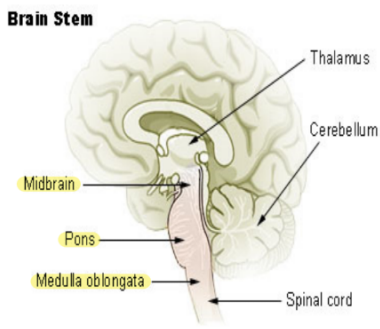


BRAIN STEM (PART 1)



* **brain stem**: stalklike shape, connects spinal cord to higher centers of fore brain, consists of: midbrain, pons, medulla

* **fore brain** = 2 cerebral hemispheres & thalamus
mid brain

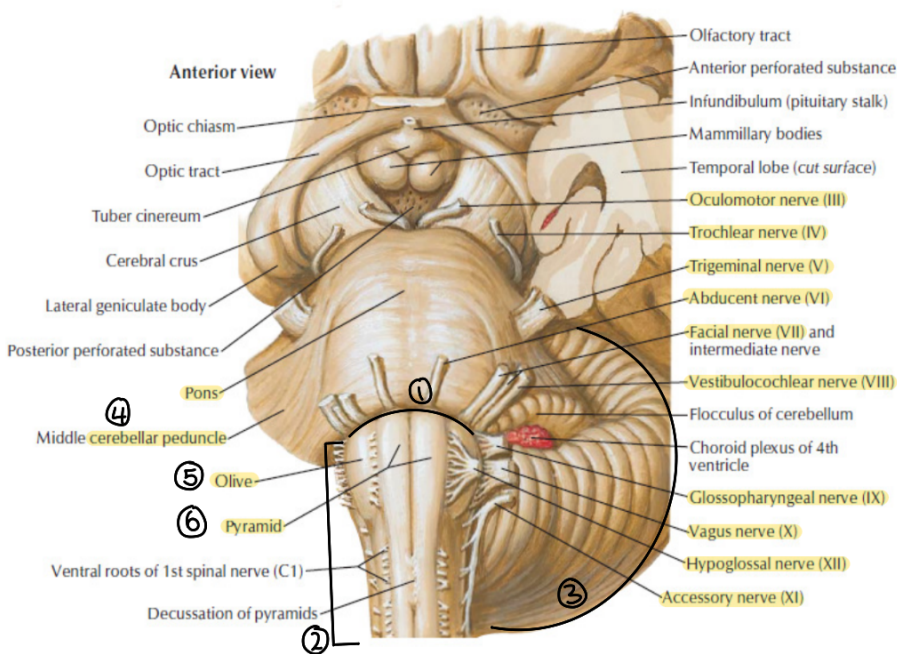
hind brain = Cerebellum + pons + medulla

* **4th ventricle**: the cavity of hind brain, its floor is lower part of pons & its roof are medulla & cerebellum

* in brain stem you'll find:

- ① ascending & descending tracts
- ② no dorsal & ventral horns, instead there are sensory, motor, parasymp. nuclei (no sympathetic)
- ③ vital centers (RS & CVS centers)
- ④ 10/12 Cranial nerves arise from it:

- midbrain → **oculomotor (3)** → in interpendueular fossa
 → **trochlear (4)** → in post. aspect of brain stem
- mid. pontine area → **trigeminal (5)**
- pontomedullary junction → **abducent (6)**
 → **facial (7)**
 → **vestibulocholear (8)**
 → **glossopharyngeal (9)**
- rest of medulla → **vagus (10)**
 → **accessory (11)**
 → **hypoglossal (12)** → bet. Olive & Pyramid (postero lat. groove)

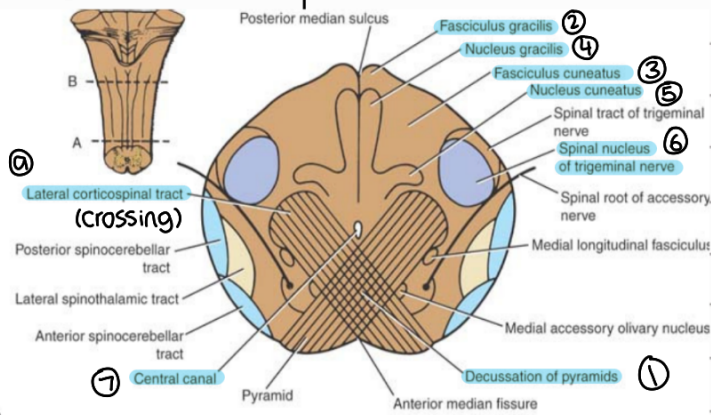


- ① → PontoMedullary junction
- ② → medulla (most inf, has antero lat. & postero lat. grooves)
- ③ → Cerebellum
- ④ → ant. part of midbrain, white matter, has interpendueular fossa
- ⑤ → lat. to ⑥, deep to it the olivary nuclear complex

* int. Structures of medulla (4 levels)

1 Level of decussation of pyramids (inferior level)

	location	notes
① decussation of pyramids	ant. to Central Canal	
② Fasciculus Gracilis	in Spinal cord (medially)	white matter that comes from spinal cord & goes up
③ Fasciculus Cuneatus	in Spinal cord (laterally)	
④ Nucleus gracilis	just above Spinal Cord (medially)	grey matter located inside it, 1st & 2nd order neurons synapse here
⑤ Nucleus cuneatus	just above Spinal Cord (laterally)	
⑥ spinal Nucleus of trigeminal N	lat. & post. to nucleus cuneatus	<ul style="list-style-type: none"> the N comes from pons, supplies: <ul style="list-style-type: none"> a) Sensory (mainly) head & neck, face, Oral cavity, b) motor: mastication Ms, tensor tympani, tensor belly palatine, ant. belly of digastric & Mylohyoid its called spinal nucleus cuz it has longitudinal extension from upper cervical segment up to mid brain



⑦ Central Canal (close medulla)

⑧ lat. & ant. white columns of Spinal cord unchanged

⑨ lat. corticospinal fibers (crossing each other)

descend: cortex → Corona radiata → int. capsule → cross Cerebri (in midbrain) → Scatter in pons → medulla → Gather in pyramid

⑩ ant. corticospinal fibers

don't cross at level of medulla, decussation occurs just ant. to Central Canal

2] Level of decussation of lemnisci (Sensory decussation)

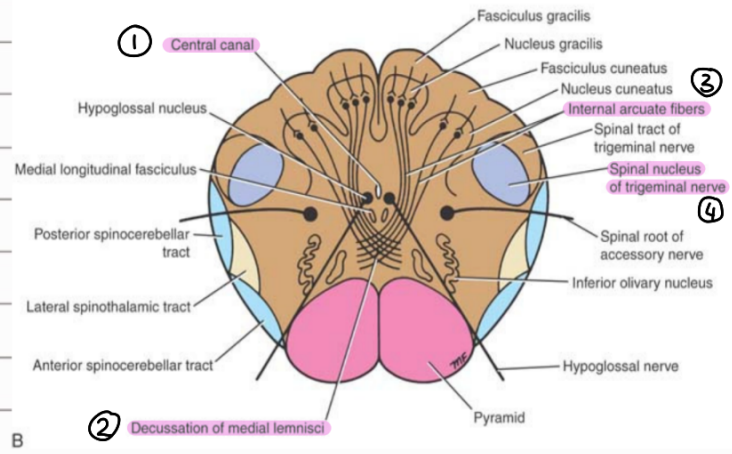
① central canal (closed medulla)

② lemniscal decussation
(ant. to central canal)

③ int. accurate fibers

1st order neurons synapse in nucleus gracilis & cuneatus → 2nd order neurons (③) arise & cross midline ant. to central canal & post. to pyramid (lemnisci are formed by ③)

④ spinal nucleus of trigeminal N → posterolaterally to central canal

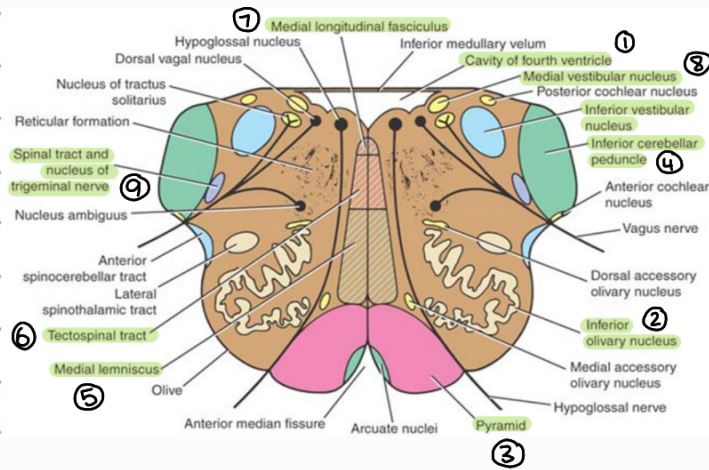


3] Level of olives (opened medulla)

① inferior part of 4th ventricle (floor, anteriorly made by medulla & pons, posteriorly made by cerebellum, tent, rhomboid shaped)

② inferior olivary nucleus

(makes olivary bulge next to pyramid, grey matter, crumpled bag appearance with medial opening, has relation with spinal cord, cerebellum & cortex, skeletal M movement)



• 2 types of fibers reach cerebellum:

① mossy fibers → spinocerebellar tract

② climbing fibers → from olive to cerebellum for coordination of skeletal M movement

• Olivary nuclear complex: dorsal, medial, inferior olivary nuclei, inf. one is the largest & most important

③ pyramid → most ant. structure

④ inf. cerebellar peduncle → posterolateral, connects medulla & cerebellum, post. spinocerebellar tract passes through it

• Midline structures (all made of white matter)

⑤ medial lemniscus → most ant. midline structure (post. to pyramid), above sensory decussation, carries sense contralaterally

⑥ tectospinal tract → post. to ⑤, for visual reflexes

⑦ medial longitudinal fasciculus → post. to ⑥, connects motor nuclei of CN 3, 4, 6, sensory nuclei of CN 8 & upper cervical segments (of neck muscles), responsible for movement of eyeball & maintenance of balance, connects nerves of eyeball movement to ⑧ to coordinate eye & head movement

⑧ vestibular nuclei → balance sensation (relation to gravity)

• by **Ocular vision**: synchronized eyes movement so they don't move in opposite directions (eg: rt lat. rectus move with lt. med. rectus)

⑨ spinal nucleus of trigeminal → laterally, ascends to mid pontine area

• **nuclei in central grey matter**

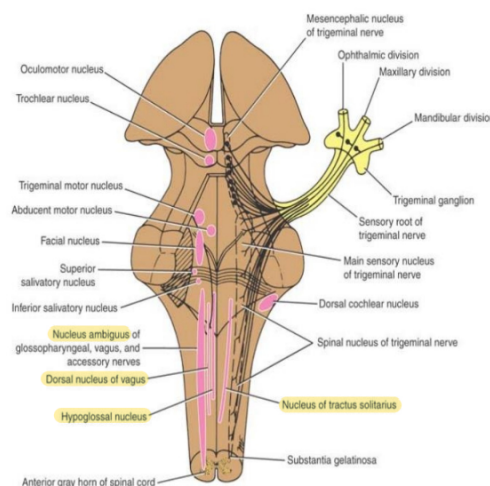
- **hypoglossal nuclei** → exits via groove bet. pyramid & olive / can be found in 4th ventricle floor / motor / most medial

- **dorsal vagal nucleus** → parasymp., exits bet. olive & inf. cerebellar peduncle

- **nucleus of tractus solitarius** → sensory (taste & visceral), connected to facial N, glossopharyngeal N (for tongue, & vagus (cuz there are taste buds on epiglottis))

- **medial & inf. vestibular nuclei on CN 8** → most lateral

- **nucleus ambiguus** → deep in reticular formation, motor nucleus for CN 9, 10, 11, elongated within brainstem, fibers supply striated muscles of larynx, pharynx, soft palate



④ Level just inferior to pons

- Similar to level 3

- lat. vestibular nucleus replaces inf. one

- Cochlear nuclei become visible on ant.

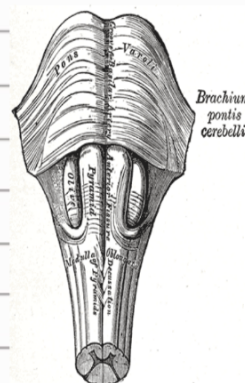
& post. surfaces of inf. cerebellar peduncle

* PONS (the bridge)

- length ≈ 1"

- convex anteriorly

- connects cerebrum & cerebellum, important in cerebro-ponto-cerebellar pathway (connects rt cerebral with lt cerebellar hemisphere)



- Gross appearance

Ant. Surface

- ① basilar groove (midline) → basilar A
- ② CN 5 → from anterolat. (mid pontine area, small motor & large sensory)
- ③ CN 6, 7, 8 → ponto medullary junction (from med. to lat.)

Post. Surface:

- ① floor of 4th ventricle (consists of upper triangular half (pons) & lower medullary half that forms rhomboid fossa)

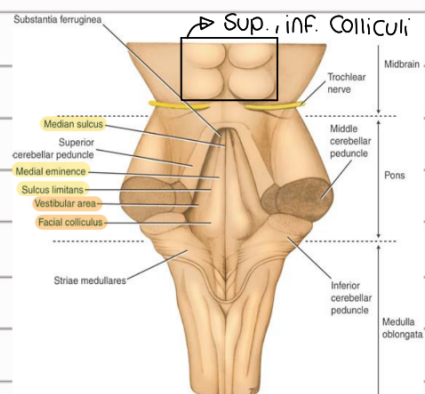
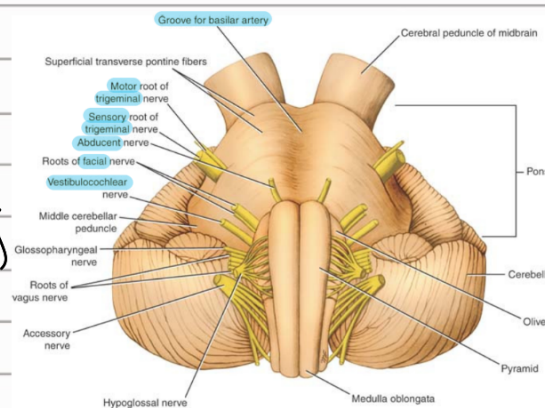
• rhomboid fossa

- ↳ Midline: median sulcus
- ↳ laterally: sulcus limitans
- ↳ between the two: median eminence, forms facial colliculus inferiorly

- ② vestibular area

lat. to sulcus limitans, sup. to median eminence & vestibular nuclei

- ③ facial colliculus (related to facial N)



- internal structure of pons:

- ① trapezoid body

part of acoustic pathway (the fibers that cross midline)

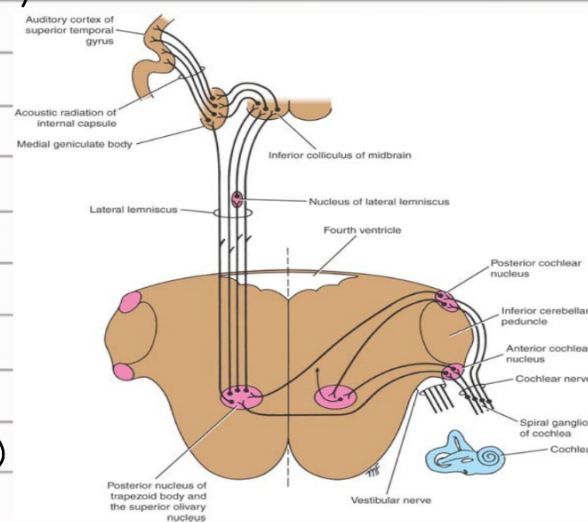
- ② basilar part

↳ ant. to ①, has basilar groove (for artery) anteriorly

- ③ tegmentum → everything post. to ①

• Acoustic pathway:

Spiral ganglion in Cochlea (inner ear) → Cochlear N (part of vestibulocochlear N) starts → goes to brain stem → pass through pontomedullary junction to reach ant, post. Cochlear nuclei (synapse with 2nd Order Neuron → most fibers decussate at midline (trapezoid body) → ascend as lat. lemniscus & reach inf. colliculus in post. aspect of midbrain → go to geniculate body (thalamus) → to auditory cortex (temporal lobe)

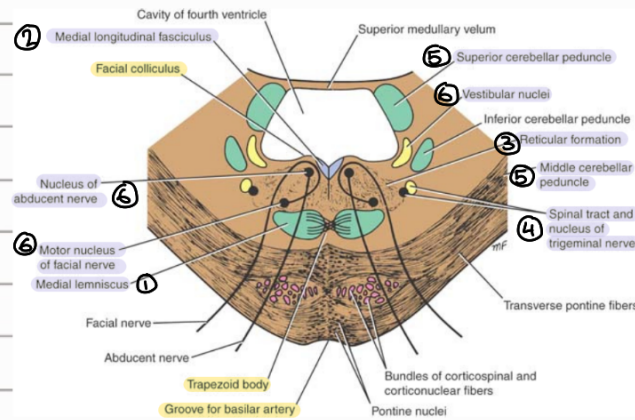


- Sup. Colliculus → related to visual pathway
 - Inf. Colliculus → related to auditory pathway
- both are parts of tectum

- Level through caudal part (facial colliculus) inferior:

tegmentum part:

- ① medial lemniscus: most ant. (just post. to basilar part)
- ② medial longitudinal fasciculus (MLF) beneath 4th ventricle on sides of midline
- ③ part of reticular formation (in core of pons)
- ④ spinal nucleus of trigeminal (in anteromedial aspect of inf. cerebellar peduncle, lat. to motor nucleus of facial N)
- ⑤ part of sup. & middle cerebellar peduncle
- ⑥ nuclei of CN 6, 7, 8
 - ↳ abducent nuclei (below floor of 4th ventricle)
 - ↳ motor facial nuclei (post. to medial lemniscus, fibers move post. → do a U-turn around abducent nuclei to form **facial colliculus** → emerge from pontomedullary junction)
 - ↳ part of vestibular nuclei in 4th ventricle floor laterally



. cerebellar peduncles (3)

- ↳ inferior: Connect medulla & cerebellum (inside)
- ↳ middle: Connect pons & cerebellum (outside)
- ↳ superior: Connect midbrain & cerebellum (inside)

basilar part:

transverse pontine fibers form middle cerebellar peduncle which will reach cerebellum posteriorly (cerebroponto cerebellar pathway) → this pathway brings **muscle-joint sense from spinal cord & info about intended movement from cortex** to cerebrum to coordinate skeletal movement (pathway: cerebrum → pons → transverse pontine fibers to cerebellum / synapse within pathway in pontine nuclei)

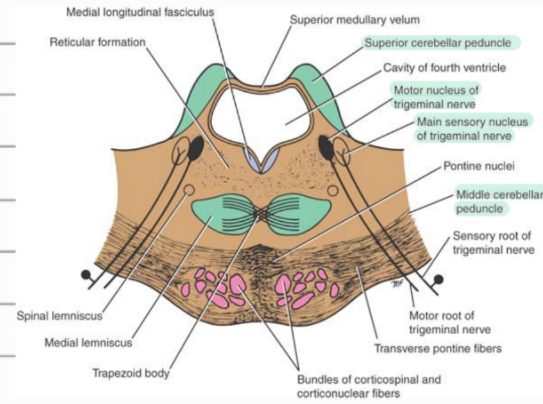
- Level through Cranial part (trigeminal nuclei)

tegmentum part:

- ① Sup. & middle Cerebellar peduncle
- ② motor nucleus of trigeminal
- ③ main Sensory nucleus

- what cant be seen at this level:

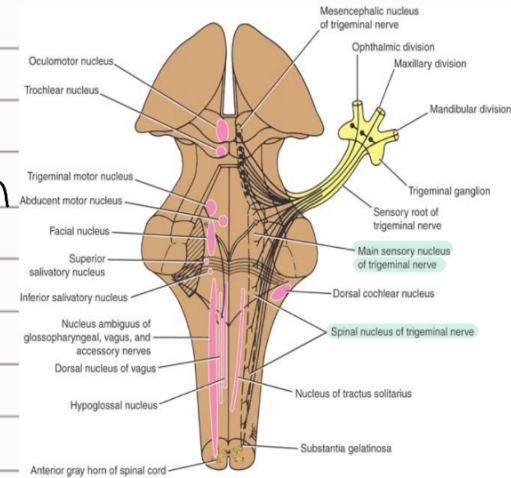
- ↳ inf. cerebellar peduncle
- ↳ spinal & lat. lemniscus (can be seen on lat. extremity of med. lemniscus)
- ↳ Spinal nucleus of trigeminal



Spinal nucleus of trigeminal N extends from lowest part of medulla to inf. part of pons

basilar part:

Same as last level



- trigeminal System

- has its own cell body of 1st order neuron in trigeminal ganglia (in cranial cavity at the tip of petrous portion of temporal bone)
- Sensory to head & Neck area (Whereas Spinal Systems (ALST, DCMLT) are sensory to rest of body)

• pathway:

① Sensory 1st Order Neurons have Cell bodies at trigeminal ganglia

② Synapse in:

- ↳ main nucleus & spinal nucleus of trigeminal → 2nd order neurons cross midline & form trigeminal lemniscus → moves towards thalamus → synapse with VPM (ventro postero medial nucleus) of head, Neck Sensation & taste
- ↳ mesencephalic trigeminal nucleus → 2nd Order Neurons not involved in lemniscus, responsible for reflexes

