Spinal Tracts

Andreas Talgø Lie

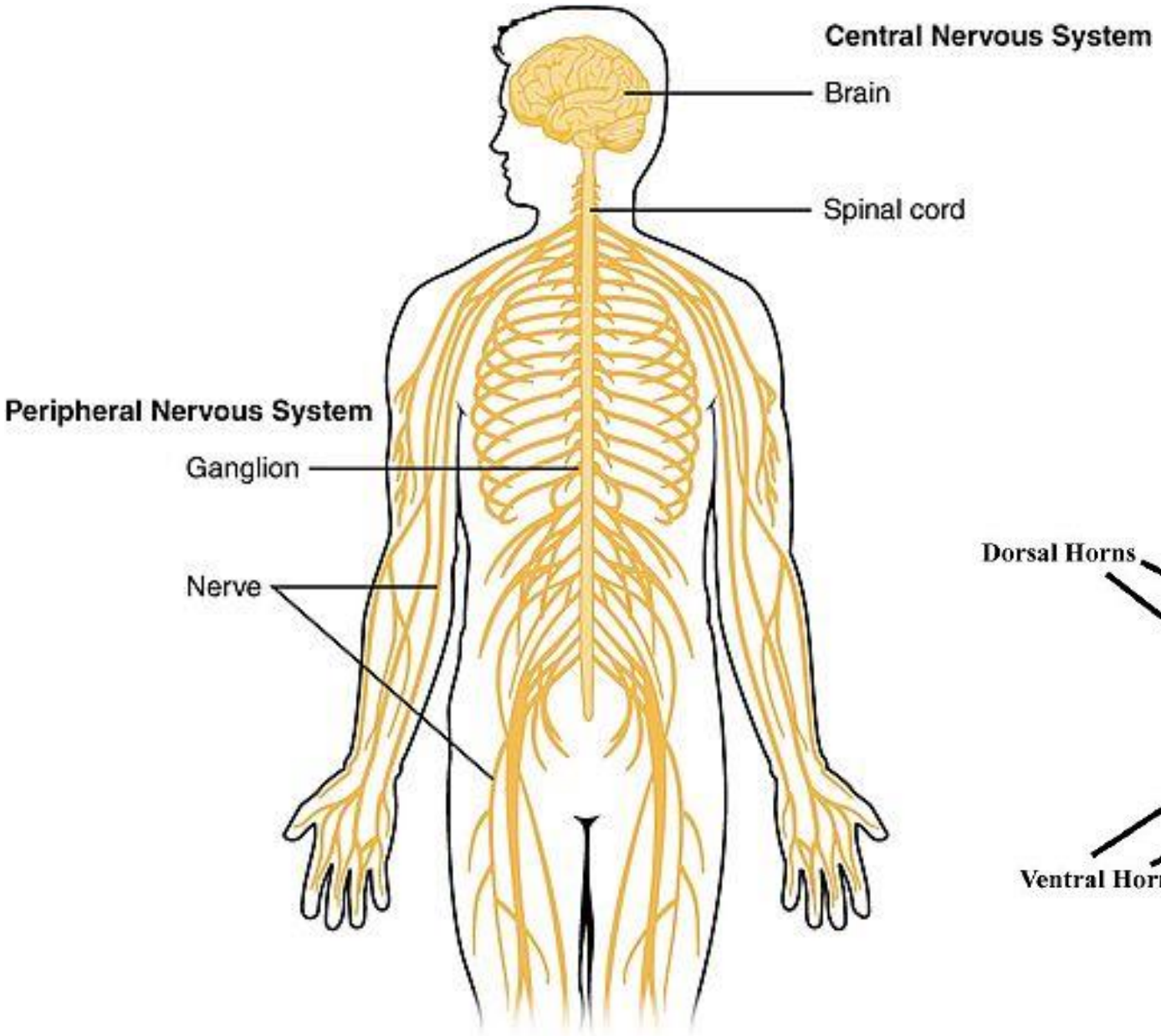
Illustrations by: Peder Olai Skjeflo Holman

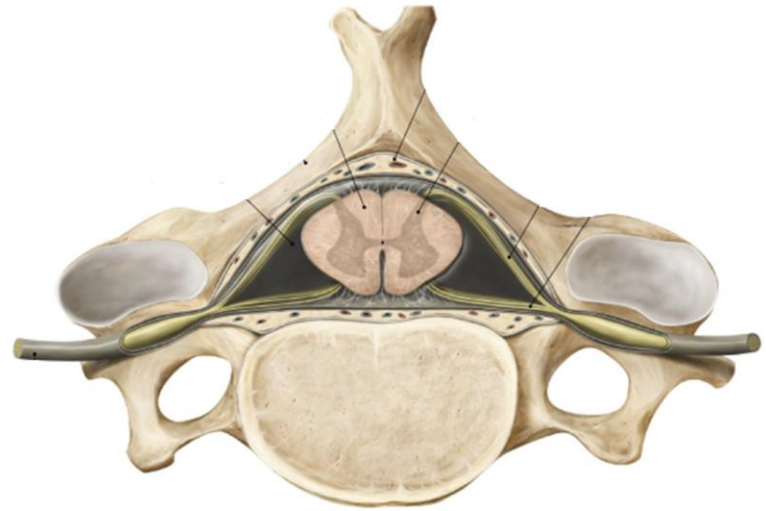
Previous material: Maja Solbakken

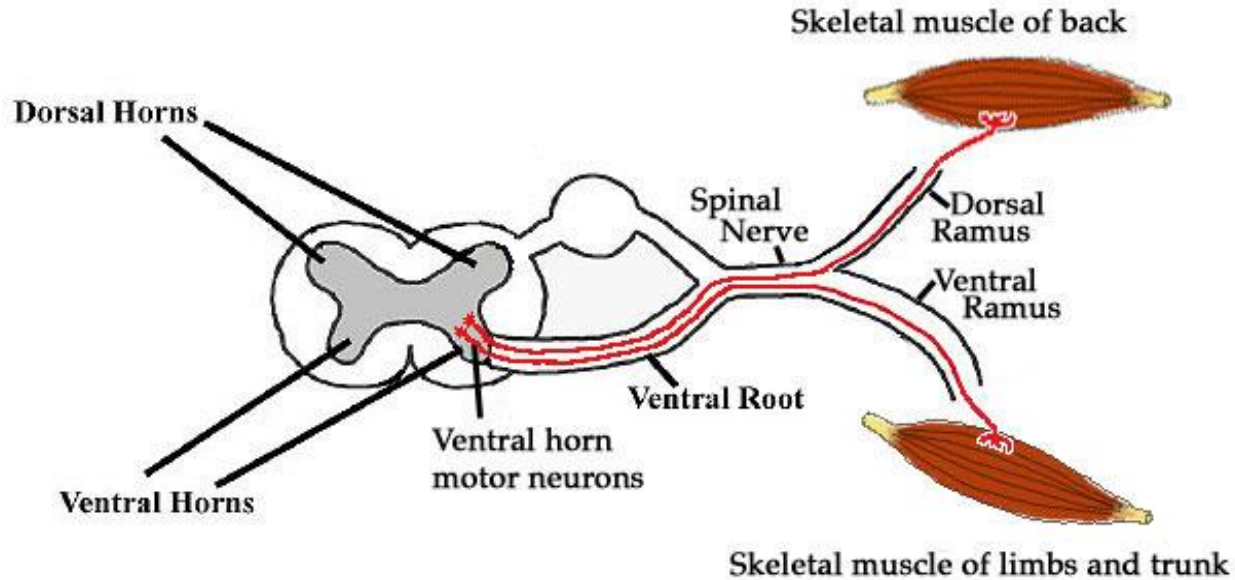

...AND THAT IS WHY WE LIFT ON THREE...
COMMUNICATION
©DOLIGHAN
dolighan.com

Definitions to bring home

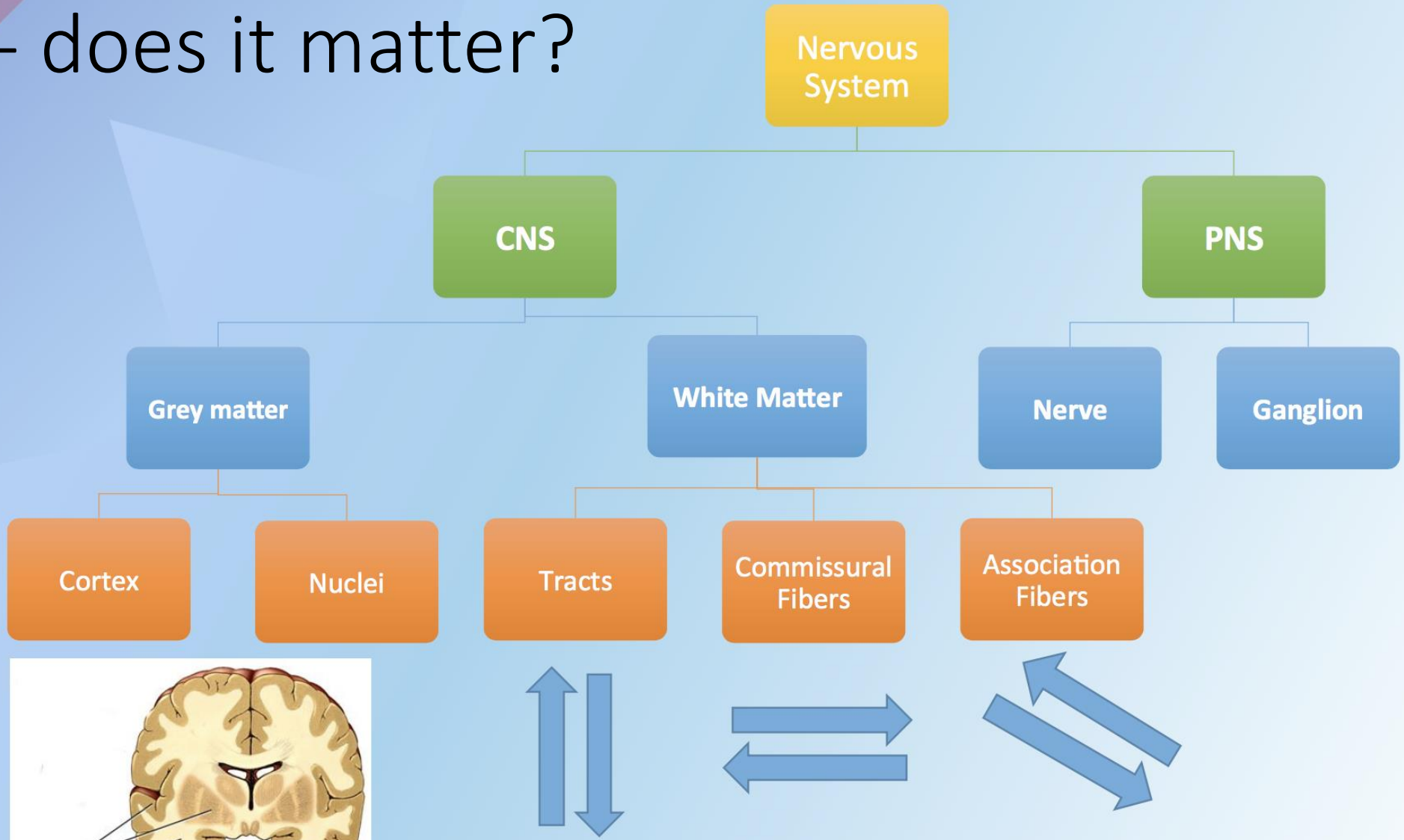
Nerve	Ganglion	Neuron	Nucleus	Tract
Collection neurons that transmits sensation or motor impulses depending on the function and destination. *Location: PNS*	*Collection of nerve cell bodies in the PNS, typically linked by synapses.* *Location: PNS*	*A single cell transmitting electrical impluses.* *Location: both*	*Collection of nerve cell bodies in the CNS, typically linked by synapses.* *Location: CNS*	*Collection of axons traveling up or down the spinal cord, depending on function and destination.* *Location: CNS*


Central Nervous System
Brain
Spinal cord
Peripheral Nervous System
Ganglion
Nerve




Skeletal muscle of back
Dorsal Horns
Spinal Nerve
Dorsal Ramus
Ventral Ramus
Ventral Root
Ventral horn motor neurons
Ventral Horns
Skeletal muscle of limbs and trunk

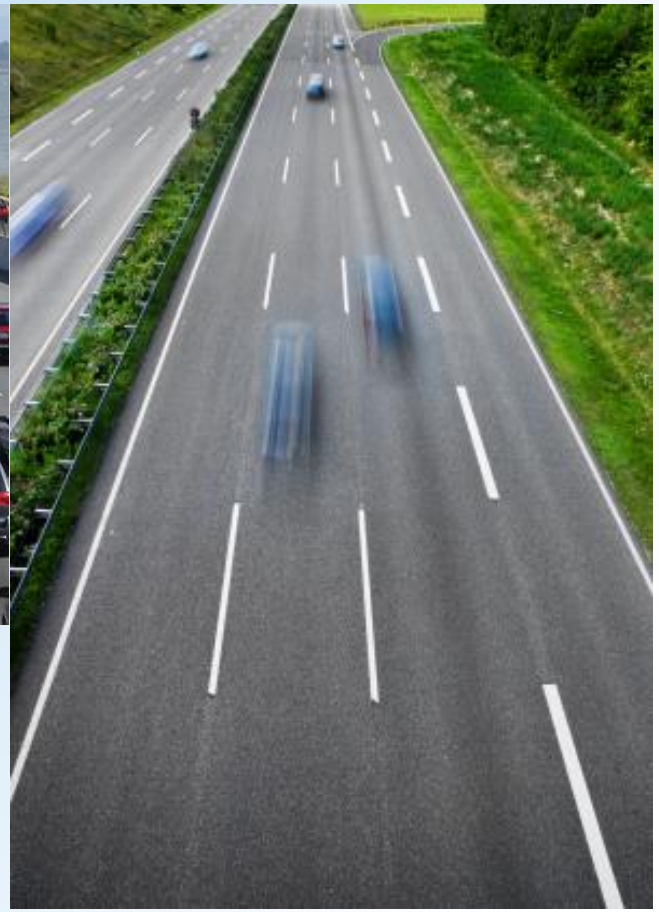
Anatomical Structure of the N.S.
- does it matter?



Tract - highway to pass anatomy exam?

- Highway = Tract
- Lane = Neuron
- Car = Signal

Slow...



Fast!!

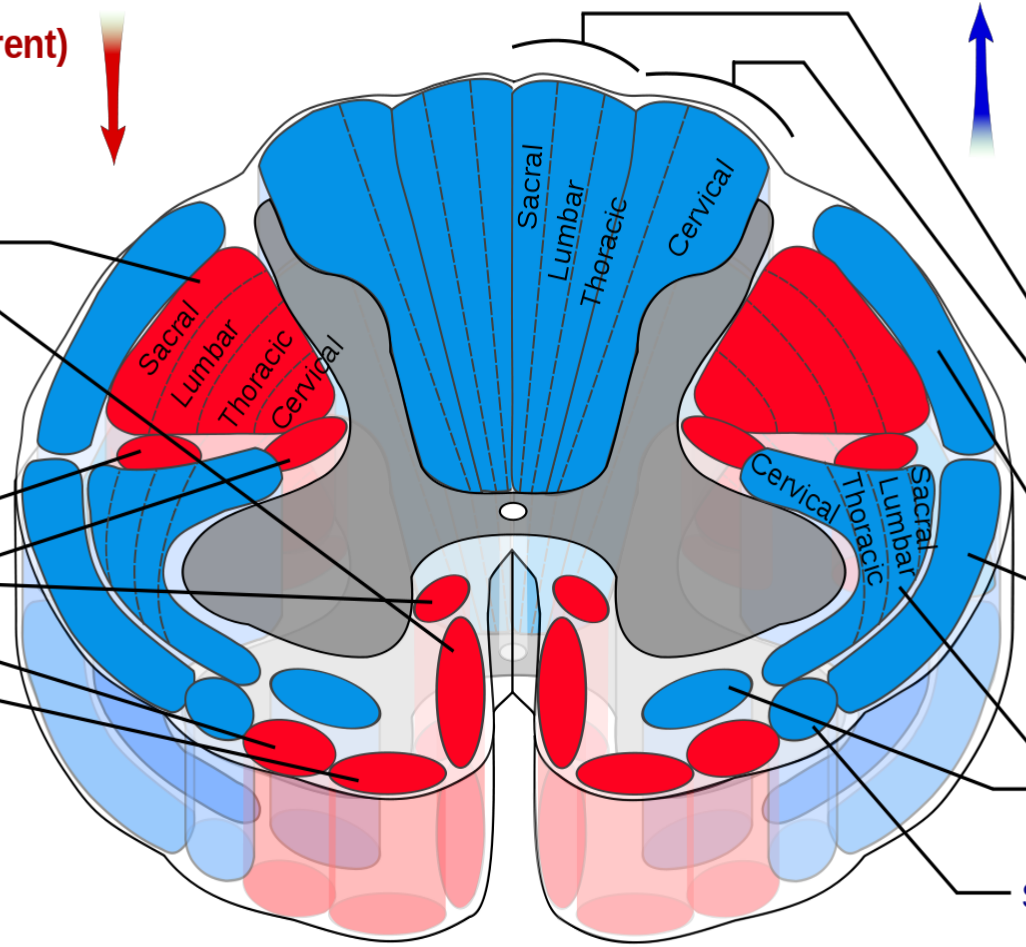
Motor and descending (efferent) pathways (red)

Pyramidal tracts

- Lateral corticospinal tract
- Anterior corticospinal tract

Extrapyramidal Tracts

- Rubrospinal tract
- Reticulospinal tracts
- Olivospinal tract
- Vestibulospinal tract



Sensory and ascending (afferent) pathways (blue)

Dorsal Column Medial Lemniscus System

- Gracile fasciculus
- Cuneate fasciculus

Spinocerebellar Tracts

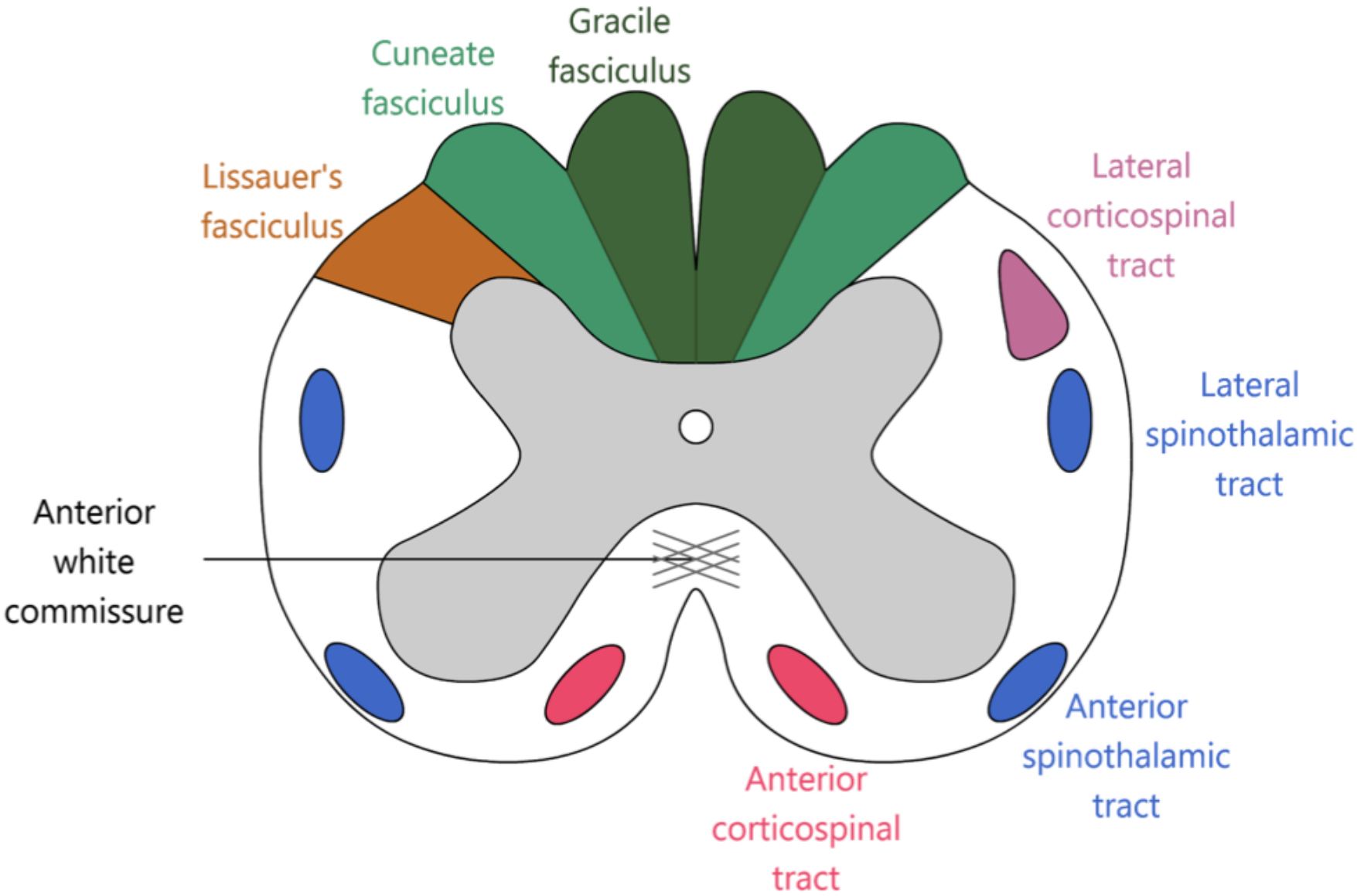
- Posterior spinocerebellar tract
- Anterior spinocerebellar tract

Anterolateral System

- Lateral spinothalamic tract
- Anterior spinothalamic tract

- Spino-olivary fibers

Tracts of the spinal cord - overview



Just to make sure...

- Ipsilateral or contralateral
- Ventral = anterior
- Dorsal = posterior

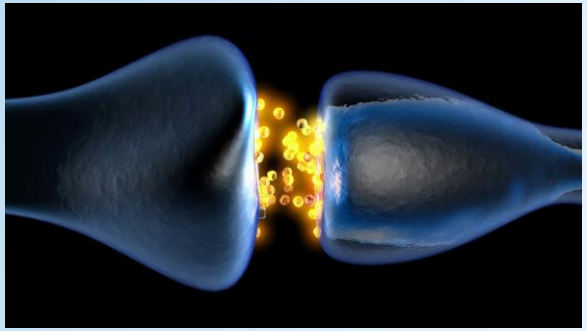
High yield points to understand

- What does the tract transmit

- Motor or sensory? If sensory: which sensation?

- Where does the neurones synapse

- 1.st, 2nd and 3rd order neron? Which ganglion/nuclei?



- Where there are decussations

- If there are any decussations at all?

ASCENDING / SENSORY TRACTS

Sensations

* Temperature
* Pressure
* Pain
* Fine touch
* Crude touch
* Proprioception
* Vibration

NOT transmitted by the tracts:

~~* Visualization~~

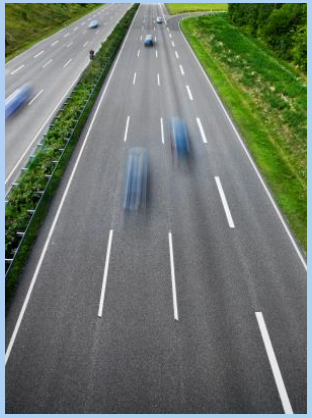
~~* Audition~~

~~* Olfaction~~

~~* Gustation~~

Sensations

Precise sensation	Primitive sensation
Fine touch	Crude touch
Pressure	Pain
Vibration	Temperature
Proprioception	*Other: sexual, itching, tickling*



Ascending tracts / Sensory tracts

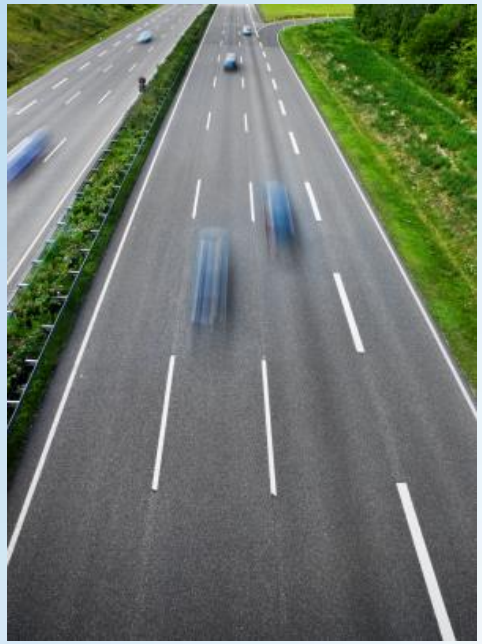
Dorsal coulmn	Lat. Spinothalamic	Ant. Spinothalamic
Fine touch	Pain	Crude touch
Pressure	Temperature	
Vibration		
Proprioception		

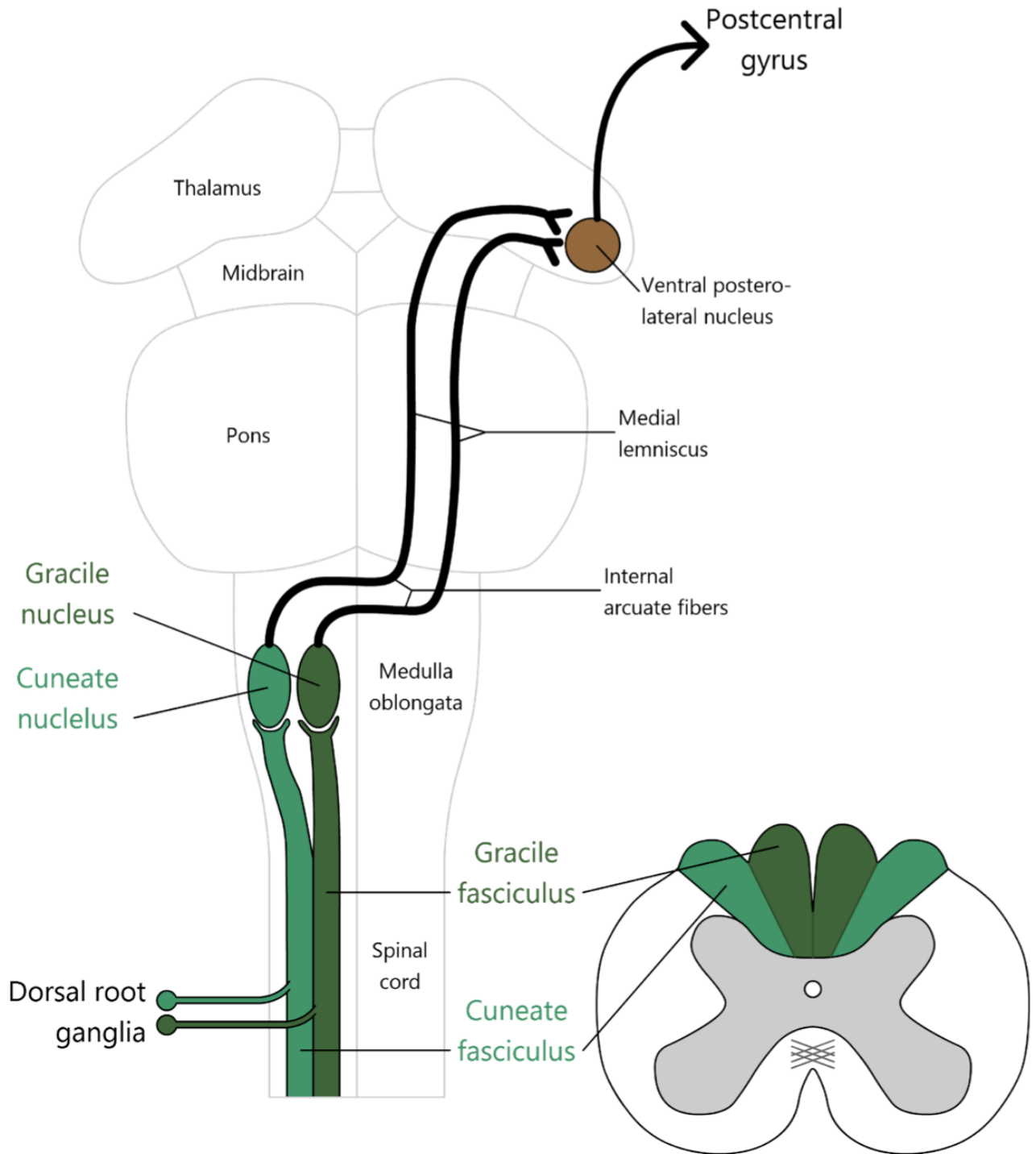
Dorsal Column-Medial Lemniscus Pathway

(Spinobulbothalamocortical tract)

Transmits precise sensation:

- Fine touch
- Pressure
- Vibration
- Proprioception




Postcentral gyrus
Thalamus
Midbrain
Ventral postero-lateral nucleus
Pons
Medial lemniscus
Internal arcuate fibers
Gracile nucleus
Cuneate nuclelus
Medulla oblongata
Gracile fasciculus
Spinal cord
Dorsal root ganglia
Cuneate fasciculus

Dorsal column summary

DORSAL COLUMN MEDIUM LEMNISCUS		
Transmission	**Synapses / Pathway**	**Decussation**
• Fine touch • Pressure • Vibration • Proprioception	*1. order neuron:* DRG *2. order neuron:* Cuneate & Gracile nuclei *3. order neuron:* ventral posterolateral nucleus (thalamus)	Decussate as ***internal arcuate fibers*** in the medulla, then become ***medial lemniscus***

Above T4	Below T4
Upper limb	Lower limb
Cuneate fasciculus/nucleus	Gracile fasciculus/nucleus

Spinothalamic tract

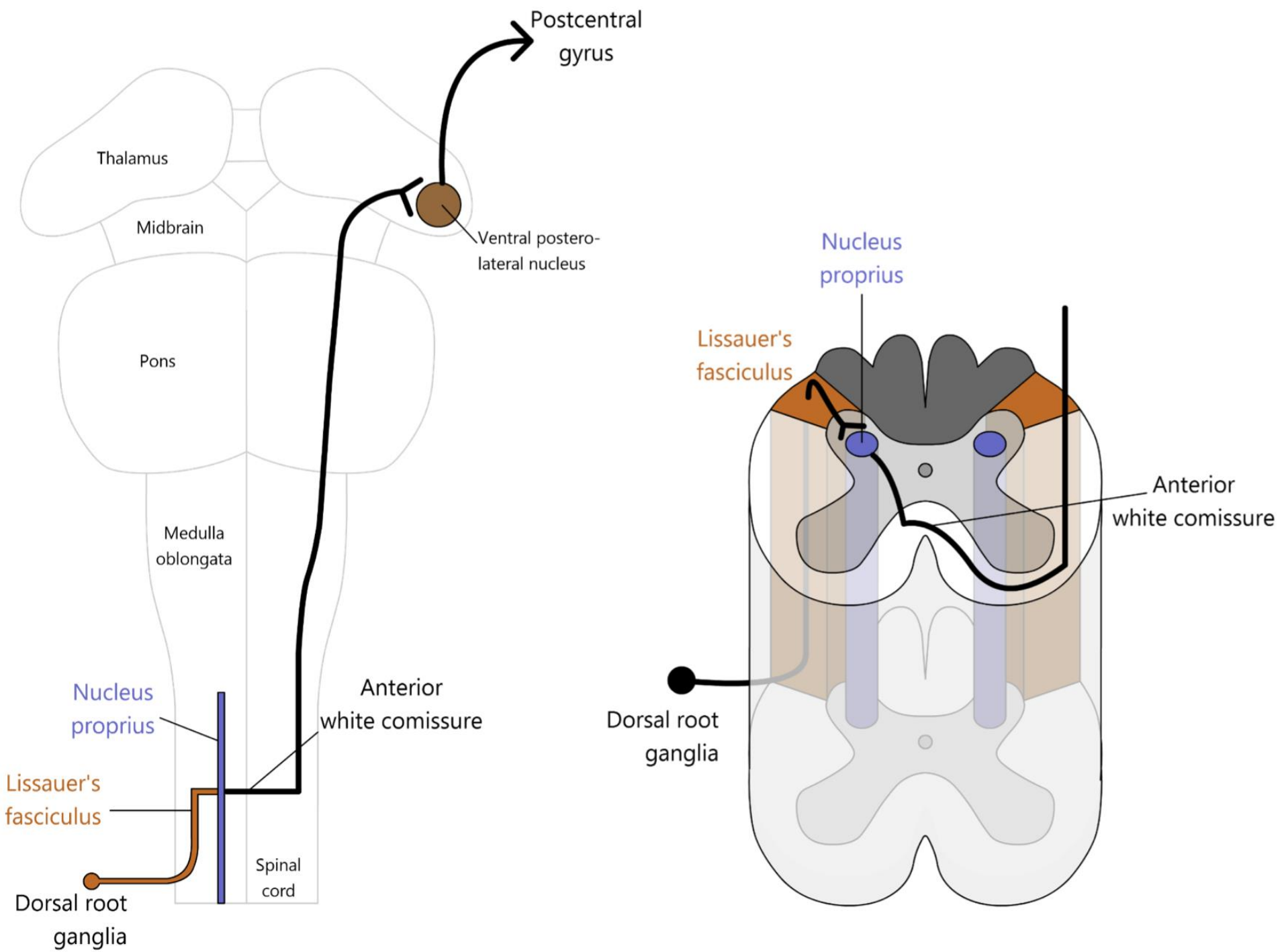
Anterior part transmit primitive sensation:

- Crude touch

Lateral part transmit primitive sensation:

- Pain
- Temperature

sPinoThalamiC


Postcentral gyrus
Thalamus
Midbrain
Ventral postero-lateral nucleus
Pons
Medulla oblongata
Nucleus proprius
Anterior white comissure
Lissauer's fasciculus
Spinal cord
Dorsal root ganglia
Nucleus proprius
Lissauer's fasciculus
Anterior white comissure
Dorsal root ganglia

SPINOTHALAMIC TRACT

Transmission	Synapses / Pathway	Decussation
• Pain • Temperature • Crude touch	*1. order neuron:* DRG *2. order neuron:* Nucleus Proprius of dorsal horn (Spinal cord) *3. order neuron:* Ventral posterolateral nucleus (thalamus)	***Anterior white commissure*** of spinal cord

Spinocerebellar tract

	Dorsal Spinocerbellar Tract	Ventral Spinocerbellar Tract
Enter spinal cord:	Dorsally (Clarks – C8 to S3)	Dorsally
Deccusation:	None	Twice *(in spinal cord and cerebellum)*
Enter cerebellum:	Inferior cerebellar peduncle	Superior cerebellar peduncle
Site of sensation:	Ipsilateral	Ipsilateral

DESCENDING / MOTOR TRACTS

Descending tracts / Motor tracts

Anterior Corticospinal Tract	Lateral Corticospinal Tract	Corticobulbar Tract
Primitive muscle movement	Advanced muscle movement	Muscle movement of head, neck and face

NB!!
Corticospinal tract = Pyramidal tract

studyaid

Corticospinal tract (Pyramidal tract)

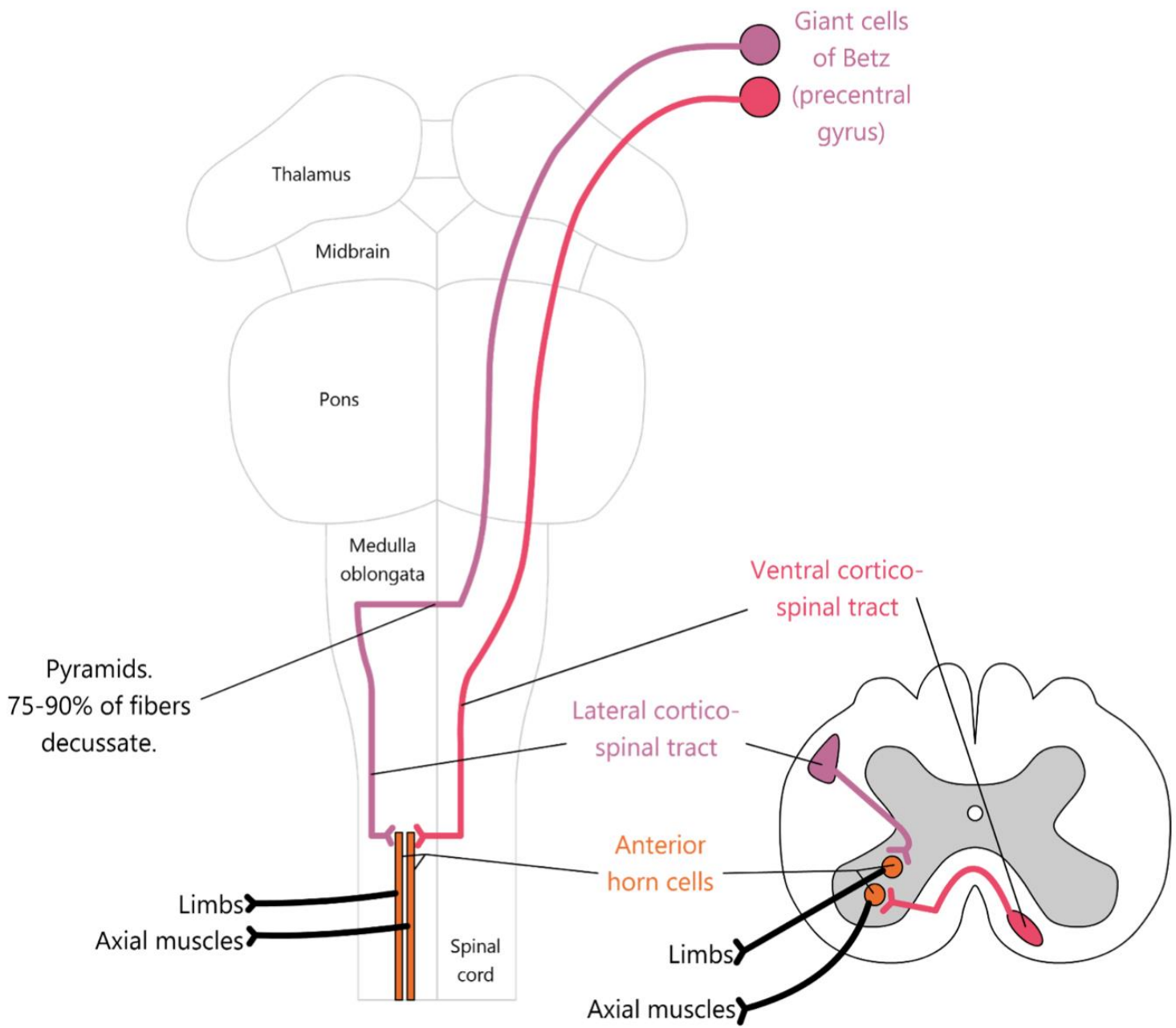
Transmission of:

- Motor function to contralateral limb

Divided into:

- Anterior part
- Lateral part

Corticospinal tracts



Corticospinal Tract Summary

CORTICOSPINAL TRACT		
Transmission	**Synapses / Pathway**	**Decussation**
• Motor function to contralateral limb	*1. order neuron:* Giant cells of Betz in precentral gyrus (motor cortex) *2. order neuron:* Anterior horn cells of spinal cord	• 75 – 90% in ***pyramidal decussation*** (to contralateral lateral white column) • 10 – 25% in ***anterior white commissure*** of spinal cord

Corticobulbar Tract

	Corticobulbar Tract
Origin:	Cortex (Giant cells of Betz)
Destination:	Different motor nucleus in brainstem
Function:	Innervate CN nucleus which control muscle movement of head, neck and face

SUMMARY

SUMMARY OF TRACTS OF THE SPINAL CORD				
	Transmission	**Synapses / Pathway**		**Decussation**
Dorsal column-medial lemniscus pathway	• Fine touch • Pressure • Vibration • Proprioception	1. order neuron	DRG	Medulla *(as internal arcuate fibers)*
		2. order neuron	Gracile or Cuneate nucleus	
		3. order neuron	VPL (thalamus)	
Spinothalamic tract	• Pain • Temperature • Crude touch	1. order neuron	DRG	Anterior white commissure (AWC)
		2. order neuron	Nucleus proprius	
		3. order neuron	VPL (thalamus)	
Corticospinal tract	• Motor function	1. order neuron	Giant cells of Betz	Medullary pyramids, AWC
		2. order neuron	Anterior horn cells	


DON'T WORRY AMIGO!
THIS IS COMPLETELY SAFE!
EVERYONE STILL SURVIVED AFTER
THE SURGERY!
MemeCenter.com