CRANIAL NERVES REVISION

Done by: Hassan Almalak & Hashem Alrebdi

We hope this revision has been of great benefit

Good luck☺

Anatomy team leaders

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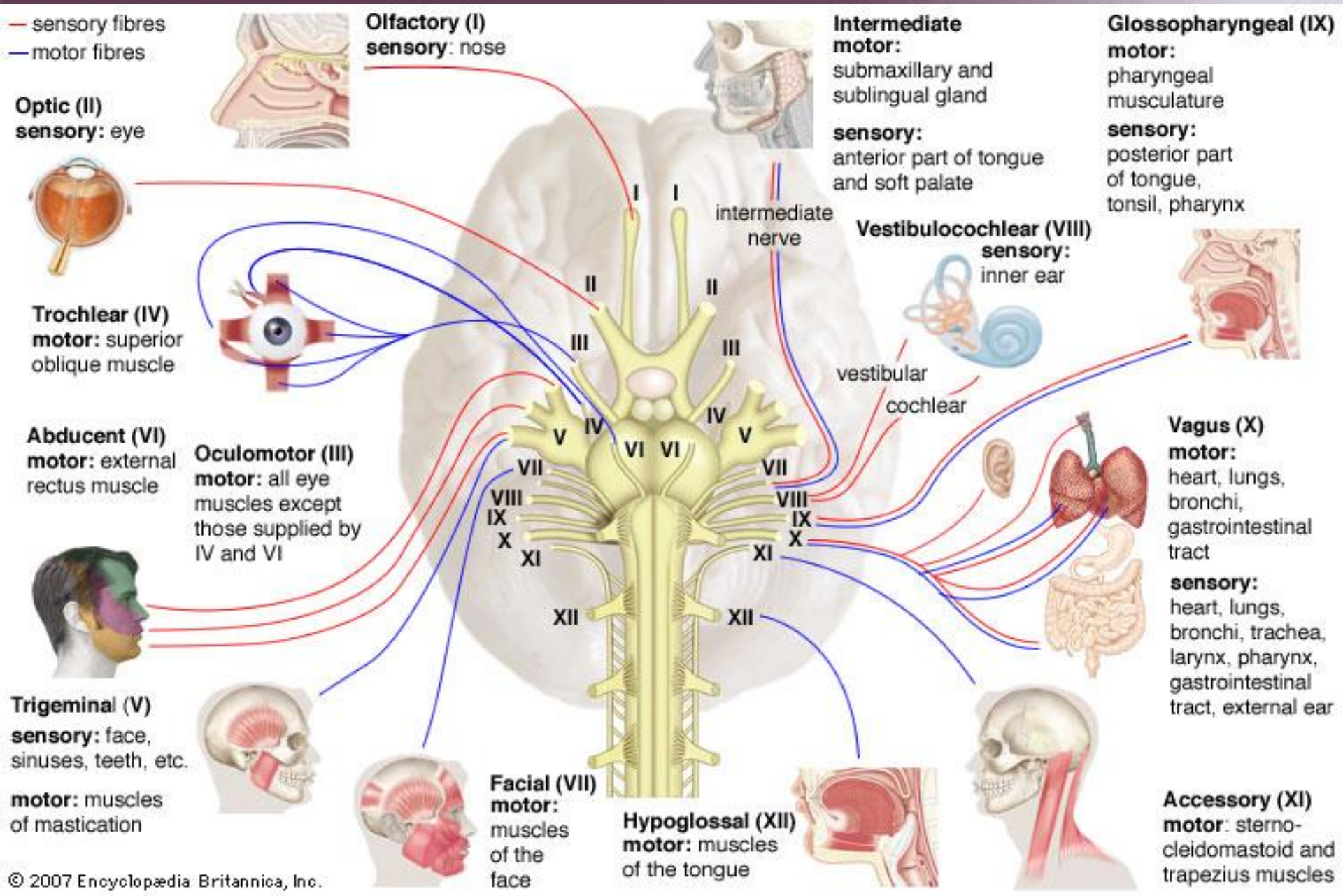
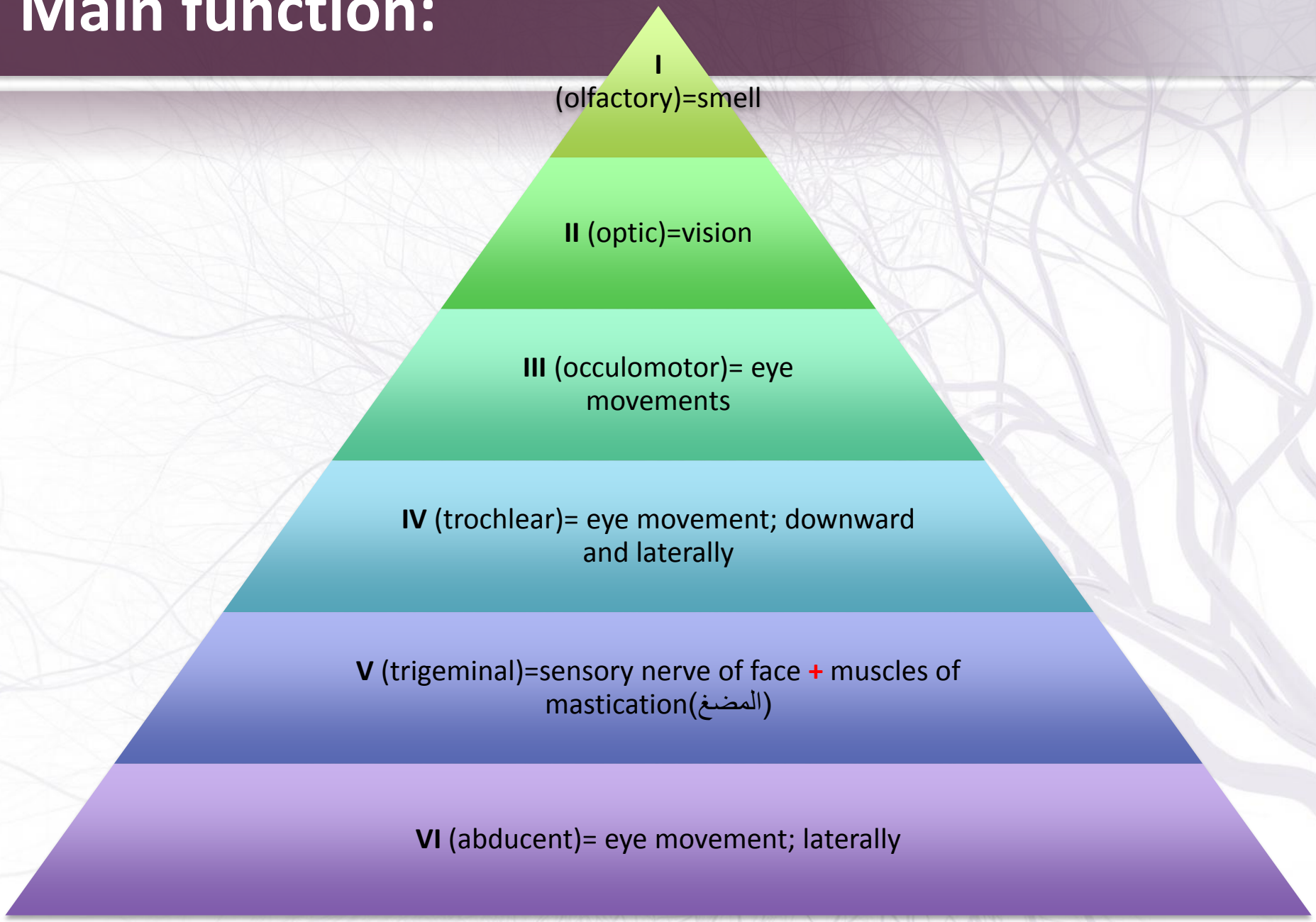
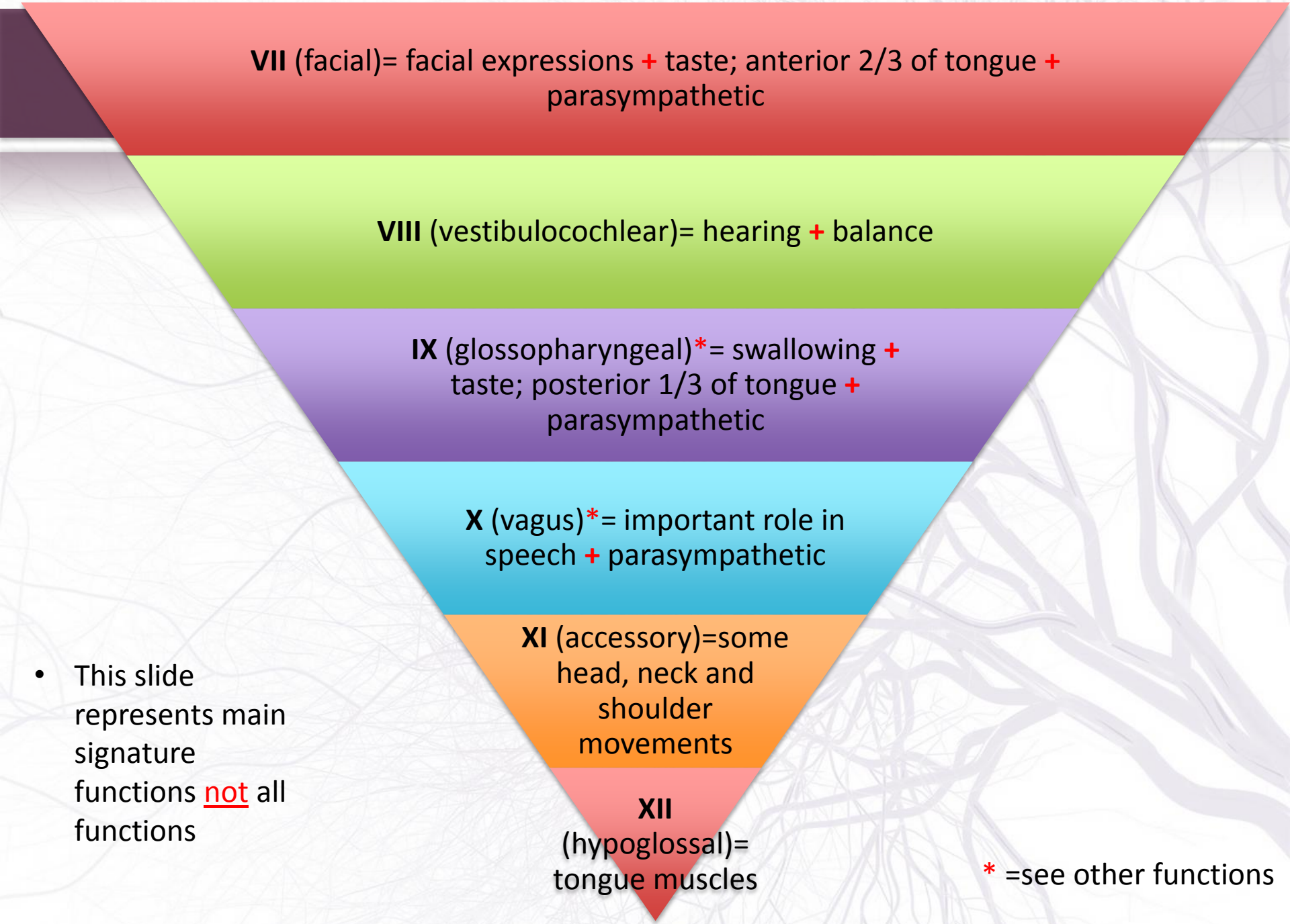
Overview:



Main function:





- This slide represents main signature functions not all functions

* =see other functions

Grouping:

Sensory:
1. **I** (olfactory)
2. **II** (optic)
8. **VIII** (vestibulocochlear)

Mixed:
5. **V** (trigeminal)
7. **VII** (facial)
9. **IX** (glossopharyngeal)
10. **X** (vagus)

Motor:
3. **III** (occulomotor)
4. **IV** (trochlear)
6. **VI** (abducent)
11. **XI** (accessory)
12. **XII** (hypoglossol)

Types of CN:
-1 , 2 & 8 sensory (I have 128 sensory)
-10, 9,7, 5 mixed (In 1975 all the world was mixed
- Others are motor

Some say marry money but my brother says big brains matter more

S - sensory (olfactory nerve - CN I)
S - sensory (optic nerve - CN II)
M - motor (oculomotor nerve - CN III)
M - motor (trochlear nerve - CN IV)
B - both (trigeminal nerve - CN V)
M - motor (abducens nerve - CN VI)
B - both (facial nerve - CN VII)
S - sensory (vestibulocochlear nerve - CN VIII)
B - both (glossopharyngeal nerve CN IX)
B - both (vagus nerve - CN X)
M - motor (spinal accessory nerve - CN XI)
M - motor (hypoglossal nerve - CN XII)

Parasympathetic:
3. **III** (occulomotor)
7. **VII** (facial)
9.**IX**(glossopharyngeal)
10. **X** (vagus)

Note:(للتوضيح فقط)
Sympathetic fibers going to structures in the head travel independently as extensions of the fibers of the thoracic chain ganglia.

Fiber type: please read and understand this table

Table 8.4 Cranial nerve functional components

Functional component	Abbreviation	General function	Cranial nerves containing component
General somatic afferent	GSA	Perception of touch, pain, temperature	Trigeminal nerve [V]; facial nerve [VII]; glossopharyngeal nerve [IX]; vagus nerve [X]
General visceral afferent	GVA	Sensory input from viscera	Glossopharyngeal nerve [IX]; vagus nerve [X]
Special afferent*	SA	Smell, taste, vision, hearing, and balance	Olfactory nerve [I]; optic nerve [II]; facial nerve [VII]; vestibulocochlear nerve [VIII]; glossopharyngeal nerve [IX]; vagus nerve [X]
General somatic efferent	GSE	Motor innervation to skeletal (voluntary) muscles	Oculomotor nerve [III]; trochlear nerve [IV]; abducent nerve [VI]; accessory nerve [XI]; hypoglossal nerve [XII]
General visceral efferent	GVE	Motor innervation to smooth muscle, heart muscle, and glands	Oculomotor nerve [III]; facial nerve [VII]; glossopharyngeal nerve [IX]; vagus nerve [X]
Special visceral efferent	SVE	Motor innervation to skeletal muscles derived from pharyngeal arch mesoderm	Trigeminal nerve [V]; facial nerve [VII]; glossopharyngeal nerve [IX]; vagus nerve [X]

Other terminology used when describing functional components:
*Special sensory, or special visceral afferent (SVA): smell, taste. Special somatic afferent (SSA): vision, hearing, balance.
**Special visceral efferent (SVE) or branchial motor.

Brainstem nuclei: (deep origin)

10 motor nuclei + 10 sensory nuclei

I (olfactory)=non
Fibers go straight into cerebrum(SA).

II (optic)=non
Fibers go straight into lateral geniculate body of thalamus(SA).

III (occulomotor)= 2 motor
- Main occulomotor nucleus(GSE).
- Accessory nucleus(Edinger-Westpal nucleus)(GVE).

IV (trochlear)=1 motor
- Trochlear nucleus(GSE).

V (trigeminal)=3 sensory+ 1motor
- mesencephalic(GSA).
- Principle sensory nucleus of trigeminal(GSA).
- Spinal nucleus(GSA).
- trigeminal motor nucleus(SVE).

VI (abducent)=1 motor
- Nucleus of abducent(GSE).

VII (facial)=1 sensory+ 2 motor
- Nucleus solitaris(SA).
- Motor nucleus of facial(SVE).
- Superior salivatory nucleus(GVE).

VIII (vestibulocochlear)=6 sensory
- Dorsal and ventral cochlear nuclei(SA).
- Superior, inferior, medial and lateral vestibular nuclei(SA).

IX (glossopharyngeal)=non of its own
<u>but takes from:</u>
- Nucleus ambiguus (SVE).
- Inferior salivatory nucleus(GVE).
- Nucleus solitaris(SA).

Brainstem nuclei:

X (vagus)=2 motor of its own

- Dorsal nucleus of vagus(GVE).
- Nucleus ambiguus(SVE).
- And also takes from:
- nucleus solitarius(SA & GVA).
- spinal nucleus of trigeminal(GSA).

XI (accessory)=non of its own but takes from:

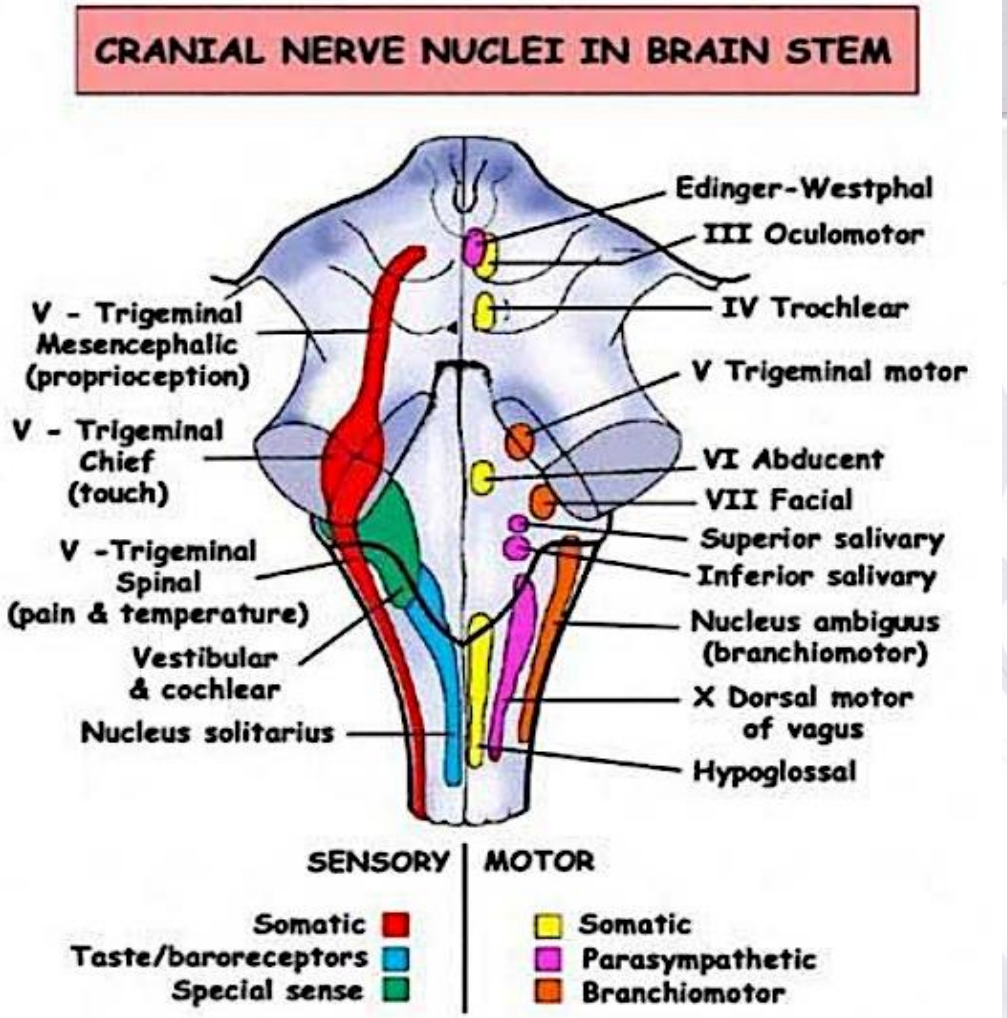
- Nucleus ambiguus(SVE).
- Spinal nucleus(GSA).

XII (hypoglossol)=1 motor

- Hypoglossol nucleus(GSE).

Important: you have to be able to describe the anatomical position and specific function of each nucleus (check brainstem lectures).

Important picture



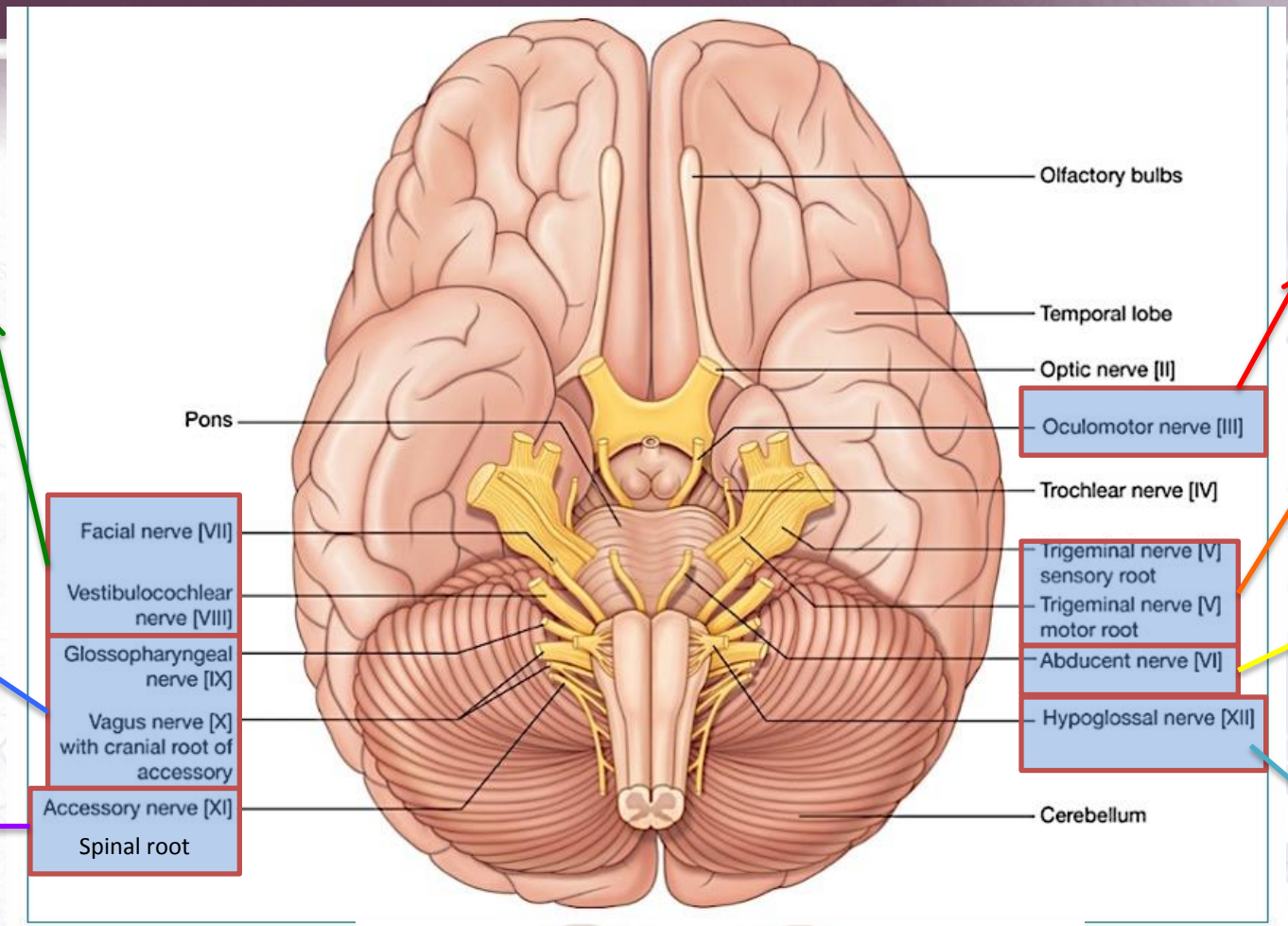
Nucleus solitarius (nucleus of solitary tracts): is a sensory nucleus that takes input from CN **VII**, **IX** and **X** related to; taste sensation(SA) and general sensation from viscera(GVA).

Origin: (point of exit from or entry to the CNS)

From cerebellopontine angle

Sulcus dorsolateral to olive (medulla) (b/t olive & Inf. Cerebellar peduncle)

Upper five segments of spinal cord leterally between dorsal and ventral roots of spinal nerves



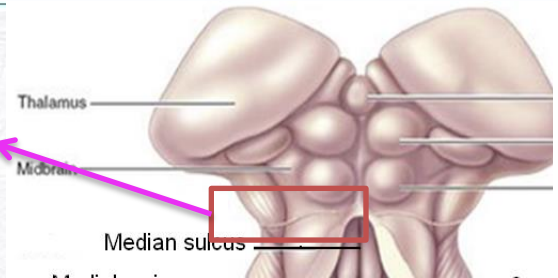
Medial aspect of crus cerebri (mid brain) (In interpeduncular fossa)

Middle of venterolateral aspect of pons

From sulcus between pons and pyramid

Sulcus between pyramid and olive (medulla)

Trochlear nerve: Caudal to inferior colliculus (posterior mid brain) dorsal surface



Posterior view of mid brain

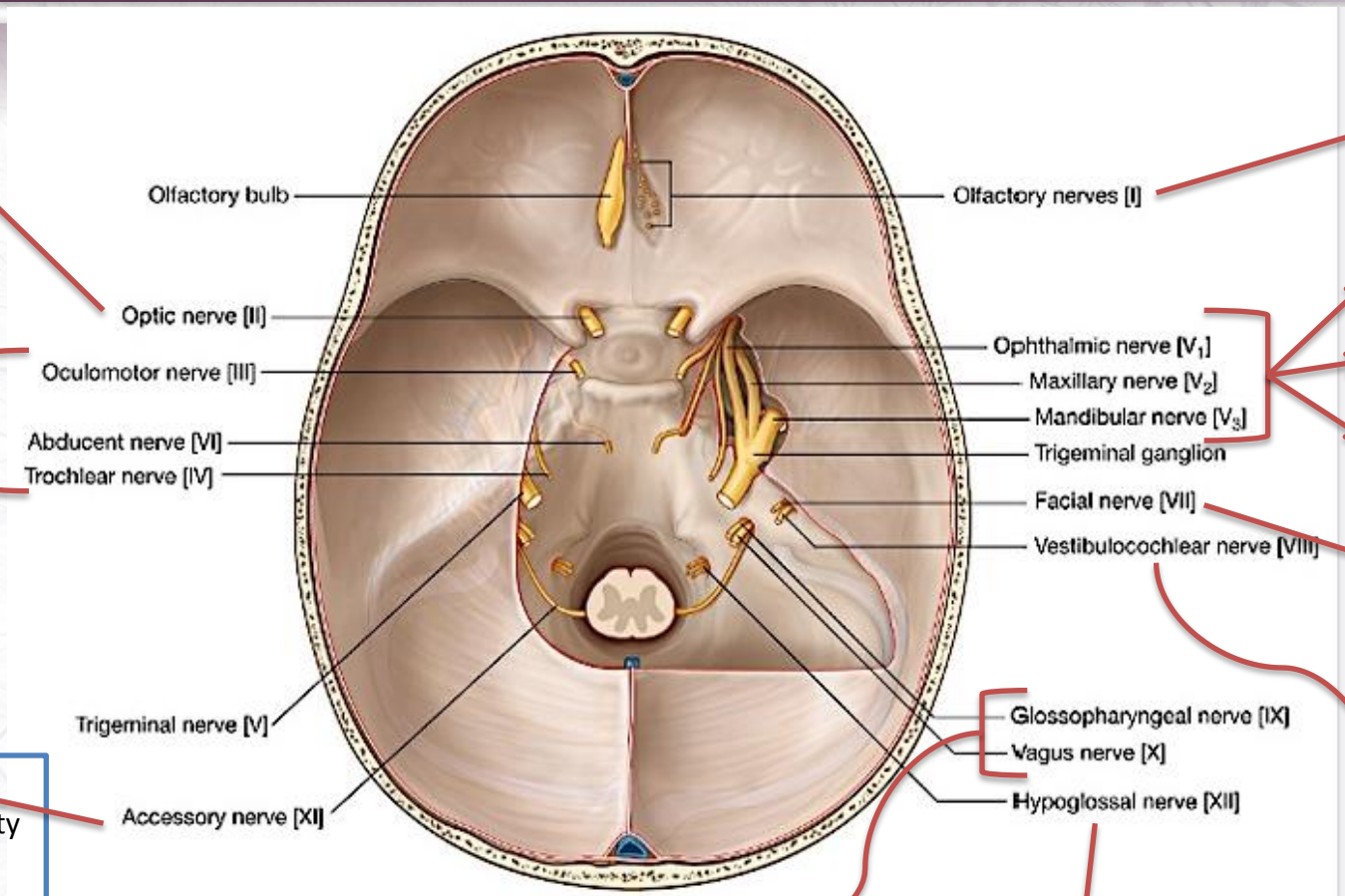
Note(للتوضيح فقط): Optic nerve is considered part of CNS

What are the sites of emergence of Cranial nerves?

All cranial nerves emerge from brainstem EXCEPT Olfactory "CN I" and Optic "CN 2"

Nerves	Site of emergence
Medulla oblongata	
Hypoglossal "CN XII"	Anterolateral Sulcus between pyramid and olive.
• Glossophyrengial "CN IX" • Vagus "CN X" • Cranial part of accessory "CN XI"	Sulcus dorsolateral to olive
Pons	
Trigeminal "CN V"	From middle ventrolateral aspect of pons as 2 roots: Small medial motor & large lateral sensory.
Abducent "CN VI"	from sulcus between pons and pyramid
Facial nerve "VII"	from cerebellopontine angle as 2 roots: Sensory and motor roots
Vestibulocochlear nerve "CN VIII"	from cerebellopontine angle as 2 roots: Vestibular root & Cochlear root
Midbrain	
Ventral surface	
Oculomotor nerve "CN III"	Through Red nucleus then medial to crus cerebri.
Dorsal surface	
Trochlear nerve "CN IV"	just caudal to inferior colliculus (The only cranial nerve emerging from dorsal surface of brain stem).

Exit from skull:



Optic canal

Cribriform plate of ethmoid

Trigeminal:
V_1=superior orbital fissure.
V_2=foramen rotundum.
V_3=foramen ovale.

Superior orbital fissure

Stylomastoid foramen (leaves cranial cavity through internal acoustic meatus).

Jugular foramen (enters cranial cavity through foramen magnum).

Leaves cranial cavity through internal acoustic meatus.

Jugular foramen

Hypoglossal canal.

Ganglia:

Non parasympathetic ganglia

Nerve	Name	Function and/or properties
V (trigeminal)	Trigeminal ganglion	Contains cell bodies: • Whose dendrites carry sensations from face & scalp. • Whose axons form the sensory root of trigeminal nerve.
VII (facial)	Geniculate ganglion	contains cell bodies of neurones carrying taste sensations from anterior 2/3 of tongue.
VIII (vestibular part)	Vestibular ganglion	Located in internal auditory meatus.
IX (glossopharyngeal) 2 ganglia	Superior and inferior ganglia of glossopharyngeal	• **Superior ganglion:** Small, with no branches. • It is connected to the Superior Cervical sympathetic ganglion. • **Inferior ganglion**: Large and carries general sensations from pharynx, soft palate and tonsil. • It is connected to Auricular Branch of Vagus.
X (vagus) 2 ganglia	Superior and inferior ganglia of vagus	• **Superior ganglion:** in the jugular foramen connected to; Inferior ganglion of glossopharyngeal nerve, Superior cervical sympathetic ganglion& Facial nerve. • **Inferior ganglion:** just below the jugular foramen connected to; Cranial part of accessory nerve, Hypoglossal nerve, Superior cervical sympathetic ganglion and 1st cervical nerve.

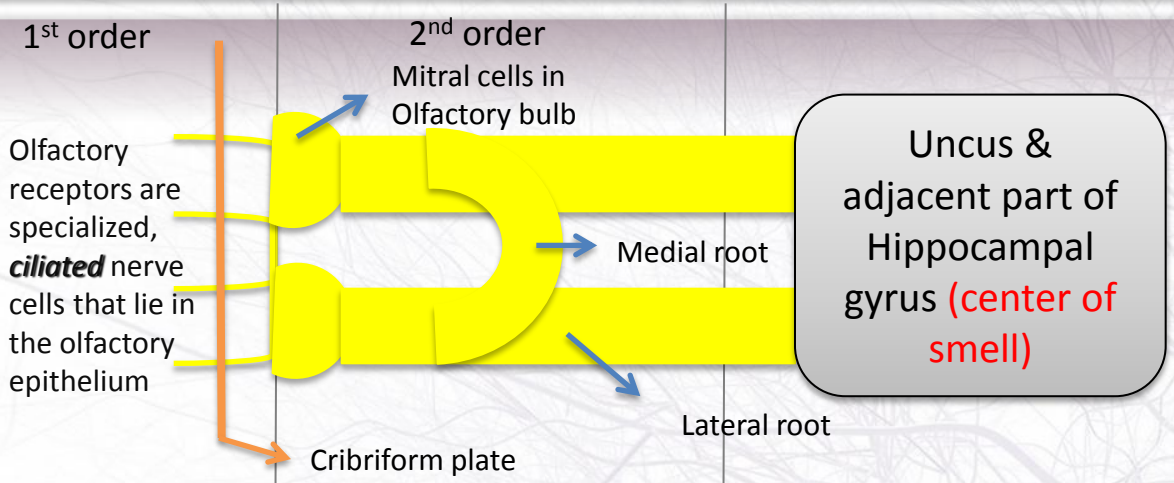
Ganglia: (parasympathetic)

Table 8.6 Parasympathetic ganglia of the head

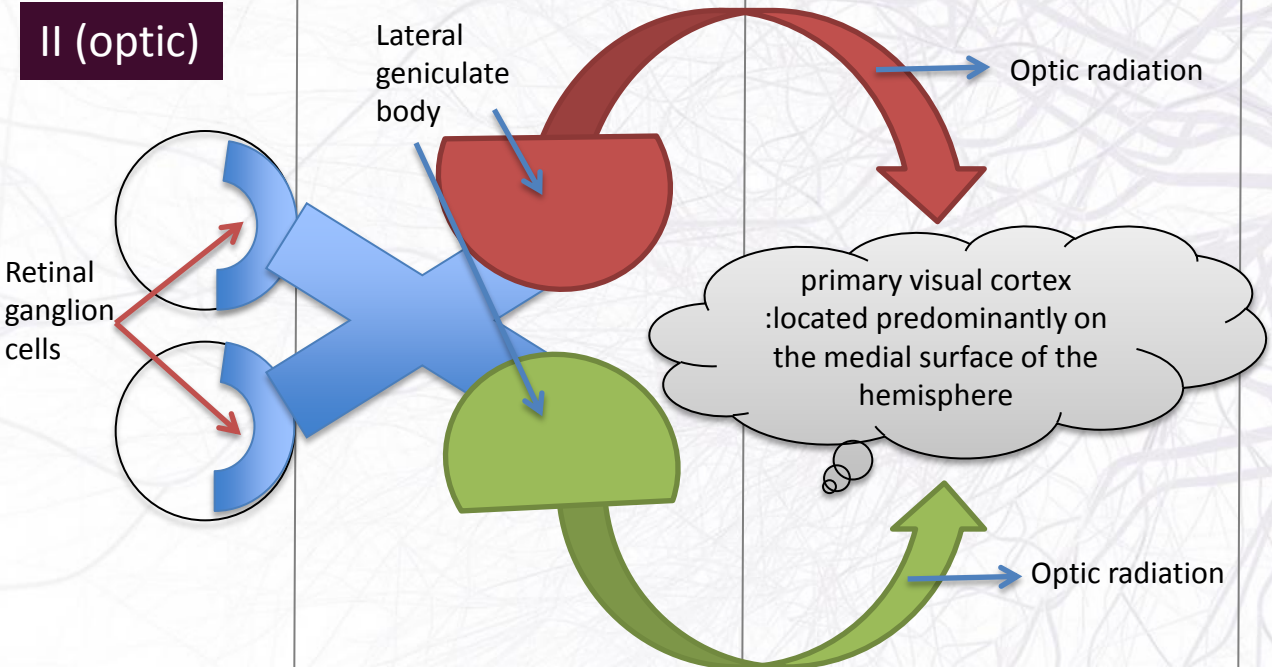
Cranial nerve origin of ganglion	Input function	Cranial nerve origin of preganglionic fibers	Function
Ciliary	Oculomotor nerve [III]	Oculomotor nerve [III]	Innervation of sphincter pupillae muscle for pupillary constriction, and ciliary muscles for accommodation of the lens for near vision
Pterygopalatine	Greater petrosal nerve	Facial nerve [VII]	Innervation of lacrimal gland, and mucous glands of nasal cavity, maxillary sinus, and palate
Otic	Lesser petrosal nerve	Glossopharyngeal nerve [IX]	Innervation of parotid gland
Submandibular	Chorda tympani to lingual	Facial nerve [VII]	Innervation of submandibular and sublingual glands

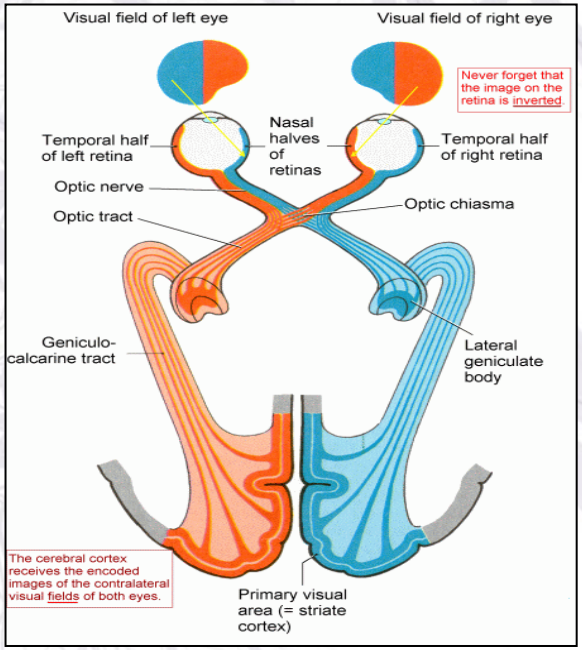
Course and branches:

I (olfactory)



II (optic)





Course and branches:

III (occulomotor)

Motor to:

1. **Levator palpebrae superioris**
2. **Superior rectus muscle**
3. **Medial rectus muscle**
4. **Inferior rectus muscle &**
5. **Inferior oblique muscle.**

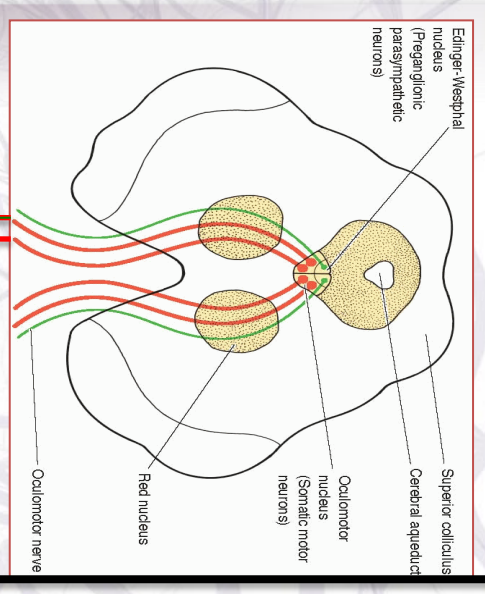
Parasympathetic fibers to
1- Constrictor pupillae and
2- Ciliary muscles.

ciliary gang-lion

Superior orbital fissure

Posterior cerebral artery

Superior cerebellar artery



IV (trochlear)

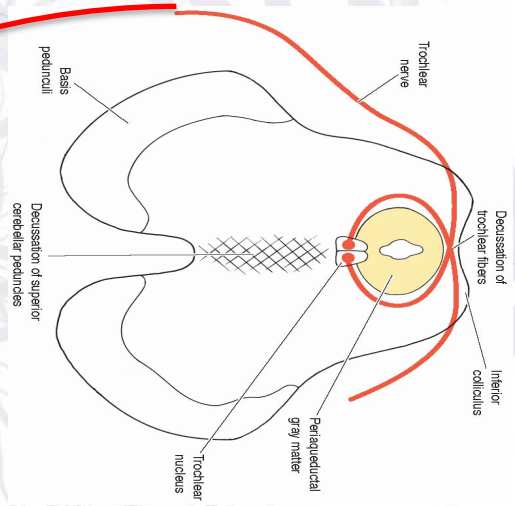
Superior orbital fissure

It supplies:

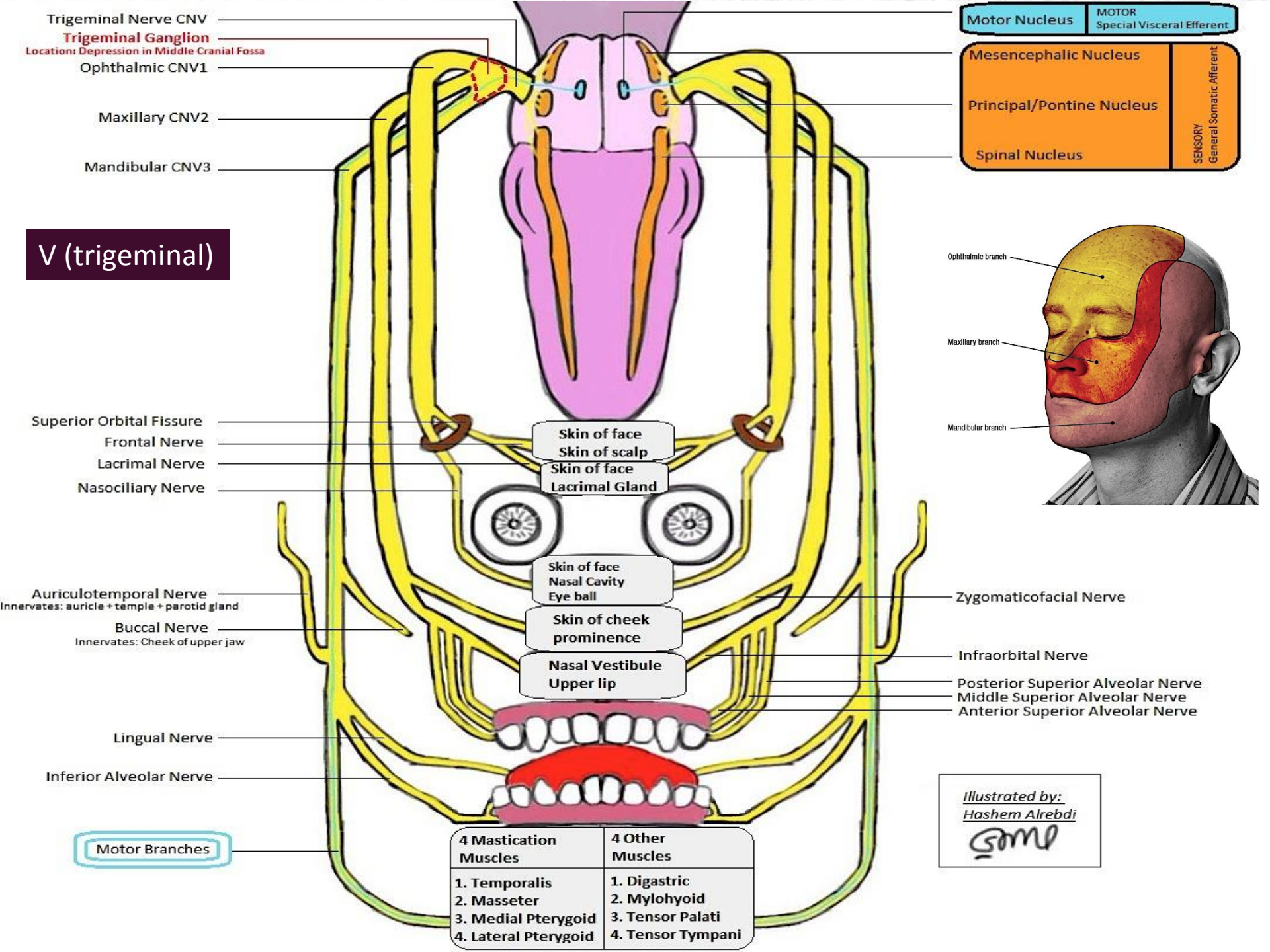
- **<u>Superior oblique muscle</u>**, (only one muscle).

Its function:

- Rotates the eye ball downwards and laterally.



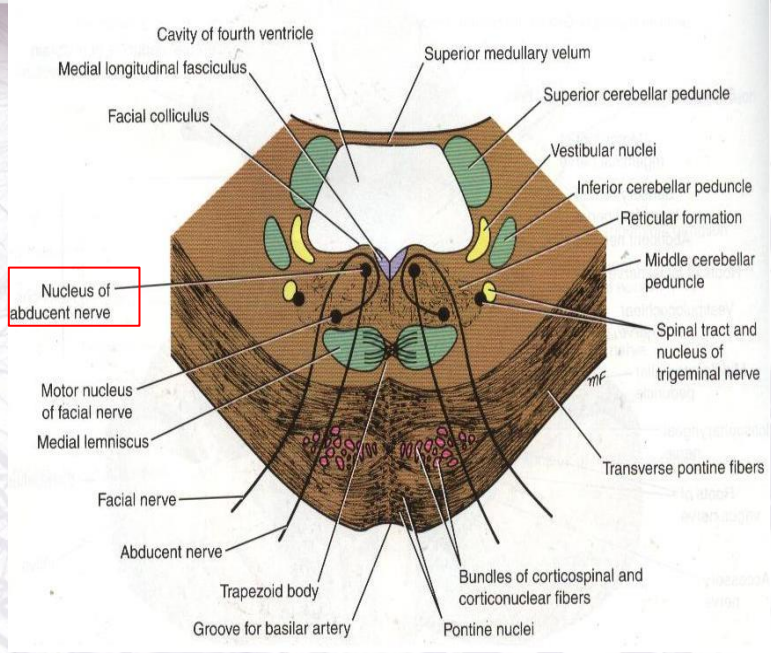
V (trigeminal)

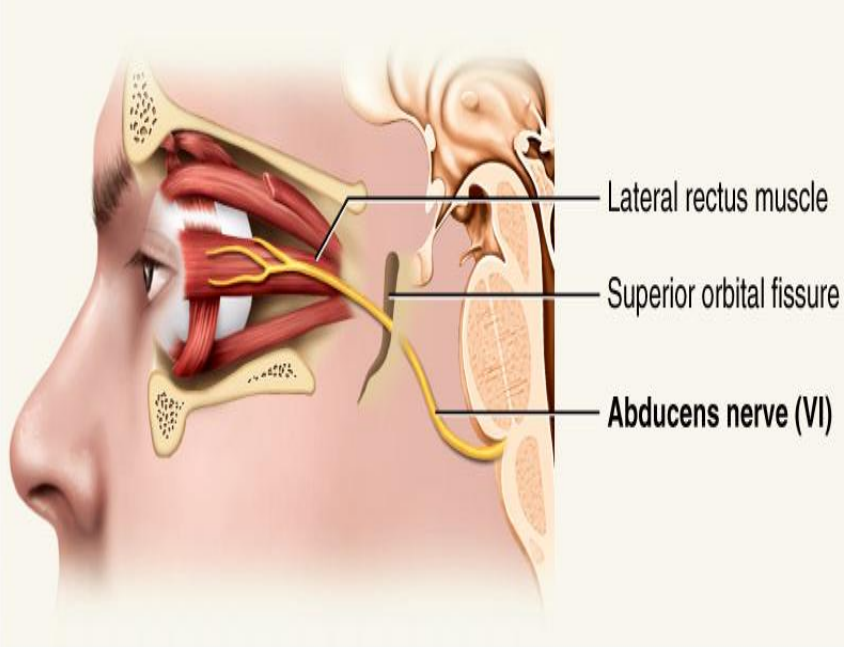


Course and branches:

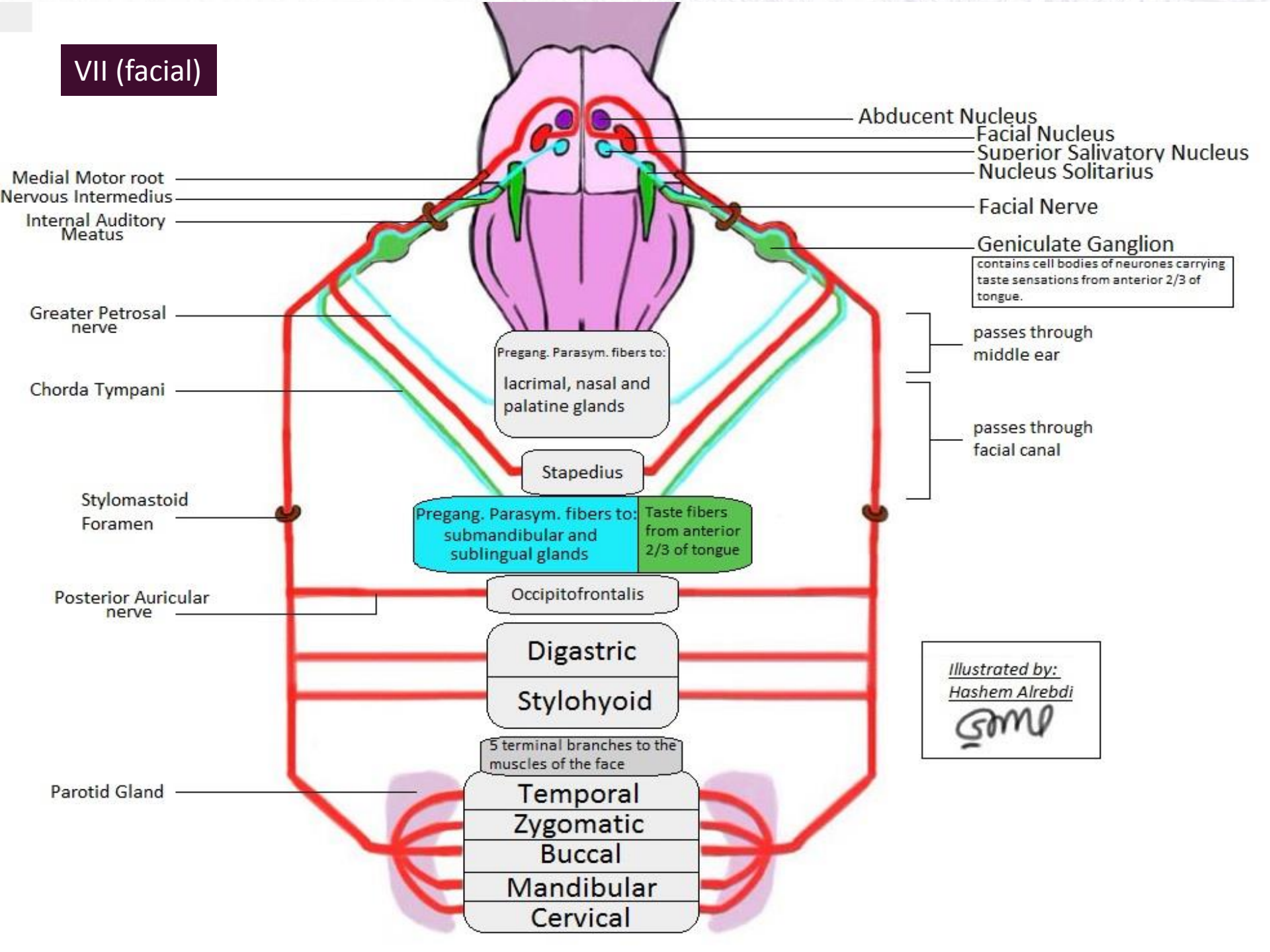
VI (abducent)

It supplies; the **lateral rectus** muscle which rotates the eye ball laterally ; (abduction).





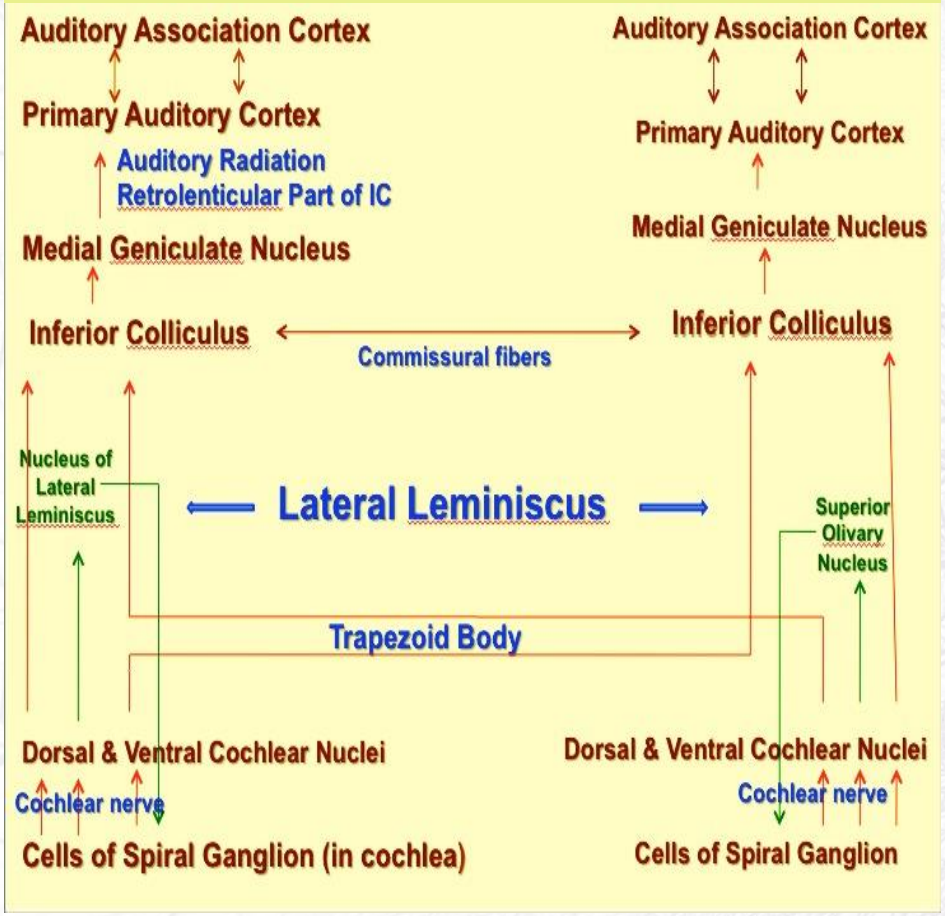
VII (facial)


Abducent Nucleus
Facial Nucleus
Superior Salivatory Nucleus
Nucleus Solitarius
Facial Nerve
Geniculate Ganglion
contains cell bodies of neurones carrying taste sensations from anterior 2/3 of tongue.
Medial Motor root
Nervous Intermedius
Internal Auditory Meatus
Greater Petrosal nerve
Chorda Tympani
Stylomastoid Foramen
Posterior Auricular nerve
Parotid Gland
Pregang. Parasym. fibers to: lacrimal, nasal and palatine glands
passes through middle ear
passes through facial canal
Stapedius
Pregang. Parasym. fibers to: submandibular and sublingual glands
Taste fibers from anterior 2/3 of tongue
Occipitofrontalis
Digastric
Stylohyoid
5 terminal branches to the muscles of the face
Temporal
Zygomatic
Buccal
Mandibular
Cervical
Illustrated by:
Hashem Alrebdi

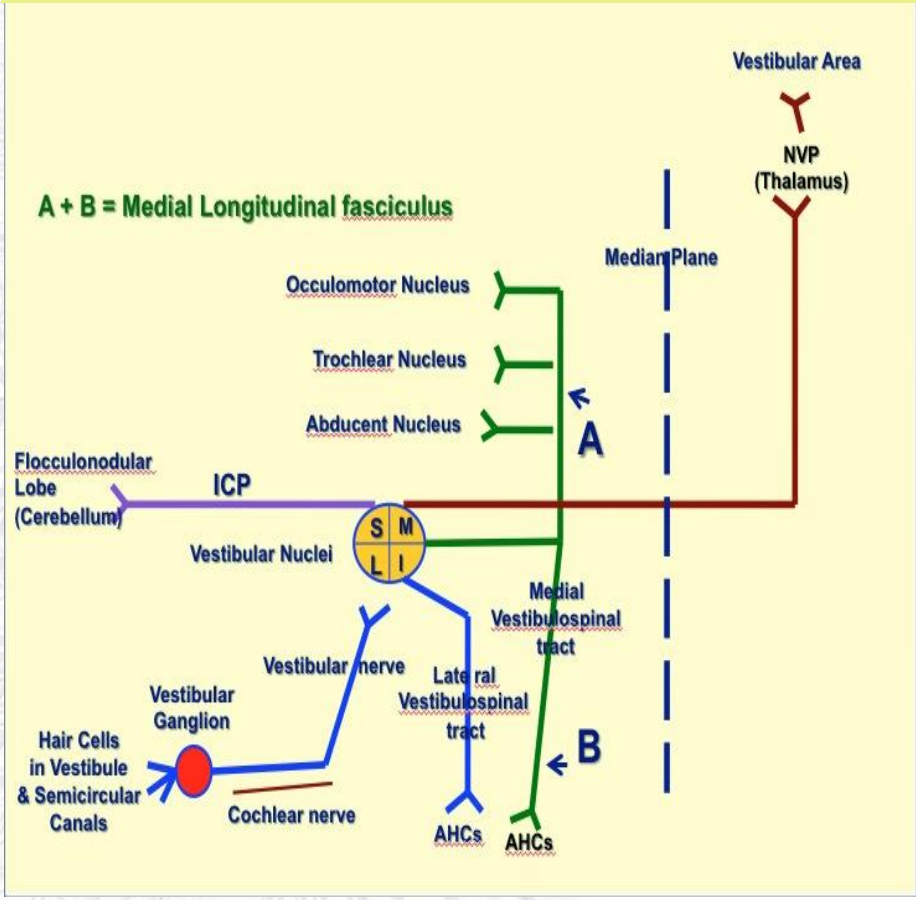
Course and branches:

VIII (vestibulocochlear)

Cochlear nerve pathway



vestibular nerve pathway

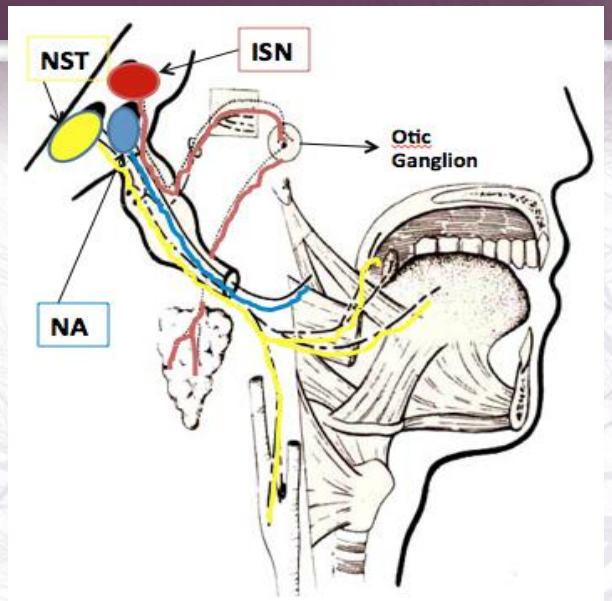


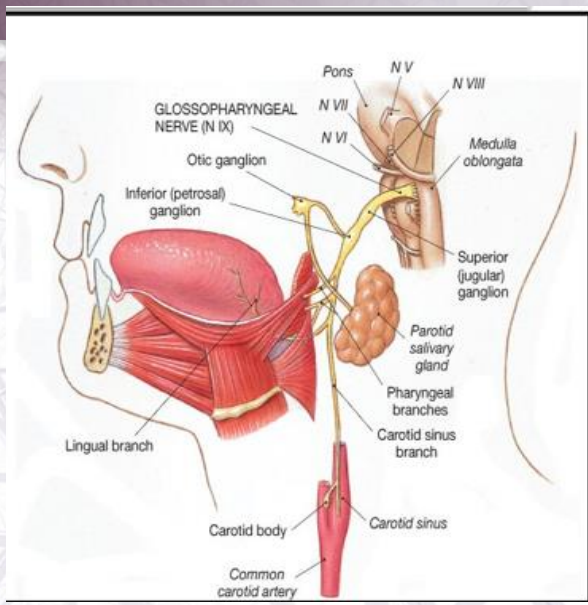
*Lateral vestibular (Deiter's) nucleus→ lateral vestibulospinal tract

Course and branches:

IX (glossopharyngeal)

- NST= nucleus of solitary tracts(nucleus solitaris).
- ISN= inferior salivary nucleus.
- NA= nucleus ambiguus

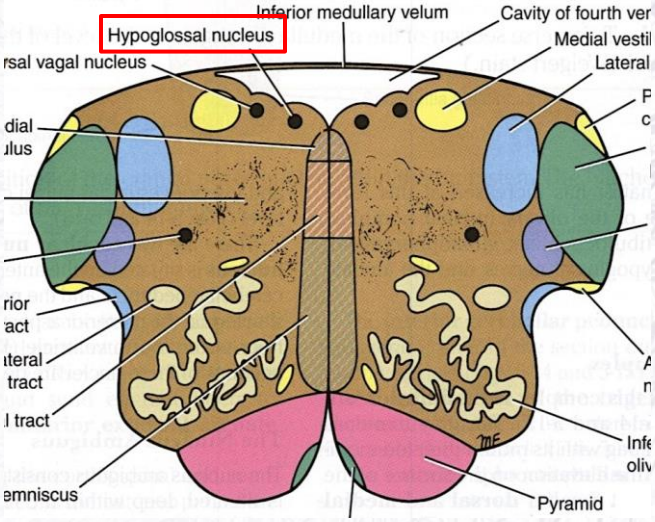


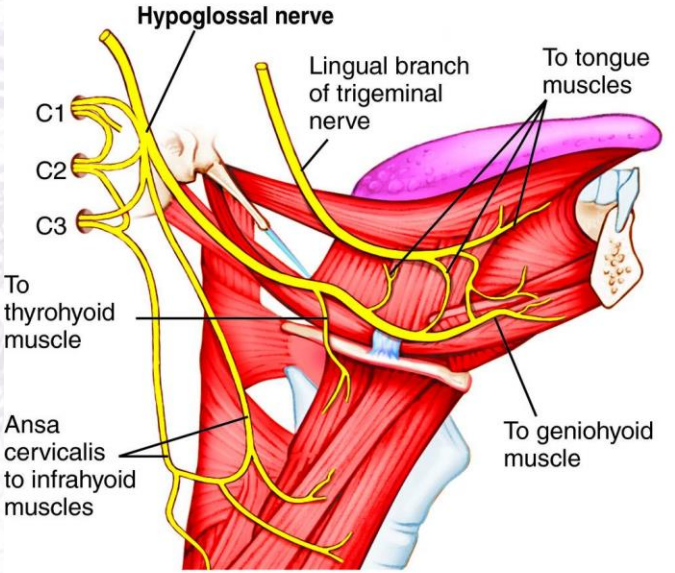


XII (hypoglossal)

Supply all the muscles of the tongue Except palatoglossus

Open medulla level





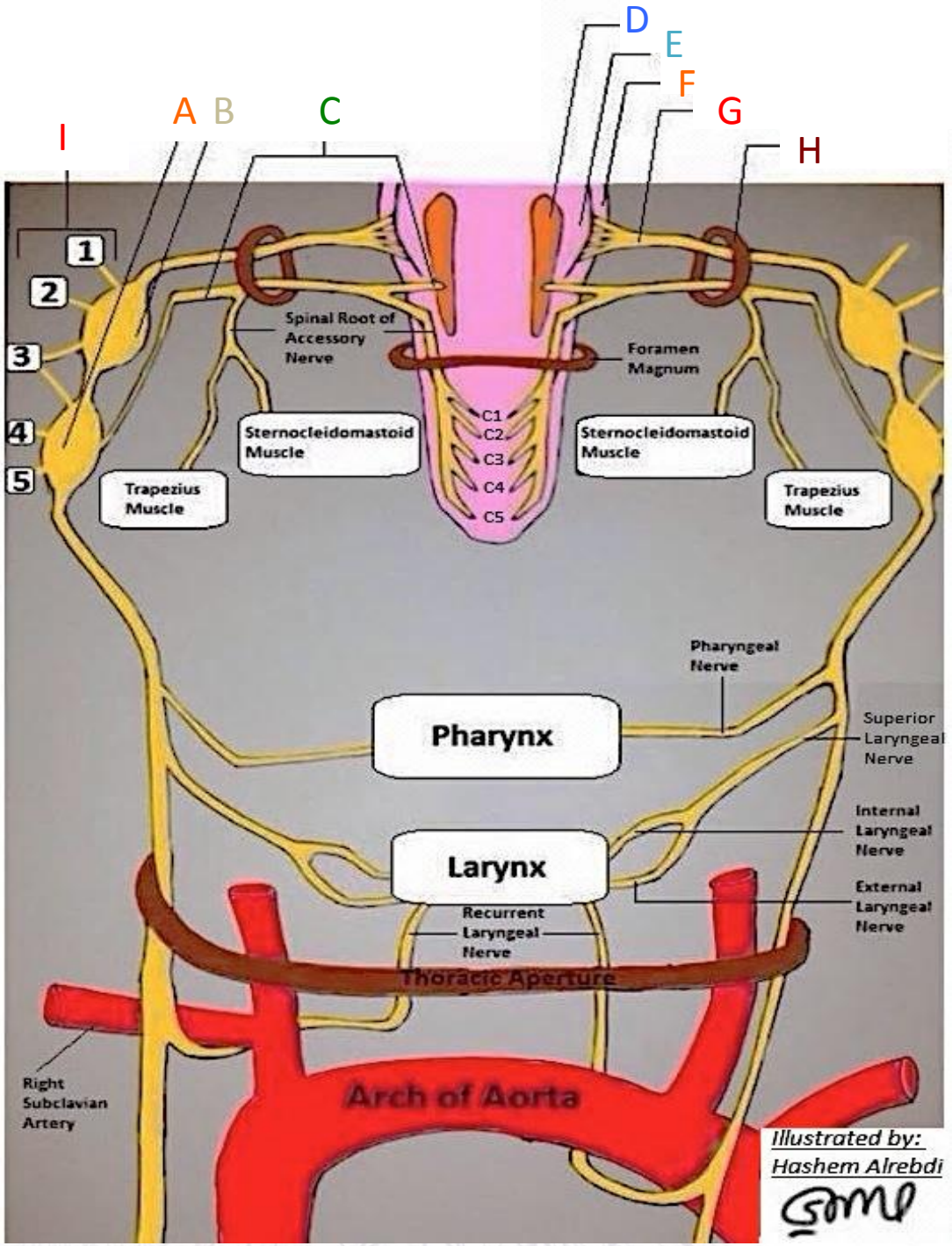
Course and branches:

X (vagus) XI (accessory)

A=inferior ganglion of vagus.
B=superior ganglion of vagus.
C=cranial root of accessory nerve.
D=nucleus ambiguus.
E=olive.
F=inferior cerebellar peduncle.
G=vagus nerve.
H=jugular foramen.

I=Communication of vagus ganglia:
1.Inferior ganglion of CN 9
2.Facial nerve
3.Superior cervical parasympathetic ganglia
4.Hypoglossal nerve
5.1st cervical nerve

Other branches of vagus not shown:
1.meningeal; to the dura.
2.auricular; to external acoustic meatus and tympanic membrane.
3.To carotid body.



Lesions:

Cranial nerve	Clinical findings	Example of lesion
Olfactory nerve [I]	Loss of smell (anosmia)	Injury to the cribriform plate; congenital absence
Optic nerve [II]	Blindness/visual field abnormalities, loss of pupillary constriction	Direct trauma to the orbit; disruption of the optic pathway
Oculomotor nerve [III]	Dilated pupil, ptosis, loss of normal pupillary reflex, eye moves down inferiorly and laterally (down and out)	Pressure from an aneurysm arising from the posterior communicating, posterior cerebral, or superior cerebellar artery; pressure from a herniating cerebral uncus (false localizing sign); cavernous sinus mass or thrombosis
Trochlear nerve [IV]	Inability to look inferiorly when the eye is adducted (down and in)	Along the course of the nerve around the brainstem; orbital fracture
Trigeminal nerve [V]	Loss of sensation and pain in the region supplied by the three divisions of the nerve over the face; loss of motor function of the muscles of mastication on the side of the lesion	Typically, in the region of the trigeminal ganglion, though local masses around the foramina through which the divisions pass can produce symptoms
Abducent nerve [VI]	Inability of lateral eye movement	Brain lesion or cavernous sinus lesion extending onto the orbit

Lesions:

Facial nerve [VII]	Face is distorted: drooping of lower eyelid, sagging of mouth angle, dribbling of saliva, loss of facial expressions, loss of chewing, loss of blowing, loss of sucking and inability to show teeth or close the eye on the effected side.	Injury, tumor or any inflammatory processes. Note: lower motor neuron lesion(bells palsy)= all face is affected, but upper motor neuron lesion =effect on lower part of the face only.
Vestibulocochlear nerve [VIII]	Progressive unilateral hearing loss and tinnitus (ringing in the ear)	Tumor at the cerebellopontine angle
Glossopharyngeal nerve [IX]	Loss of taste to the posterior one-third of the tongue and sensation of the soft palate	Brainstem lesion; penetrating neck injury
Vagus nerve [X]	Soft palate deviation with deviation of the uvula to the normal side; vocal cord paralysis	Brainstem lesion; penetrating neck injury
Accessory nerve [XI]	Paralysis of sternocleidomastoid and trapezius muscles	Penetrating injury to the posterior triangle of the neck
Hypoglossal nerve [XII]	Atrophy of ipsilateral muscles of the tongue and deviation toward the affected side; speech disturbance	Penetrating injury to the neck and skull base pathology

Also commonly injured in surgery

Cranial nerves by the numbers

The next time you're trying to remember the locations and functions of the cranial nerves, picture this drawing. All twelve cranial nerves are represented, though some may be a little harder to spot than others. For example, the shoulders are formed by the number "11" because cranial nerve XI controls neck and shoulder movement. If you immediately recognize that the sides of the face and the top of the head are formed by the number "7," you're well on your way to using this memory device.

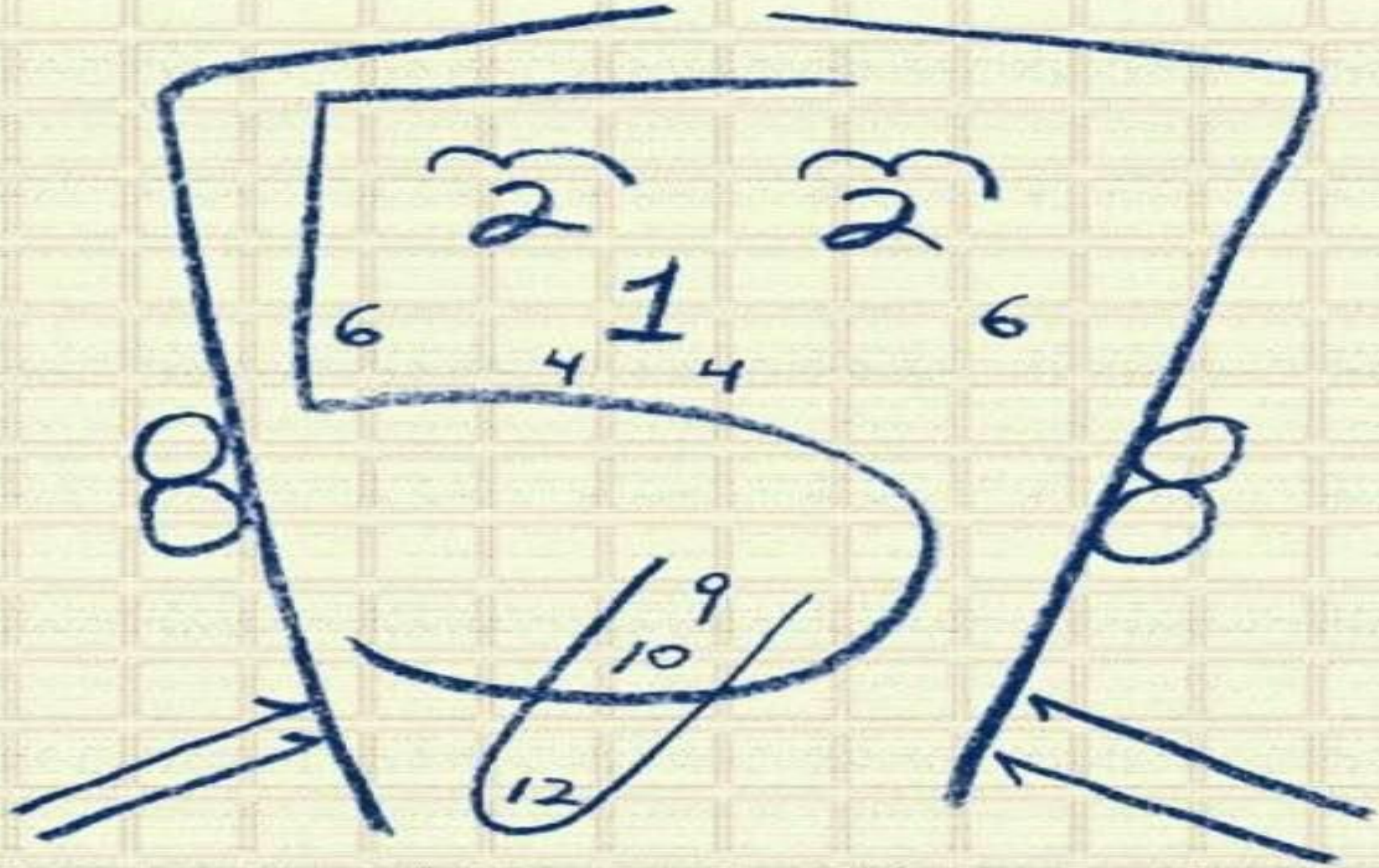


Table 8.5 Cranial nerves (see Table 8.4 for abbreviations)

Nerve	COMPONENT		Exit from skull	Function
	Afferent	Efferent		
Olfactory nerve [I]	SA		Cribriform plate of ethmoid bone	Smell
Optic nerve [II]	SA		Optic canal	Vision
Oculomotor nerve [III]		GSE, GVE	Superior orbital fissure	GSE—innervates levator palpebrae superioris, superior rectus, inferior rectus, medial rectus, and inferior oblique muscles GVE—innervates sphincter pupillae for pupillary constriction; ciliary muscles for accommodation of the lens for near vision
Trochlear nerve [IV]		GSE	Superior orbital fissure	Innervates superior oblique muscle
Trigeminal nerve [V]	GSA	BE	Superior orbital fissure—ophthalmic division [V_1] Foramen rotundum—maxillary nerve [V_2] Foramen ovale—mandibular division [V_3]	GSA—sensory from: ophthalmic division [V_1]—eyes, conjunctiva, orbital contents, nasal cavity, frontal sinus, ethmoidal cells, upper eyelid, dorsum of nose, anterior part of scalp, dura in anterior cranial fossa, superior part of tentorium cerebelli; maxillary nerve [V_2]—dura in middle cranial fossa, nasopharynx, palate, nasal cavity, upper teeth, maxillary sinus, skin covering the side of the nose, lower eyelid, cheek, upper lip; mandibular division [V_3]—skin of lower face, cheek, lower lip, anterior part of external ear, part of external acoustic meatus, temporal fossa, anterior two-thirds of tongue, lower teeth, mastoid air cells, mucous membranes of cheek, mandible, dura in middle cranial fossa BE—innervates temporalis, masseter, medial and lateral pterygoids, tensor tympani, tensor veli palatini, anterior belly of digastric, and mylohyoid muscles

Table 8.5—cont'd Cranial nerves (see Table 8.4 for abbreviations)

Nerve	COMPONENT		Exit from skull	Function
	Afferent	Efferent		
Abducent nerve [VI]		GSE	Superior orbital fissure	Innervates lateral rectus muscle
Facial nerve [VII]	GSA, SA	GVE, BE	Stylomastoid foramen [nerve leaves cranial cavity through internal acoustic meatus]	GSA—sensory from part of external acoustic meatus and deeper parts of auricle SA—taste from anterior two-thirds of tongue GVE—innervates lacrimal gland, submandibular and sublingual salivary glands, and mucous membranes of nasal cavity, hard and soft palates BE—innervates muscles of face (muscles of facial expression) and scalp derived from the second pharyngeal arch, and stapedius, posterior belly of digastric, stylohyoid muscles
Vestibulocochlear nerve [VIII]	SA		[nerve leaves cranial cavity through internal acoustic meatus]	Vestibular division—balance Cochlear division—hearing
Glossopharyngeal nerve [IX]	GVA, SA, GSA	GVE, BE	Jugular foramen	GVA—sensory from carotid body and sinus GSA—posterior one-third of tongue, palatine tonsils, oropharynx, and mucosa of middle ear and pharyngotympanic tube SA—taste from posterior one-third of tongue GVE—innervates parotid salivary gland BE—innervates stylopharyngeus muscle
Vagus nerve [X]	GSA, GVA, SA	GVE, BE	Jugular foramen	GSA—sensory from larynx, laryngopharynx, deeper parts of auricle, part of external acoustic meatus, and dura in posterior cranial fossa GVA—sensory from aortic body chemoreceptors and aortic arch baroreceptors, esophagus, bronchi, lungs, heart, and abdominal viscera of the foregut and midgut SA—taste from the epiglottis and pharynx GVE—innervates smooth muscle and glands in the pharynx, larynx, thoracic viscera, and abdominal viscera of the foregut and midgut BE—innervates one tongue muscle (palatoglossus), muscles of soft palate (except tensor veli palatini), pharynx (except stylopharyngeus), and larynx
Accessory nerve [XI]		GSE	Jugular foramen	Innervates sternocleidomastoid and trapezius muscles
Hypoglossal nerve [XII]		GSE	Hypoglossal canal	Innervates hyoglossus, genioglossus, and styloglossus muscles and all intrinsic muscles of the tongue

TABLE 8.1 Cranial Nerves

Nerve	Type	Brain Pathway	Transmits Nerve Impulses to (Motor) or from (Sensory)
Olfactory (I)	Sensory	I: Mucous membrane of nose to olfactory bulbs	Olfactory receptors for sense of smell
Optic (II)	Sensory	II: Retina → optic nerve → thalamus → occipital lobe	Retina for sense of sight
Oculomotor (III)	Motor	III: Midbrain → eye and eyelid	Eye muscles (including eyelids and lens); pupil (parasympathetic division)
Trochlear (IV)	Motor	IV: Midbrain → eye	Eye muscles
Trigeminal (V)	Mixed: Sensory	V: Sensory: Teeth, eye, skin, Tongue → pons	Teeth, eyes, skin, and tongue
	Mixed: Motor	Motor: Pons → jaw muscles	Jaw muscles (chewing)
Abducens (VI)	Motor	VI: Pons → eye	Eye muscles
Facial (VII)	Mixed: Sensory	VII: Sensory: Tongue → pons	Taste buds of anterior tongue
	Mixed: Motor	Motor: Pons → facial muscles, Salivary glands, tear glands	Facial muscles (facial expression) and glands (tear and salivary)
Vestibulocochlear (VIII) (also called auditory; acoustic)	Sensory	VIII: Inner ear → pons and medulla	Inner ear for sense of balance and hearing
Glossopharyngeal (IX)	Mixed: Sensory	IX: Sensory: Tongue, throat → pons	Pharynx
	Mixed: Motor	Motor: Pons → Salivary gland, Throat muscles	Pharyngeal muscles (swallowing), salivary glands
Vagus (X)	Sensory	X: Sensory: Eardrum, ear canal, throat, heart, lungs, abdominal organs → medulla	Internal organs, external ear canal, eardrum, back of throat
	Motor	Motor: Medulla → throat and larynx, heart, lungs, abdominal organs	Internal organs (parasympathetic division), throat muscles (somatic motor division)
Spinal accessory (XI)	Motor	XI: Medulla → muscles of throat, neck, shoulder	Neck and back muscles
Hypoglossal (XII)	Motor	XII: Medulla → tongue muscles	Tongue muscles

Cranial Nerve	Fibres	Structures Innervated	Functions	Brainstem Nucleus
I Olfactory	Sensory	Olfactory epithelium (via olfactory bulb)	Olfaction	----------
II Optic	Sensory	Retina	Vision	----------
III Oculomotor	Motor	Superior/middle/inferior rectus, inferior oblique, levator palpebrae.	Movement of eye ball	Oculomotor nucleus
	Parasympathetic	Pupillary constrictor, cillary muscle of eyeball. Both via the ciliary ganglion	Pupillary constriction and accommodation	Oculomotor nucleus
IV Trochlear	Motor	Superior oblique	Movement of eyeball	Trochlear nucleus
V Trigeminal	Sensory	Face, scalp, cornea, nasal and oral cavities, cranial dura mater.	General sensation	Trigeminal sensory nucleus
	Motor	Muscles of mastication	Opening/closing mouth	Trigeminal Motor nucleus
		Tensor Tympani muscle	Tension of tympanic membrane	Trigeminal Motor nucleus
VI Abducens	Motor	Lateral rectus	Movement of eyeball	Abducens nucleus
VII Facial	Sensory	Anterior 2/3 of tongue	Taste	Nucleus Solitarius
	Motor	Muscles of facial expression	Facial Movement	Facial Motor nucleus
		Stapedius Muscle	Tension of ossicles	Facial Motor Nucleus
	Parasympathetic	Salivary and lacrimal glands via submandibular and pterygopalatine ganglia	Salivation and Lacrimation	Superior Salivaroty Nucleus
VIII Vestibulocochlear	Sensory	Cochlea	Hearing	Cochlear Nucleus
		Vestibular apparatus	Proriception of head, balance.	Vestibular nucleus
IX Glossopharyngeal	Sensory	Eustachian tube, middle ear	General Sensation,	Trigeminal Sensory nucleus
		Caroitd Body, and sinus	Chemo/baroreception	
		Pharynx, posterior 1/3 of tongue	Taste	Nucleus Solitarius
	Motor	Styropharyngeous	Swallowing	
	Parasympathetic	Salivary glands via the otic ganglion	Salivation	Inferior Salivatory nucleus
X Vagus	Sensory	Pharynx, larynx, oesophagus, external ear	General Sensation	Trigeminal Sensory nucleus
		Aortic bodies and arch	Chemo/baroreception	
		Thoracic and abdominal viscera	Visceral Sensation	Nucleus Solitarus
	Motor	Soft Palate, larynx, pharynx, upper oesophagus	Speech, swallowing	Nucleus Ambiguus
	Parasympathetic	Cardiovascular, respiratory and gastrointestinal systems.	Control of these systems	Dorsal Motor nucleus of Vagus
XI Accessory	Motor	Sternomastoid, trapezius	Movement of head and shoulders	Nucelus Ambiguus, cranial nerves
XII Hypoglossal	Motor	Intrinsic and extrinsic muscles of tongue	Movement of tongue	Hypoglossal nucleus

Table 10.1 **Summary of components, connections and functions of the cranial nerves**
The components are colour-coded according to their embryological origin (see also Fig. 1.11 and Fig. 10.2).

Cranial nerve		Component fibres	Structures innervated	Central connections	Functions
I	Olfactory	Sensory	Olfactory epithelium	Olfactory bulb	Olfaction
II	Optic	Sensory	Retina	Lateral geniculate nucleus; pretectal nucleus	Vision; pupillary light reflex
III	Oculomotor	Motor	Superior, inferior and medial rectus muscles; inferior oblique muscle; levator palpebrae superioris muscle	Oculomotor nucleus	Movement of eyeball; elevation of upper eyelid
		Parasympathetic	Sphincter pupillae and ciliary muscle of the eyeball, via ciliary ganglion	Edinger–Westphal nucleus	Pupillary constriction and accommodation
IV	Trochlear	Motor	Superior oblique muscle	Trochlear nucleus	Movement of eyeball
V	Trigeminal	Sensory	Face, scalp, cornea, nasal and oral cavities, cranial dura mater	Trigeminal sensory nucleus	General sensation
		Motor	Muscles of mastication; tensor tympani	Trigeminal motor nucleus	Opening and closing mouth; tension on tympanic membrane
VI	Abducens	Motor	Lateral rectus muscle	Abducens nucleus	Movement of eyeball
VII	Facial	Sensory	Anterior two-thirds of tongue	Nucleus solitarius	Taste
		Motor	Muscles of facial expression; stapedius muscle	Facial nucleus	Facial movement; tension on bones of middle ear
		Parasympathetic	Salivary and lacrimal glands, via submandibular and pterygopalatine ganglia	Superior salivatory nucleus	Salivation and lacrimation
VIII	Vestibulocochlear	Sensory	Vestibular apparatus; cochlea	Vestibular nuclei; cochlear nuclei	Vestibular sensation (position and movement of head); hearing
IX	Glossopharyngeal	Sensory	Pharynx, posterior third of tongue, Eustachian tube, middle ear	Trigeminal sensory nucleus	General sensation
			Posterior third of tongue; carotid body, carotid sinus	Nucleus solitarius	Taste; chemoreception, baroreception
		Motor	Stylopharyngeus muscle	Nucleus ambiguus	Swallowing
		Parasympathetic	Parotid salivary gland, via otic ganglion	Inferior salivatory nucleus	Salivation
X	Vagus	Sensory	Pharynx, larynx, trachea, oesophagus, external ear	Trigeminal sensory nucleus	General sensation
			Thoracic and abdominal viscera; aortic bodies, aortic arch	Nucleus solitarius	Visceral sensation; chemoreception, baroreception
		Motor	Soft palate, pharynx, larynx, upper oesophagus	Nucleus ambiguus	Speech, swallowing
		Parasympathetic	Thoracic and abdominal viscera	Dorsal motor nucleus of vagus	Innervation of cardiac muscle. Innervation of smooth muscle and glands of cardiovascular system, respiratory and gastrointestinal tracts
XI	Accessory (spinal roots)	Motor	Sternomastoid and trapezius muscles	Spinal cord	Movement of head and shoulder
XII	Hypoglossal	Motor	Intrinsic and extrinsic muscles of tongue	Hypoglossal nucleus	Movement of tongue