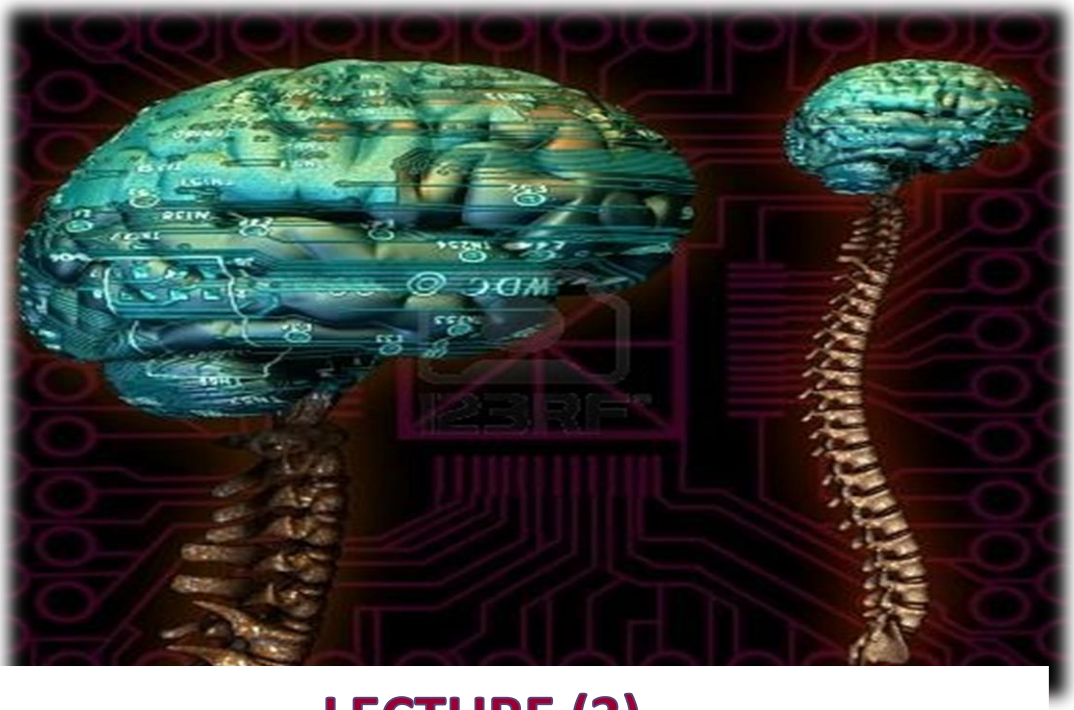
CNS Block



LECTURE (3)

ASCENDING SENSORY TRACTS

Done by: Noor Alzahrani

Reviewed by: Salman Al Hammad

تنويه : هذا العمل لا يعتبر مصدر رئيسي للمذاكرة وانما هو للمراجعه فقط

If there is any mistake please feel free to contact us:

Anatomyteam32@gmail.com

Both - Black

Male Notes - BLUE

Female Notes - GREEN

Explanation and additional notes - ORANGE

Very Important note - Red

Objectives:

- By the end of the lecture, the student will be able to:
- Define the meaning of a tract.
- Distinguish between the different types of tracts.
- Locate the position of each tract.
- Describe the sensory pathway.
- Identify the different sensory spinal tracts and their functions.
- Identify the course of each of these tracts.

-Column = FASCICULUS

-Short tract is **not** connected to the brain

-Crossed Axons of 2nd-ordered-nueron = Lemniscuses

*-Information reaches a **conscious level*** (the **cerebral cortex) > 3 orders of neurons**

*-Information destined for **subconscious centers*** (e.g. the **cerebellum**) > **2 orders of neurons**

-The ventral part of the Spinal cord has FISSURE "large groove" while the dorsal has a sulcus "line"

-FC is located **laterally to the Sulcus** while the FG is **medially to the Sulcus**

-S.C = Spinal cord

-B.S = brain stem

-non-discriminative = Crude touch

White matter consists of **Ascending** and **Descending Nerve Fibers**

White matter is divided into ***Dorsal, Lateral*** & ***Ventral Columns*** or **Funiculi**

WHITE MATTER TRACTS: **Bundles of fibers that occupy more or less definite positions in the white matter.**

They have the same **Origin, Termination** and carry the same **Function.**

They are classified into:

1- ***Short Tracts (intersegmental).***

2-Long Tracts: *They* serve to join the brain to the spinal cord.

A) Ascending (sensory or afferent).

B) Descending (motor or efferent). ***>> this point won't be discussed in this Lec.***

INTERSEGMENTAL "PROPRIOSPINAL" Tracts	
Definition	Fibers that occupy narrow band peripheral to the grey matter "FASCICULUS PROPRIUS" and interconnect adjacent or distant segments of the spinal cord and permit intersegmental coordination.
Location	They lie close to the grey matter

Ascending Tracts;

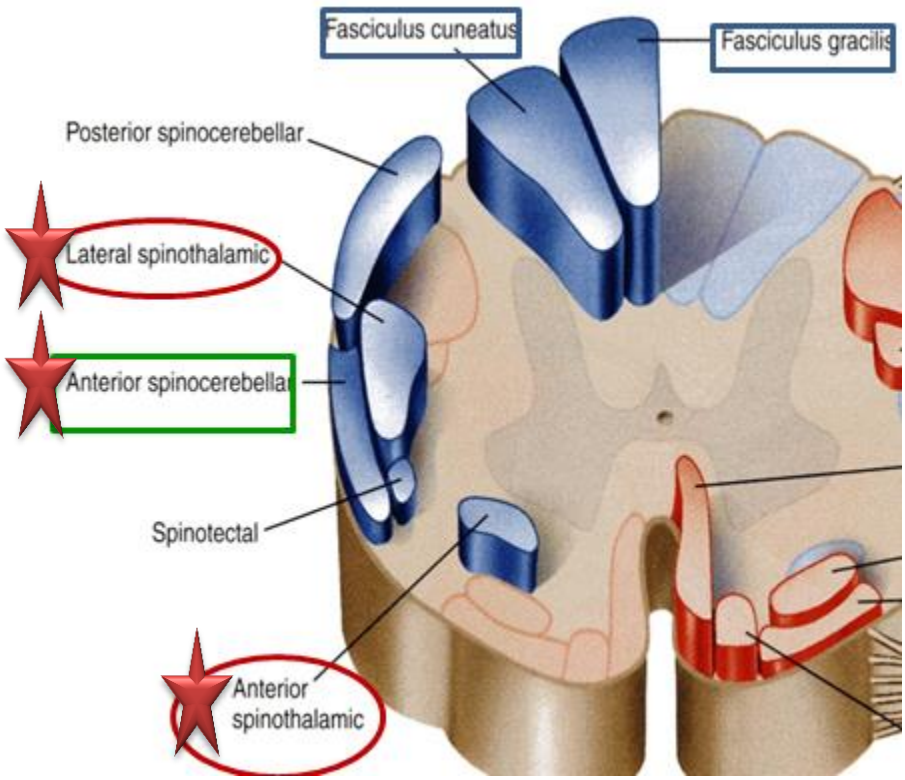
- Carry impulses from pain, thermal, tactile, muscle and joint receptors to the brain.

  يعتمد على اخر نقطة يصل إليها

- *Some of this information eventually reaches a **conscious level*** (the **cerebral cortex),**
- *while some is destined for **subconscious centers*** (e.g. the **cerebellum**).

NOW!

Let's study each tract ☺



Ascending "Sensory" Tracts *"reaches a **conscious level*** (the **cerebral cortex),"**

have common features:

-Pathways that carry information to a **conscious level** share certain common characteristics.

-There is a *sequence of* three *neurons* between the peripheral receptor and the cerebral cortex.

1st **The first-order neurone or primary afferent neurone)** enters the spinal cord through the **dorsal root** of a spinal nerve and its **cell body lies in the dorsal root ganglion**.

2nd The main fiber remains on the ipsilateral side of the cord and terminates in synaptic contact with **the second neurone** either in the spinal grey matter or in the medulla oblongata of the brain stem.

The **second order neurone** has its cell body in the ***cord*** or ***medulla oblongata.***

3rd Its axon crosses over (decussates) to the opposite side of the CNS and ascends to the ***thalamus,*** where it terminates upon the third neurone.

The **third-order neurone** has its cell body in the ***thalamus***. Its axon passes to the ***somatosensory cortex*** of the parietal lobe of the cerebral hemisphere.

الحزمة العصبية التي تصل الى الـ **"سيريبرال كورتكس"** تمر بـ 3 محطات "نواة" وهي على التالي :

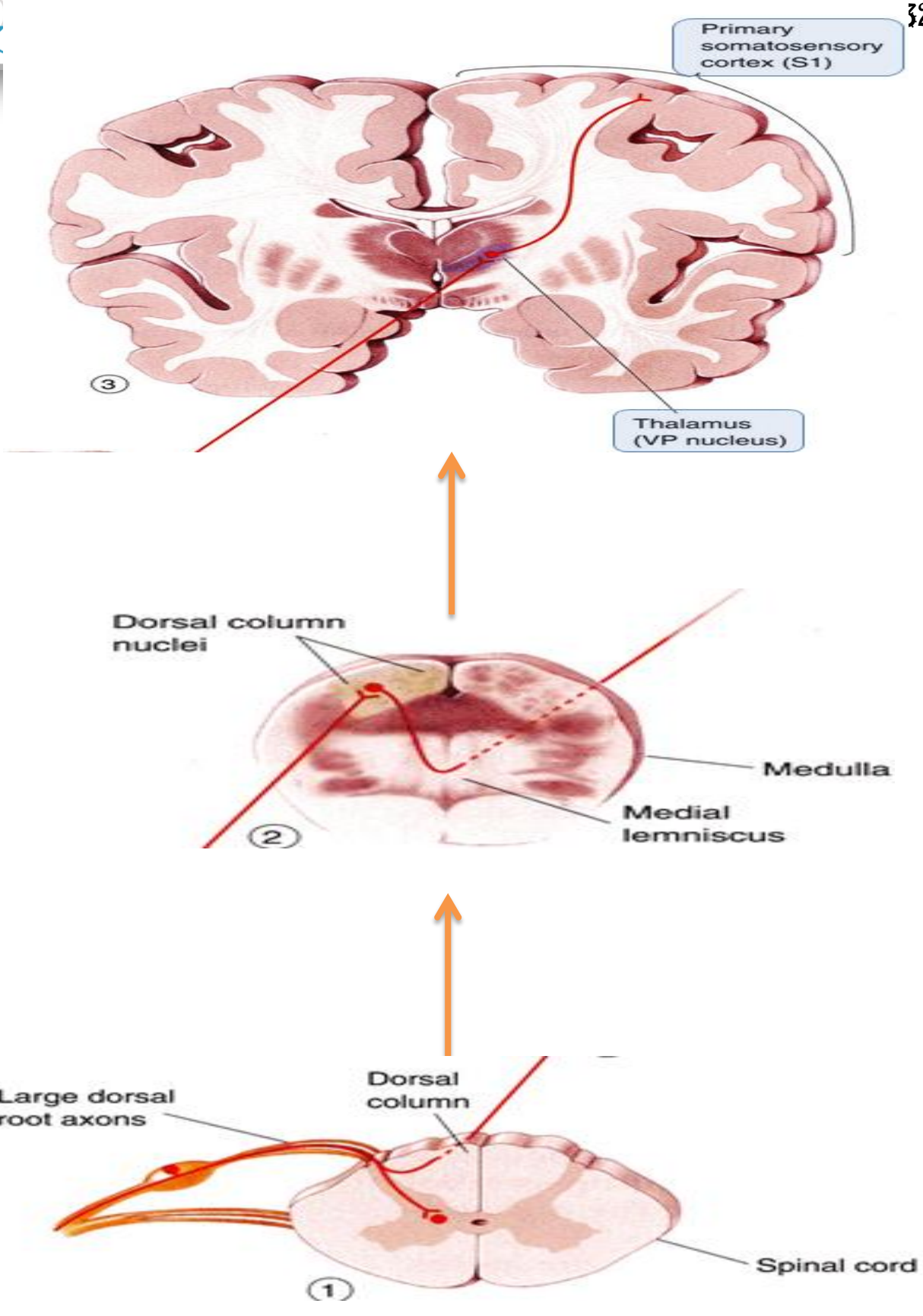
1- نواة الخلية العصبية الاولى خارج الحبل الشوكي وتدخل إليه عن طريق "الدورسال روت جانجليون"

2- تدخل الحزمة العصبية الحبل الشوكي ويحدث التشابك العصبي وهناك مساران اما ان تبقى الحزمة لتلتقي النواة الثانية في الجري ماتر او تصعد لتكون النواة الثانية في الميدولا اوبلونجاتا في البرين ستيم"

*بعد نواة الخلية العصبية الثانية تصعد الحزمة ليحدث الـ كروسينج > اذا دخلت من اليمين بتتحول وتلف لجهة اليسار

هي عبارة عن الاكسون الى طالع من النواة الثانية Lemniscuses

3- الوصول الى الثالاموس وهي نواة الخلية العصبية الثالثة , اما الاكسون فيمتد الى الـ "الباريتال لوب"


Primary somatosensory cortex (S1)
Thalamus (VP nucleus)
3
Dorsal column nuclei
Medulla
Medial lemniscus
2
Large dorsal root axons
Dorsal column
Spinal cord
1

- Three main tracts carry sensory information :

القاعدة السابقة عامة ، اما بالنسبة للاحساس الواعي الذي يصل الى الكورتكس فهناك 3 مسارات ندرسها وهي مشابهة للقاعدة السابقة لكن الاختلاف في نواة الخلية العصبية الثانية

1- Dorsal (posterior) column "Gracile & Cuneate fasciculi"

2- Anterolateral pathway "Spinothalamic"

3- Spinothalamic tracts.

1- Dorsal (posterior) column: (reaches a conscious level)

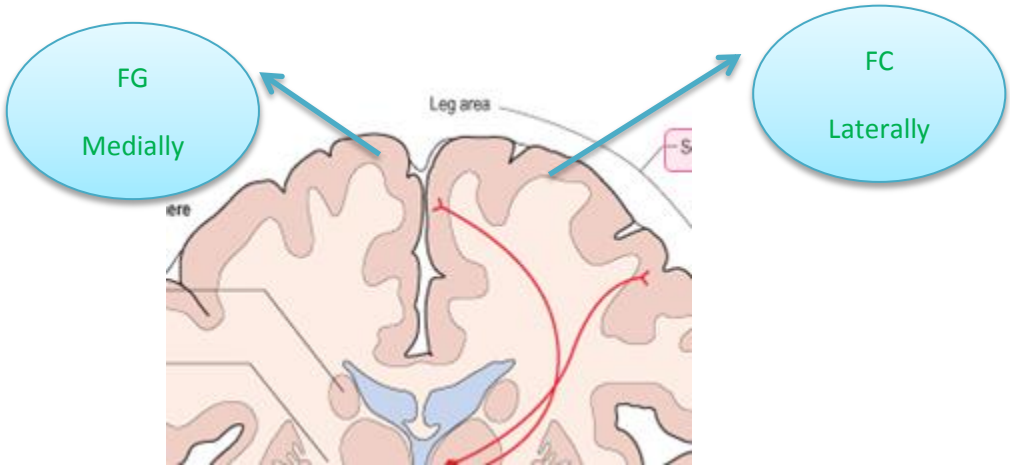
Contains 2 tracts: *FG "Fasciculus Gracilis" & *FC "Fasciculus Cuneatus"

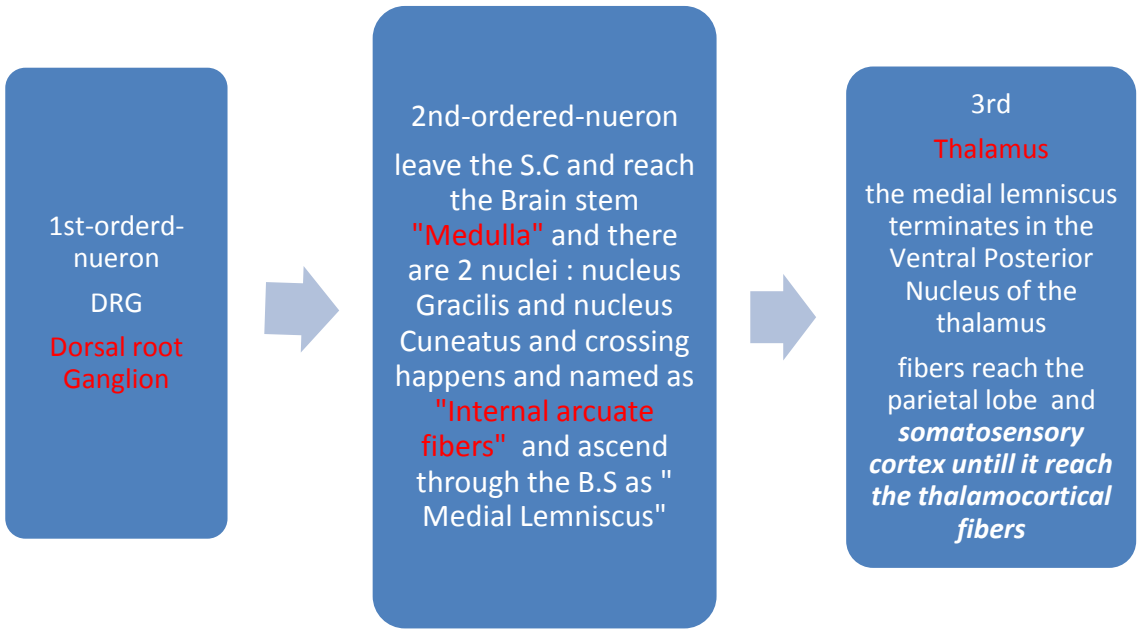
Function: Carry proprioceptive (deep) & fine touch sensations to sensory area of the cerebral cortex from ipsilateral (same) side of the body. المقصود انها مسؤولة عن لمس الاشياء والتعرف عليها بدون النظر

The dorsal column contains the ***axons of the neurons*** that have entered the cord through the dorsal roots of spinal nerves.

Fibers of Fasciculus Gracilis enter via the ***sacral, lumbar and lower thoracic levels; (lower limbs).***

Fibers of Fasciculus Cuneatus enter via the ***upper thoracic and cervical levels; (upper limbs).***





Medial Lemniscus = "Internal arcuate fibers" = Axons of the 2nd order-neurons of Gracilus and Cuneatus

-sensory decussation (crossing over)= moving from ipsilateral side to contralateral side- (in this case it happens at the medulla)

Medial lemniscus = Reil's band = Reil's ribbon

2- Spinothalamic tracts (reaches a conscious level)

SPINOTHALAMIC	Lateral	Ventral
Function	***pain and temperature***	**crude *touch and pressure***
Neuron 1	**Small cells** in the dorsal root ganglia	**Medium sized** cells in the dorsal root ganglia.
Neuron 2	**substantia gelatinosa of Rolandi in the tip of dorsal horn.**	Cells of main sensory nucleus or **(nucleus proprius) deeper than the tip**
Neuron 3	Cells of **(VP) nucleus of the thalamus.**	Cells of VP nucleus of thalamus.
	2nd-order-nueron has cell bodies that lie in the contralateral dorsal horn	Effect of lesion= loss of crude touch below level of lesion

Both Ventral and lateral spinothalamic fibers decussate to become a spinal lemniscus

If injury happens to the tip of posterior horn of S.C, which type of sensation will be loss?? PAIN & TEMP of same side.

- (Neuron 2) decussates at the same level on the anterior white commissure of the spinal cord then ascends

> ***Syringomyelia**, (widening of the central canal) leads to Loss of **pain & temperature** below the level of the lesion.*
>
> *After leaving the parent cell bodies, spinothalamic axons decussate to the opposite side of the cord by passing through the **ventral white commissure,** which lies ventral to the central canal of the cord, and, thus, enter the contralateral spinothalamic tract.*

3- Spinocerebellar tracts (subconscious area)

The spinocerebellar system consists of a *sequence of **only two neurons**.*

- **Neuron I: Large cells of dorsal root ganglia.**
- **Neuron II: cells of the nucleus dorsalis (Clark's nucleus) deeper to the large**

*Fibers of spinocerebellar tracts form **dorsal** and **ventral tracts** that are located near the dorsolateral & ventrolateral surfaces of the cord, respectively.

* Both tracts carry information derived from *muscle spindles, Golgi tendon organs and tactile receptors* to the cerebellum for the **control of posture & coordination of movement.**

*contain axons of 2nd-orderd-nueron

بعد ما يعمل ريلاي, نواة الخلية العصبية الثانية من السباينل كورد الي من اليمين مثلا يطلع مباشرة الى السيريبيللم لنفس الجهة "يمين" وبعدها تطلع فايبرز "انفيريور سيريبلار بيدنكيل"

A) Dorsal Direct Spinocerebellar tract

***present only above level L3**

*cell bodies of 2nd-nueron-order- lie in Clark's column

*The axons ascend ipsilaterally to enter the cerebellum through the **inferior cerebellar peduncle**

* **Direct Spinocerebellar tract convey sensory information to the same side of cerebellum**

B) Ventral (Indirect) Spinocerebellar Tract

*The cell bodies of 2nd order neuron lie in base of the dorsal horn of the lumbosacral segments

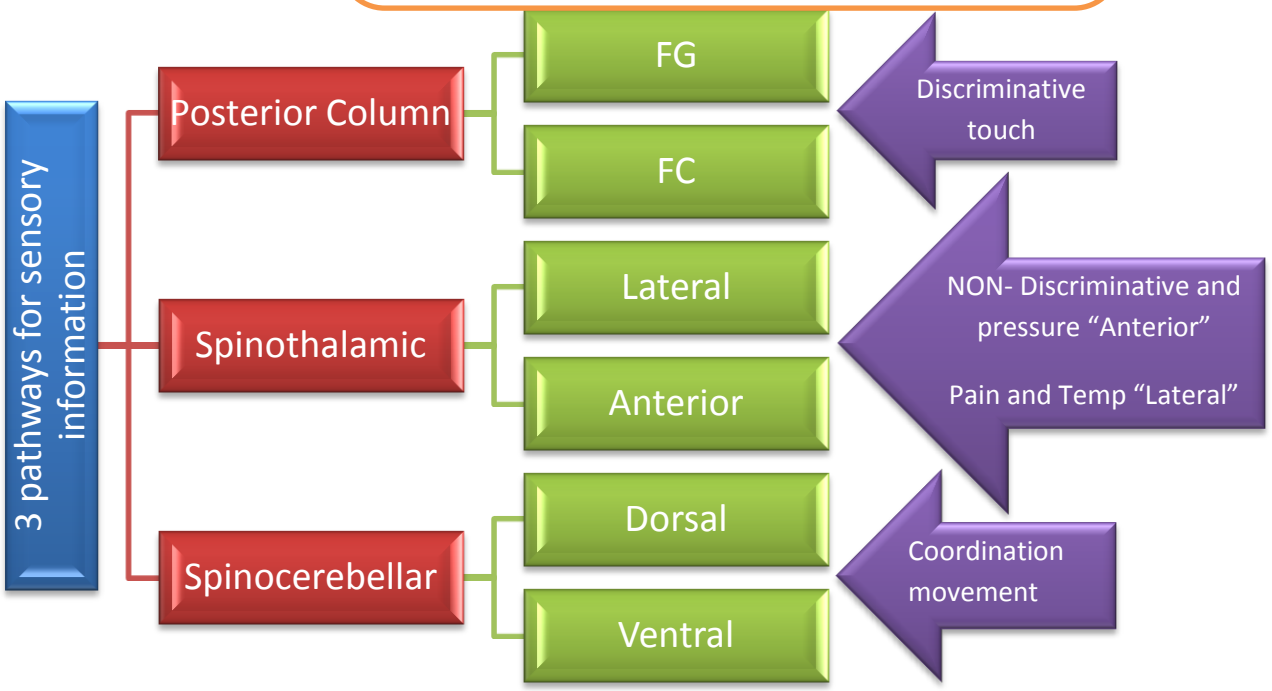
*Axons of 2nd order neuron **cross to opposite side, asc**end as far as the midbrain, and then make a sharp turn caudally and enter the **superior cerebellar peduncle.**

*The fibers cross the midline for a second time within the cerebellum before terminating in the cerebellar cortex

*Ventral spinocerebellar tract convey sensory information to the same side of the cerebellum

بعد ما يعمل ريلاي, نواة الخلية العصبية الثانية من السباينل كورد الي من اليمين مثلا ما يطلع مباشرة الى السيريبيللم, لا ! يسوي كروس قبل مايروح للبرين ستيم وبعدها تطلع فايبرز "سوبريور سيريبلار بيدنكيل" وتعمل كروس ثاني ويرجع للجهة الاساسية "اليمين"

لتصل الى الميدولا



**Spinotectal Tract

- Ascends in the anterolateral part, in close association with spinothalamic system.
- Primary afferents reach dorsal horn through dorsal roots and terminate on 2nd order neurons
- The cell bodies of 2nd order neuron lie in **base of the dorsal horn**.
- Axons of 2nd order neuron cross to opposite side, and project to the periaqueductal gray matter and **superior colliculus in the midbrain**.
- **Involved in reflexive turning of the head and eyes toward a point of cutaneous stimulation.**

مسؤول عن تحريك الرقبه والراس والعين باتجاه المؤثر ' مثل التعرض لضربة من الخلف , فورا يلتفت الانسان للخلف

**Spino - olivary Tract

***Indirect spinocerebellar pathway (spino-olivo-cerebellar)**

***Impulses from the spinal cord are relayed to the cerebellum via inferior olivary nucleus.**

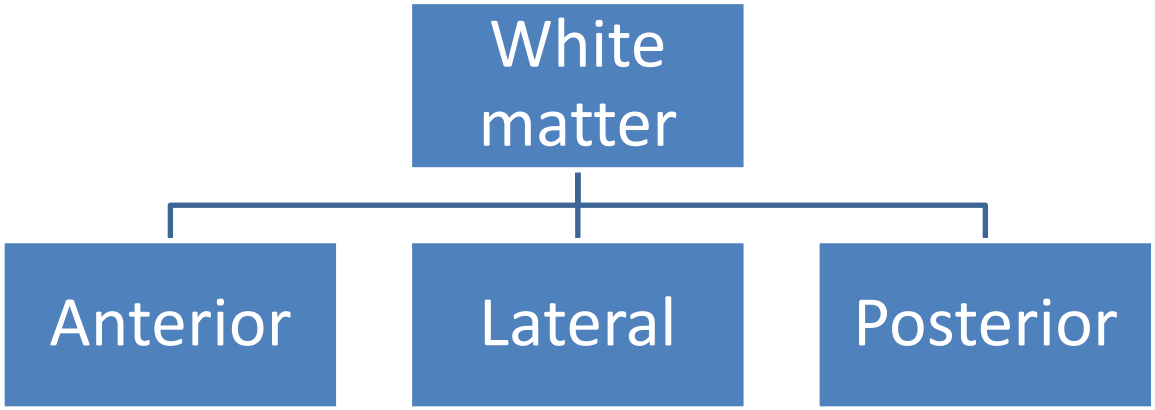
***Conveys sensory information to the cerebellum.**

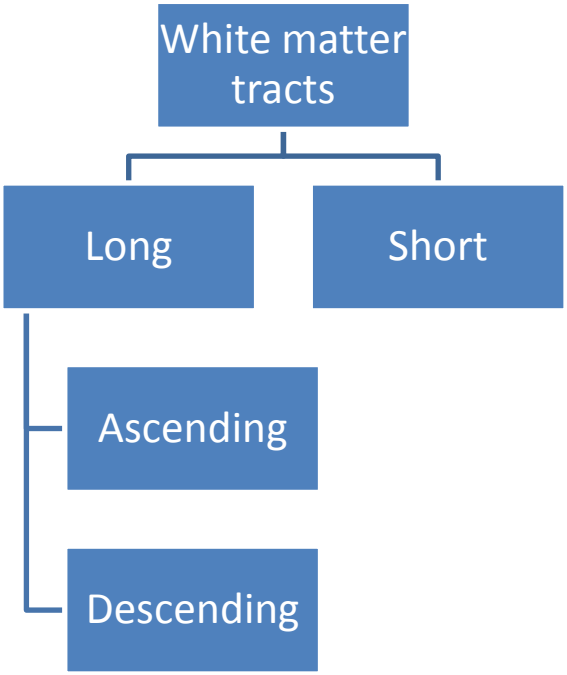
*Fibers arise at all levels of the spinal cord.

*Contribute to movement coordination associated primarily with balance.

**Spinoreticular Tract

- Originates in laminae IV-VIII
- Contains uncrossed fibers that end in medullary reticular formation &
- Crossed & uncrossed fibers that terminate in pontine reticular formation. (of brain stem)
- Forms part of the ascending reticular activating system.
- Involved in arousing consciousness in the reticular activating system through cutaneous stimulation. (dull –ache- pain not sharp pain)





MCQs:

1- Intersegmental coordination is a feature of which tract?

A. Spinothalamus

B. Spinotectal

C. Short tract

2-Axons crossed after the 2nd-nueron is ……

A. Lemniscus

B. Funiculi

C. Column

3-Which one does not reach the Thalamus?

A. Posterior column (Gracile & Cuneate fasciculi)

B. Anterolateral pathway (Spinothalamic)

C. Spinocerebellar pathway

4- FG & FC are concerned with ……

A. pain

B. pressure

C. discriminative touch

5- Syringomyelia leads to loss of _____ below the level of the lesion:

A. Crude touch & Pressure

B. Pain & Temperature

C. Fine touch & Temperature

Q	A
1	C
2	A
3	C
4	C
5	B

GOOD LUCK

Anatomy Team Leaders:

Fahad AlShayhan & Eman AL-Bediea.