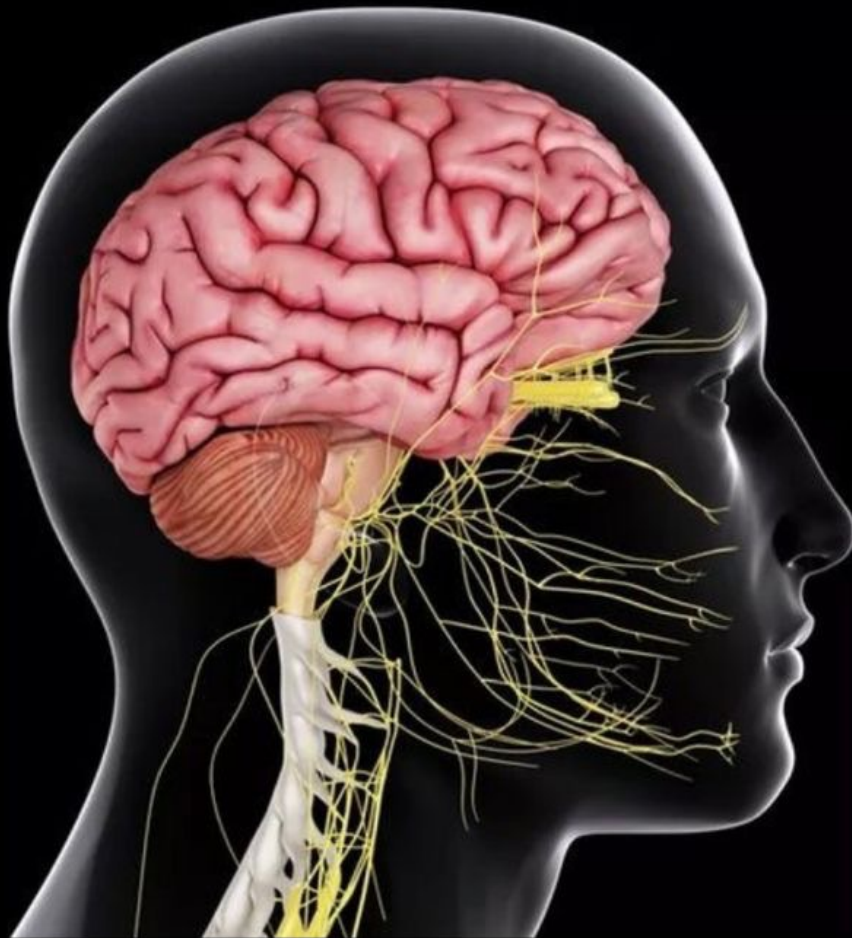




# CENTRAL NERVOUS SYSTEM



SUBJECT : Anatomy

LEC NO. : 3

DONE BY : Batool ALzubaidi & Hashem Ata

وَقُلْ رَبِّ زِدْنِي عِلْمًا



بخلي المريض يقعد بهاي الطريقة على  
كرسي و يعطينا ظهره و بحقن بين  
L4 & L5، كيف اعرف وين ؟ امشي  
على امتداد ال iliac crest على  
الجهتين عيين ما يلتقوا medial هون  
يكون level L4/L5 .. انتبه ا لشغلة  
لو كنا بناخد العينة من طفل بنزل ل  
level اقل يعني ل L3

سلايد ٩ محاضرة ٢ اخر اشي عدلوها ل " انتبه لشغلة لو كنا بناخذ  
العينة من طفل بنزل ل level اقل S1/S2 " مش ل3 ال spinal cord  
الي بنتهي عند L3 مش مكان ال puncture

عذراً على الخطأ بس في طلاب كانت تحكي مع الدكتور ف ما ميزت  
الجملتين من بعض



# Ascending tracts 1

**Dr Ashraf Sadek *PhD, MD, MRCPCH***

Assistant Professor of anatomy and embryology

ملاحظة صغيرة الهياليت مش شامل كل اشي قرأه ف لما ترجعوا للمحاضرة تسمعوها انتبهوا

# Gracile & Cuneate tracts

## Posterior column tracts

### conscious proprioception

T6 in thoraces - neck -  
cervical.  
End in cl

The head has cranial  
nerves not control by  
T6

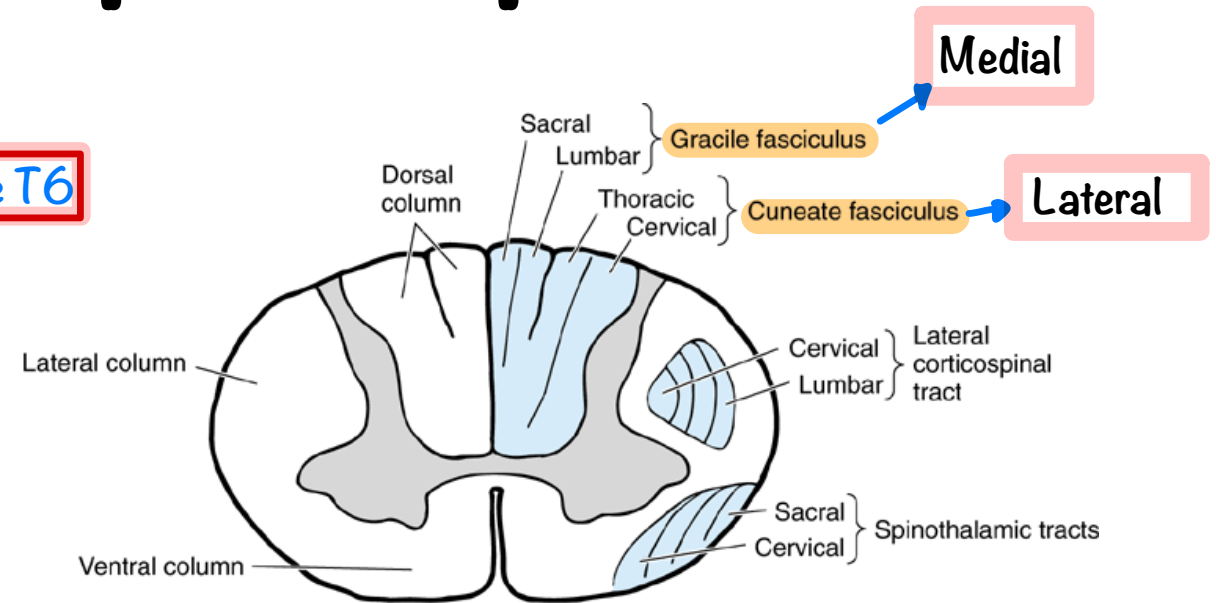
- **conscious proprioception (sense of position, sense of movement and sense of vibration)**

Gracile carry from lower part below T6

Cuneate carry from upper part above T6

- **Fine touch (tactile discrimination, tactile localization and stereognosis)**

Recognition objects by touch



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**First Neuron:** Dorsal Root Ganglion cells which are pseudounipolar.

Their **peripheral processes** carry sensations from deep receptors (in muscles, tendons & joints).

Their **central processes** pass to the spinal cord via the **dorsal root**.

Fibers from the lower part of the body (below T6) ascend **medially** in the **dorsal column** forming the **gracile tract**.

Fibers from the upper part of the body (above T6) ascend **laterally** in the **dorsal column** forming the **cuneate tract**.

**Lamination:** sacral fibers are most medial & cervical fibers are most lateral.  
↖ With gracile      ↘ With cuneate

**From medial to lateral sacral - lumbar - thoracic - cervical**

**Second Neuron:** Gracile & Cuneate Nuclei of the medulla oblongata.

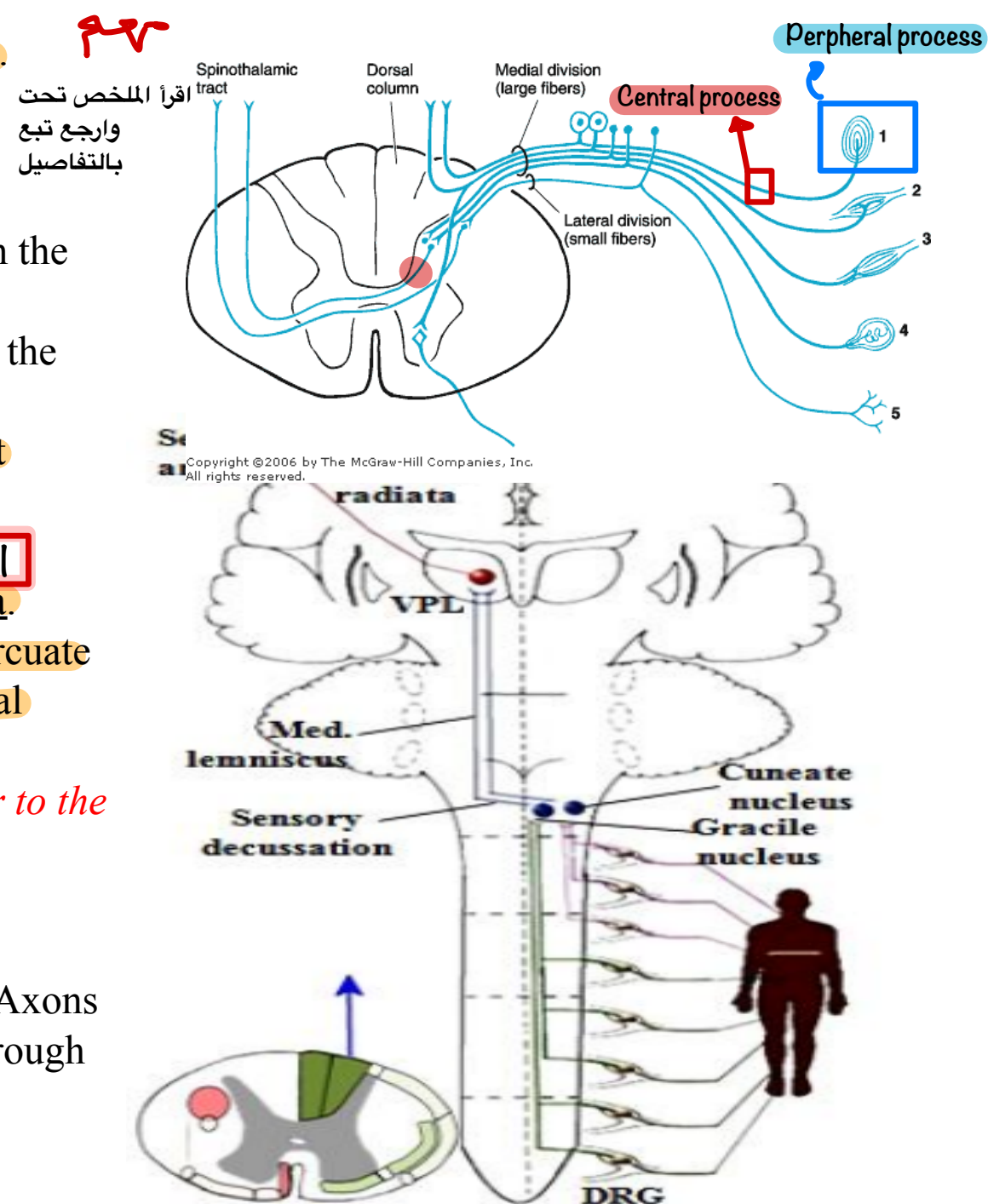
Axons of these nuclei cross the **median plane** (forming the **internal arcuate fibers** (sensory decussation)). Fibers **ascend in brain stem** as the **medial lemniscus** in the opposite side to **reach the thalamus**

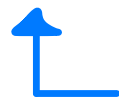
\* *Some cervical fibers end on the accessory cuneate nucleus (posterior to the cuneate nucleus), its axons (cuneo-cerebellar fibers) pass to the cerebellum.*

\* **تصل مباشرة للcerebellum**

**Third Neuron:** Ventral posterolateral Nucleus of thalamus (VPLN). Axons of these cells **pass through posterior limb of internal capsule**, then through **corona radiata** to reach sensory area of cerebral cortex.

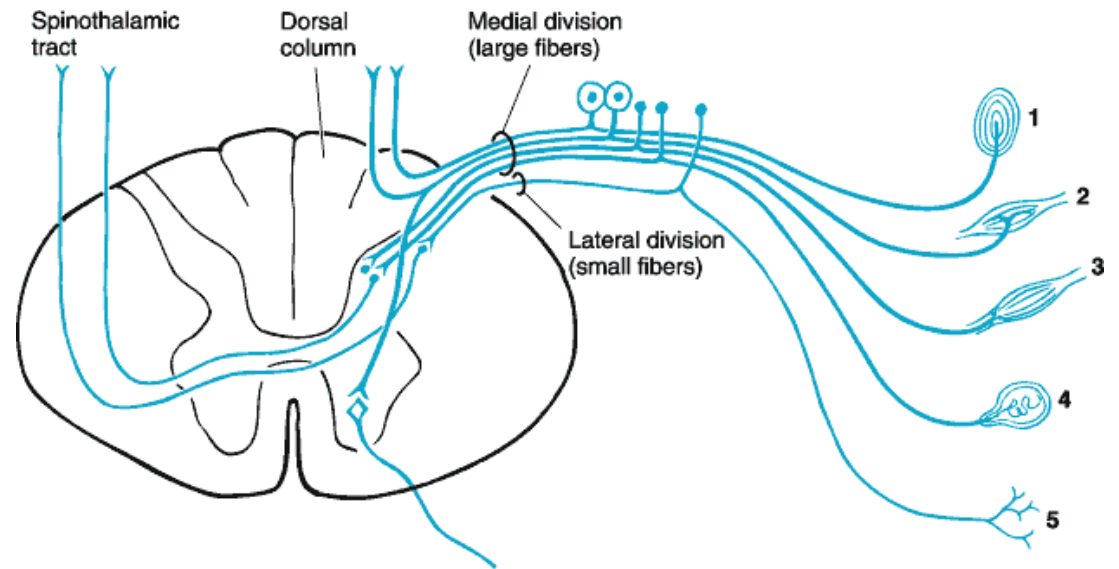
\* **The internal capsule has upper limb - lower limb - genu**



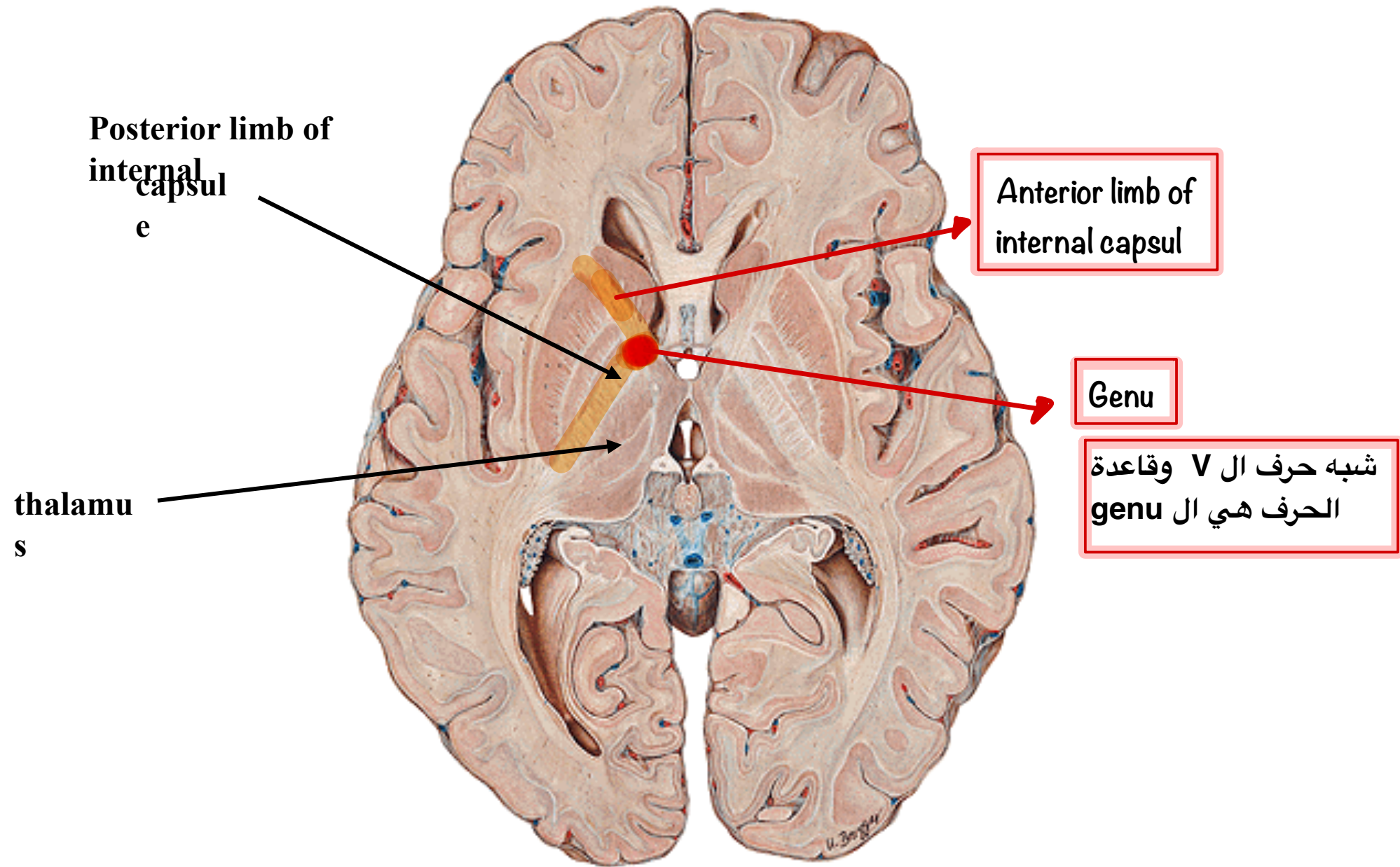


بوصل ال sensory fibers لل Spinal e وبمشي فوق ليوصل لل C/G  
بعدها بكمو طريقهم لل thalamus وتحديدًا لل VPLN وصولاً بالنهاية  
لل internal capsule

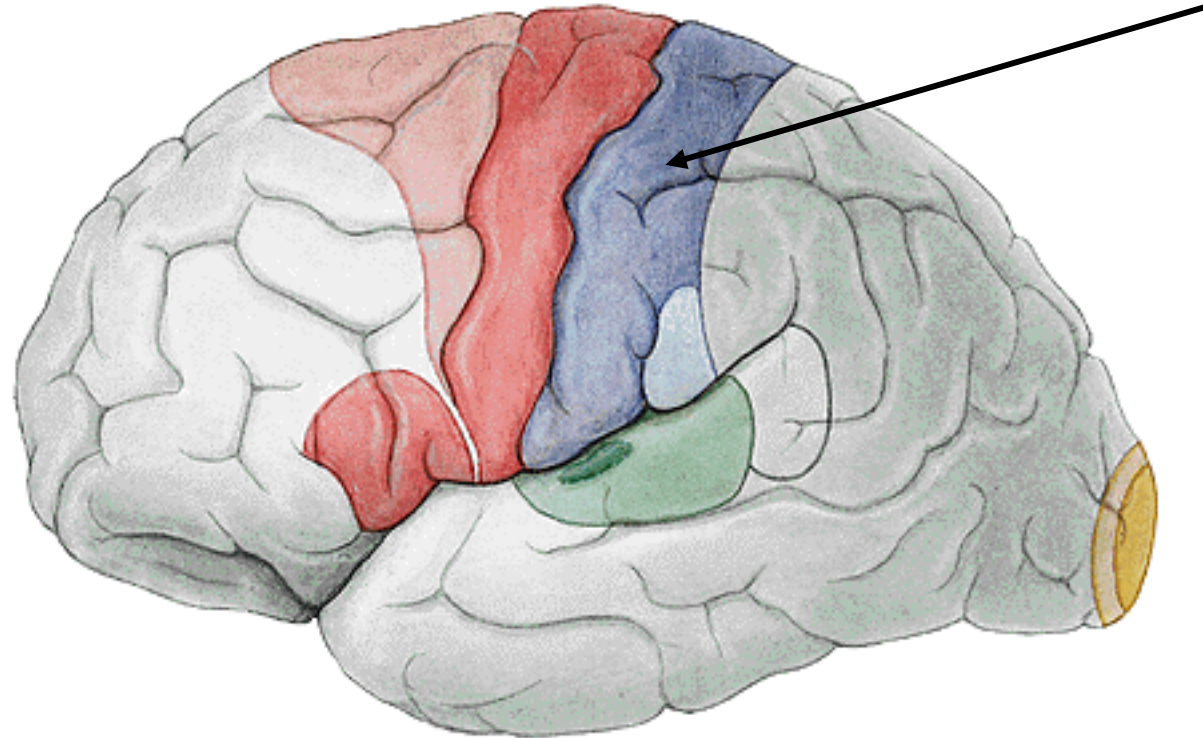
- Formed by central process of dorsal root ganglia , fibers enter spinal cord via dorsal root
- Lamination : coccygeal& sacral fibers are **most medial** and cervical are lateral
- End in **gracile and cuneate** nuclei in medulla



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**Sensory  
area**





Cortex=conscious

Right Cortex control the left side of the body and the left cortex control the right side of the body ( control sensory and motor )  
Cerebellum is unlike the cortex  
Right with right and left with left

## Unconscious Proprioception (to the cerebellum)

**Posterior spinocerebellar**

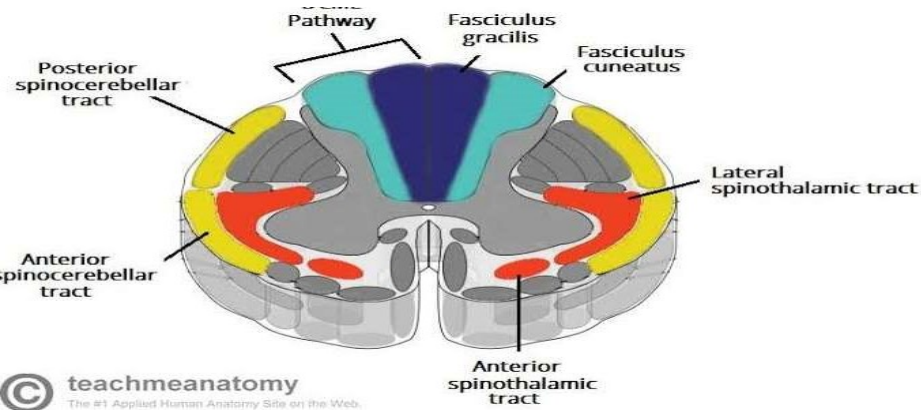
- Carries proprioception from lower limb & trunk

**Anterior spinocerebellar**

- Carries proprioception from lower limb

**Spino-olivary**

- Carries from upper and lower limbs



# Spino- cerebellar tracts

- **Posterior spino cerebellar tract**
- Carries proprioception from the **lower limb & trunk**.
- The central processes of DRG cells enter the spinal cord via the dorsal root to end on **ipsilateral Clarke's nucleus**.
- The tract ascends **ipsilaterally** in the lateral white column, posterior to the anterior spino-cerebellar tract enters the **ipsilateral cerebellum** via the inferior cerebellar peduncle (ICP).

- **Anterior spino-cerebellar tract**
- Carries proprioception from the **lower limb**.
- The central processes enter the spinal cord via the dorsal root to end on Clarke's nucleus. -

Axons forming the tract mostly decussate but few remain ipsilateral.

then **cross again** to reach the ipsilateral cerebellum  
They enter the cerebellum via the **superior cerebellar peduncle (SCP)**

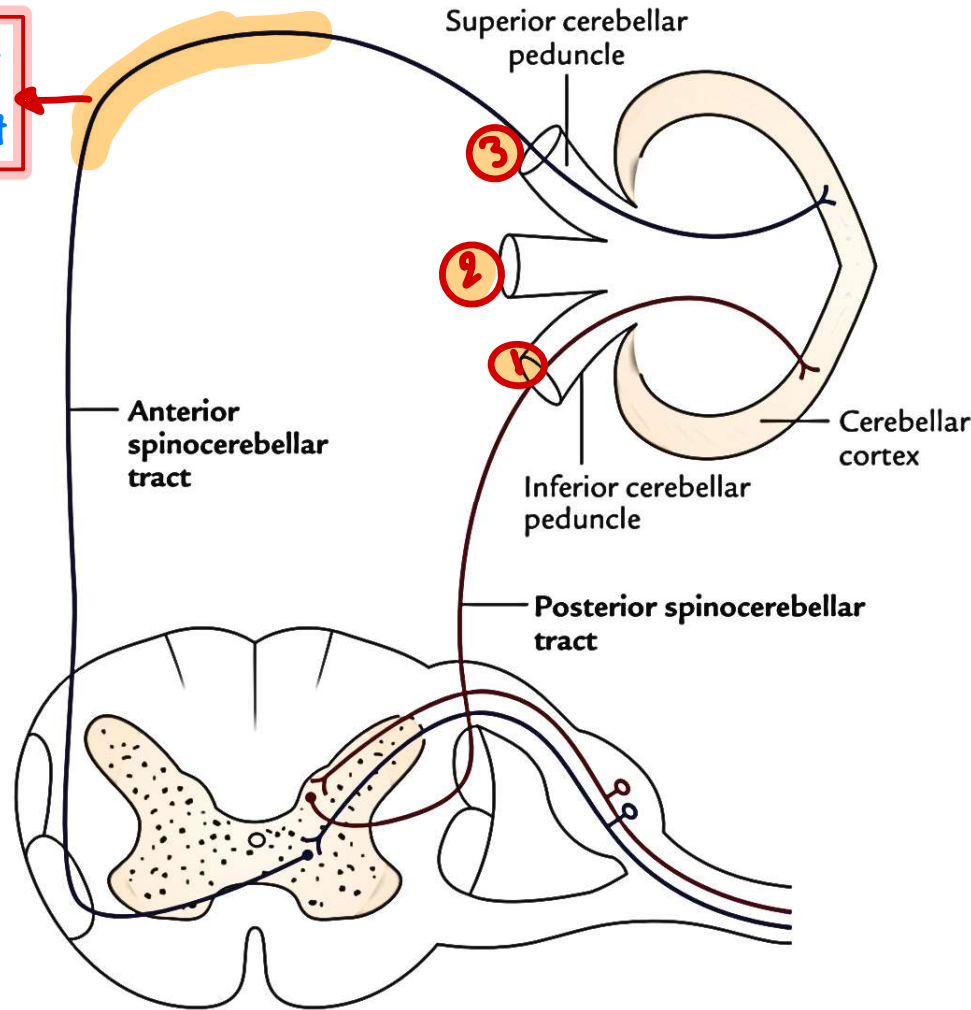
خذ المعلومة هاي وانزل كمان طابق نغلبك  
وبعدها ارجع لهون شوف الرسمة

The cerebellum attached with the brainstem by 3 bridges ( peduncle )

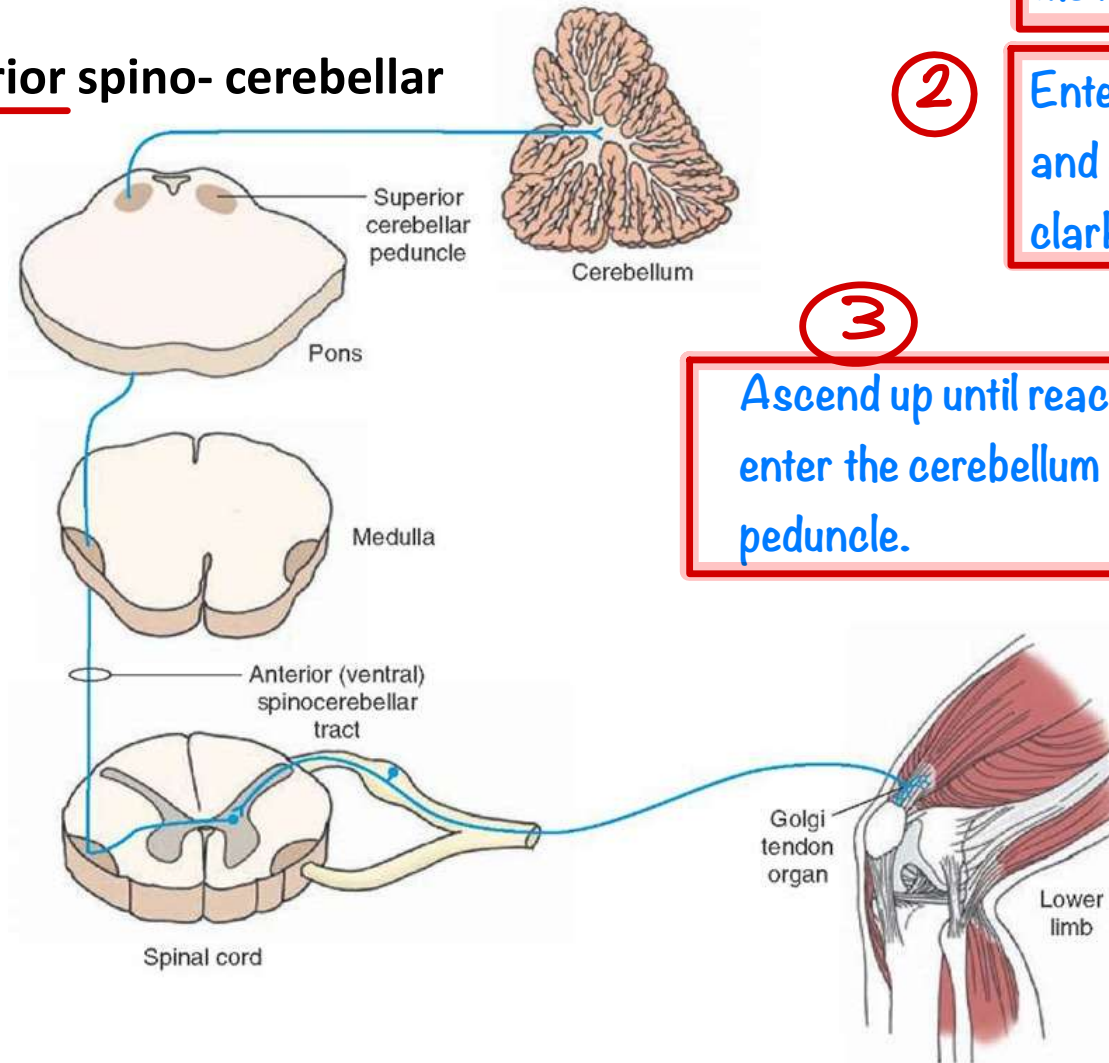
- 1) Inferior cerebellar peduncle ( with medulla )
- 2) Medile cerebellar peduncle ( with pons )
- 3) Superior cerebellar peduncle ( with med brian )

Spino cerebellar tracts

The cross of anterior  
spinocerebellar tract



## anterior spino- cerebellar



①

Anterior spinocerebellar  
Carries proprioception from  
the lower limb

②

Enter the dorsal root ganglia  
and continue until reach  
clarkes nucleus

③

Ascend up until reach the midbrain and cross to  
enter the cerebellum by superior cerebellar  
peduncle.

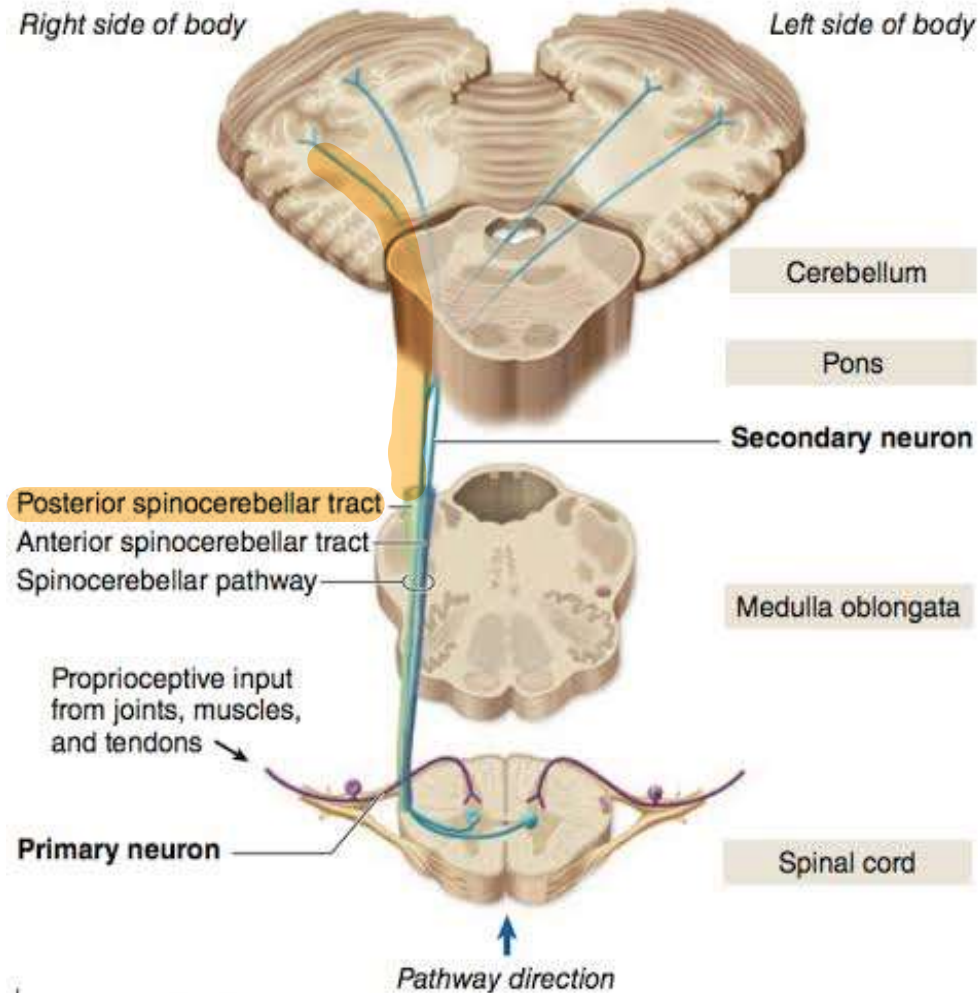


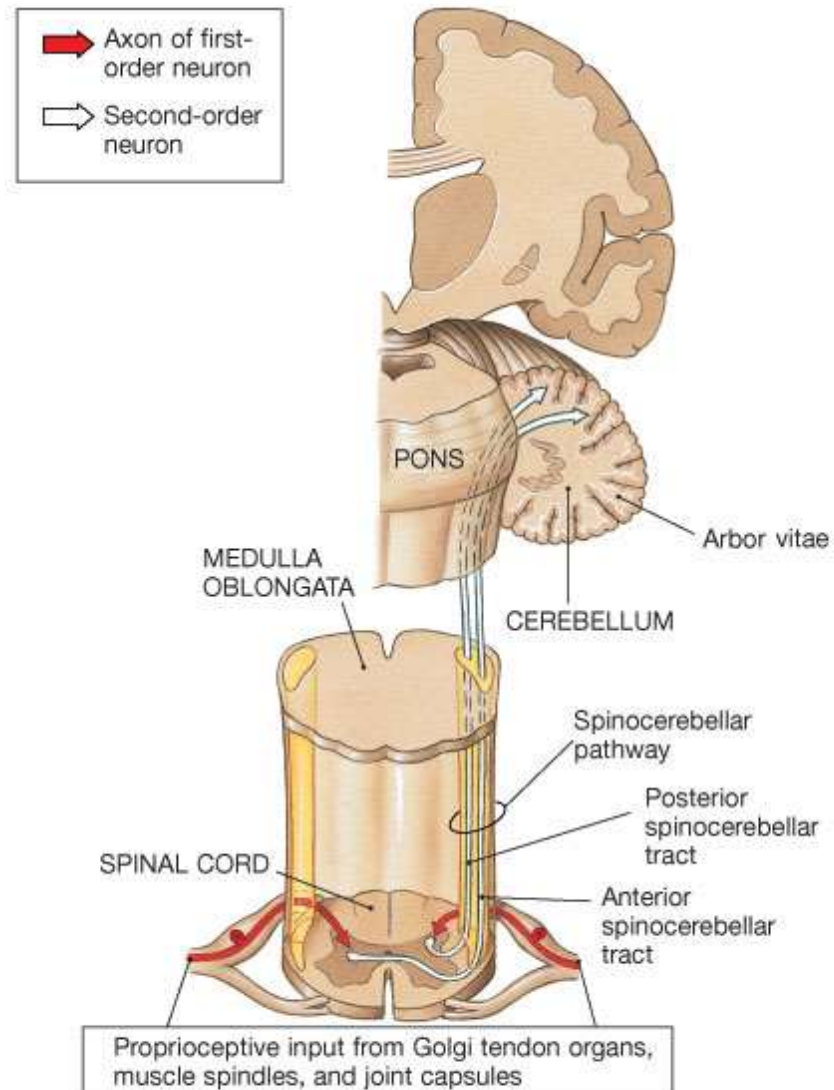
③

Continue in the same side and enter the cerebellum through the inferior cerebellar peduncle

1+2 steps are like the anterior

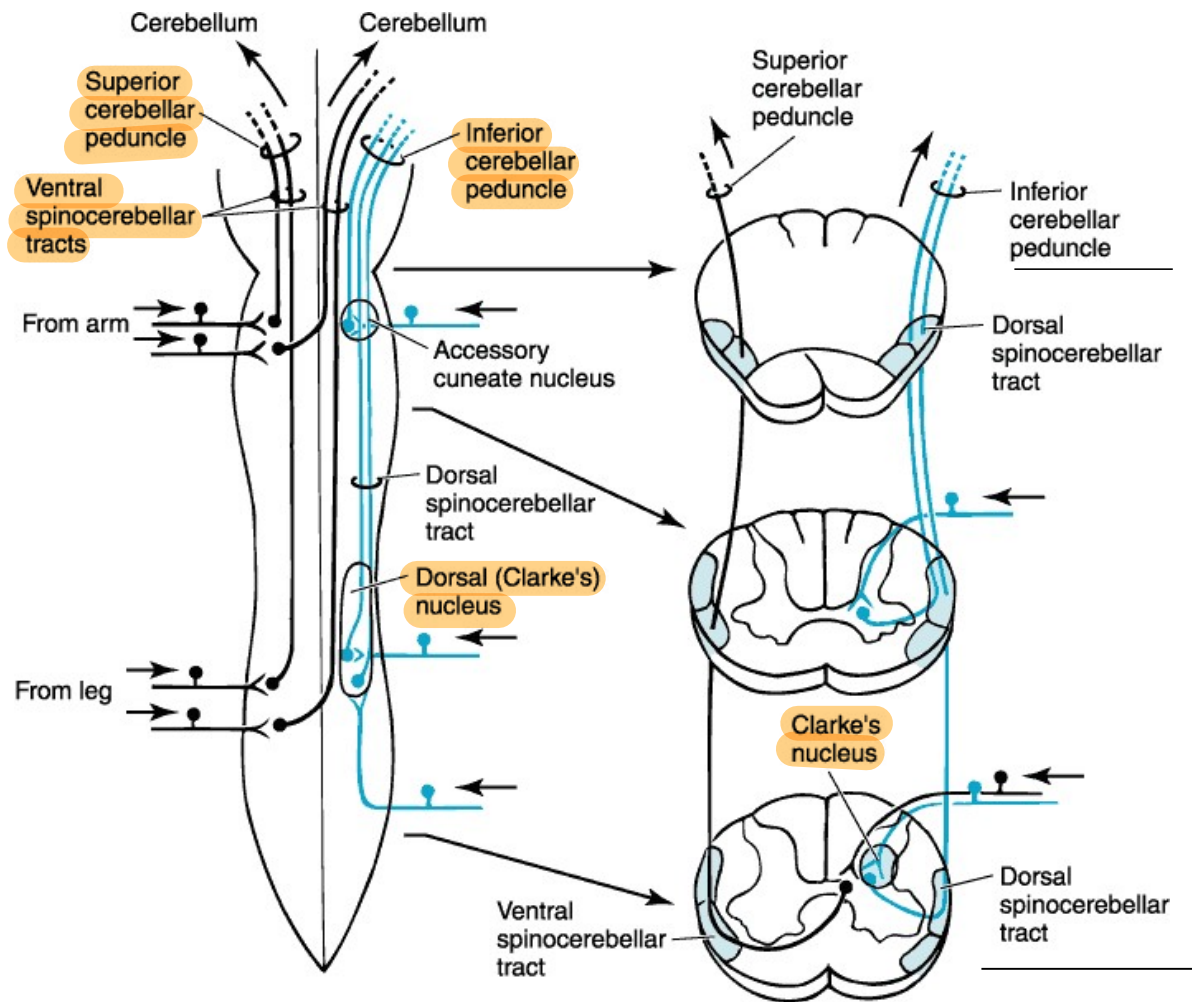
### posterior spinocerebellar





**(d) Spinocerebellar pathway**

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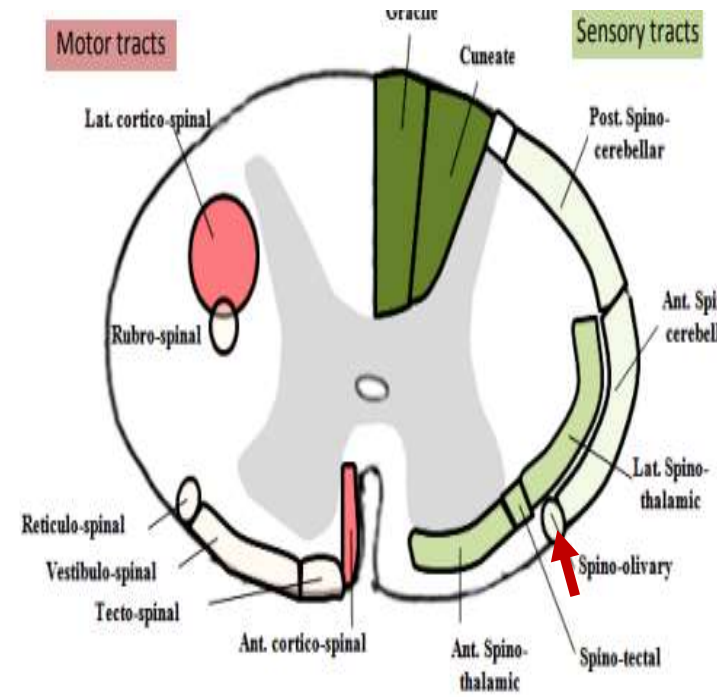
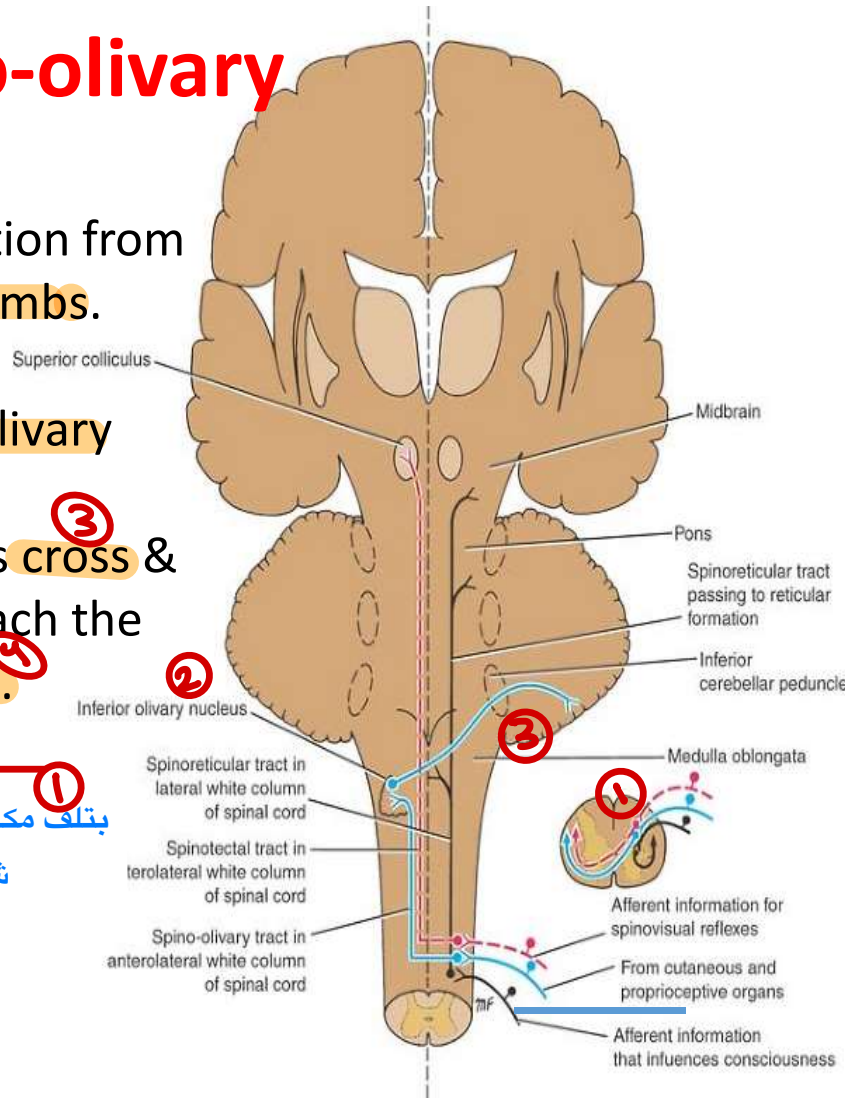


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# Spino-olivary

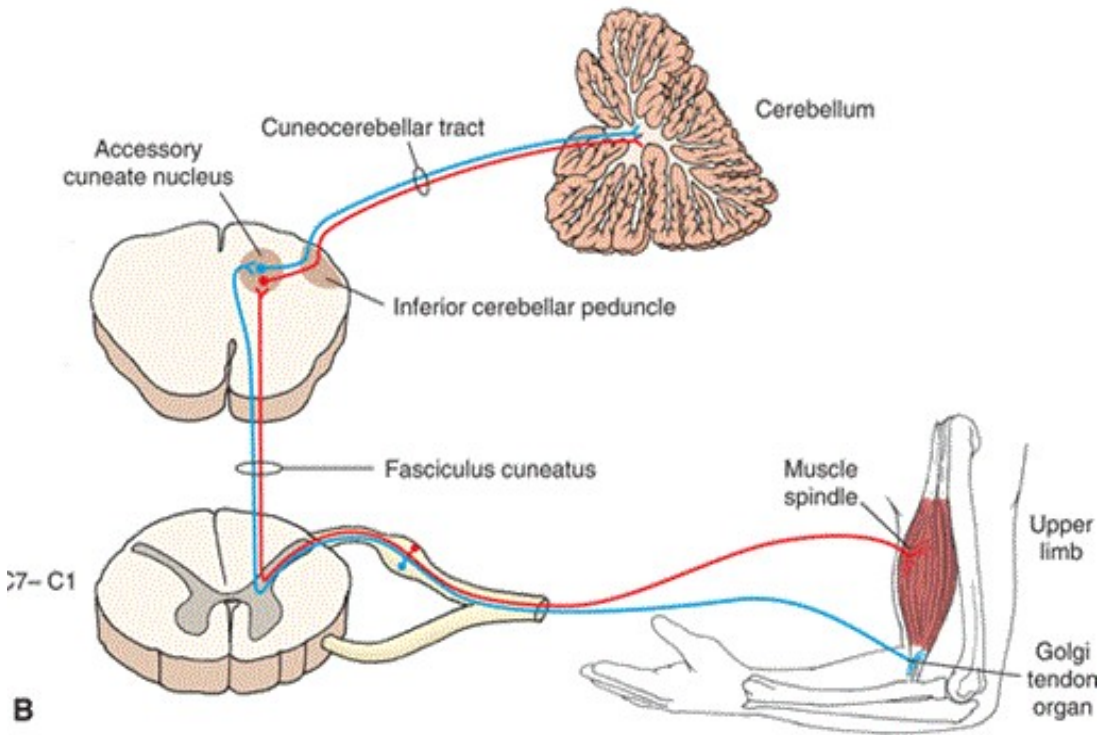
- It carries proprioception from both upper & lower limbs.
- Fibers cross
- End in contralateral olivary nucleus
- Olivocerebellar fibers cross & pass via the ICP to reach the ipsilateral cerebellum.

١ بتلف مكانها وبتطلع ل فوق وبتكمل لتوصل ل ٢  
شوفوا الترقيم مع المعومات والصورة



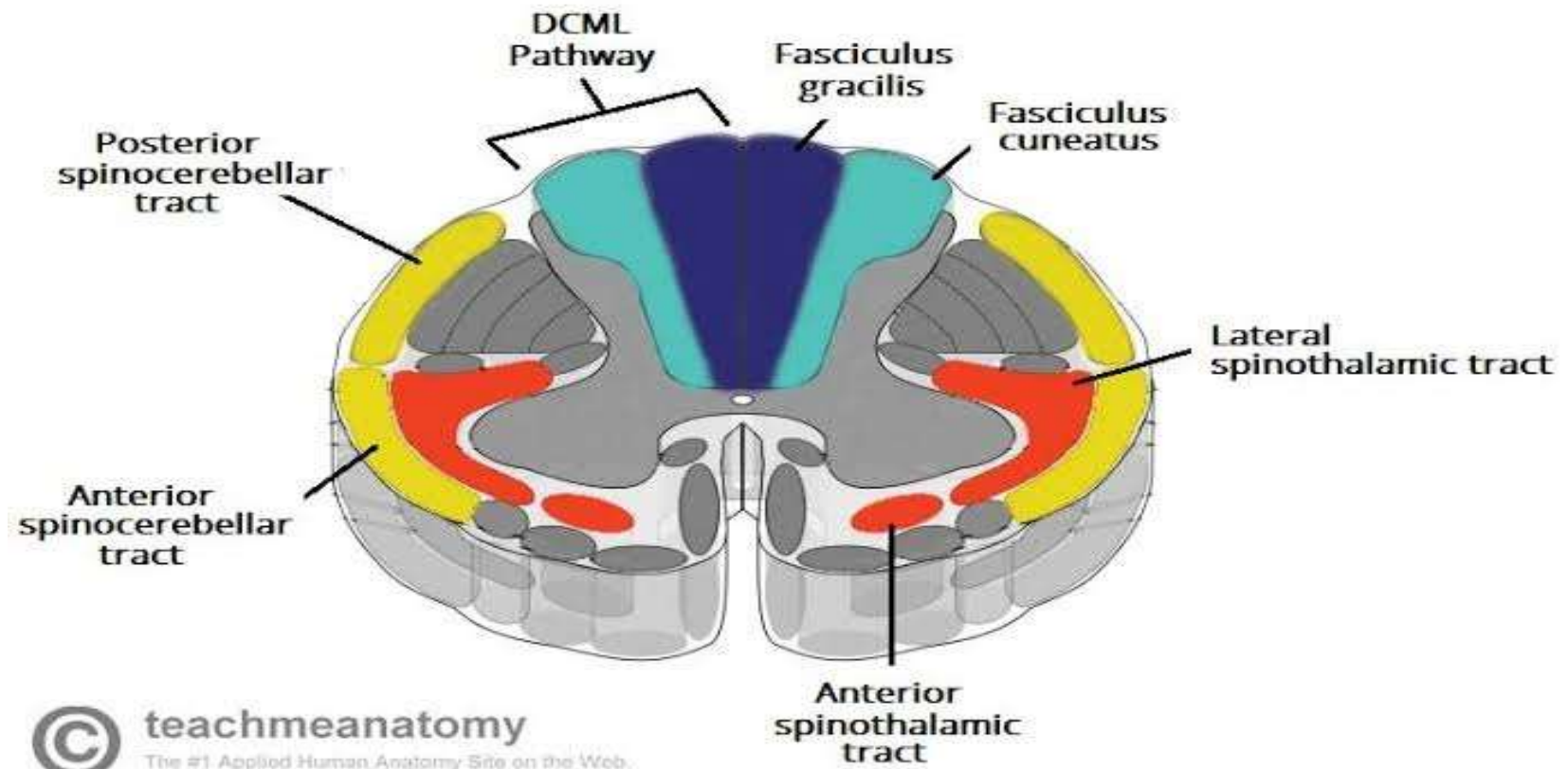


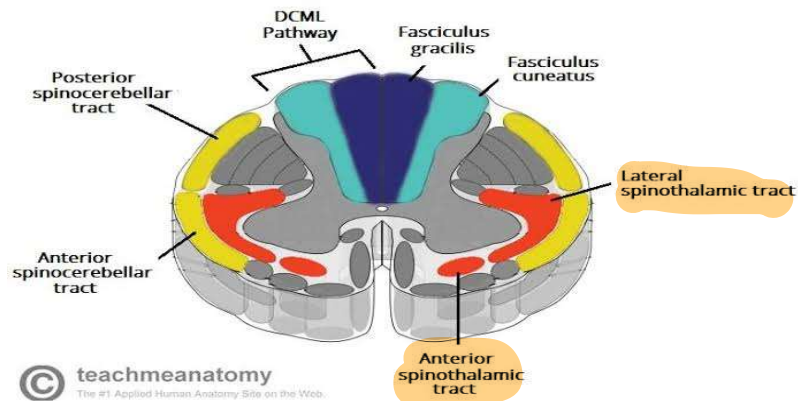
## Collaterals from cuneate tract



- ❑ Proprioception from upper limb to accessory cuneate nucleus
- ❑ Fibers from accessory cuneate form external arcuate fibers (Cuneocerebellar tract)
- ❑ Reach ipsilateral cerebellum via the ICP

- Unconscious Proprioception from upper limb is carried by spino olivary and Cuneocerebellar tracts.
- Unconscious Proprioception from lower limb is carried by spino olivary and spinocerebellar tracts.





## Antero lateral system (Spino-thalamic)

### Lateral Spino-thalamic Tract

### Ventral spino-thalamic tract

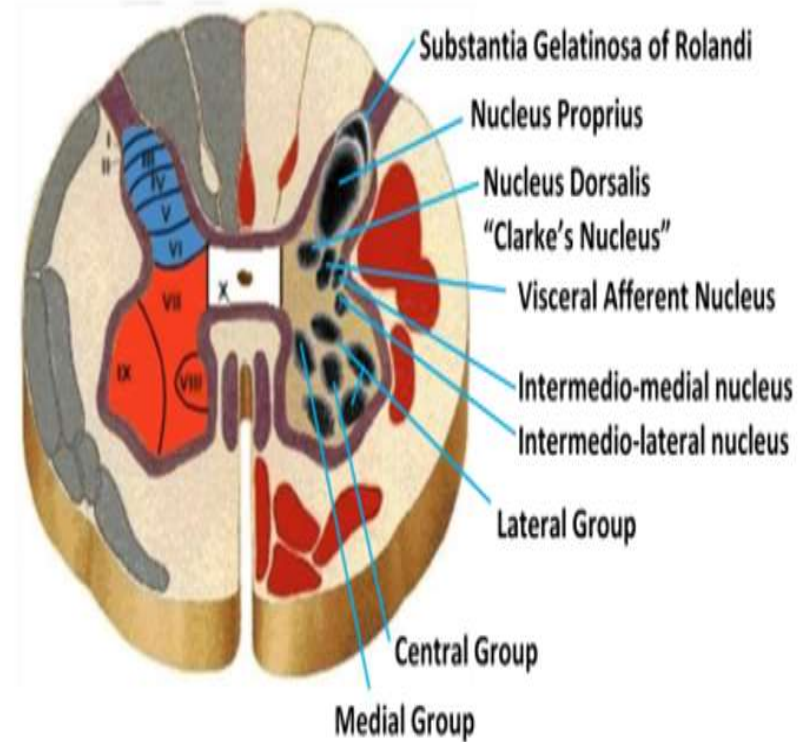
### Pain pathway

مسؤول ال pain and temperature

### Pathway of touch & pressure

# Lateral Spino-thalamic Tract

- Carries pain and temperature , it lies in lateral white column
- Begins from lamina I, IV, VIII
- Lamination cervical fibers are medial
- End on VPL of thalamus





# Pain pathway

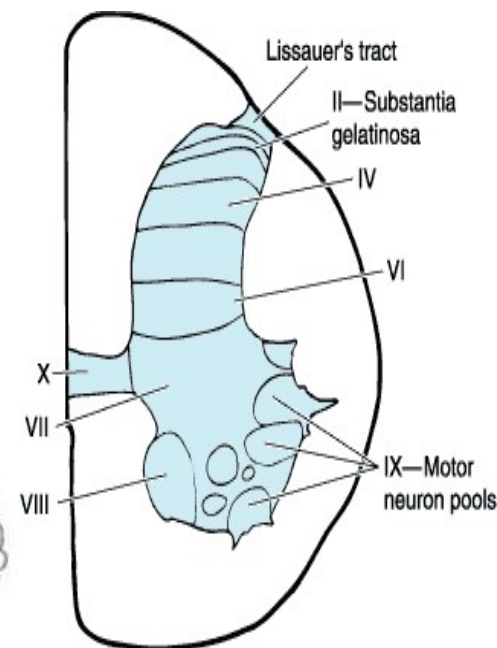
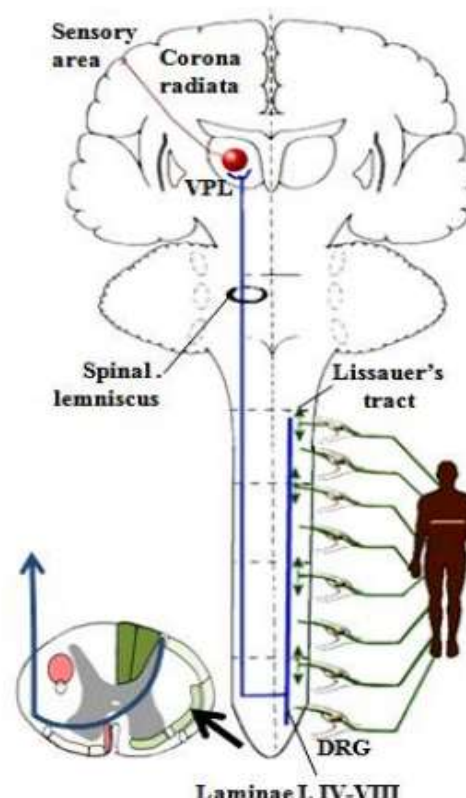
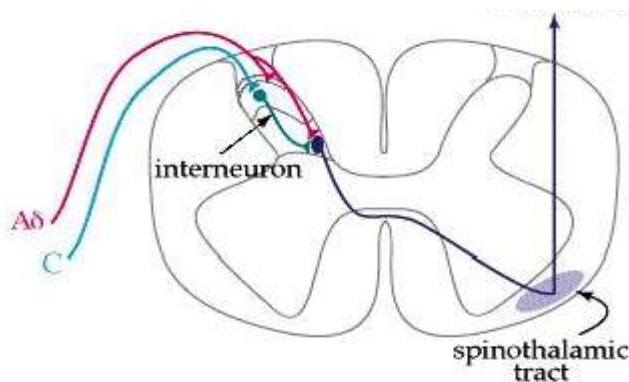
## Lateral Spino-thalamic Tract

**First neuron**; Dorsal root ganglion cells (pseudounipolar) Their peripheral processes carry pain & temperature sensations from the receptors (free nerve endings in skin).

Their central processes enter the spinal cord via the dorsal root and divide into ascending & descending branches for few segments, These fibers run in the dorsolateral (Lissauer's) tract which lies over the apex of the dorsal horn.

They end on neurons in many Laminae of the grey matter of the spinal cord mainly **Lamina I & IV – VIII**

الاخضر مش مهم



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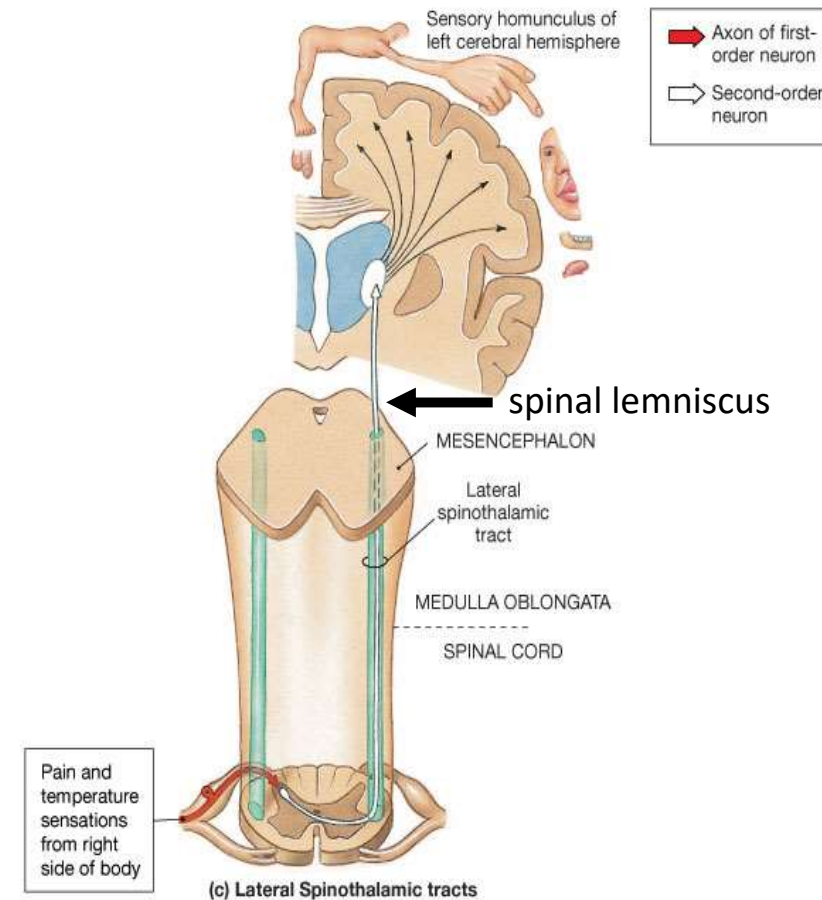
## Second neuron :

Neurons in Laminae I, IV-VIII of grey matter of spinal cord. Axons of these neurons cross to the opposite side in the ventral commissure & ascend in the lateral white column as the lateral spinothalamic tract. As the tract ascends, its fibers are laminated so that cervical fibers are most medially and sacral fibers most laterally.

The tract ascends in the brain stem as the **spinal lemniscus**.

It reaches the thalamus where it ends on **VPLN of thalamus**.

Third neuron : Axons of VPLN pass in posterior limb of internal capsule to reach sensory area



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# Ventral spinothalamic

- Carries touch and pressure, lies in anterior white column
- Begins from lamina IV- VII
- Cervical fibers are medial
- End on VPL

# Pathway of crude touch & pressure

**First neuron** : Peripheral processes of these cells carry touch & pressure from the receptors & Central processes of dorsal root ganglia enter spinal cord via dorsal root end on lamina IV-VII

## **Second neuron** :

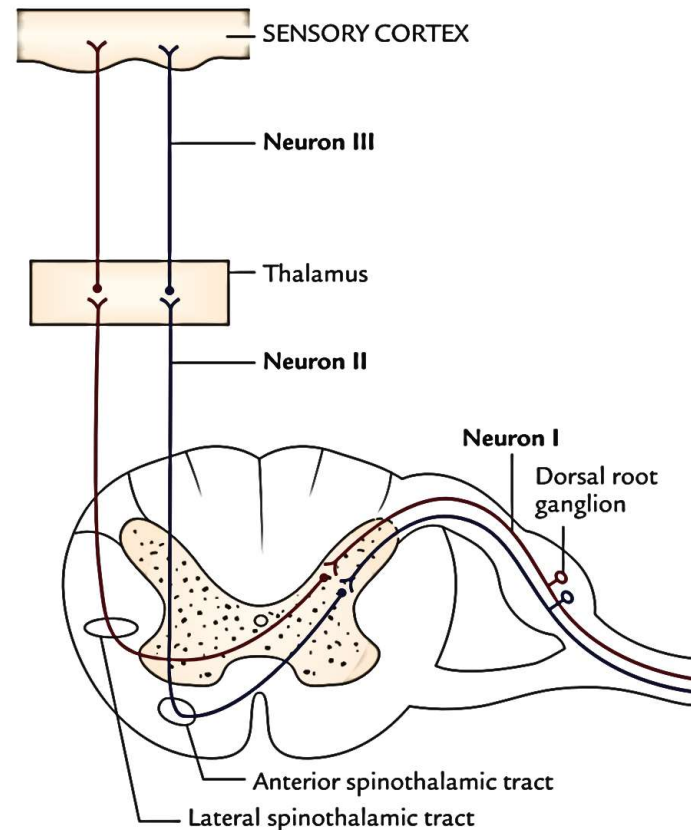
- Axons of lamina cross in ventral white column ascend as ventral spinothalamic tract, cervical fibers are medial
- Ascends in brain stem , joins medial lemniscus
- Reach VPL of thalamus

## **Third neuron** :

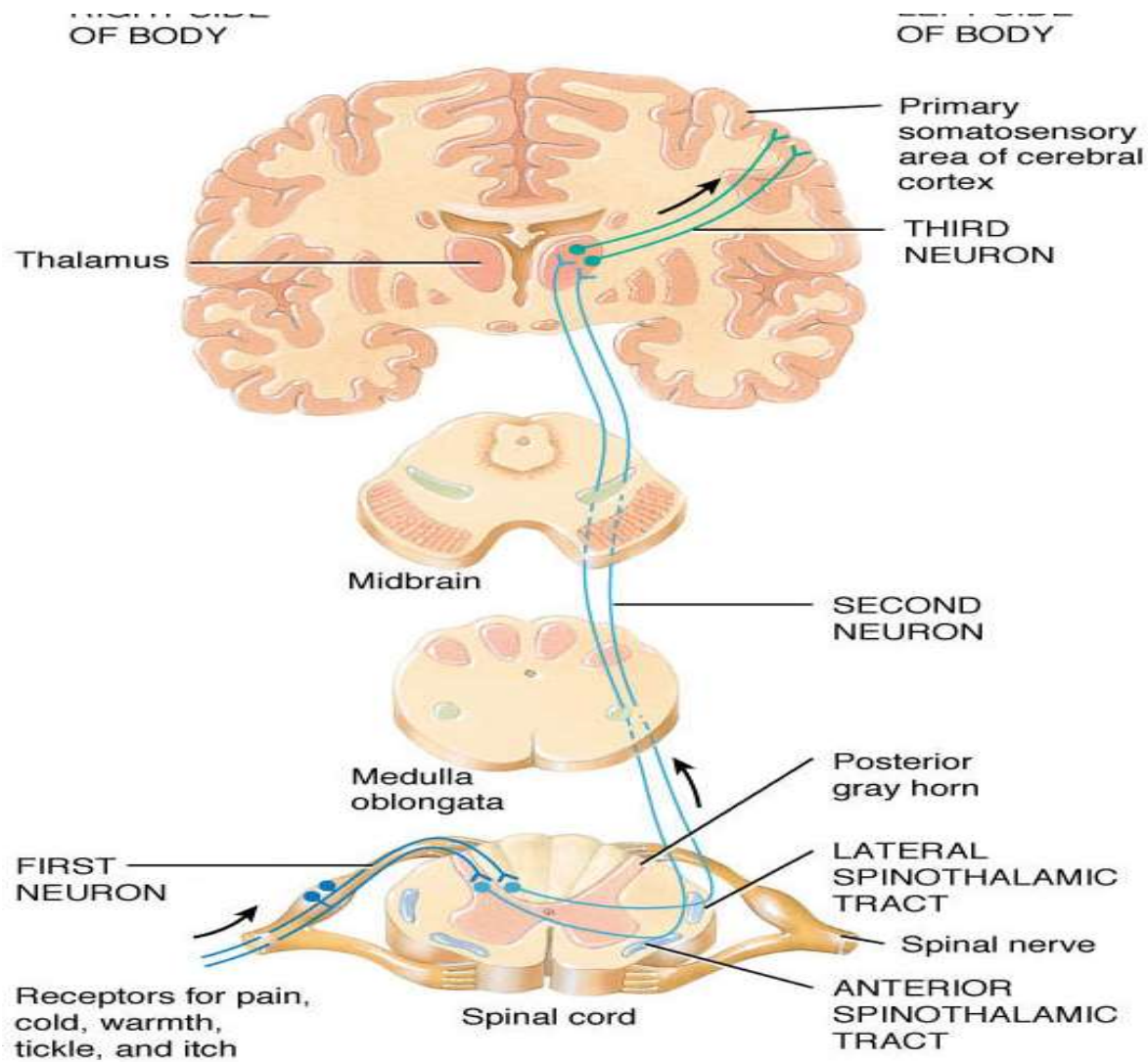
- fibers of VPL Pass in posterior limb of internal capsule
- Reach sensory area of cerebral cortex

- **Note: Not all spinothalamic fibers end on VPLN of thalamus, some fibers end on intralaminar nuclei and midline nuclei. These fibers are probably involved in arousal behavior.**

**Sacral fibers lateral and cervical fibers medial**







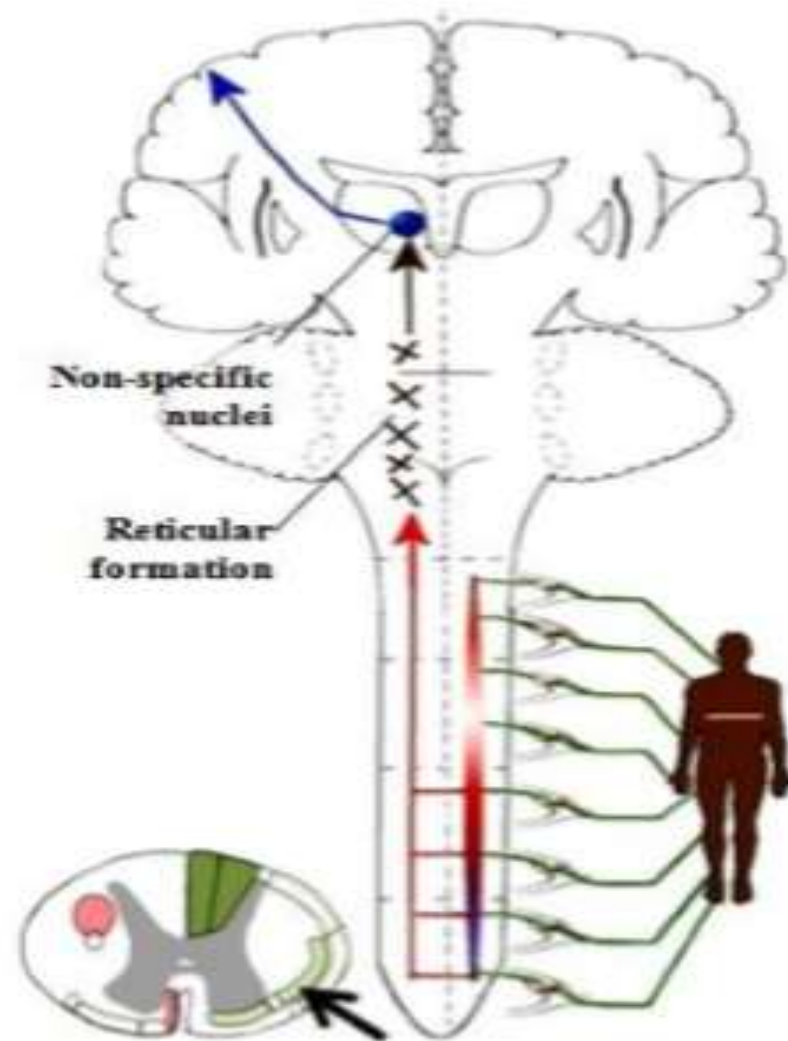
(b) Anterolateral (spinothalamic) pathways

وظيفته ينبهك وانت نايم مثلا لو وقعت من السرير او تعرضت لضربة او شي مثل هيك ويصحيك

## Other Ascending Tracts

### Spino- reticular

- In lateral & ventral white column
- Mostly crossed
- End in pontine and medullary reticular formation
- Route for slow dull pain

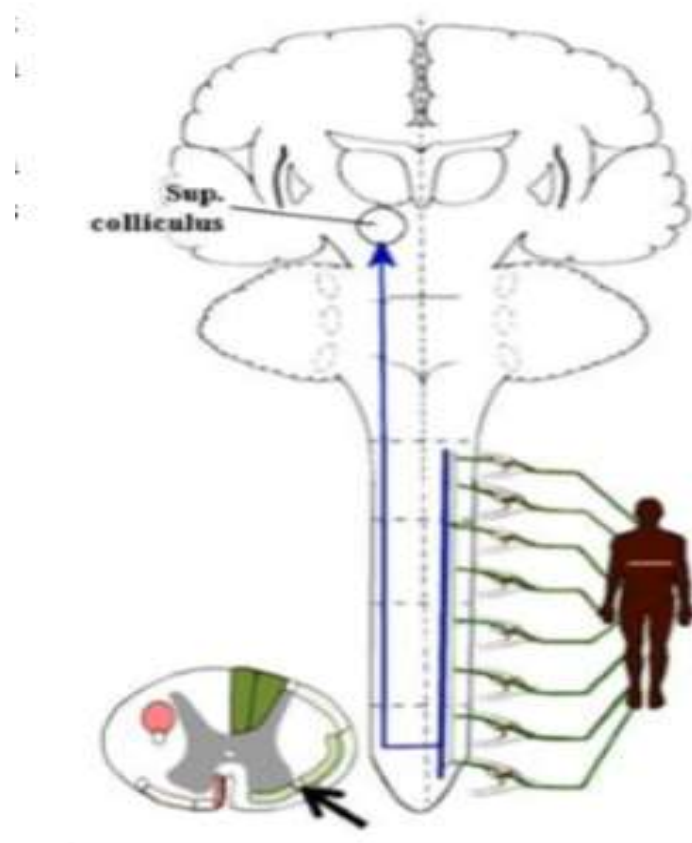


## Other Ascending Tracts

### Spino-tectal

- In lateral white column
  - mostly Crossed
  - End in superior colliculus of mid brain
  - Head turning towards source of pain

زي لما حد يضربك وانت مش منتبه بتلف وجهك تلقائي باتجاهه وهيك بكون ال stimulus عن طريق الجلد وممكن يكون يكون عن طريق النظر او السمع ( لما تسمع صوت خبطة او حادث بتلف عليه تشوف مصدر الصوت )



# Pain & temperature from the face

is carried by the **trigeminal nerve**.

1. **First Neuron** is **Trigeminal Ganglion** (formed of pseudounipolar cells as DRG)  
2. **Second Neuron** is **Spinal Nucleus of Trigeminal**. Its axons cross to opposite side forming **trigemino-thalamic tract** which ascends to end on the **ventral posteromedial nucleus (VPMN)** of thalamus

3. **Third Neuron** is VPMN of thalamus whose axons pass in **internal capsule**, then the corona radiata to reach sensory area of face in cerebral cortex.

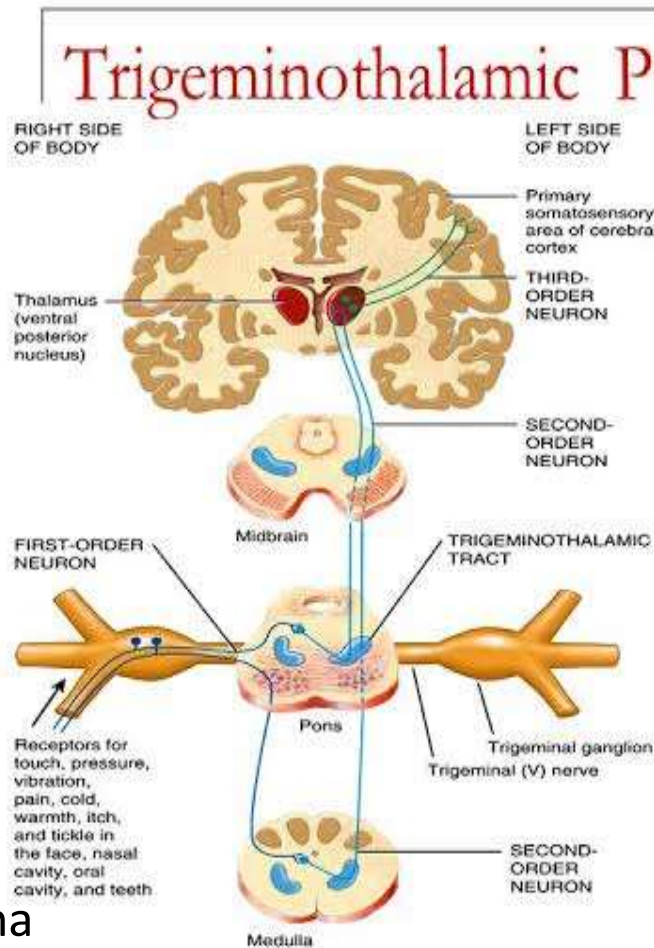


Figure 16.07 Tortora - PAP 12/e  
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Conveys nerve impulses for most somatic sensations from the face, nasal cavity, oral cavity and teeth to the cerebral cortex.

Thank you

رايحين لفين دانا الملك 👑🥁