Learning Objectives

- At the end of the lecture, students should be able to:
- Describe the detailed Anatomy of medulla oblongata
- Define its location
- Describe the External features
- Describe the Internal structure at four different levels (sections)
- Know the Applied anatomy of medulla oblongata

MEDULLA OBLONGATA OVERVIEW

- The **brainstem** is the lower extension of the brain anterior to the cerebellum.
- It serves as a pathway for information to be relayed between the brain and spinal cord
- Composed of three structures including
  - **midbrain**
  - **pons**
  - **medulla oblongata**

Figure AB-25: Brainstem
MEDULLA OBLONGATA

- The lowest part of the brain stem
- It is the direct and expanded upward continuation of spinal cord
- Includes important fiber tracts
- Contains important control centers
  - Heart rate control
  - Blood pressure regulation
  - Breathing
  - Swallowing
  - Vomiting

MEDULLA OBLONGATA LOCATION

- By anatomical terms of location it is rostral to the spinal cord
- The medulla oblongata extends from the lower margin of the pons to a plane passing transversely below the pyramidal decussation and above the first pair of cervical nerves
- This plane corresponds with the upper border of the atlas behind, and the middle of the odontoid process of the axis in front
- At this level the medulla oblongata is continuous with the medulla spinalis.
MEDULLA OBLONGATA
ANATOMY

The medulla is often thought of as being in two parts: open and closed
✓ an open part or superior part where the dorsal surface of the medulla is formed by the fourth ventricle.
✓ a closed part or inferior part where the central canal lies within the medulla.

MARKINGS ON SURFACES OF MEDULLA OBLONGATA
- Anterior Median Fissure/Sulcus - Central fissure on anterior surface
- Antero-lateral fissure/Sulcus on anterior surface
- Posterior median fissure/Sulcus on posterior surface
- Postero-lateral fissure/Sulcus on posterior surface
- Gracile & Cuneate Tubercle on posterior surface
- Inferior Cerebellar peduncles on anterior surface

BETWEEN THE ANTERIOR MEDIAN SULCUS AND THE ANTEROLATERAL SULCUS
- The region between the anterior median sulcus (label 1) and the anterolateral sulcus is occupied by an elevation on either side known as the PYRAMID OF MEDULLA OBLONGATA (label 3)
- This elevation is caused by corticospinal tract
- In the lower part of the medulla some of these fibers cross each other thus obliterating the anterior median fissure. This is known as the Decussation Of The Pyramids
- Some other fibers that originate from the anterior median fissure above the decussation of the pyramids and run laterally across the surface of the pons are known as the external arcuate fibers.
ANTEROINFERIOR VIEW OF THE MEDULLA OBLONGATA AND PONS
BETWEEN THE ANTEROLATERAL AND POSTEROLATERAL SULCI

- The region between the anterolateral and posterolateral sulci in the upper part of the medulla is marked by a swelling known as the **Olivary body (label 2)**
- It is caused by a large mass of gray matter known as the **INFERIOR OLIVARY NUCLEUS**
BETWEEN THE POSTERIOR MEDIAN SULCUS AND THE POSTEROLATERAL SULCUS

- The posterior part of the medulla between the posterior median sulcus and the posterolateral sulcus contains tracts that enter it from the posterior funiculus of the spinal cord.
- These are the **fasciculus gracilis**, lying medially next to the midline, and the **fasciculus cuneatus**, lying laterally.
- These fasciculi end in rounded elevations known as the gracile and the cuneate tubercles. They are caused by masses of gray matter known as the **nucleus gracilis** and the **nucleus cuneatus**.
- Just above the tubercles, the posterior aspect of the medulla is occupied by a triangular fossa, which forms the lower part of the floor of the **fourth ventricle**.
- The fossa is bounded on either side by **the inferior cerebellar peduncle**, which connects the medulla to the **cerebellum**.
DECUSSION OF PYRAMIDS

DECUSSION OF MEDIAL LEMNISCI
MEDULLA OBLONGATA: LOWER PART

- The lower part of the medulla, immediately lateral to the fasciculus cuneatus, is marked by another longitudinal elevation known as **tuberculum cinereum**.
- It is caused by an underlying collection of gray matter known as the **spinal nucleus of the trigeminal nerve (Label 4)**.
- The gray matter of this nucleus is covered by a layer of nerve fibers that form the spinal tract of the **trigeminal nerve**.

1. Mesencephalic nucleus
2. Sensory nucleus
3. Motor nucleus
4. Spinal nucleus
The base of the medulla is defined by the commissural fibers; crossing over from the ipsilateral side in the spinal cord to the contralateral side in the brain stem.

Below this is the spinal cord.
### Comparison of the Different Levels of the Medulla Oblongata, Showing the Major Structures at Each Level

<table>
<thead>
<tr>
<th>Level</th>
<th>Cavity</th>
<th>Nuclei</th>
<th>Motor tracts</th>
<th>Sensory tracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decussation of pyramids</td>
<td>Central canal</td>
<td>Nucleus gracilis, nucleus cuneatus, spinal nucleus of cranial nerve V, accessory nucleus</td>
<td>Decussation of Corticospinal tracts, pyramids</td>
<td>Spinal tract of cranial nerve V, posterior spinocerebellar tract, lateral spinothalamic tract, anterior spinocerebellar tract</td>
</tr>
<tr>
<td>Decussation of medial lemnisci</td>
<td>Central canal</td>
<td>Nucleus gracilis, nucleus cuneatus, spinal nucleus of cranial nerve V, accessory nucleus, hypoglossal nucleus</td>
<td>Pyramids</td>
<td>Decussation of medial lemnisci, fasciculus gracilis, fasciculus cuneatus, spinal tract of cranial nerve V, posterior spinocerebellar tract, lateral spinothalamic tract, anterior spinocerebellar tract</td>
</tr>
<tr>
<td>Olives, inferior cerebellar peduncles</td>
<td>Fourth ventricle</td>
<td>Inferior olivary nucleus, spinal nucleus of cranial nerve V, vestibular nucleus, glossopharyngeal, vagal, hypoglossal nucleus, nucleus ambiguous, nucleus of tractus solitarius</td>
<td>Pyramids</td>
<td>Medial longitudinal fasciculus, tectospinal tract, medial lemniscus, spinal tract of cranial nerve V, lateral spinothalamic tract, anterior spinocerebellar tract</td>
</tr>
<tr>
<td>Pons just inferior to</td>
<td>Fourth ventricle</td>
<td>Lateral vestibular nucleus, cochlear nuclei</td>
<td>Same</td>
<td>Same</td>
</tr>
</tbody>
</table>
FUNCTIONS

The medulla oblongata controls autonomic functions, and relays nerve signals between the brain and spinal cord. It is also responsible for controlling several major autonomic functions of the body like:

- Respiration Via Dorsal Respiratory Group And Ventral Respiratory Group
- Blood Pressure
- Heart Rate
- Reflex Arcs
- Vomiting
- Defecation
- Swallowing
- Ability To React
- Reflexes

BLOOD SUPPLY

Blood to the medulla is supplied by a number of arteries.

- **Anterior spinal artery:**
  The anterior spinal artery supplies the whole medial part of the medulla oblongata. A blockage (such as in a stroke) will injure the pyramidal tract, medial lemniscus, and the hypoglossal nucleus. This causes a syndrome called Medial Medullary Syndrome.
- **Posterior inferior cerebellar artery (PICA):**
The posterior inferior cerebellar artery is a major branch of the vertebral artery, supplies the posterolateral part of the medulla, where the main sensory tracts run and synapse.

- **Direct branches of the vertebral artery:**
The vertebral artery supplies an area between the other two main arteries, including the nucleus solitarius and other sensory nuclei and fibers. *Lateral Medullary Syndrome* can be caused by occlusion of either the PICA or the vertebral arteries.
The PICA syndrome is also known as "lateral medullary syndrome", or "Wallenberg's syndrome", after Wallenberg's description. The most commonly affected artery is the vertebral artery, followed by the PICA, superior middle and inferior medullary arteries. Sensory deficits affecting the trunk and extremities on the opposite side of the infarction and sensory deficits affecting the face and cranial nerves on the same side. The spinothalamic tract is damaged, resulting in loss of pain and temperature sensation to the opposite side of the body. The damage to the cerebellum or the inferior cerebellar peduncle can cause ataxia. Other clinical symptoms and findings are swallowing difficulties (dysphagia) slurred speech, facial pain, vertigo, nystagmus, Horner syndrome, diplopia, and possibly palatal myoclonus. Prognosis is generally quite good with full or near full recovery expected at 6 months.
MEDIAL MEDULLARY SYNDROME

MEDIAL MEDULLARY INFARCTION (SYNDROME OF DEJERINE)

- Results from occlusion of the *vertebral artery or of a branch* of the vertebral or lower basilar artery. This results in the infarction of the medial part of the medulla oblongata.
- Small vessel disease (diabetes, hypertension, hypercholesterolemia) is the usual cause.
- The infarction leads to death of the *ipsilateral medullary pyramid, the ipsilateral medial leminiscus, and hypoglossal nerve fibers* that pass through the medulla.
- *Contralateral hemiparesis* sparing the face,
- *Hemisensory loss of the posterior column type (contralateral)*
- Deviation of the tongue. *Weakness of the tongue is ipsilateral* to the infarct