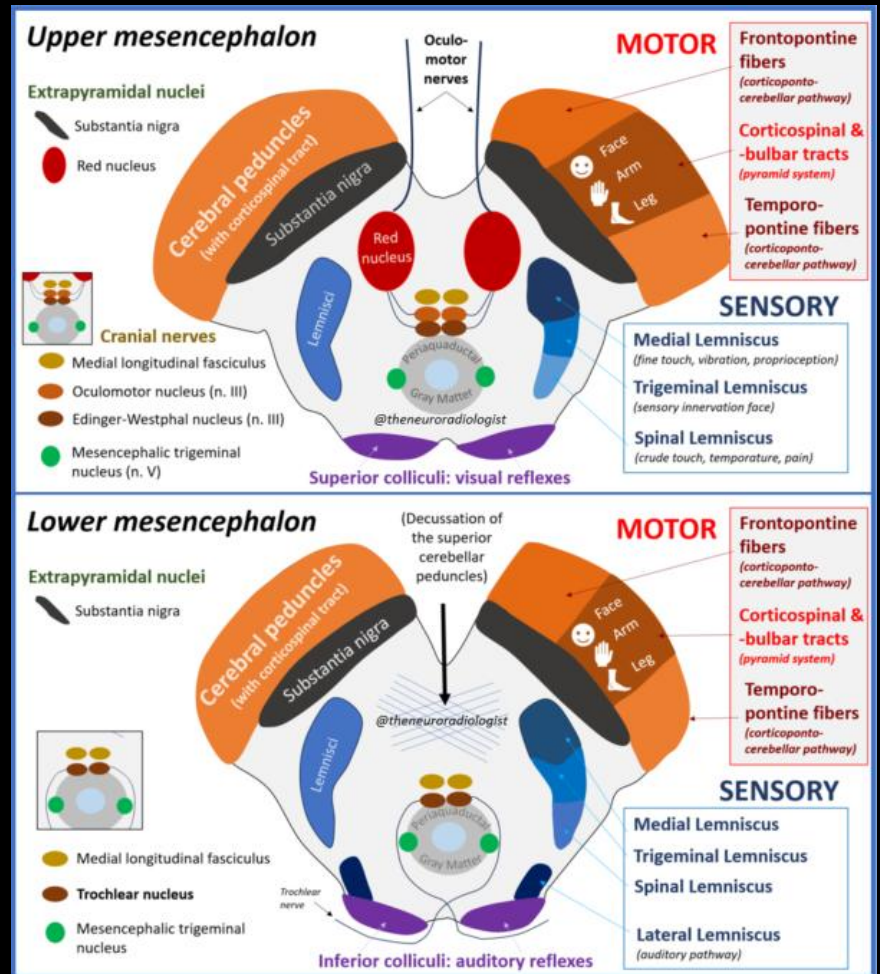
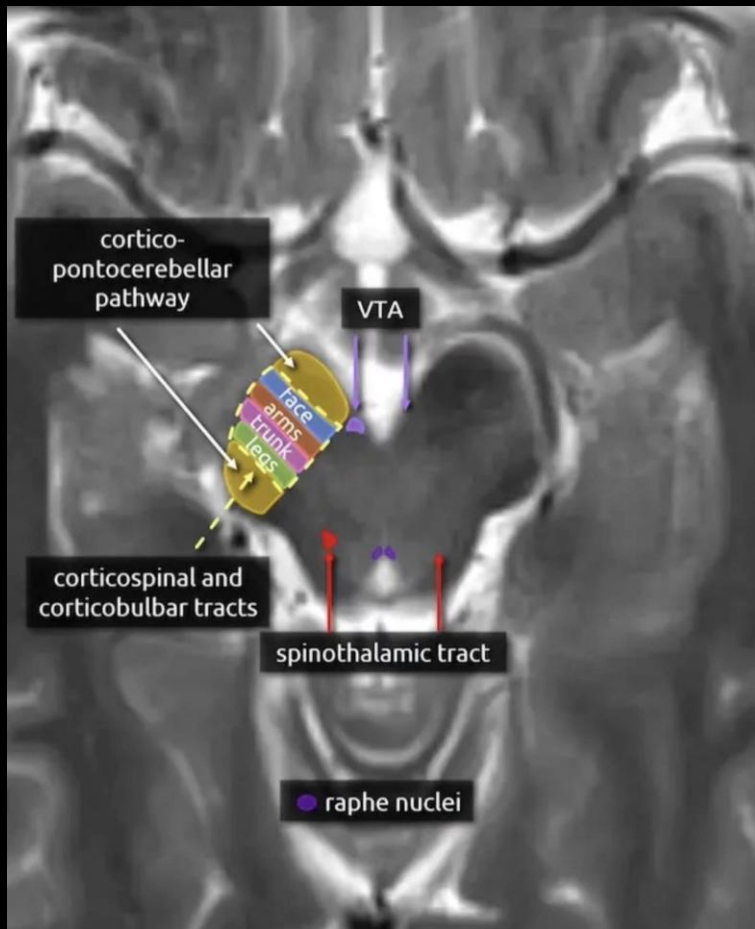


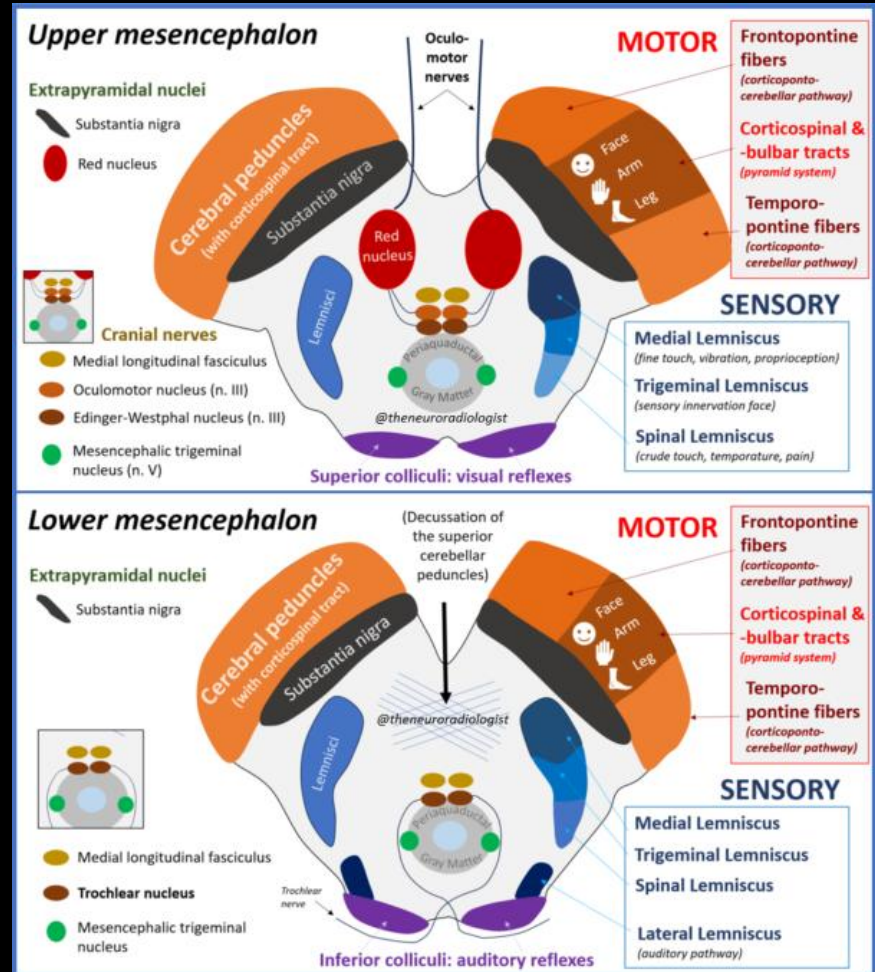


Midbrain: Key Structures and Why They Matter

• ——— Brief MRI anatomy reference ——— •



Structure	Purpose / Why It Matters
Tectum	Posterior 'roof' of the midbrain. Contains the colliculi. Important for visual and auditory reflex pathways.
Superior colliculi	Help coordinate eye movements and visual reflexes.
Inferior colliculi	Part of the auditory pathway. Helps process sound information.
Cerebral aqueduct	Narrow CSF channel connecting the 3rd and 4th ventricles. Obstruction can cause hydrocephalus.
Periaqueductal gray	Gray matter around the aqueduct. Involved in pain modulation and autonomic responses.
Tegmentum	Central portion of the midbrain. Contains important nuclei and nerve pathways.
Red nuclei	Motor coordination pathway, especially related to limb movement. Often visible on axial MRI.
Substantia nigra	Dopamine-producing region involved in movement control. Degeneration is associated with Parkinson disease.
Cerebral peduncles / crus cerebri	Large anterior white matter tracts carrying motor signals from brain to body. Important in stroke, tumor, or Wallerian degeneration.
Oculomotor nerve nuclei / CN III region	Controls most eye movements, eyelid elevation, and pupil constriction. Lesions can cause diplopia or ptosis.
Trochlear nerve nucleus / CN IV region	Controls the superior oblique muscle of the eye. Lesions can cause vertical diplopia.
Medial longitudinal fasciculus (MLF)	Coordinates eye movements between both eyes. Lesions can cause internuclear ophthalmoplegia.



What Is a Lemniscus?

- A major ribbon-like tract of nerve fibers (axons)
 - Ascends through the brainstem
 - Carries sensory information to higher centers of the brain
- In the midbrain, housed primarily in the tegmentum
 - The central core of the midbrain
- The midbrain contains four distinct lemniscal pathways

The 4 Lemnisci in the Midbrain

- **Medial Lemniscus**

- Conscious proprioception, vibration, fine touch from the body
- Ascends from gracile and cuneate nuclei to thalamus; lies posterolateral to the red nucleus

- **Spinal Lemniscus**

- Pain, temperature, crude touch
- **Anterior + lateral spinothalamic tracts**; runs lateral to the medial lemniscus

- **Trigeminal Lemniscus**

- Touch, pain, temperature from the face and head
- Trigeminothalamic tract; posterior and slightly medial to the spinal lemniscus

- **Lateral Lemniscus**

- Auditory (hearing) information
- From cochlear nuclei and superior olivary complex; terminates in the inferior colliculus

Medial Lemniscus

- Conscious proprioception, vibration, and fine touch from the body
- Ascends from gracile and cuneate nuclei to the thalamus
- In the midbrain, lies posterolateral to the red nucleus

Spinal Lemniscus

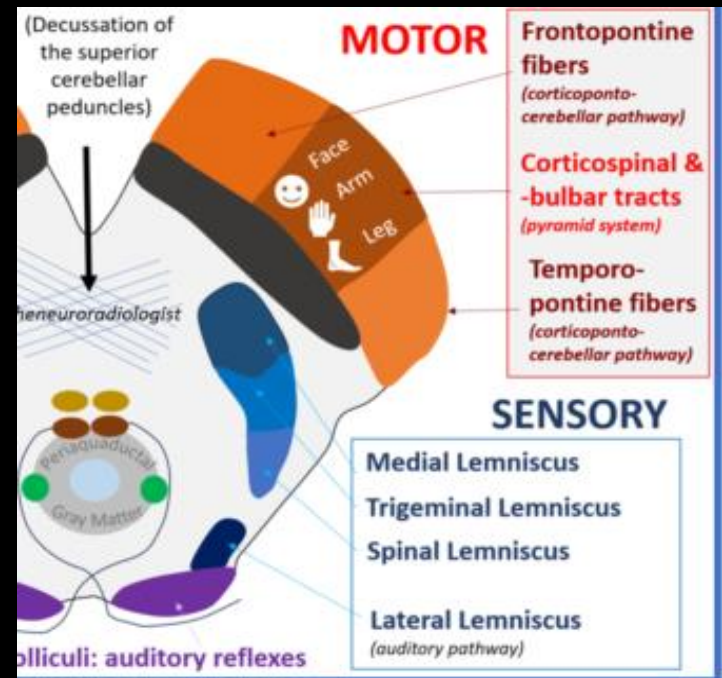
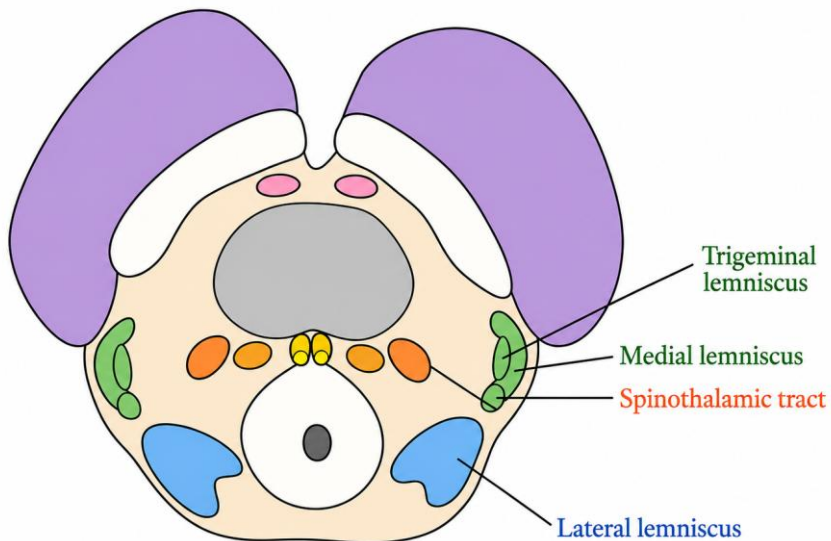
- Pain, temperature, and crude touch from the body
- Includes anterior and lateral spinothalamic tracts
- Runs lateral to the medial lemniscus

Trigeminal Lemniscus

- Touch, pain, and temperature from the face and head
- Trigemino-thalamic pathway
- Posterior and slightly medial to the spinal lemniscus

Lateral Lemniscus

- Auditory pathway carrying hearing information
- From cochlear nuclei and superior olivary complex
- Terminates in the inferior colliculus



Spinal Lemniscus vs Spinothalamic Tracts

- Related, but not the same
 - Spinothalamic tracts are components of the spinal lemniscus
- Spinal lemniscus = anterolateral system in the brainstem
 - Lateral spinothalamic tract – pain and temperature
 - Anterior spinothalamic tract – crude touch and pressure
 - Ascends to the VPL nucleus of the thalamus
- Do not confuse with the medial lemniscus
 - Dorsal column pathway – fine touch, vibration, proprioception

Substantia Nigra

- Divided into
 - Superficial - pars reticularis
 - Deep - pars compacta

