

Brain, Spinal Cord, & Spinal Tracts

By Sayeh Mirshojae

Overview

- Brain
- Spinal cord
- Spinal Cord Tracts
- WOOclap Questions

Brain

Brain

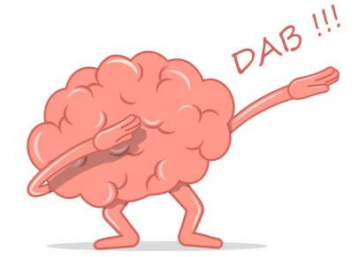
Gray matter outside and white matter inside.

Cerebrum: Higher brain function

Cerebellum: Fine motor skills, posture, equilibrium, and balance

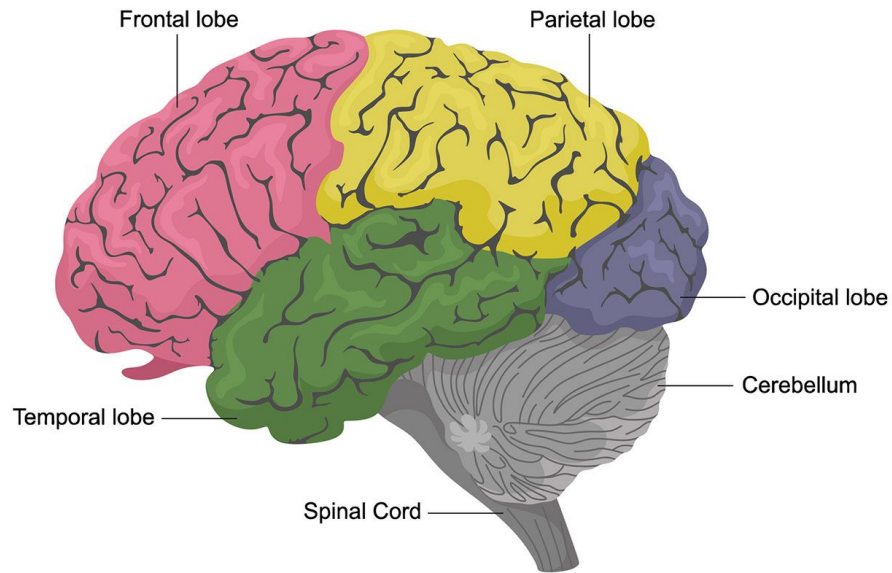
Brainstem:

- **Midbrain:** Eye movement and processes visual and auditory information.
- **Pons:** Connect different parts of the brain, facial movements, and transmitting sensory information.
- **Medulla:** Control center for the function of the heart and lungs. Regulate breathing, swallowing, and sneezing.



Brain

Human Brain Anatomy



Cerebrum:

- **Frontal lobe:** Cognitive functions and control of voluntary movement or activity
- **Parietal lobe:** Receiving and processing sensory input - temperature, taste, touch, and movement. In other words: Somatic interpretation and understanding of speech.
- **Temporal lobe:** Auditory
- **Occipital lobe:** Vision

Brain: Ventricles

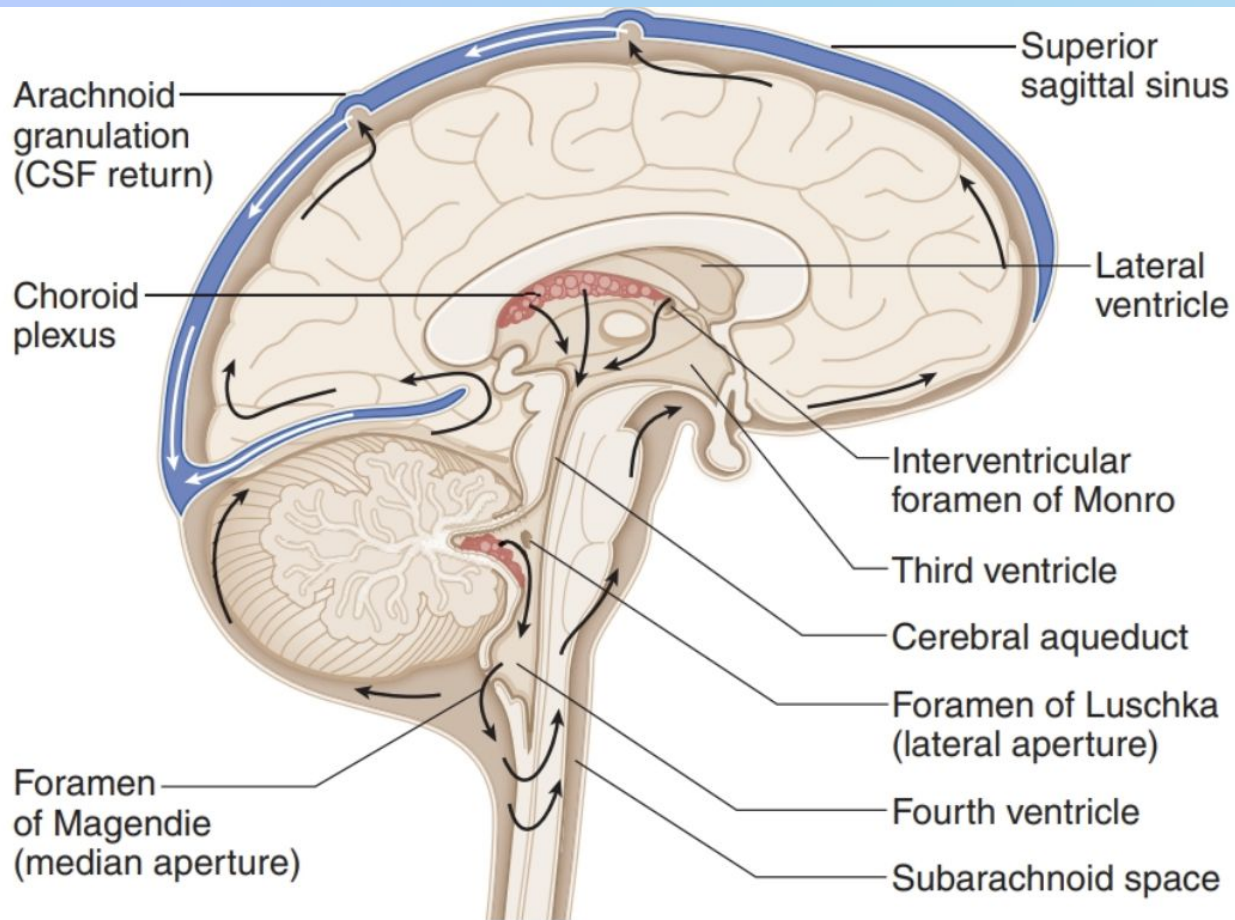


Figure III-3-2. Sagittal Section of the Brain

CSF is formed and secreted by choroid plexus.

Arachnoid granulations are sites of CSF reabsorption

Pathway of CSF:

Choroid plexus → Lateral ventricles → Third ventricle → Fourth ventricle → subarachnoid space → arachnoid granulations

IVF of Monro Cerebral aqueduct
Magendie & Luschka

Overview

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- Spinal Cord Tracts

Spinal Cord

Spinal Cord

Gray matter inside and white matter outside.

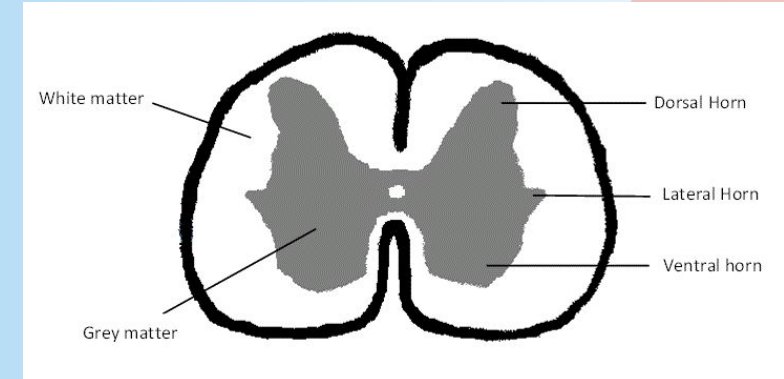
3 Main functions:

- Motor conduction FROM the brain (to the muscles)
- Sensory conduction TO the brain (from receptors)
- Reflexes

Bell-Magendie Law: The spinal nerves' anterior roots consist of motor fibers, while the posterior roots contain sensory fibers. Movement of nerve impulse is only in one direction.

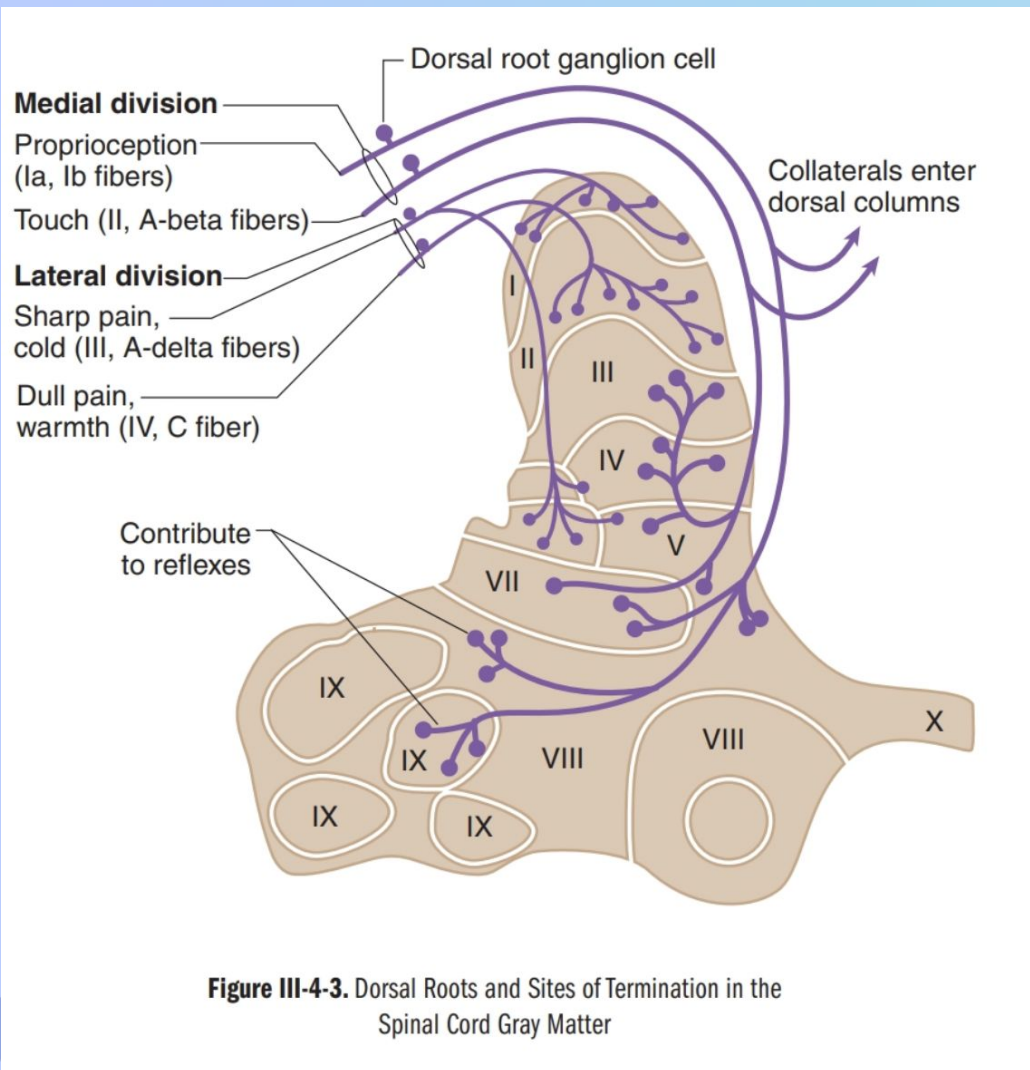
Grey matter = Cell bodies (Butterfly shape)

White matter = Axons



Spinal Cord: Dorsal Horn

Gray matter



Dorsal (posterior) Horn = Sensory

Rexed Laminae I-VI

Medial division:

- Proprioception (Ia, Ib fibers)
- Touch (II, A-beta fibers)

Lateral division:

- Sharp pain, cold (A-delta fibers)
- Dull pain, warmth (IV, C fiber)

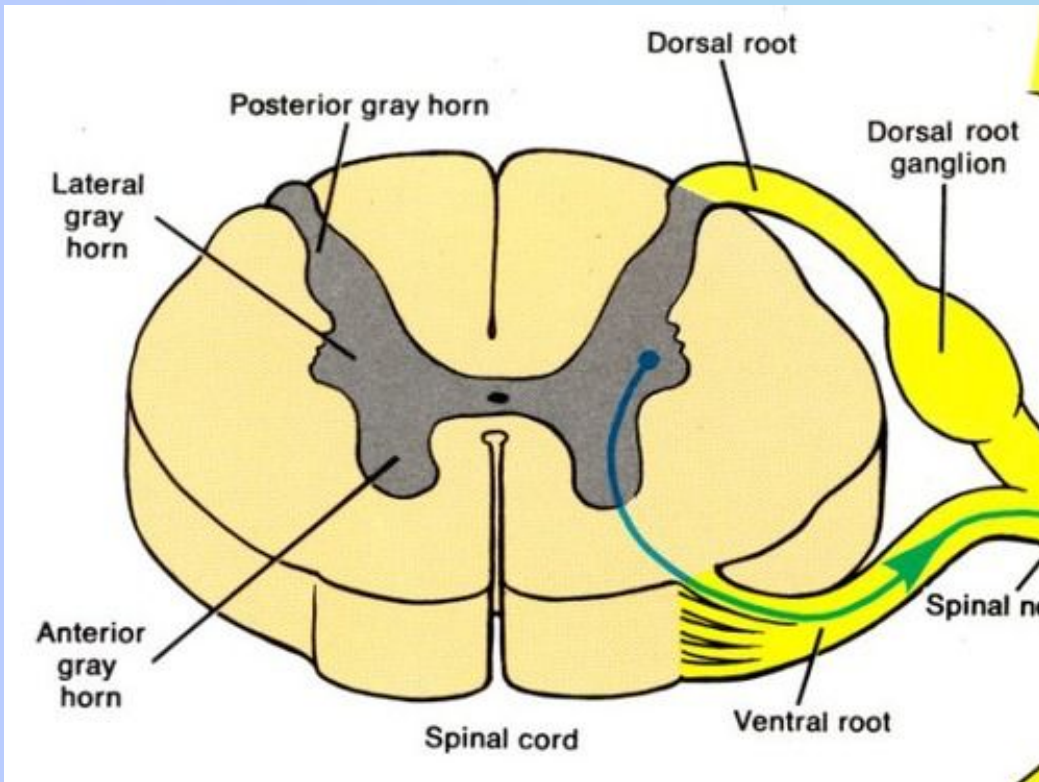
Slower

Muscle spindle: Stretch Ia

Golgi tendon organ: Force Ib

Spinal Cord: Lateral Horn

Gray matter



Lateral (Intermediate Zone) Horn = Mixed

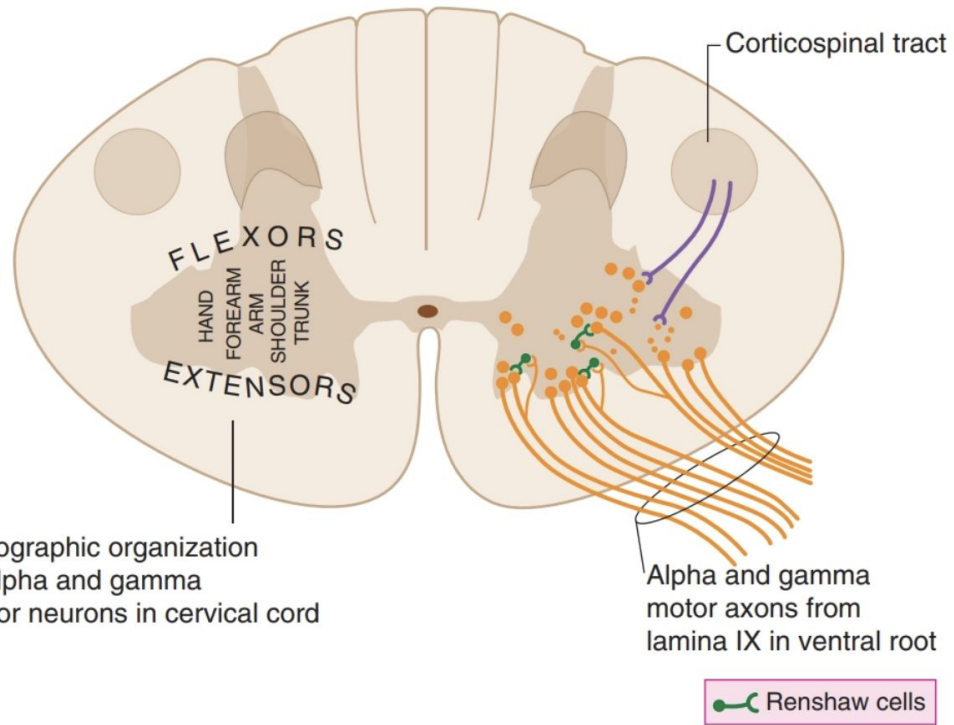
Rexed Laminae: VII

T1 - L2 contain, autonomic, preganglionic sympathetic neuron cell bodies & Clarke nucleus.

- Send unconscious proprioception to the cerebellum.

Spinal Cord: Ventral Horn

Gray matter



Topographic organization of alpha and gamma motor neurons in cervical cord

Alpha and gamma motor axons from lamina IX in ventral root

Renshaw cells

Figure III-4-4. Topographic Organization of Alpha and Gamma Motoneurons (LMNs) in Lamina IX

Ventral (Anterior) Horn = Motor

Rexed laminae VIII-IX

Contains α and γ motor neurons:

- α make skeletal muscle contract (innervate extrafusal muscle fibers).
- γ make muscle spindles more sensitive to stretch (voluntary movement).

Renshaw cells: regulate activity of α motor neurons by a feedback inhibition mechanism.

- Tetanus toxins

Overview

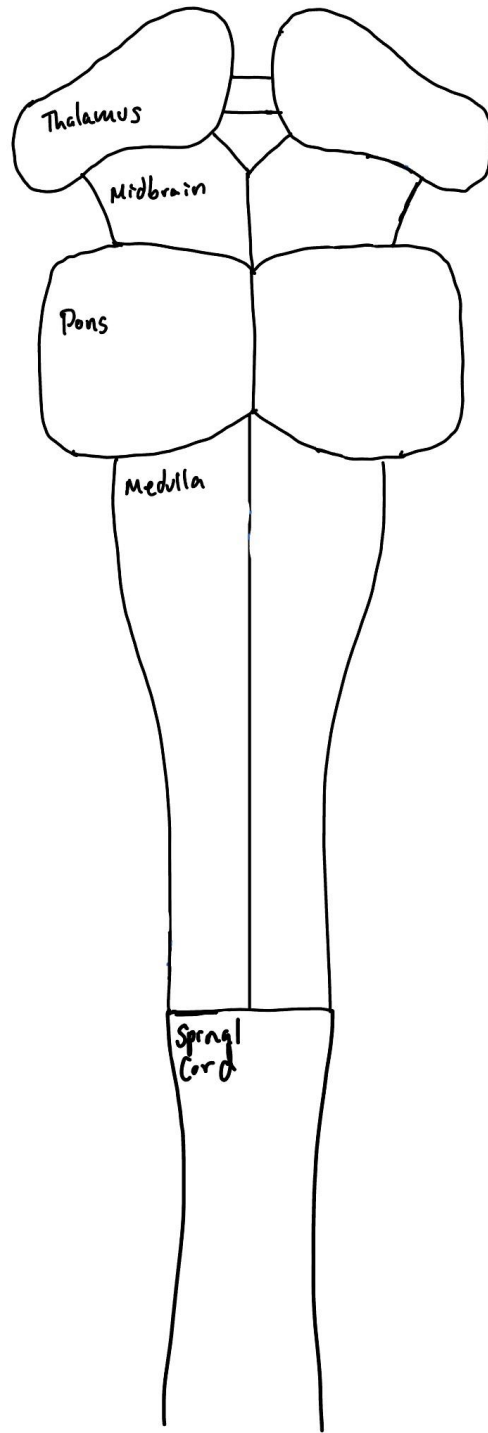
- ~~Brain~~
- ~~Spinal cord~~
- Spinal Cord Tracts

Spinal Cord Tracts

Spinal Cord Tracts

White matter

| DESCENDING (MOTOR) PATHWAYS | ASCENDING (SENSORY) PATHWAYS |
|--------------------------------------|---------------------------------------|
| Corticospinal | Dorsal Column - Medial Lemniscus |
| Corticobulbar | Spinothalamic |
| | Spinocerebellar |



Spinal Cord Tracts: Descending (Motor)

White matter

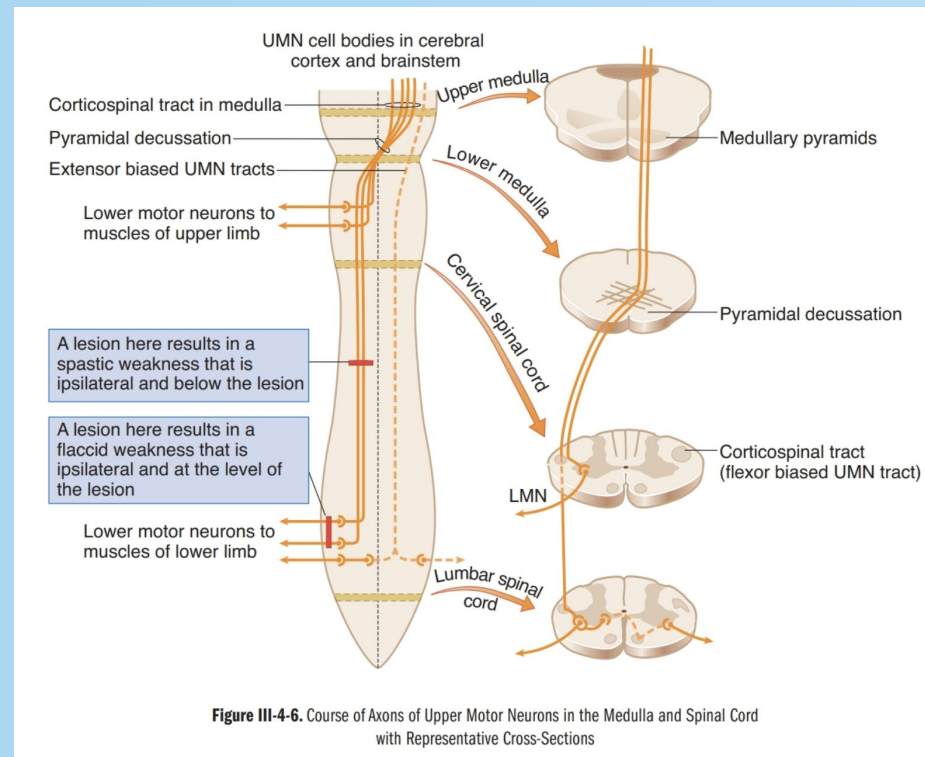
| PYRAMIDAL | EXTRAPYRAMIDAL |
|--|---|
| <p>Sign of humanity</p> <p>Responsible for motions we learn how to do</p> <p>When learning something new (process of learning)</p> <p>Tracts: Corticospinal Corticobulbar</p> <p>Terminate on ALL levels of spinal cord after decussation in medulla</p> | <p>Don't have to think about what we are doing (we already learned)</p> <p>Responsible for phrenic nerve (helps us breath)</p> <p>Huntington, polio, parkinsons</p> <p>Tracts: Rubrospinal Reticulospinal Olivospinal Vestibulospinal</p> |

Spinal Cord Tracts: Descending (**Motor**)

White matter

Pyramidal Tracts:

| CORTICOSPINAL | CORTICOBULBAR |
|---|---|
| Spine & limbs | Voluntary movement of head & neck |
| Terminate in motor neurons of spinal cord | Lowest fibers reach medulla, terminate in motor neuron of nuclei of cranial nerve |



Spinal Cord Tracts: Ascending (**Sensory**)

DRG → Decussate (Brainstem or Spinal Cord) → VPL, Thalamus →

1st order
neuron

2nd order
neuron

3rd order
neuron

Primary Somatosensory cortex (in postcentral gyrus of parietal lobe)

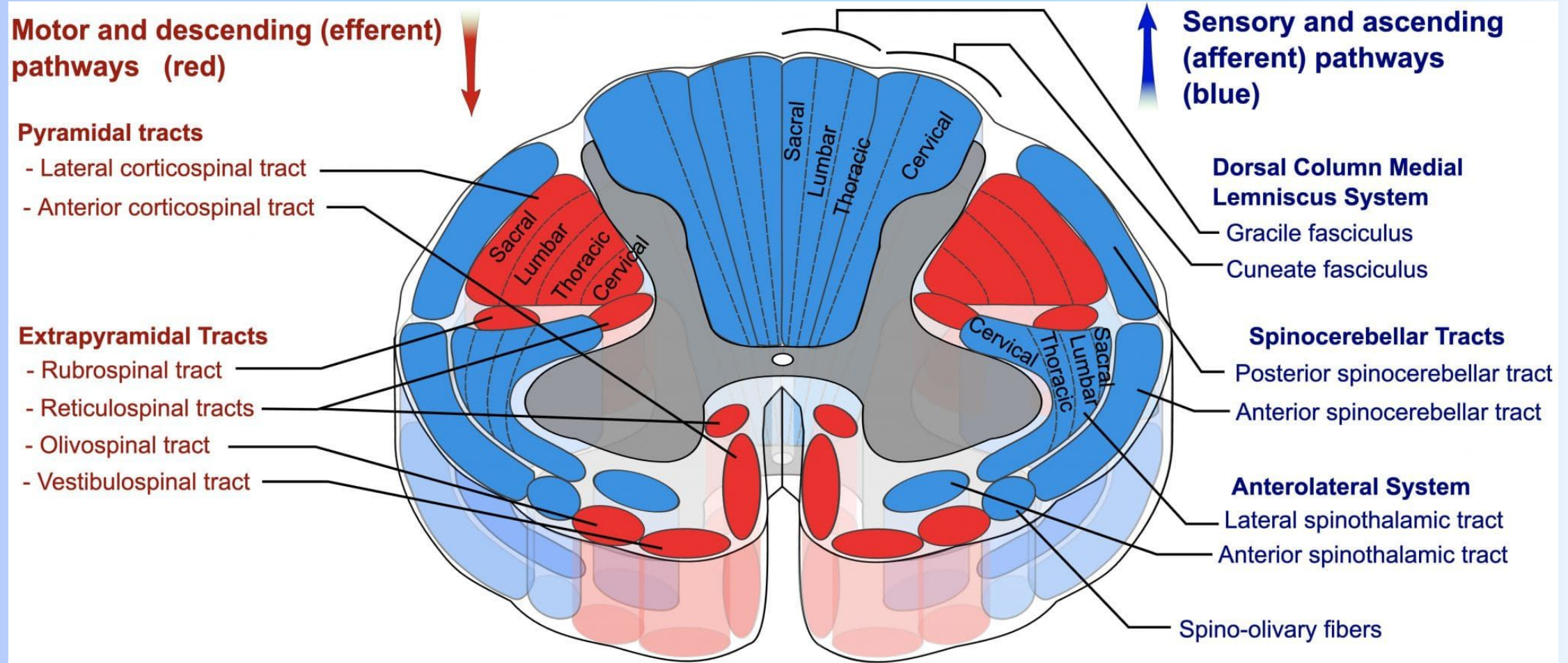
Spinal Cord Tracts

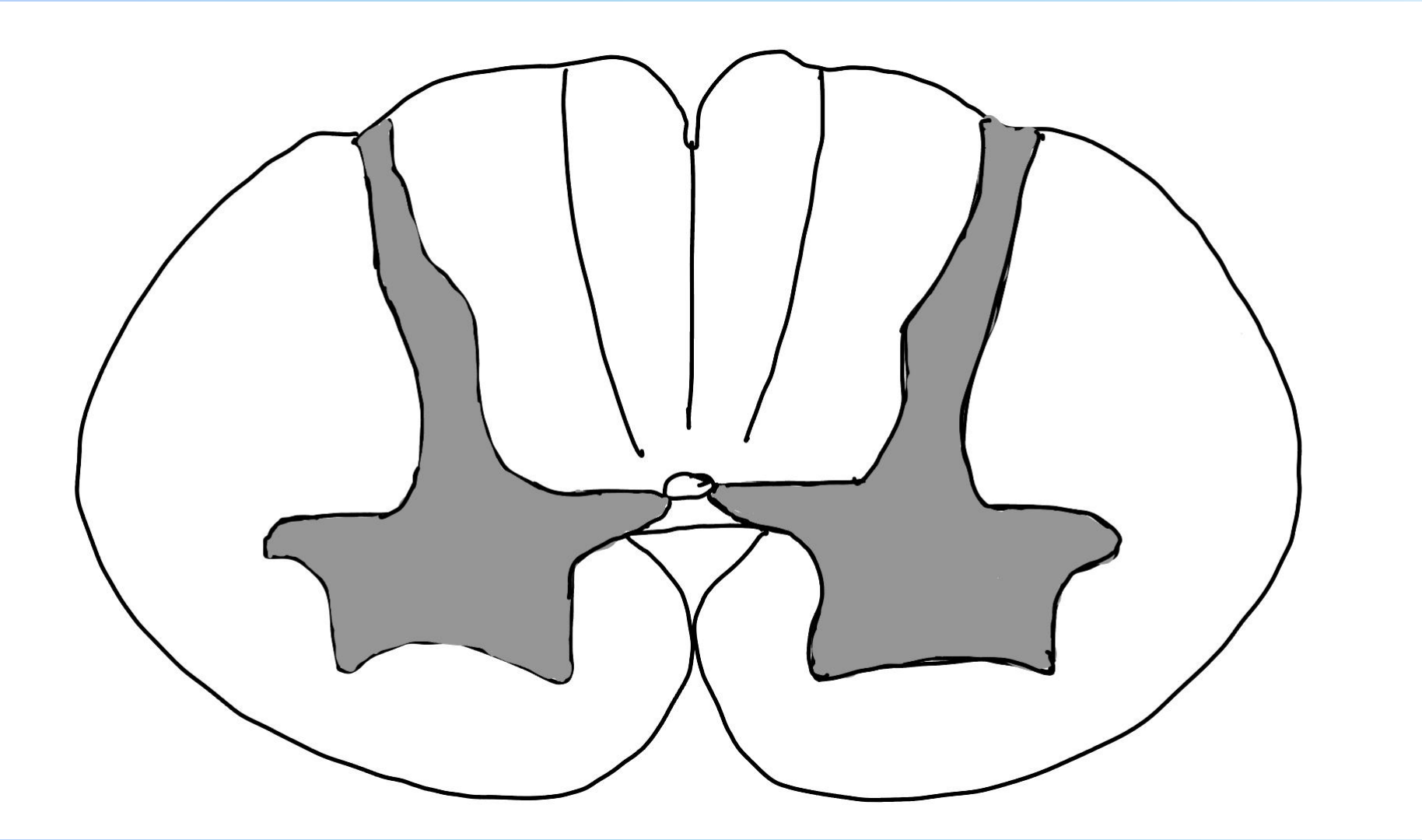
White matter

| DORSAL COLUMN MEDIAL LEMNISCUS | SPINOTHALAMIC | SPINOCEREBELLAR |
|--|---|---|
| <p>Pressure, vibration, fine touch, conscious proprioception</p> <p>After decussation goes by medial lemniscus</p> | <p>Pain, temperature (lateral), and crude touch (ventral)</p> <p>Lissauer's tract</p> | <p>Unconscious proprioception, touch pressure</p> <p>Dorsal spinocerebellar: Lower extremities and lower trunk</p> <p>Cuneocerebellar: Upper extremities and upper trunk</p> <p>Ventral spinocerebellar: Entire body</p> |

Spinal Tracts

White matter





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