

CNs 3, 4, 6, 12, 11 - The Somatomotor Set

[Neuroanatomy](#) > [Cranial Nerves](#) > [Cranial Nerves](#)

OVERVIEW

- Here we'll learn the somatomotor set comprises CNs 3, 4, 6, 12, 11, which have midline-situated nuclei and activate midline musculature.
- They have pure motor function with only one autonomic function: pupillary constriction from CN 3.

CRANIAL NERVES EXIT FROM BRAINSTEM

- First, let's show the cranial nerves as they exit the brainstem.
- CN 3, the oculomotor nerve, exits the midbrain near midline.
- CN 6, the abducens nerve, exits near midline from the pontomedullary junction.
- CN 12, the hypoglossal nerve, emerges paracentrally from the mid-medullary level. Just like CNs 3 and 6, CN 12 has a central (midline) course.
- CN 11, the spinal accessory nerve, emerges laterally from the cervical spinal cord – we include it here because its nuclei lie centrally.
- CN 4, the trochlear nerve, wraps around the outside of the pons (even though it originates from midline of the lower midbrain).

AXIAL RADIOGRAPHIC SECTIONS

- Next, let's draw axial, radiographic-orientation sections:

MIDBRAIN

- Medially, draw the oculomotor complex of CN 3 in midline, include the Edinger-Westphal nucleus of CN 3.
- Draw the trochlear nucleus of CN 4 adjacent to them.
- Show that the oculomotor fascicles emerge from the anterior, medial midbrain and enter the interpeduncular cistern.
- Then, show that the trochlear nerve passes posteriorly out of the opposite side of the midbrain, through the ambient cistern to innervate the superior oblique muscle on the side opposite its nucleus of origin; it's the only CN (other than some CN 3 fibers) to decussate.

Pons

- Medially, draw the abducens nucleus of CN 6, and show that its fibers exit along a paracentral course.
- As well show that CN 7 sweeps over the abducens nucleus as it exits the brainstem in an internal genu, which generates a small bump in the floor of the fourth ventricle: the facial colliculus.

Medulla

- Medially, draw the hypoglossal nucleus, CN 12, and show that the hypoglossal nerve passes anteriorly through the medulla and exits between the medullary pyramid (medially) and the inferior olive (laterally).

MID-SAGITTAL BRAINSTEM SECTION

Next, let's walk through a midsagittal brainstem section from superior to inferior.

- Specify the clivus (a fusion of the sphenoid and occipital bones), the cavernous sinus; and the superior orbital fissure.

[CN 3](#)

- Now, draw the oculomotor complex of cranial nerve 3 within the posterior, center of the midbrain at the level of the superior colliculus.
- Show that the oculomotor nerve passes anteriorly through the prepontine cistern, cavernous sinus, and the superior orbital fissure to innervate its respective eye muscles: the recti muscles: medial, sup., & inf, the inferior oblique, and levator palpebrae. And also its Edinger Westphal innervation provides pupillary constriction.

[CN 4](#)

- Next, draw the trochlear nucleus of cranial nerve 4 at the level of the inferior colliculus.
- Show that the trochlear nerve passes posteriorly out of the posterior aspect of the midbrain and courses around the outside of the opposite cerebral peduncle to innervate the superior oblique muscle on the side opposite its nucleus of origin.

[CN 6](#)

- Then draw the abducens nucleus of cranial nerve 6 in the posterior, inferior pons. Show that the abducens nerve exits the brainstem at the pontomedullary sulcus, climbs the clivus, and then passes through the cavernous sinus and superior orbital fissure to enter the orbit to innervate the lateral rectus muscle.
- Finally, indicate that the sixth nerve passes through Dorello's canal; it is fixed where it pierces the dura and can be stretched when there is downward herniation of the brainstem, thus a CN 6 palsy can be a warning sign of increased intracranial pressure.

[CN 12](#)

- Now, draw the hypoglossal nucleus of CN 12, the hypoglossal nerve, within the posterior, medial medulla.

- Draw the hypoglossal canal directly across from the nucleus.
- Then, indicate that it crosses through the premedullary cistern and exits the skull base through the hypoglossal canal to activate the tongue muscles (most clinically notably, genioglossus).

CN 11

- Lastly, to set up CN 11, draw the foramen magnum and jugular foramen.
- Indicate that CN 11, the spinal accessory nerve, originates from the upper cervical spinal cord, ascends through foramen magnum and exits the cranium through the jugular foramen; it innervates the sternocleidomastoid for head turn and the trapezius muscle for shoulder shrug.

USMLE PEARLS

Spinal Accessory Nerve (CN 11)

- The spinal accessory nerve is a pure motor nerve.
- It innervates [sternocleidomastoid](#) and [trapezius](#).
- Because it lies superficially, it is vulnerable to iatrogenic injury (eg, lymph node dissection).

CLINICAL EVALUATION

To learn about a clinical evaluation of the cranial nerves, see the following links:

PUPILLARY EVALUATION

[Pupillary evaluation at rest](#) [Pupillary evaluation to direct light](#) [Pupillary light reflex pathologies](#) [Swinging flashlight test](#) [Accommodation Reflex](#) [Evaluation of Anisocoria](#)

EXTRAOCULAR MOVEMENT EVALUATION

[Eyelid Position](#) [Ocular Alignment](#) [Ocular Misalignment \(Strabismus\)](#) [Ocular Misalignment Terminology](#) [Six Cardinal Positions of Gaze](#) [Eye Movement Abnormalities](#) [Dysconjugate Gaze](#) [Nystagmus](#) [The Dix-Hallpike Maneuver](#) [Optokinetic nystagmus \(OKN\)](#) [Oculocephalic reflex \(Doll's maneuver\)](#) [Vestibulo-oculogyric Reflex \(Caloric Reflex\)](#)