

NeuroAnatomy

Spinal Cord 2

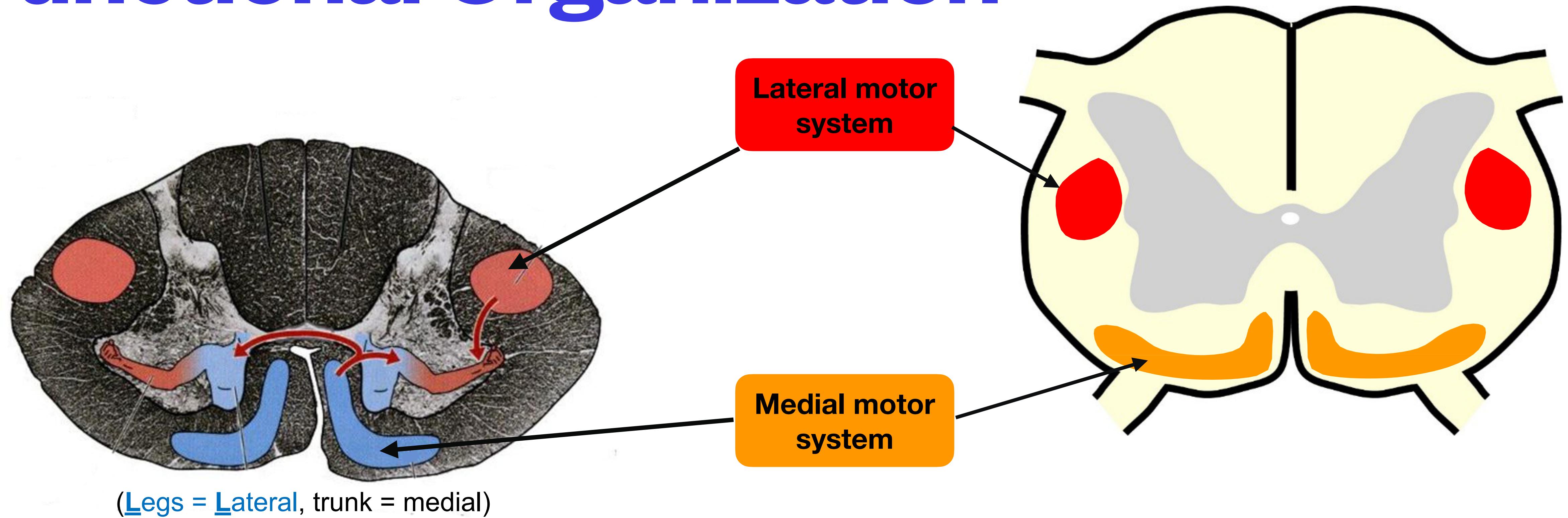
SEPTEMBER 25TH, 2025

Motor Tracts



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Functional Organization



Lower Motor Neurons (LMNs) controlling the **limbs** are located in the **lateral** portion of ventral horn

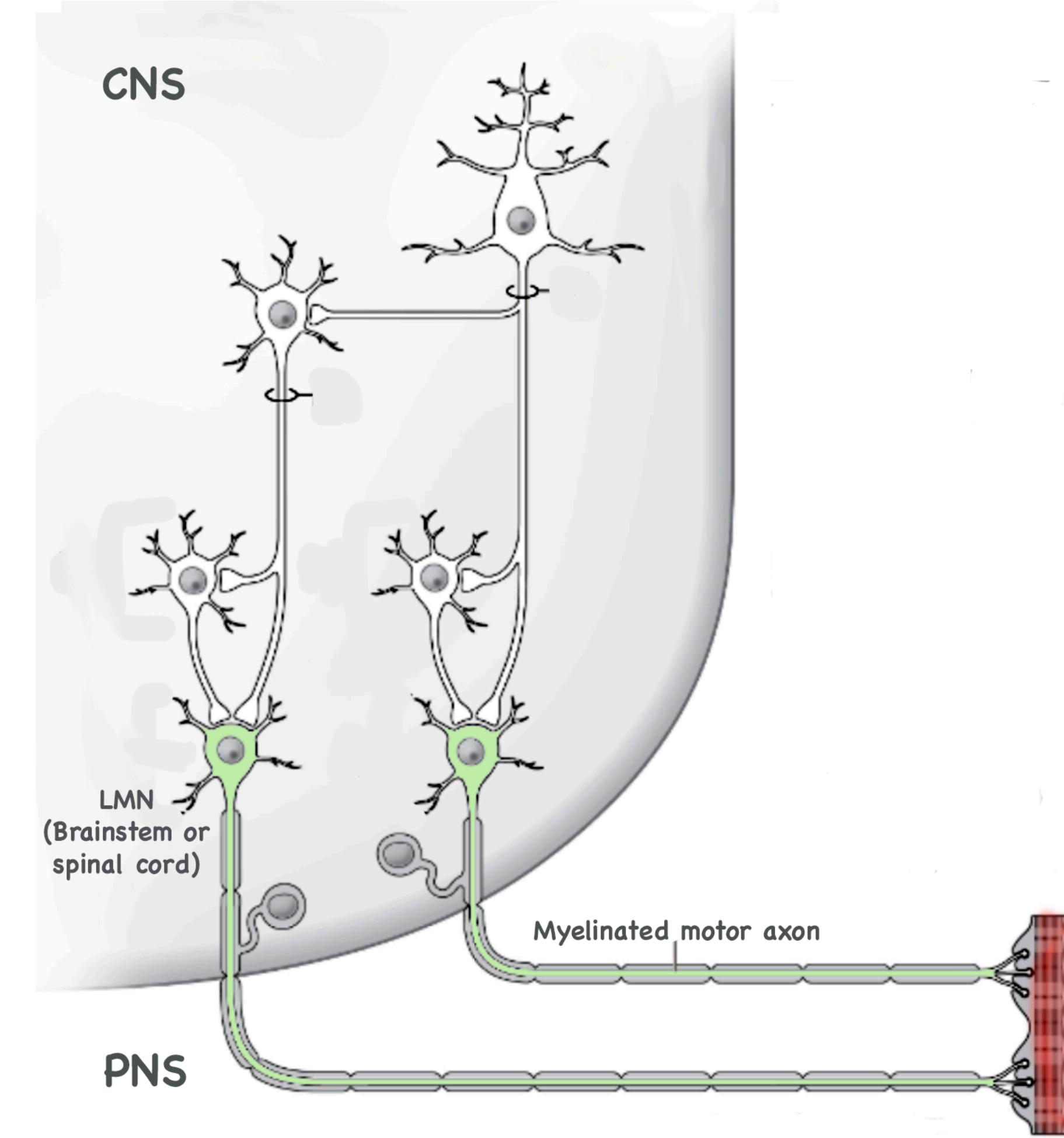
Lower Motor Neurons (LMNs) controlling the **trunk** are located in the **medial** portion of the ventral horn

LIMBS = DISTAL MUSCLES; TRUNK = AXIAL MUSCLES

Upper and Lower Motoneurons

LMNs: Synapse on striate muscles

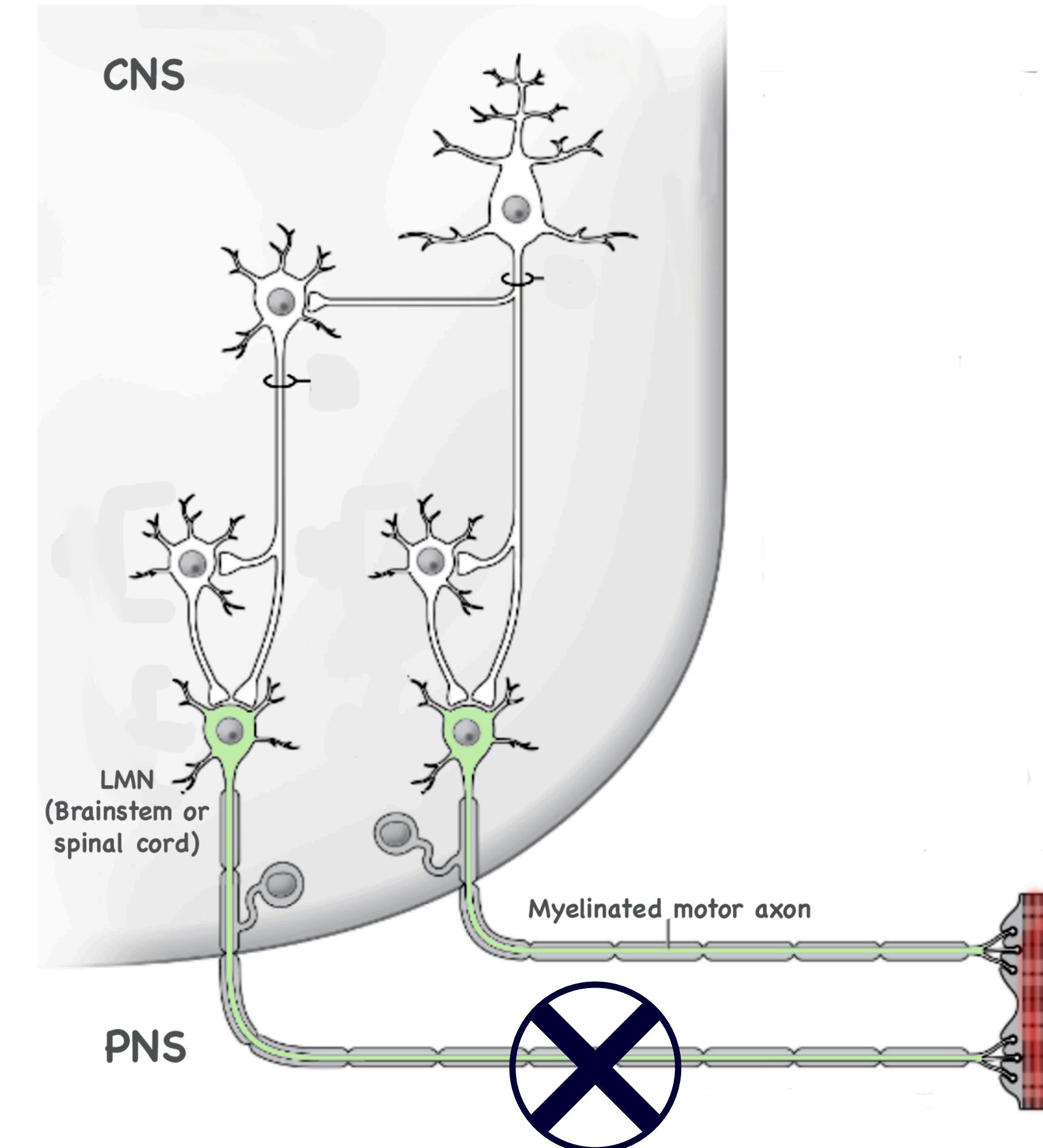
UMNs: Synapse on LMNs



Important

Lower Motoneuron Syndrome

LMNs: Synapse on striate muscles



Important

CLINICALLY RELEVANT

Lower Motor Neuron Syndrome



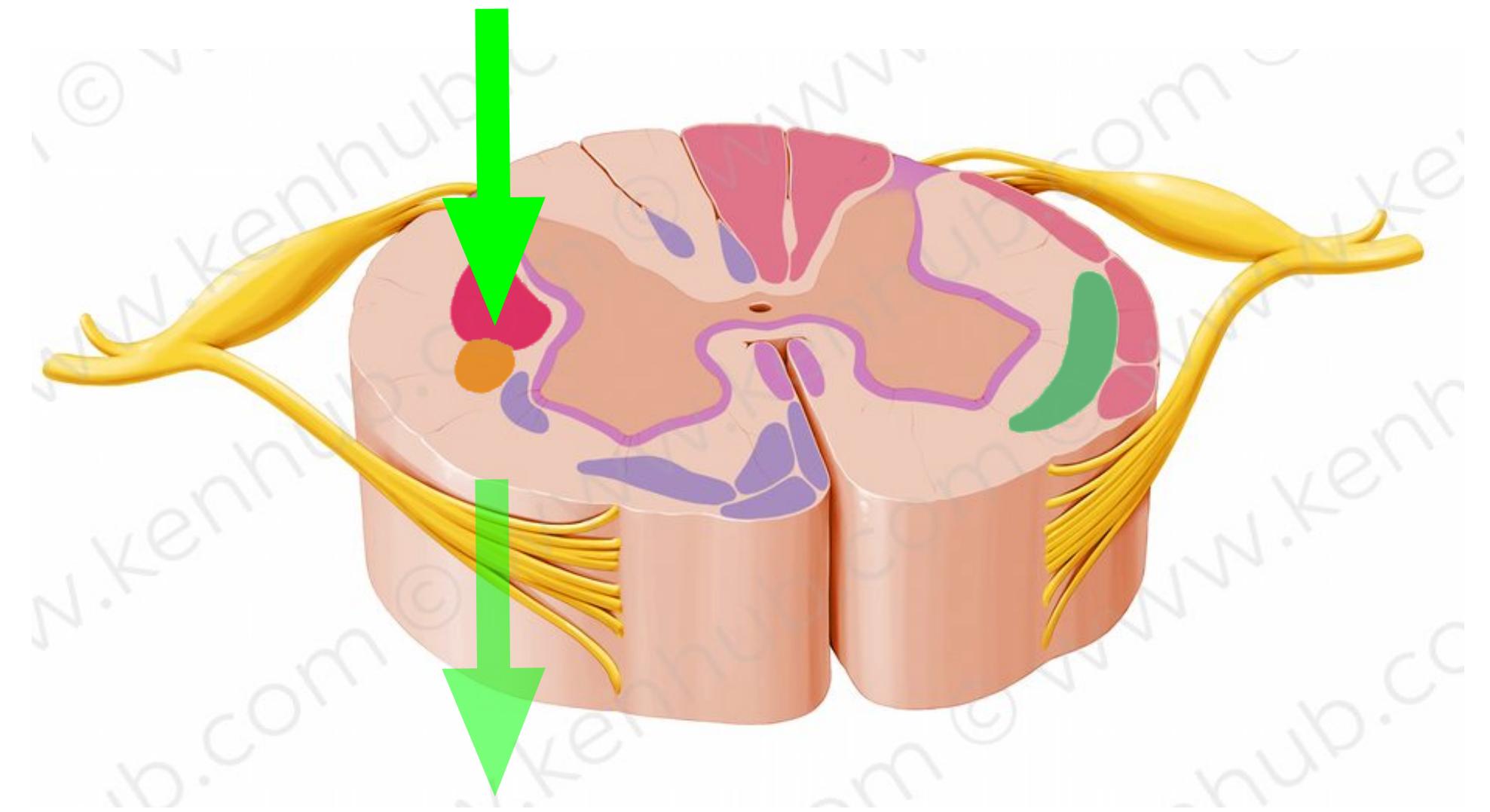
Signs/Symptoms	
Motor strength	↓
Reflexes (-)	↓
Muscle tone (flaccid paralysis)	↓
Fibrillation and Fasciculations	↑
Muscle atrophy (wasting)	↑

LIKE A RAG DOLL

Lower Motorneuron Syndrome

- Paralysis/plegia (loss of movement) or paresis (weakness) of the muscles depending on the extent of the damage.
- Loss (arreflexia) or decrease of reflexes (hyporreflexia) due to interruption of the efferent (motor) output.
- Loss of muscle tone because of the absence/decrease of the stretch reflex.
- Fibrillation and fasciculation (spontaneous twitches) that are abnormal muscle contractions resulting from changes in the excitability of motor neurons or their outputs.
- Muscle atrophy (wasting) due to denervation and disuse.

Lateral Motor System



Controls **voluntary movement of limbs** (*distal muscles*)

Main tract (UMNs):

Lateral corticospinal tract (CST) from motor cortices (ex.
Precentral gyrus in the frontal lobule = Primary motor cortex).

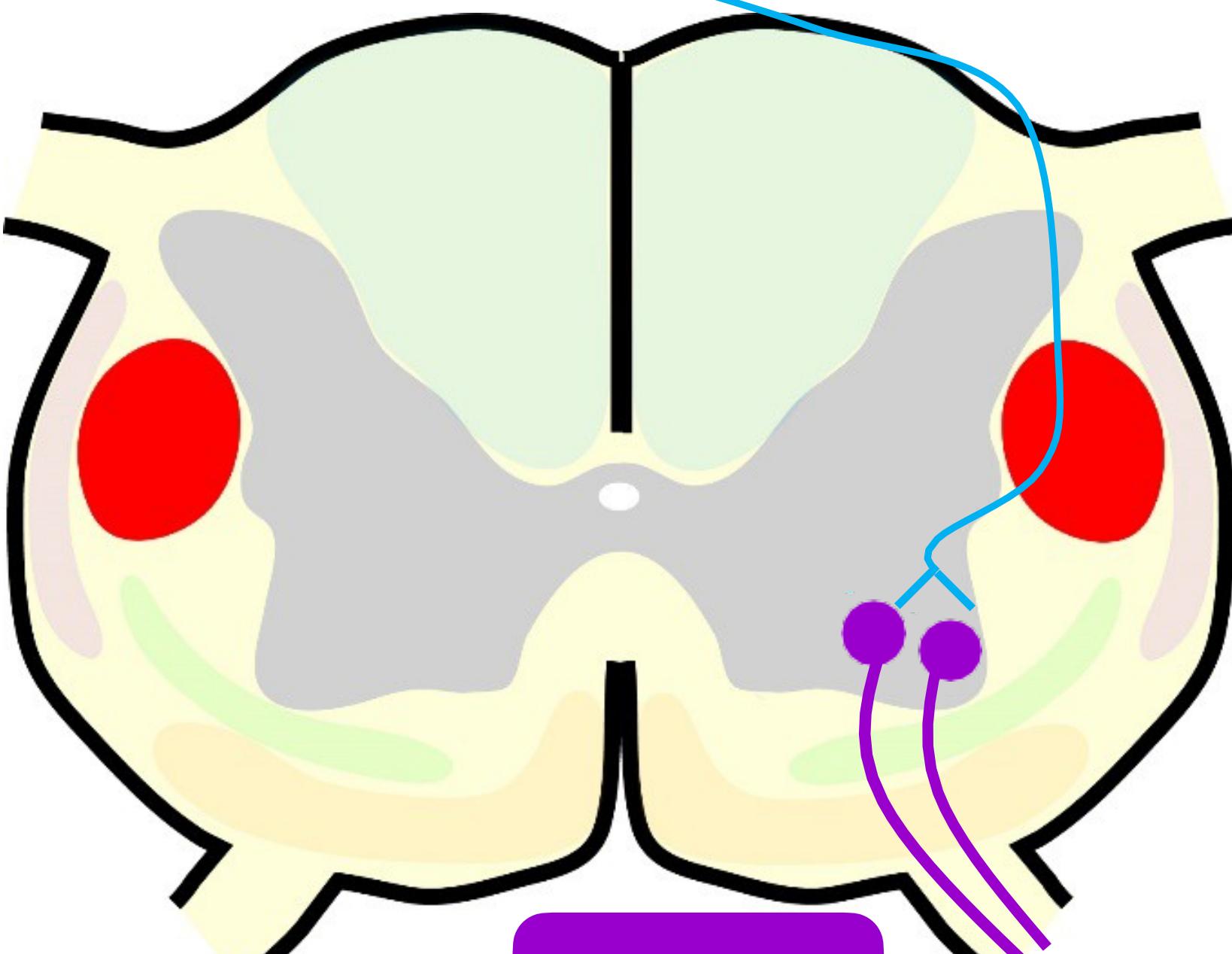
A lesion of the lateral motor system (within spinal cord) results in **the loss of motor function ipsilateral to the lesion**

POWERFUL TRACT

Motor Cortices (Contralateral)

Important

Corticospinal Tract



LMNs

To skeletal muscles

Medial Motor System

Important

Three main Pathways (all bilateral):

Reticulospinal
Tract

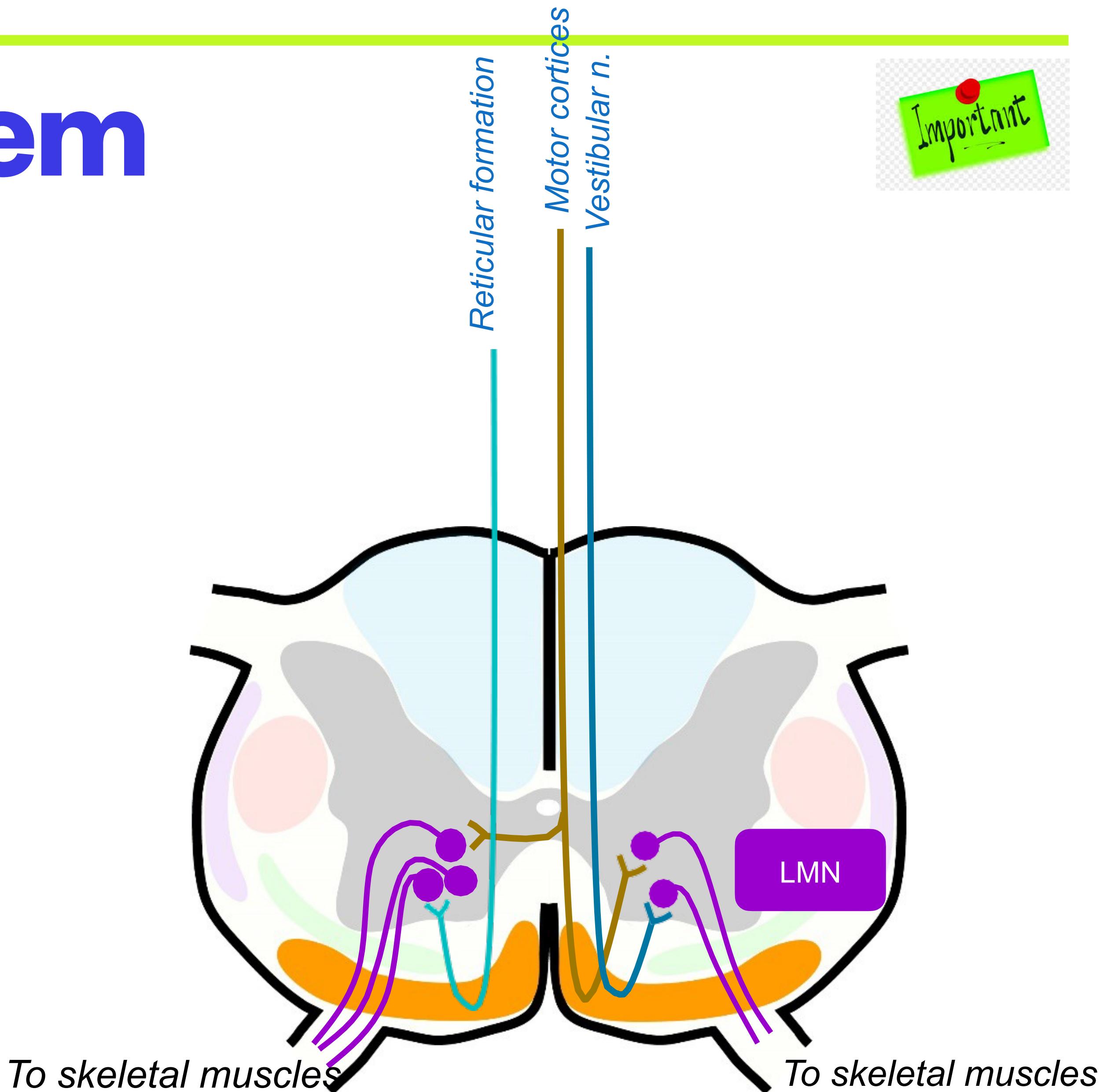
Corticospinal
Tract

Vestibulospinal
Tract

-**Anterior (ventral) corticospinal tract** originates in motor cortices and controls bilateral axial (trunk) muscles.

-**Vestibulospinal tract** originates in vestibular nuclei in brainstem and controls balance and posture.

-**Reticulospinal tract** comes from the reticular formation in brainstem and controls muscle tone (via stretch reflex).



FOR OUR PURPOSES, THESE TRACTS ARE BILATERAL

Somatosensory Pathways



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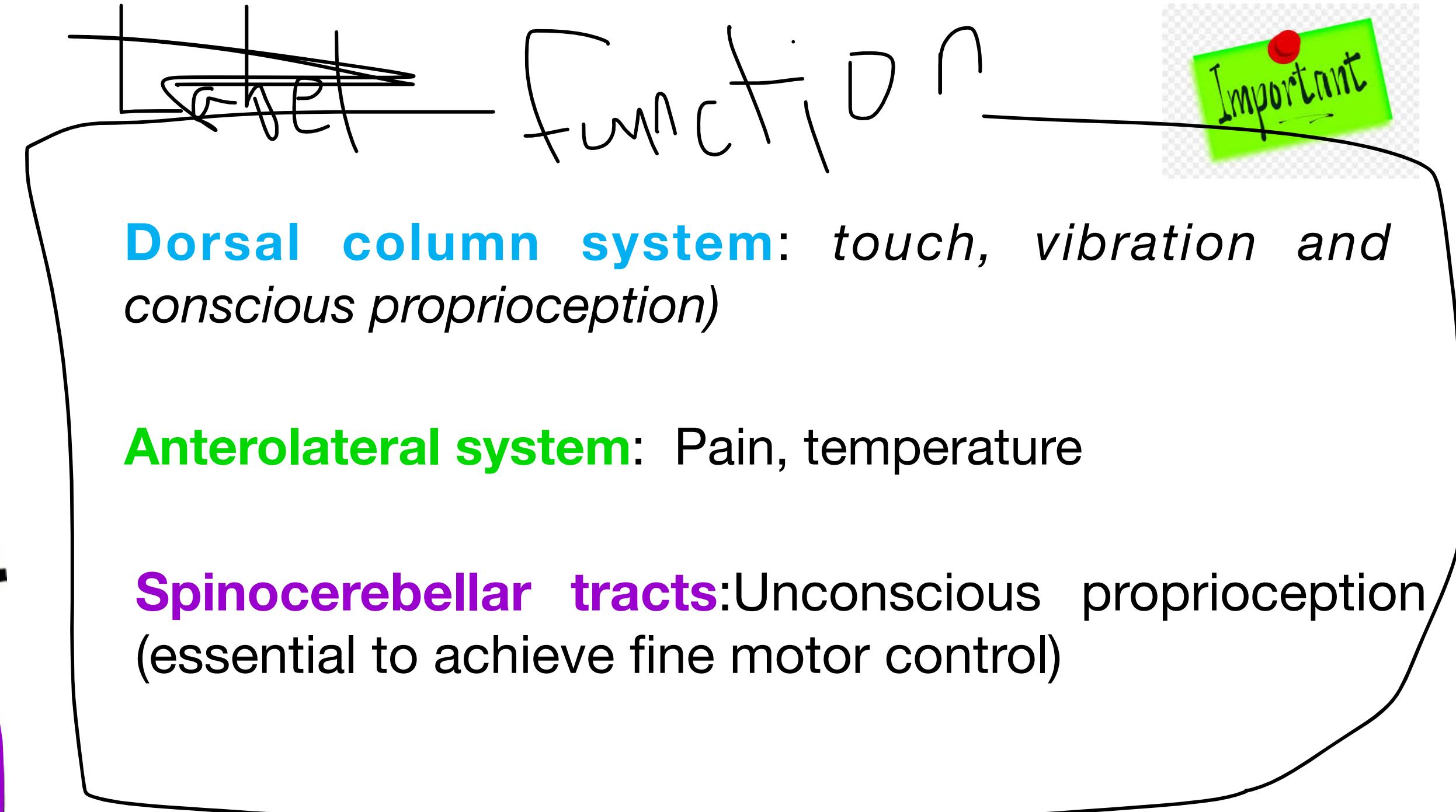
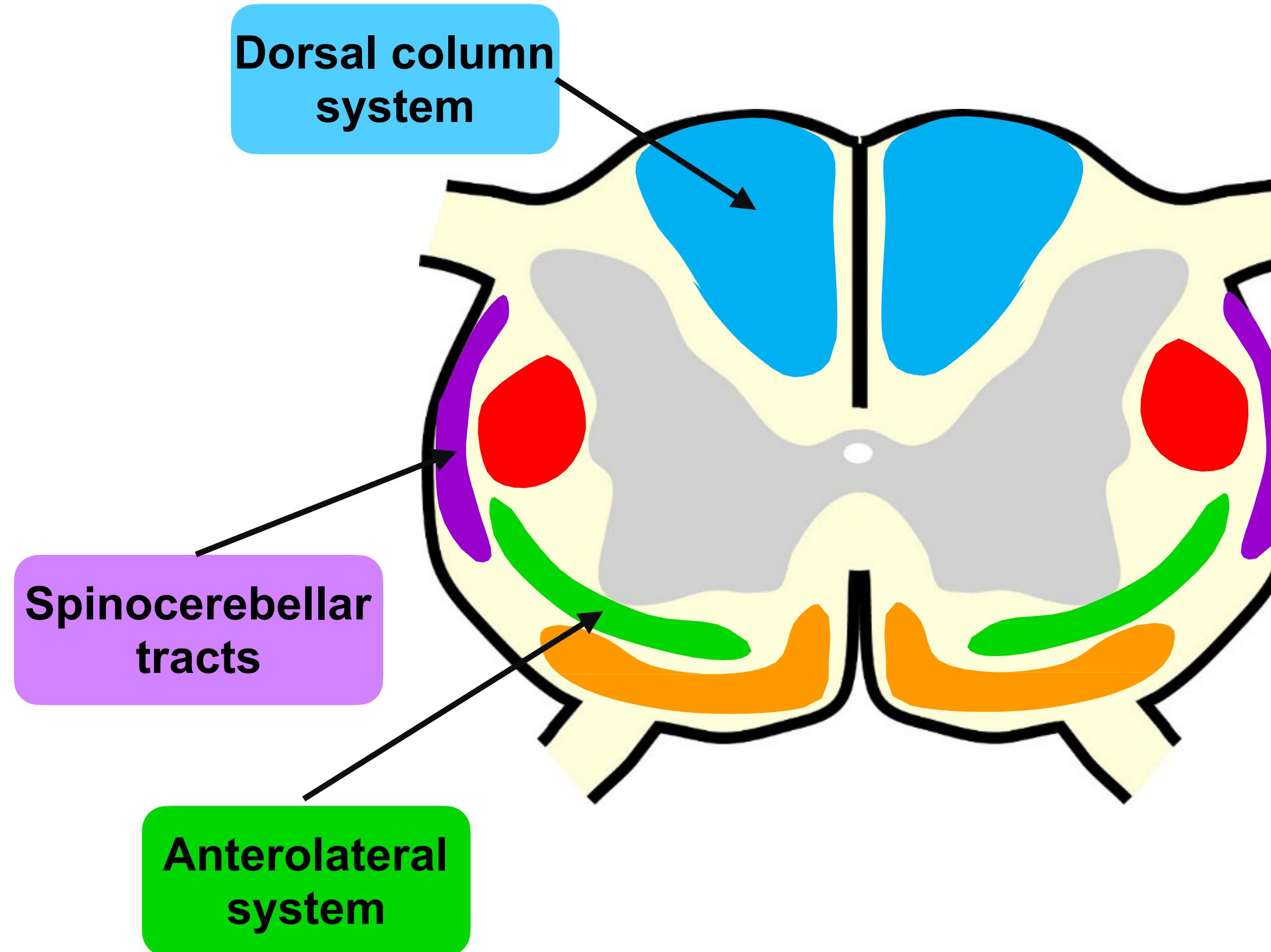
Somatosensory Modalities

Sensations:

- **Mechanical:**
 - Proprioceptive (limb position) and vibration
 - Cutaneous (touch)
- **Pain and temperature**



Ascending Tracts



**Sensory tracts
(ascending pathways)**

Dorsal column system

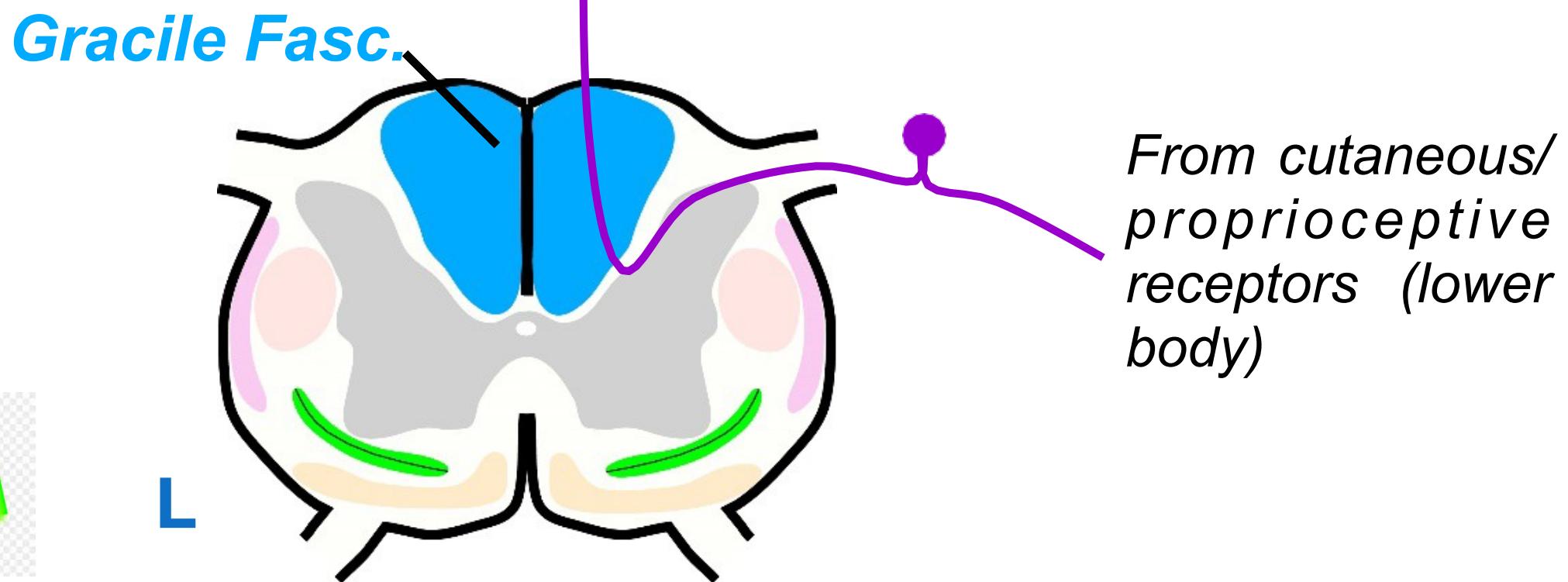
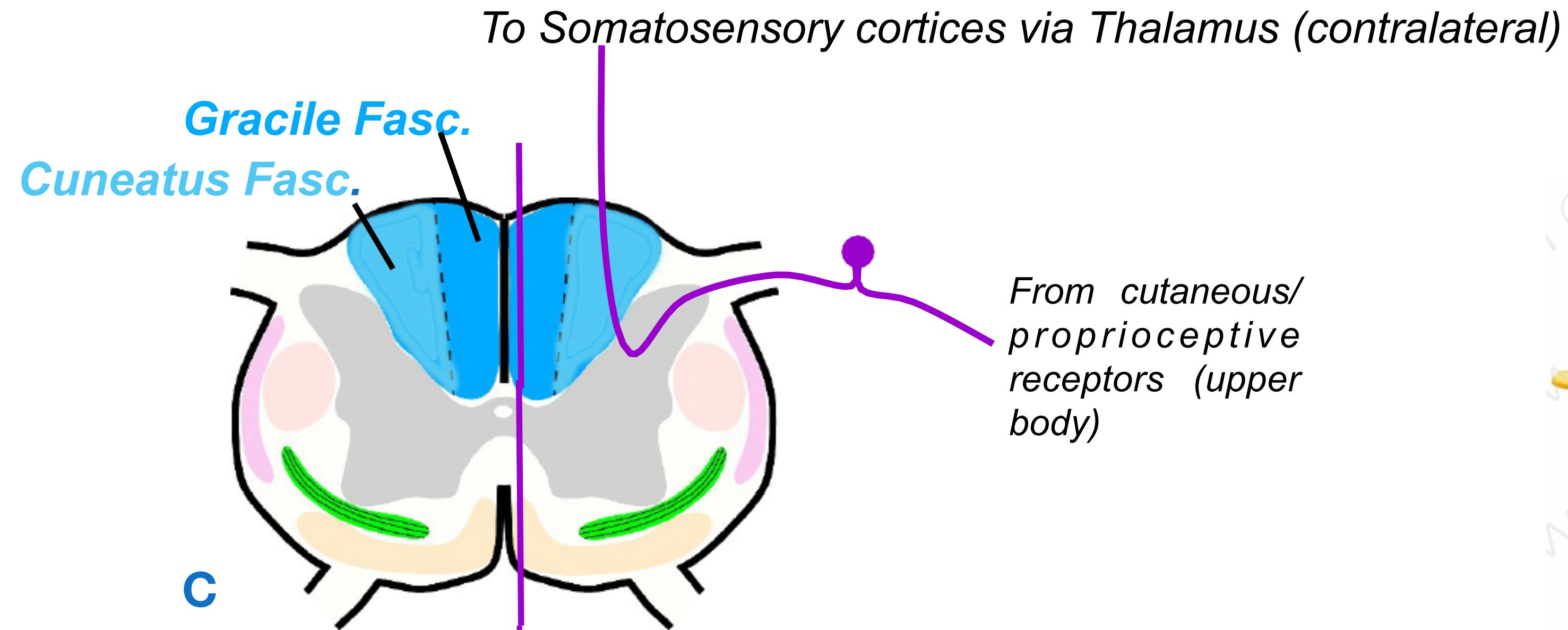
Anterolateral system

Spinocerebellar tracts

**(aka medial lemniscus system)*

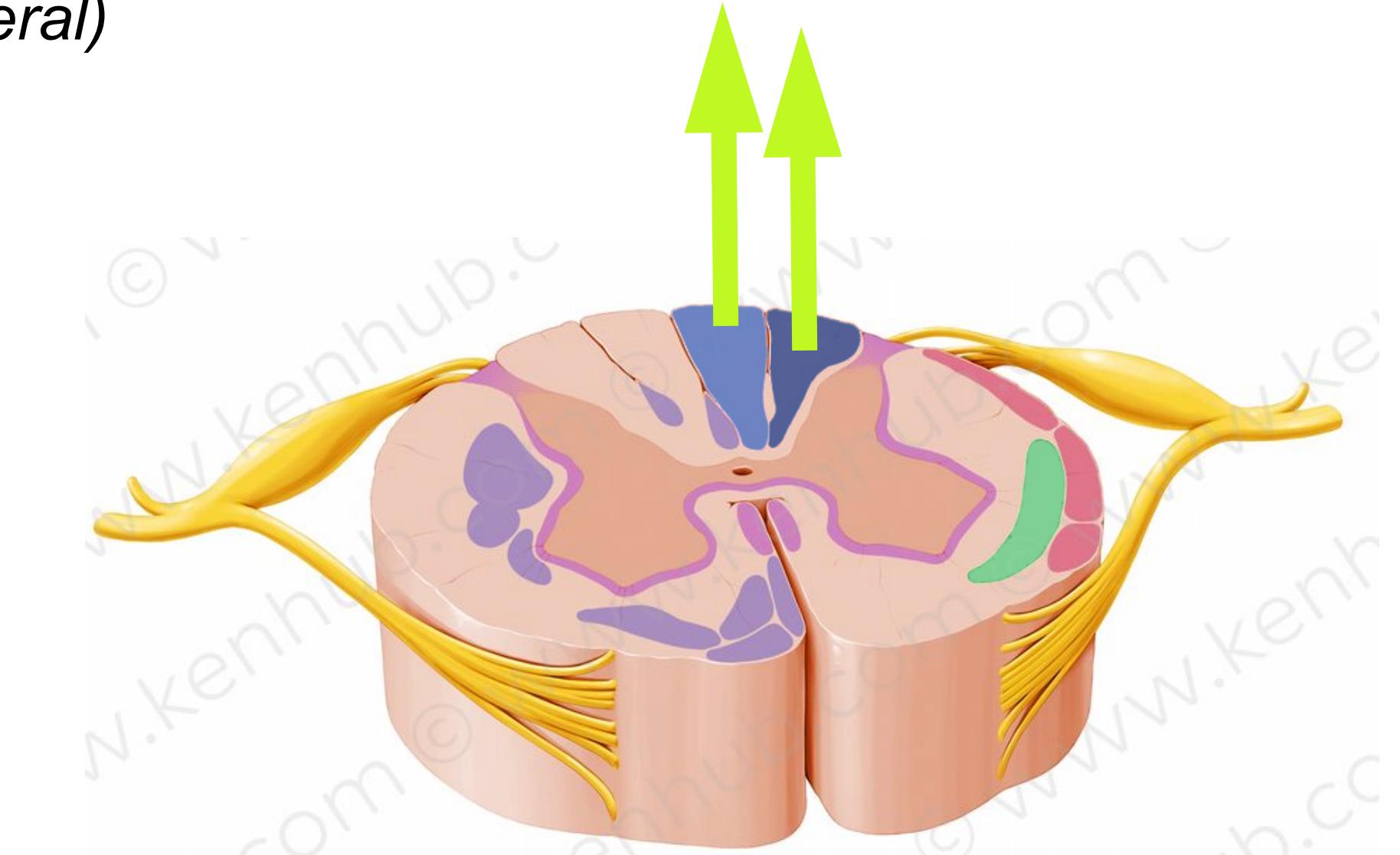
TO CEREBRAL CORTEX AND CEREBELLUM

Dorsal Column (medial lemniscus) System



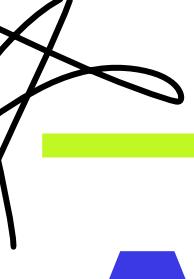
Important

THE MOST COMPLEX



Fibers from the upper trunk, arms and neck form subdivision called **cuneate fasciculus** (cuneate: “wedge-shaped”)

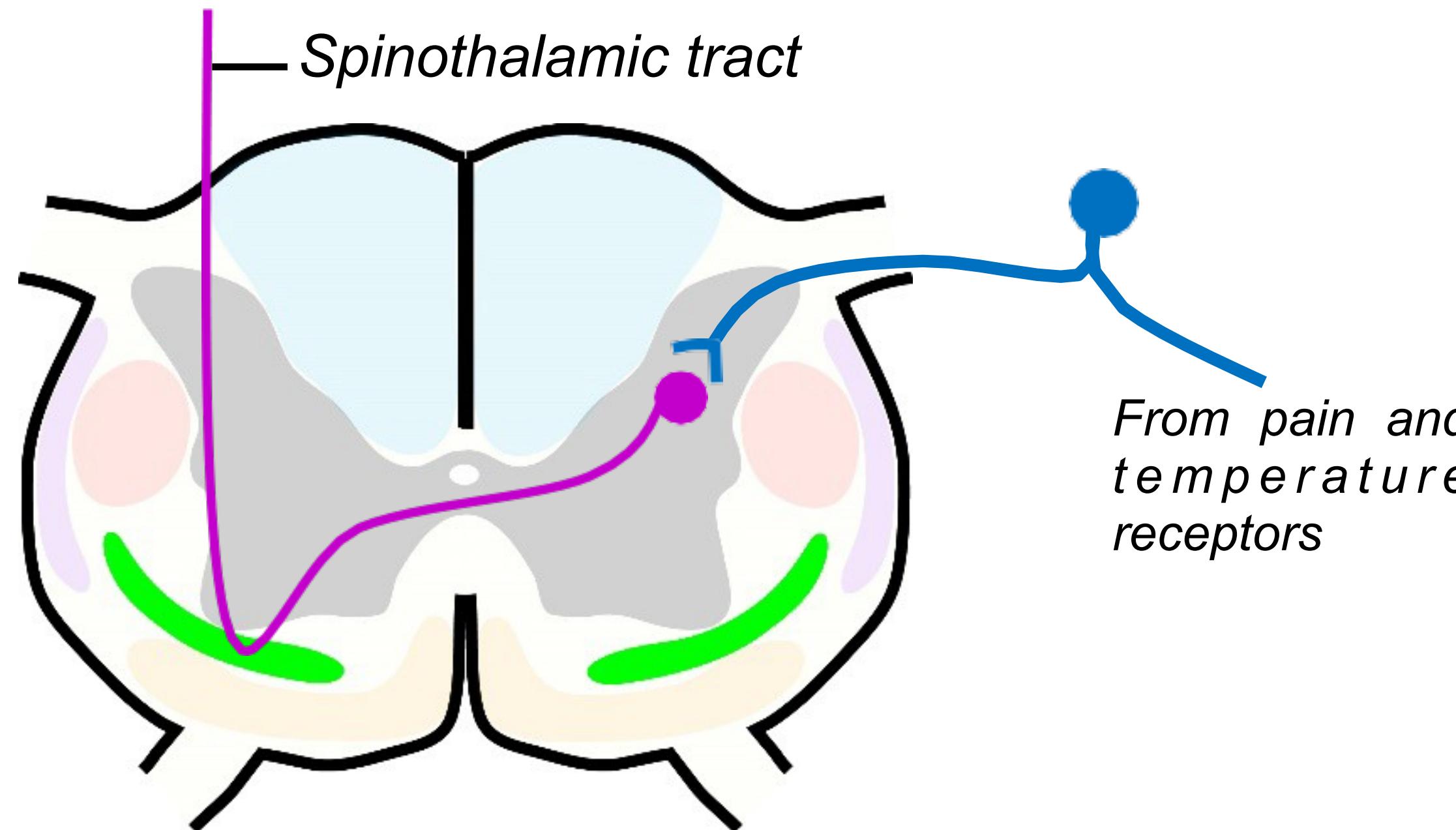
Somatotopic arrangement: Legs=medial; arms = lateral



Anterolateral System

Pathway

To somatosensory Cortex (Contralateral)



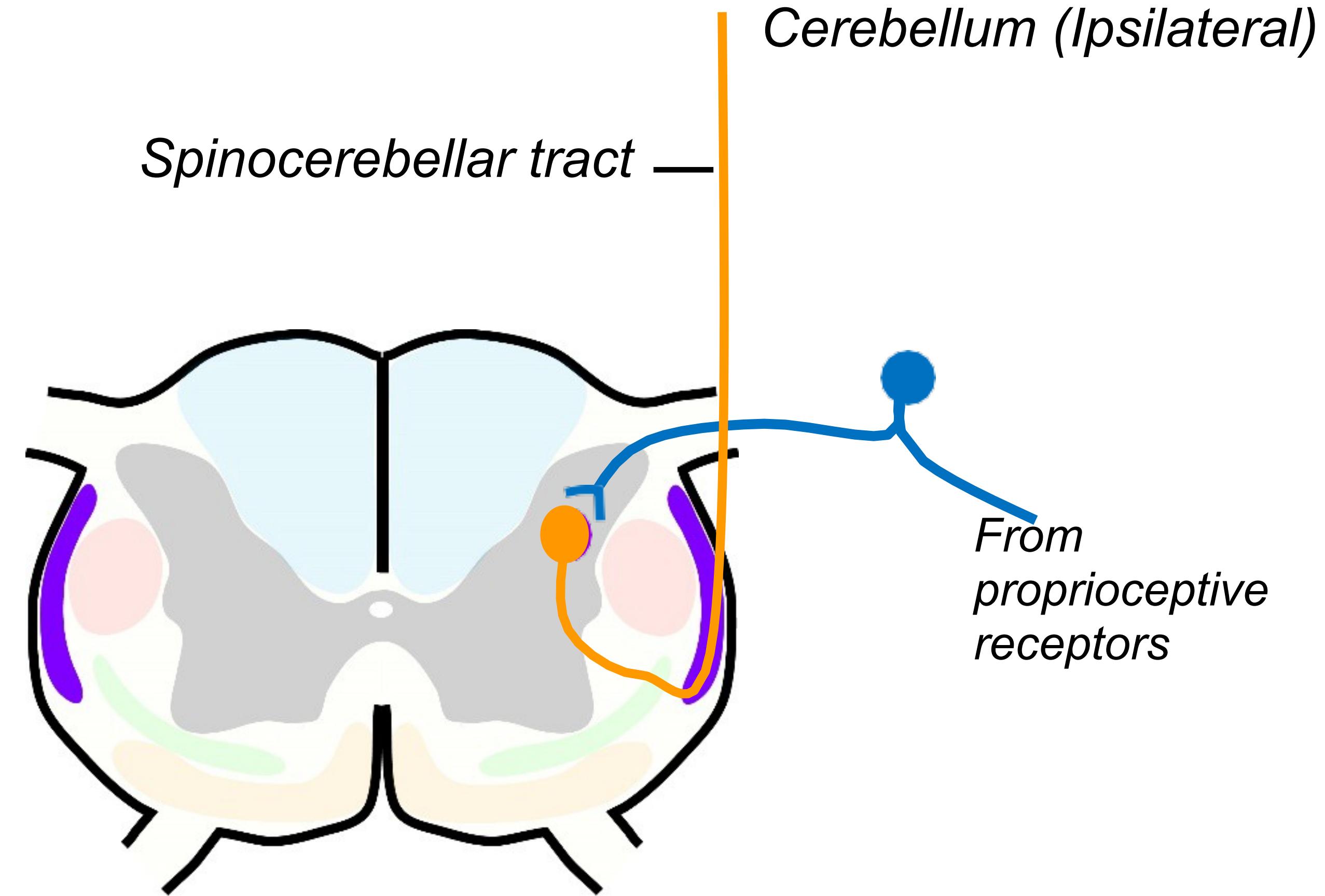
Neurons in the **dorsal horn** receive input from neurons in the dorsal root ganglion. Axons of dorsal horn neurons decussate via the spinal **anterior commissure**, and go up in the anterior column, forming the **spinothalamic tract**

Conveys sensations of **pain, temperature**

The tract travels up to the **thalamus** and ultimately to **somatosensory cortices**, postcentral gyrus in the parietal lobule.

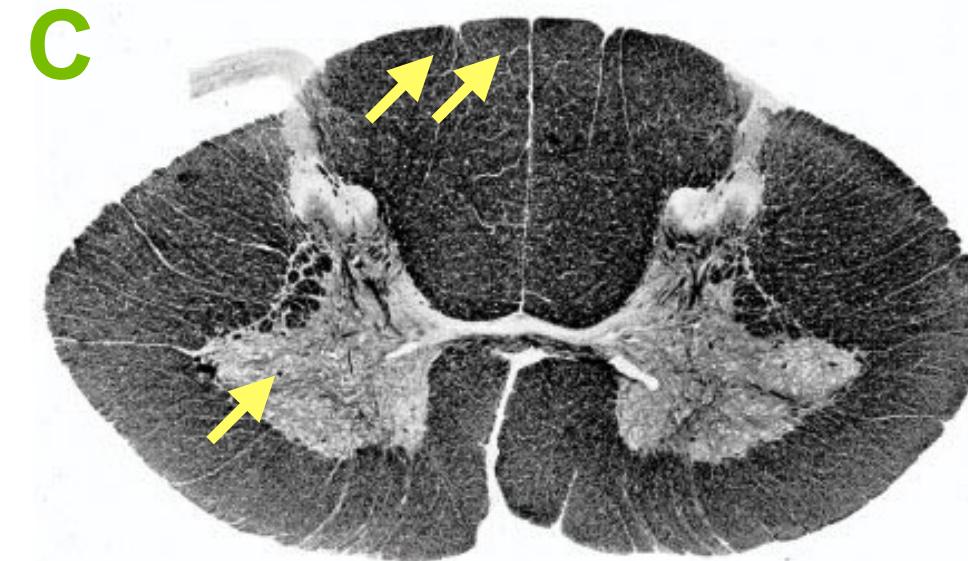
Note that **decapsulation occurs within the spinal cord**, in contrast to the dorsal column system that decapsulates in brainstem.

SpinoCerebellar Tracts

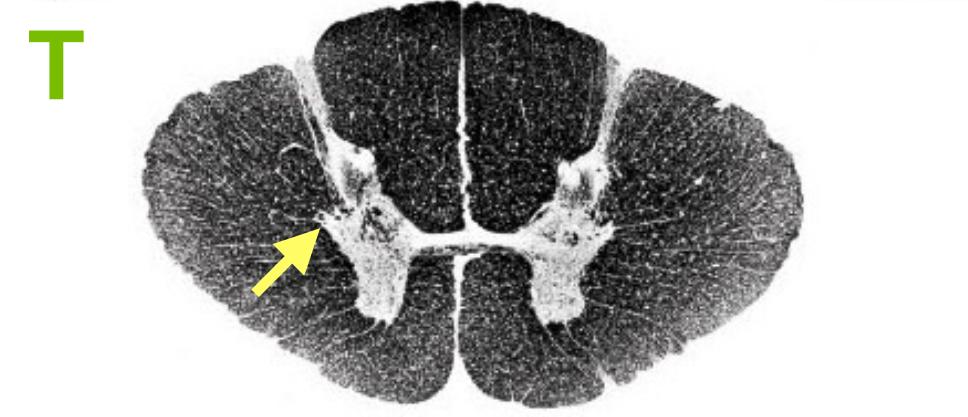


TRANSMITS UNCONSCIOUS PROPIOCEPTION TO IPSILATERAL CEREBELLUM

Summary: SC levels



- Thickest white matter
- Large ventral horn because of arm LMNs
- Two fasciculi present in the dorsal column



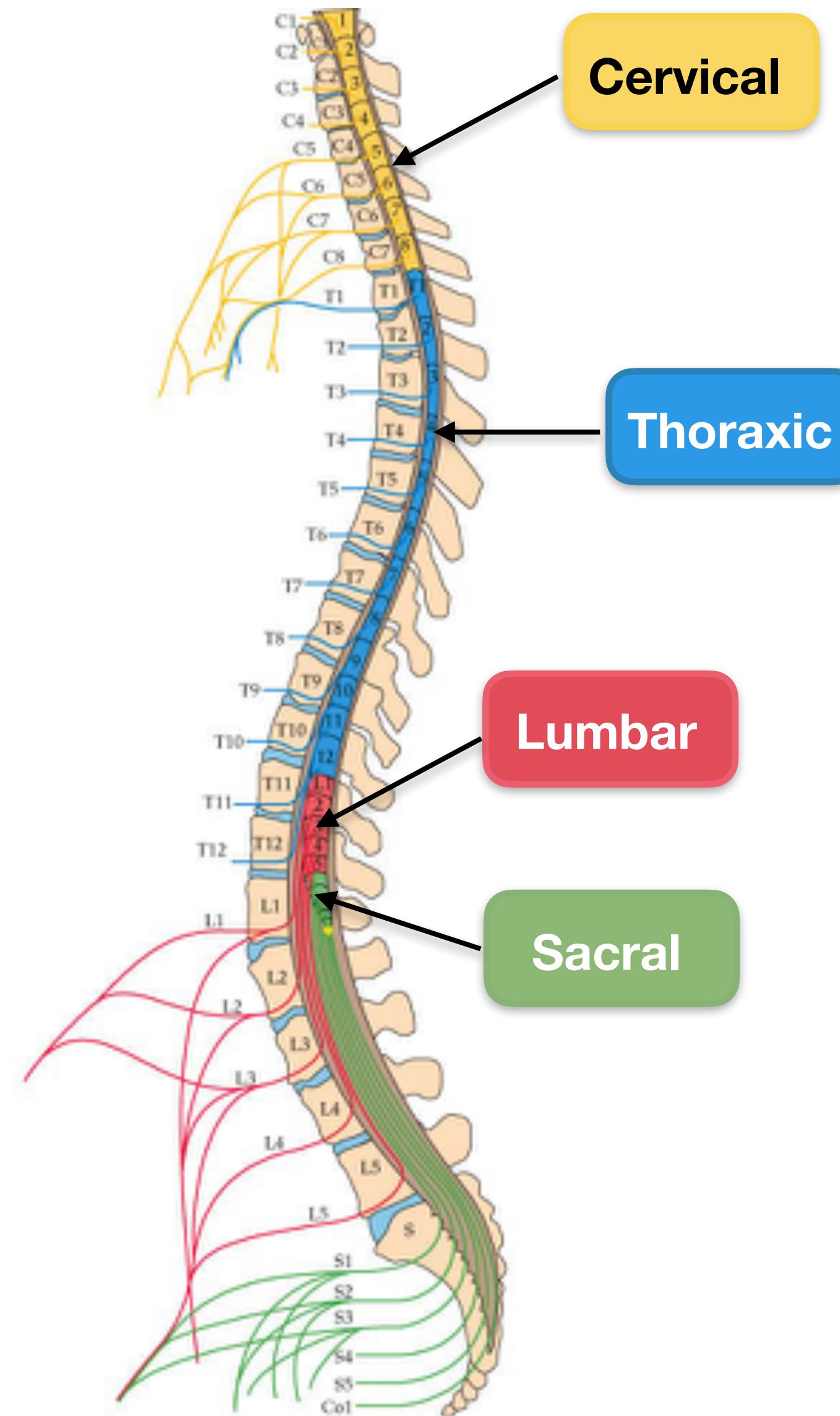
- Visceral control = lateral horn



- Large ventral horn because of leg LMNs
- Only one fasciculus in the dorsal column



- Mostly gray matter



Important

What Can Go Wrong?

Group Work

Back of the room



Amygdala



Limbic



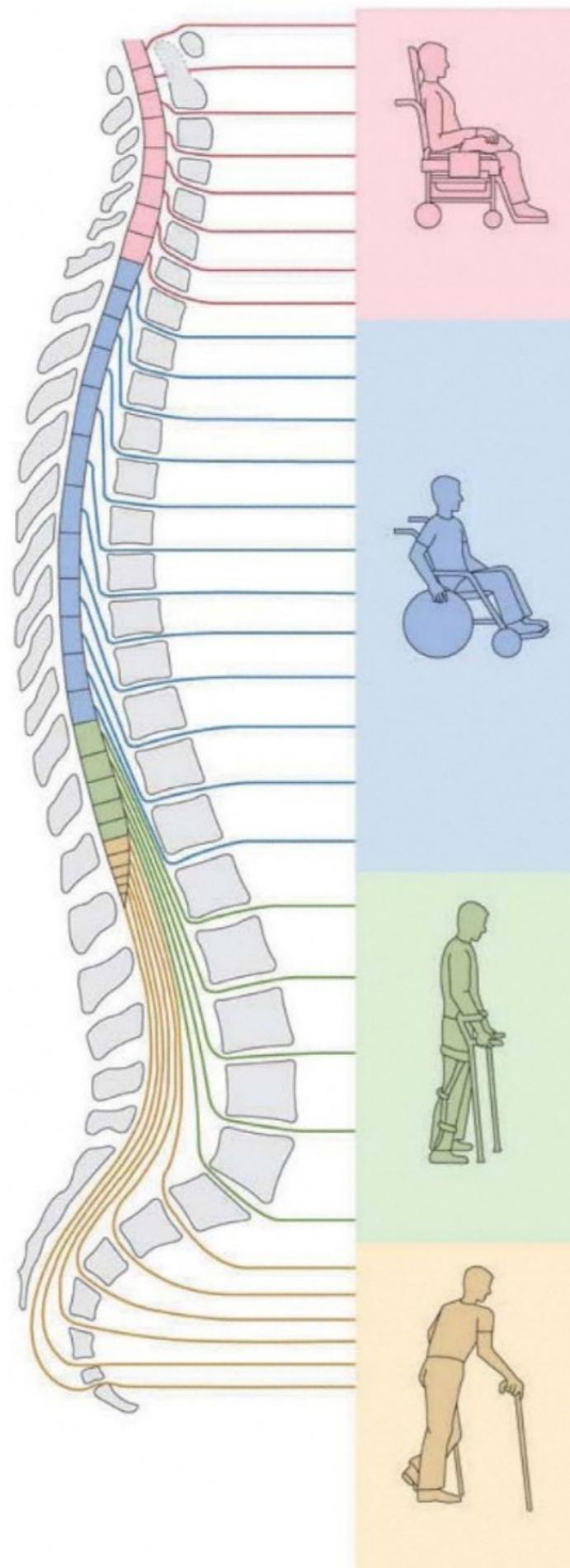
Tempestas



Hipocampus

Front of the room

Primer on Spinal Cord Lesions

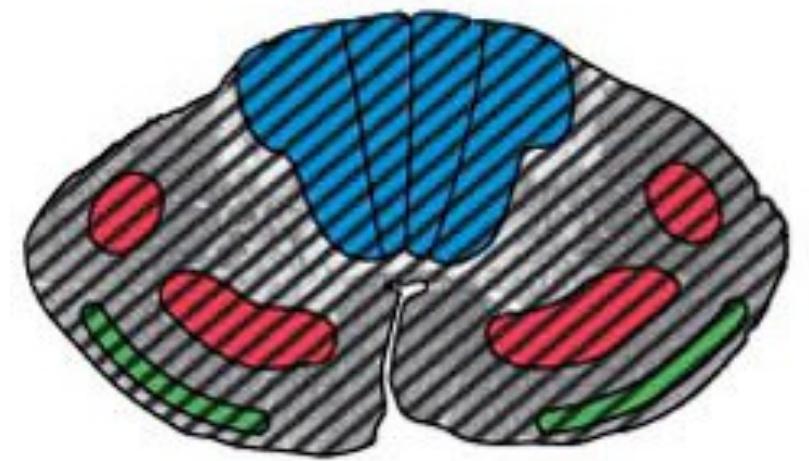


Spinal cord lesions are a major source of disability because they can affect motor, sensory and autonomic functions.

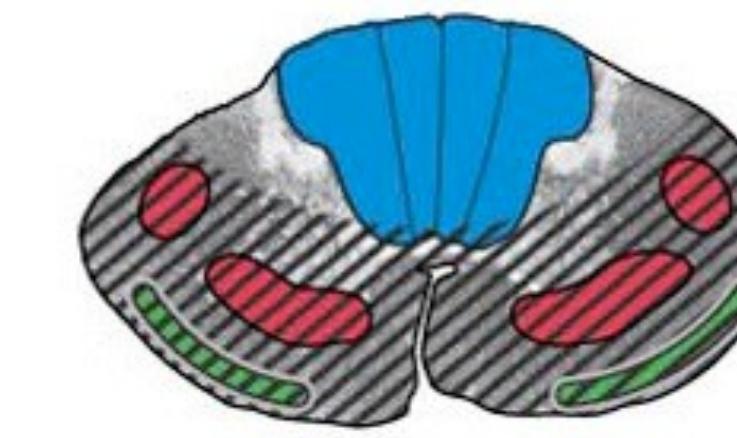
Causes of spinal cord dysfunction: extrinsic compression due to degenerative disease of the spine, trauma, metastatic cancer, cysts, infections and stroke.

A basic concept to the spinal cord syndromes is that motor/somatosensory dysfunctions occur **below** the level of lesion.

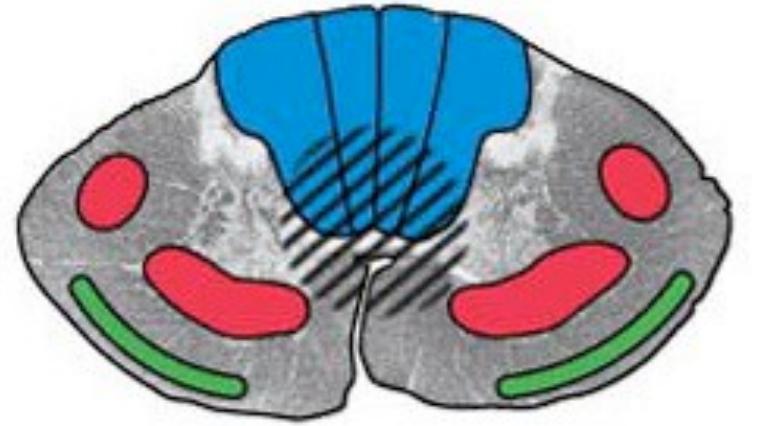
Syndromes



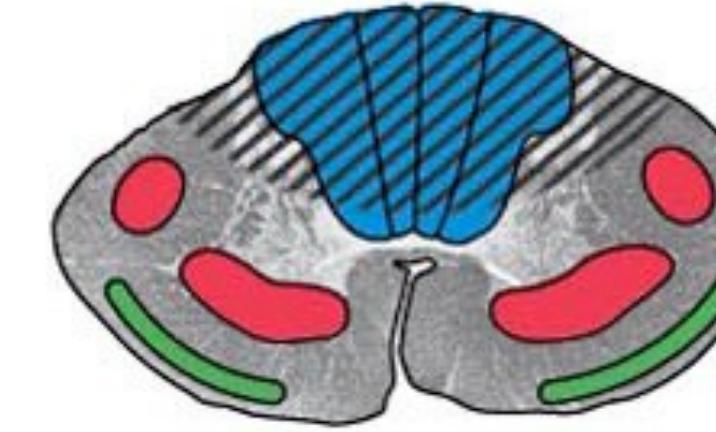
Transverse cord lesion



Anterior cord syndrome



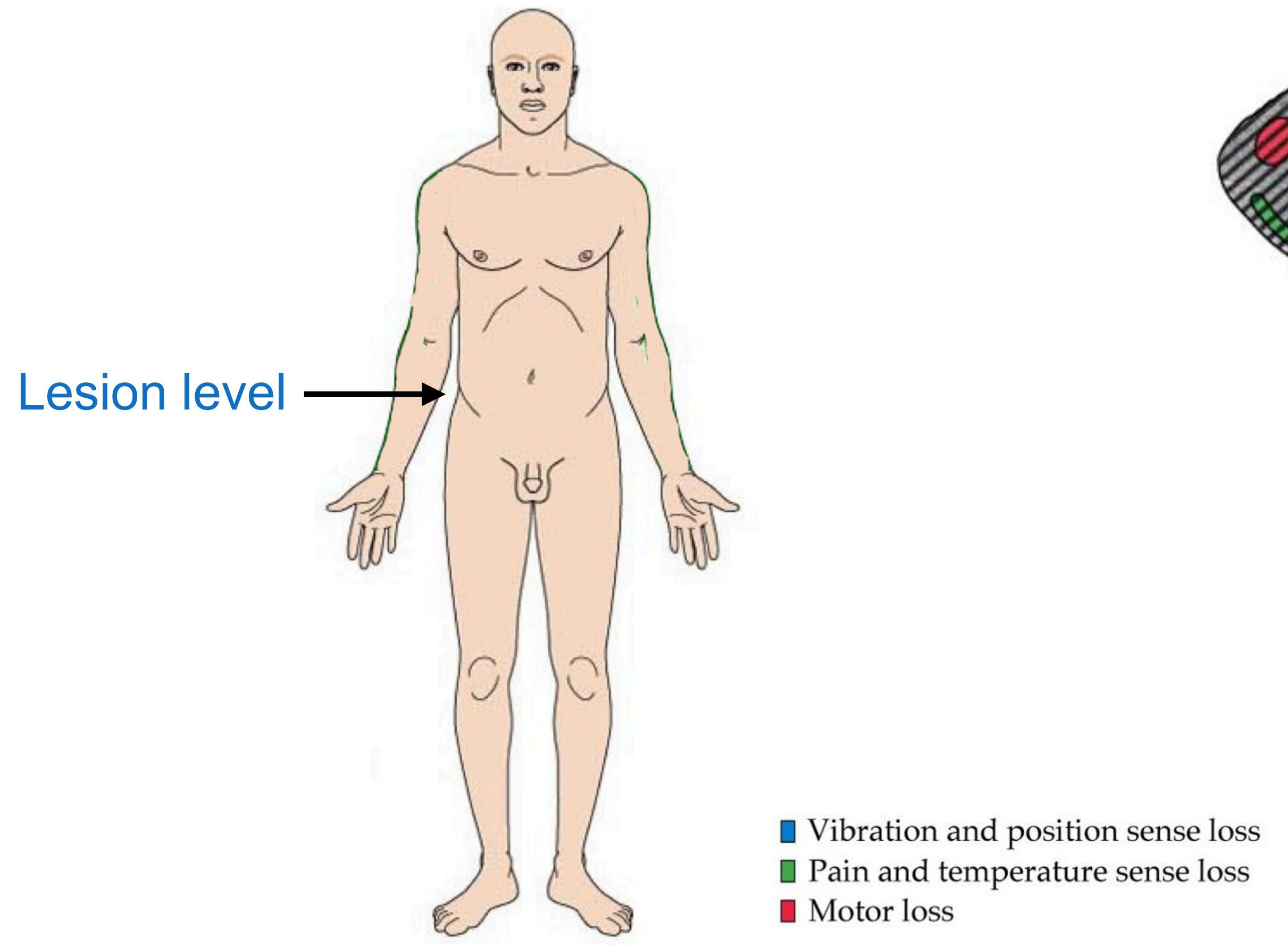
Central cord syndrome



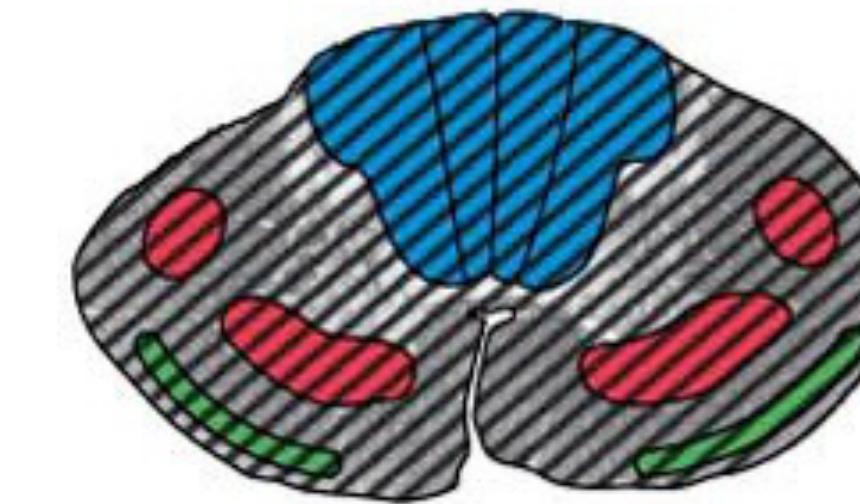
Posterior cord syndrome

//// : lesioned area

Transverse SC lesions



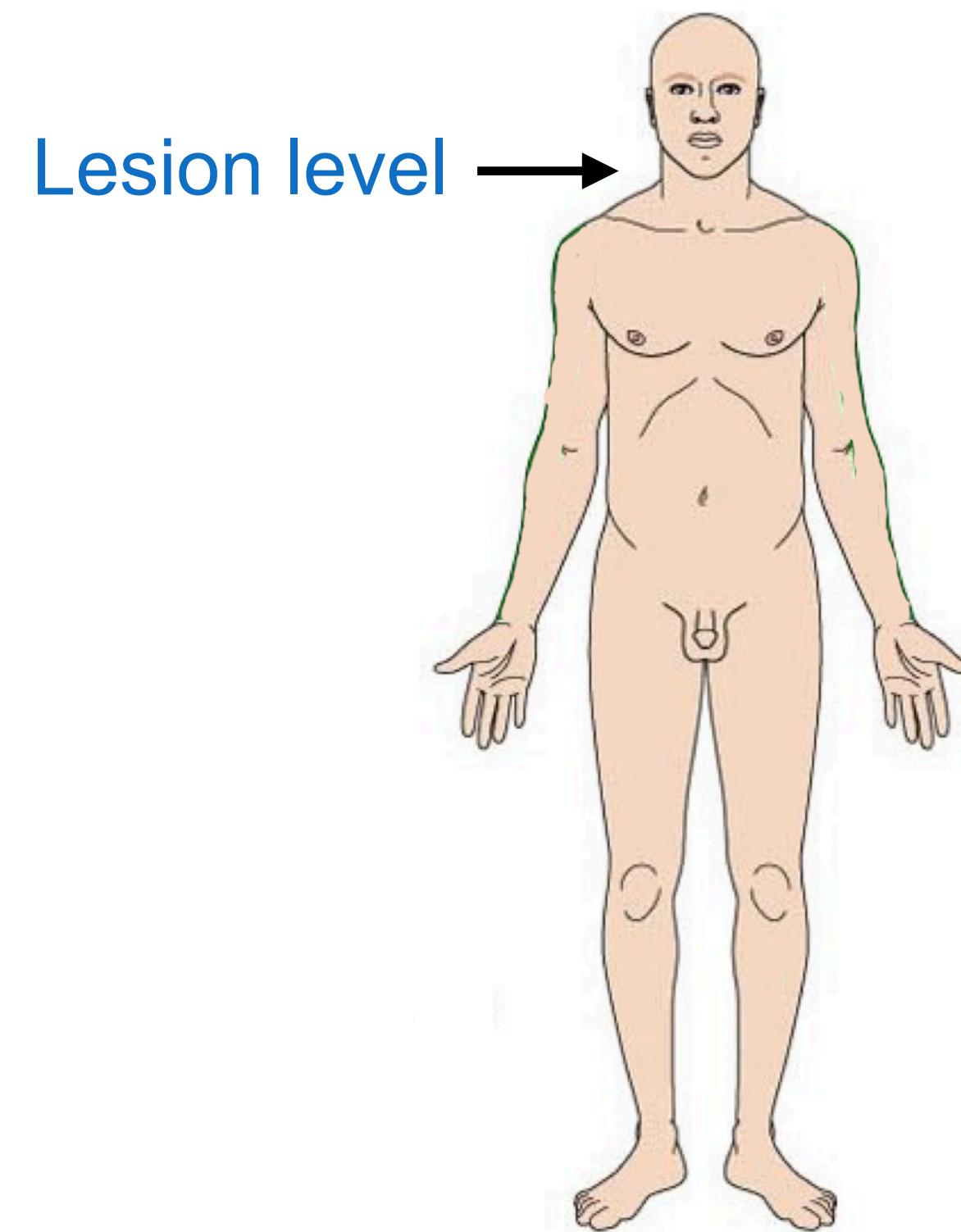
- Vibration and position sense loss
- Pain and temperature sense loss
- Motor loss



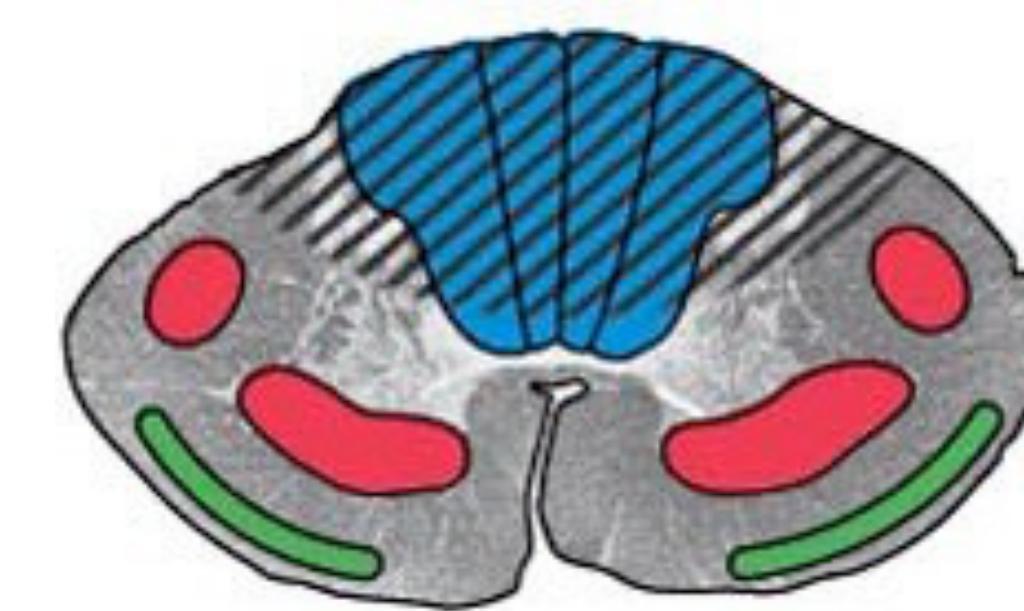
Complete lesion of the spinal cord

- Gray matter/white matter
- Somatosensory/Motor

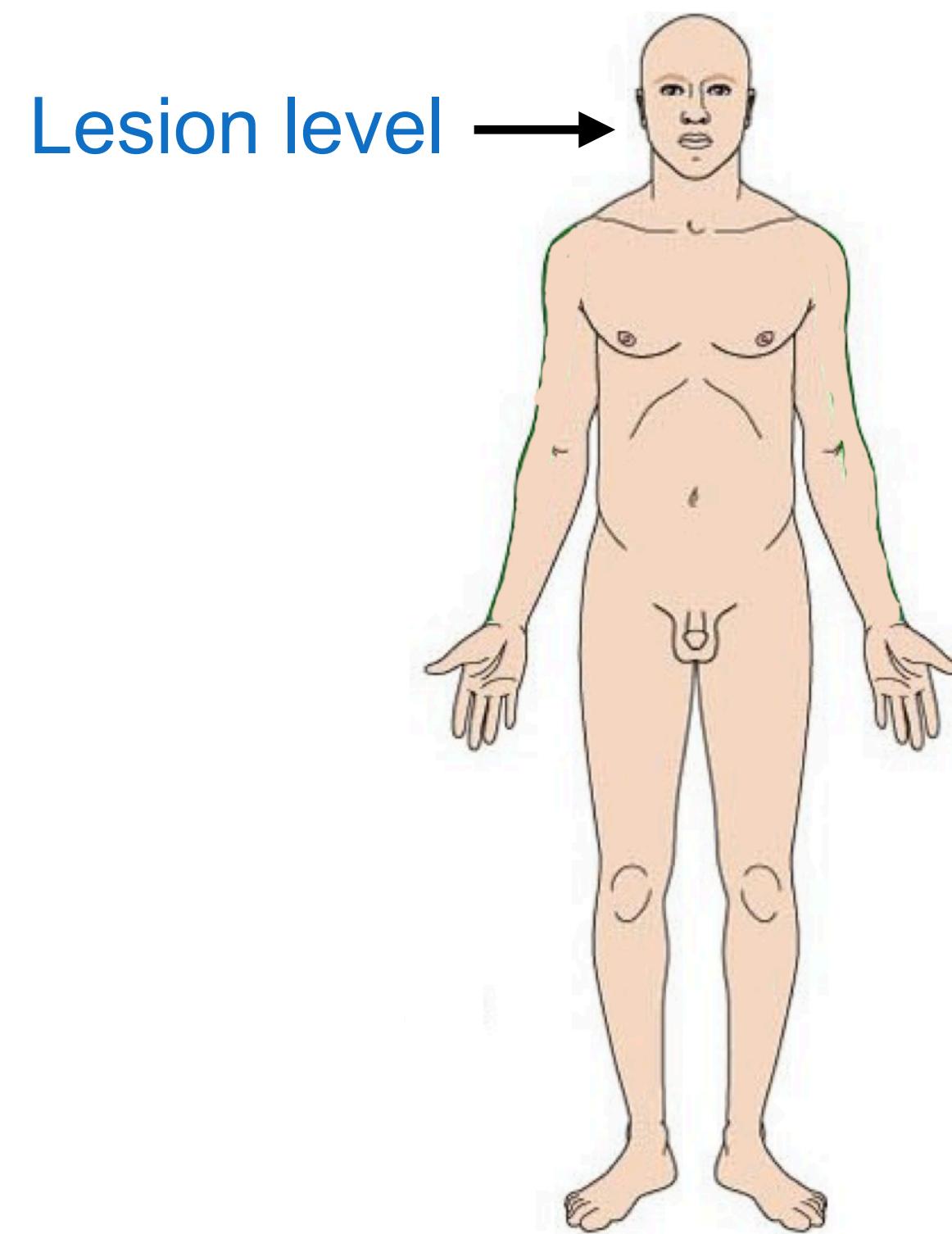
Posterior Cord Lesion



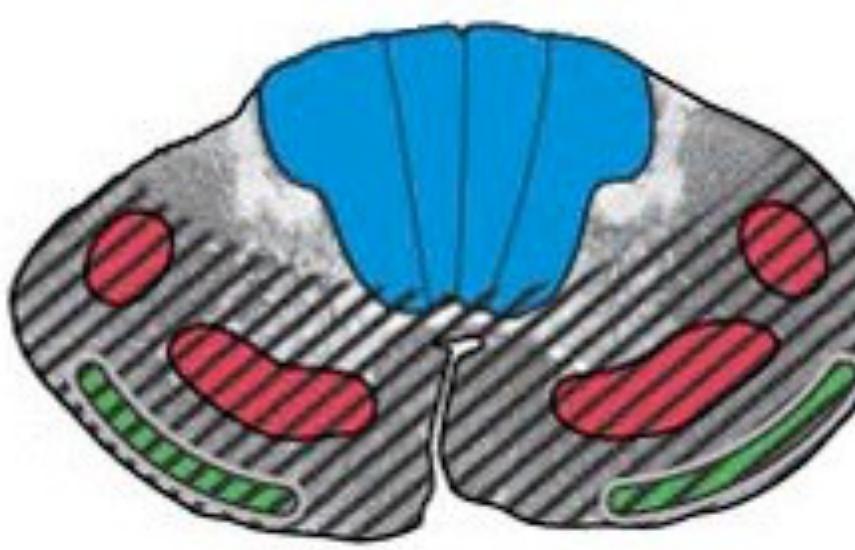
- Vibration and position sense loss
- Pain and temperature sense loss
- Motor loss



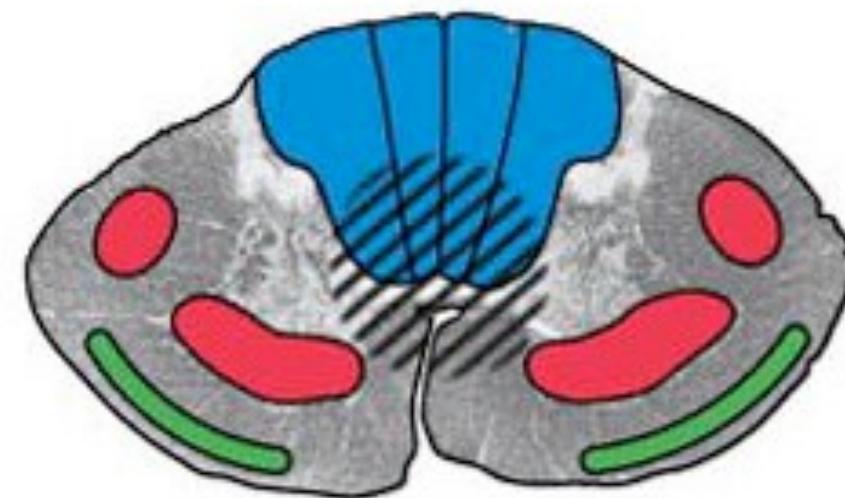
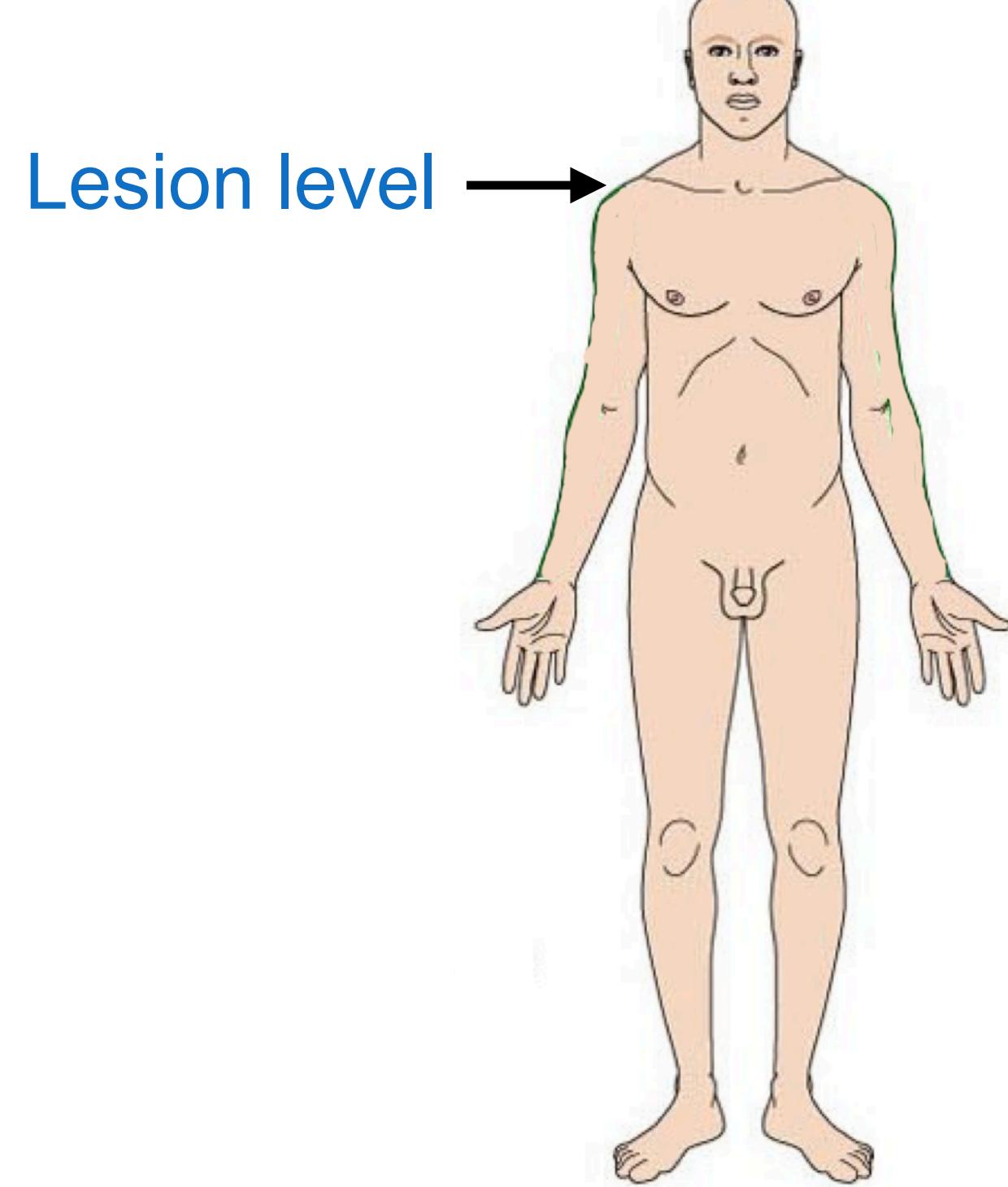
Anterior Cord Syndrome



- Vibration and position sense loss
- Pain and temperature sense loss
- Motor loss



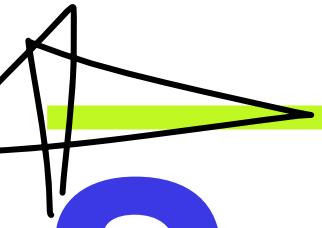
Central Cord lesion



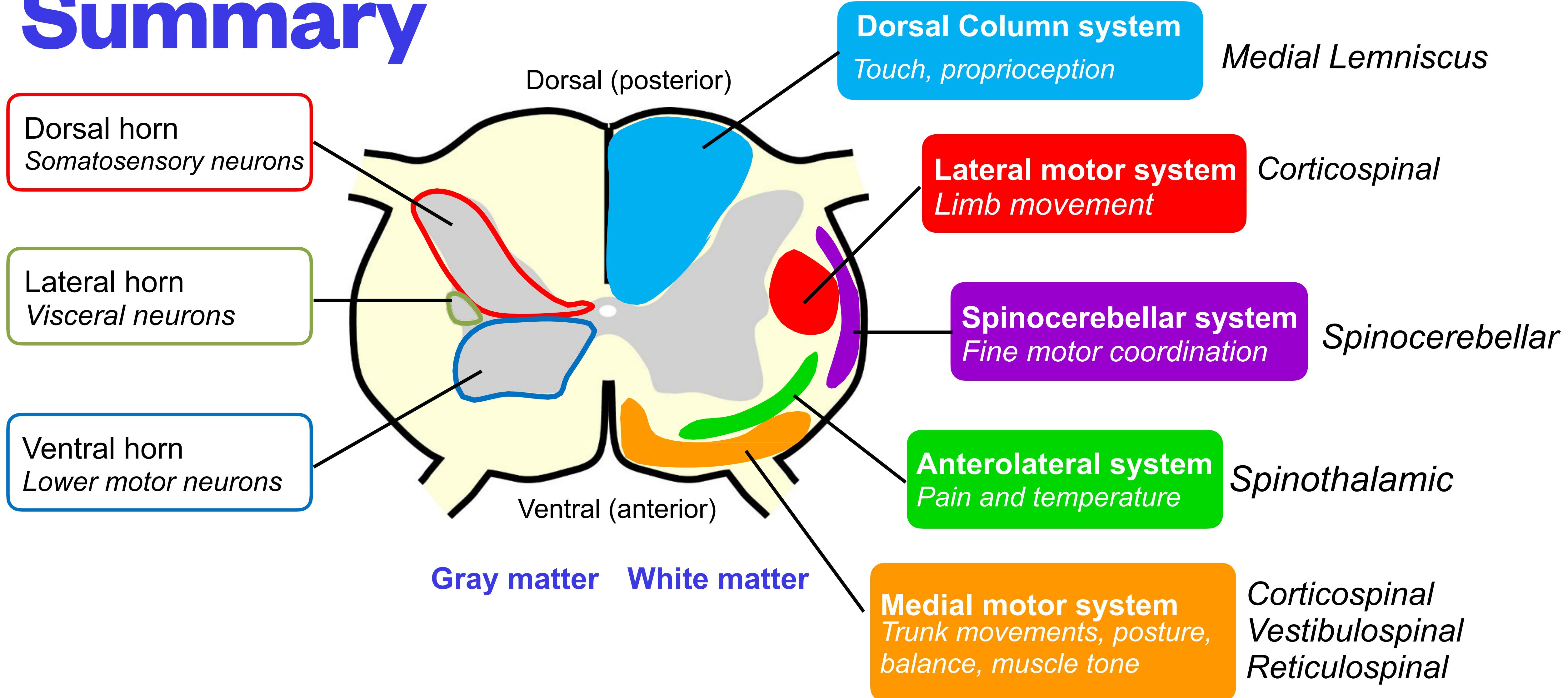
- Vibration and position sense loss
- Pain and temperature sense loss
- Motor loss

Can we review the mainest points again??





Summary



Thanks for your Attention

