

جَدِيد



ANATOMY

SHEET NO. 8

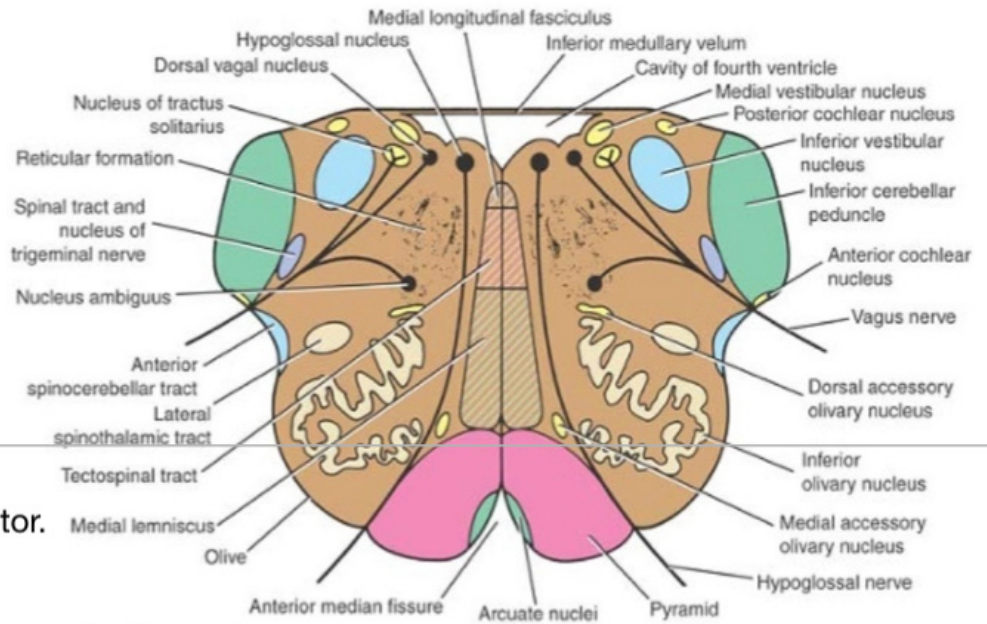
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Central gray matter

- Lies beneath the floor of 4th ventricle
- Passing from M to L:
 1. Hypoglossal nucleus
 2. Dorsal nucleus of vagus
 3. Solitary nucleus
 4. Vestibular nuclei (medial and inferior)



Notes:

hypoglossal nerve is purely motor. (no sensation or autonomic)

dorsal Vagal nucleus is a parasympathetic nucleus.

solitary nucleus (nucleus of tractus solitarius) → sensory nucleus for taste and visceral sensation.

- the taste sensation is related to the inferior vagal ganglia which contain the cell bodies of the afferent neurons then the fibers go to the solitary nucleus as the relay station for taste sensation to be projecting to the VPM nucleus in the thalamus and then to the primary sensory cortex.
- the superior vagal ganglia is related to general sensation.

vestibular nucleus related to the vestibular part of the vestibulocochlear nerve and it is a sensory nucleus → for the sense of balance, the first order neurons cell bodies are located in Scarpa ganglia.

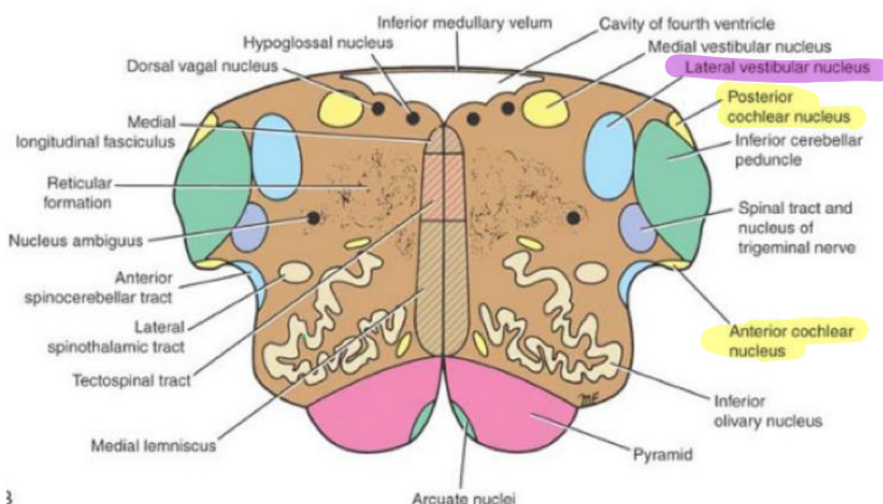
The last section in medulla oblongata:

4. Level just inferior to the pons

No major changes compared to the last level (level of olives).

The lateral vestibular nucleus replaces the inferior vestibular nucleus.

Cochlear nuclei become visible on the anterior (ventral) and posterior (dorsal) surfaces of the inferior cerebellar peduncle.

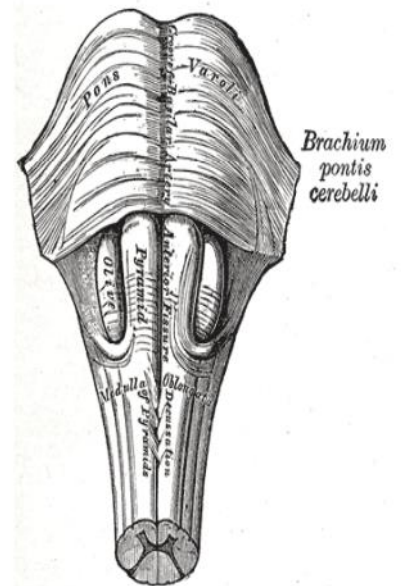


Pons (the bridge)

The length of the pons is approximately 1 inch.

Anterior surface of the pons is convex.

Pons in Latin means Bridge, which connects between cerebrum and cerebellum. It is an important part of cerebro-Ponto-Cerebellar pathway>>>How does this connection form? From Rt. cerebral hemisphere, pons and Lt. Cerebellar hemisphere.



Gross appearance of the anterior surface of pons (Refer to figure 1)

- Basilar groove (midline). Contains basilar artery (important blood supply for the brain)
- **Cranial nerve 5** (trigeminal) emerges from **anterolateral surface** (small motor (medial) and large sensory (lateral)). It emerges from the **mid-pontine area**.
- **6th 7th & 8th** emerges at **pontomedullary junction** (from medial to lateral).

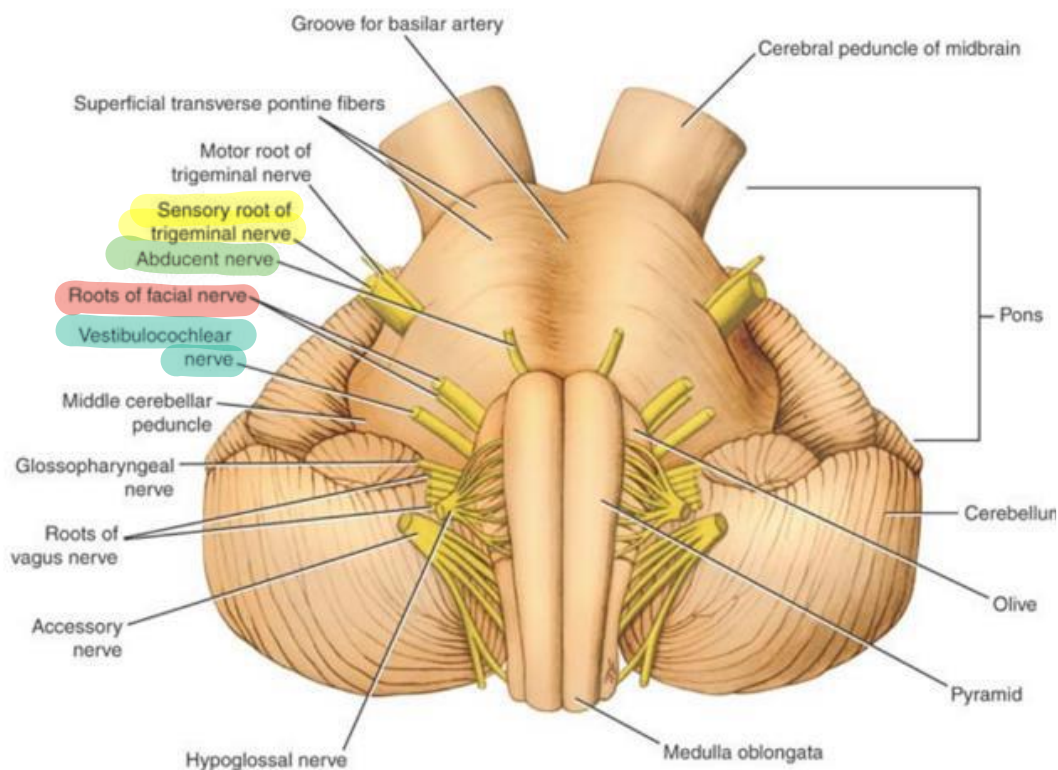


Figure 1. Anterior surface of pons

Gross appearance of the posterior surface of pons (cerebellum removed) (refer to figure 2)

- The floor of the 4th ventricle can be seen. It is rhomboid-shaped (pons + medulla oblongata). However, if we are only talking about the pons, then the floor is triangular in shape (upper half of the floor). Collectively, the upper triangular half of the pons and the lower medullary half forms the **rhomboid fossa**.
- In the 4th ventricle floor (rhomboid fossa), the midline is made by a sulcus known as the **median sulcus**. Lateral to the midline, another sulcus can be seen, which is called the **sulcus limitans**. Between the median sulcus and the sulcus limitans is the **median eminence**, which forms the **facial colliculus** inferiorly.
- Vestibular area (lateral to sulcus limitans and superior to the facial colliculus) is related to underlying structure which is **vestibular nuclei**.
- Facial colliculus (inferior end of medial eminence) is related to **facial nerves** (not nuclei) more details later.

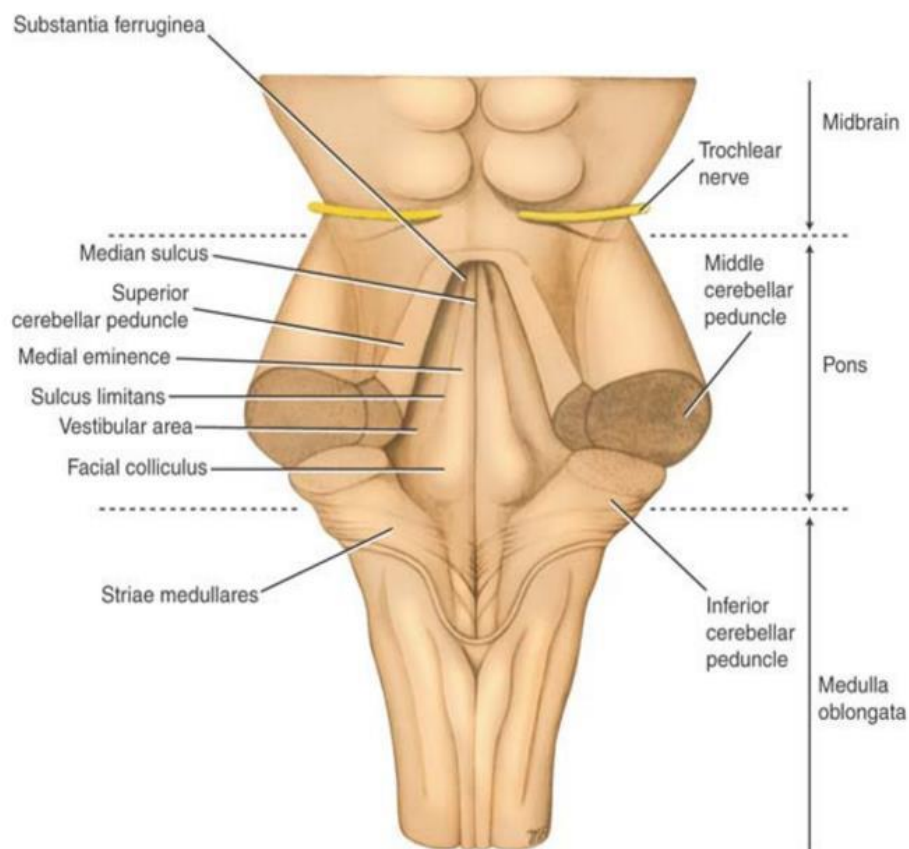


Figure 2 Posterior surface of pons (cerebellum removed)

In studying the pons, we will divide it to 2 sections. The first section will be “section of facial colliculus (caudal)” and the second section will be “section of trigeminal nuclei (cranial)”. However, before we investigate these two different sections, we need to know the internal structure of pons.

Internal structure of pons

In the pons, there is the **trapezoid body**.

Anterior to the trapezoid body is the **basilar part**, which has the basilar groove most anteriorly.

(contains basilar artery)

Posterior to the trapezoid body is collectively known as the **tegmentum**.

These three structures (**basilar part, trapezoid body, and tegmentum**) are important for differentiating the anterior-posterior direction of pons at its different levels.

What is the trapezoid body?

Trapezoid body is part of the acoustic pathway (Auditory pathway) Made up of fibers derived from cochlear nuclei.

The acoustic pathway starts from the cochlea in inner ear, from which the cochlear nerve (part of vestibulocochlear nerve) which has its cell body in the spiral ganglion of cochlea, goes to the brainstem (it pass through pontomedullary junction) to reach the anterior and posterior cochlear nuclei. Where synapse with 2nd order neuron occurs. Most of the 2nd order neurons decussates at the midline (contralateral) (some stay ipsilateral)

These fibers that cross the midline are known as the **trapezoid body**.

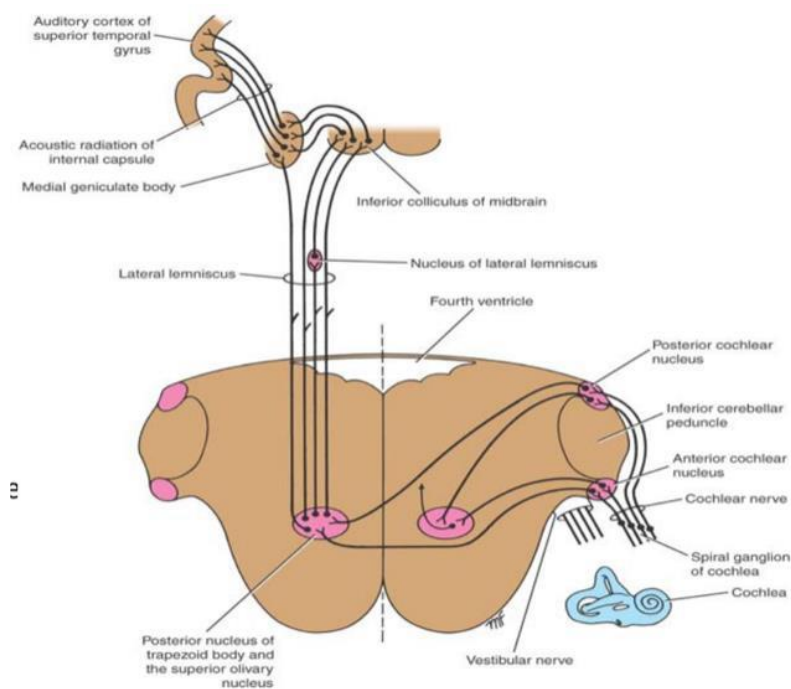
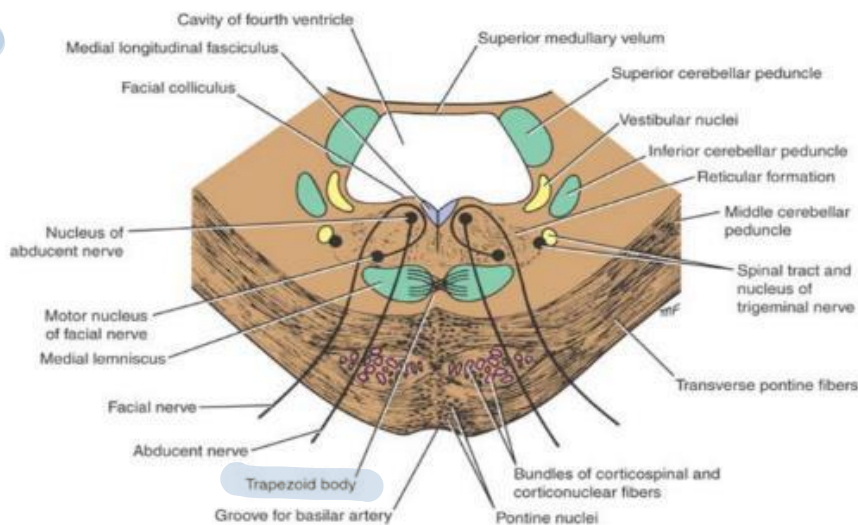
From the trapezoid body, these fibers ascend in what is known as the **lateral lemniscus**. These fibers will reach the inferior colliculus (In

posterior aspect of midbrain/part of tectum), then they will go to the **medial geniculate body** within the thalamus, and finally they will project to the auditory part of cortex (temporal lobe)

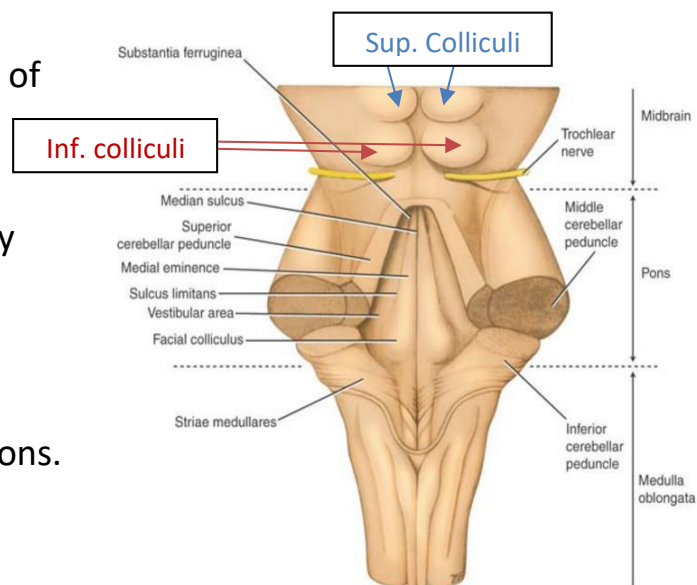
Visual system → lateral geniculate body.

Auditory system → medial geniculate body.

Remember in previous lectures we said that all sensations must pass through the thalamus before reaching the cortex. Rule still applies here.



Returning to this figure on the right for a second, we can see in the posterior aspect of midbrain (the tectum), the **superior colliculi** (related to visual pathway) and the **inferior colliculi** (related to the auditory pathway).



Now let's get into the first section of the pons.

Level through caudal part (facial colliculus) (inferior)

Cavity seen in the section is the 4th ventricle.

1. The Tegmentum: (everything posterior to the trapezoid body)

1

The **medial lemniscus** is the most anterior part of the tegmentum (just posterior to the basilar part).

2

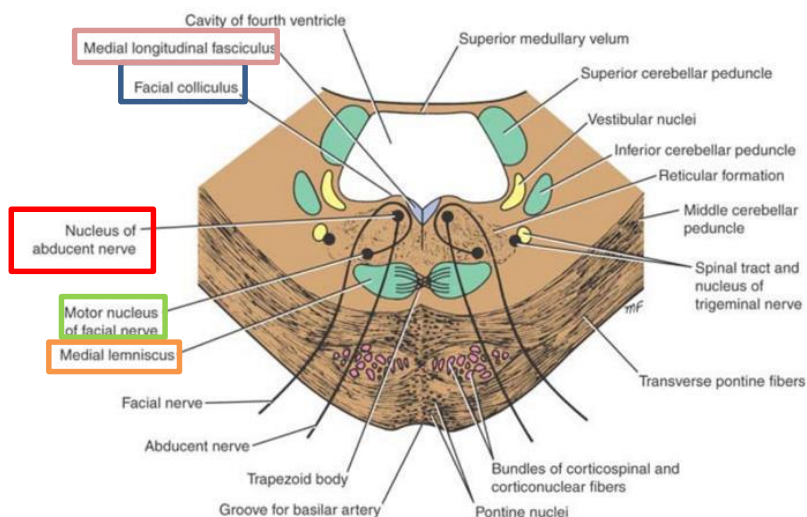
The **medial longitudinal fasciculus (MLF)**, which was explained in the

last lecture in the medulla oblongata, can be seen beneath the floor of the fourth ventricle on either side of the midline.

3 Part of the reticular formation is found in the core of the pons in the tegmentum.

4 The spinal nucleus of trigeminal nerve (also from previous lecture) can be found on the **anteromedial aspect** of the inferior cerebellar peduncle. And it is lateral to the motor nucleus facial nerve.

5 Part of the superior cerebellar peduncle and middle cerebellar peduncle can be seen.



Note there are 3 cerebellar peduncles (Refer to figure 2 in pg 2)

1. Inferior cerebellar peduncle (connect medulla oblongata and cerebellum)
2. Middle cerebellar peduncle (connect pons and cerebellum)

3. Superior cerebellar peduncle (connect Midbrain and cerebellum)
Middle cerebellar peduncle is found on the outside, whereas the superior and inferior cerebellar peduncles are found to the inside. That is why all three can be found in the same section.

6 Nuclei of the 6th, 7th, and 8th cranial nerves can be seen.

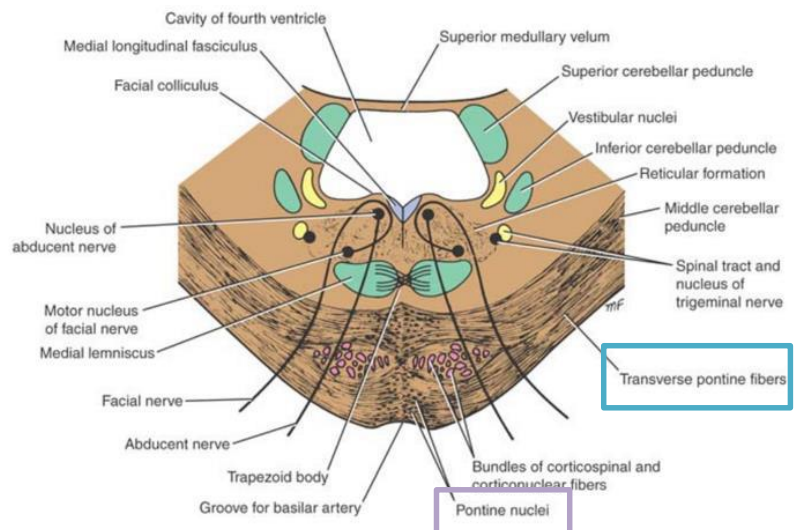
1. The **abducent nuclei** is found just underneath the floor of the fourth ventricle.
2. The **motor facial nuclei** are found directly posterior to the **medial lemniscus**.
The fibers of the motor facial nuclei have an unusual pathway. The fibers move posteriorly and turn (do a U-turn) around the **abducent nuclei**, then they emerge from the ponto-medullary junction. This turn is responsible for the formation of the **facial colliculus**.
3. Part of the vestibular nuclei found in the lateral aspect of the floor of 4th ventricle

Medial vestibular nucleus

2. The basilar part (anterior to the trapezoid body)

Notice the **basilar groove** most anteriorly.

1 Transverse fibers, known as **transverse pontine fibers**, form the middle cerebellar peduncle which will reach the cerebellum posteriorly. This pathway is known as the **cerebro-ponto-cerebellar pathway**, which means that it connects the cerebrum with the cerebellum. This pathway is very important because the cerebellum receives information from the spinal cord about the muscle-joint sense (position of body) and because the cerebellum must also receive information about the **intended movement** (which is generated in the higher centers in the cortex) in order for the cerebellum to coordinate the skeletal muscles movement. Fibers in this pathway descend from the cerebrum to the pons, then they move in a transverse fashion (**transverse pontine fibers**) to the cerebellum.



2 Within the cerebro-ponto-cerebellar pathway **pontine nuclei** are where synapse occurs.

3 Bundles of corticospinal tract fibers are scattered due to the presence of the **pontine nuclei**.

The fibers that going to the lacrimal gland synapse in the palatine ganglia.

Fibers to the submandibular or to the sublingual synapse in the submaxillary (submandibular) ganglia.

Nuclei of the facial nerve:

1. Superior salivatory nucleus/ Salivatory lacrimatory nucleus (Parasympathetic nuclei)

It gives parasympathetic supply to the submandibular and sublingual glands (salivatory) but **NOT** parotid gland. It also supplies the lacrimal gland (lacrimatory). Parotid by Glossopharyngeal nerve.

It is located posterolateral to the main motor nucleus. (discussed above)

2. Part of the nucleus of tractus solitarius (sensory nucleus of facial nerve)

Located posterolateral to the parasympathetic nucleus of facial nerve.

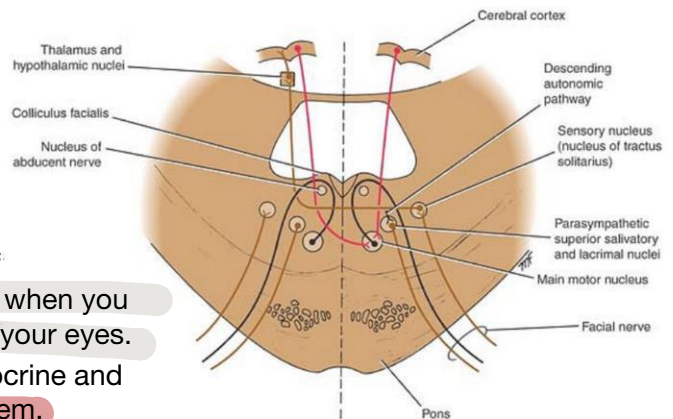
It receives taste sensation from the anterior 2/3 of the tongue.

Superior salivatory: receives from the hypothalamus.

Lacrimal nucleus: receives from ² Hypothalamus (emotional) and sensory nuclei of the trigeminal (reflex).

Reflex is like when you have dust in your eyes.

Hypothalamus involves in 3 systems: autonomous, endocrine and limbic systems. *and it's the major output for limbic system.



2. Level through cranial part (trigeminal nuclei)

This is the midpontine area.

Cavity seen in this section is the 4th ventricle.

1. The tegmentum

Inferior cerebellar peduncle not visible. Only ¹ superior and middle cerebellar peduncles can be seen.

² The spinal lemniscus & lateral lemniscus (not on this level) can be

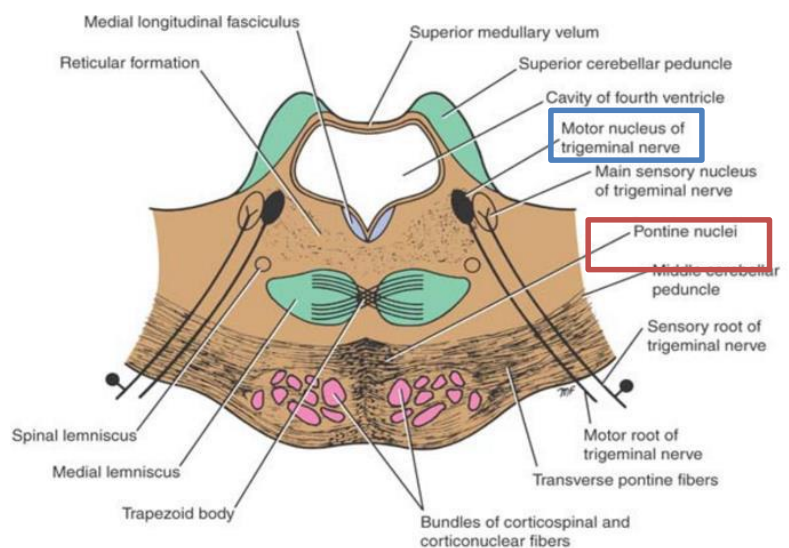
seen on the lateral extremity of the medial lemniscus. The lateral Lemniscus fibers are still crossing.

³ Motor nucleus of trigeminal nerve can be seen.

Lateral to it is the ⁴ main/principle sensory nucleus.

Motor nucleus is the medial.

Notice that the spinal nucleus of trigeminal nerve cannot be seen in this section. It is located inferiorly. The principle nucleus replaces the spinal nucleus of trigeminal.

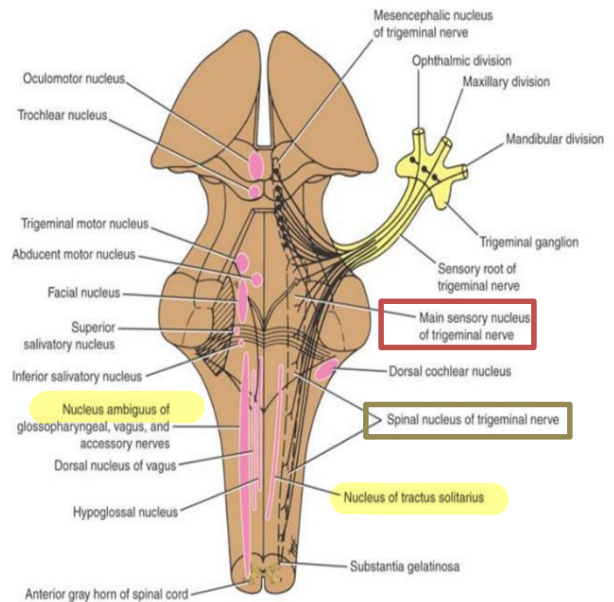


beneath the lateral part of the fourth ventricle within the reticular formation.

The spinal nucleus of trigeminal nerve extends from the lowest part of medulla oblongata all the way to the caudal part of pons (inferior part of pons).

At the level of the cranial part of pons, the spinal nucleus of trigeminal nerve cannot be seen. However, the **principle/main sensory nucleus of trigeminal nerve** can be seen instead.

Remember in the previous lecture we said that the spinal nucleus of the trigeminal nerve is similar in its function to the ALST, which senses pain, temperature, and crude touch. And the main sensory nucleus of trigeminal nerve is like the DCMLT, which senses discriminative touch.



2. The basilar part

Similar to the previous level. No change from previous level.

Trigeminal system: (contains the last lemniscus in the body)

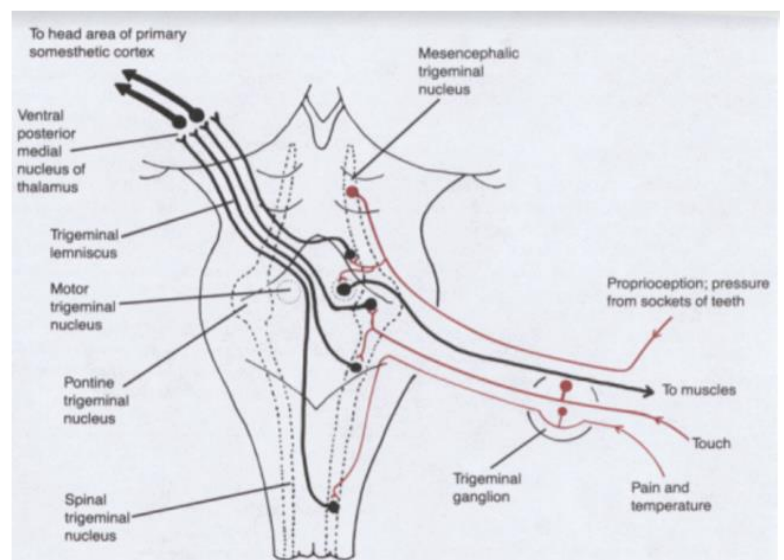
Remember that the trigeminal nerve has its cell body of the 1st order neuron in the **trigeminal ganglia**, which is found in the **cranial cavity on the tip of the petrous portion of the temporal bone.**

The trigeminal system is **sensory** to the **head and neck area**. Whereas the spinal systems (ALST & DCMLT) are sensory to the rest of the body.

Pathway of trigeminal system:

Sensory 1st order neurons of trigeminal nerve have the cell bodies in the **trigeminal ganglia**. The 1st order neurons synapse in the **main/principle nucleus** and the **spinal nucleus of trigeminal nerve**. The 2nd order neurons arising upon the synapsis with the nuclei **cross the midline**. Once these 2nd order neurons cross the midline, they form a lemniscus called the **trigeminal lemniscus**.

There is a third nucleus where sensory 1st order neurons of trigeminal nerve can synapse at known as the **mesencephalic trigeminal nucleus**. However, 2nd order



neurons arising from this nucleus are not involved in the trigeminal lemniscus. This nuclei is mainly responsible for reflexes (e.g. periodontal ligament reflex). The trigeminal lemniscus is moving towards the thalamus, where they will synapse with the **ventropostomedial (VPM) nucleus**. The VPM nucleus is mainly responsible for head and neck sensation and taste.

Notes:

- The nucleus ambiguus is a motor nucleus that give fibers for 3 cranial nerves :glossopharyngeal, vagus and the accessory nerves.
- The solitary nucleus is a sensory nucleus that receive fibers from 3 cranial nerves :facial, vagus and glossy pharyngeal nerves.
- The three nerves associated with taste are the facial nerve (cranial nerve VII), which provides fibers to the anterior two-thirds of the tongue; the glossopharyngeal nerve (cranial nerve IX), which provides fibers to the posterior third of the tongue; and the vagus nerve (cranial nerve X), which provides fibers to the epiglottis region.
- The doctor says something about basilar artery if you are interested please refer to the live lecture [13:15](#)

