



431

CNS System
central Nervous

Block

Physiology Team

Female Side

Male side


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CNS System Nervous central

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Slide No.(1)

THE BRAIN STEM

- The brain stem is the lower part of the brain, adjoining and structurally continuous with the spinal cord.

Team Notes :

Nothing else was mentioned about this slide.

Slide No.(2)

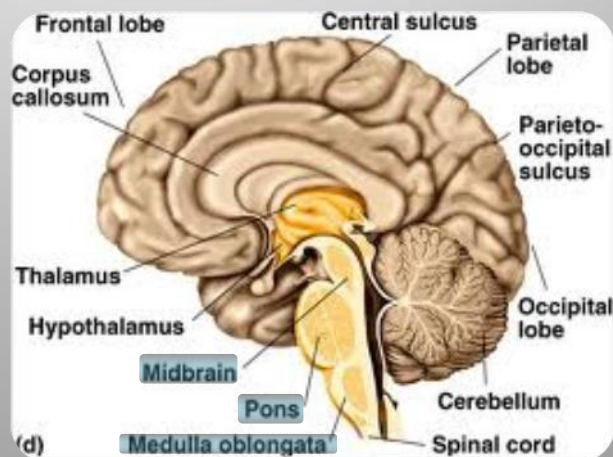
Components of Brain stem

- Mid Brain
- Pons
- Medulla Oblongata

The superior, middle and inferior peduncles connect the cerebellum to the midbrain, pons and medulla respectively.

Team Notes :

As shown here :



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Slide No.(4) (slide 3 is picture we add a clearer picture instead of it in previous page)

Midbrain

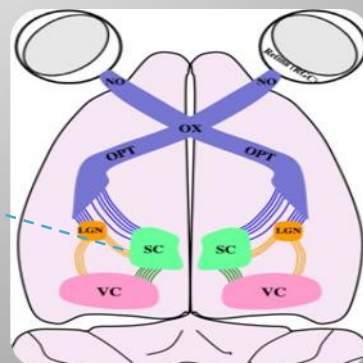
- The midbrain is divided into three parts:
- 1- The tectum ("roof" in Latin). It includes:
 - A- The superior colliculus. It is involved in the special sense of vision and sends its superior brachium to the lateral geniculate body of the thalamus.

Team Notes :

The midbrain are divided into three parts :

1. Tectom
2. Tegmentum
3. Cerebral peduncles

Superior brachium of **superior colliculus (SC)** to the **Lateral Geniculate body (LGN)** of thalamus



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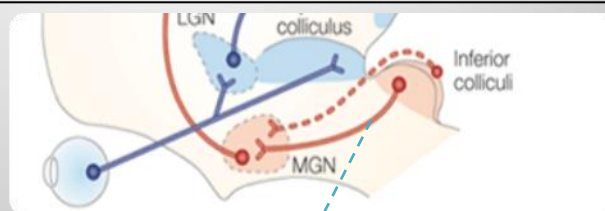
Block

Slide No.(5)

B- The inferior colliculus, is involved in the special sense of hearing & sends its inferior brachium to the medial geniculate body of the thalamus.

The cerebral aqueduct runs through the midbrain, beneath the colliculi.

Team Notes :



Inferior colliculus send an inferior brachium to the Medial Geniculate body. (MGN)

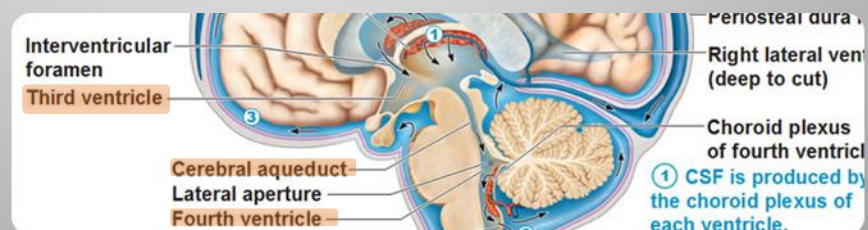
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Slide No.(6)

- 2- The tegmentum, ventral to the cerebral aqueduct. Several **nuclei**, **tracts** and the **reticular formation** is contained here.
- 3- The ventral side is comprised of paired cerebral peduncles. These transmit axons of UMN.

Team Notes :

- UMN= Upper motor neuron
- The **Cerebral Aqueduct** is the narrow conduit between the **third** and the **fourth** ventricles





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Midbrain internal structures

- Periaqueductal gray: Around the cerebral aqueduct, contains neurons involved in the **pain desensitization** pathway.

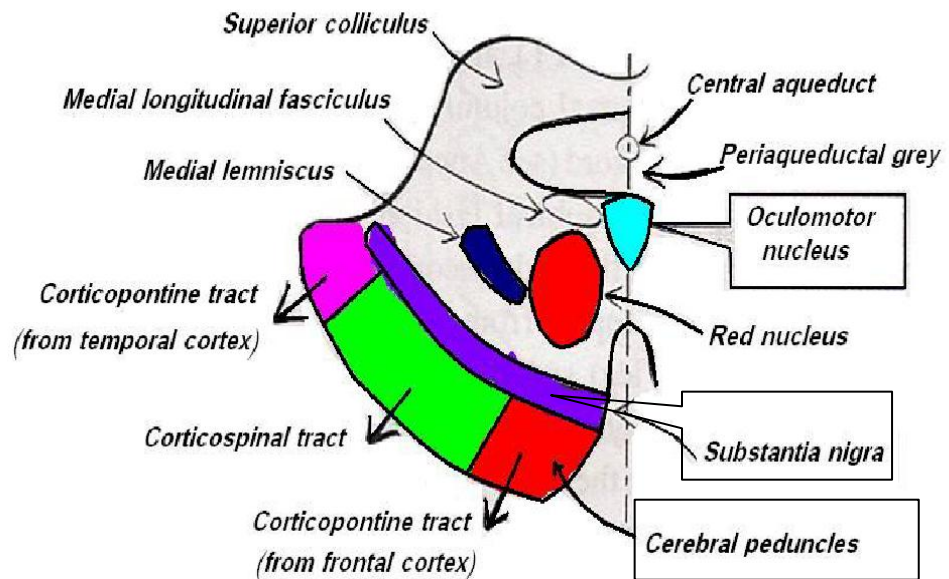
Team Notes :

Pain desensitization:(analgesic) decrease the sensation of pain.

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Slide No.(8)

Cross section of the upper midbrain



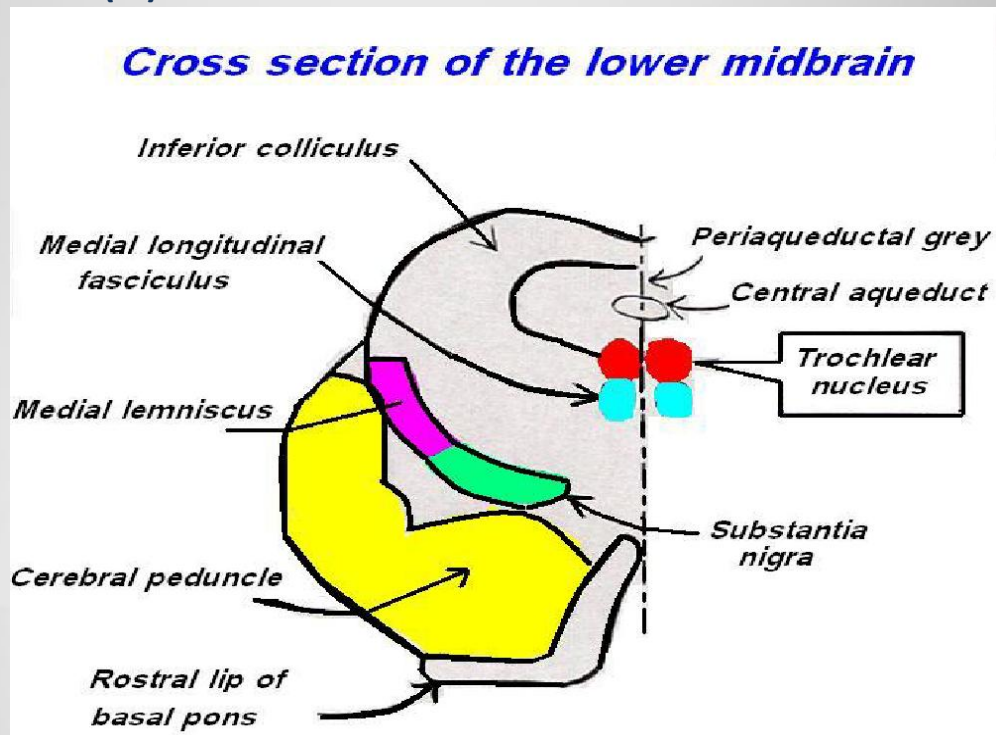
Team Notes :

Red Nucleus: This is a motor nucleus that sends a descending tract to the lower motor neurons .It is not red in color.

Substantia nigra: This is a concentration of neurons in the ventral portion of the midbrain that is involved in motor function

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Slide No(9)



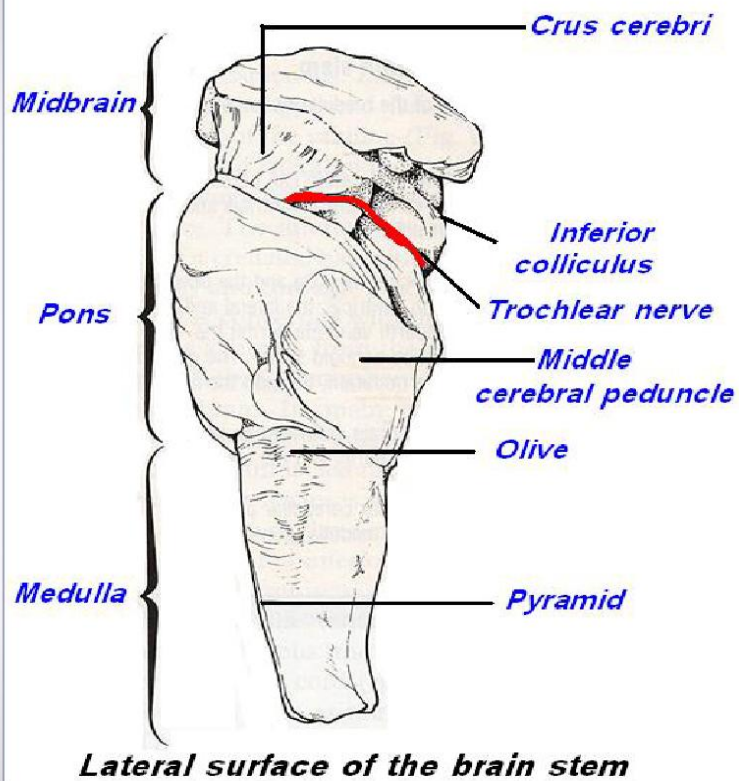
Team Notes :

Nothing else was mentioned about this slide.

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Slide No.(10)



Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(11)

- Occulomotor nerve (CN III) nucleus.
- Trochlear nerve (CN IV) nucleus.
- Red Nucleus: This is a motor nucleus that sends a **descending tract** to the lower motor neurons.

Team Notes :

Nothing else was mentioned about this slide.




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Slide No.(12)

- Substantia nigra: This is a concentration of neurons in the ventral portion of the midbrain that is involved in motor function.
- Central tegmental tract: Directly anterior to the floor of the 4th ventricle, this is a pathway by which many tracts project up to the cortex and down to the spinal cord.

Team Notes :

substantia nigra is very rich in dopamine, and this richness of dopamine control the body movement.



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Slide No.(13)

Reticular formation: A large area that is involved in various important functions of the midbrain:

- ❖ It contains **LMN**
- ❖ It is involved in the **pain desensitization** pathway
- ❖ It is involved in the **arousal** and **consciousness** systems
- ❖ It contains the **locus ceruleus**, which is involved in intensive alertness modulation and in autonomic reflexes.

Team Notes :

The Reticular formation is most influential component of The reticular activating system (RAS)that is responsible for regulating arousal and sleep-wake transitions.


LMN = Lower Motor neurons

Reticular Formation also contains **centers** for **cardiovascular** and **respiratory systems**.

Reticular formation has 2 pathway

Asending Reticular formation: going to cortex keep you alert

Desending Reticular formation it will control the tone , body position and control balance



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Slide No.(14)

Ventral view of the pons

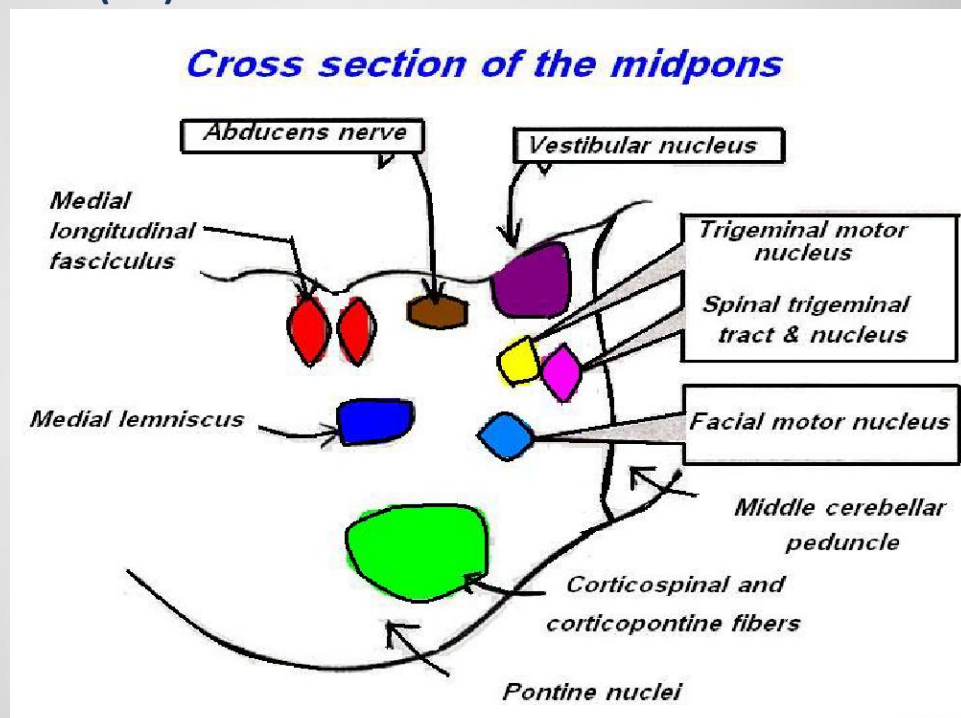
- Between the basal pons, cranial nerve 6 (abducens), 7 (facial) and 8 (vestibulocochlear) emerge (medial to lateral).
- At the level of the midpons, the large trigeminal nerve, CN V, emerges.

Team Notes :

if there is damage to the pons , cranial nerve, abducent 6th and facial 7th will be lost

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Slide No.(15)



Team Notes :

At the level of the midpons, the large trigeminal nerve, CN V, emerges.



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Slide No.(16)

Ventral view of the medulla

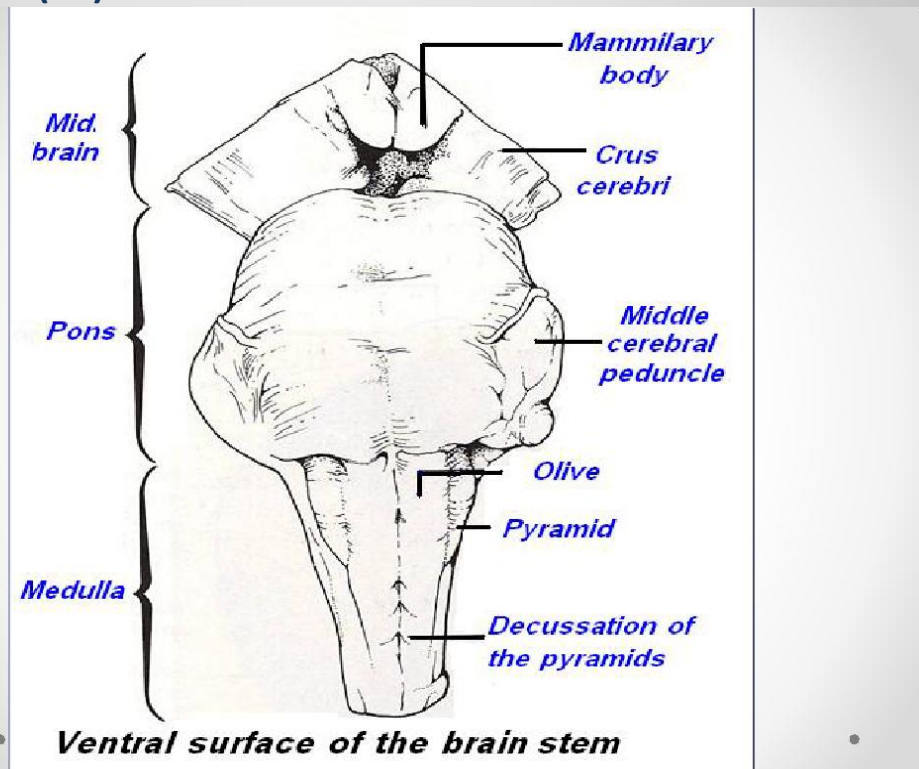
- The most medial part of the medulla is the anterior median fissure. Moving laterally on each side are the pyramids. The pyramids contain the fibers of the corticospinal (pyramidal) tract as they head inferiorly to synapse on lower motor neuronal cell bodies within the ventral horn of the spinal cord.
The anterolateral sulcus is lateral to the pyramids.

Team Notes :

Nothing else was mentioned about this slide.


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Slide No.(17)



Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(18)

- Emerging from the anterolateral sulci are the [hypoglossal nerve](#) (CN XII) rootlets. Lateral to these rootlets and the anterolateral sulci are the [olives](#). The olives are swellings in the medulla containing underlying inferior olivary nuclei (containing various nuclei and afferent fibers). Lateral (and dorsal) to the olives are the rootlets for [cranial nerves](#) IX and X ([glossopharyngeal](#) and [vagus](#), respectively).

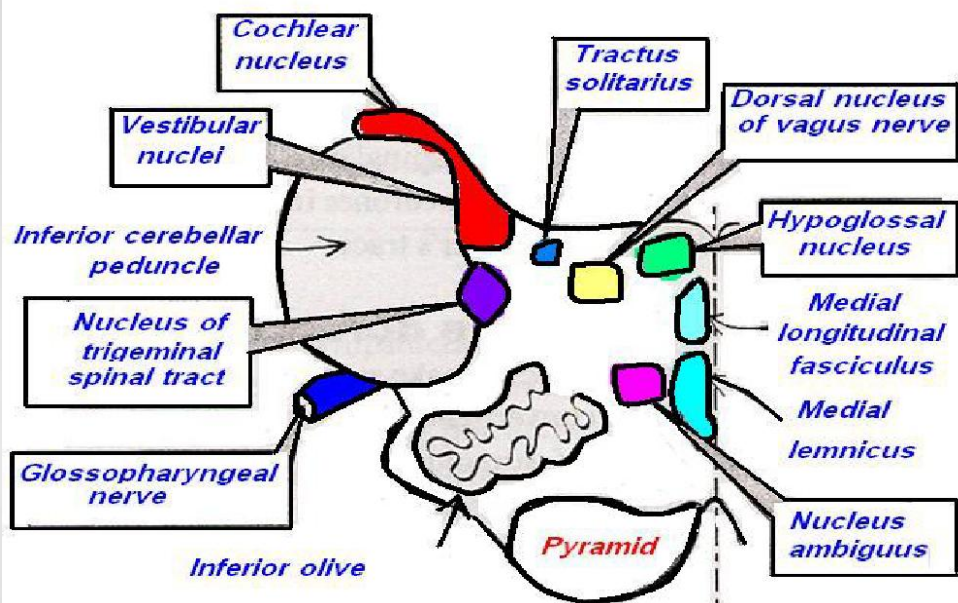
Team Notes :

Nothing else was mentioned about this slide.

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Slide No.(19)

Cross section of the upper medulla



Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(20)

Dorsal view of the medulla

- The most medial part of the medulla is the posterior median fissure. Moving laterally on each side is the fasciculus gracilis, and lateral to that is the fasciculus cuneatus. Superior to each of these, are the gracile and cuneate tubercles, respectively. Underlying these are their respective nuclei.

Team Notes :

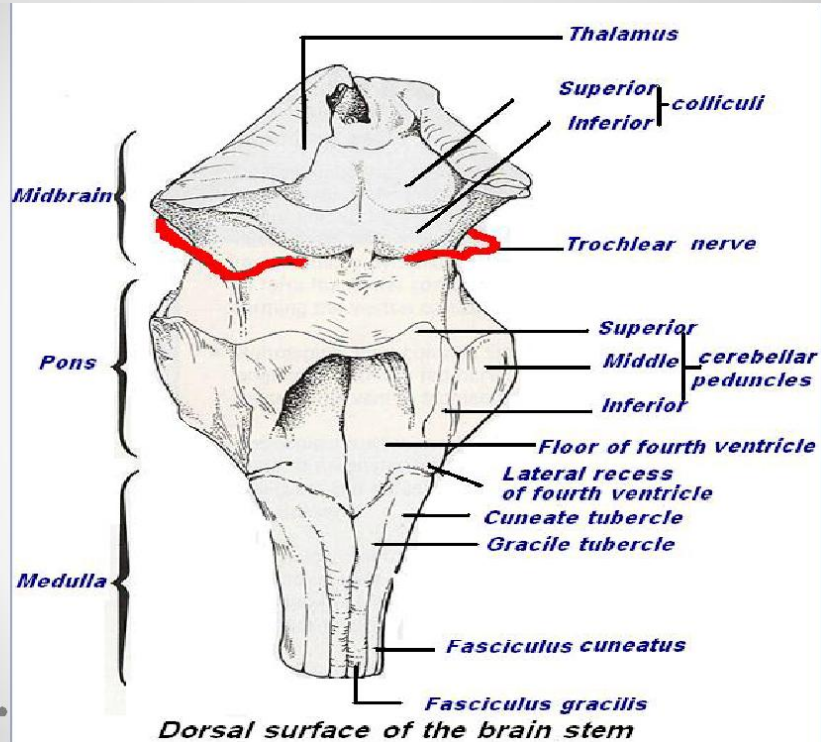
fasciculus gracilis and fasciculus cuneatus are part of the dorsal column (Ascending white matter of the spinal cord).

The **Fasciculus Gracilis** provides proprioception and fine sensations of the lower limbs and trunk (Sacral, Lumbar and lower thoracic level) to the brain stem.

and **Fasciculus Cuneatus** provides proprioception and fine sensations of the Upper limbs (upper thoracic and cervical level)


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Slide No.(21)



Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(22)

- In the midline is the [vagal trigone](#) and superior to that is the [hypoglossal trigone](#). Underlying each of these are motor nuclei for the respective cranial nerves.

Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(23)


Functions of the brain stem

Though small, brain stem is an extremely important part of the brain:

1. Conduct functions.
2. Provides the origin of the cranial nerves (CN III-XII).
3. Conjugate eye movement.
4. Integrative functions.

Team Notes :

If brain stem does not work, it is called Brain death.



CNS System central Nervous Block

Slide No.(24)


Functions of the brain stem

1. Conduct functions.

All information related from the body to the cerebrum and cerebellum and vice versa, must traverse the brain stem.

Team Notes :

Vice versa: the reverse of the previous statement



CNS System central Nervous Block


Slide No.(25)

A- The ascending sensory pathways coming from the body to the brain include

- * The spinothalamic tract for pain and temperature sensation.
- * The dorsal column, fasciculus gracilis, and cuneatus for touch, proprioceptive and pressure sensation.

Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(26)

B- Descending tracts are


* **The corticospinal tract (UMN)**

runs through the crus cerebri, the basal part of the pons and the medullary pyramids; 70-90 % of fibers cross in the pyramidal decussation to form the lateral corticospinal tract, destined to synapse on lower motor neurons in the ventral horn of the spinal cord.

Team Notes :

Crus cerebri: the cerebral peduncle which contains the motor tracts, the plural of which is cerebral crura.

The function of corticospinal tract (pyramidal tract) in mid brain control the other side of the body. So, right corticospinal tract control the left side of the body and vice versa.




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Slide No.(27)

* Upper motor neurons that originate in the brain stem's vestibular, red, and reticular nuclei, which also descend and synapse in the spinal cord.

Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(28)

- 2. The brain stem provides the main motor and sensory innervation to the face and neck via the [cranial nerves](#) (CN III-XII). The fibers of cranial nerve nuclei except for [olfactory & optic nerve](#) either originating from, or terminating in, the cranial nerve nuclei in brain stem.

Team Notes :

Nothing else was mentioned about this slide.



CNS System central Nervous Block

Slide No.(29)

Origin & functions of the cranial nerves

* From midbrain

CN III (oculomotor)


CN IV (trochlear)

Both moves eyes; CN III constricts the pupils, accommodates.

Team Notes :

(Additional)

Accommodation reflex is a reflex action of the eye, in response to focusing on a near object.



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Slide No.(30)

* From pons

- CN V (trigeminal): Chews and feels front of the head.
- CN VI (abducens): Moves eyes.
- CN VII (facial): Moves the face, tastes, salivates, cries.
- CN VIII (acoustic): Hears, regulates balance.


Team Notes :

Trigeminal nerve:

receives sensation from face and innervates the muscles of mastication(the muscles are responsible for adduction and lateral motion of the jaw)

Facial:

provides motor innervations to the muscles of facial expression and receive the special sense of taste from the anterior 2/3 of the tongue



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Slide No.(31)

* From medulla

CN IX (glossopharyngeal): Tastes, salivates, swallows, monitors carotid body and sinus.

CN X (vagus): Tastes, swallows, lifts palate, talks, communication to and from thoraco-abdominal viscera.

CN XI (accessory): Turns head, lifts shoulder.

CN XII (hypoglossal): Moves tongue.

Team Notes :

Glossopharyngeal nerve:

receives taste from the posterior 1/3 of the tongue and provides secretomotor innervations to parotid gland and provides motor innervations to the stylopharyngeus muscle(muscle that facilitating swallowing) .

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Slide No.(32)

- Sensory

CN I, CN II, CN VIII

- Motor

CN III, CN IV, CN VI, CN XI,
CN XII

- Mixed

CN V, CN VII, CN IX, CN X

Team Notes :

To help:

CRANIAL NERVES

- 12 pairs
- 4 pairs are mixed
 - trigeminal n. (5th)
 - facial n. (7th)
 - glossopharyngeal n. (9th)
 - vagus n. (10th)
- 5 pairs are motor:
 - oculomotor n. (3rd)
 - trochlear n. (4th)
 - abducent n. (6th)
 - accessory n. (11th)
 - hypoglossal n. (12th)
- 3 pairs are sensory:
 - olfactory n. (1st)
 - optic n. (2nd)
 - vestibulocochlear n. (8th)

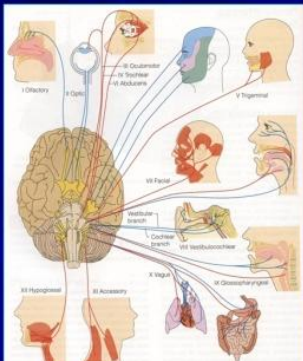
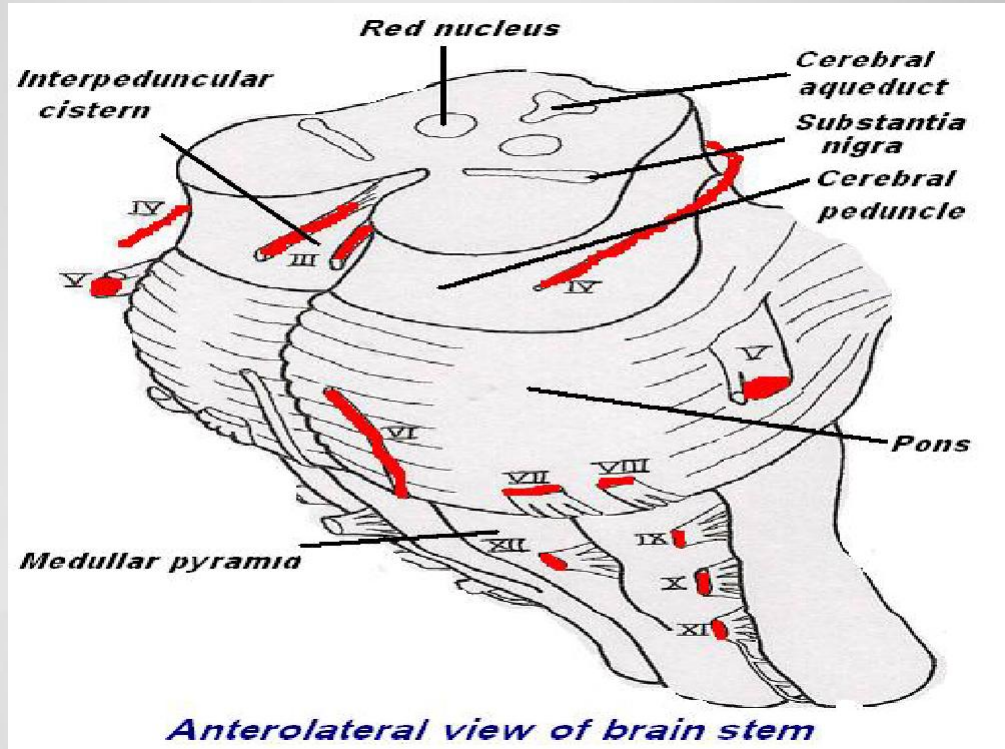


Figure 27. Distribution of cranial nerves. Sensory nerves are yellow in color, motor nerves in red, although cranial nerves III, IV, and VI have sensory fibers, and are not shown. Cranial nerves I, II, and VIII are shown in blue. These are the three pairs of cranial nerves that are purely sensory.

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Slide No.(33)



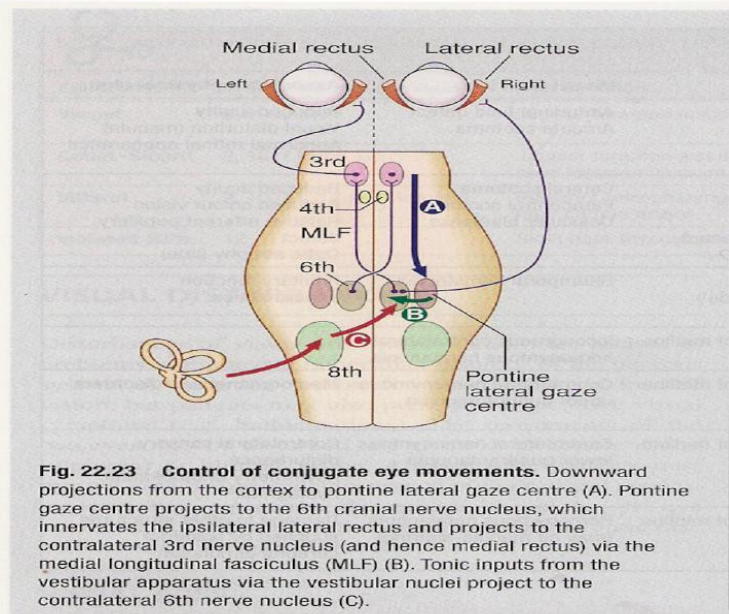
Team Notes :

Nothing else was mentioned about this slide.

CNS System central Nervous Block

Slide No.(34)

3. Conjugate eye movement.



Team Notes :

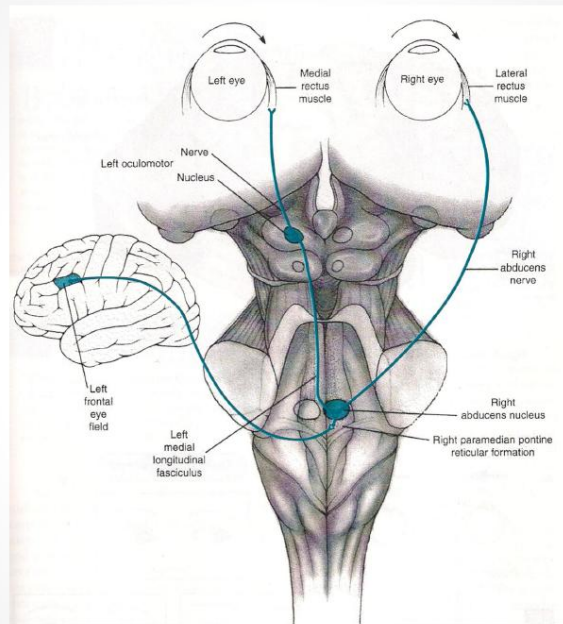
Conjugate eye movement are those that preserve the angular relationship between the right and left eyes.

For example, when you move both eyes left and then right, a conjugate movement is made. Up and down movements and combinations of vertical and lateral movements.



CNS System central Nervous Block

Slide No.(35)



Team Notes :

all the three cranial nerve oculomotor(3rd), trochlear (4th), abducens(6th) are involved in motor movement for eyes

Oculomotor (3rd), supply all the muscle of eyeball except lateral rectus and superior oblique


Lateral rectus supplied by abducens (6th) cranial nerve

Superior oblique supplied by the trochlear (4th) cranial nerve

if there is any weakness or paralysis of any eyeball muscle ,the patient will see 2 images(diplopia)

pupil has 2 fibers: circular fiber and radial fiber

dilated pupil is caused by a radial fiber, so if a radial fiber contract the size of pupil will increase (sympathetic stimulation)



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Slide No.(36)


4. The brain stem has integrative functions:-

- * It controls consciousness & sleep cycle (alertness and arousal) through reticular formation.
- * It has got center for cardiovascular, respiratory & autonomic nervous system.
- * It has centers for cough, gag, swallow, and vomit.
- * Sense of body balance (Vestibular functions)

Team Notes :

The pharyngeal reflex or gag :

is a reflex contraction of the back of the throat, evoked by touching the roof of your mouth



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Slide No.(37)

- **Substantia** which is a part of the basal ganglia is present in midbrain and is involved in control of movement.
- Midbrain also contain **red nucleus** which regulate the motor activity through cerebellum.

Team Notes :

There are 2 neurotransmitters: acetylcholine and dopamine. They are in equal amount and essential for any smooth movement

Supposing the dopamine is less: acetylcholine will be high which lead to movement disorder (Parkinson disease)



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Slide No.(38)

- Inferior and superior colliculi are situated on the dorsal surface of the midbrain and is involved in auditory & visual processing required for head movements.
- Pain sensitivity control:
Periaqueductal grey matter of mesencephalon is an area which is rich in endogenous opioid and is important in modulation of painful stimuli.

Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(39)

- Ventral layer of brainstem is **motor** in function.
- Middle layer is **sensory** in function & contains medial lemniscus which conveys sensory information from dorsal column.

Team notes

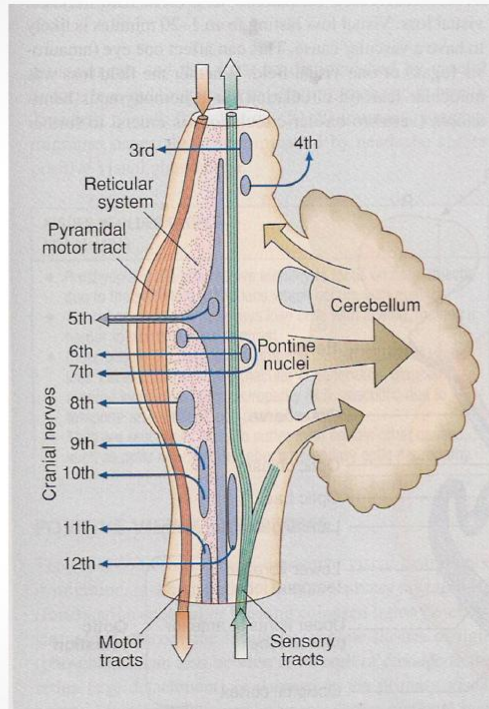
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Team notes

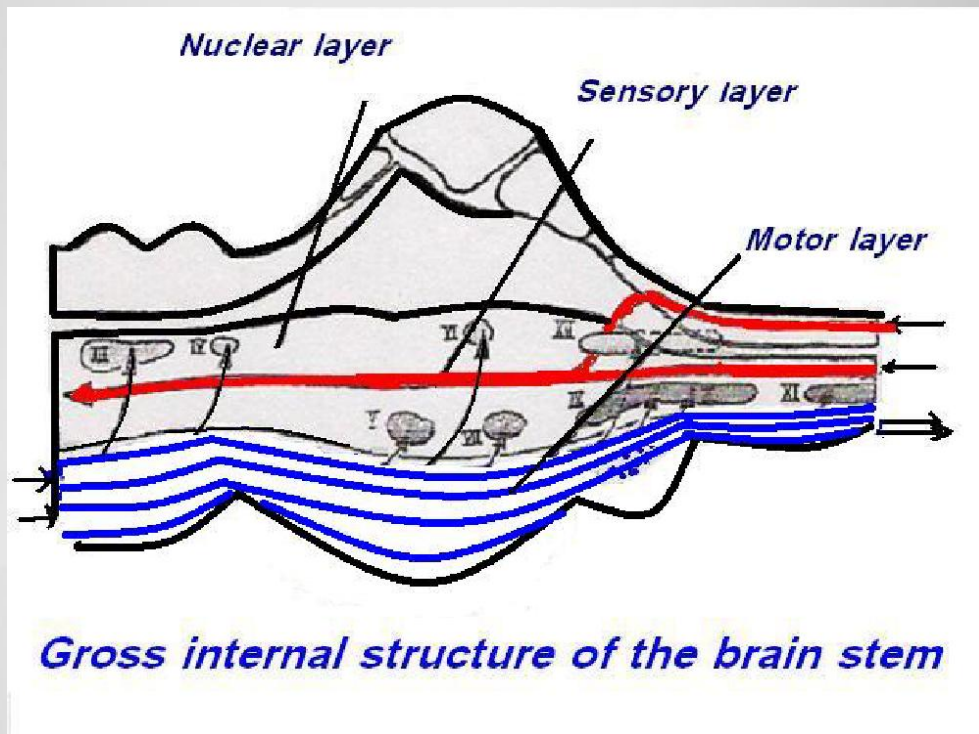
Nothing else was mentioned about this slide.

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Slide No.(41)



Team notes

Nothing else was mentioned about this slide.

Slide No.(42)

Brain Stem Function Tests

- To test reticular formation
 - ❖ Alertness, Consciousness & Sleep.
- Corticospinal tract
 - ❖ Motor power, reflexes
- Pain response
 - ❖ Facial grimacing on firm pressure over the supra orbital ridge.
- To test respiratory center
 - ❖ look for the normal pattern of respiration

Team notes:

Nothing else was mentioned about this slide.

Slide No.(43)

Brain Stem Function Tests

- To test cardiovascular center : Look for normal circulatory function
- To test brainstem reflexes:
 - Pupillary and corneal reflexes.
 - Vestibulo-ocular reflex: Injection of iced water into the ear will produce eyes movement.
 - Oculo-cephalic reflex: Eyes will be fixed when head is moved in one or another directions.
 - Gag reflex. Cough reflex

Team notes:

(Additional)

The pharyngeal reflex or gag :

is a reflex contraction of the back of the throat, evoked by touching the roof of your mouth

The corneal reflex, also known as the blink reflex:

is an involuntary blinking of the eyelids elicited by stimulation of the cornea (such as by touching or by a foreign body), or bright light