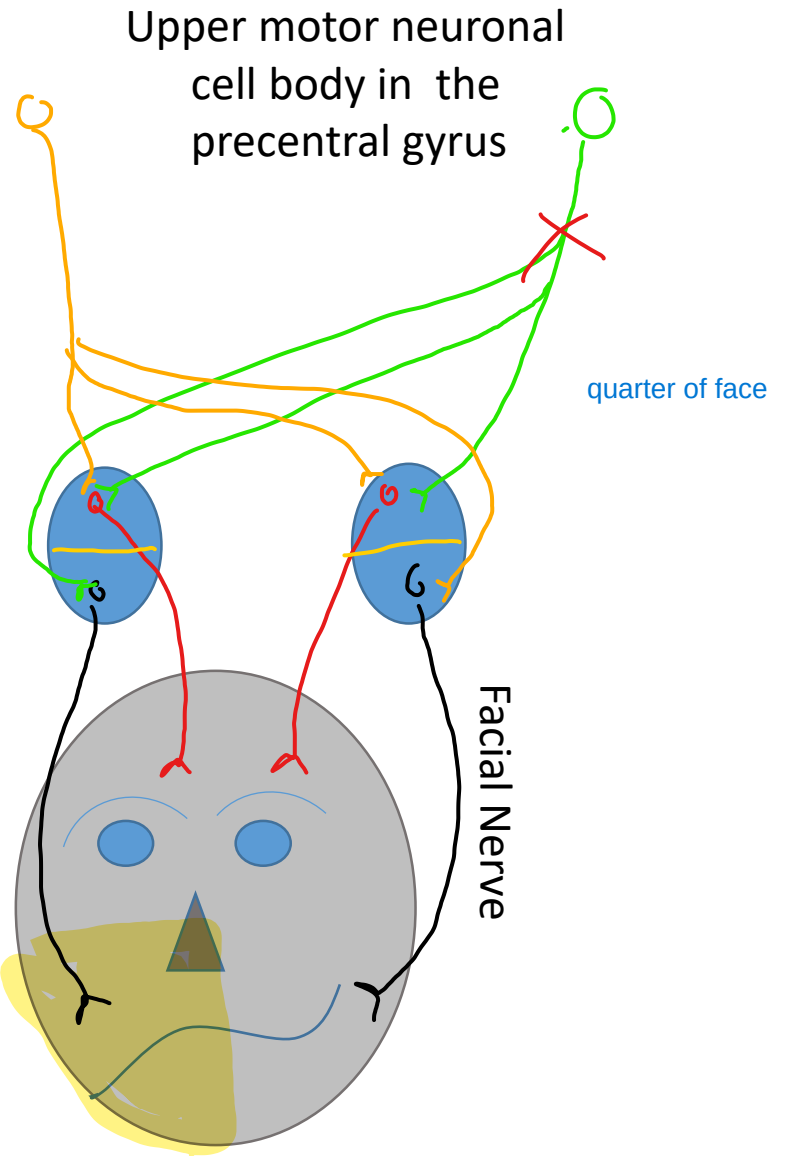
Lesion to the Facial Motor Nucleus or Nerve = Ipsilateral flaccid paralysis of the muscles of facial expression
Bell Palsy

Bell palsy vs. Central Facial palsy



Facial Motor Nuclei in the Pons

Contain cell bodies of lower motor neurons whose axons are CN VII

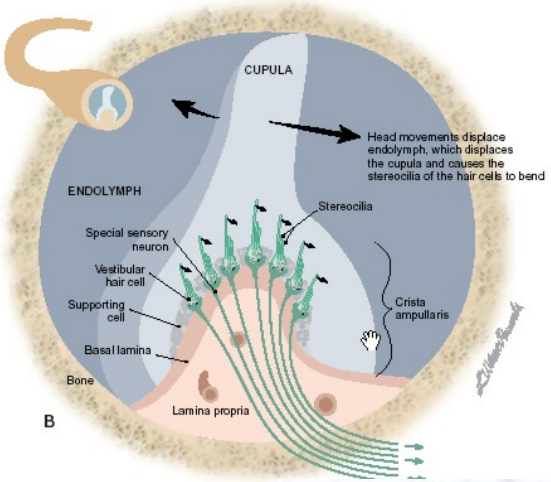


Bell palsy = CN VII lesion (lower motor neuron)

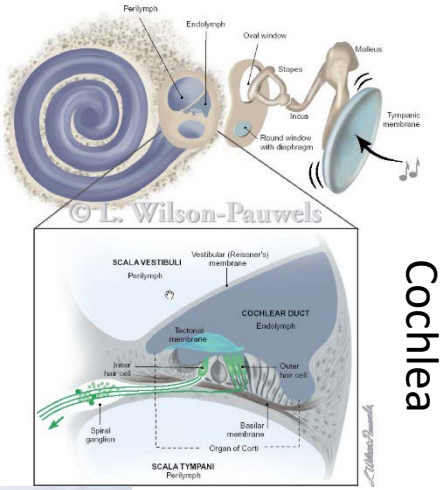
Central Facial palsy = upper motor neuron

Cranial Nerve VIII = Vestibulocochlear Nerve

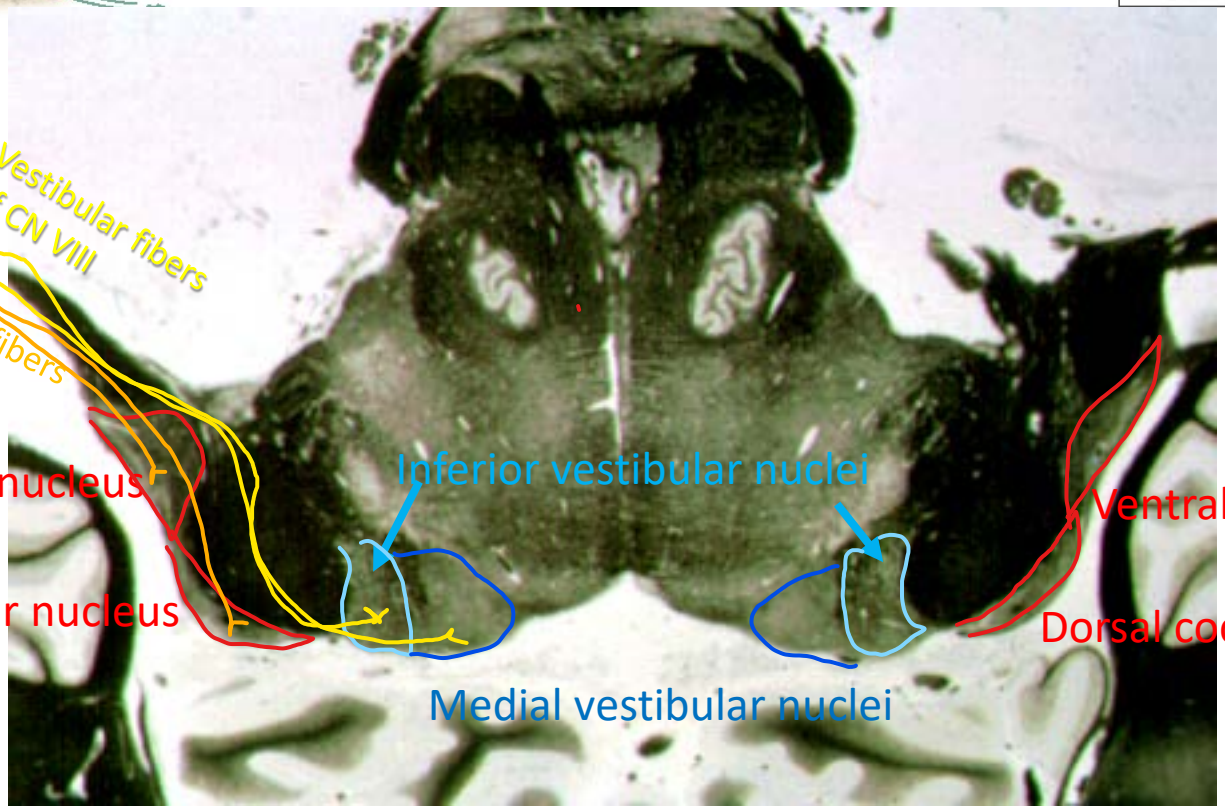
Semicircular canal



Relays
vestibular and auditory sense
to the brain

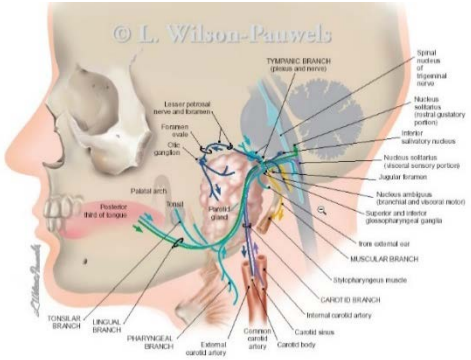


Cochlea

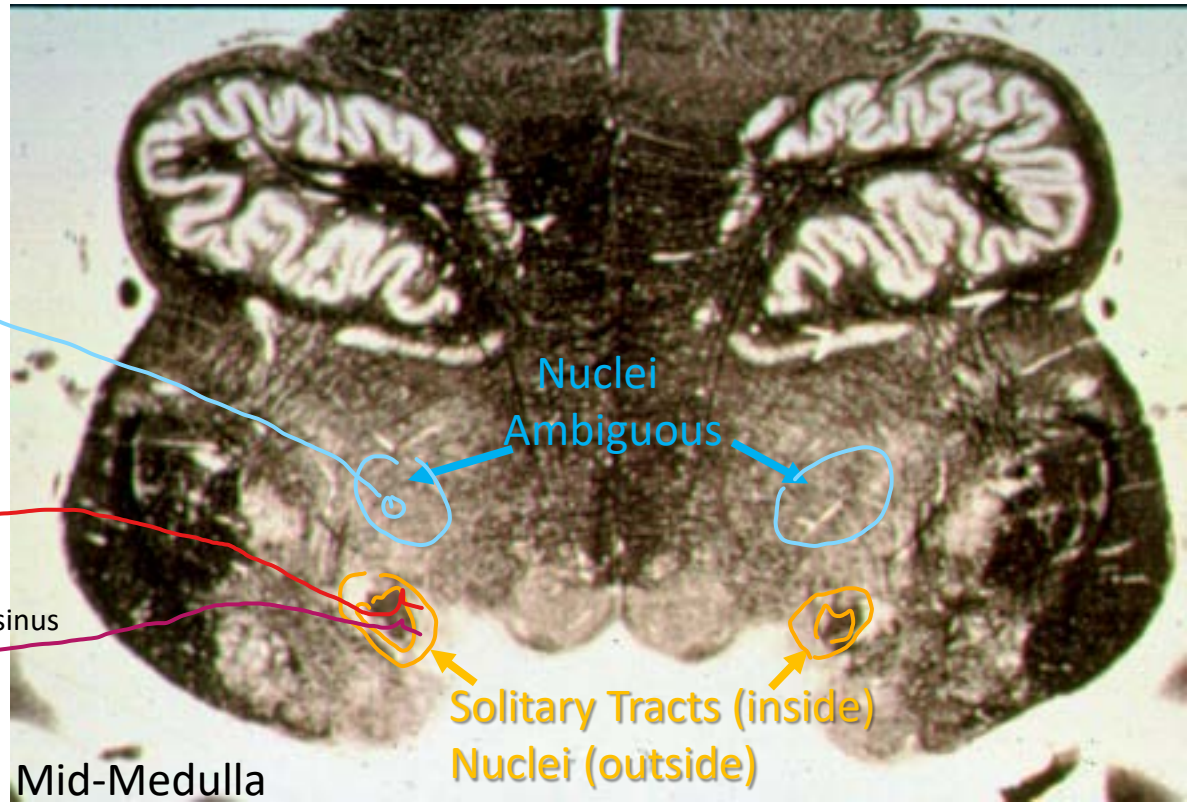


Rostral Medulla

Cranial Nerve IX = Glossopharyngeal Nerve



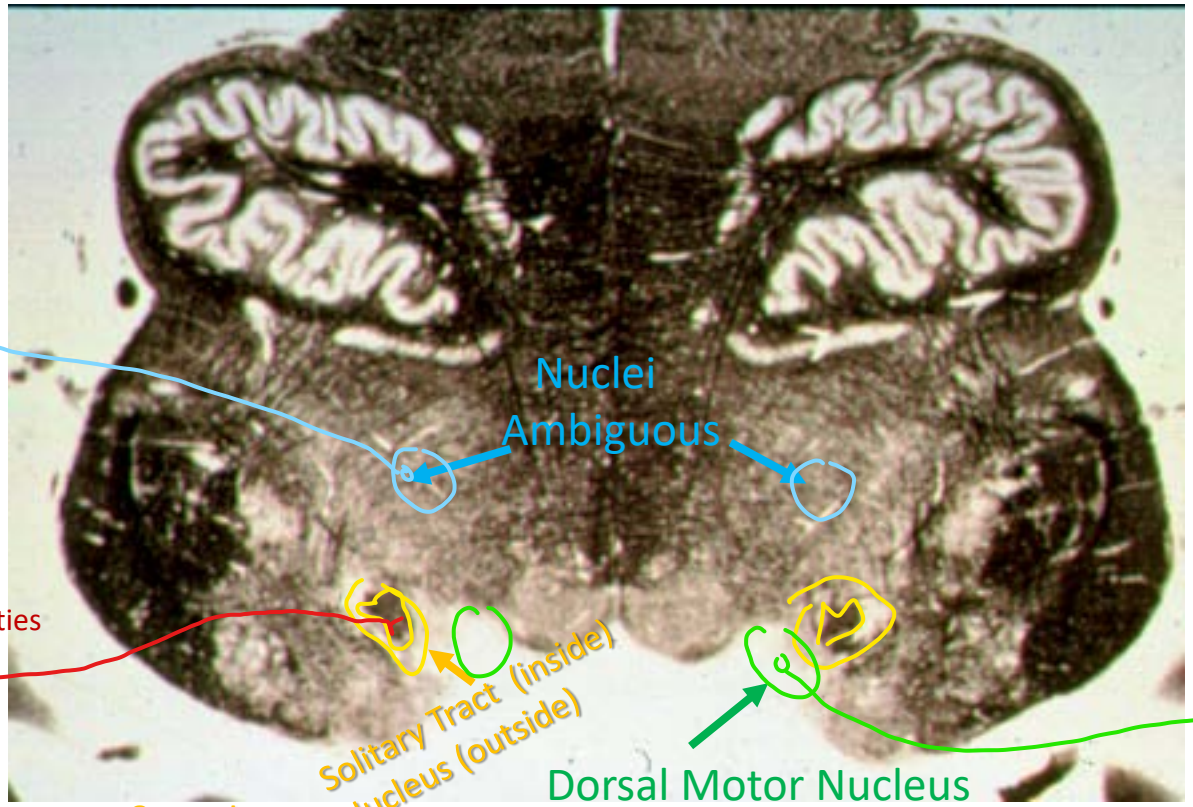
Relays visceral sensation from the carotid body and sinus
Relays taste sensation from the posterior 1/3 of tongue
Lower motor neuron that innervates the stylopharyngeus m.
Also
parasympathetic preganglionic to the parotid gland
relays sensation from posterior tongue, inner tympanic membrane and skin of ear



Cranial Nerve X = Vagus Nerve

Relays visceral sensation from visceral organs of thoracic and abdominal cavities
Lower motor neuron that innervates the muscles of the larynx and pharynx
Parasympathetic preganglionic to the visceral organs of thoracic and abdominal cavities
Also relays sensation from pharynx, external tympanic membrane and skin of posterior ear

Lesion to ipsilateral nucleus ambiguous = Ipsilateral dysarthria and dysphagia



Function of the Dorsal Motor Nucleus of the Vagus = Preganglionic Parasympathetic cell bodies whose axons synapse on postganglionic neurons

Function of the solitary tract & nucleus = receives visceral sensation and taste from CNs VII, IX, X

Smooth muscle of visceral organs

Cranial Nerve XI = Spinal Accessory Nerve

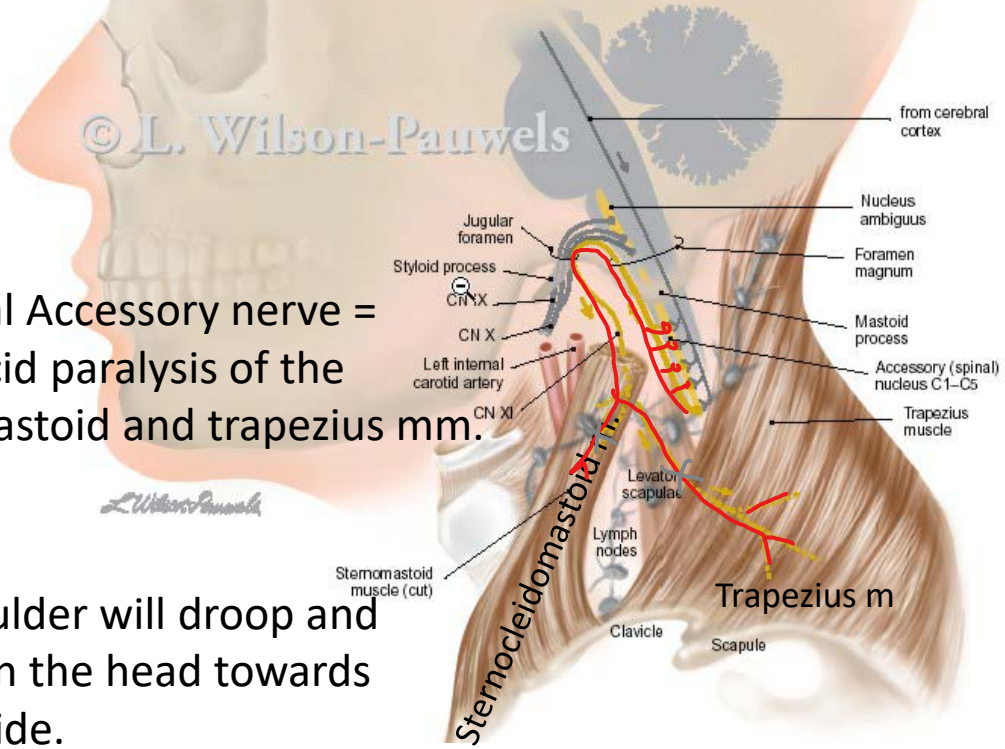
Lower motor neuron whose cell body resides in cervical anterior horn.

Nerve leaves spinal cord and goes into the cranium via the foramen magnum and leaves via jugular foramen.

Innervates the ipsilateral Trapezius and Sternocleidomastoid mm.

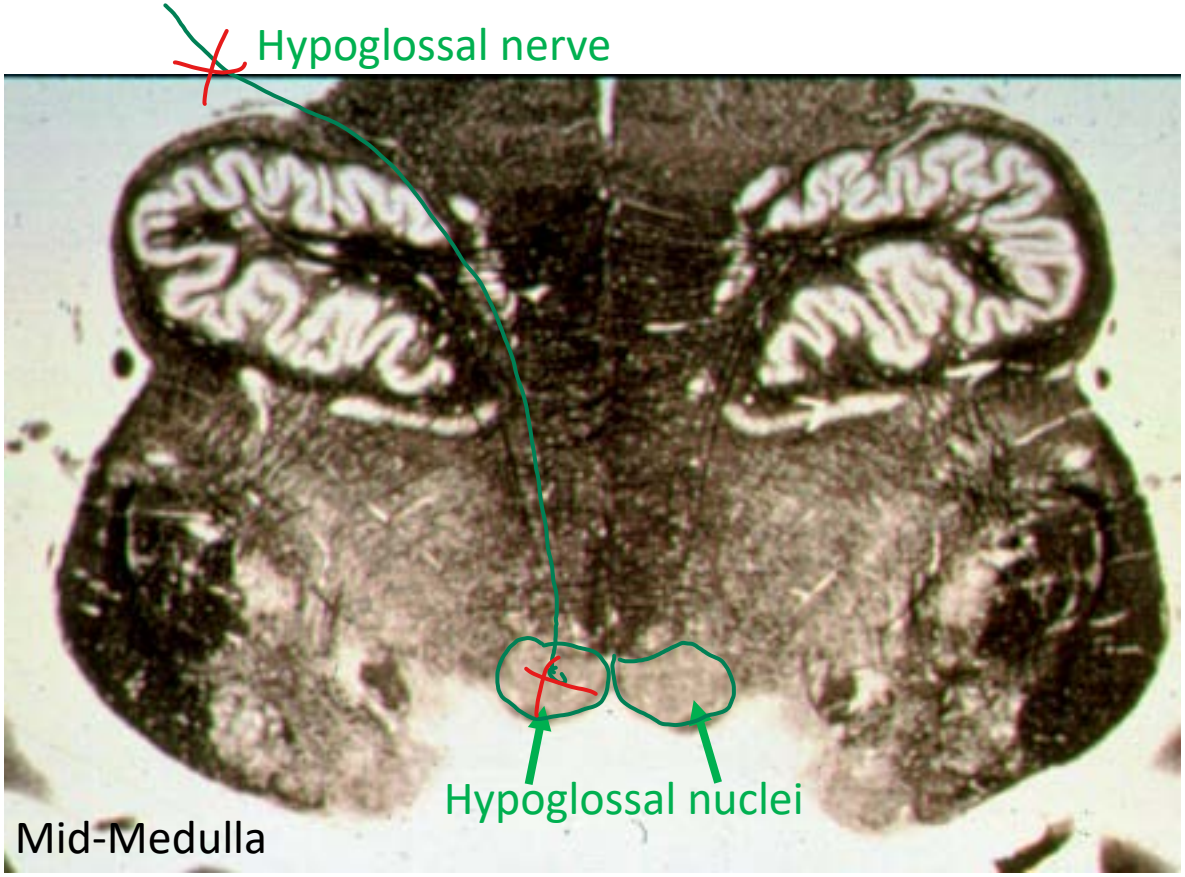
Lesion to spinal Accessory nerve = Ipsilateral flaccid paralysis of the sternocleidomastoid and trapezius mm.

Ipsilateral shoulder will droop and inability to turn the head towards the opposite side.



Cranial Nerve XII = Hypoglossal Nerve

Lower motor neurons that innervate the ipsilateral tongue muscles



Lesion to the hypoglossal nucleus or nerve = ipsilateral flaccid paralysis/ atrophy of the tongue

can test if pt can stick out tongue and will deviate toward lesioned side

Tongue will deviate towards the ipsilateral side when protruded

Cranial Nerve XII/Hypoglossal Nerve Lesion (LMN)
vs.
Corticobulbar/Corticonuclear tracts (UMN)

Lesion to the Hypoglossal nucleus or nerve = ipsilateral flaccid paralysis of the tongue, tongue will deviate towards the lesioned (ipsilateral) side when protruded

Upper motor neuron lesion = tongue deviates to the opposite side of the lesion(contralateral)

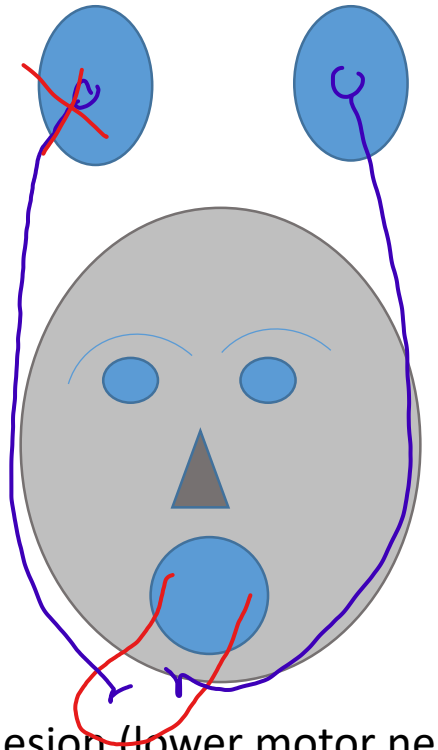
Upper motor cell body and axon

Hypoglossal Nuclei in the Medulla

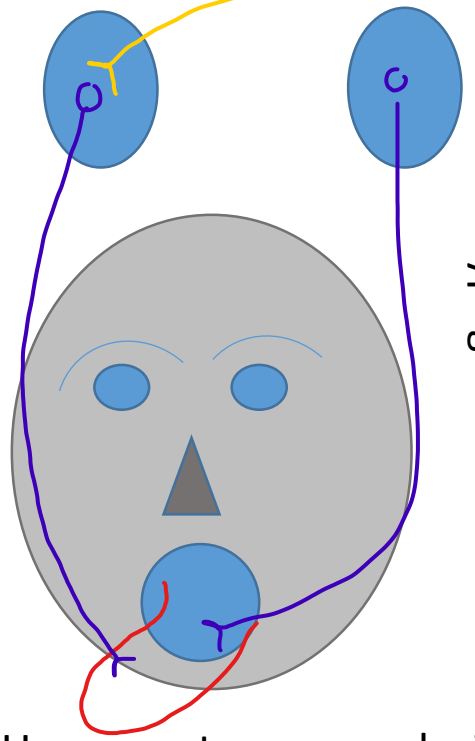
Contain cell bodies of lower motor neurons whose axons are CN XII

If tongue deviates to the right AND the surface of the tongue has atrophied = CN XII right side

Hypoglossal Nerve



CN XII lesion (lower motor neuron)



Hypoglossal Nerve

Upper motor neuron lesion