



إِنَّ اللَّهَ

وَمَلَائِكَتَهُ

يُصَلُّونَ عَلَى النَّبِيِّ

يَا أَيُّهَا الَّذِينَ ءَامَنُوا صَلُّوا عَلَيْهِ

وَسَلِّمُوا تَسْلِيمًا

سورة الأمزاب

٥٦

GHAJARALFI

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





Mike Keefe THE DENVER POST 8.20.10



# Ascending Pathways- The Spinothalamic Tract

DR SARAH SHAHID

ASSISTANT PROFESSOR

FCPS MEDICINE

MPHIL PHYSIOLOGY SCHOLAR

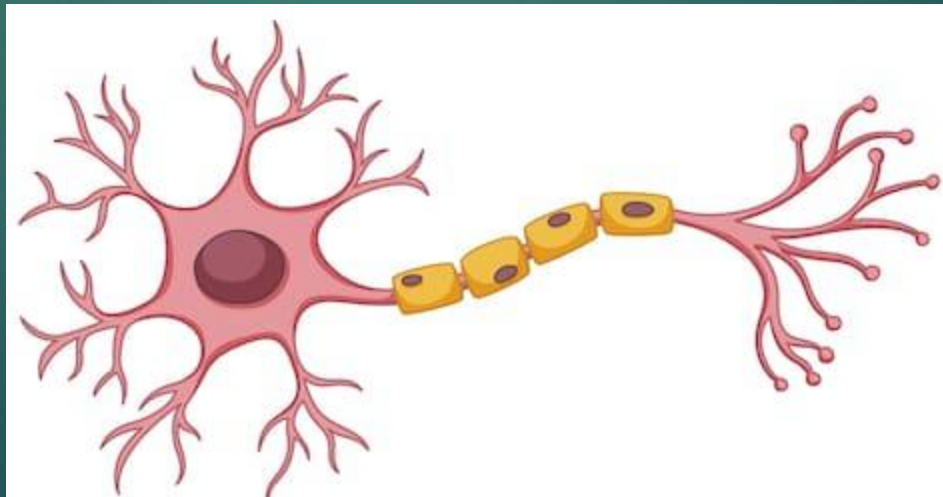
# Learning Objectives

At the end of this lecture the students should be able to:

- ▶ Enumerate the Ascending tracts responsible for carrying different type of sensations.
- ▶ Describe the formation, course & functions of each tract.
- ▶ Explain the Lesions associated with these Tracts

# Recap the previous lecture...

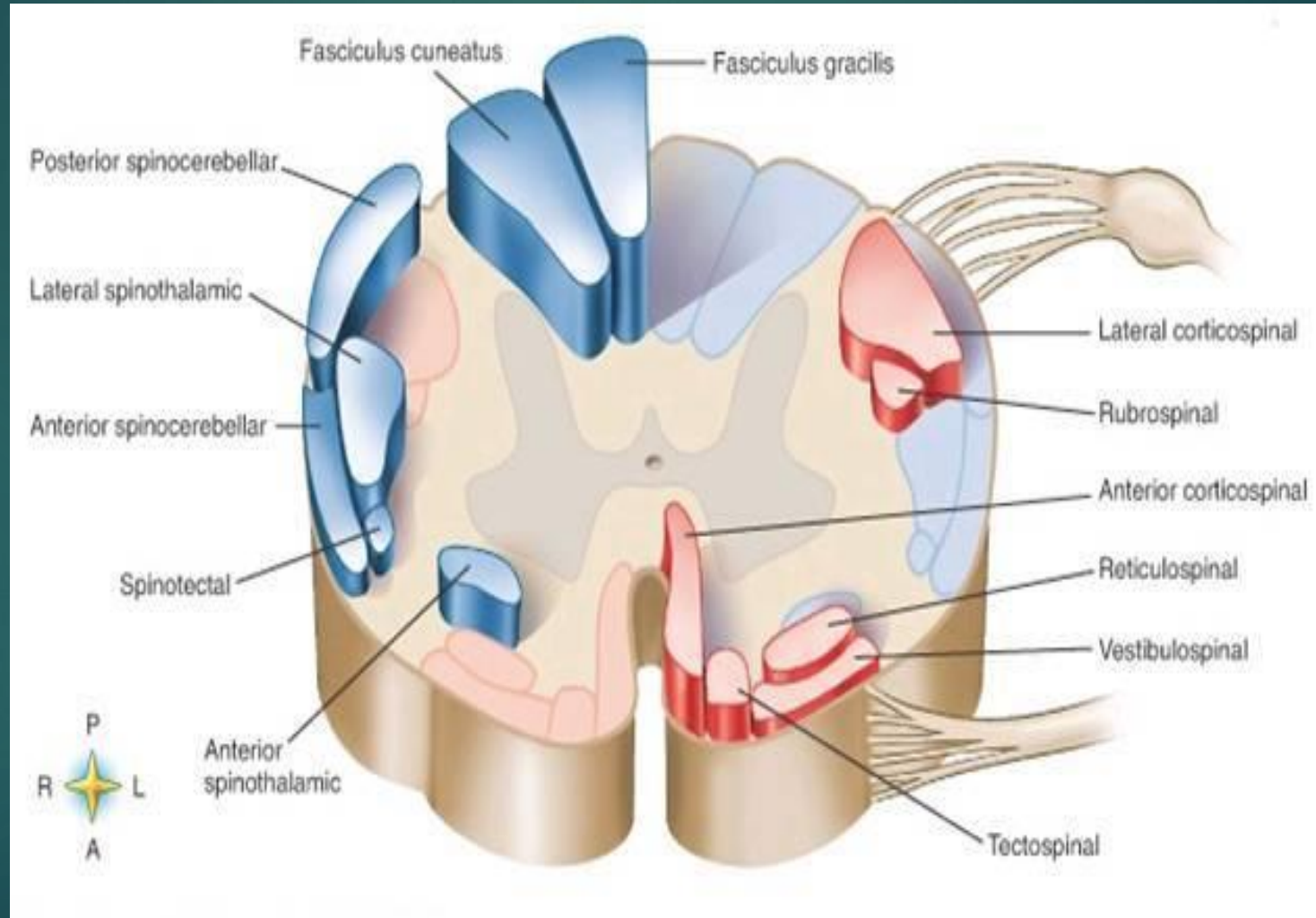
- Ascending tracts
- Dorsal column
- Lesions of dorsal column



# Ascending Pathways:

- 1. Dorsal column-medial Lemniscal System**
  1. Fasciculus Gracilus (Medial)
  2. Fasciculus Cuneatus (Lateral)
- 2. Antero-lateral system (Spino-thalamic)**
  1. Anterior Spinothalamic Tract
  2. Lateral Spinothalamic tract
- 3. Spinocerebellar tracts**
  1. Dorsal
  2. ventral
4. Spino-tectal, Spino-olivary, Spino-Vestibular tracts

# Transverse section of Spinal cord showing Ascending & Descending Tracts





# The Anterolateral System

The Anterolateral system consists of two separate tracts:

- ▶ **Anterior spinothalamic tract**

carries the sensory modalities of crude touch and pressure

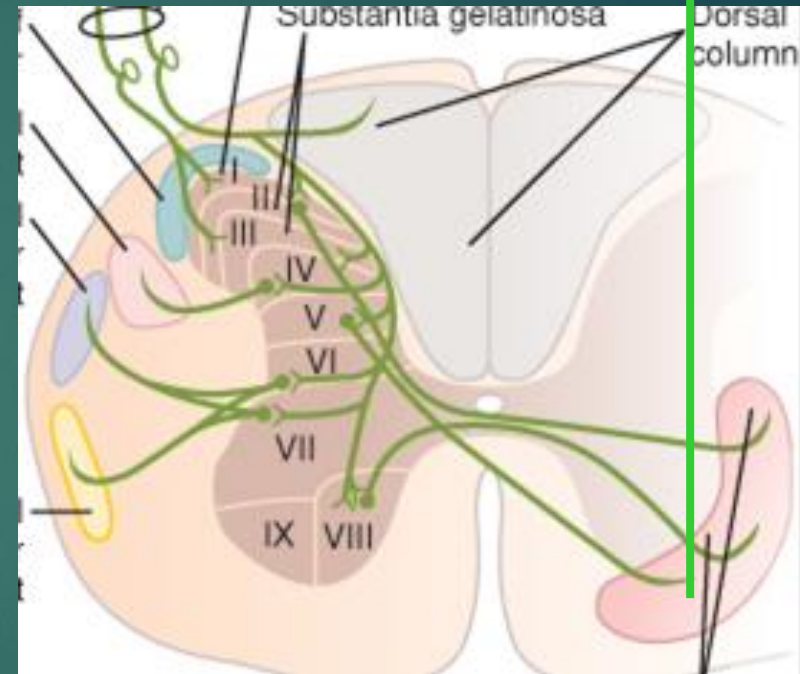
- ▶ **Lateral spinothalamic tract**

carries the sensory modalities of pain and temperature.

# Antero-Lateral Pathway

## Types of Sensations Carried:

- Crude touch & Pressure
- Pain
- Thermal sensations  
Heat & Cold
- Tickle & Itch
- Sexual Sensations



## Descending Tracts (Motor)

Lateral Corticospinal Tract  
main voluntary motor  
upper extremity motor  
pathways are more medial  
(central)

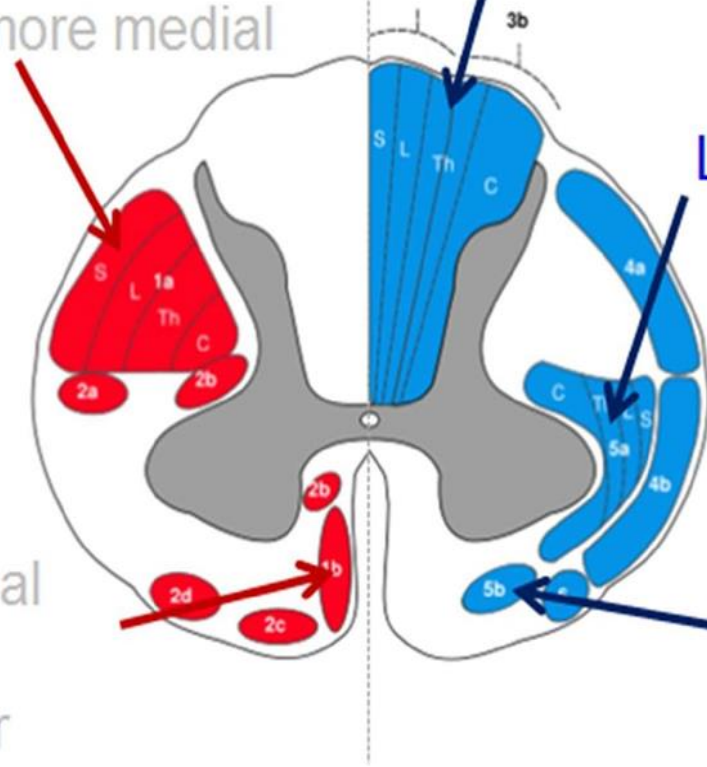
Ventral Corticospinal  
Tract  
voluntary motor

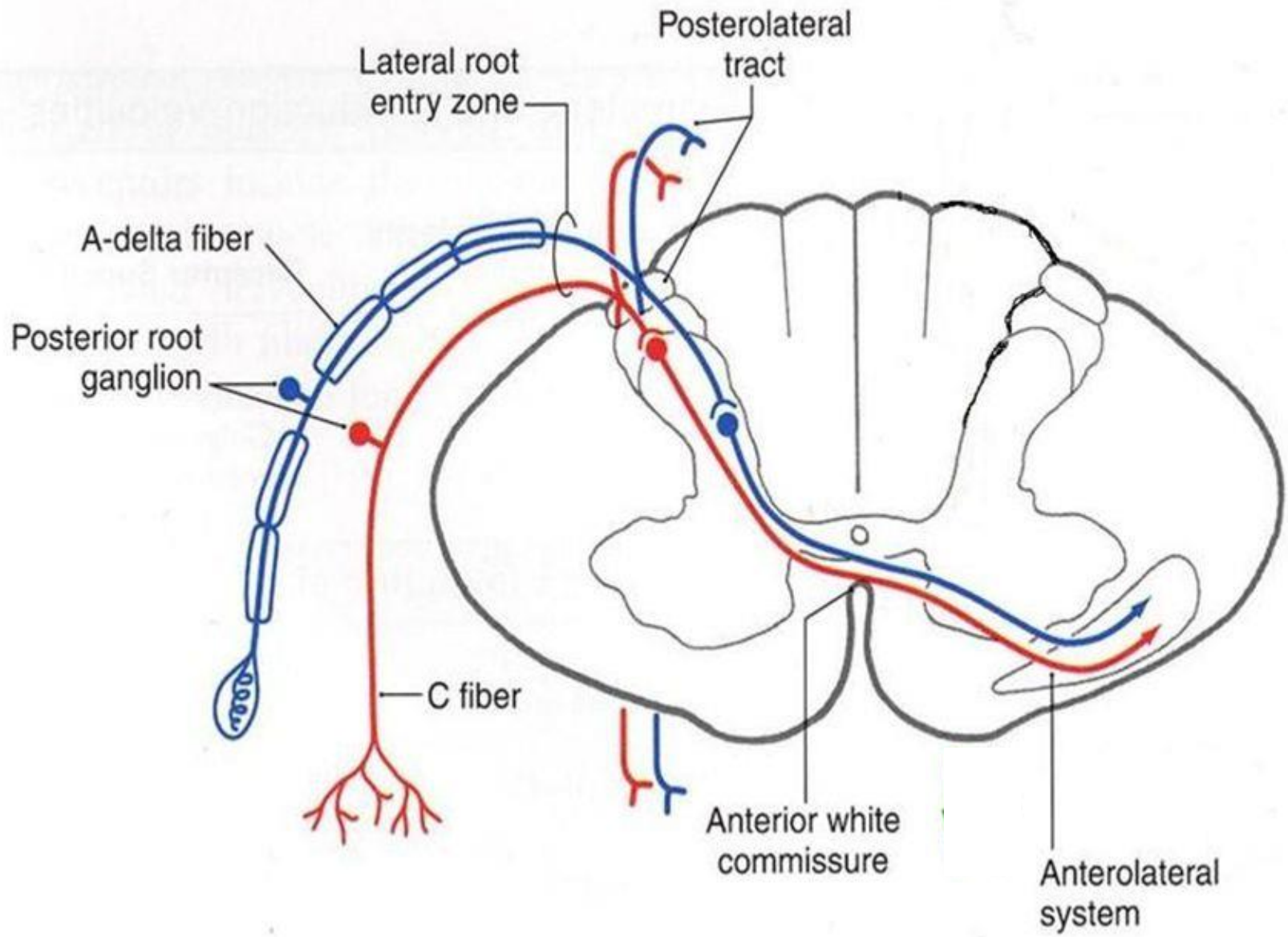
## Ascending Tracts (Sensory)

Dorsal Columns (posterior funiculi)  
deep touch, proprioception,  
vibratory

Lateral spinothalamic tract  
pain and temperature

Ventral spinothalamic  
tract  
light touch





# Rexed Laminae

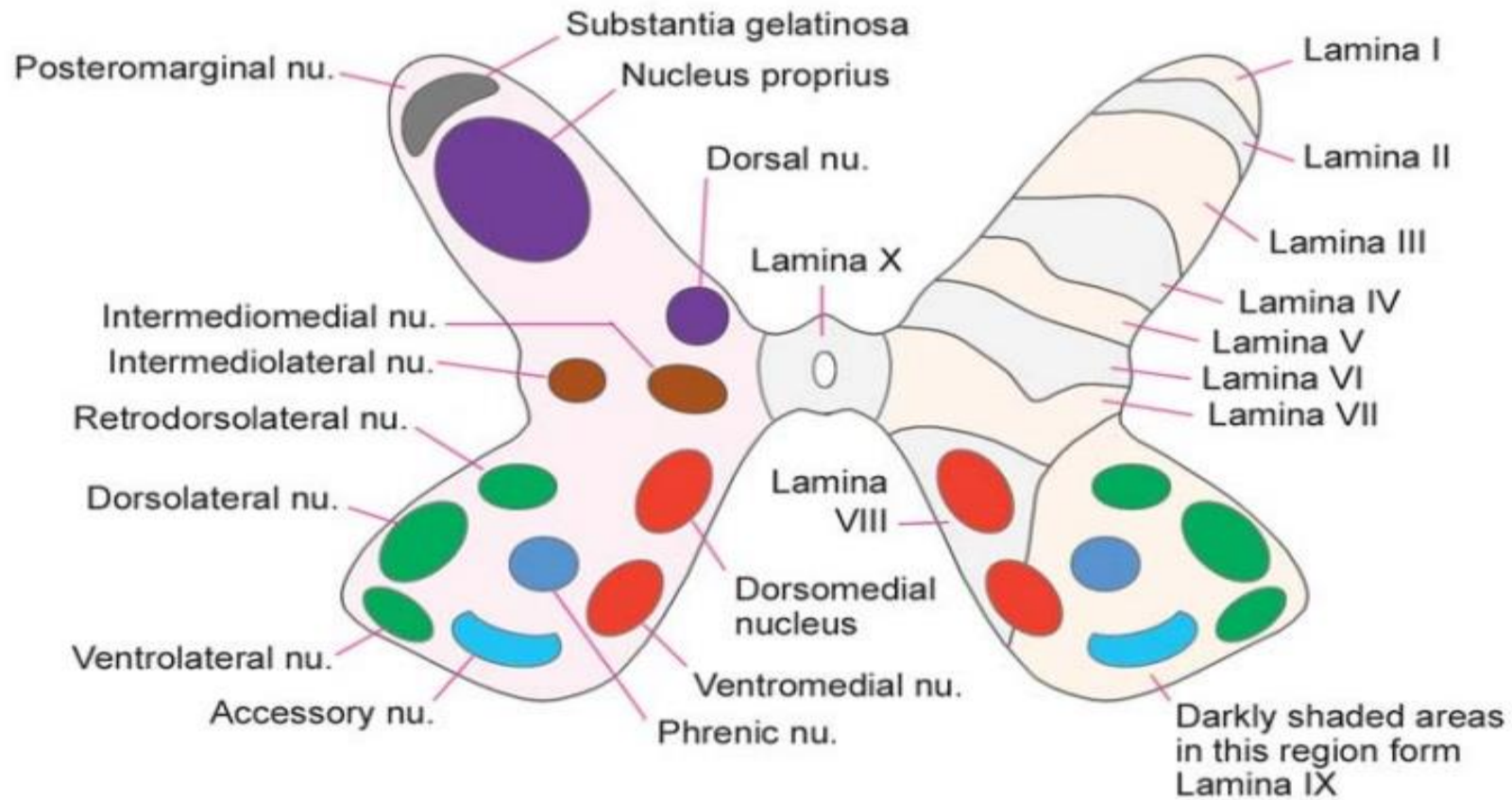
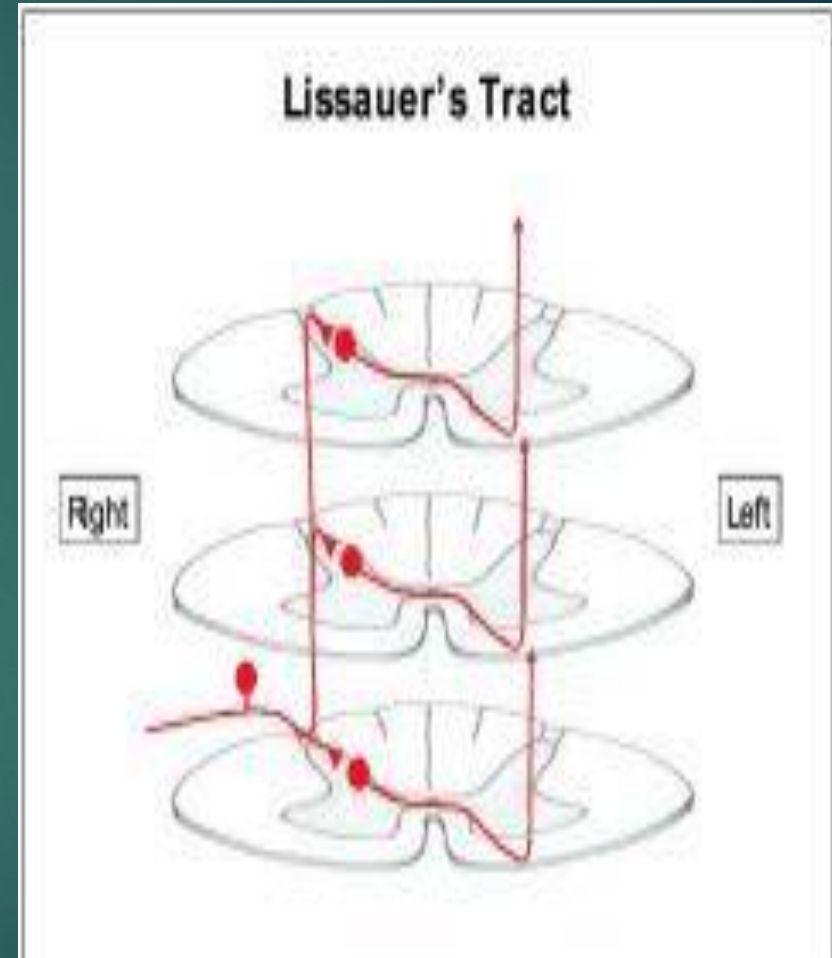


Fig. 5.2. Subdivisions of the grey matter of the spinal cord. The left half of the figure shows the cell groups usually described. The right half shows the newer concept of laminae.

# Tract Of Lissauer

**Lissauer's tract is a white matter tract in the spinal cord that projects up or down one or two spinal segments.**

- ▶ Some of those fibers ascend or descend locally, across one or two spinal segments.
- ▶ The white matter bundles only project within the spinal cord.
- ▶ These axons mostly carry crude touch and pressure information.



# Antero-Lateral Pathway

## 1st. Order Neurons

from receptors to the Laminae I, IV, V & VI on the same side

## 2<sup>nd</sup> Order Neurons

From Laminae I, II, IV, V & VI

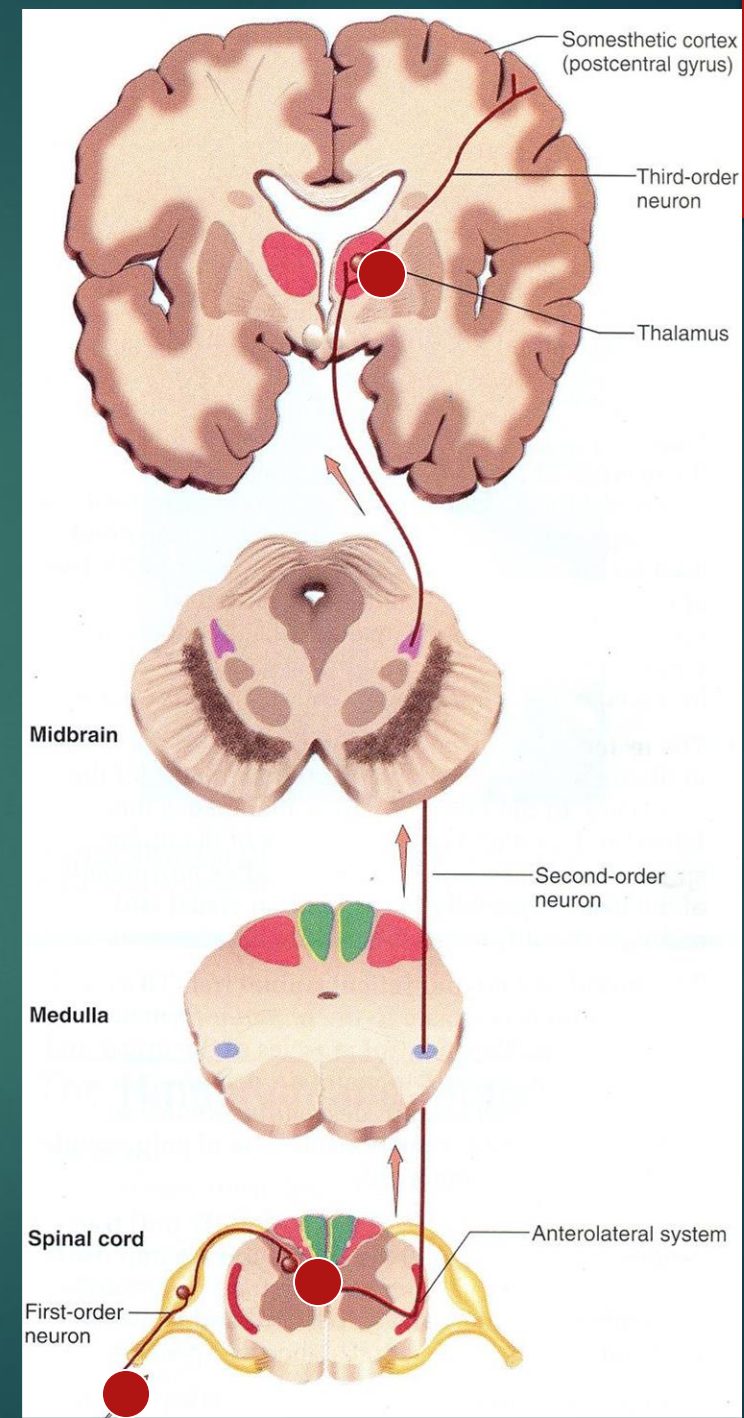
Cross to opposite side obliquely,

Ascend up & relay in Anterior & Lateral White columns of the spinal cord

1. Reticular formation of Brain stem.
2. VPLN & Intralaminar Nuclei of the Thalamus

## 3<sup>rd</sup> Order Neurons

From Thalamus – Pass through Internal capsule to the Primary Sensory Cortex



## **Dorsal Column–Medial Lemniscal System**

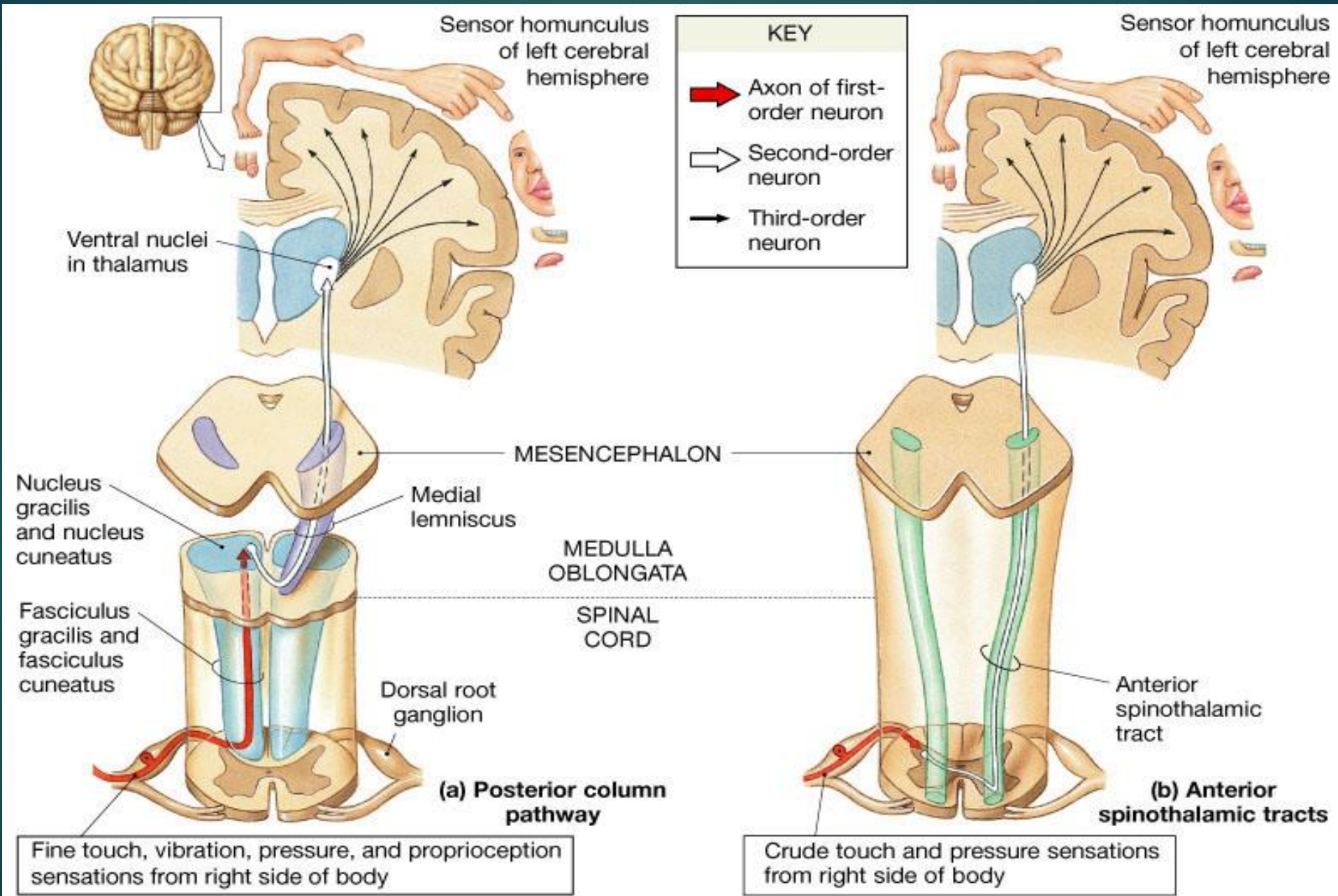
1. Touch sensations requiring a high degree of localization of the stimulus
2. Touch sensations requiring transmission of fine gradations of intensity
3. Phasic sensations, such as vibratory sensations
4. Sensations that signal movement against the skin
5. Position sensations from the joints
6. Pressure sensations having to do with fine degrees of judgment of pressure intensity

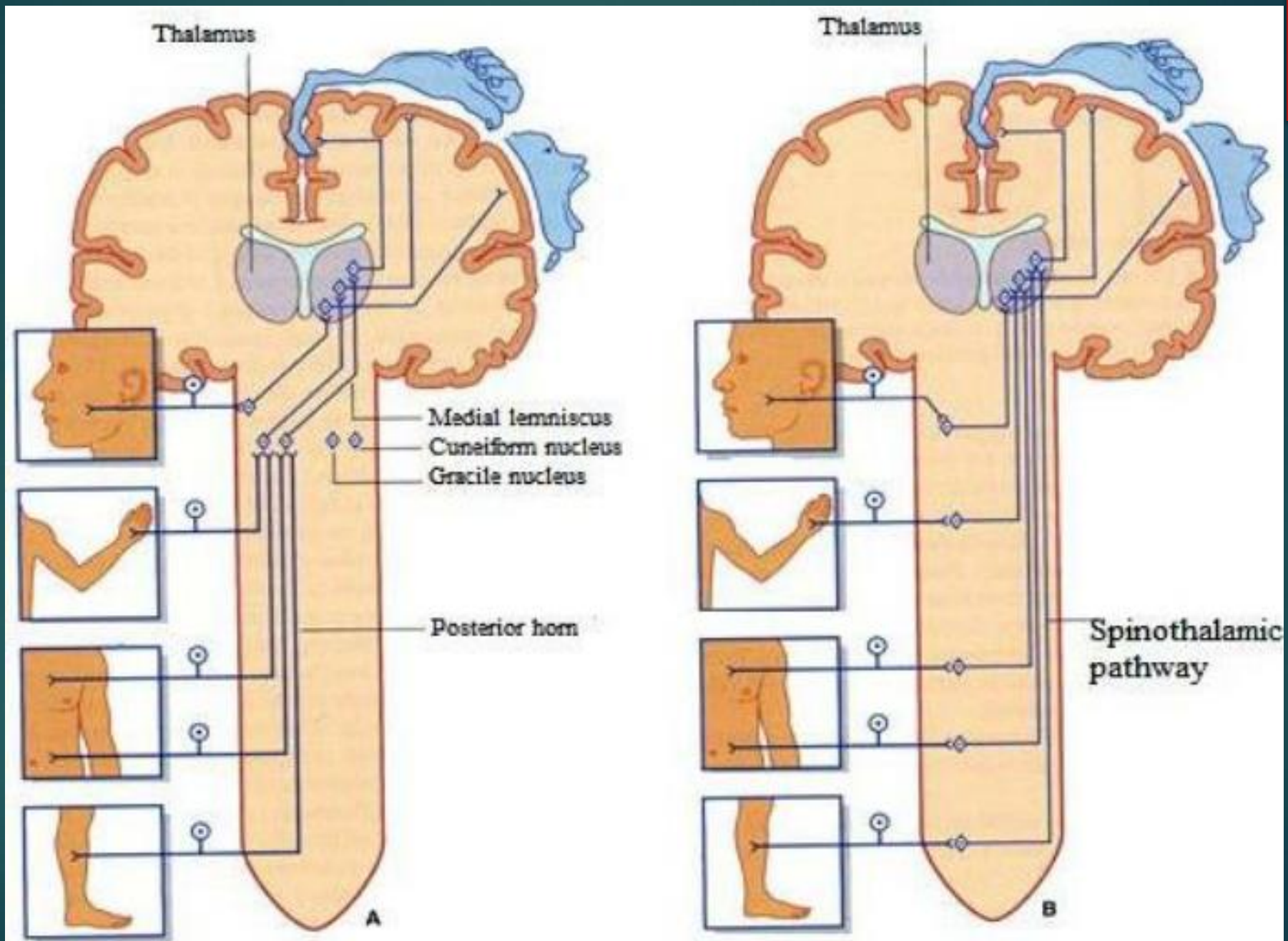
## **Anterolateral System**

1. Pain
2. Thermal sensations, including both warmth and cold sensations
3. Crude touch and pressure sensations capable only of crude localizing ability on the surface of the body
4. Tickle and itch sensations
5. Sexual sensations

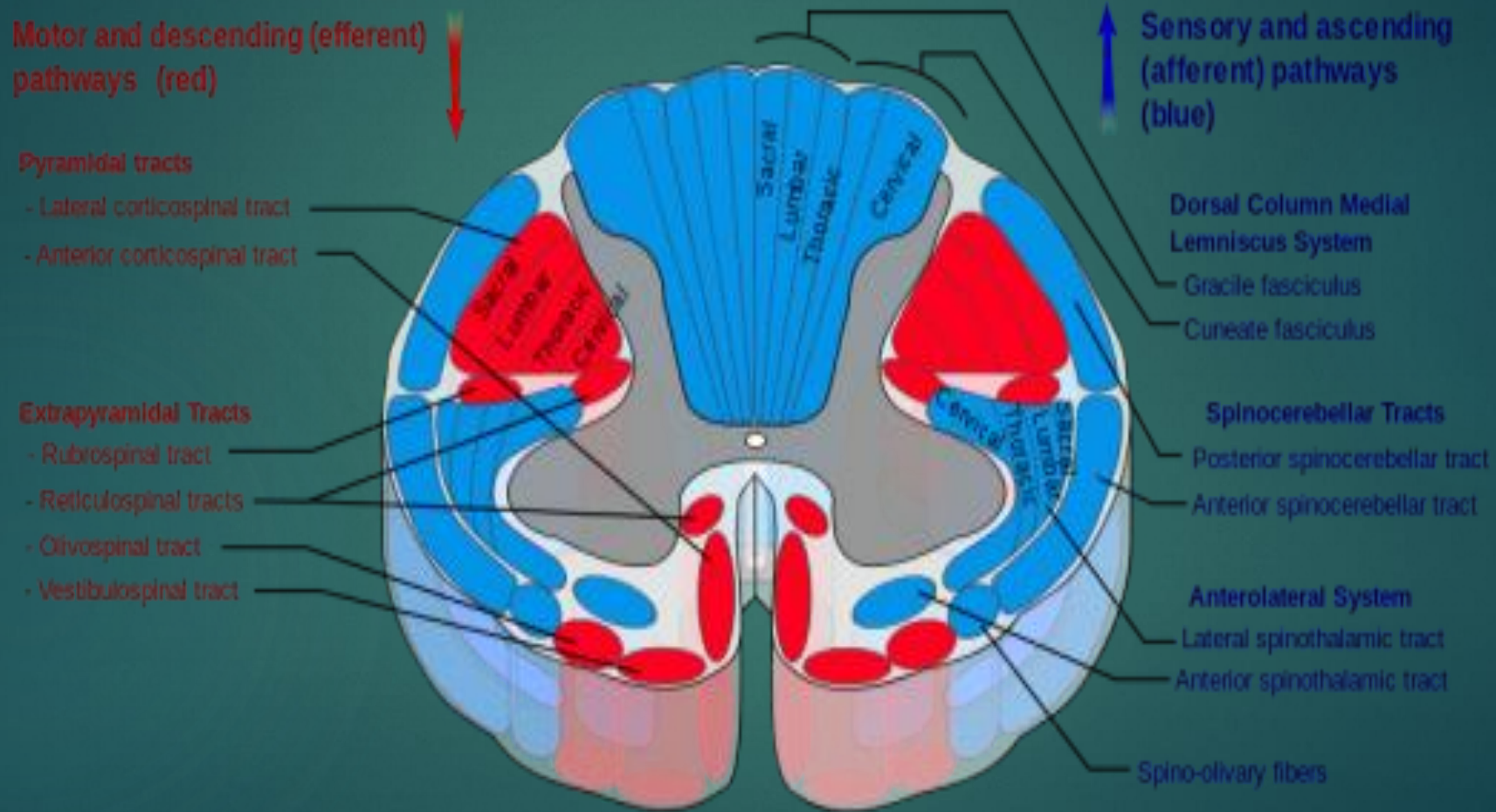


# Dorsal Column & Anterolateral





# Somatotopic organization



# Types of touch:

## 1) Fine Touch:

- Enables the subject to detect the shape and texture of objects.
- Receptors are capsulated and hair end organs.
- Carried by the dorsal column-medial lemniscus system.

## 2) Crude Touch:

- Poorly localized sensation which needs a relatively strong stimulus.
- Emotionally important.
- Receptors are less differentiated free nerve endings,
- Carried by the anterolateral system.

## DORSAL COLUMN PATHWAY

- Carries fine touch, position, pressure, vibration, two point discrimination, stereognosis
- Afferent sensory fibers  $a\beta$  type.
- Very fast velocity 30 – 70 m/s

## ANTEROLATERAL PATHWAY

- Carries pain & temperature (lat. Sp.Th)
- Crude touch & pressure (vent, sp. Th)
- Afferent sensory fibers  $a\delta$
- 6 – 30 m/s (myelinated) fast pain
- C fibers – 0.5 – 2 m/s (unmyelinated) slow pain

# Spinothalamic tract lesion

## Peripheral Neuropathy

- ▶ symmetrical damage to peripheral nerves is relatively common and is usually a result of either toxic, metabolic, inflammatory or infectious causes.
- ▶ Most commonly this is seen in patients with diabetes.
- ▶ Initially symptoms in this case is commonly sensory loss and those nerves which are longest, particularly those that transmit stimuli from the lower limb are affected first later producing the 'stocking-glove' distribution.
- ▶ Whilst vibration sense is usually the first to be affected, pin-prick, temperature and light-touch soon follow.

# Spinothalamic tract lesion

## Syrigomyelia

Enlargement of the central canal compressing the adjacent nerve fibres of the 2nd order neuron, conveying pain and temperature

Leads to selective loss of pain and temperature with retaining of light touch and proprioceptive sensation (dissociated sensory loss) with Charcot's joint .

# Assessment of Anterolateral System

## **Pain:**

- ▶ Can be examined using neuro tips or safety pin, assessing various aspects of the limb comparing left and right. These objects have both a sharp and blunt end, and asking whether the patient is experiencing either sharp or dull pain allows the clinician an insight of their ability to discriminate between the two.





# Assessment of Anterolateral System

- ▶ **Temperature:**
- ▶ Can be examined by using two tubes; one with warm water and one with cold. Testing various aspects of the limb and comparing left to right, can they differentiate between hot and cold?



# Assessment of Anterolateral System

- ▶ **Crude Touch:**
- ▶ Using cotton wool / a piece of paper towel touch various parts of their extremities again comparing left to right. Ask whether or not the can feel you touching them and if so can they tell you where you are touching them?



# *The Spinocerebellar Tracts –*

# The Spinocerebellar Tracts – Unconscious Sensation

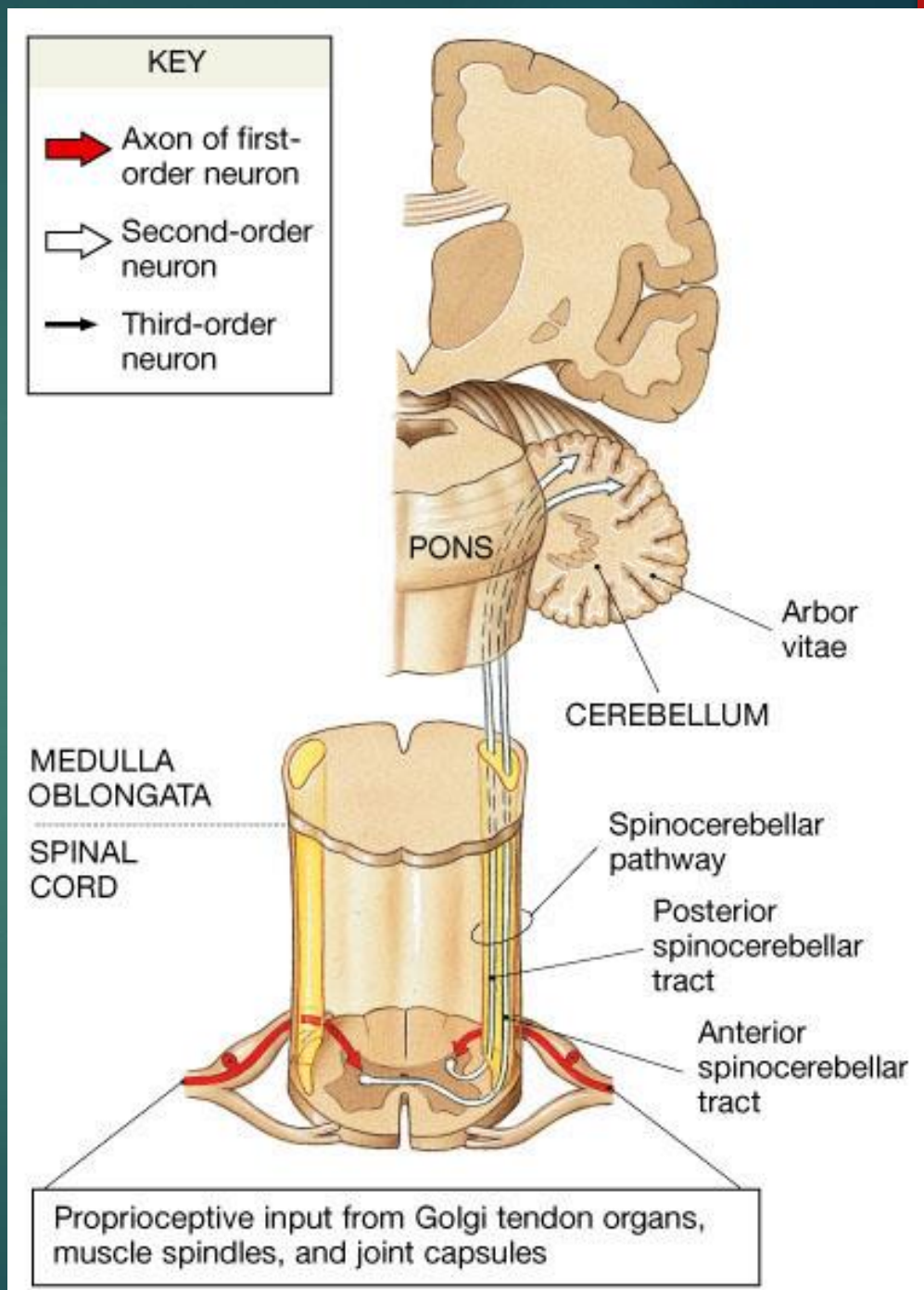
- ▶ The tracts that carry **unconscious proprioceptive** information are collectively known as the **spinocerebellar tracts**.
- ▶ Although we cannot physically acknowledge these signals, they help our brain co-ordinate and refine motor movements.

# Spinocerebellar Pathway

Includes :

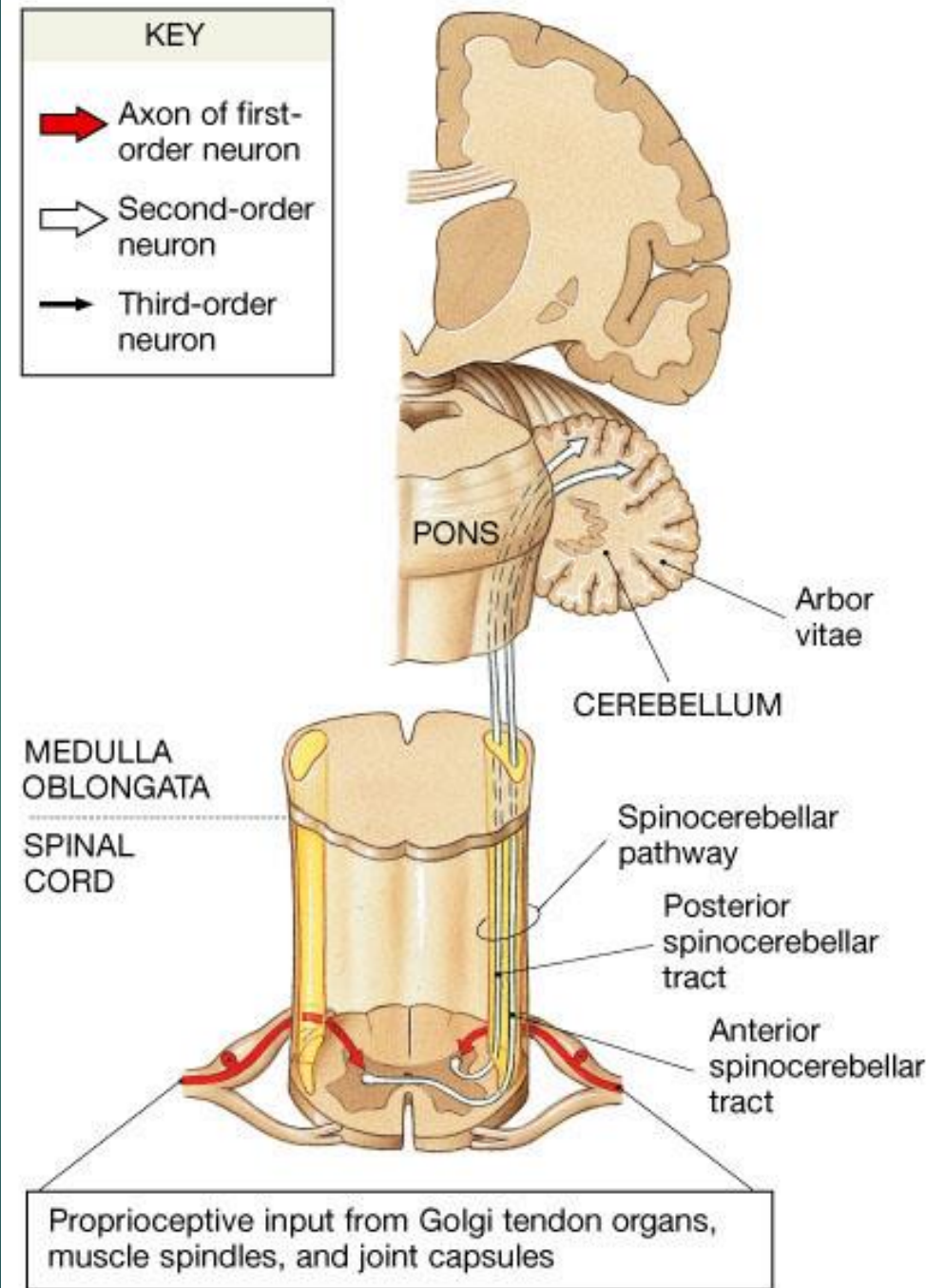
- Ventral spinocerebellar T.
- Dorsal spinocerebellar T.

**Dorsal** Carries sensation to the cerebellum concerning position of muscles, tendons and joints.



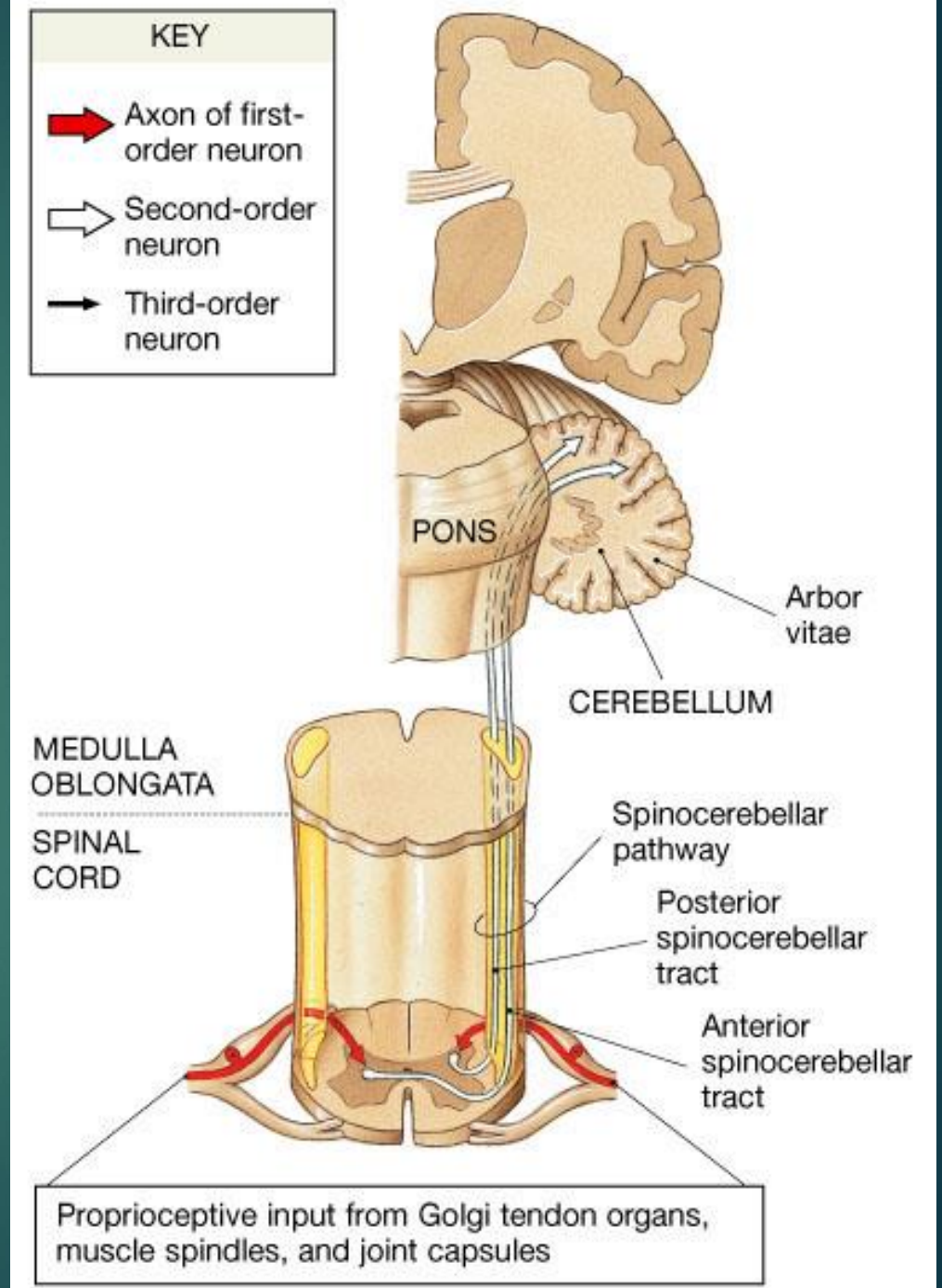
# Spinocerebellar Pathway

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.



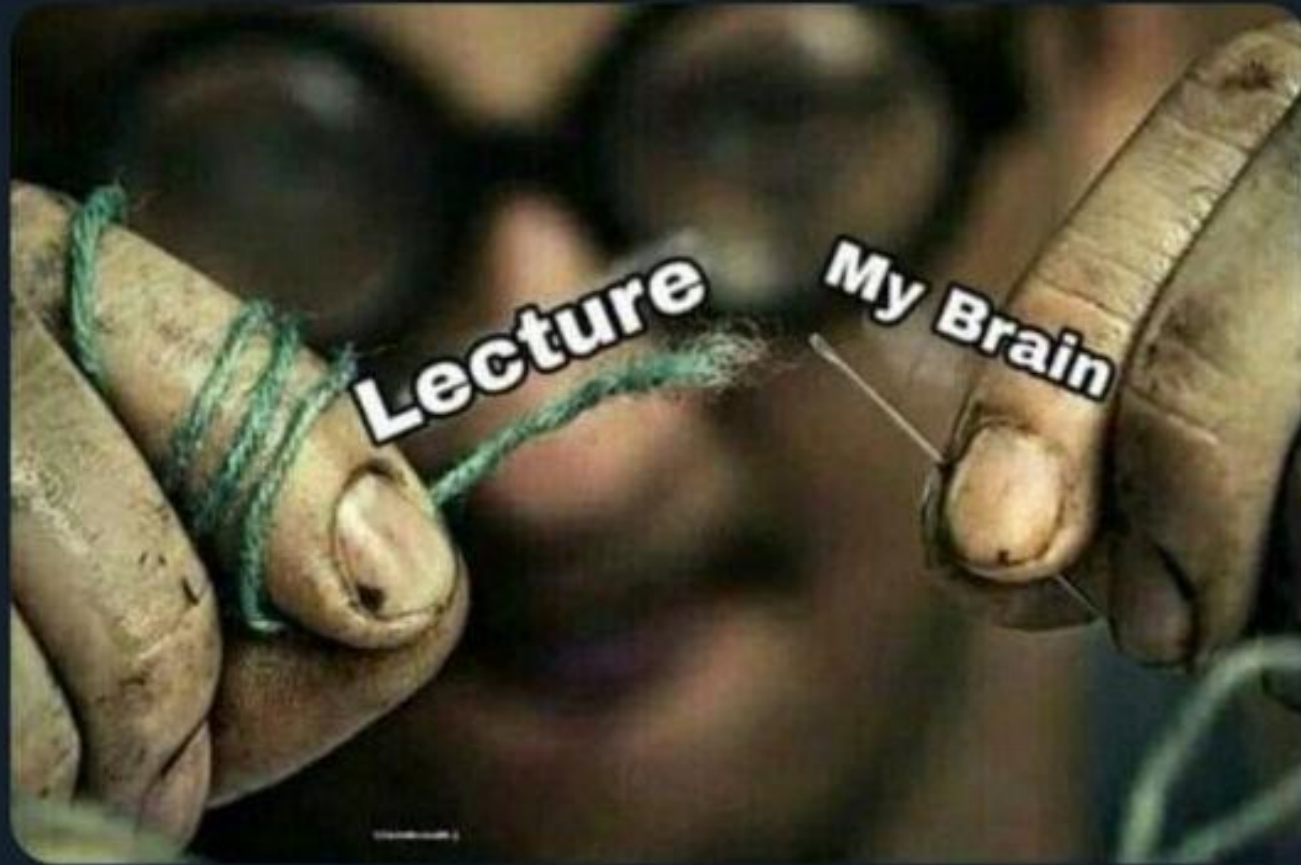
# Spinocerebellar Pathway

- The spinocerebellar system consists of a sequence of only two neurones.
- Neurone I: Large cells of dorsal root ganglia.
- Neurone II: cells of the nucleus dorsalis Clark's nucleus.  
give rise to axons ascending to the cerebellum of the same side
- The tract neurons terminate directly in the cerebellar cortex.  
Mostly vermis



Me in Class .. 😞

Yeh Saalla Kbhi nhi Ghussy ga..!!! 😞





When you're **physically** present  
but **mentally** absent in the class

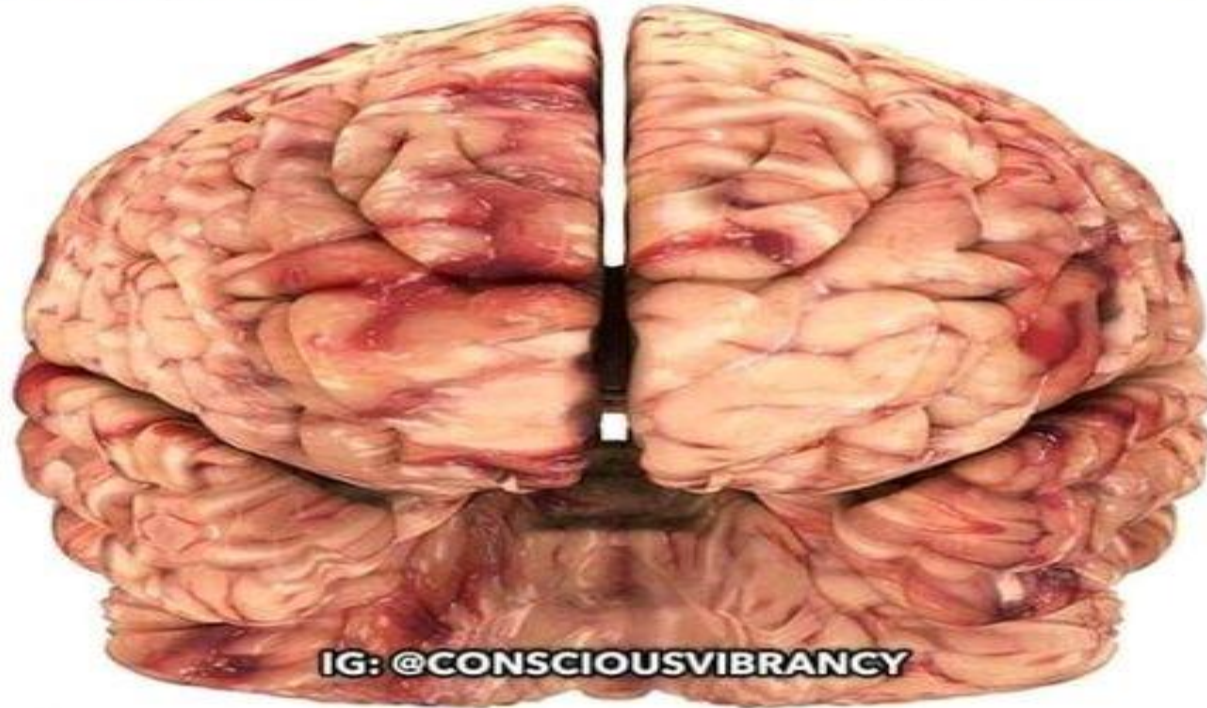


# Fun Facts



# DID YOU KNOW?

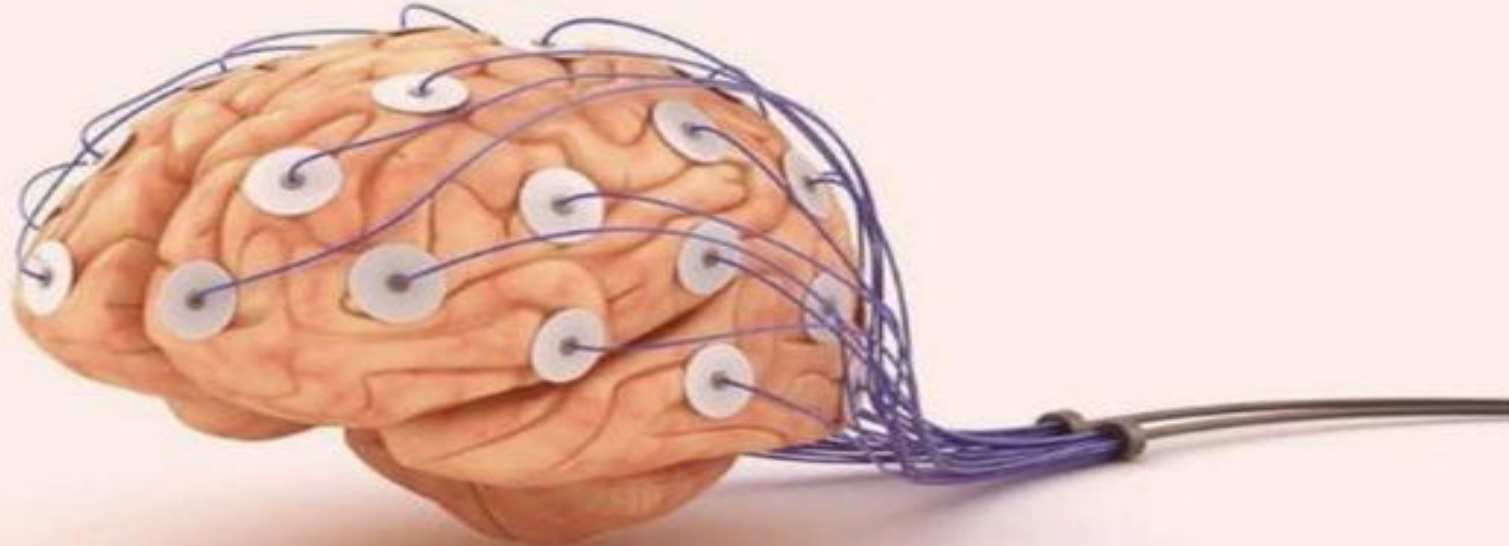
Happy Thoughts And Positive Thinking Support Brain Growth



Every thought releases brain chemicals. Being focused on negative thoughts effectively saps the brain of its positive forcefulness, slows it down, and can go as far as dimming your brain's ability to function, even creating depression. On the flip side, thinking positive, happy, hopeful, optimistic, joyful thoughts decreases cortisol and produces serotonin, which creates a sense of well-being.

SOURCE: PSYCHOLOGYTODAY

# DID YOU KNOW?



YOU CAN "REWIRE" YOUR BRAIN TO BE HAPPY  
BY SIMPLY RECALLING 3 THINGS YOU'RE  
GRATEFUL FOR EVERY DAY FOR 21 DAYS.

# DID YOU KNOW?

ONE TABLESPOON OF COCONUT OIL PER DAY



In the Journal of Neurobiology of Aging, researchers found that the the fats in coconut oil improved the memory problems especially in older subjects. The fats are accessed in the brain without the use of insulin. Thus, they are able to fuel brain cells more efficiently

# Best Foods for Your BRAIN



Brain Food Beauty



Almonds



Walnuts



Hazelnuts



Brazil nuts



Broccoli



Blueberries



Pomegranate



Avocados



Sage



Sesame seeds



Flax seeds



Pumpkin seeds

# Recommended Books

- ▶ Principles of Human Physiology  
-Lauralee Sherwood
- ▶ Textbook of Medical Physiology-  
Guyton & Hall
- ▶ Essentials of Medical Physiology-  
Sembulingam
- ▶ Ganong's review of Medical  
Physiology



*That's all Folks!*





*Until Next Time...*