



Neuroanatomy: Discriminative Touch & Conscious Proprioception

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Major Objectives

1. Define discriminative touch and conscious proprioception
2. Outline the Dorsal Column, Medial Lemniscus (DCML) pathway
3. Locate each of the four neurons in the DCML pathway
4. Identify the level of decussation for the DCML pathway

Definitions

discriminative touch -- the perception of location, intensity, and quality of tactile sensation (pressure, vibration, and texture)

conscious proprioception -- the appreciation of relative position and movement of the body in space

DC-ML Pathway

- ✧ Peripheral nerves
- ✧ Gracile/cunrate fasciculi
- ✧ 1°→2° neurons in the gracile/cunrate nuclei
- ✧ Arcuate fasciculations
- ✧ Medial lemniscus
- ✧ 2°→3° neurons in the VPL thalamus
- ✧ Post. limb of the internal capsule
- ✧ 3°→primary somatosensory cortex

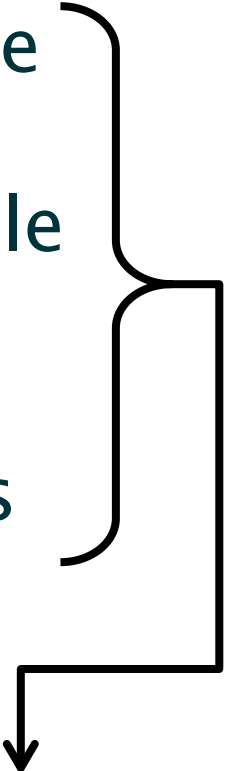
Crosses
Midline



Periphery & Spinal Cord

Peripheral nerve

- Mechanoreceptors
 - Pacinian corpuscle
 - Ruffini endings
 - Meissner corpuscle
 - Merkel disks
- Muscle spindles
- Golgi tendon organs



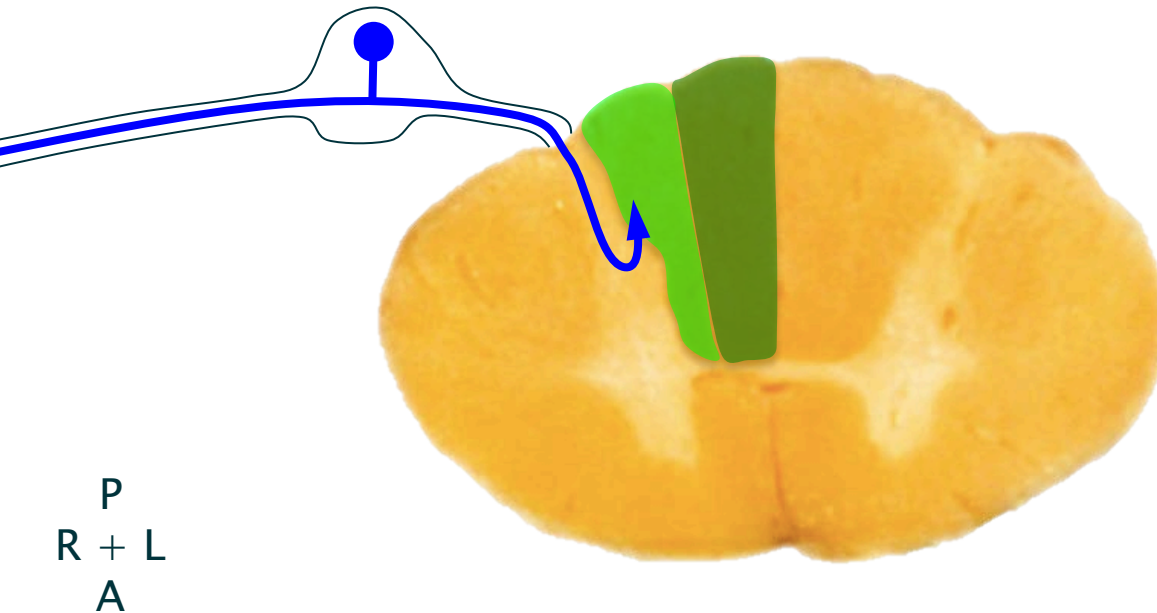
Spinal cord
via dorsal root

Periphery & Spinal Cord

Peripheral nerve

Cell bodies in dorsal root ganglia

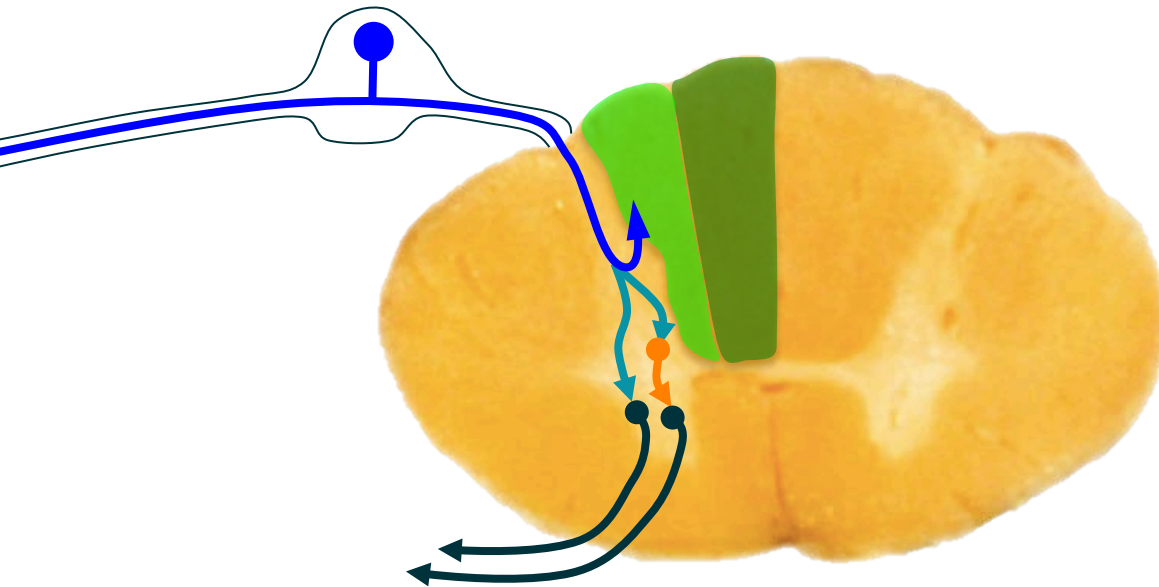
- Pseudounipolar neurons ()
- Entry below T6 (gracile fasciculus)
- Entry above T6 (cuneate fasciculus)



Periphery & Spinal Cord

Collaterals

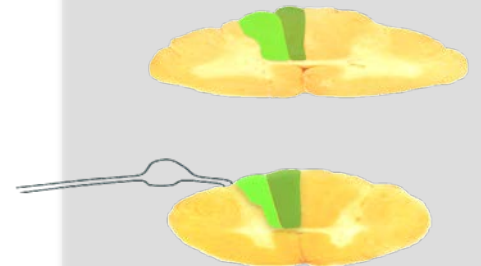
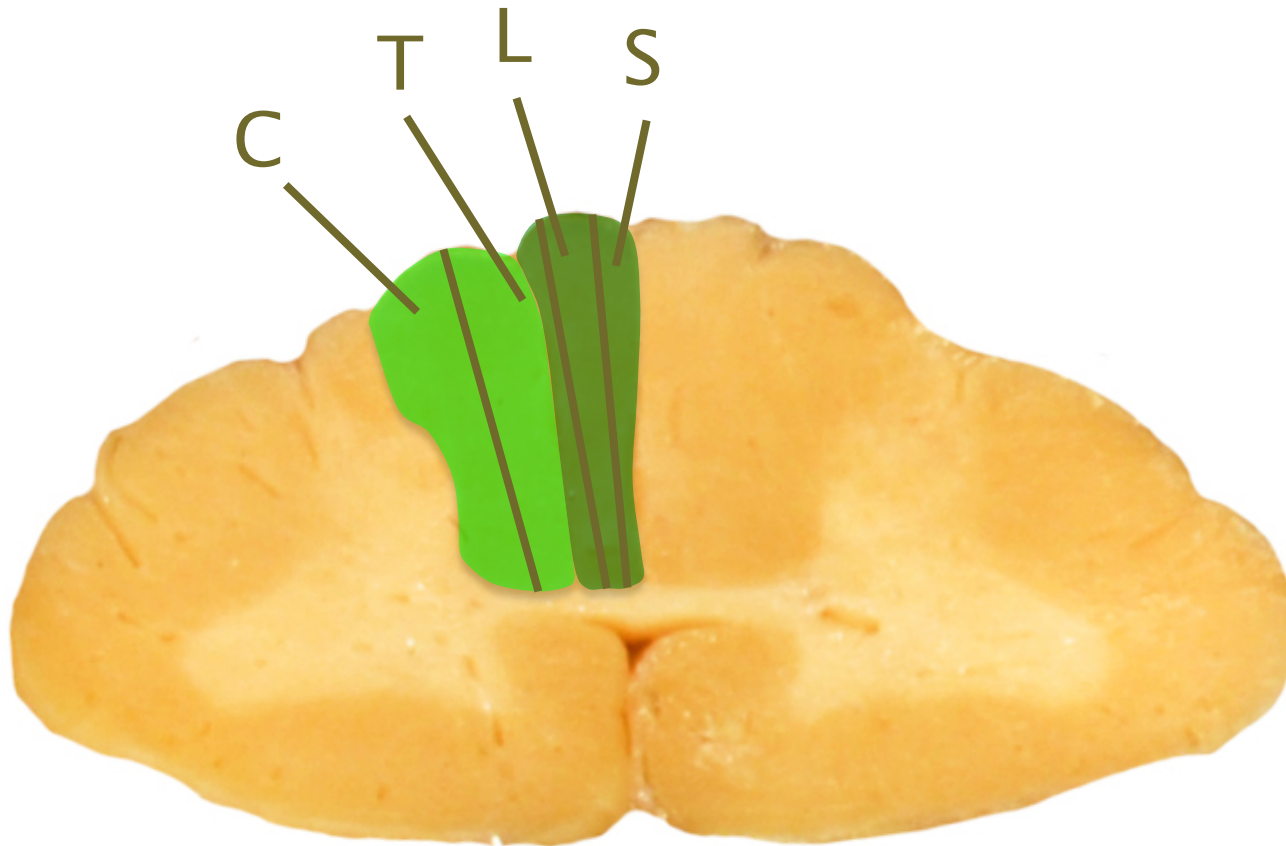
- Somatosensory neurons are often branched
- Collaterals account for reflexes & intersegmental connections



Periphery & Spinal Cord

Fasciculi

- Entry below T6 (gracile fasciculus)
- Entry above T6 (cuneate fasciculus)
- Somatotopic organization (C→S)



Brainstem

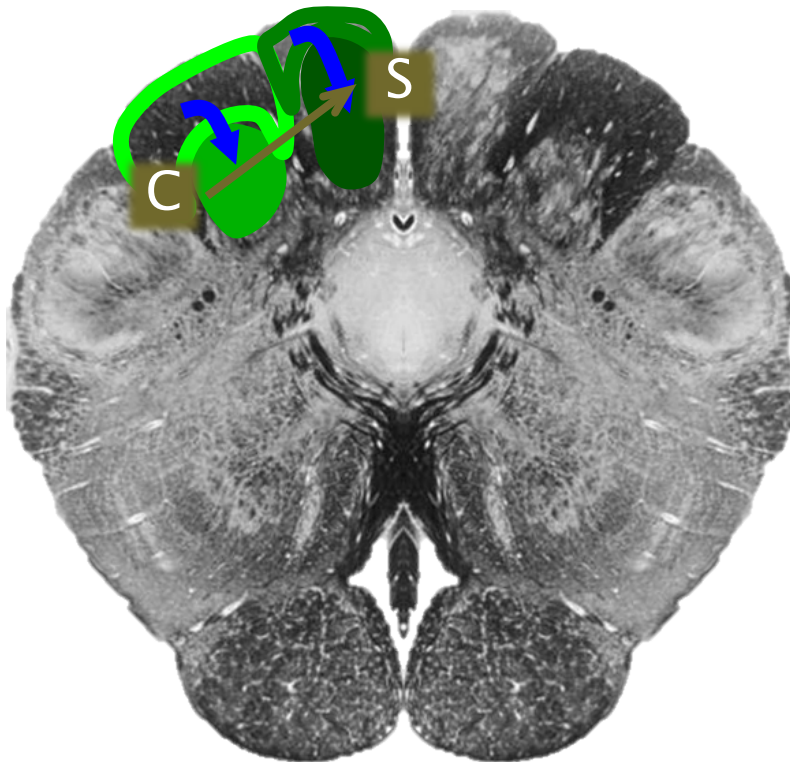
Caudal medulla

■ Nucleus gracilis

■ Nucleus cuneatus

1° axons synapse in nuclei

■ Somatotopic organization (C→S)



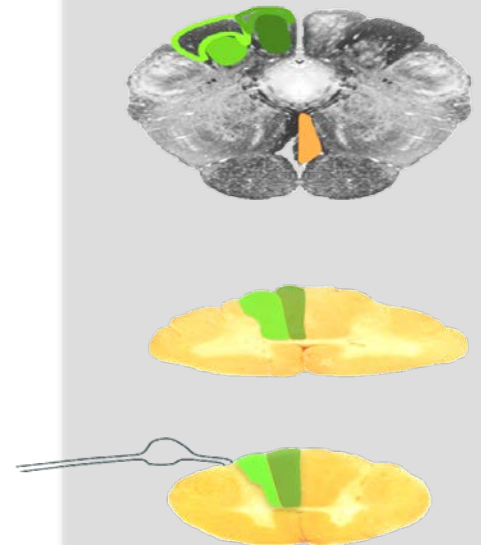
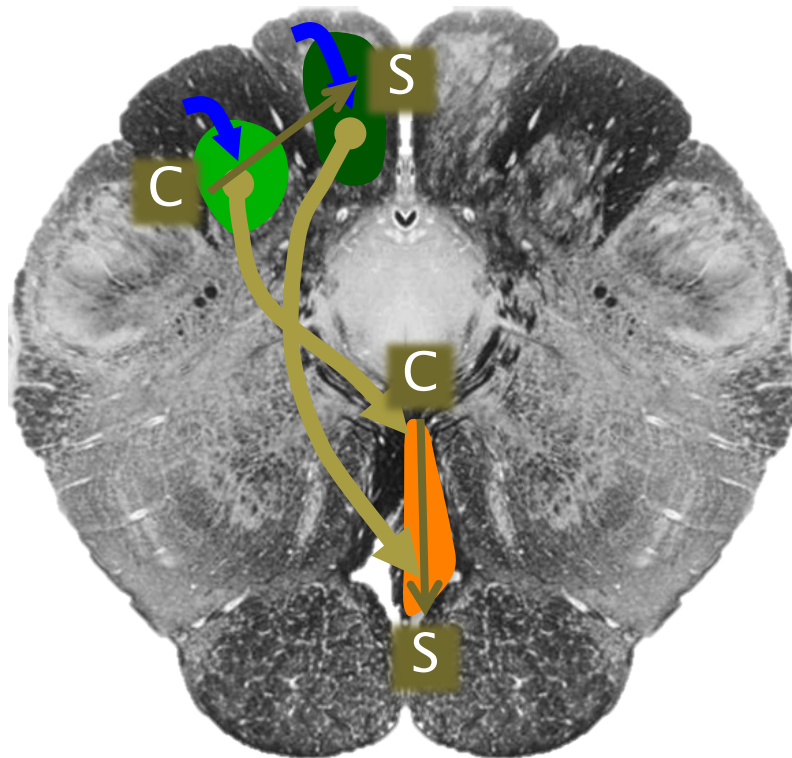
Brainstem

Caudal medulla

2° axons cross in arcuate fasciculus

■ Medial lemniscus

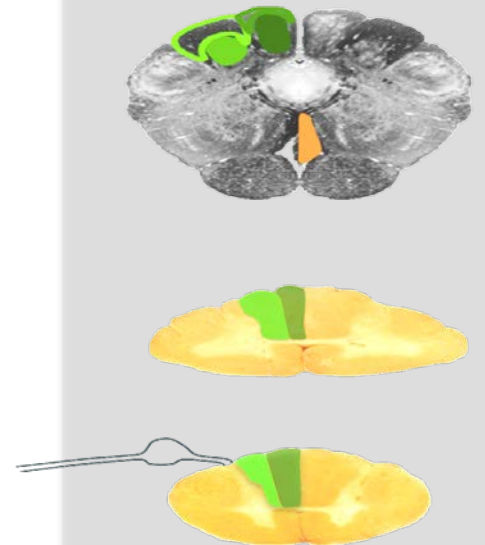
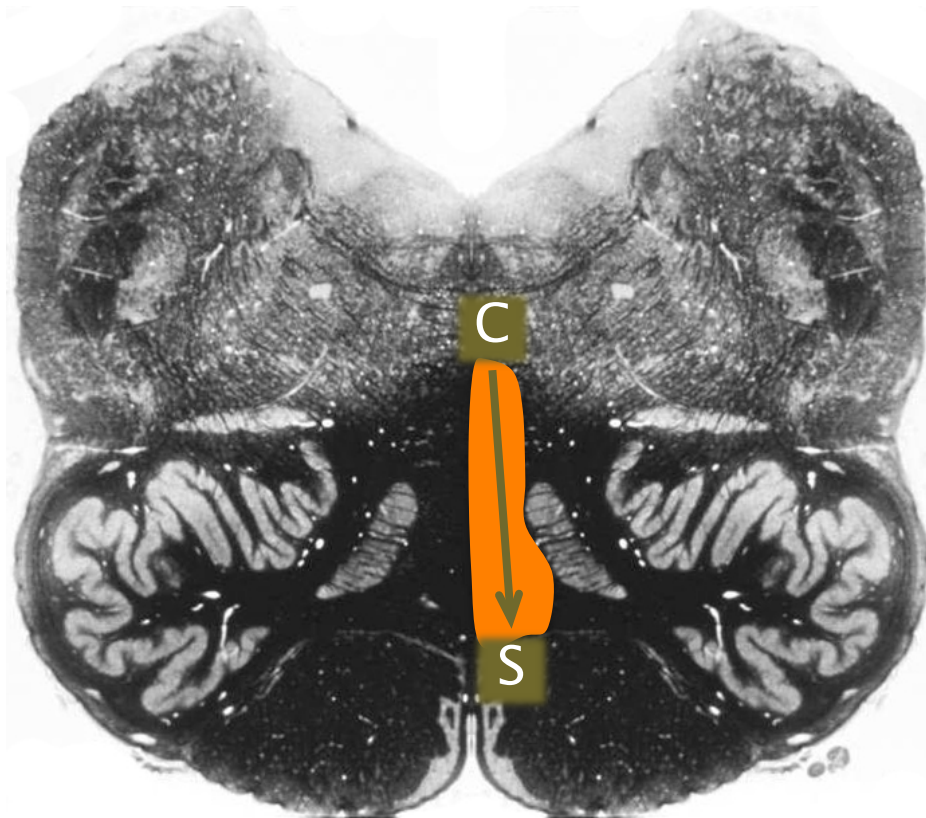
■ Somatotopic organization (C→S)



Brainstem

Rostral medulla

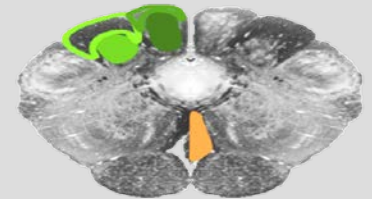
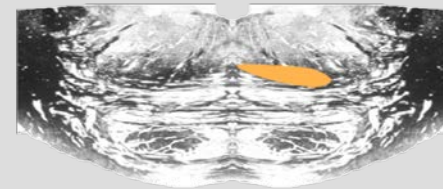
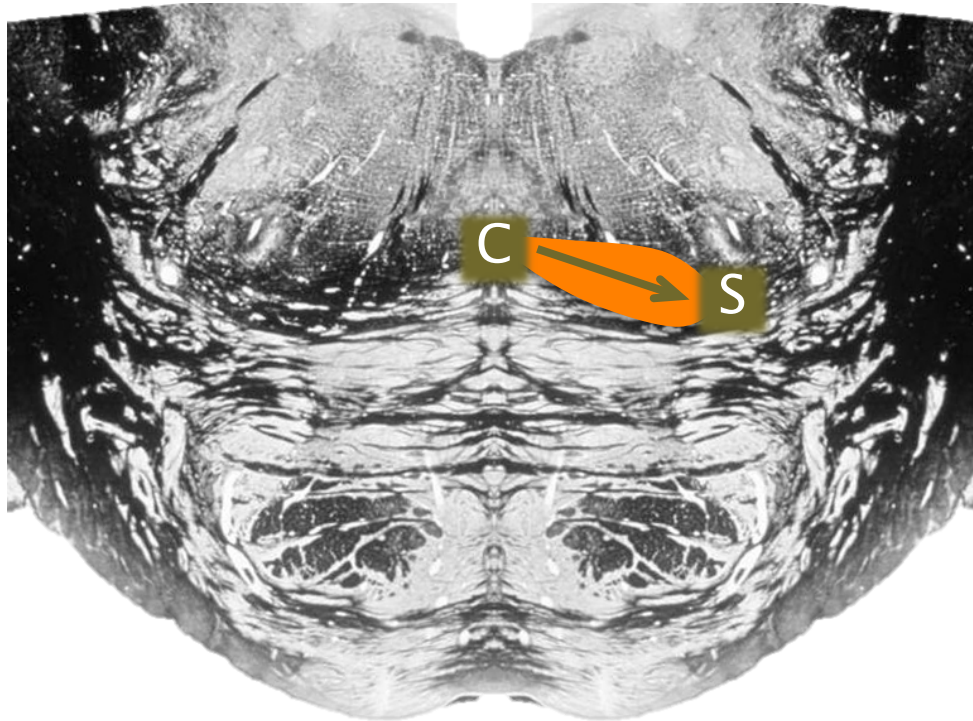
- Medial lemniscus
- Somatotopic organization (C→S)



Brainstem

Caudal pons

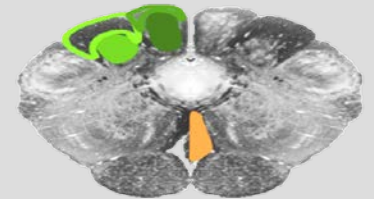
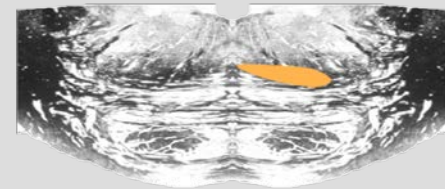
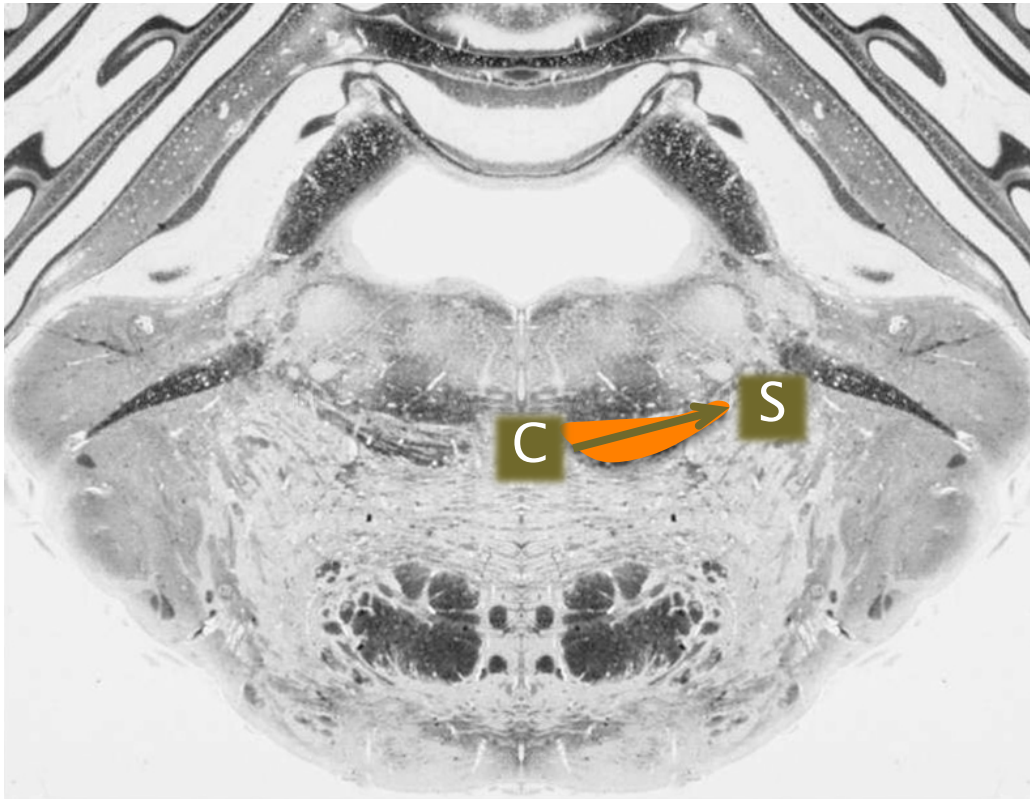
- Medial lemniscus
- Somatotopic organization (C→S)



Brainstem

Middle pons

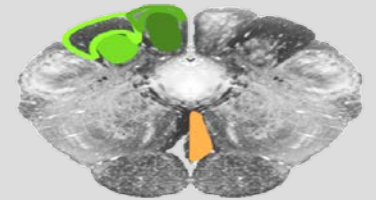
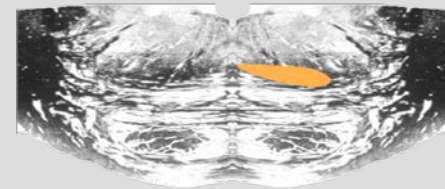
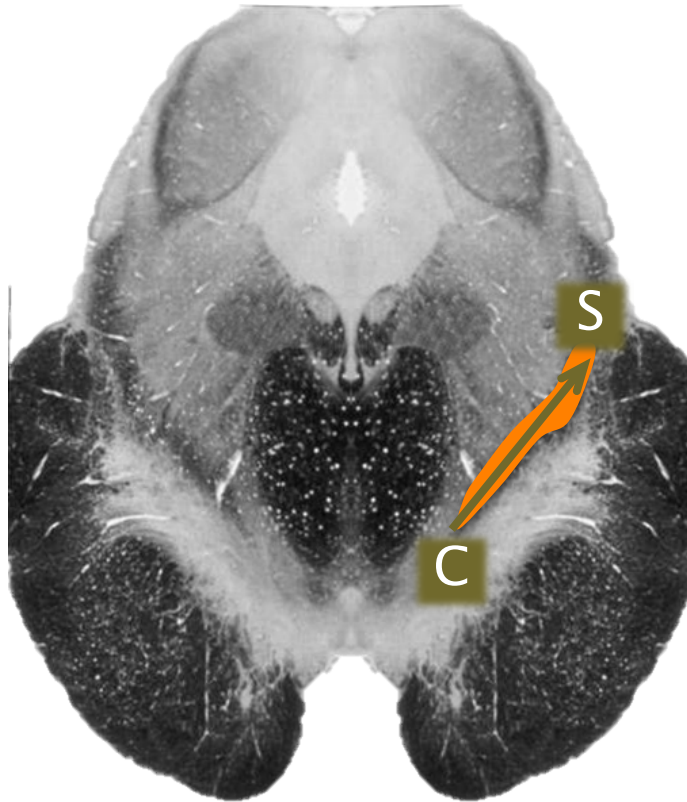
- Medial lemniscus
- Somatotopic organization (C→S)



Brainstem

Caudal midbrain

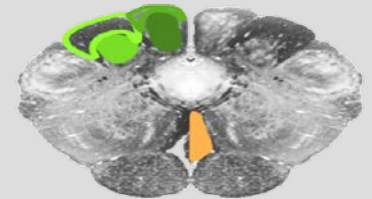
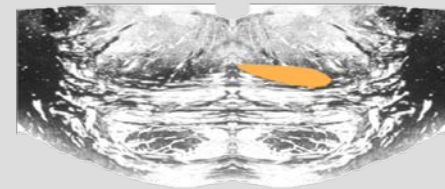
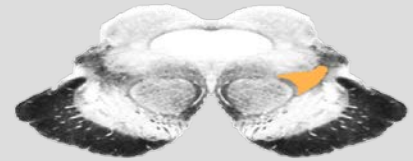
- Medial lemniscus
- Somatotopic organization (C→S)



Brainstem

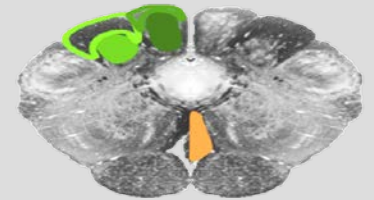
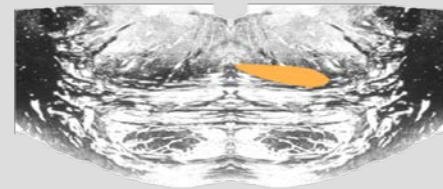
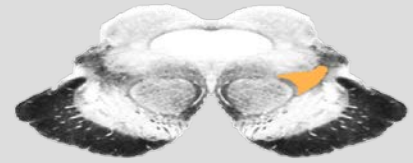
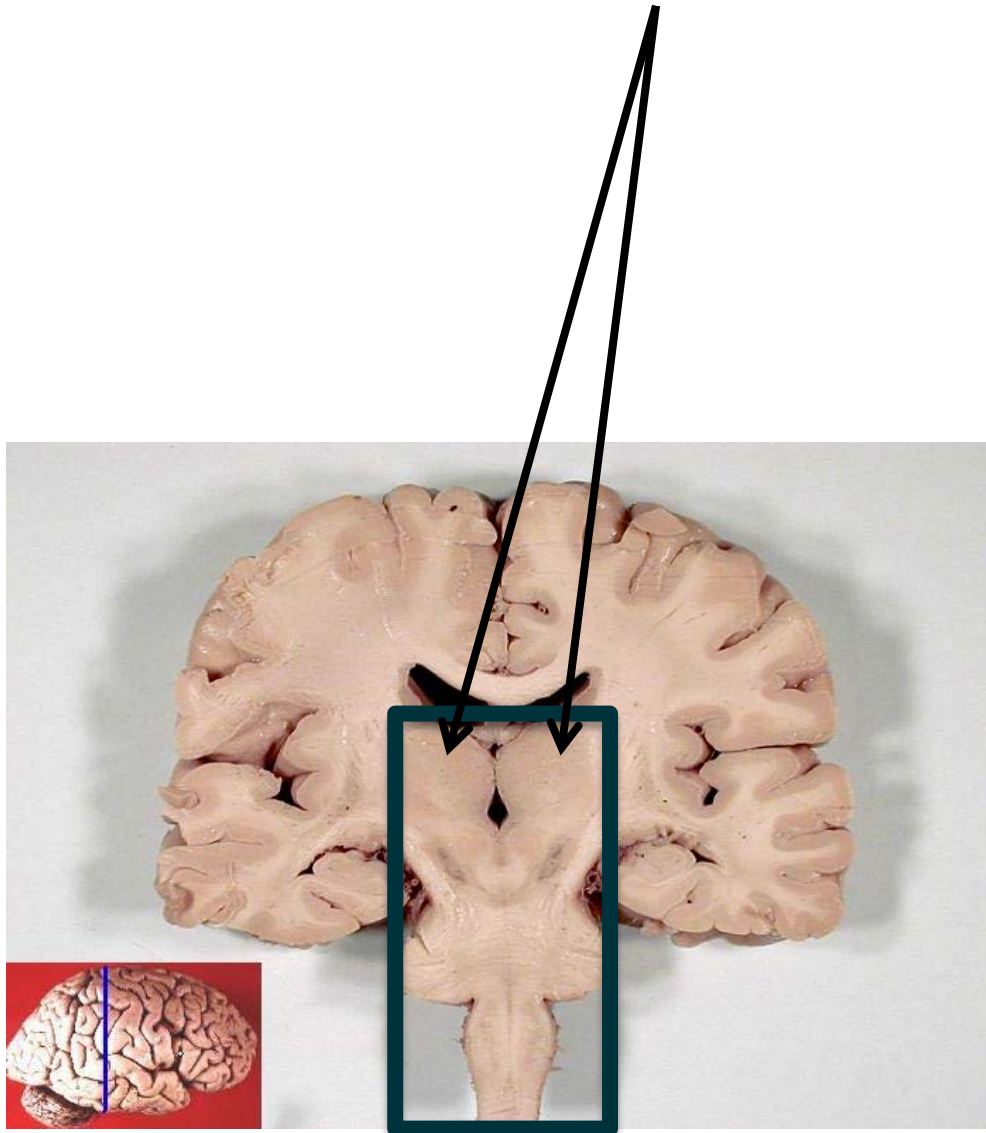
Rostral midbrain

- Medial lemniscus
- Somatotopic organization (C→S)



Diencephalon

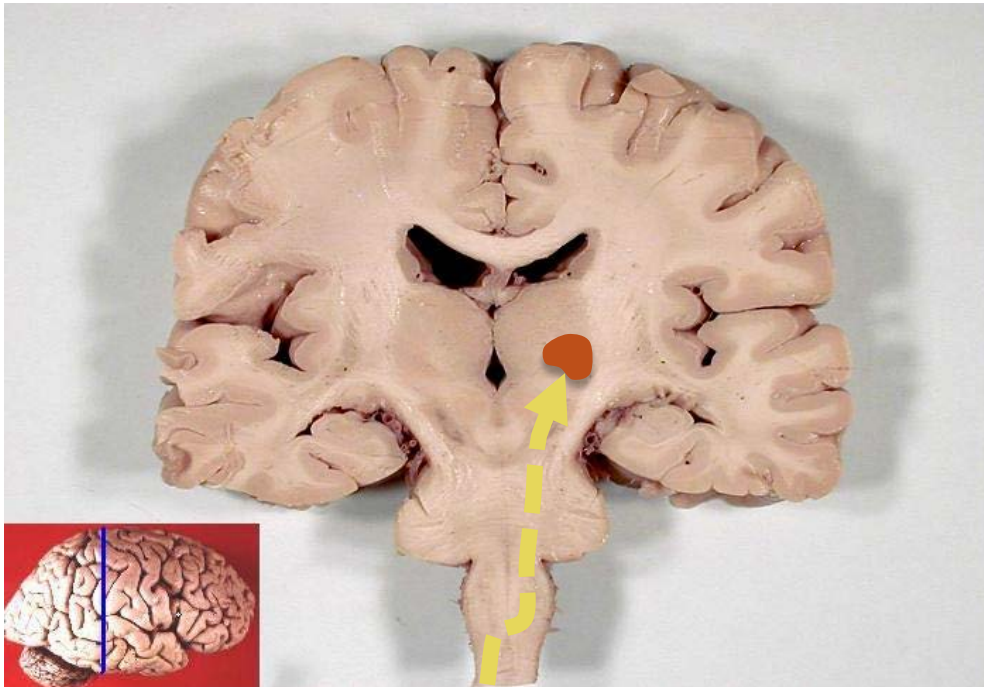
Thalamus



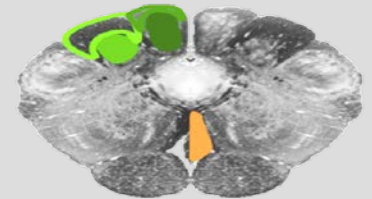
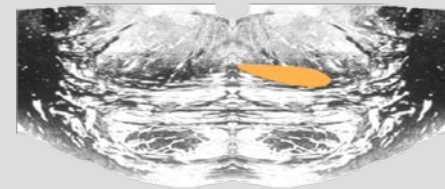
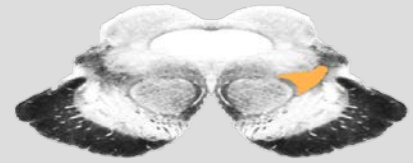
Diencephalon

Thalamus

- Ventral Posterolateral (VPL) nucleus
- 2° axons synapse in VPL
- Somatotopic organization (C→S)



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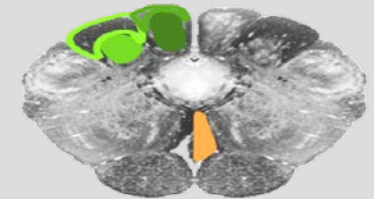
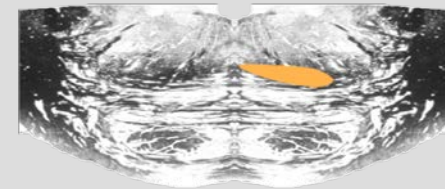
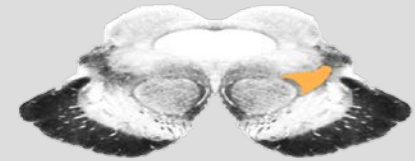
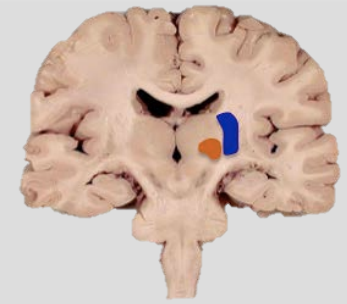
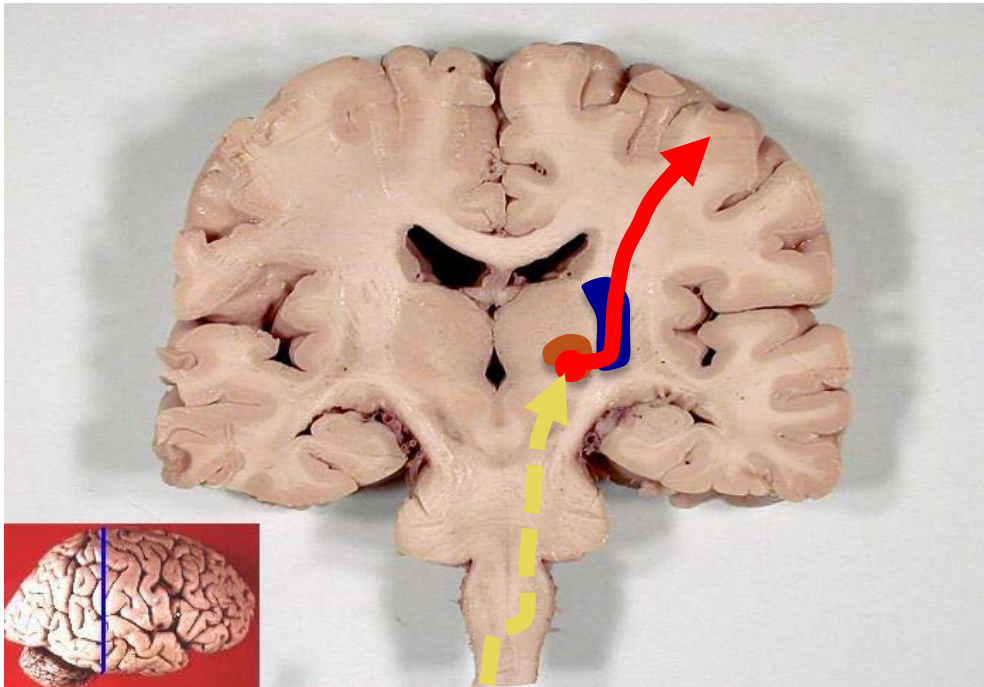
Diencephalon

Thalamus

■ Ventral Posterolateral (VPL) nucleus
Internal capsule

■ Posterior limb

3° axons exit VPL thalamus



Diencephalon

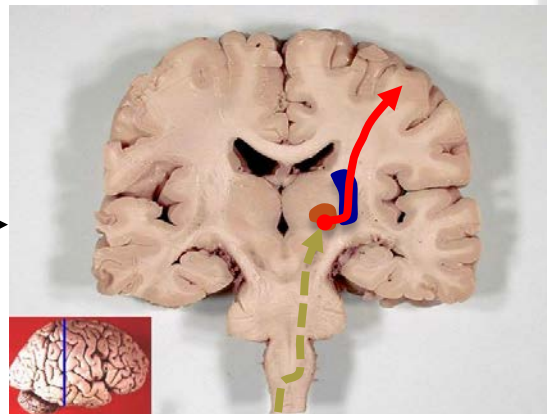
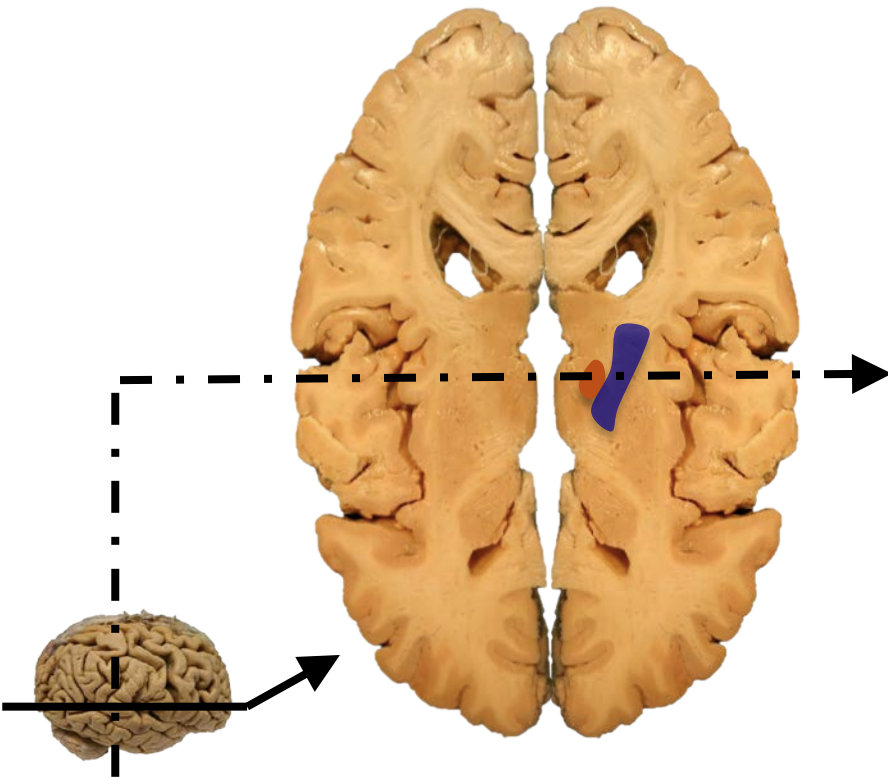
Thalamus

■ Ventral Posterolateral (VPL) nucleus

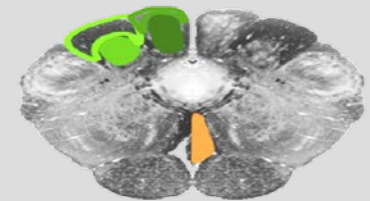
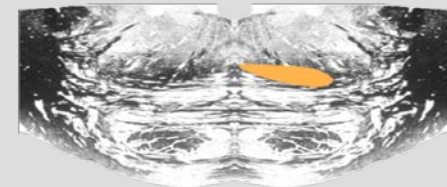
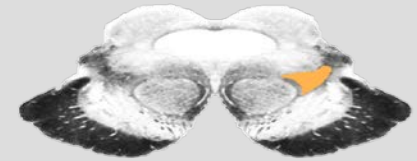
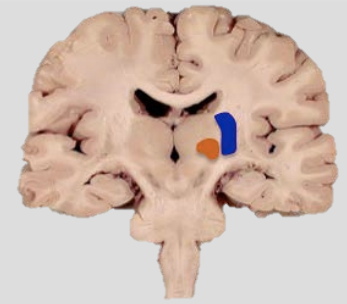
Internal capsule

■ Posterior limb

3° axons exit VPL thalamus

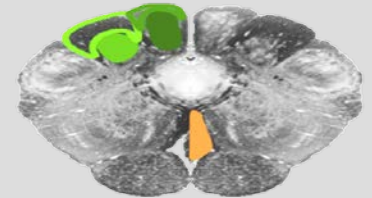
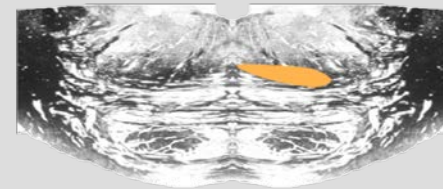
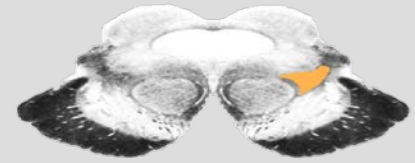
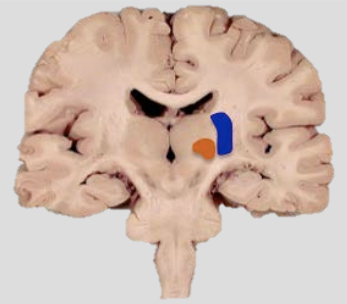
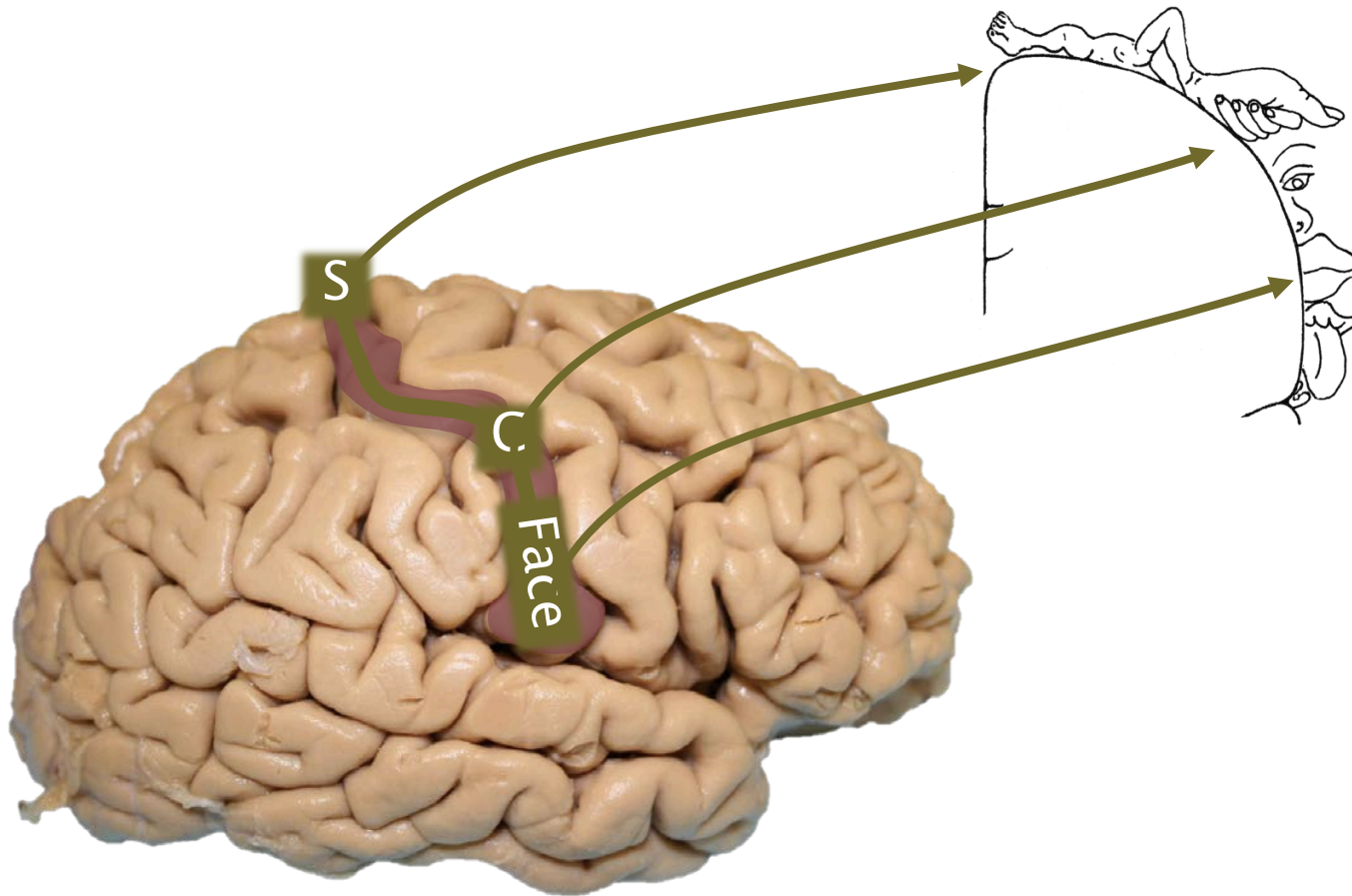


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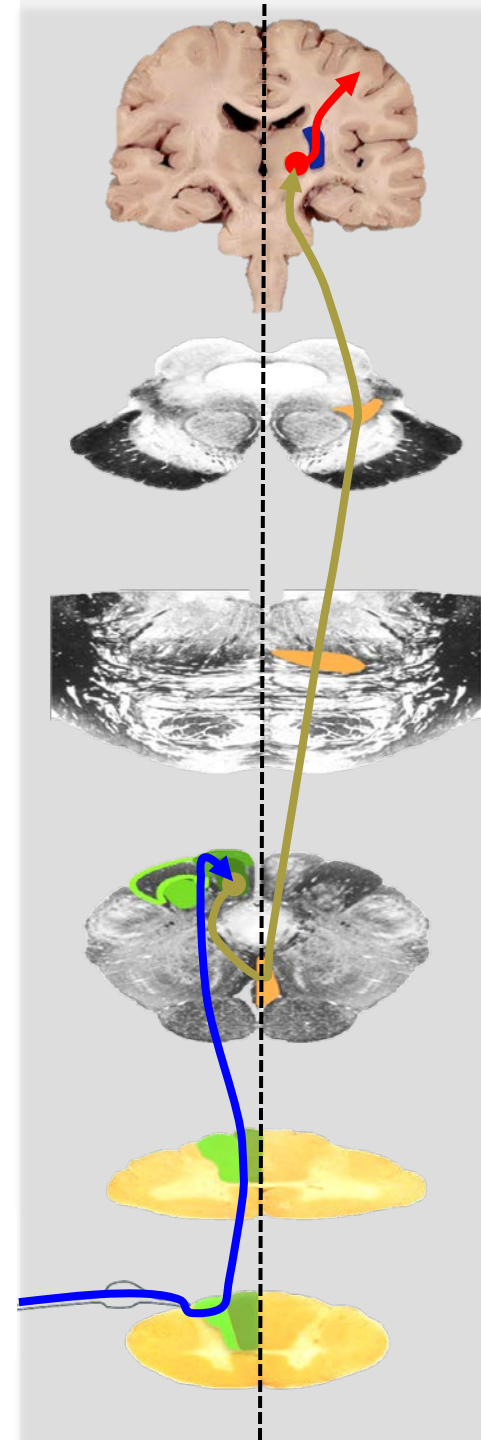
Forebrain

- Postcentral gyrus
- Somatotopic organization (homunculus Face+C→S)



DC-ML Review

- ✧ Peripheral nerves
- ✧ Gracile/cunrate fasciculi
- ✧ $1^{\circ} \rightarrow 2^{\circ}$ neurons in the gracile/cunrate nuclei
- ✧ Arcuate fasciculations
- ✧ Medial lemniscus
- ✧ $2^{\circ} \rightarrow 3^{\circ}$ neurons in the VPL thalamus
- ✧ Post. limb of the internal capsule
- ✧ $3^{\circ} \rightarrow$ primary somatosensory cortex



Pearls & Problems

- Don't ✓ Try to learn all the details on your first pass.
- Do ✓ Pay attention to orientation changes. It is uncommon for neuroanatomical features to all be seen best in the same orientation.
- Don't ✓ Limit yourself to the perspective's we've shown.
- Do ✓ Once you have the tract locations down and the decussation makes sense, add the somatotopic "fluff" details.