



# Brainstem Glioma

CNS Block  
Case 1 (PBL)



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# + Learning Issues:

- Anatomy and physiology of the brainstem.
- Anatomy and physiology of the cranial nerves (5<sup>th</sup>, 7<sup>th</sup>, 9<sup>th</sup>, and 10<sup>th</sup>).
- Anatomical structure responsible for the production of voice.
- What are the mechanisms responsible for initiating swallowing (in the oropharynx) and mechanisms responsible for taste sensation?
- What are the differences between cranial nerves and peripheral nerves?
- Anatomy and physiology of the motor system.
- The modalities of sensory sensations (pain & temperature) in regard to anatomical pathways and function?
- Pathology of brain tumors.
- Impact of serious diseases on patients and their families.

# ■ NEW TERMS



## What is the medical terminology of:

<b>Taste sensation</b>	The sense for the appreciation of the flavor of substances in the mouth. The taste buds are stimulated when the food dissolves in the saliva. Generally there are four basic taste sensation: sweet, bitter, sour and salt. Others are: alkaline and metallic.
<b>Swallowing</b>	The process by which food is transferred from mouth to the pharynx. The process stimulates reflex action in which the larynx is closed by the epiglottis and the nasal passages by the soft palate.
<b>Tingling sensation</b>	To feel a stinging or prickling sensation
<b>Numbness</b>	Unable to feel anything in a particular part of your body because of cold, injury, etc.
<b>Drooping</b>	To become depressed or weakened .
<b>Unsteady Gait</b>	Walking abnormalities are unusual and uncontrollable walking patterns that are usually due to diseases or injuries to the legs, feet, brain, spinal cord, or inner ear.
<b>Double Vision (diplopia)</b>	A disorder of vision in which a single object appears double (two).

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# The Case (Scenario)

## Trigger



Key Information	Presenting Problems
<ol style="list-style-type: none"><li>1. Ahmed Saleh (male).</li><li>2. 28 –year- old.</li><li>3. Construction engineer.</li></ol>	<ol style="list-style-type: none"><li>1. Loss of taste sensation over the last few (3-4) months.</li><li>2. He has changes in his voice which has been for some time.</li><li>3. Difficulty in swallowing large pieces of food over the last 3 weeks; he has choked 3 times.</li></ol>

## + History:

- Tingling sensations of the right side of the face.
- Right sided face drooping.
- Numbness of the left arm.
- Unsteady gait.
- He has NO double vision, headache, or changes in his hearing.



## + History (cont.):

### ■ Past Medical History:

1. He has always been healthy & well.
2. He has never been admitted to hospital.

### ■ Family History:

1. He has no history of any medical problems in his family.
2. His parents are alive & healthy.
3. He has 2 elder brothers & both are healthy.

### ■ Tobacco & Alcohol / Medication & Allergy: Nil.

### ■ Social History:

1. Ahmed has been married for 2 yrs & has a 9-month-old girl.
2. He works as an engineer in an international construction company in Riyadh.
3. He's planning to travel to Canada to study a Master in Engineering at the end of the year.



## + Clinical Examination

- He looks a little anxious.
- **Vital signs** (blood pressure, pulse rate, temperature, & respiratory rate):

Normal.

- **Abdominal Examination:**

Normal.

- **Cardiovascular & Respiratory Examinations:**

Normal.



## CNS Examination:

### A) Cranial Nerves:

<ul style="list-style-type: none"><li>• 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 11<sup>th</sup>, &amp; 12<sup>th</sup>.</li><li>• All cranial nerves on the left side.</li></ul>	Normal.
<ul style="list-style-type: none"><li>• 5<sup>th</sup></li></ul>	<ul style="list-style-type: none"><li>✓ Loss of corneal sensation on the right side.</li><li>✓ Loss of pain &amp; temperature sensations on the right side of the face.</li></ul>
<ul style="list-style-type: none"><li>• 7<sup>th</sup></li></ul>	<ul style="list-style-type: none"><li>✓ Weakness on the lower right part of the face.</li></ul>
<ul style="list-style-type: none"><li>• 9<sup>th</sup> and 10<sup>th</sup></li></ul>	<ul style="list-style-type: none"><li>✓ Right palatal movement is poor.</li><li>✓ Loss of sensation of the soft palate on the right side.</li></ul>

### B) Motor Power:

<ul style="list-style-type: none"><li>• Gait.</li></ul>	<ul style="list-style-type: none"><li>✓ Unsteady.</li></ul>
<ul style="list-style-type: none"><li>• Upper &amp; lower limb muscle tone.</li></ul>	<ul style="list-style-type: none"><li>✓ INcrease on the left.</li></ul>
<ul style="list-style-type: none"><li>• Knee &amp; ankle reflexes.</li><li>• Extensor planter reflex.</li></ul>	<ul style="list-style-type: none"><li>✓ Exaggerated on the left (knee &amp; ankle).</li><li>✓ Exaggerated on the left.</li></ul>
<ul style="list-style-type: none"><li>• Biceps, triceps, &amp; brachioradialis reflexes.</li></ul>	<ul style="list-style-type: none"><li>✓ Exaggerated on the left.</li></ul>

### C) Sensory System:

<ul style="list-style-type: none"><li>• Pain &amp; temperature sensations</li></ul>	<ul style="list-style-type: none"><li>✓ Loss on the entire left side of the body.</li></ul>
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## + Investigation

### ■ Brain MRI scan:

Report: MRI scan showing a mass occupying the brainstem, most likely a brainstem glioma.

## Progress:

- The mass is gradually growing causing the symptoms due to pressure on surrounding structures.
- Ahmed & his family were stressed after knowing the nature of the illness.
- The surgery of removing the tumor is difficult due to the location of the mass.
- Focal radiotherapy could help in reducing the tumor mass hence the pressure on the surrounding brain structures.

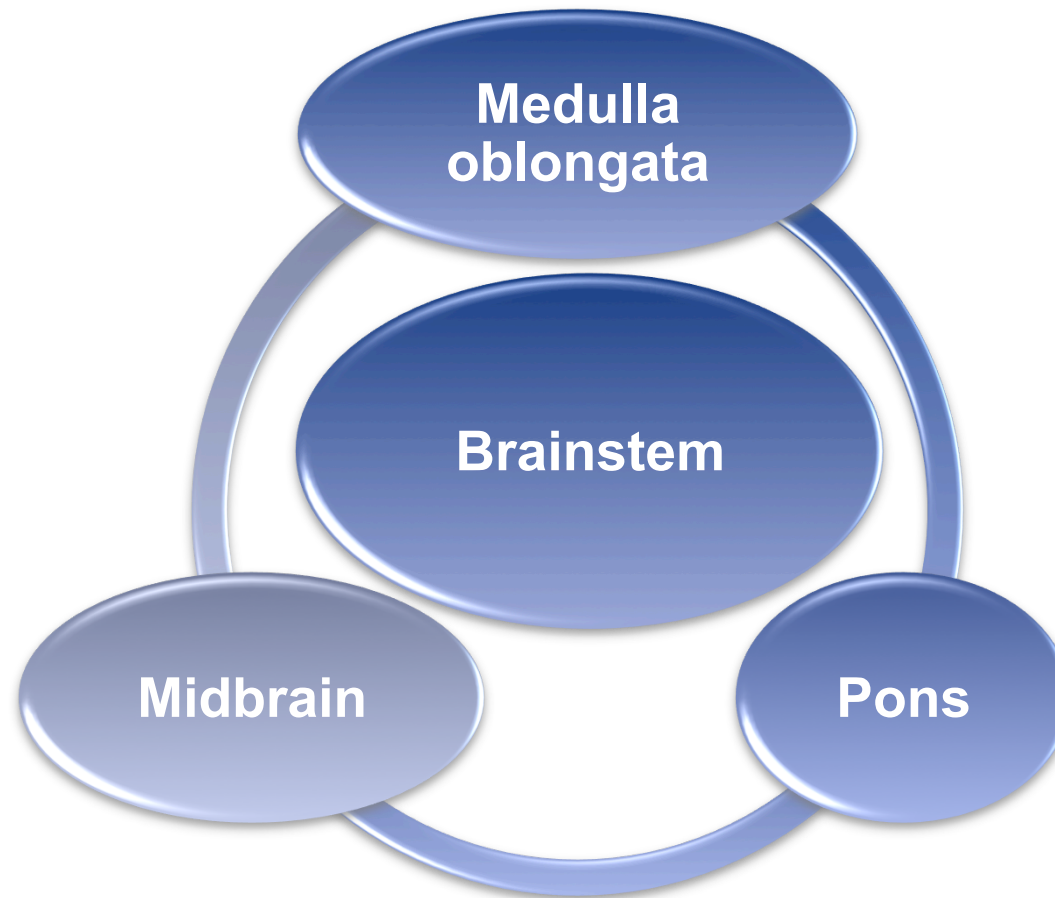


## + Management:

- Over the next 2 weeks Ahmed has **focal radiotherapy & further management.**
- He recovered from the treatment procedure & was discharged 2 weeks later on **corticosteroids** (which help in reducing the local edema around the tumor mass).
- His family **supported** him a lot & he was **regularly seen by his treating doctor.**
- He didn't live longer, he died 14 months later.

End of the case

## + Anatomy of Brainstem



FOR MORE DETAILS:

<http://www.youtube.com/watch?v=F-epmByelmE>

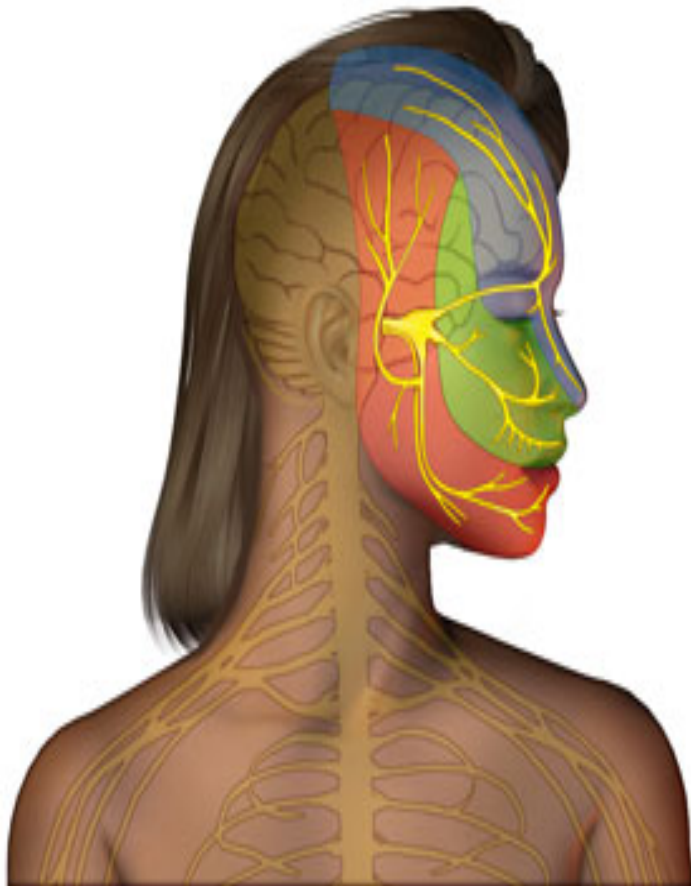
# + Function of Brainstem



1. Pathway of tracts between cerebral cortex & spinal cord.
2. Site of origin of nuclei of cranial nerves (from 3rd to 12th).
3. Site of emergence of cranial nerves (from 3rd to 12th).
4. Contains groups of nuclei & related fibers known as reticular formation responsible for: control of level of consciousness, perception of pain, regulation of cardiovascular & respiratory systems.

# + V, VII, IX, and X Cranial Nerves

## Trigeminal Nerve (V)

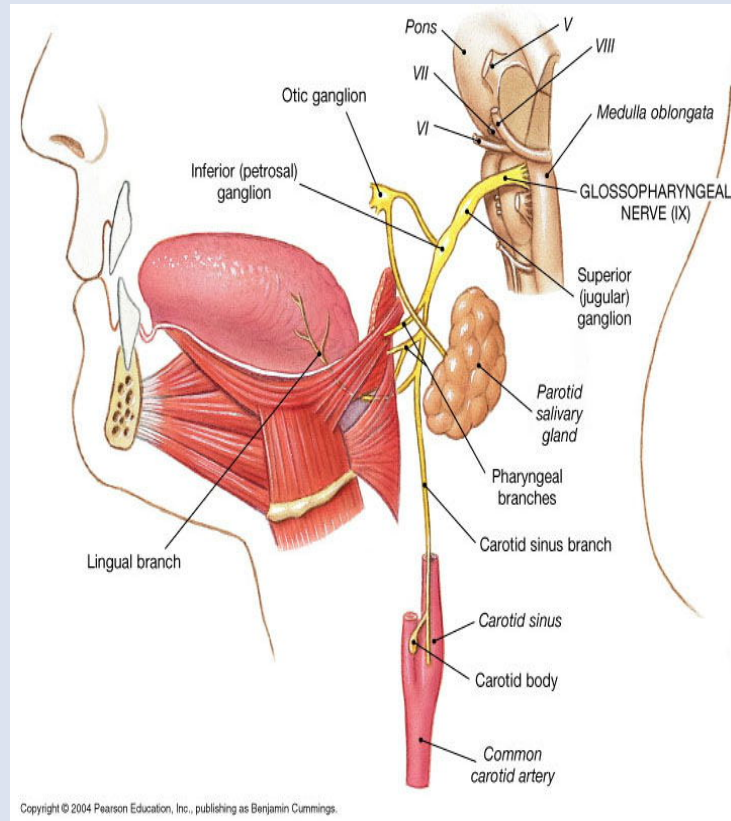


## Facial Nerve (VII)

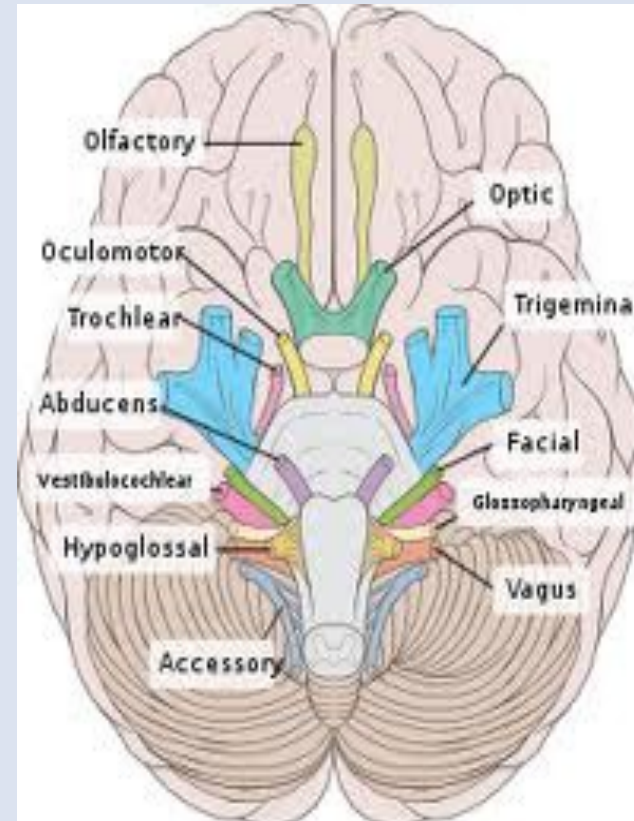


# + V, VII, IX, and X Cranial Nerves

## Glossopharyngeal Nerve (IX)



## Vagus Nerve (X)

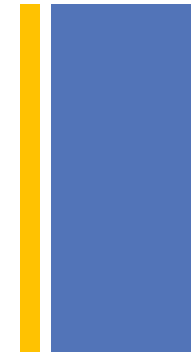


# + V, VII, IX, and X Cranial Nerves

## ■ Trigeminal Nerve (V)

Cranial Nerve	Branches	Component Fibers	Nuclei	Structure innervated	Function
Trigeminal	<ul style="list-style-type: none"> <li>- Ophthalmic (pure sensory)</li> <li>- Maxillary (pure sensory)</li> <li>- Mandibular (mixed)</li> </ul>	Sensory (GSA)	<ul style="list-style-type: none"> <li>- Mesencephalic</li> <li>- Principal sensory</li> <li>- Spinal</li> </ul>	Face, scalp, cornea, nasal and oral cavities, cranial dura matter	General sensation
		Motor (SVE)	Motor nucleus	Muscles of mastication	Opening and closing of mouth
		---	---	Tensor tympani muscle	Tension on tympanic membrane

# + Facial Nerve (VII)



Cranial Nerve	Branches	Component Fibers	Nuclei	Structure innervated	Function
Facial	-Temporal -Zygomatic	Motor (SVE)	Motor facial nucleus	Muscles of facial expression	Facial movement
	-Buccal -Mandibular			Stapedius muscle	Tension of bones of middle ear
	-Cervical	Sensory (SVA)	Nucleus solitarius	Anterior 2/3 of tongue	Taste
		Parasympathetic (GVE)	Superior salivatory nucleus	Salivary and lacrimal glands	Salivation and lacrimation





## ■ Glossopharyngeal Nerve (IX)

Cranial Nerve	Component Fibers	Nuclei	Structure innervated	Function
Glossopharyngeal	SVE	Nucleus Ambiguus	Stylopharyngeal muscle	Swallowing
	SVA	Nucleus of solitary tract	Posterior 1/3 of tongue	Taste
	GVA	Nucleus of solitary tract	mucosa of posterior third of tongue, pharynx, auditory tube and tympanic cavity, carotid sinus	Visceral sensation
	GVE	Inferior salivatory nucleus	Parotid gland	Salivation



## ■ Vagus Nerve (X)

Cranial Nerve	Component Fibers	Nuclei	Structure innervated	Function
Vagus	SVE	Nucleus Ambiguus	Soft palate, muscles of pharynx and larynx, upper esophagus	Speech, swallowing
	SVA	Spinal tract and nucleus of Trigeminal	auricle, external acoustic meatus and cerebral dura matter	General sensation
	GVA	Nucleus of solitary tract	Thoracic and abdominal viscera	Control of CVS, respiratory and GIT
	GVE	Dorsal nucleus of vagus	Thoracic and abdominal viscera	Control of CVS, respiratory and GIT

# + Anatomical structures we need to produce voice:



1. Larynx.
2. Vocal cords.
3. Recumbent laryngeal nerve.
4. Tongue.
5. Soft palate.
6. Palate.
7. Buccinator muscles.
8. Muscles of lips.
9. Maxilla & paranasal sinuses.
10. Normal lower jaw movement.

# Mechanisms for initiating swallowing



Oral phase:	Pharyngeal phase:	Esophageal phase
<p>1) <b>Moistening:</b> by saliva.</p> <p>2) <b>Mastication:</b> Food is broken down by the action of the teeth controlled by the muscles of mastication (Vc) acting on the <b>temporomandibular joint</b>. This results in a bolus which is moved from one side of the oral cavity to the other by the tongue.</p> <p>3) <b>Trough formation:</b> A trough is then formed at the back of the tongue by the intrinsic muscles (XII). The trough obliterates against the hard palate from front to back, forcing the bolus to the back of the tongue.</p> <p>4) <b>Movement of the bolus posteriorly</b> in pharynx.</p>	<p>5) <b>Closure of the nasopharynx.</b></p> <p>6) <b>The pharynx prepares to receive the bolus.</b></p> <p>7) <b>Opening of the auditory tube:</b> This does not contribute to swallowing, but happens as a consequence of it.</p> <p>8) <b>Closure of the oropharynx.</b></p> <p>9) <b>Laryngeal closure:</b> to prevent aspiration during swallowing.</p> <p>10) <b>Bolus transits pharynx: towards esophagus.</b></p>	<p>11) <b>Esophageal peristalsis</b></p> <p>12) <b>Relaxation phase</b></p>

# + Mechanisms for taste sensation

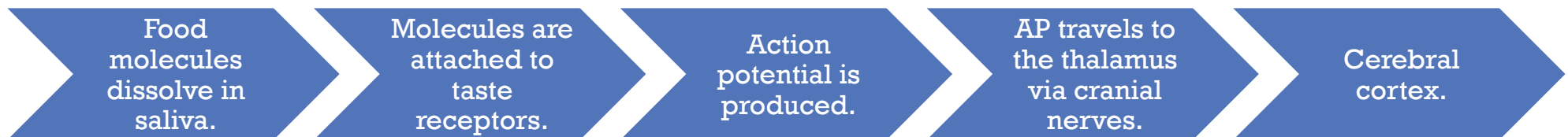
- The structures:

1. Tongue (taste receptors).
2. Nerve supply.
3. Saliva.
4. Flavour of the food.
5. Normal smell function.

- Which food do you think we taste better, hot or cold food & why?

Hot food because the smell receptors in the nose help in reinforcing the taste sensations.

- The Physiology:

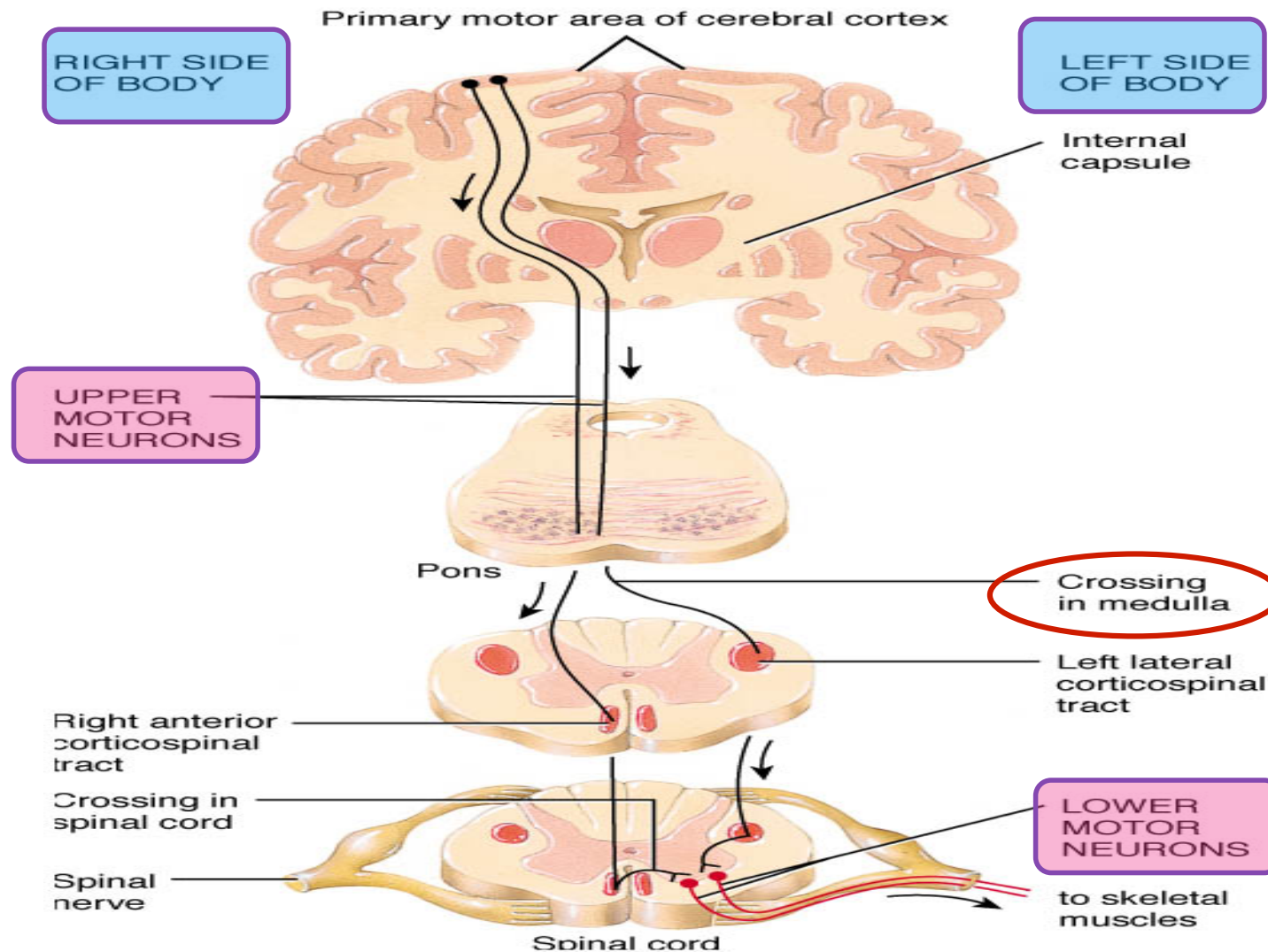


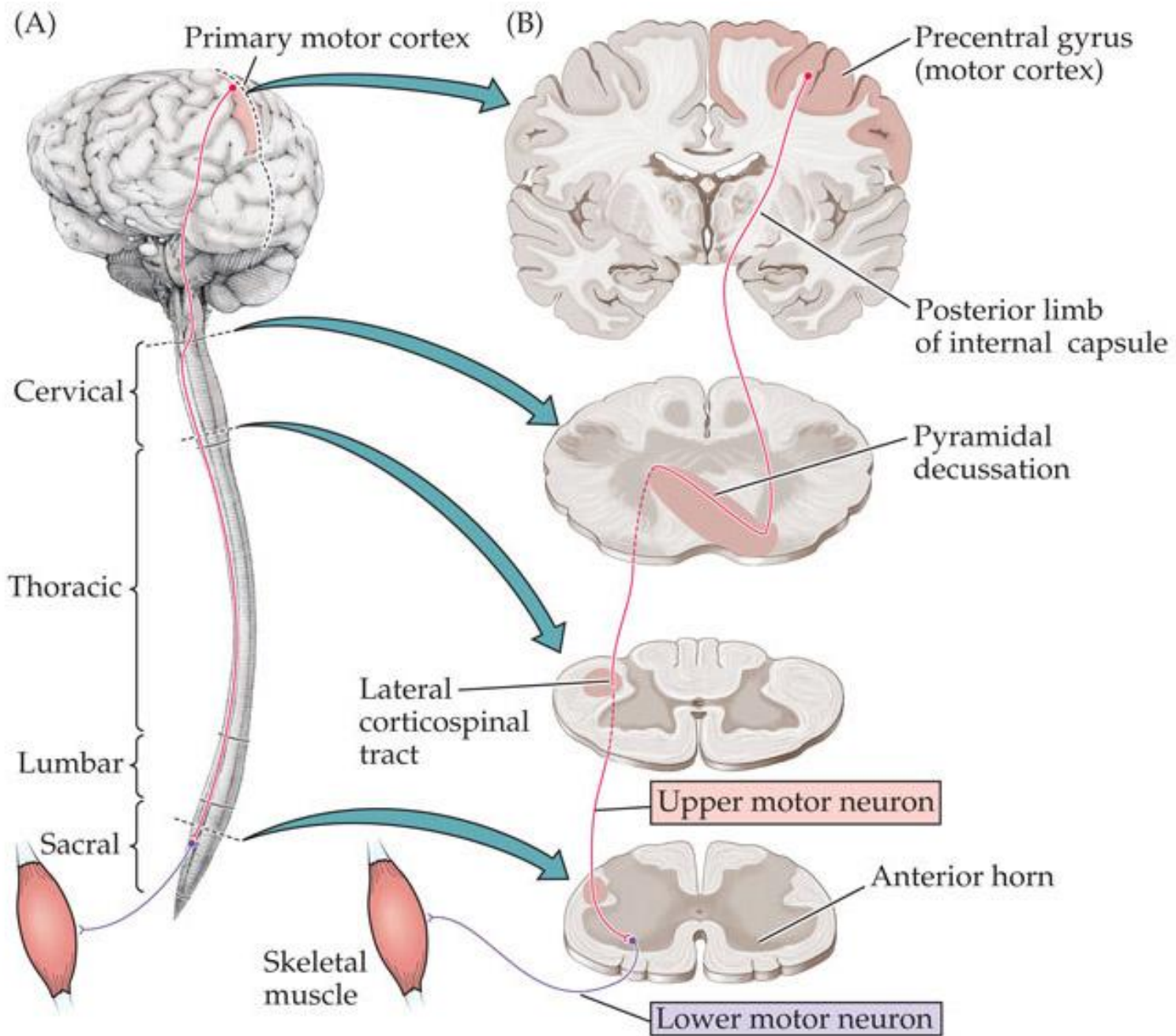
# + What are the differences between cranial nerves and peripheral nerves?



<b>Cranial nerves</b>	<b>Peripheral (spinal) nerves</b>
Emerge directly from the brain.	Emerge from the various segments of the spinal cord.
Innervate head & neck (e.g. ear, nose, throat...).	Innervate muscles, internal organs.
12 pairs.	31 pairs.
Nerves contain either sensory, motor, or mixed fibers.	Nerves contain both sensory & motor fibers.

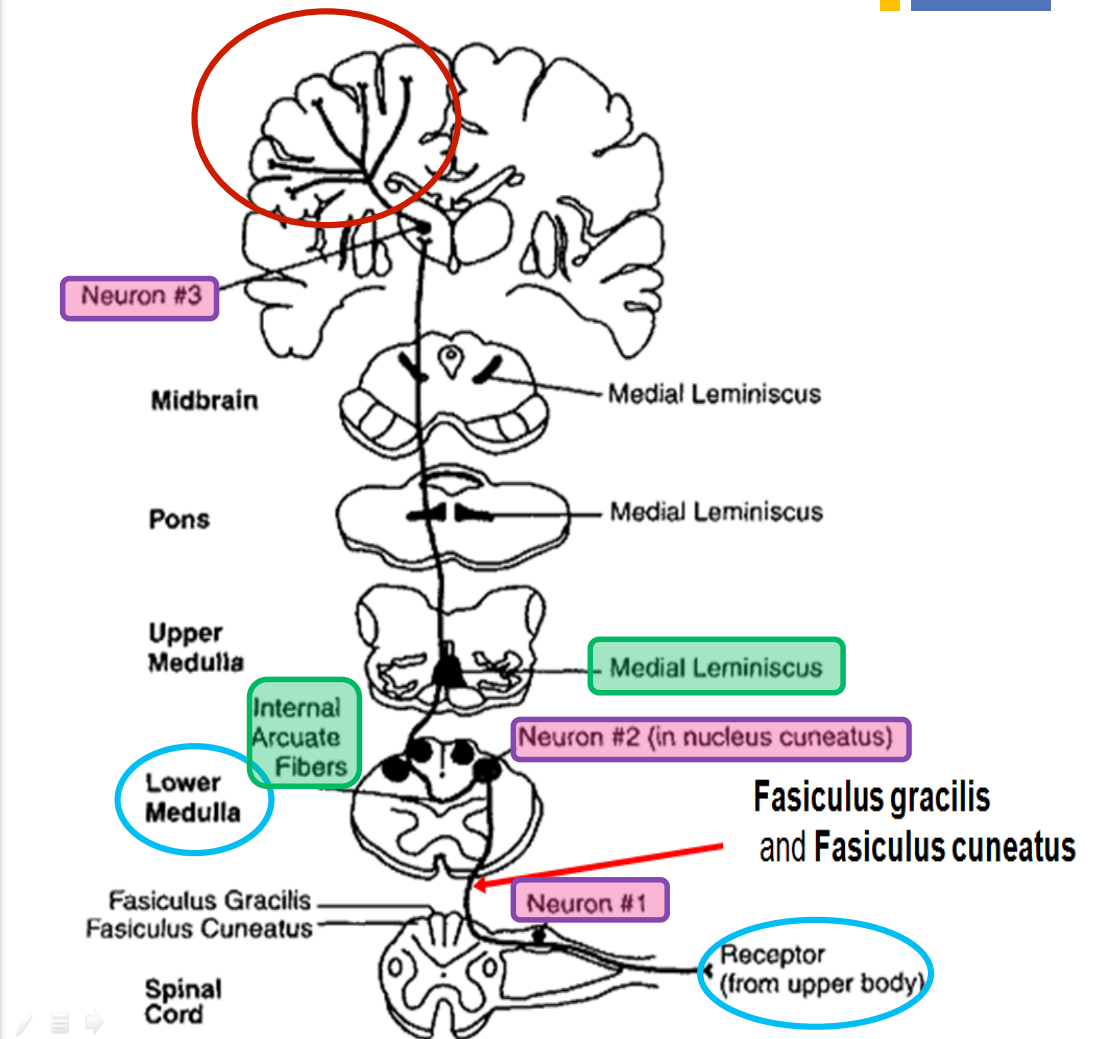
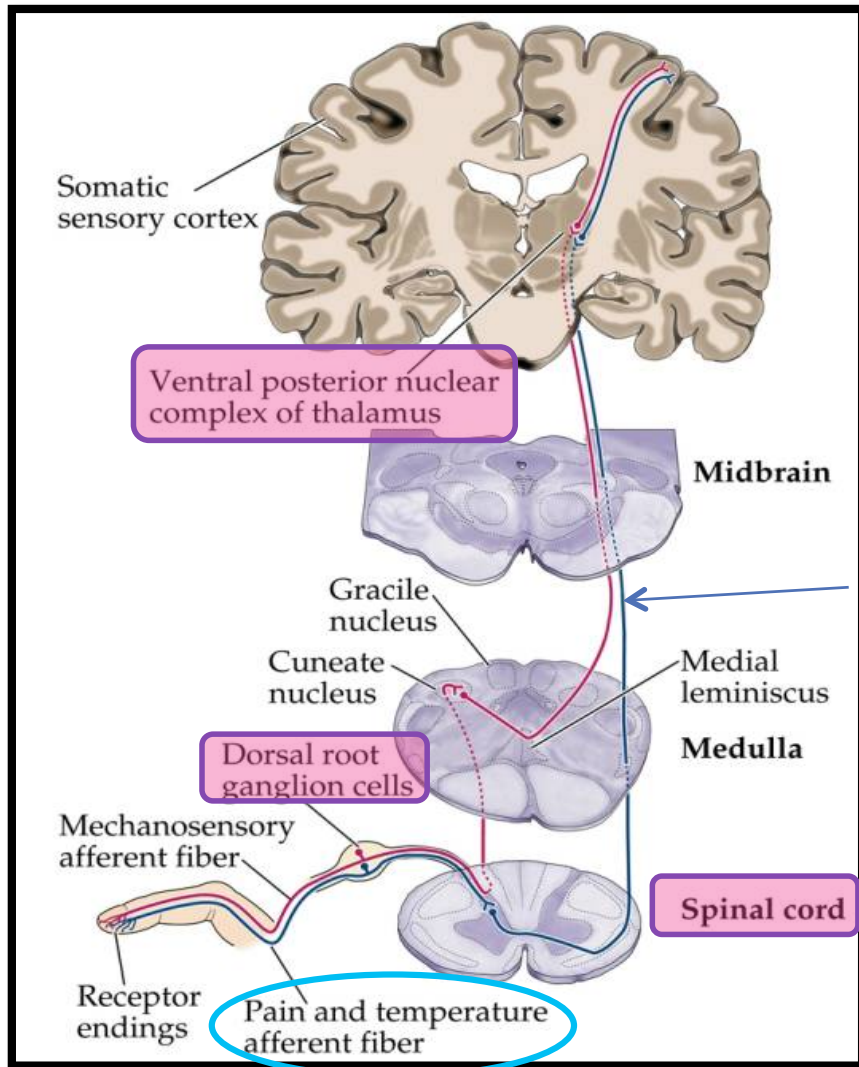
# + Anatomy and physiology of the motor system

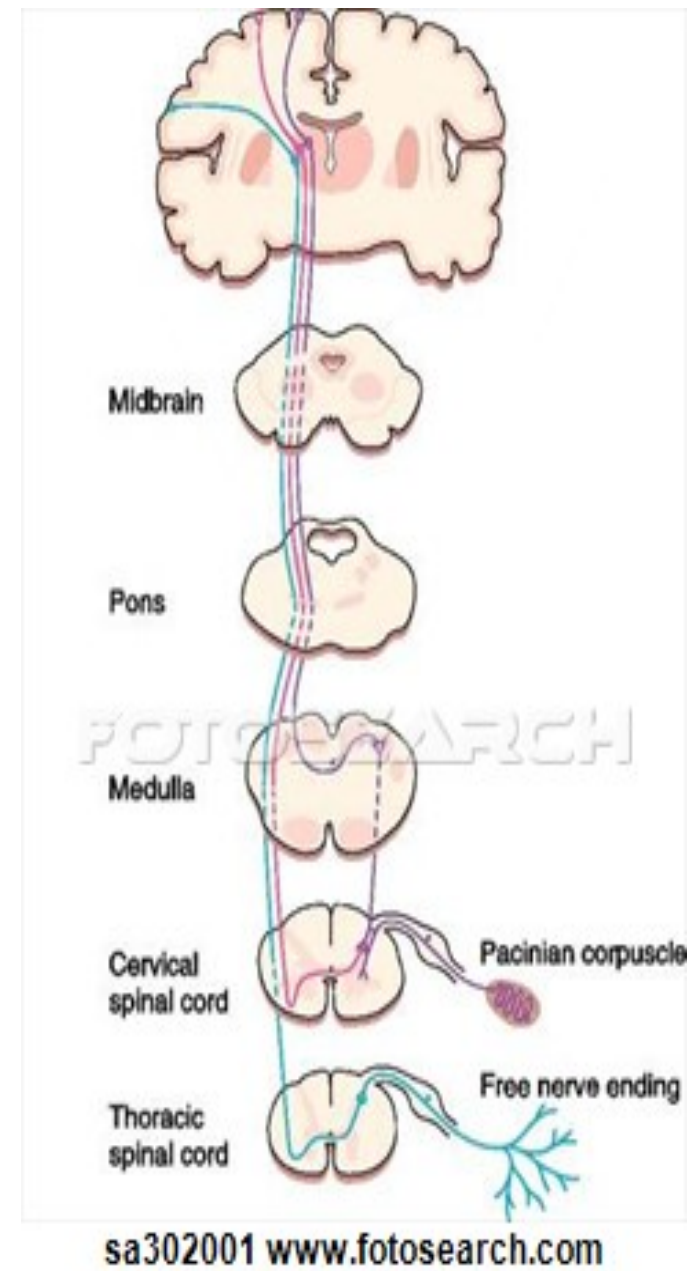
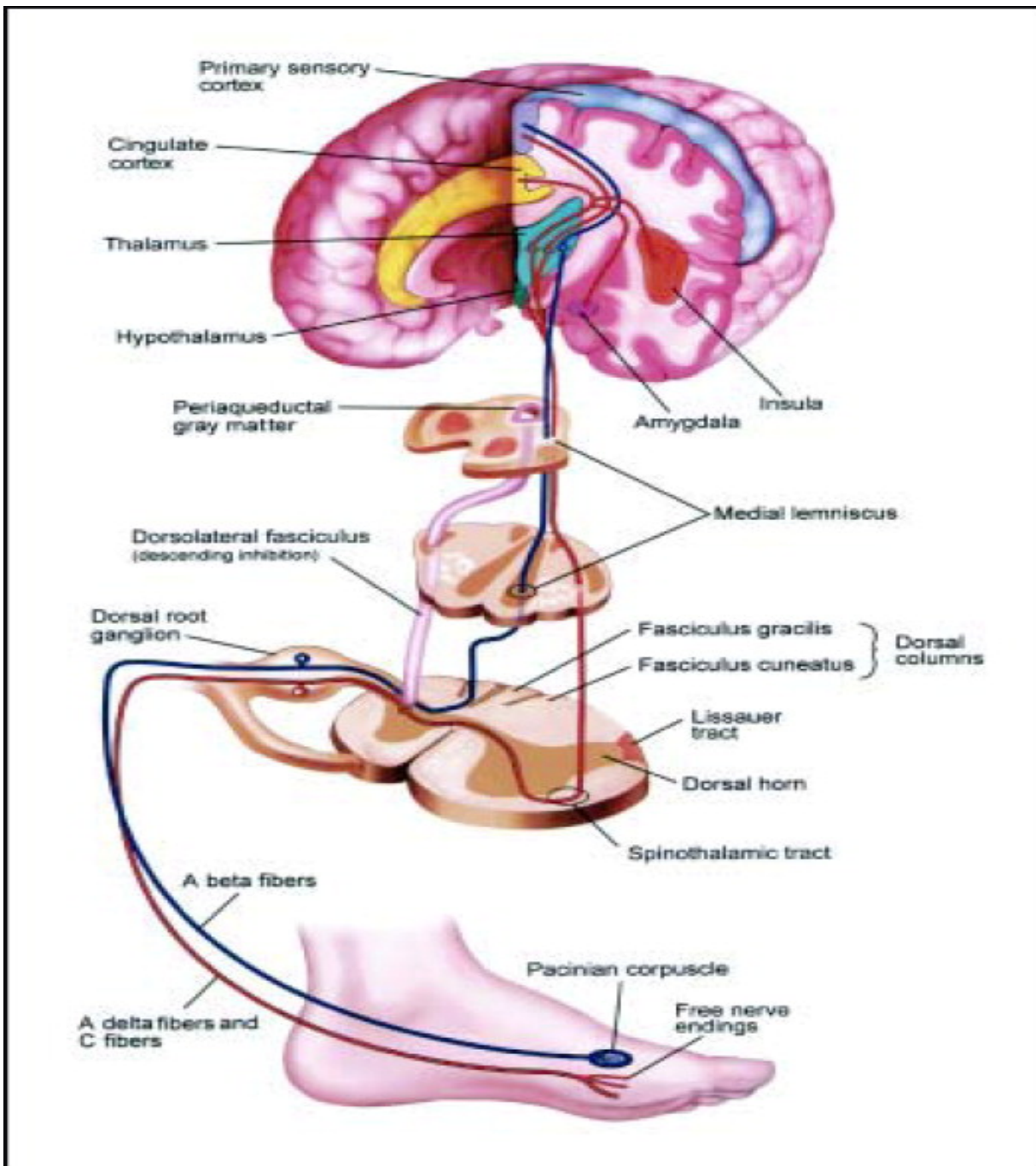






# + The modalities of sensory sensations (pain & temperature) in regard to anatomical pathways and function

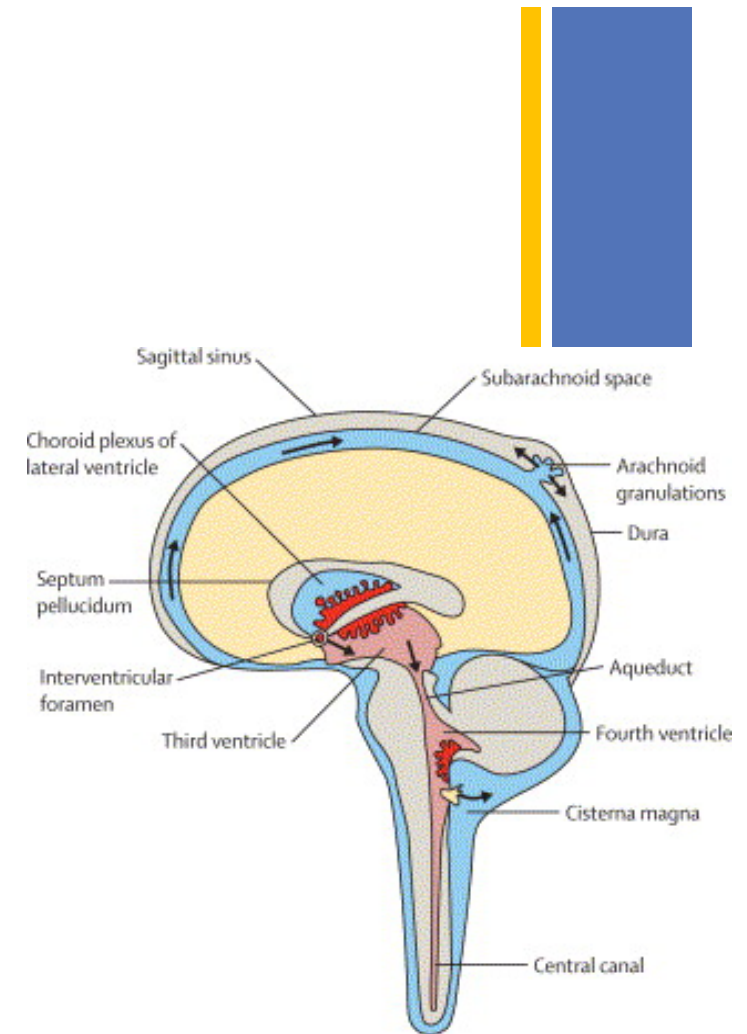




Pain and temperature pathway: <http://www.youtube.com/watch?v=Au04X0Xz6PU>

# + Pathology of brain tumors

1. Primary intracranial tumors account for some 10% of neoplasms.
2. Metastases are the commonest intracranial tumors than primary.
3. CNS tumors in childhood differ from those in adults both in histologic subtype & location.
4. The anatomic site of the neoplasm can have bad prognosis regardless of histologic classification (grading).
5. Primary CNS tumors metastasize rarely even it's malignant. However, the subarachnoid space does provide a pathway for spread.



# Types of Primary Brain Tumors

- **According to the type of cells or the part of the brain in which they begin.**

<b>Gliomas</b>	<b>Neuronal tumors</b>	<b>Poorly differentiated neoplasms</b>	<b><u>Meningiomas</u></b>
<b><u>Astrocytoma</u></b> (most common in <b>adults</b> )	Central neurocytoma	<b><u>Medulloblastoma</u></b> (most common in <b>children</b> )	(most common in <b>adults</b> )
<b><u>Oligodendroglioma</u></b> (most common in <b>adults</b> )	Ganglioglioma		
<b><u>Ependymoma</u></b> (most common in <b>children</b> )			

# + Pathology of brain tumors

## ■ Gliomas and the brain stem :

Diffuse Intrinsic Pontine Gliomas ( brain stem glioma ) :

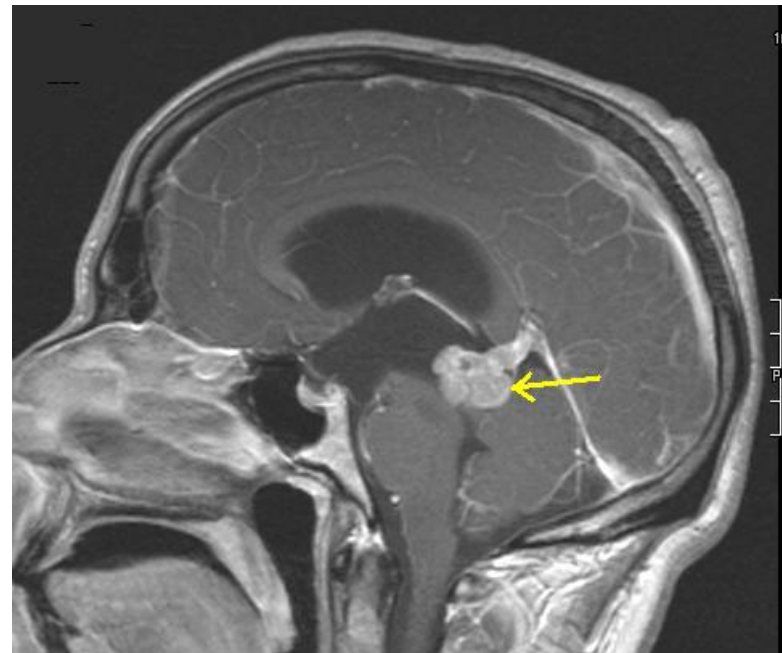
- Astrocytomas
- Oligodendroglioma
- Ependymoma





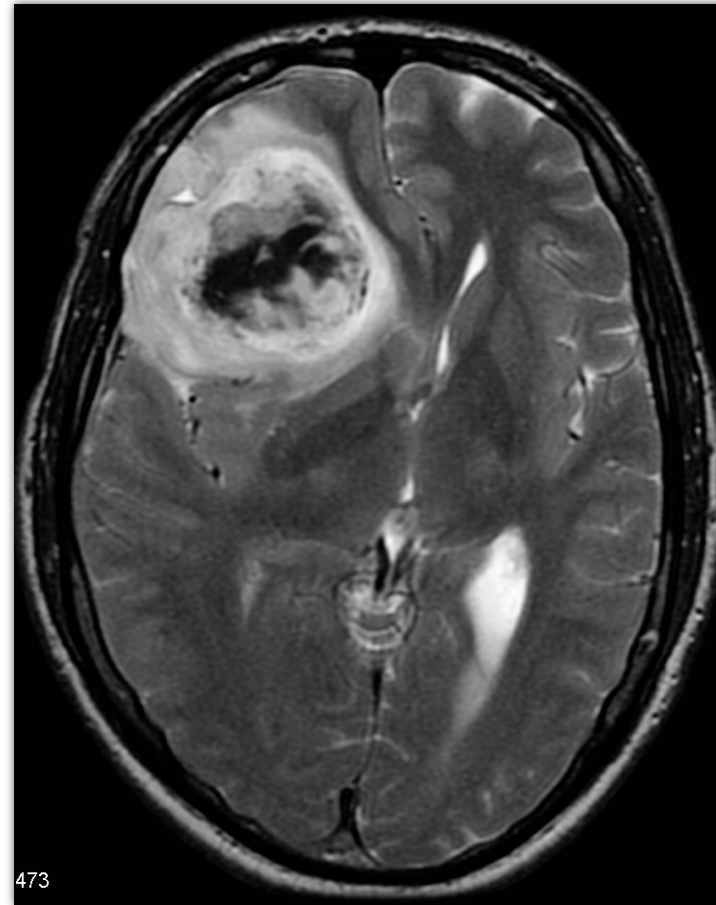
# + Astrocytomas

- **Pilocytic Astrocytoma**
- **Fibrillary Astrocytoma :**
  - Diffuse
  - Anaplastic
  - Glioblastoma



# +Oligodendroglioma

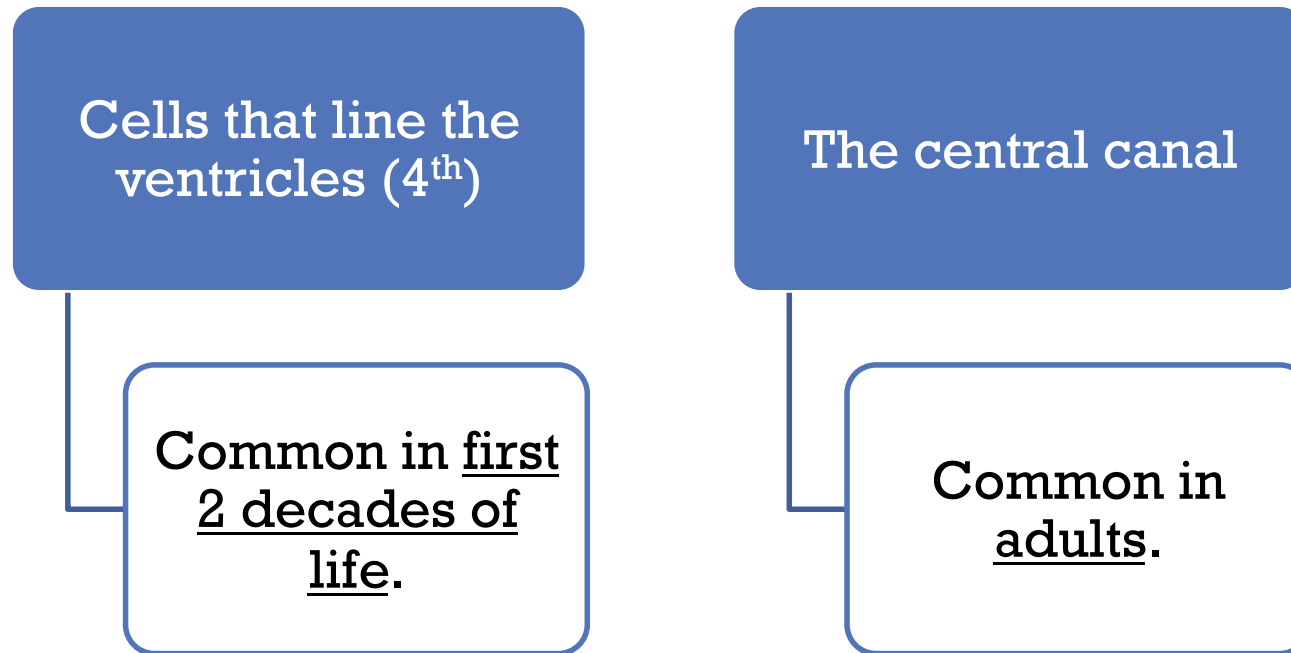
- The tumor arises from cells that make the fatty substance (myelin) that covers and protects nerves.
- It usually occurs in the cerebrum.
- It can be grade II or III.
- These cells have egg-fried.



# +Ependymoma



## 1. The tumor arises from:



2. Because ependymomas usually grow **within the ventricles**, CSF dissemination is a common occurrence.
3. solid or papillary masses from the floor of the ventricle.
4. regular, round nuclei with abundant granular chromatin.



# +Symptoms

- It depends on tumor size, type, and location.
- Most often, these symptoms are not due to a brain tumor. Another health problem could cause them.

## These are the most common symptoms of brain tumors:

1. Changes in speech, vision, or hearing
2. Changes in mood, personality, or ability to concentrate
3. Muscle jerking or twitching (seizures or convulsions)
4. Numbness or tingling in the arms or legs



# + Impact of Serious Diseases on Patients & Their Families



## **1- Distress:**

A certain amount of distress is normal but some people may be affected more than others.

## **2- Anxiety.**

## **3- Fear of losing that person.**

## **4- Depression.**