Nerve	Nucleus	Innervates	Nerve course	Injury
Oculomotor nerve [#3]	Found at the level of the superior colliculus in the midbrain / anterior to the cerebral aqueduct. 1 motor nucleus. 1 parasympathetic nucleus called: Edinger Westphal nucleus. It is located posterolaterally to the motor nucleus.	-**Extrinsic muscles** of the eye such as levator palpebrae superiosis, superior/medial/inferior rectus, and inferior oblique [ALL eyeball muscles except lateral rectus -CN#6- and superior oblique -CN#4-]. -**Intrinsic muscles** such as constrictor pupillae of the iris and ciliary muscles.	-Passes through > red nucleus without synapsis > through substantia nigra and emerge from the interpeduncular fossa > enter middle cranial fossa in the lateral wall of the cavernous sinus > leaves through superior orbital fissure > gets divided into superior and inferior rami. Inferior ramus >synapse in the ciliary ganglion > postganglionic fibers through short ciliary nerve.	1-Complete lesion: all muscles are paralyzed except lateral rectus and superior oblique. Symptoms: -external strabismus [+diplopia]. -ptosis. -mydriasis. -paralyzed accommodation. 2-Incomplete lesion: *Internal ophthalmoplegia [sphincter pupillae and ciliary muscle]. Symptoms: pupil > widely dilated & nonreactive to light. *External ophthalmoplegia. Symptoms: external strabismus, diplopia, and ptosis ONLY. *Notes/ 1. the parasympathetic fibers run superficially > a partial lesion will affect them. 2. diabetic neuropathy affects the motor fibers only.
Trochlear nerve [#4]	1 **motor** nucleus found at the level of the inferior colliculus in the midbrain / anterior to the cerebral aqueduct.	**Superior oblique muscle** [responsible for the **depression** of the eyeball > downward and lateral rotation].	Fibers go **posteriorly** around the cerebral aqueduct and mesencephalic nucleus > emerge from the *posterior* aspect of the midbrain > turn around crus cerebri.	Symptoms: 1. diplopia. 2. difficulty in turning the eye downward + laterally. 3. difficulty in descending the stairs.
Abducent nerve [#6]	1 **motor** nucleus found underneath the floor of the 4th ventricle at the level of the facial colliculus [caudal part] of pons.	Lateral rectus.	Leaves the brainstem anteriorly at the pontomedullary junction medial to facial nerve > enters cavernous sinus below and lateral to ICA > enters through the superior orbital fissure.	Symptoms: 1. diplopia. 2. Internal strabismus [can't turn the eye laterally].

Trigeminal nerve [#5] <<biggest cranial nerve>>	**4 nuclei**: **3 sensory** > -main sensory:in the pons area >posterior part / [lateral]. -spinal nucleus [C2 to midpontine area]. -mesencephalic nucleus [midbrain]. **1 motor** > posterior part of pons [medial].	Receives sensation from all the face + the oral cavity, nasal cavity, paranasal sinuses **except for** the angle of the mandible which is supplied by the great auricular nerve. Motor / Mandibular : 1.muscles of mastication. 2. tensor tympani. 3. tensor veli palatini. 4. mylohyoid. 5. anterior belly of digastric.	Motor root runs **inferior** to sensory root > in the middle cranial fossa they expand to form the trigeminal ganglion [in the petrous bone / Meckel's cave] which is **lateral** to the cavernous sinus > divides: -ophthalmic / inferior part of SN > superior orbital fissure -maxillary / middle part of SN > foramen rotundum > pterygopalatine fossa. -mandibular / superior part of SN > foramen ovale > infratemporal fossa.	***Extra notes*** / not injury-related. Modalities Main sensory nucleus > fine and light touch + conscious proprioception [just like PCML...] Spinal nucleus [SN]> crude touch, pain, temperature [just like ALS...] Mesencephalic nucleus > reflex to proprioception and periodontal ligament and of muscles of mastication. Motor nucleus receives fibers from corticonuclear tract, red nucleus, reticular formation, and the tectum. For the mandibular N only!
Facial nerve [#7] ***S*eventh**	1 **motor** nucleus at the level of pons / curves around abducent nerve forming the facial colliculus. [upper part of face > bilateral / lower part > contralateral]. 1 **parasympathetic** nucleus [superior salivatory lacrimatory nucleus]. the lacrimatory parts receive fibers from the hypothalamus, it also receives fibers from the trigeminal sensory nuclei (reflex tears for foreign bodies). **Sensory** nuclei -geniculate ganglia > tractus solitarius [taste] -spinal nucleus of trigeminal [general sensations]	Sensory function: >taste [anterior ⅔ of the tongue], cells are in the **geniculate ganglia** [*chorda tympani*] > synapse with 2nd order neurons in the nucleus of tractus solitarius > VPM of thalamus > primary gustatory nucleus [**area 43**] in the parietal lobe. >general sensation from external acoustic meatus carried with the facial nerve [geniculate ganglion] into the spinal trigeminal nucleus]. Parasymp. > ***S*ubmandibular + *S*ublingual glands. Motor: muscles of facial expression.	Emerges from the pontomedullary junction > enters internal acoustic meatus in the petrous part of the temporal bone > passes through facial canal [behind the medial wall of the middle ear] > curves and forms geniculate ganglion > turns to the posterior wall of the tympanic cavity > emerges from the stylomastoid foramen. **Branches**: 1. Chorda tympani: leaves middle ear through *petrotympanic fissure* > attaches to lingual n. -carries preganglionic parasymp- for [submandibular ganglion] + taste fibers. 2. Greater petrosal: emerges from geniculate ganglion > passes through middle ear > enter middle cranial fossa through greater petrosal foramen > over foramen lacerum > joins deep petrosal nerve > nerve of pterygoid canal > pterygopalatine fossa [ganglion] > leave with zygomatic n to reach the orbit > attach to lacrimal n. > innervate gland.	Location of the lesion 1. In the **pons**: abducens and facial not working. 2. **Internal acoustic meatus**: vestibulocochlear and facial. 3. Chorda tympani: Loss of taste over the anterior two-thirds of the tongue Order of the neuron affected: 1. Lower motor neuron lesion -> ipsilateral half paralysis 2. Upper motor neuron lesion -> contralateral lower part paralysis *Remember that the **upper part of the face** is supplied bilaterally by upper motor neurons, so if there is a lesion on one side the other side will compensate. Bell's palsy: Usually unilateral, lower motor neuron paralysis, the cause is still not known.

Glosso-pharyngeal nerve [#9]	1 **motor** nucleus In the reticular formation in the medulla, arises from the superior end of the nucleus ambiguous. 1 **parasympathetic** nucleus [inferior salivatory nucleus] > posterior to ambiguous / passes through otic ganglion. **Sensory** nuclei -inferior ganglia > tractus solitarius > VPM > primary gustatory nucleus. -inferior ganglia > tractus solitarius which is connected to dorsal nucleus of vagus nerve > carotid sinus reflex. -superior ganglion > spinal nucleus of the trigeminal.	Sensory function: >taste [posterior ⅓]. -carotid reflex [visceral sensation] to decrease blood pressure. >general sensation of the tongue [posterior ⅓], the skin of auditory meatus, middle ear, auditory tube, pharynx ***except for*** the nasopharynx (maxillary). Parasympathetic: supplies the parotid gland. Motor: stylopharyngeus.	1. The glossopharyngeal nerve emerges from the groove between the olive and the inferior cerebellar peduncle. 2. Descends from jugular foramen to leave the skull and there it forms two ganglia (superior and inferior) 3. At the level of the inferior ganglia, it gives a branch called the tympanic branch (preganglionic parasympathetic fibers) 4. It enters through the tympanic canaliculus to reach the tympanic cavity where it joins the tympanic plexus near the tympanic membrane 5. It leaves the tympanic cavity as the lesser petrosal nerve through the lesser petrosal hiatus to reach the middle cranial fossa. 6. From the middle cranial fossa, it descends through *foramen ovale* to the infratemporal fossa and synapses in the **otic ganglia** which is suspended by the mandibular nerve, and through the **auriculotemporal** it reaches the parotid gland.	Loss of the gag reflex (normally induces vomiting) Loss of the carotid sinus reflex Loss of taste from the posterior third of the tongue
Vagus nerve [#10]	1 **motor** nucleus -lower part of nucleus ambiguous. 1 **parasympathetic** nucleus Dorsal nucleus of vagus, anterior to the floor of the lower part of the fourth ventricle / receives afferents from the hypothalamus + CN XI **Sensory** nuclei -inferior ganglia > inferior part of tractus solitarius. -spinal nucleus of the trigeminal nerve [general sensation].	Sensory function: >taste [epiglottis] >general sensation of the outer ear, mucosa of the larynx, and the **dura** of posterior cranial fossa. Parasympathetic: Efferent to involuntary muscles of the bronchi, heart, esophagus, stomach, small intestines, and large intestines as far as the distal one-third of the transverse colon.	Course not required; just remember that it can reach the abdomen. :]	Uvula deviates to the **healthy side**. Hoarseness of voice (paralysis in the muscles of the larynx) Dysphagia and nasal regurgitation (paralysis in the muscles of the pharynx) Arrhythmia in heart and irregularity in GI tract because (parasympathetic dysfunction)

		Motor: constrictor muscles of the pharynx + larynx muscles.		
Accessory nerve [#11]	2 **motor** roots cranial > nucleus ambiguous spinal > lamina IX / upper 7 cervical segments > ascends through foramen magnum > > they leave together through the jugular foramen > get separated again, cranial joins vagus.	*The soft palate is thought to be supplied by the cranial root *trapezius and sternocleidomastoid are supplied by the spinal root.		
Hypoglossal nerve [#12]	1 **motor** nucleus [beneath the floor of the lower part of the fourth ventricle].	Motor: Supplies all the muscles of the tongue except palatoglossus (from the vagus). **Cells responsible for supplying the genioglossus muscle receive from the **opposite** cerebral hemisphere (not bilateral)	Emerges between the olive and the pyramid (the other medullary cranial nerves emerge between the inferior cerebellar peduncle and the olive). Leaves the skull through the hypoglossal canal. Courses between the internal carotid artery and the internal jugular vein to eventually reach the tongue, during its course it attaches to the C1 spinal nerve but doesn't mix with it.	**Lower motor neuron lesion**: tongue deviates toward the **paralyzed** side during protrusion with muscle atrophy (ipsilateral) Upper motor neuron lesion: on the protrusion, the tongue will deviate to the side opposite the lesion (genioglossus paralysis) with no atrophy.

Lesions notes

-**MLF lesion**:
right lesion > ask patient to look to the left
decreased adduction [right eye cant look to the left / problem with right oculomotor / medial rectus] + left eye would get nystagmus!

Notes/

1- Recall that **oblique** = function opposite of name + rotation. // superior oblique> moves eyeball downward and medially / inferior oblique> moves eyeball upward and laterally.

2- The nerves that pass through the superior orbital fissures: CN3 + CN4 + CN6.

3-Facial nerve supplies muscles of facial expression > orbicularis oris, orbicularis oculi, zygomaticus major and minor, risorius, platysma, buccinator.

4-Tensor veli palatini > trigeminal / Levator veli palatini > vagus.
5-Medial longitudinal fasciculus > CN 3, 4, 6 ++ 8.

Exam questions notes:
Fracture in the foramen magnum > LMN.
A 70-year-old smoker, hypertensive > stroke!!