بسم الله الرحمن الرحيم

إخواني الطلاب ، أخواتي الطالبات:

This is Dr.mujeeb lecture about sensory tracts & somatosensory cortex

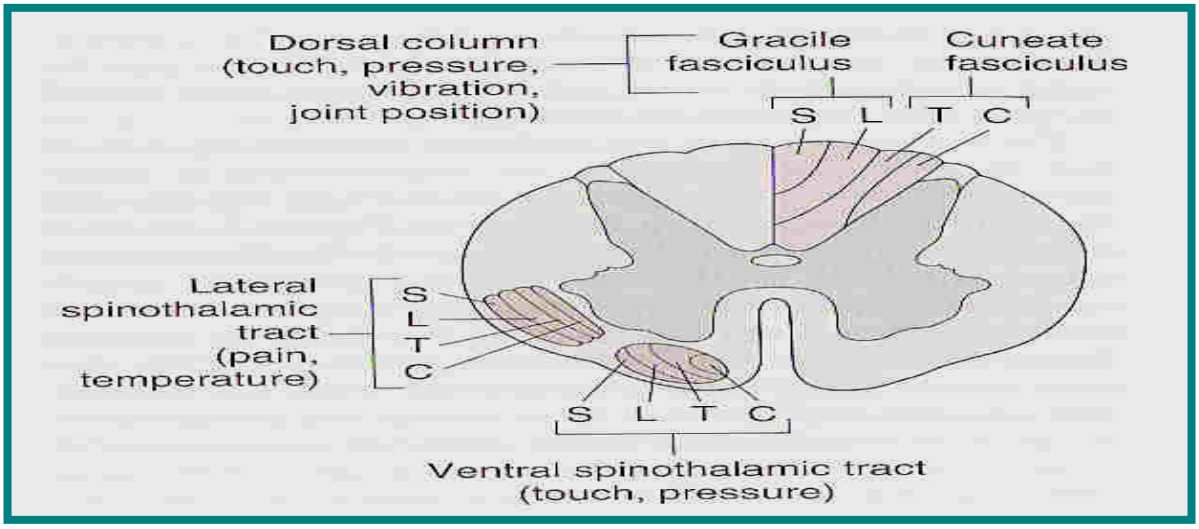
قد قمنا بإعادة تنظيم المعلومات فيها ومحاولة توضيحها ، طبعا لم نحذف أي معلومة من السلايدات بل أضفنا وعدلنا بعض المصطلحات لتصبح أسهل للمذاكرة ، أضفنا بعض الصور التوضيحية وملخص في آخر كل جزء

ناسف على التأخير ونتمنى لكم التوفيق

الدكتور / شهيد تكلم عن نفس الموضوع

PSL team

Introduction



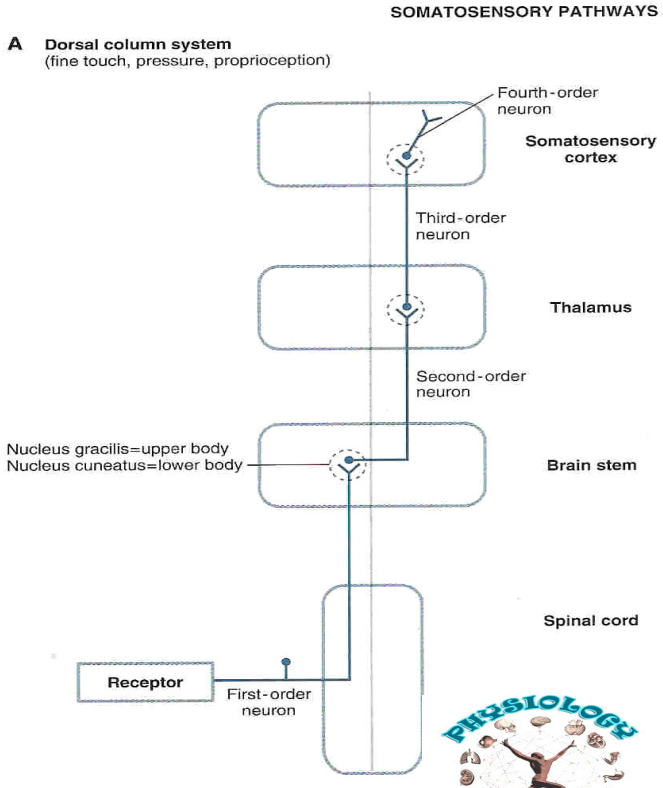
- from the figure : we can say that we have 2 sensory tracts:

  1- dorsal column tracts (lemniscal system): which is consisting of :

  a. gracile fasciculus
  b. cuneate fasciculus

  2. Anterolateral System (Ventral & lateral spinothalamic tracts)

☑ The dorsal column tract :



♣ Characteristics:

- Types of fibers : myelinated type Aβ

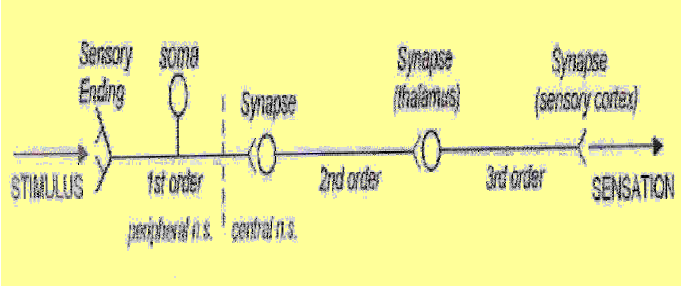
- The pathway contains 3 order neurons

♣ Functions:

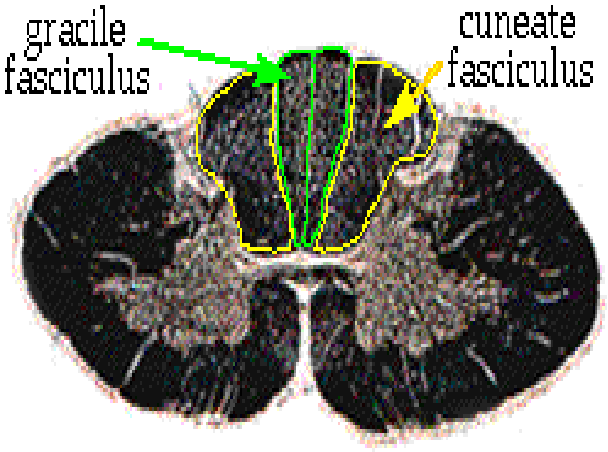
1- fine touch sensation
2- fine pressure sensation
3- vibration sensation
4- conscia peoprioceptia
5- strereognosis

1st order neurons:

- Afferent fiber enters the spinal cord & they terminate at the dorsal column nuclei (gracile & cuneate) which is present in medulla oblingata



✓ Note: the axons are arranged in a way that the distal parts of the lower leg run more *medially* while those from proximal parts run *laterally*



Therefore :

a. sacral & lumbar is located in the gracile part

b. thoracic & cervical is located in the cuneate part

2nd order neurons :

- They originate in gracile & cuneate nuclei of medulla , give rise to axon which forming sensory decusation , they pass up wall as medial lemniscus which end in the thalamus.

3rd order neurons :

- These arise from the thalamus & pass in the opposite limb of intrnal capsule to somatosensory cortex in the centragyri.

☑ Anterolateral System :

- It contains 2 types of nerve fibers:

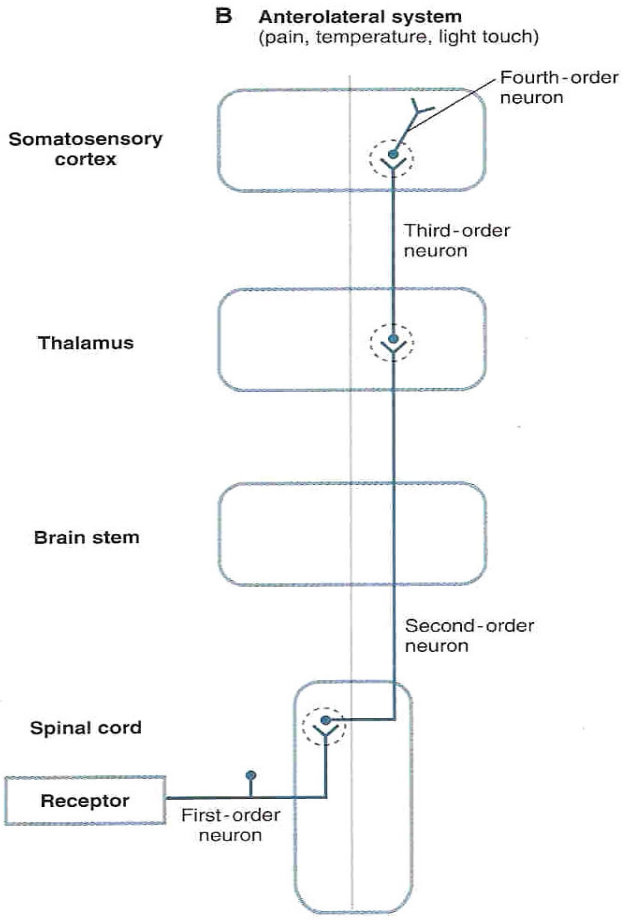
    a. Type A nerve fibers (excessive myelination, fast conduction).
    b. Type C nerve fibers (unmyelinated, slow conduction).

- Has 3 <u>main</u> order neurons (stations):

    a) 1st order neurons (receptors to spinal cord).

    b) 2nd order neurons (spinal cord to thalamus).

    c) 3rd order neurons (thalamus to somatosensory cortex).



- ⌖ In this system, the order neurons synapse at the same level of a certain place of the body.

- ⌖ The nerve fibers cross the midline to the opposite side (shown in previous figure) in front of the central canal and ascend along the anterolateral cord as:

    - o Lateral spinothalamic tract (carries pain and temperature sensations)

    - o Ventral spinothalamic tract (carries crude touch, pressure and sexual sensation)

- After synapsing in the thalamus, 2nd order neurons ascend to the thalamus then by sending axons which ascend along the posterior limb of the internal capsule and finally reaching the somatosensory cortex where another synapse occur that give 3rd order neurons.

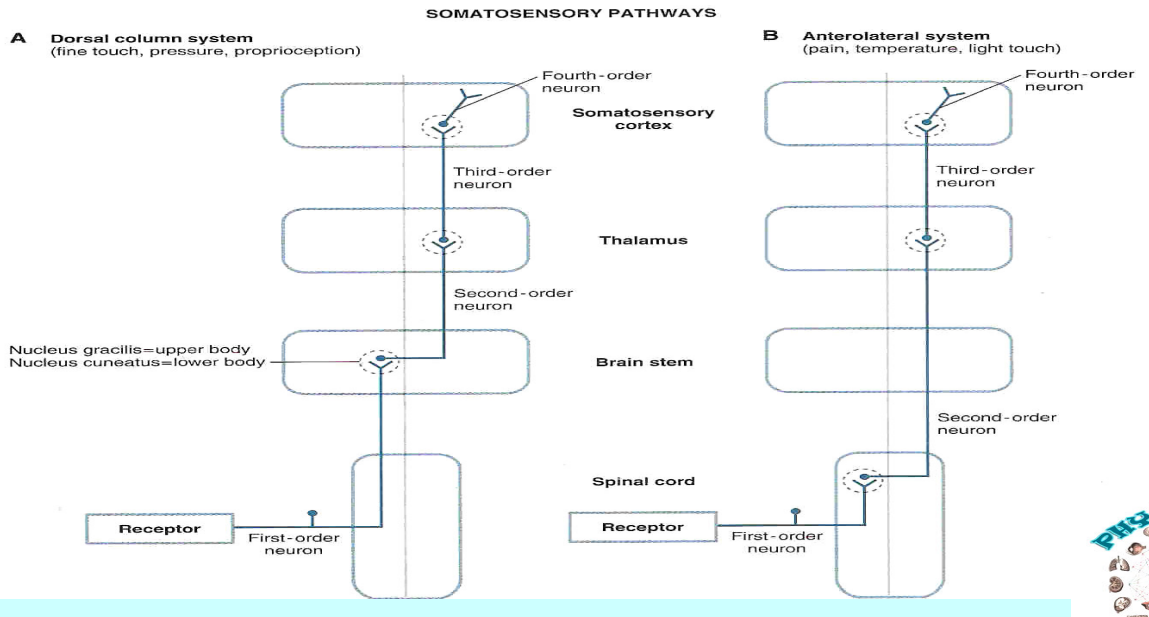
♣ Functions of the anterolateral sensory system:

1. Pain.
2. Temperature.
3. Crude touch and pressure.
4. Tickling and itching.
5. Sexual sensations.

Comparison between the two systems:

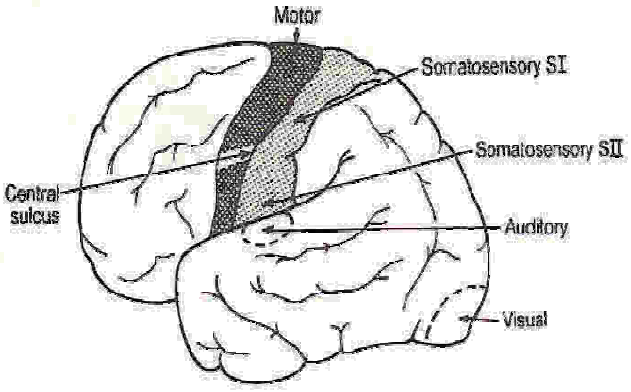
Dorsal Column Pathway	Anterolateral Pathway
• Carries fine touch, position, pressure, vibration, two point discrimination and stereognosis	• Carries pain and temperature (lat. Sp.Th) • Carries crude touch and pressure (vent. Sp. Th)
• Afferent sensory fibers Aβ type	• afferent sensory fibers a. Aδ (myelinated and fast) b. C fibers (unmyelinated and slow)
• Very fast velocity 30 – 70 m/s	• Relatively slow velocity Aδ – 6 – 30 m/s. C – 0.5 – 2 m/s
• 3 neuron system	• 3 neurons system

- note that the fibers in both systems end in the somatosensory cortex.



THE SOMATOSENSORY CORTEX

- It is the part of the cerebral cortex in which all sensory signals are projected and analyzed.



- It has 2 main parts:
  A. Somatosensory area I (the main area)
  B. Somatosensory area II

Somatosensory area I (SI):

- It is the main sensory area which lies in the post-central gyrus.
- It corresponds to Broadmann's area no.1, 2 and 3.
- The body is represented upside down in this area (legs on top and head on bottom of the gyrus)
- The size of the sensory area for each part of the body is directly proportional to the number of specialized sensory receptors in each respective peripheral area of the body.
- It receives sensory information from the contralateral (opposite) part of the body.
- The cortex is made up of six layers. The incoming sensory signal excites neuronal layer 4 first and then the signal spreads both towards the surface of the cortex and towards the deeper layers.
- Functionally the neurons of the somatosensory cortex are arranged in vertical columns (e.g. sacral column, thoracic column)
- Each of these columns severs a single specific sensory modality.

Somatosensory area II (SII):

- It is present in the wall of the sylvian fissure.
- The localization is poor when compared to SI.
- The face is represented anteriorly, the arms centrally and the legs posteriorly.
- Note that an ablation of SI results in deficits in sensory processing in SII, whereas ablation of SII has no gross effect on the processing in SI.

Somatosensory association areas:

- Situated in Brodmann's area no. 5 and 7 of the central cortex located in the parietal cortex behind SI area.
- It plays an important role in translating and understanding the meaning of the sensory information that enters the somatosensory areas.
- When damaged it loses the ability to recognize complex objects on the opposite side of the body (e.g. apraxia: loss of the ability to perform intentional motions, sensory inattention: inability to concentrate at two objects at the same time)

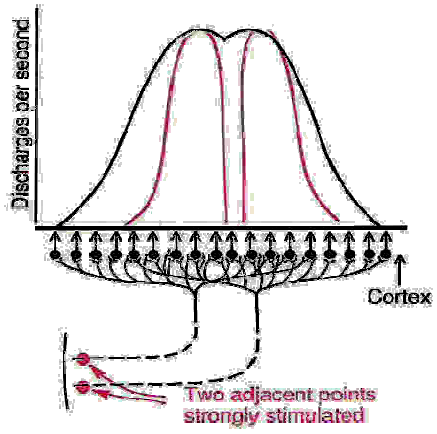


Figure 47–10. Transmission of signals to the cortex from two adjacent pinpoint stimuli. The solid black curve represents the pattern of cortical stimulation without "surround" inhibition, and the two colored curves represent the pattern with "surround" inhibition.

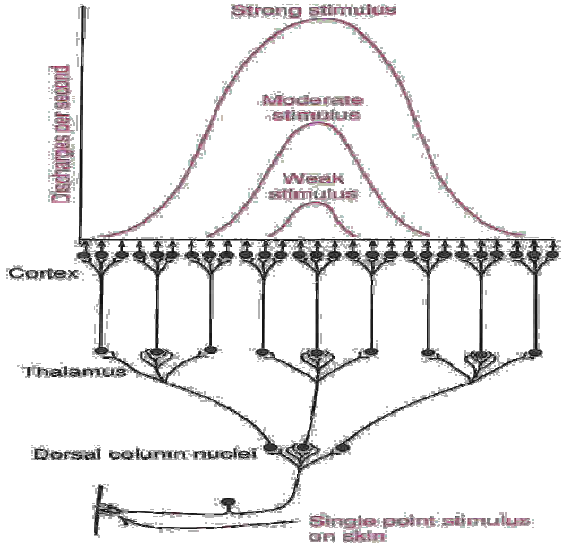


Figure 47–9. Transmission of a pinpoint stimulus signal to cortex.

The sensory modalities represented by the somatosensory systems

Modality	Sub Modality	Sub-Sub Modality	Somatosensory Pathway - Body	Somatosensory Pathway - Face
Pain	sharp cutting pain		Neospinothalamic	Spinal Trigeminal
	dull burning pain		Paleospinothalamic	
	deep aching pain		Archispinothalamic	
Temperature	Warm/hot		Paleospinothalamic	
	cool/cold		Neospinothalamic	
Touch	itch/tickle & crude touch		Paleospinothalamic	
	discriminative touch	Touch	Medial Lemniscal	Main Sensory Trigeminal
		Pressure		
		Flutter		
		Vibration		
Proprioception	Position: Static Forces	Muscle length		
		Muscle tension		
		Joint pressure		
	Movement: Dynamic Forces	Muscle length		
		Muscle tension		
		Joint pressure		
		joint angle		