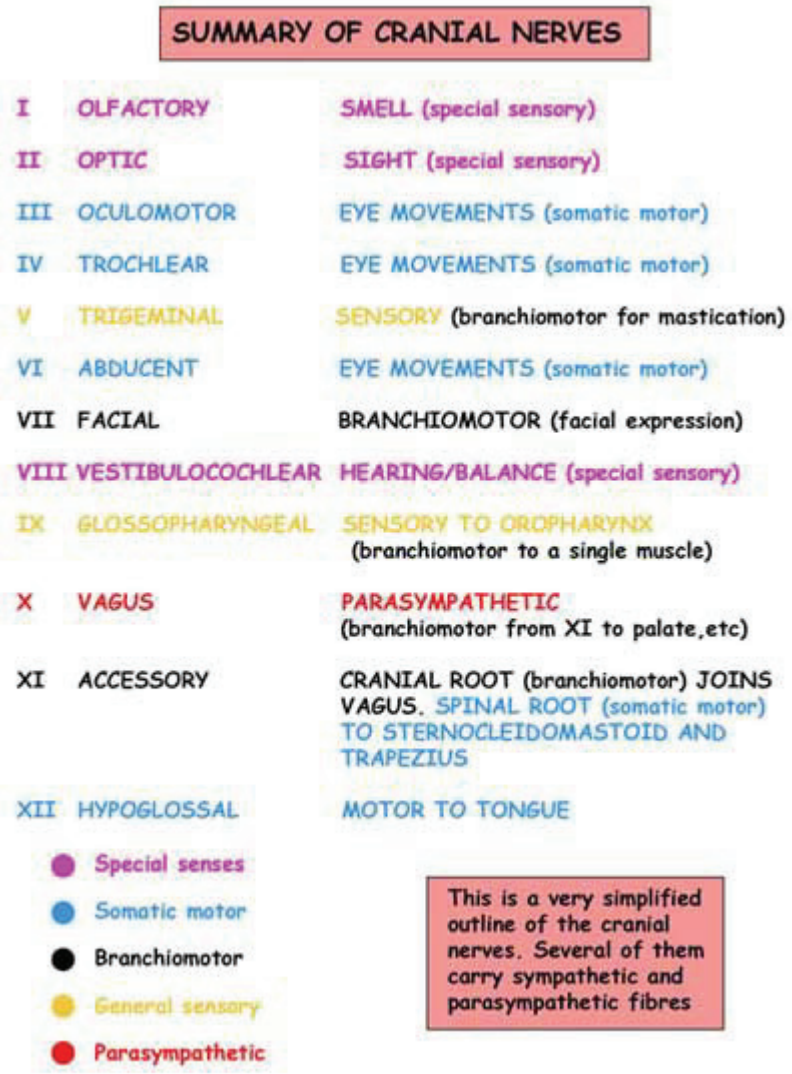
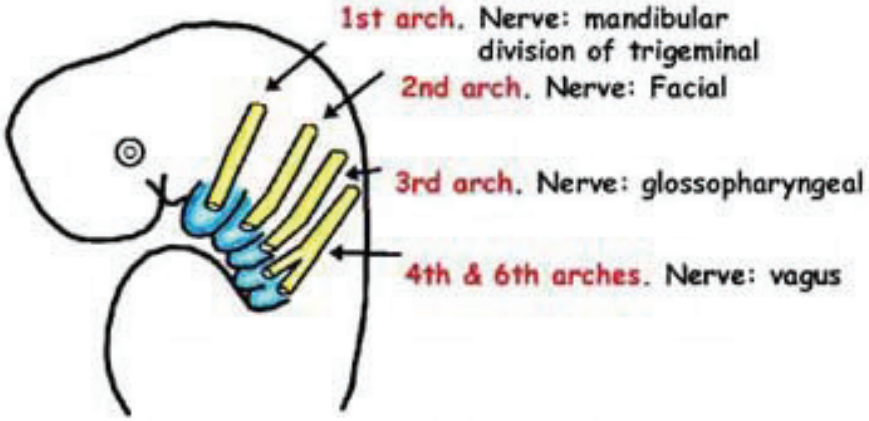
Use the following to supplement or reinforce your Cranial Nerve knowledge!!



CRANIAL NERVES WITH MOTOR SUPPLY TO MUSCLES OF BRANCHIAL ORIGIN

	BRANCHIOMOTOR (MUSCLES OF BRANCHIAL ORIGIN)
V	Nucleus: Motor of trigeminal M of mastication, mylohyoid, ant digastric, tensors palati & tympani
VII	Nucleus: Facial M of facial expression, buccinator, post digastric, stylohyoid, stapedius
IX	Nucleus: Ambiguus Stylopharyngeus
X	Nucleus: Ambiguus M of pharynx, upper oesophagus, palate, larynx (from cranial XI)
XI	Nucleus: Ambiguus M of palate & pharynx via vagus

Cranial nerves V, VII, IX, X are the nerves to the branchial (pharyngeal) arches 1, 2, 3, 4/6 respectively. In addition the cranial part of XI dumps its fibres on the vagus to be distributed with it



CRANIAL NERVES THAT CARRY PARASYMPATHETIC FIBRES

	PARASYMPATHETIC (GENERAL VISCERAL MOTOR)
III	Nucleus: Edinger-Westphal Ciliary ganglion Ciliary body & muscle, Sphincter pupillae
VII	Nucleus: Superior salivary Pterygopalatine & submandibular ganglia Lacrimal, submandibular, sublingual & palatine glands
IX	Nucleus: Inferior salivary Otic ganglion Parotid, glands in post 1/3 tongue & oropharynx
X	Nucleus: Dorsal motor of vagus Cardiac & visceral muscle in thorax & abdomen

Cranial nerves III, VII, IX and X all carry parasympathetic fibres from the various central parasympathetic nuclei and they take these fibres to their respective parasympathetic ganglion where they synapse and then are distributed via a branch of the trigeminal to the end organ

CRANIAL NERVES THAT SUPPLY SOMATIC FIBRES TO SKELETAL MUSCLES

	SOMATIC MOTOR TO SKELETAL MUSCLE
III	Nucleus: Oculomotor Recti (Sup, med, inf), inf oblique, levator palpebrae superioris
IV	Nucleus: Trochlear Sup oblique
VI	Nucleus: Abducent Lat rectus
XI	Nucleus: Lat roots C1-5 Sternocleidomastoid & trapezius
XII	Nucleus: Hypoglossal M of tongue (not palatoglossus)

Cranial nerves III, IV, VI, XI and XII carry somatic nerve fibres to head and neck muscles that have NOT originated from the branchial arches

CRANIAL NERVES THAT CARRY SOMATIC SENSORY FIBRES

	SOMATIC SENSORY
V	Nucleus: Sensory of V Mesencephalic: proprioception main: touch Spinal: pain & temperature For V (face, orbit, tongue)
VII	Nucleus: Sensory of V Some skin of ext auditory Meatus & tympanic Membrane
IX	Nucleus: Sensory of V Posterior 1/3 tongue, palate, pharynx, tonsil, middle ear
X	Nucleus: Sensory of V Skin of posterior/inferior auricle, external auditory meatus; pharynx; larynx
NB	Cell bodies outside central nervous system except mesencephalic nucleus

The trigeminal nerve is the main sensory nerve for the head. Note that whichever nerve carries the sensation, the fibres all eventually reach the sensory nucleus of the trigeminal nerve. Remember that the Facial Nerve (VII) is essentially a motor nerve even though it does have a small sensory component

CRANIAL NERVES CARRYING GENERAL AND SPECIAL SENSORY FIBRES

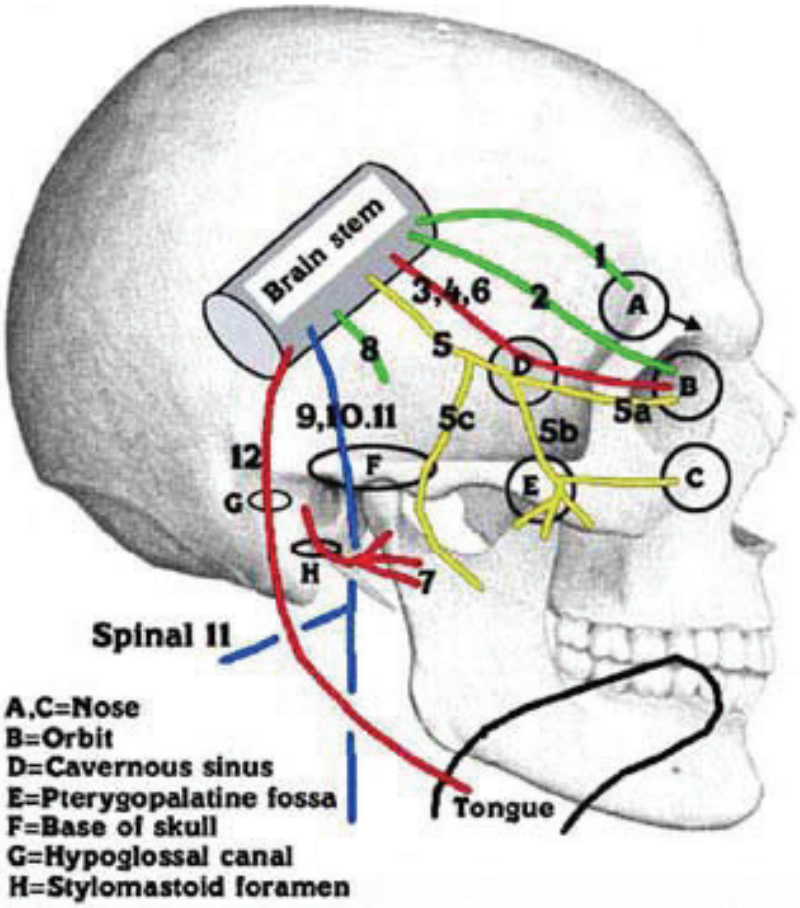
	GENERAL VISCERAL SENSORY	SPECIAL VISCERAL SENSORY
VII		Nucleus: Solitarius Chorda tympani Taste: ant 2/3 tongue
IX		Nucleus: Solitarius Taste: post 1/3 tongue, vallate papillae, oropharynx; baro & chemoreceptors
X	Nucleus: Solitarius or dorsal sensory of Vagus. From heart, lungs & abdominal viscera	Nucleus: Solitarius Taste: vallecula & epiglottis; baro & chemoreceptors
NB	From heart, lungs & gut	Taste; baro & chemoreceptors

Note that in the case of the vagus the sensation travels with this parasympathetic nerve but the fibres are really general visceral sensory and not parasympathetic.
Special visceral sensory comprises taste and baroreception

CRANIAL NERVES FOR SPECIAL SENSES

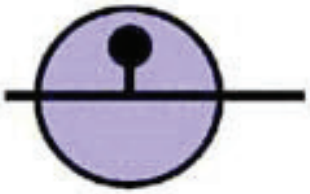
	SPECIAL SENSES
I	SMELL Limbic system
II	SIGHT Lateral geniculate body
VIII	HEARING: 2 nuclei EQUILIBRIUM: 4 nuclei

DIAGRAMATIC SUMMARY OF COURSES OF CRANIAL NERVES FROM BRAIN TO END ORGAN



The purpose of this figure is to show how some cranial nerves pass directly to their end organ (1,2,5c,8,9,10,11,12) whilst others pass through well defined cavities such as the cavernous sinus (3,4,5a,5b,6) or the pterygopalatine fossa (5b). For purposes of remembering the likely exit from the skull of cranial nerves, they can be grouped into those that pass to the nose (1), to the orbit (2,3,4,5a,6), to the front of the face (5b) and through the base of the skull (5c,7,9,10,11,12)

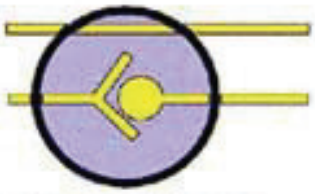
GANGLIA



SENSORY

Somatic sensory cell bodies

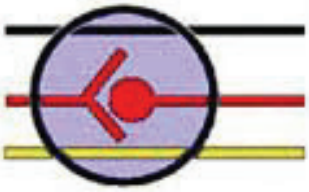
Posterior (dorsal) root
Trigeminal
Geniculate
Glossopharyngeal
Vagal



SYMPATHETIC

Sympathetics either synapse or pass through to synapse later

Sympathetic chain
Sympathetic peripheral
eg Coeliac
Sup mesenteric
Renal



PARASYMPATHETIC

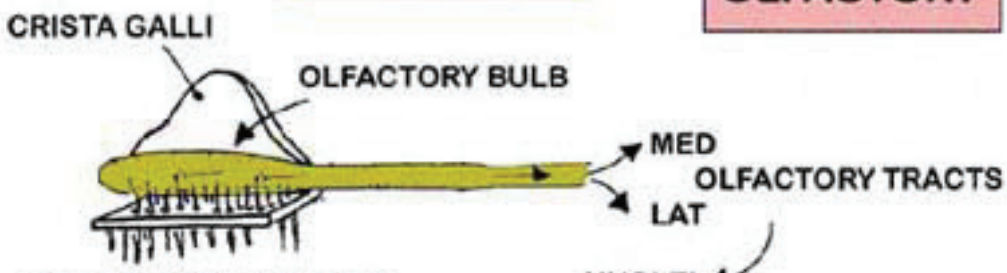
Parasympathetic synapse Somatic sensory & sympathetic pass through

Ciliary
Pterygopalatine
Submandibular
Otic

Each nerve has a cell body. For the sensory system this cell body is in the dorsal root ganglion or the equivalent for the sensory cranial nerves. There are no synapses in such ganglia.
In the sympathetic ganglia there are two alternatives. For those nerves that synapse there are cell bodies belonging to the post-ganglionic fibres. Others pass through without synapsing (gut & adrenal).
In the parasympathetic ganglia in the head and neck there is always a synapse with a post-ganglionic cell body.

I OLFACTORY

SPECIAL SENSE



20 OLFACTORY NERVES

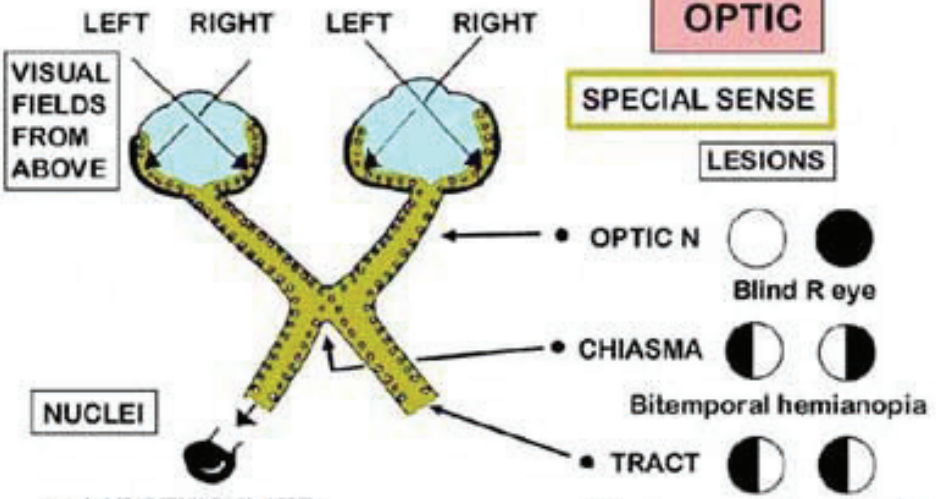
- Under-surface of cribriform plate
- Upper med & lat nose

NUCLEI

- ANTERIOR OLFACTORY in post bulb
- BRAIN
  - Anterior perforating substance
  - Uncus

II OPTIC

SPECIAL SENSE



LESIONS

- OPTIC N — Blind R eye
- CHIASMA — Bitemporal hemianopia
- TRACT — L homonymous hemianopia

- LAT GENICULATE BODY IN THALAMUS

- PRETECTAL NUCLEUS : "Pupillary light reflex"
- SUP COLLICULUS: "Near reflex"
  - Accommodation
  - Pupillary constriction
  - Convergence

III, IV, VI EYE MUSCLES

SOMATIC MOTOR

III OCULOMOTOR

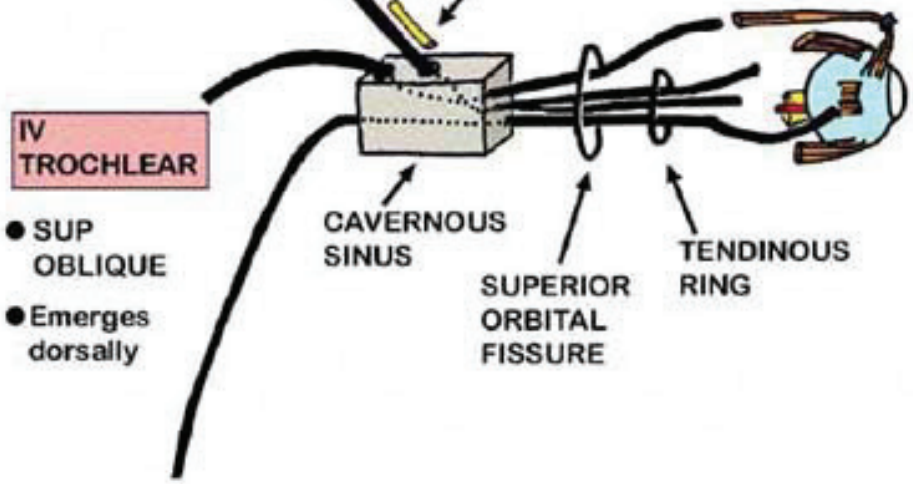
- SUP RECTUS
- INF RECTUS
- MED RECTUS
- INF OBLIQUE

PARASYMPATHETIC VIA CILIARY GANGLION

From: Edinger Westphal nucleus
To: ciliary muscle & sphincter pupillae
For: accomodation & pupillary constriction

SYMPATHETIC FROM CAVERNOUS SINUS

From: internal carotid art
To: levator palpebrae superioris



IV TROCHLEAR

- SUP OBLIQUE
- Emerges dorsally

CAVERNOUS SINUS

SUPERIOR ORBITAL FISSURE

TENDINOUS RING

VI ABDUCENT

- LAT RECTUS

Va
TRIGEMINAL: OPHTHALMIC

SENSORY

- Scalp
- Upper face
- Eye
- Sinuses

DELIVERS

10 short ciliary n's →

PARASYMPATHETIC VIA CILIARY GANGLION

- Ciliary muscle (accommodation)
- Sphincter pupillae
- Lacrimal gland (via pterygopalatine ganglion)

SYMPATHETIC VIA CAVERNOUS SINUS

2-3 long ciliary n's →

- Dilator pupillae

KEY BRANCHES

5 SENSORY TO FACE

- Supra-orbital → FRONTAL
- Supratrochlear → FRONTAL
- LACRIMAL
- Infratrochlear → NASOCILIARY
- External nasal → NASOCILIARY
- NASOCILIARY → Branches to long ciliary, short ciliary

Vb
TRIGEMINAL: MAXILLARY

SENSORY

- Middle face
- Palate
- Sinuses
- Nasopharynx/nose

DELIVERS

PARASYMPATHETIC VIA PTERYGOPALATINE GANGLION

- Lacrimal gland
- Mucous glands of sinuses, nose, palate, nasopharynx

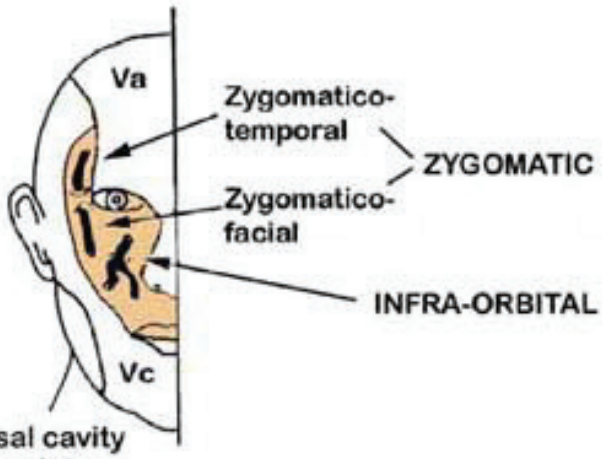
CARRIES

TASTE

- Hard & soft palate

KEY BRANCHES

3 SENSORY TO FACE



OTHER

- Nasopalatine to nasal cavity
- Greater palatine to palate
- Lesser palatine to palate
- Pharyngeal to nasopharynx
- Alveolar to upper teeth

Vc
TRIGEMINAL: MANDIBULAR (1st arch)

SENSORY
- Lower face
- Hairy temple
- Ant 2/3 tongue

BRANCHIOMOTOR
- Muscles of mastication
- Tensors tympani & palati

DELIVERS

PARASYMPATHETIC VIA SUBMANDIBULAR & OTIC GANGLIA
- Parotid gland
- Submandibular/sublingual glands
- Mucous glands floor of mouth, gums & sides of tongue

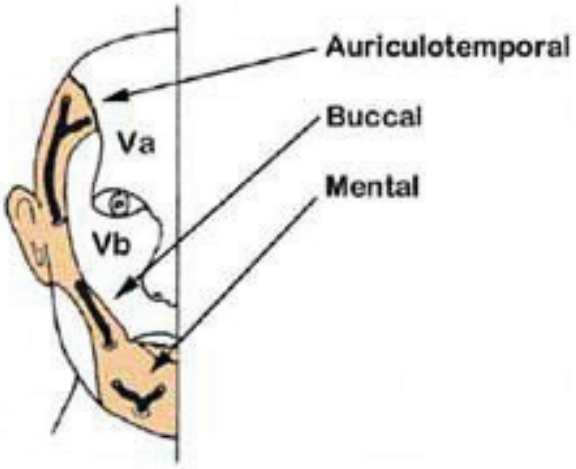
CARRIES

TASTE
- Ant 2/3 tongue

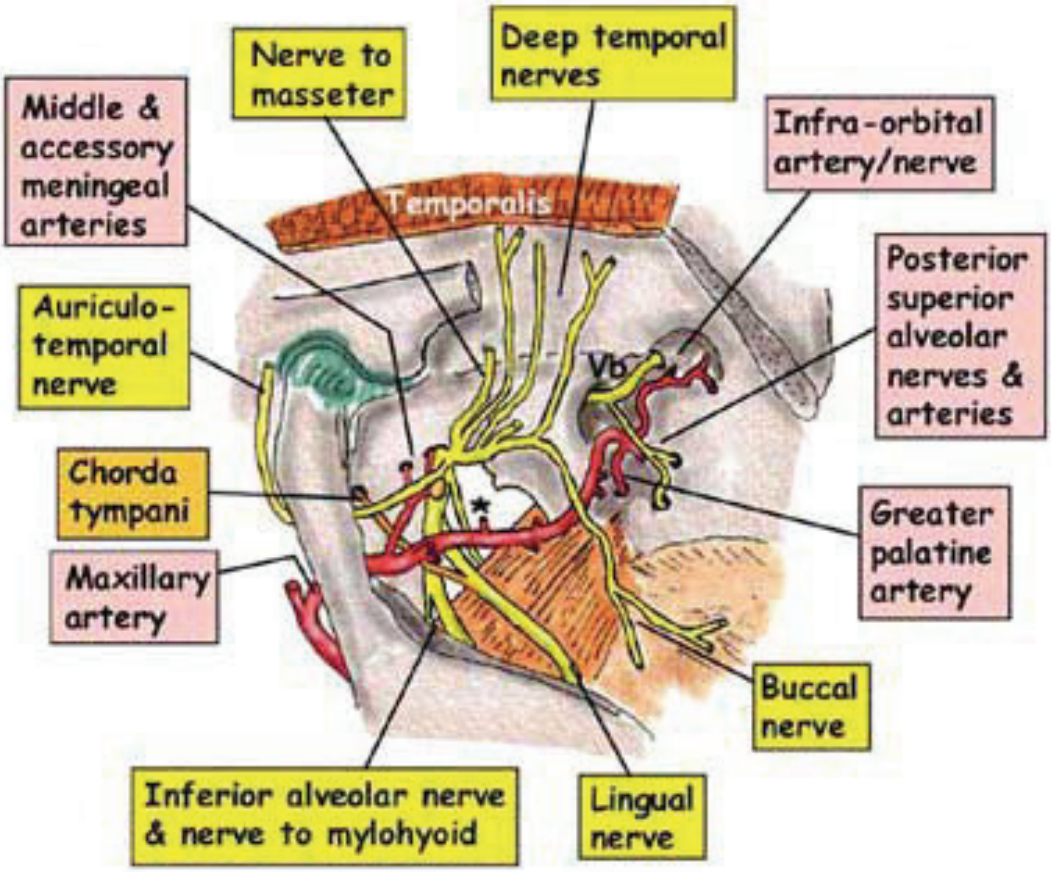
KEY BRANCHES

3 SENSORY TO FACE

OTHER
- Lingual
- Muscular



INFRATEMPORAL FOSSA - DEEP DISSECTION



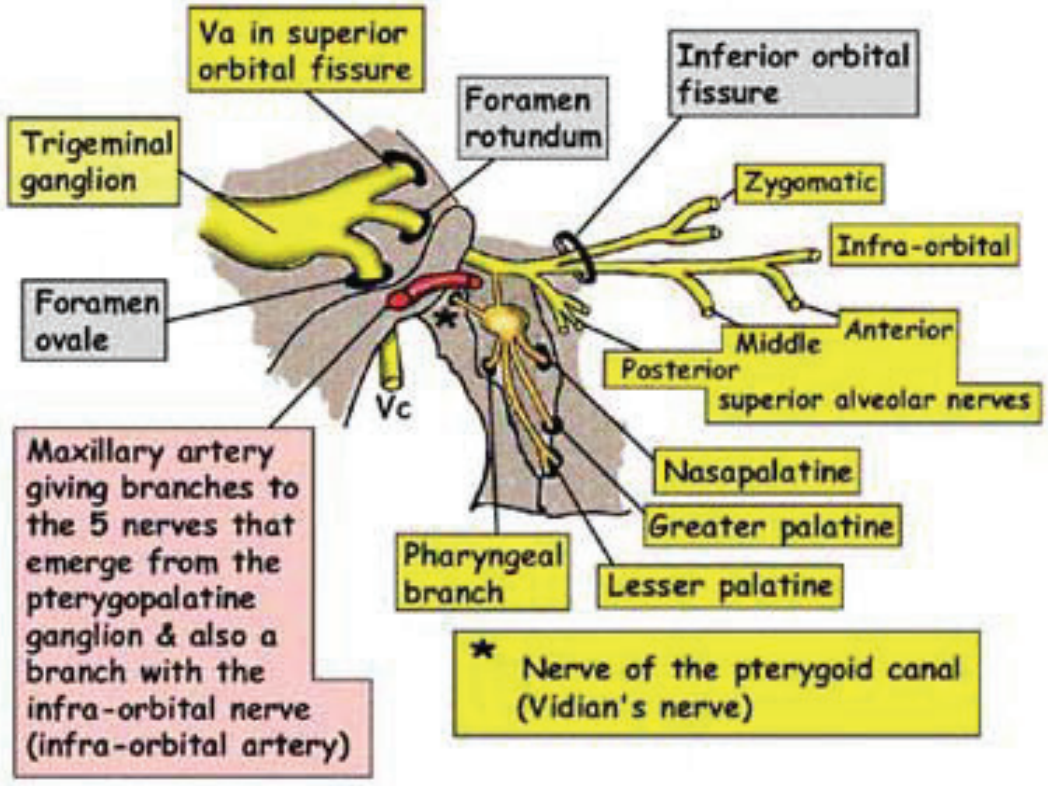
* Nerve to lateral pterygoid and just to its left is the otic ganglion

PTERYGOPALATINE FOSSA 1

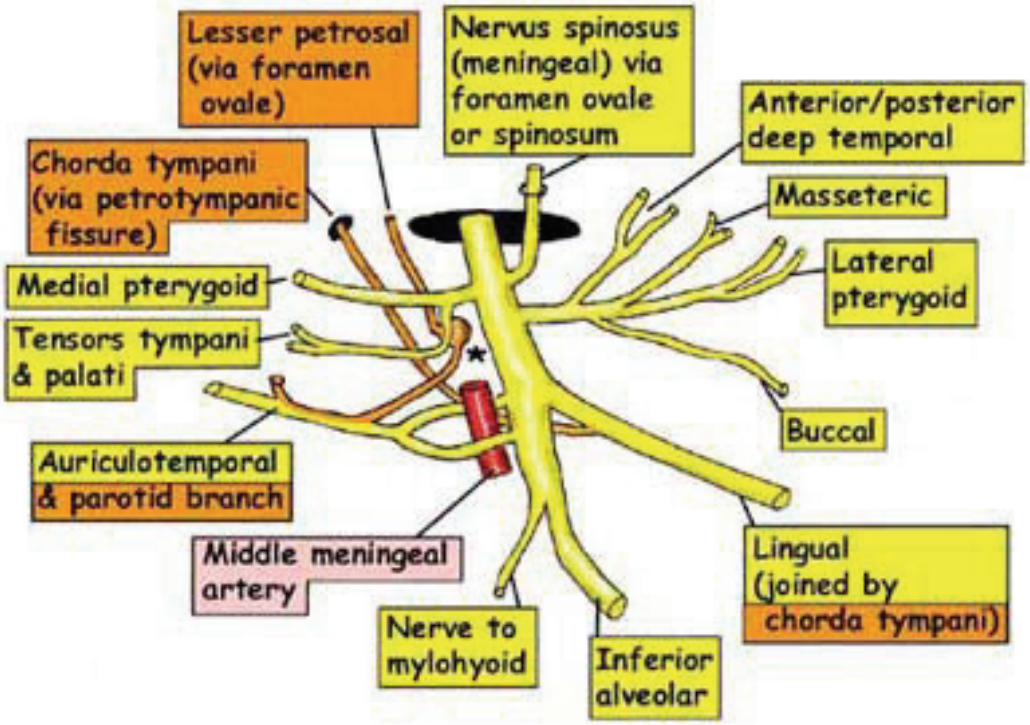
Right side of skull cut away to show trigeminal ganglion lying in Meckel's cave and the maxillary division entering the pterygopalatine fossa through foramen rotundum. The nerve of the pterygoid canal is seen entering the pterygopalatine ganglion and connecting to Vb so that sensory fibres can be distributed with the parasympathetic fibres from the ganglion and so that parasympathetics can pass on Vb to be distributed to sinuses and lacrimal gland.

The contents of the pterygopalatine fossa are:

- Terminal branches of the maxillary artery
- Maxillary nerve (Vb) to upper teeth, floor of orbit, face/skin
- Pterygopalatine ganglion for distribution of parasympathetics to nose and palate



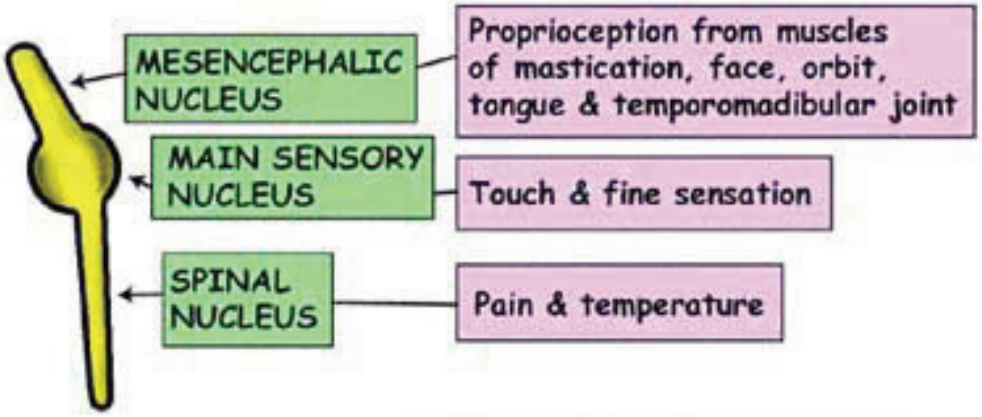
MANDIBULAR DIVISION OF TRIGEMINAL NERVE, EMERGING FROM FORAMEN OVALE DEEP IN INFRATEMPORAL FOSSA



★ Otic ganglion. Parasympathetics from lesser petrosal nerve synapse within it and post-ganglionic fibres are taken to the parotid gland by the auriculotemporal nerve

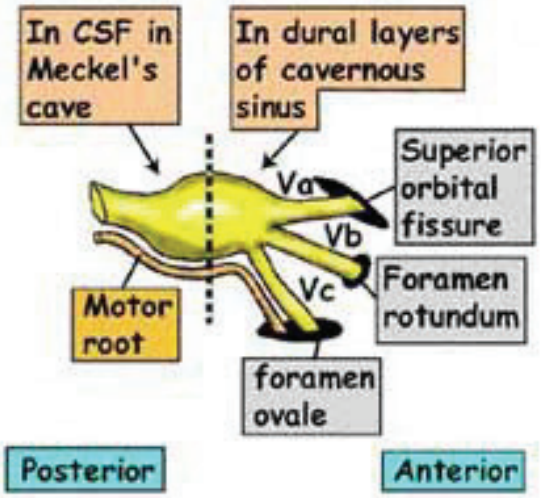
TRIGEMINAL NERVE (V) EXTRA NOTES

- Nerve of the first pharyngeal arch
- 3 nuclei in brain stem (see below)
- Somatic but carries parasympathetic and sympathetic
- Mostly sensory but small motor branch in mandibular division
- Motor is branchiomotor (special visceral motor)
- All cell bodies are in the trigeminal ganglion EXCEPT for proprioception and these are in the mesencephalic nucleus in the brain stem



GANGLION

In Meckel's cave
Motor root inferior
Blood supply from internal carotid in cavernous sinus & accessory meningeal via foramen ovale
Nerve supply from nervus spinosus (Vc)



VII FACIAL (2nd arch)

BRANCHIOMOTOR

- Muscles of facial expression
- Stapedius
- Post belly digastric, stylohyoid, occipitofrontalis

SENSORY (via nervus intermedius)

- Small contribution to external acoustic meatus

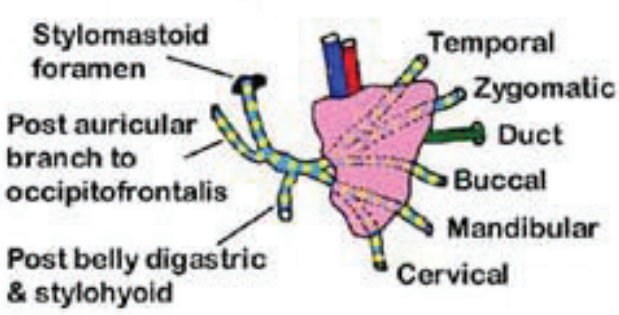
PARASYMPATHETIC (via nervus intermedius)

- Greater petrosal to pterygopalatine ganglion then to hay fever glands via Vb
- Chorda tympani to submandibular ganglion then to submandibular & sublingual glands via Vc

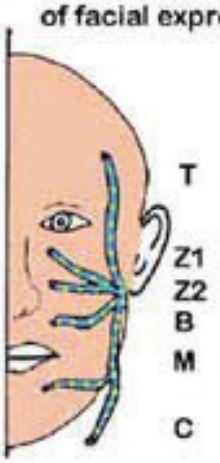
TASTE (via nervus intermedius)

- Palate via greater petrosal
- Ant 2/3 tongue via chorda tympani

KEY BRANCHES



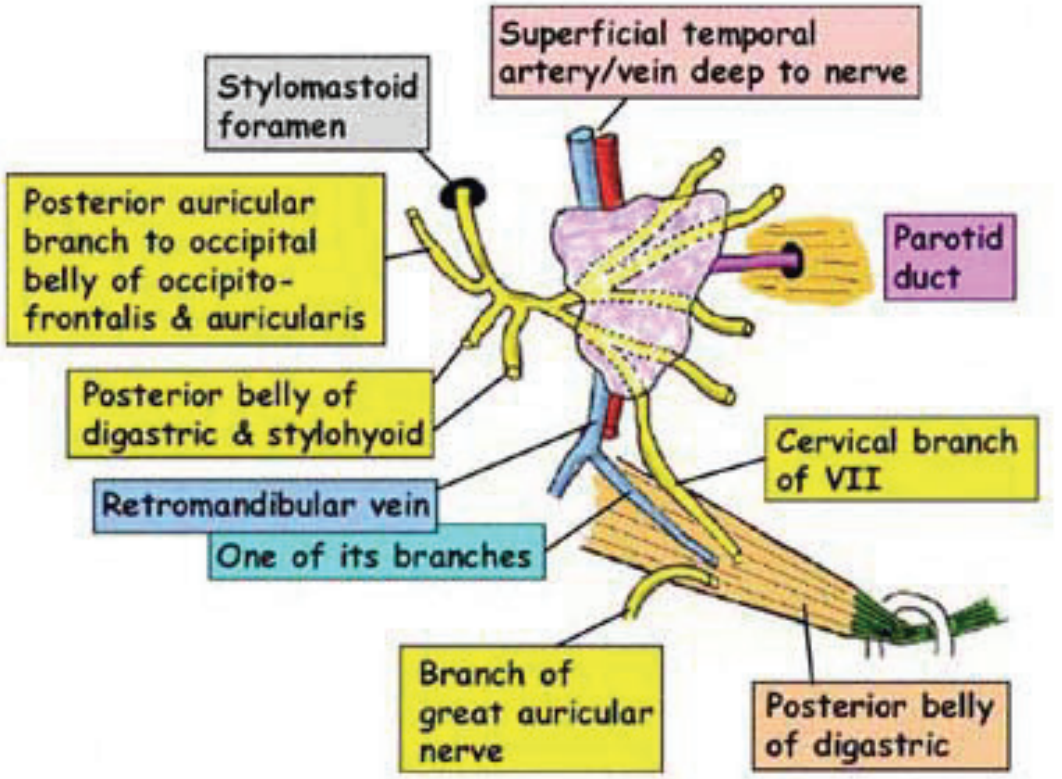
6 motor to muscles of facial expression



OTHER

- Greater petrosal
- Chorda tympani
- Small sensory br
- N to stapedius

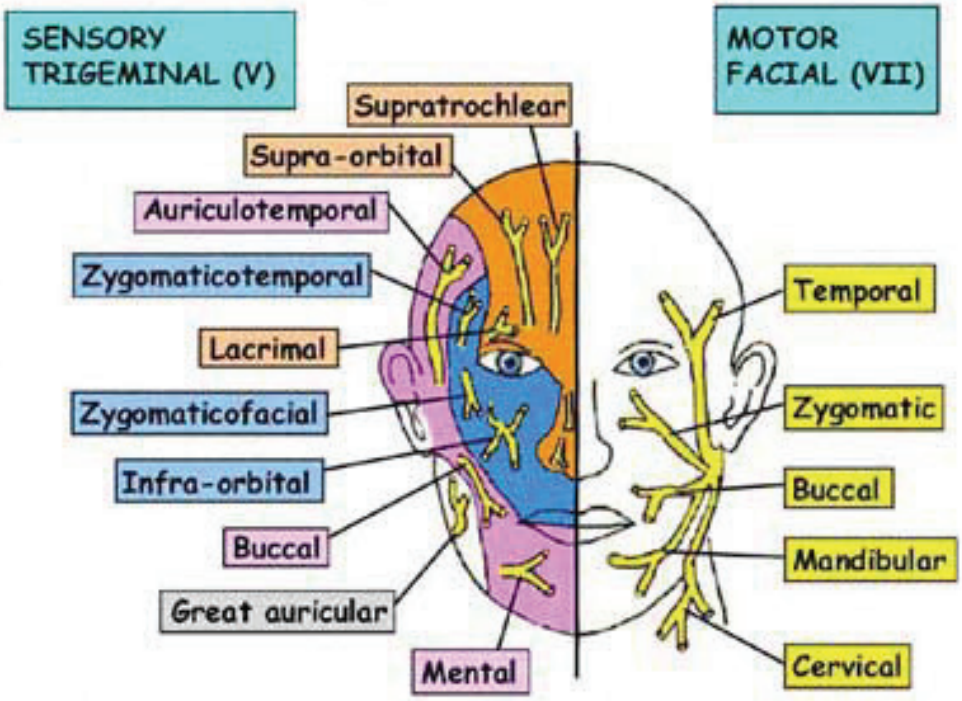
RIGHT FACIAL NERVE IN & BEFORE THE PAROTID



Note: Only three structures lie anterior to the posterior belly of digastric:-

- Cervical branch of VII
- Branch of the retromandibular vein
- Branch of great auricular nerve (cervical plexus)

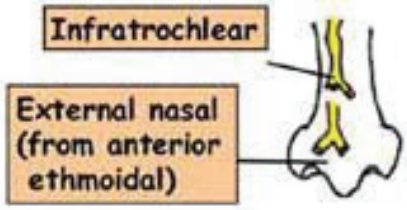
FACE: MOTOR AND SENSORY SUPPLY



Ophthalmic (5 branches)

Maxillary (3 branches)

Mandibular (3 branches)



Facial nerve branches:
Temporal: frontalis & procerus
Zygomatic 1: eye & around orbit
Zygomatic 2: mid face & smile
Buccal: buccinator & upper lip
Mandibular: lower lip & orbicularis oris
Cervical: platysma
(note: proprioception is supplied by trigeminal)

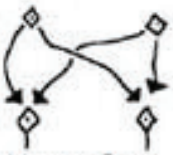
Mnemonic:
Two
Zulus
Befriended
My
Cat

FACIAL NERVE LESIONS

SUPRANUCLEAR LESION

Upper face has bilateral innervation (bilateral cortical representation)

Frontal lobe to corticonuclear fibres



Part of hemiplegia
Upper motor neurone lesion
Lower face worse for voluntary movement but may be OK for emotion

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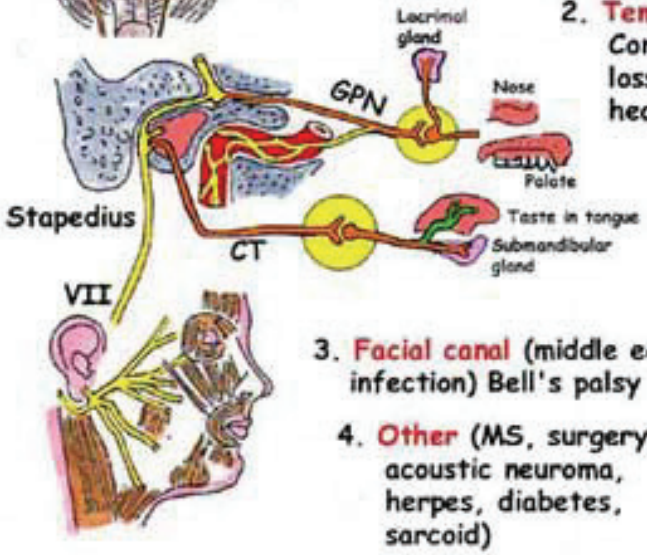
NUCLEAR/INFRANUCLEAR LESION

Ipsilateral

VII from cerebello-pontine angle

1. **Lesion ofnucleus/pontine fibres**
   Complete unilateral palsy. Loss of VII, VI, V, taste, opposite limbs long tracts



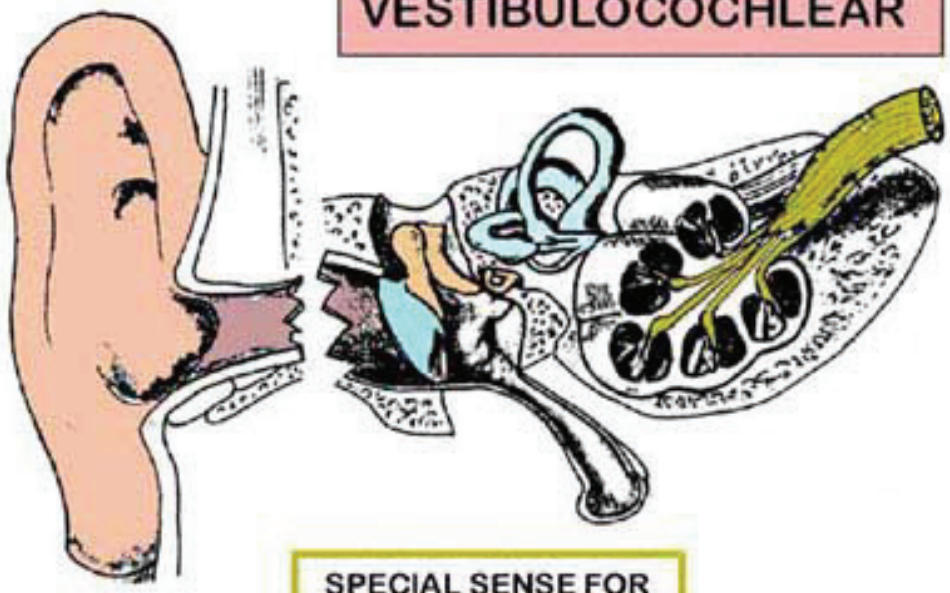
2. **Temporal bone** (fracture)
   Complete unilateral palsy, loss of taste, decreased hearing or hyperacusis

Lower motor neurone lesion

3. **Facial canal** (middle ear infection) Bell's palsy

4. **Other** (MS, surgery, acoustic neuroma, herpes, diabetes, sarcoid)

VIII
VESTIBULOCOCHLEAR



SPECIAL SENSE FOR HEARING & BALANCE

COCHLEAR DIVISION - HEARING

- From organ of Corti in cochlea
- Hair cells to cell bodies in spiral ganglion (in modiolus)
- To 2 cochlear nuclei (ventral & dorsal)

VESTIBULAR DIVISION - BALANCE

- From semicircular canals, utricle & saccule
- Cell bodies in vestibular ganglion in outer part of internal acoustic meatus
- To 4 vestibular nuclei (medial, lateral, superior & inferior)

IX GLOSSOPHARYNGEAL (3RD ARCH)

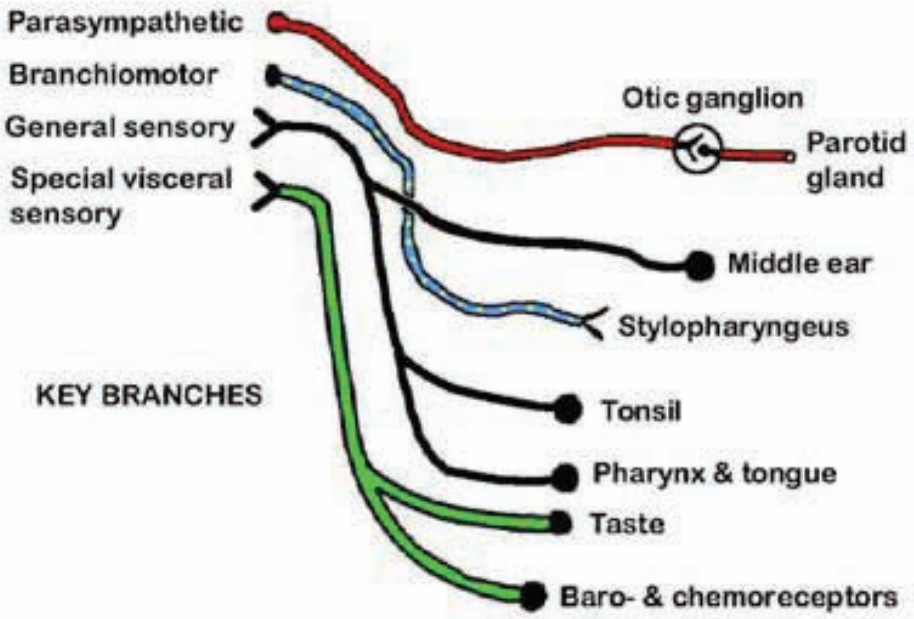
SENSORY
- Oropharynx
- Post 1/3 tongue
- Tonsil
- Middle ear

SPECIAL VISCERAL SENSORY
- Carotid body/sinus

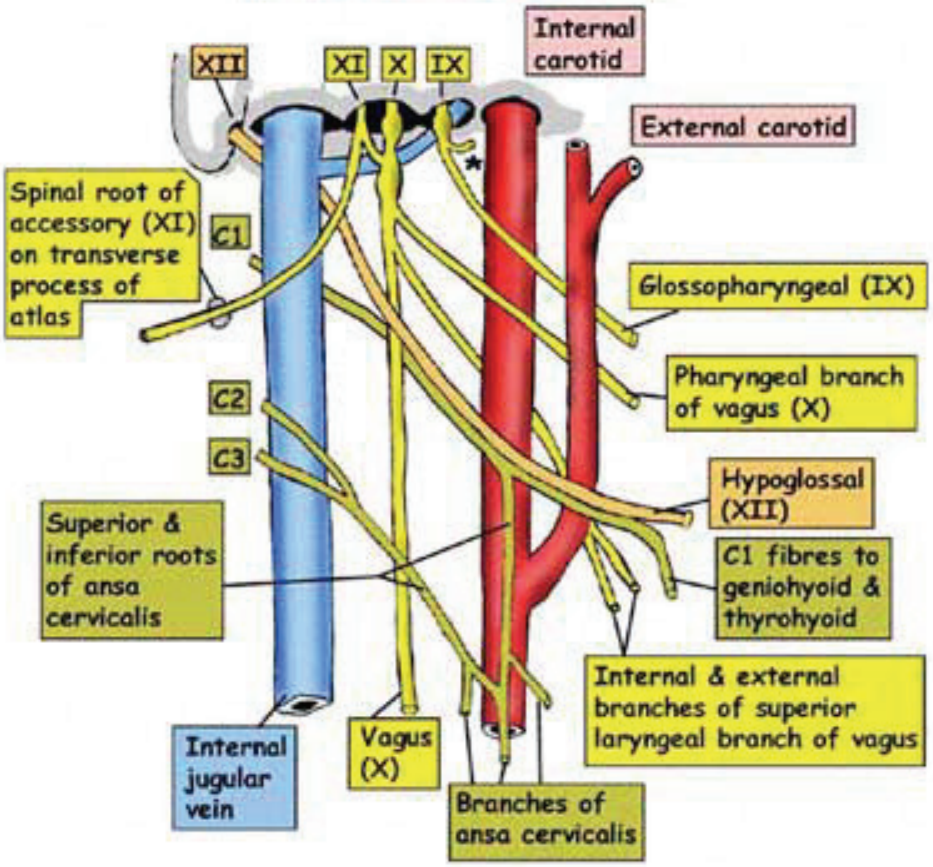
BRANCHIOMOTOR
- Stylopharyngeus

PARASYMPATHETIC
- Lesser petrosal n to otic ganglion to parotid gland via Vc

TASTE
- Post 1/3 tongue & oropharynx



JUGULAR FORAMEN EXPLODED VIEW



- The vagus lies most medial in the foramen
- Glossopharyngeal nerve & inferior petrosal sinus exit from the anterior compartment of the foramen
- Vagus & accessory nerves exit from the middle compartment
- The sigmoid sinus exits from the posterior compartment, is soon joined by the inferior petrosal sinus to become the internal jugular vein

★ = Tympanic branch of IX (Jacobson's nerve)

X
VAGUS
(4th & 6th arches)

PARASYMPATHETIC
- Cardiac branches
- Thorax &abdomen

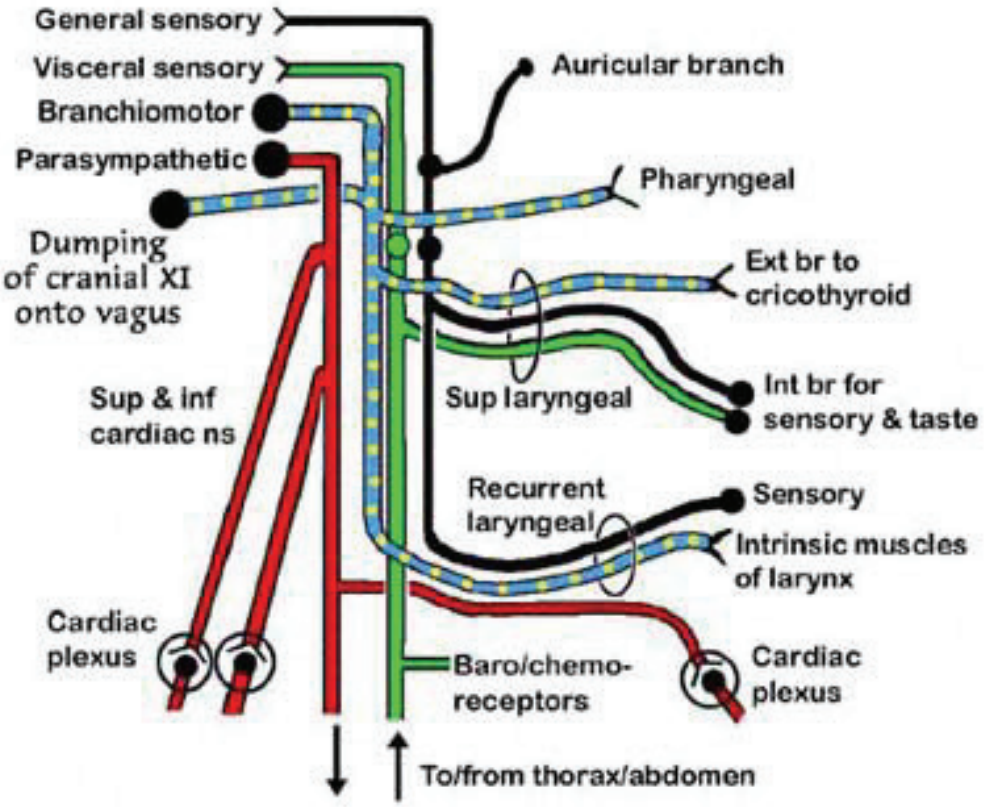
VISCERAL SENSORY
- Thorax & abdomen

TASTE
- Valleculae

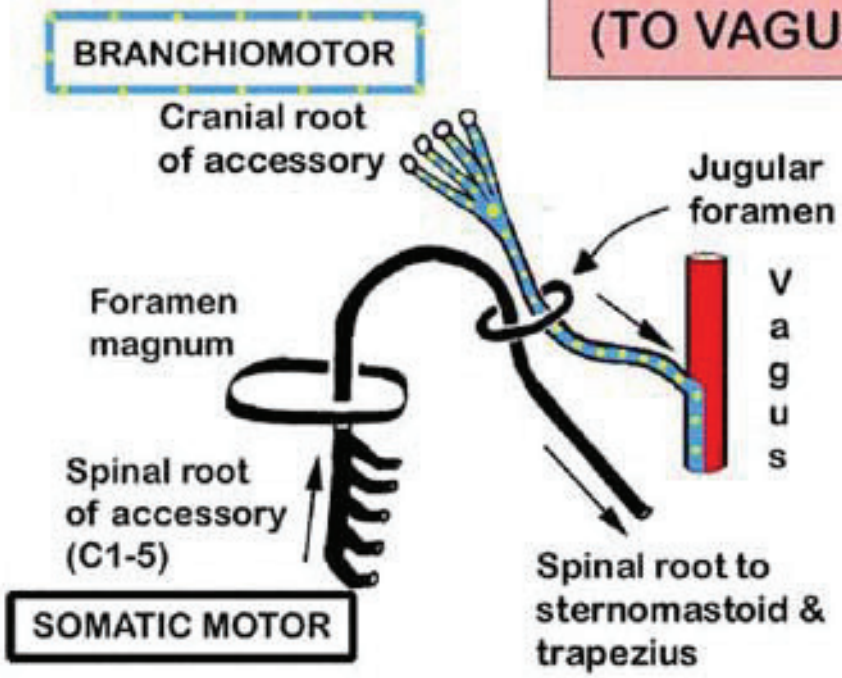
BARO/CHEMO-RECEPTORS

BRANCHIOMOTOR
(from cranial accessory)
- Muscles of pharynx,larynx, palate & upper oesophagus

SENSORY
- Larynx, laryngopharynx, valleculae
- Small areas of skin: ext auditory meatus, eardrum & behind ear

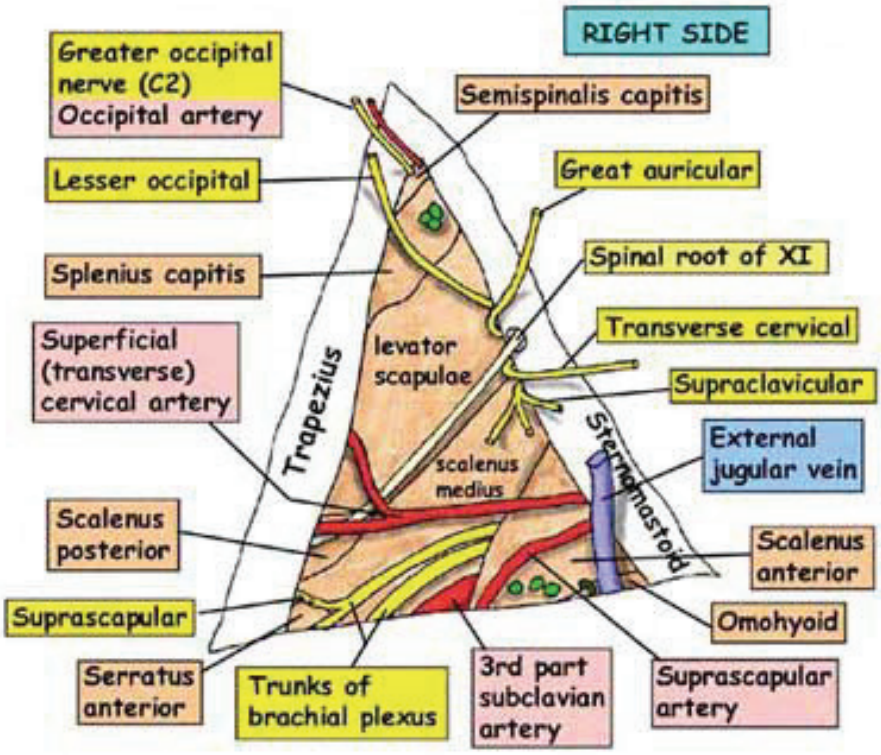


XI ACCESSORY (TO VAGUS)



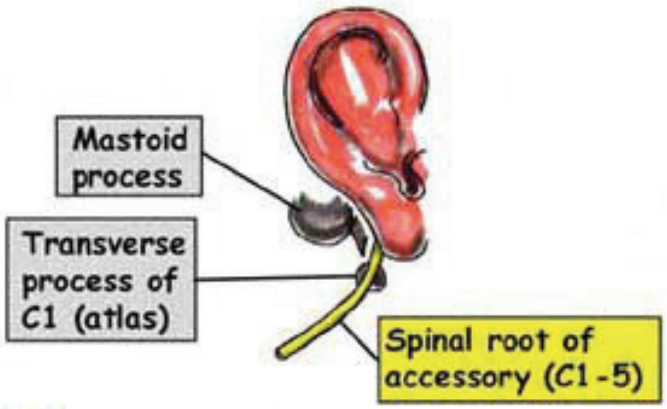
POSTERIOR TRIANGLE OF NECK

- Boundaries: Posterior border of sternocleidomastoid, anterior border of trapezius, mid 1/3 clavicle
- Shape: Spiral
- Roof: Investing fascia, platysma, external jugular vein
- Floor: Prevertebral fascia covering muscles, subclavian artery, trunks of brachial plexus & cervical plexus
- Contents:
  - Arteries: Occipital, superficial cervical, suprascpular
  - Veins: Transverse cervical, suprascapular, external jugular
  - Nerves: Branches of cervical plexus, spinal root of accessory
  - Muscle: Omohyoid with its sling
  - Lymph nodes: Occipital (rubella/scalp infections) Supraclavicular (part of the deep chain)



SPINAL ROOT OF ACCESSORY NERVE

SURFACE MARKINGS



Method one

1. Find transverve process of atlas just anterior mastoid process
2. Draw a line to anterior border of trapezius, 5cm above the clavicle
3. This is the line of the nerve through sternocleido-mastoid and posterior triangle

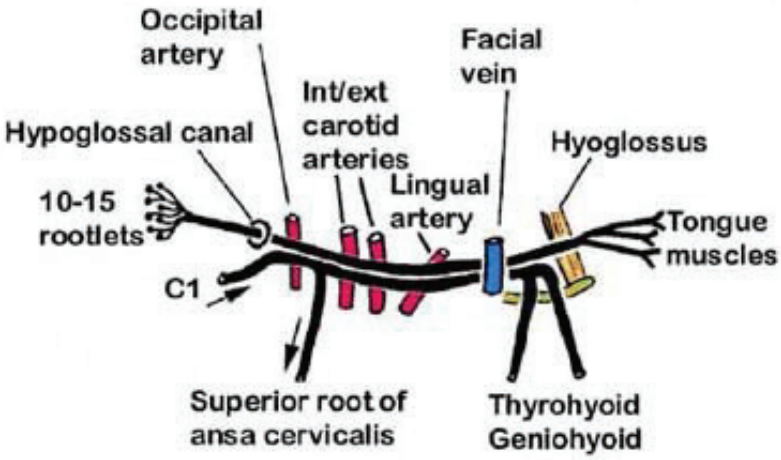
Method two

1. Draw a line from a third of the way down the posterior border of sternocleidomastoid to a third of the up the anterior border of trapezius
2. This is the line of the nerve through sternocleido-mastoid and posterior triangle

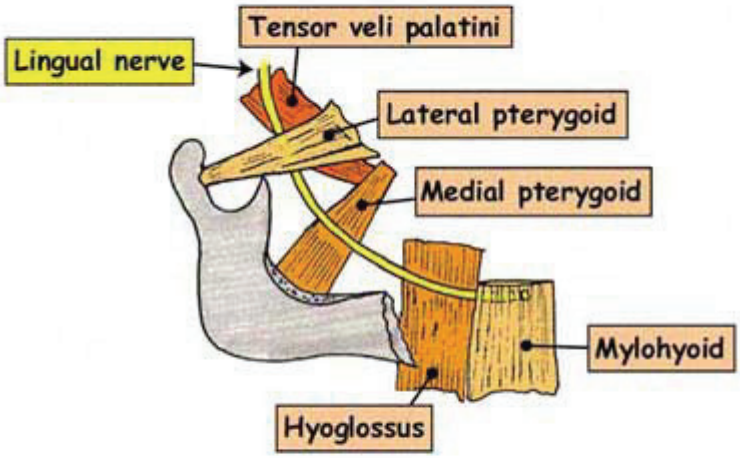
For details of sternocleidomastoid, see muscle section of Instant Anatomy

SOMATIC MOTOR

XII HYPOGLOSSAL



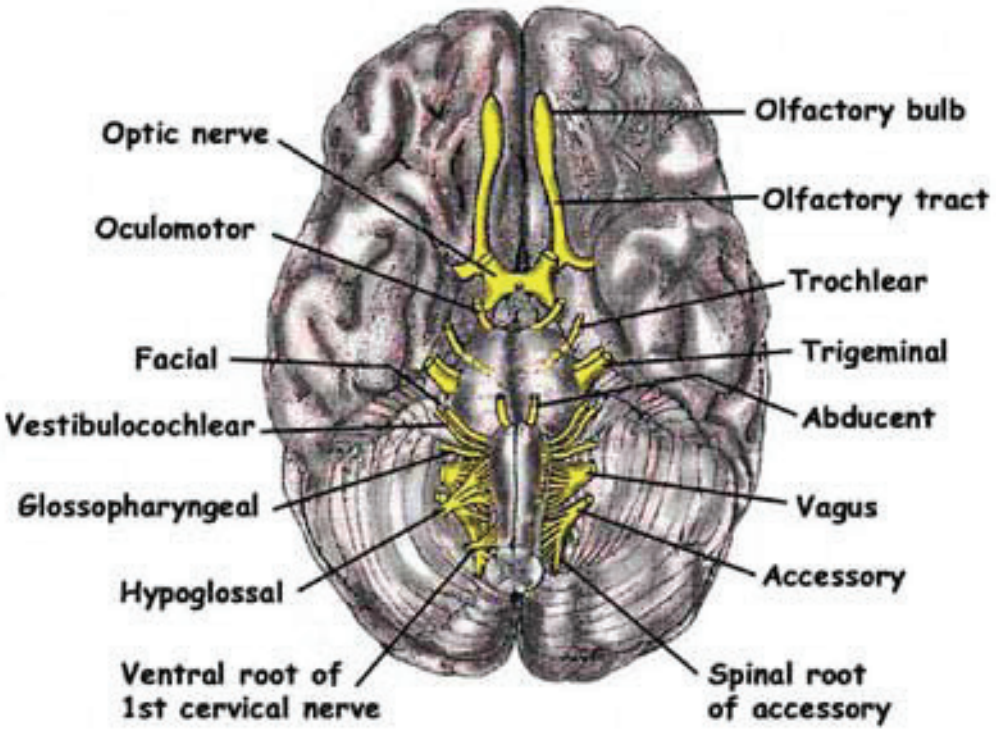
LINGUAL NERVE: RELATION TO MUSCLES



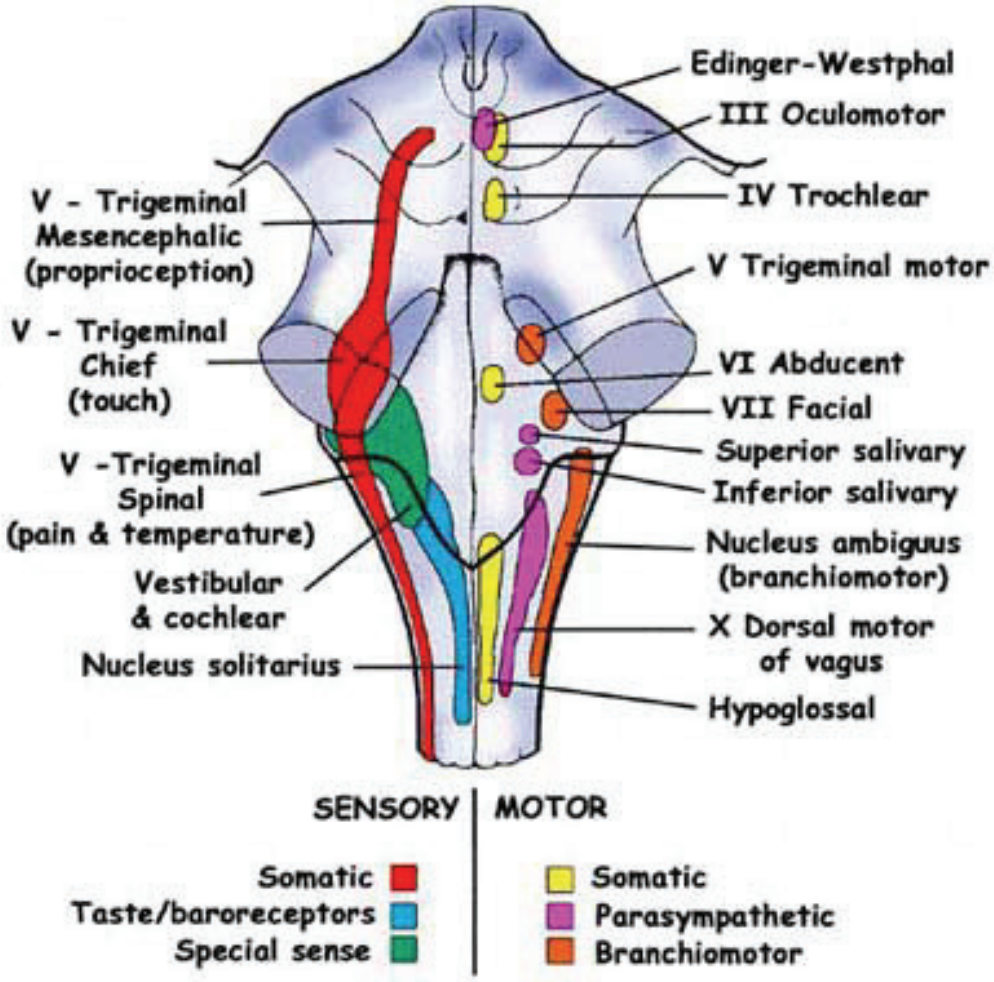
The lingual nerve passes between:

1. Tensor veli palatini and lateral pterygoid
2. Medial pterygoid and mandible
3. Mandible and mucosa of mouth
4. Mylohyoid and hyoglossus

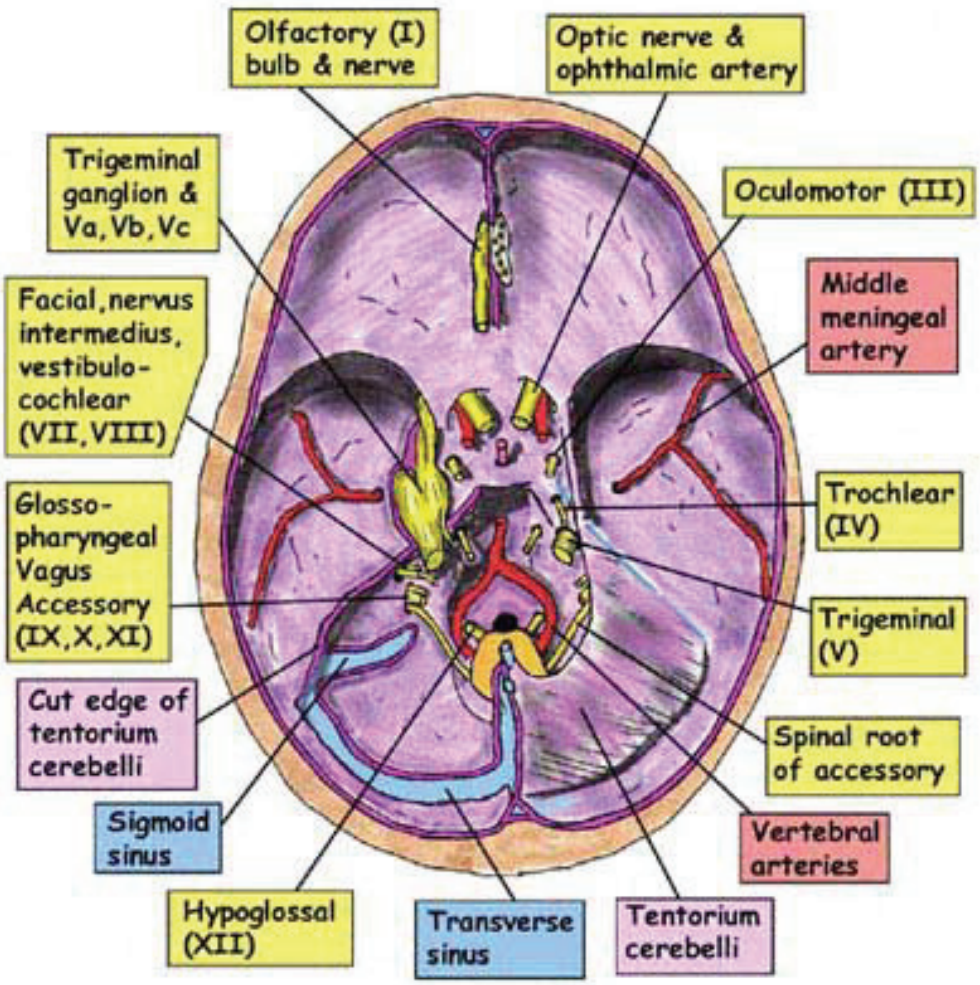
CRANIAL NERVES EMERGING FROM BASE OF THE BRAIN

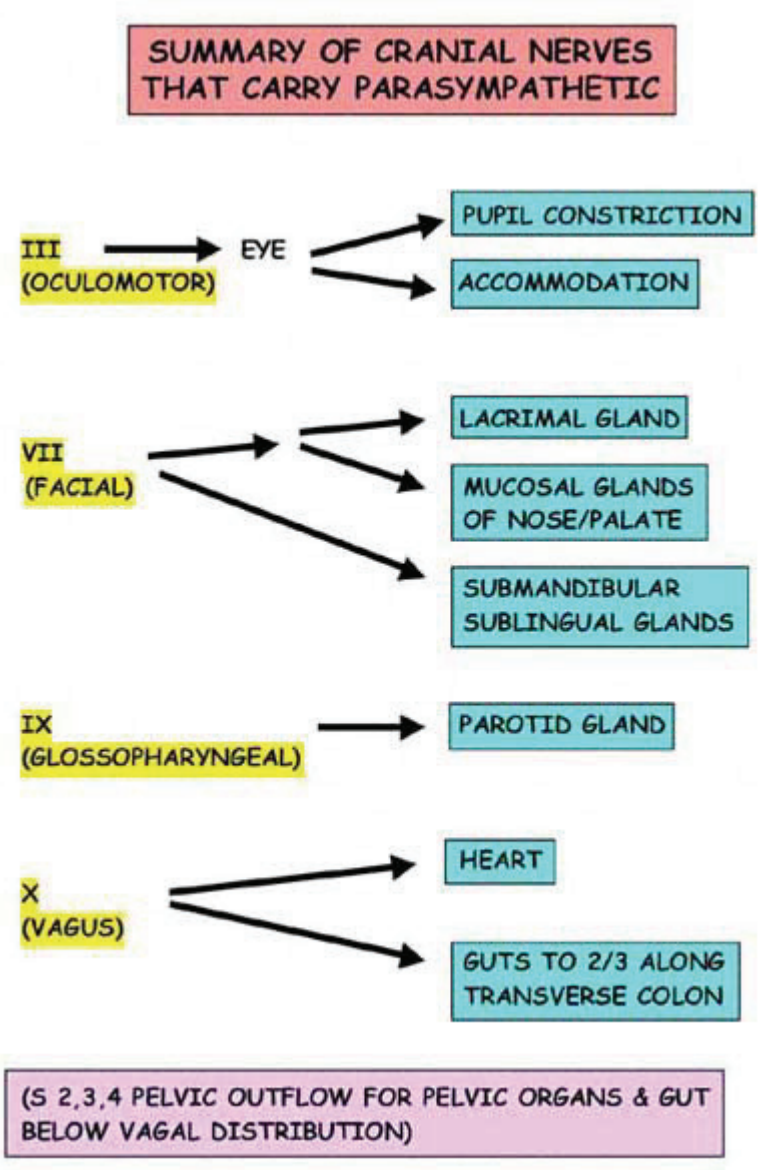


CRANIAL NERVE NUCLEI IN BRAIN STEM



STRUCTURES PIERCING THE DURA IN THE BASE OF THE SKULL





This info is the brainchild of Dr. Bob Whitaker, a Urological Surgeon in England. It is available in clickable HTML format on www.instantanatomy.net and in more detail on CD (also available for purchase at the aforementioned website). I had to give him mad props for the way he breaks this down. I found it a great supplement for our CN handouts! ~AP