Cranial Nerve	Nuclei	Course	Injury	Notes
Oculomotor [III]	**Motor ->** 1. *Somatic*: the main motor nucleus of oculomotor at the level of superior colliculus for all extrinsic muscles of the eye except lateral rectus and superior oblique. 2. *Autonomic* (parasympathetic): Edinger-Westphal nucleus (posterolateral to the motor nucleus), supplies constrictor pupillae and ciliary.	The fibres (from both nuclei) pass through the red nucleus w/o synapse and then through substantia nigra to emerge from the interpeduncular fossa to the middle cranial fossa and pass through the lateral wall of cavernous sinus, then to the orbital cavity between the wings of sphenoid (superior orbital fissure), it *divides to sup. and inf. rami*.	Complete: external strabismus, diplopia, ptosis, mydriasis, loss of accommodation, Partial: 1. Internal ophthalmoplegia: loss of autonomic functions, *mydriasis* and unresponsiveness to light 2. External: *external strabismus, ptosis and diplopia only*.	**Bilateral** innervation The preganglionic parasympathetic fibres pass through the inferior ramus and synapse in the **ciliary ganglia** then make the short ciliary nerve. Parasympathetic fibres are superficial so any **pressure** mainly affects autonomic functions **Diabetic neuropathy** -> affects motor only.
Trochlear [IV]	**Motor only** -> motor nucleus at the level of inf. colliculus	The fibres turn around the cerebral aqueduct and emerge from the post. aspect of midbrain to the middle cranial fossa -> lateral wall of cavernous sinus -> orbital cavity through sup. orbital fissure to **superior oblique**.	Medial and upward rotation of the eye -> diplopia and difficulty ascending stairs	**Bilateral** innervation Superior oblique passes through a trochlea medially and it turns the eye lateral and downwards. People with this injury tend to *tilt* their head to **compensate**.
Abducens/Abducent [VI]	**Motor only** -> motor nucleus at the caudal level of pons (level of facial colliculus)	Passes medial to the facial nerve through the pontomedullary junction to the MCF and enters the cavernous sinus below and lateral to the internal carotid artery, then to the orbital cavity through sup. orbital fissure to **lateral rectus**.	Internal strabismus and diplopia.	**Bilateral** innervated.

Trigeminal [V]	**Motor** -> <u>motor nucleus</u> at the cranial level of pons, medial to the main sensory nucleus **Sensory** -> (head and neck) 1. <u>*Spinal nucleus*</u>: extends from level of C2 to mid-pontine area [pain, temperature and crude touch] 2. <u>*Main/principle nucleus*</u>: at the cranial level of pons [fine touch and pressure) 3. <u>*Mesencephalic nucleus*</u>: in the midbrain around the cerebral aqueduct (reflex proprioception, periodontal ligament of muscles of mastication)	The sensory component emerges from the three nuclei and the motor from the motor nucleus, both fibres emerge from the mid-pontine area (*motor medial to sensory*), then enter the MCF to the **<u>trigeminal ganglion in Meckel's cave</u>** and then it divides to its three branches, Ophthalmic -> sup. orbital fissure Maxillary -> foramen rotundum to pterygopalatine fossa Mandibular -> foramen ovale to infratemporal fossa.		**Bilateral** innervation. Divisions : ophthalmic (sup. part of spinal nucleus), maxillary (middle part), mandibular (inf. part). The motor nucleus (for the **mandibular**) receives fibres from corticonuclear, reticular formation, red nucleus and tectum. <u>Supplies</u> -> *muscles of mastication, tensor tympani, tensor veli palatini,mylohyoid, ant. belly of digastric*.
Facial [VII]	**Motor** -> 1. *Somatic*: <u>motor nucleus of facial</u> in the caudal part of pons (muscles of facial expressions) 2. *Autonomic*: <u>sup. salivatory lacrimatory nucleus</u> (submandibular, sublingual and lacrimal glands). Fibres from *hypothalamus*. **Sensory** -> 1. *General*: <u>spinal nucleus of trigeminal</u> (external acoustic meatus) through geniculate ganglion of facial 2. *Special*: <u>nucleus tractus solitarius</u> (taste from anterior ⅔ of the tongue), 1st order neurons in geniculate ganglion. The fibres reach *VPM in the thalamus*.	It emerges from the pontomedullary junction to the MCF and enters the internal acoustic meatus passing in the facial canal behind the medial wall of the tympanic cavity then it turns forming the *geniculate ganglion* and passes along the posterior wall and exists from the stylomastoid foramen, In the tympanic cavity it gives: 1. ***Chorda tympani*** (parasympathetic and special sensation) -> passes through petrotympanic fissure to the infratemporal fossa and	Lesion in the pons -> both abducens and facial are affects Lesion in internal acoustic meatus -> both facial and vestibulocochlear Lesion to chorda tympani -> loss of taste. UMN lesion: <u>contralateral</u> lower part of face affected LMN lesion: <u>ipsilateral</u> lower part of the face affected.	Facial nuclei receive fibres **bilaterally** <u>except</u> fibres that innervate the lower part of the face. Parasympathetic fibres from *chorda tympani* synapse in the <u>submandibular</u> ganglia.

		attaches to the **lingual nerve**. 2. ***Greater petrosal*** (parasympathetic to lacrimal gland)-> passes through greater petrosal foramen, then over foramen lacerum and joins sympathetic fibres of **deep petrosal,** then through pterygoid canal to the pterygopalatine fossa, synapse in pterygopalatine ganglion and leaves with zygomatic nerve to the orbit then attaches to **lacrimal nerve**.	Bell's palsy -> unilateral, LMN paralysis for unknown reason(infection, diabetes, cold)	Parasympathetic fibres of greater petrosal synapse in pterygopalatine ganglion.

CRANIAL NERVES

Nerve	Nuclei / Fibres	Course	Injury	Notes
Glossopharyngeal [IX]	**Motor** -> 1. *Somatic*: nucleus ambiguus at the level of olives in the medulla oblongata. [stylopharyngeus] 2. *Parasympathetic*: inferior salivatory [post. to nucleus ambiguus] to parotid gland. **Sensory** -> 1. *Special* [taste from posterior ⅓ of the tongue]: nucleus tractus solitarius. 2. *General*: spinal nucleus of trigeminal 3. *Visceral*: nucleus tractus solitarius which is connected to the dorsal nucleus of vagus [baroreceptors in the carotid sinus]	It leaves the brainstem from the groove between the olive and inferior cerebellar peduncle then it leaves through jugular foramen where it forms the 2 sensory ganglia, then it gives *tympanic branch* [parasympathetic] which enter the tympanic cavity then it continues as the *lesser petrosal nerve*, it leaves the middle cranial fossa to the *infratemporal* fossa through foramen ovale then it synapses in the **otic ganglia** and supplies the parotid gland.	Loss of gag reflex Loss of carotid sinus reflex Loss of taste and sensations in the post. ⅓ of the tongue.	**Bilateral** innervation The cell bodies of the 1st order sensory neurons could be found in two ganglia: **superior and inferior.** The superior contains cell bodies for general sensation fibres while the inferior contain cell bodies for the visceral and special sensation. The visceral sensation reports changes in blood pressure activating the vagal reflex in cases of high BP.
Vagus [X]	**Motor** -> 1. *Somatic*: nucleus ambiguus to the muscles of the pharynx and larynx 2. *Parasympathetic*: dorsal nucleus of vagus nerve to the heart and GIT **Sensory** -> 1. *Special* -> taste from the epiglottis to nucleus tractus solitarius 2. *General* -> mucosa of the larynx, outer ear and dura of the posterior cranial fossa to the spinal nucleus of trigeminal	Reaches as far as the abdomen	Deviation of the uvula to the healthy side Dysphagia [pharynx] Hoarseness [larynx] Arrhythmias and GIT problems [parasympathetic]	**Bilateral** innervation The cell bodies of the 1st order sensory neurons are located in two sensory ganglia: **superior** [general sensations] and **inferior** [special sensations]

Accessory [XI]	**Motor** -> 1. Cranial root -> nucleus ambiguus 2. Spinal -> lamina IX of the upper 5 cervical segments	The spinal root ascends through foramen magnum, joins the cranial root and leave through the jugular foramen and separate again		**Bilateral** innervation The spinal root supplies trapezius and sternocleidomastoid
Hypoglossal [XII]	**Motor** -> Motor nucleus of hypoglossal near the floor of the fourth ventricle	Emerges from the groove between the pyramids and olives and leaves the skull through hypoglossal canal, joines the spinal nerve of C1 but the fibres don't mix until it reaches the oral cavity and supplies the muscles of the tongue	*Lower motor* neuron injury -> deviation of the tongue to the paralyzed side, **ipsilateral** [you ask the patient to protrude their tongue] *Upper motor* neuron injury -> deviation of the tongue to the side opposite to the lesion, **contralateral**.	Supplies all muscles of the tongue except **palatoglossus**. **Bilateral**, except **Genioglossus** muscle receives innervation from the contralateral hemisphere [not bilateral]