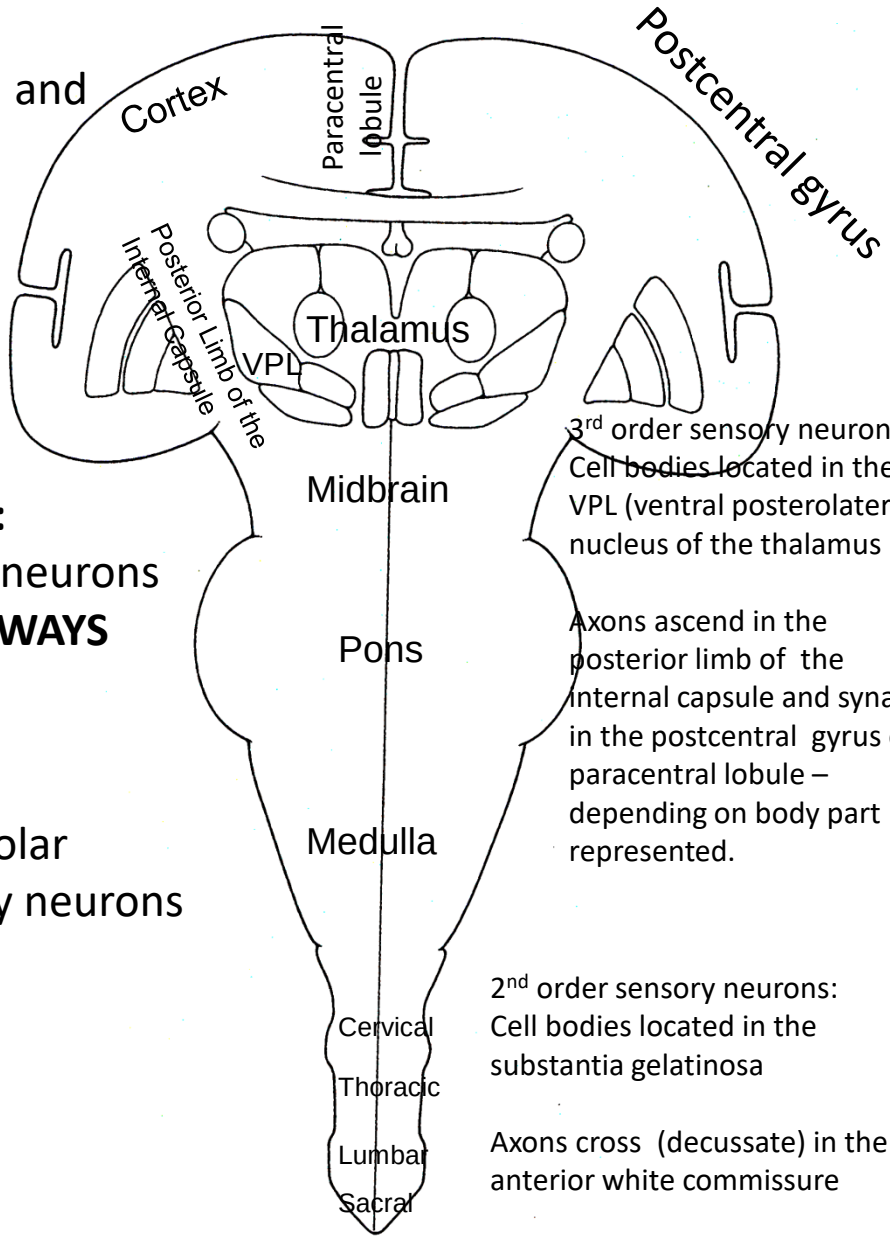
Body Pathways Review

Anterolateral system
Posterior columns/Medial lemniscus
and
Voluntary Motor
Pathways

B. Puder, PhD

Haines diagram :

Anterolateral system = Relays nociception (pain) and Thermoception (temperature) from the body



Points to Remember about Sensory Pathways:

They ascend and contain 1st, 2nd, and 3rd order neurons

The axons of the **2nd order sensory** neurons **ALWAYS** decussate to the opposite side.

Pseudounipolar
1st order sensory neurons

Upper extremity

Trunk

Lower extremity

3rd order sensory neurons:
Cell bodies located in the VPL (ventral posterolateral nucleus of the thalamus

Axons ascend in the posterior limb of the internal capsule and synapse in the postcentral gyrus or paracentral lobule – depending on body part represented.

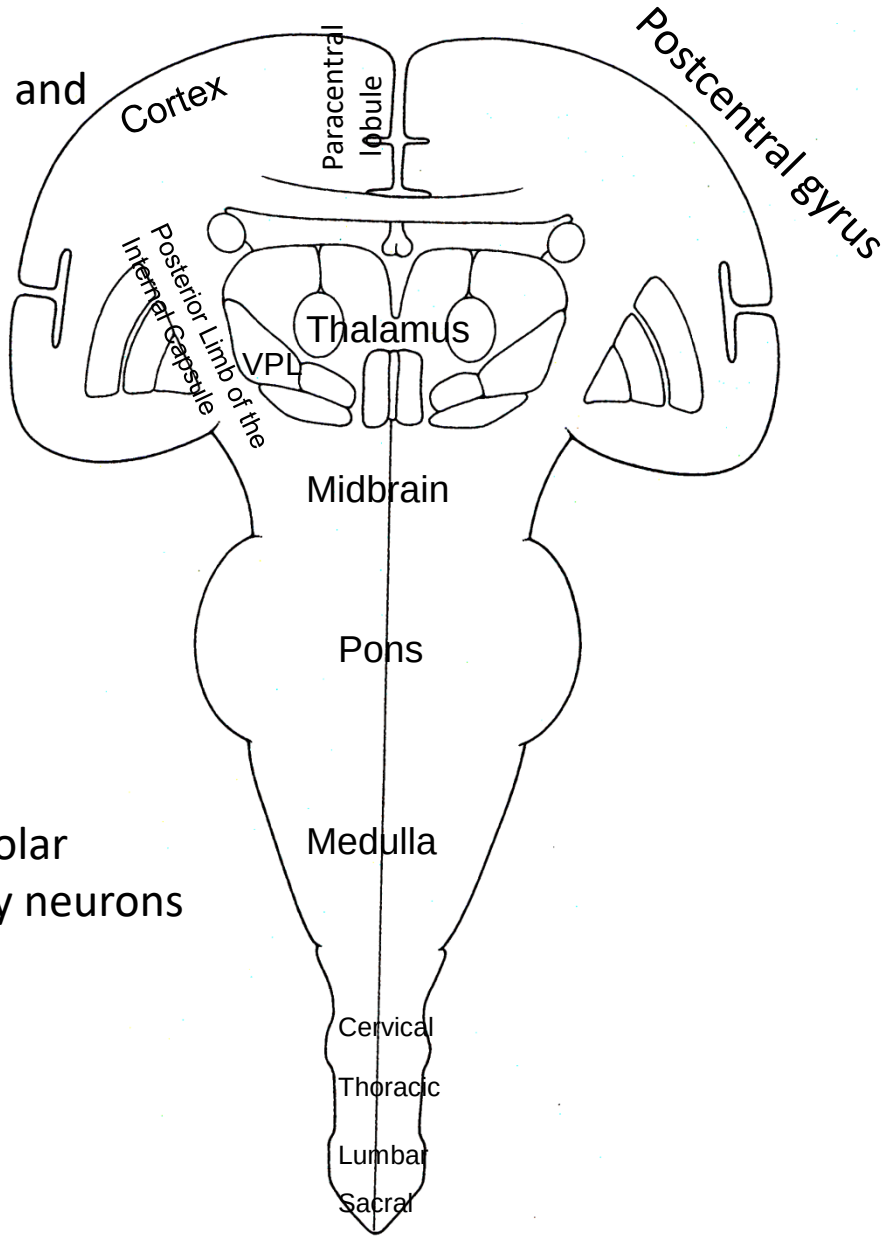
2nd order sensory neurons:
Cell bodies located in the substantia gelatinosa

Axons cross (decussate) in the anterior white commissure

Axons continue ascending as the anterolateral system (spinothalamic tracts)

Haines diagram :

Anterolateral system = Relays nociception (pain) and Thermoception (temperature) from the body



Lesion of a pseudounipolar neuron:
Ipsilateral loss of pain and temperature from that specific dermatome level

Pseudounipolar
1st order sensory neurons

Upper extremity

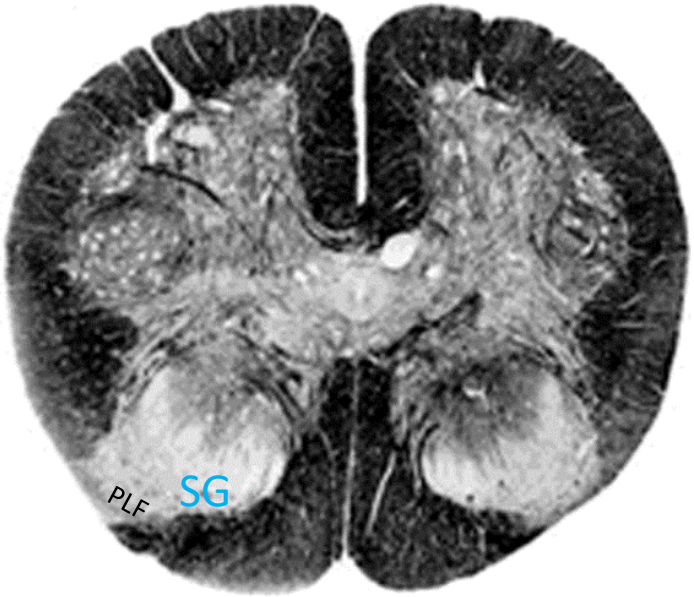
Trunk

Lower extremity

Haines diagram :

Anterolateral system = Relays nociception (Thermoception (temperature) from the body

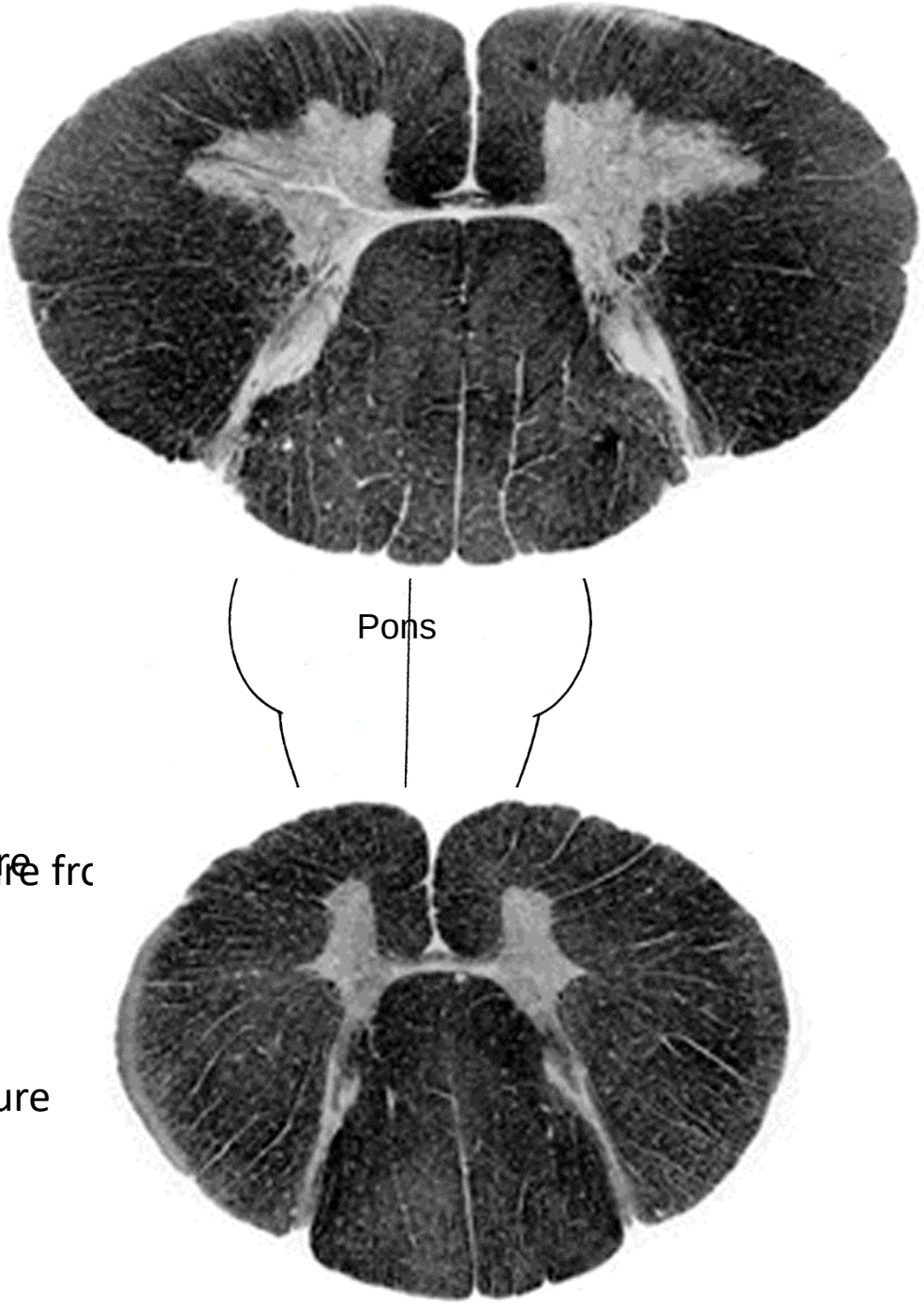
Ipsilateral loss of pain and temperature to this **cervical** level **only**

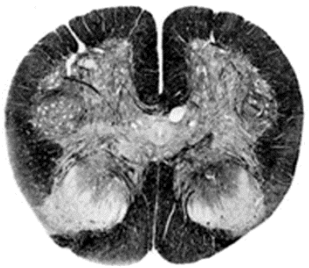


Ipsilateral loss of pain and temperature to this **sacral level only**

Ipsilateral loss of pain and temperature fro that specific spinal cord level only.

Ipsilateral loss of pain and temperature to this **thoracic** level **only**





: Relays noc and

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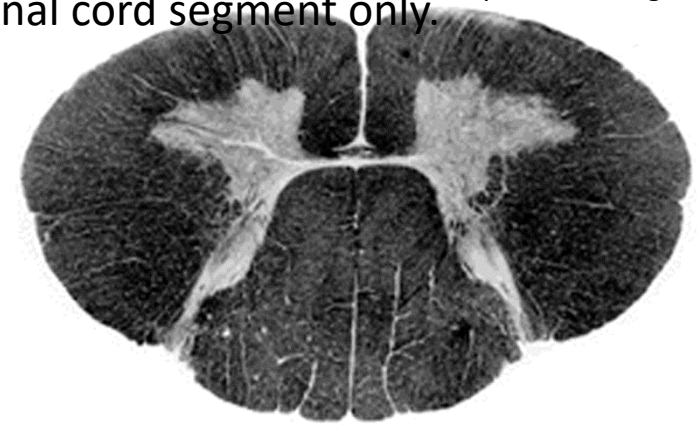
f

issure lesion =

Bilateral loss of pain and temperature to this **sacral** spinal cord segment **only**

Bilateral loss of pain and temperature to this **thoracic** spinal cord segment **only**

bilateral loss of pain and temperature to this spinal cord segment only.

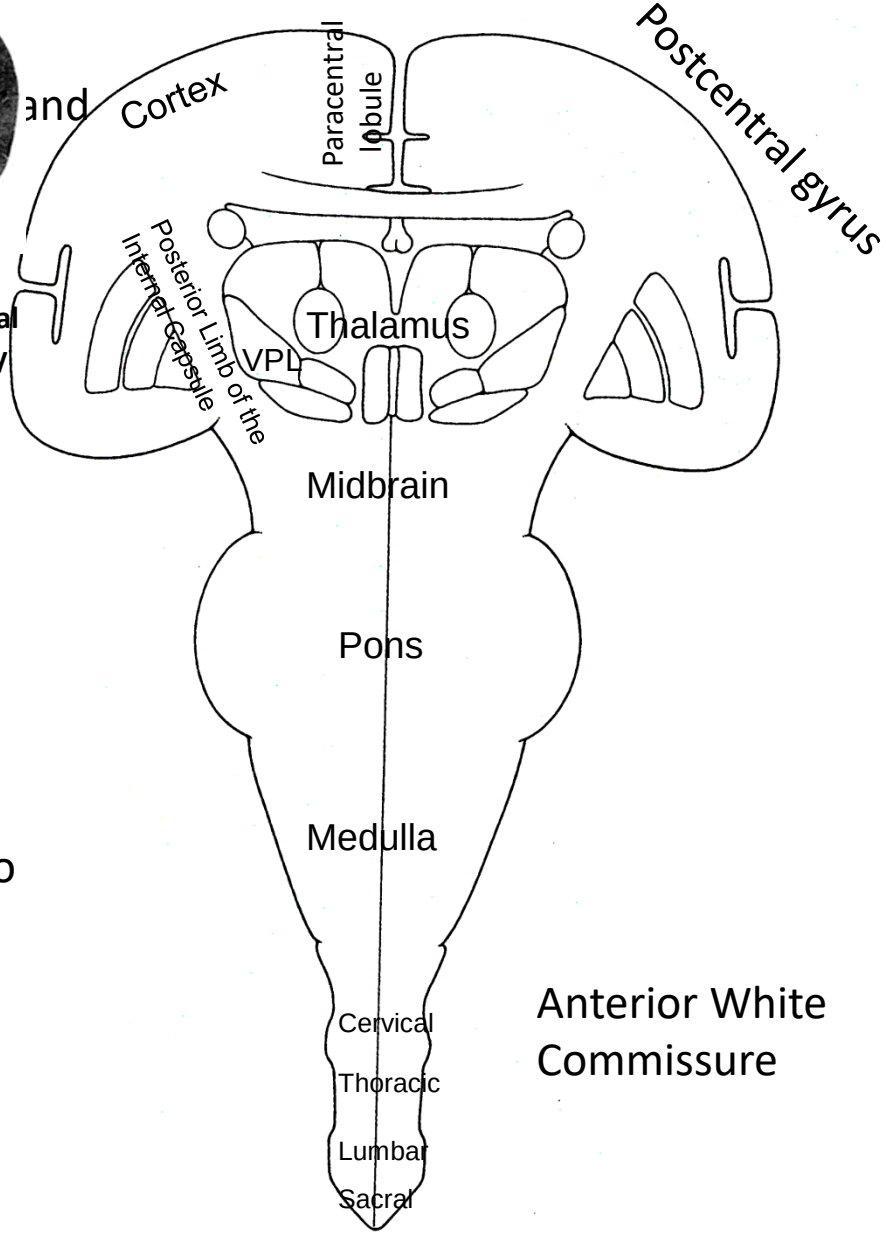


Bilateral loss of pain and temperature to this **cervical** spinal cord segment **only**.

Upper extremity

Trunk

Lower extremity

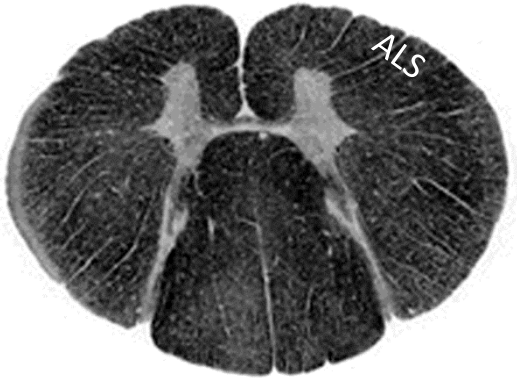


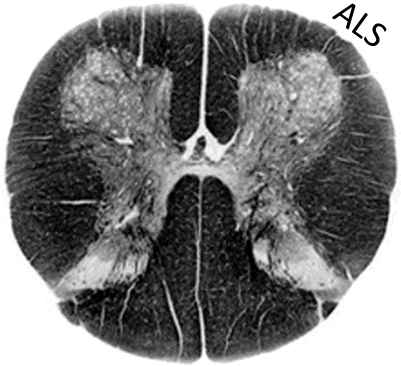
Anterior White Commissure

Haines diagr
Anterolatera
Thermocept
from the boc

pain) and

Contralateral loss of pain and temperature from this **cervical level and below** (neck and below)





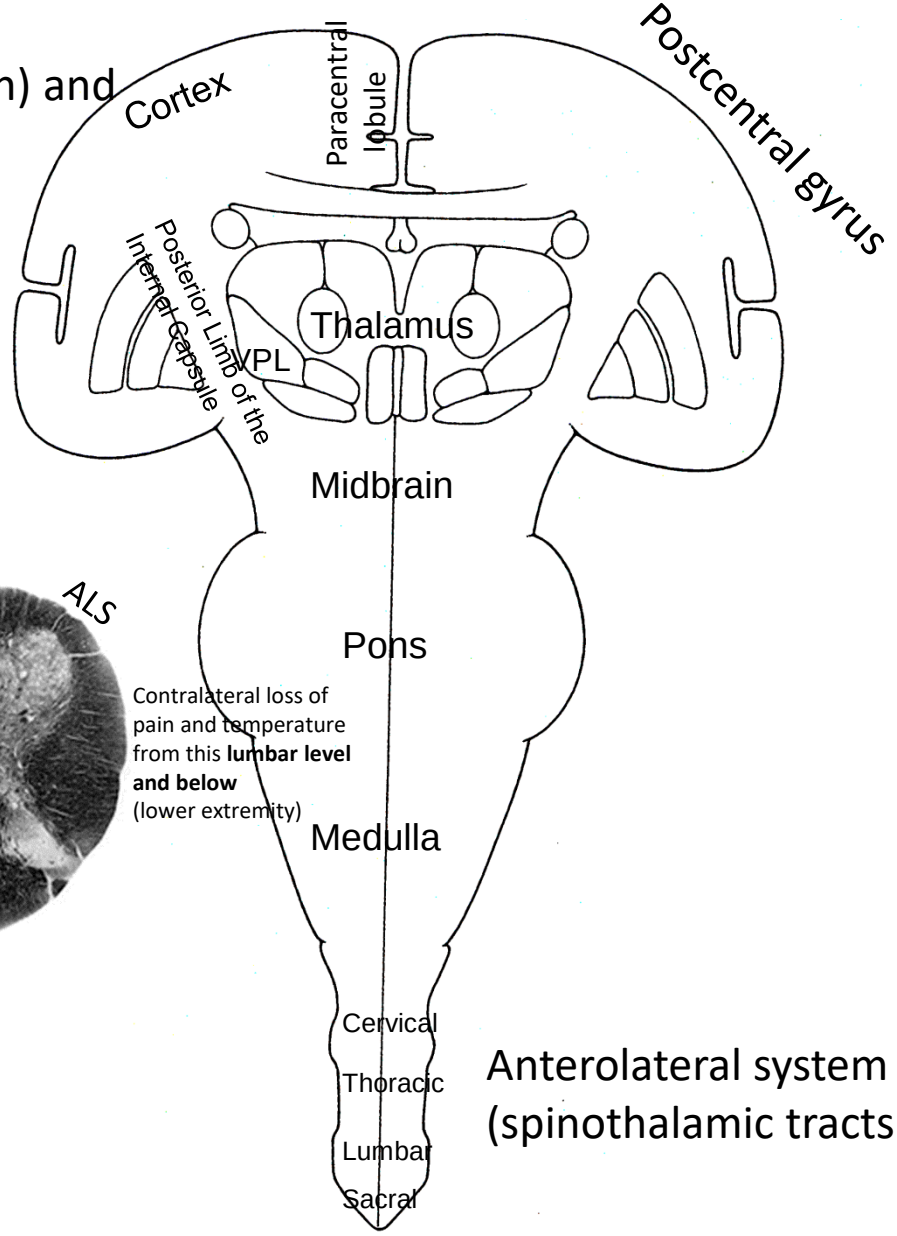
Contralateral loss of pain and temperature from this **lumbar level and below** (lower extremity)

Anterolateral system lesion—F
Contralateral loss of pain and ter
contralateral loss of pain and ter
to this thoracic segment and bel
segment and below
(trunk and below)

Upper extremity

Trunk

Lower extremity

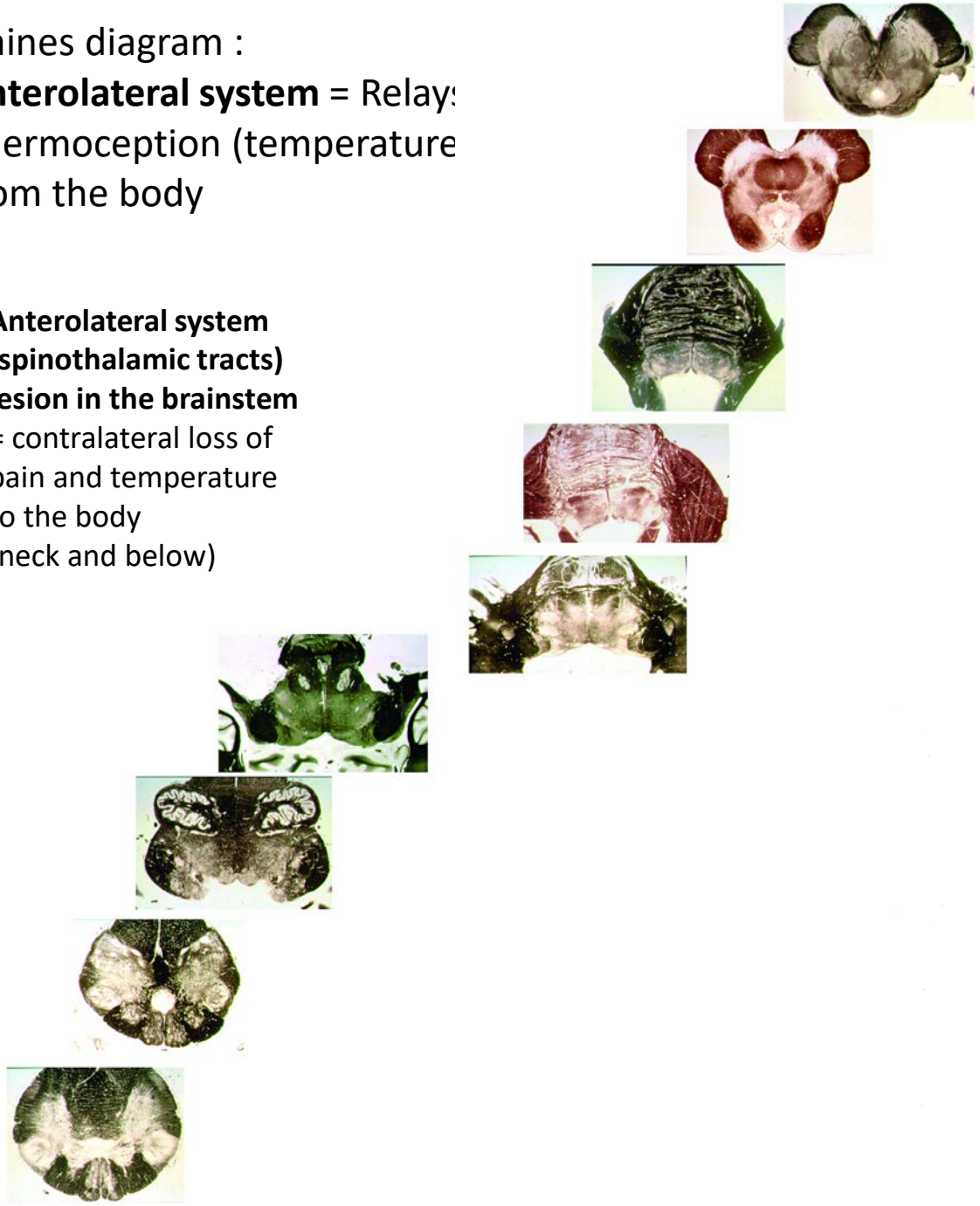


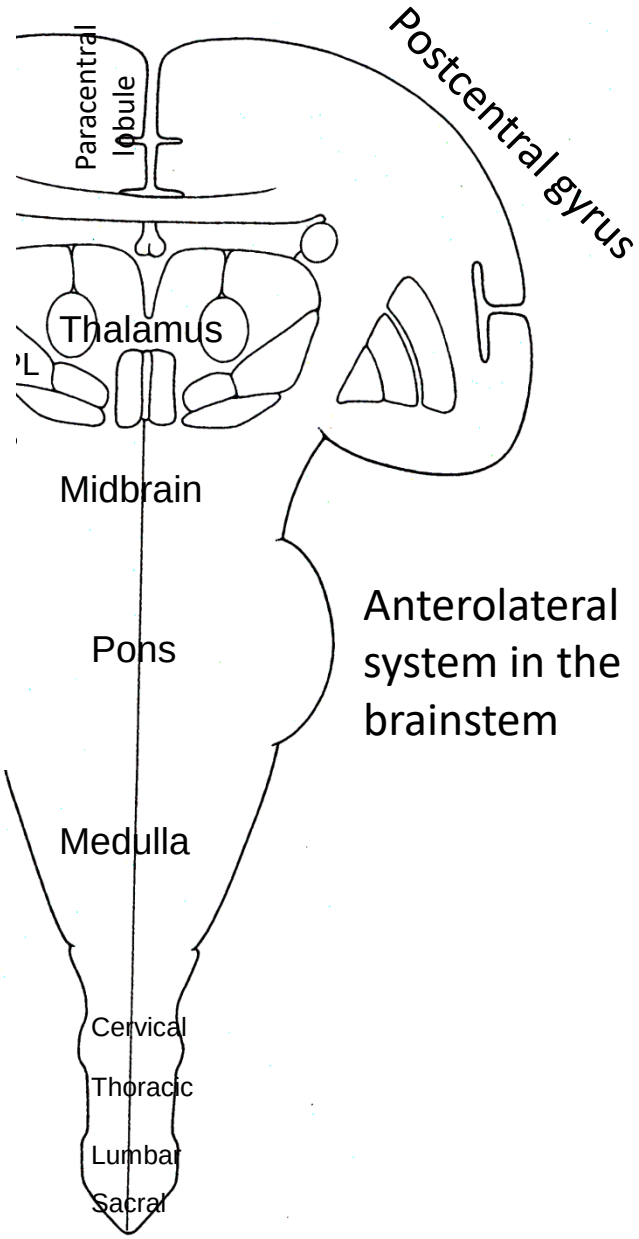
Anterolateral system
(spinothalamic tracts)

Haines diagram :

Anterolateral system = Relays
Thermoception (temperature
from the body

Anterolateral system (spinothalamic tracts) lesion in the brainstem
= contralateral loss of pain and temperature to the body (neck and below)

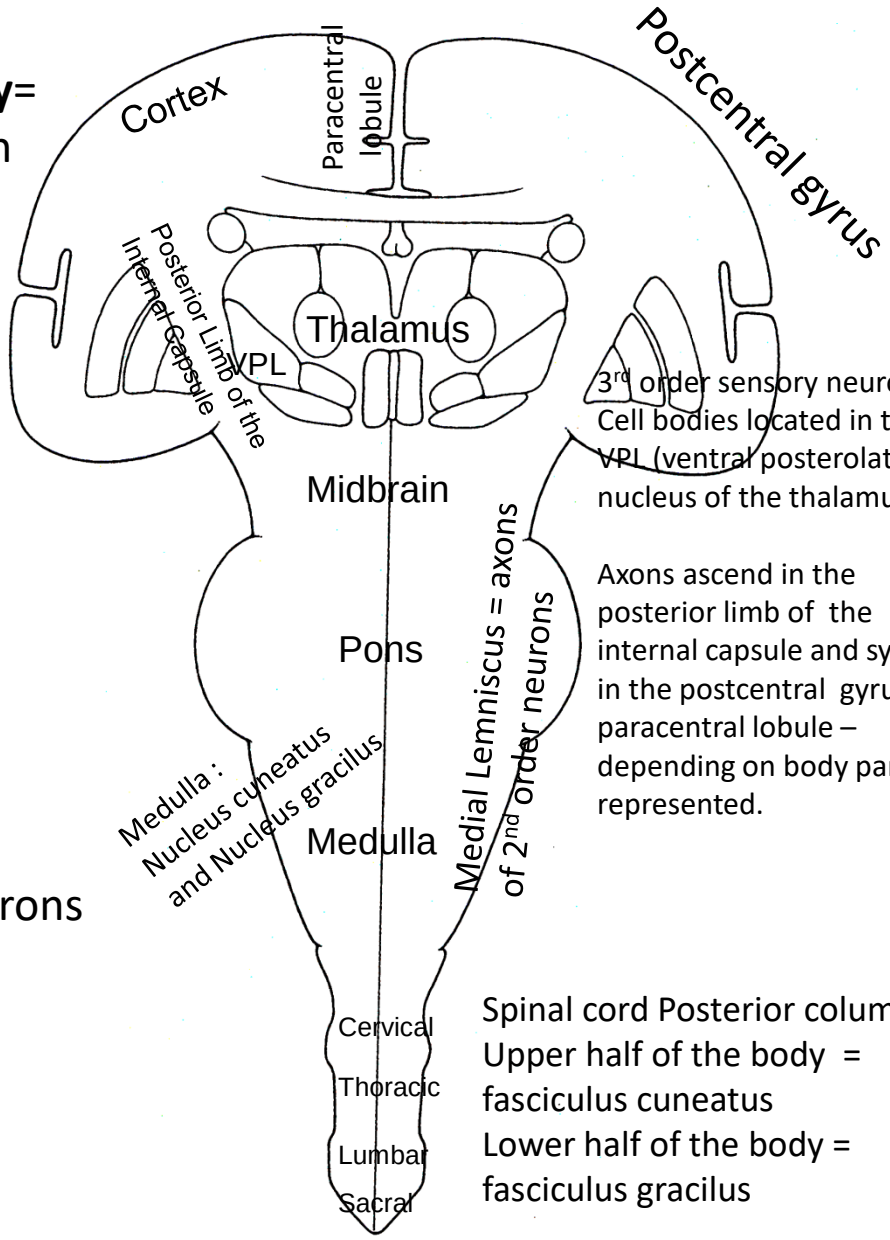




Anterolateral system in the brainstem

Haines diagram:

Posterior columns/Medial lemniscus pathway=
Relays discriminative touch, vibration, position sense from the body



3rd order sensory neurons: Cell bodies located in the VPL (ventral posterolateral nucleus of the thalamus

Axons ascend in the posterior limb of the internal capsule and synapse in the postcentral gyrus or paracentral lobule – depending on body part represented.

Pseudounipolar
1st order sensory neurons

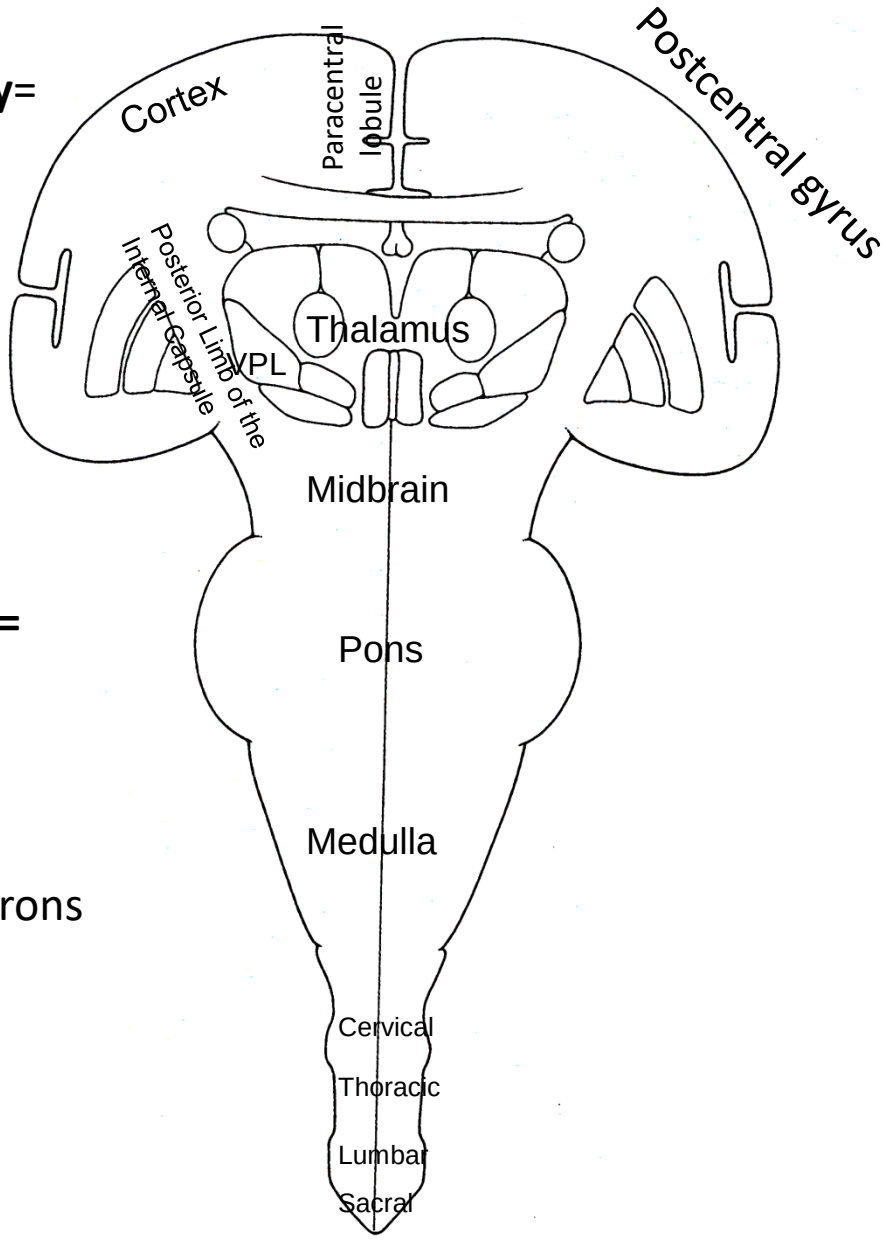
Upper half of the body
C1 – T6 nerves

Lower half of the body
T7 – Co1 nerves

Spinal cord Posterior columns
Upper half of the body = fasciculus cuneatus
Lower half of the body = fasciculus gracilus

Haines diagram:

Posterior columns/Medial lemniscus pathway=
Relays discriminative touch, vibration, position sense from the body



Lesion to the pseudounipolar neuron =
Ipsilateral loss of discriminative touch, vibration, position sense from that specific dermatome level

Pseudounipolar
1st order sensory neurons

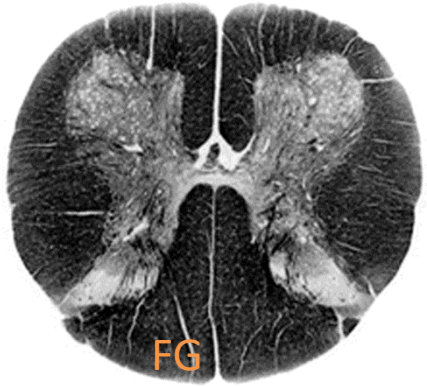
Upper half of the body
C1 – T6 nerves

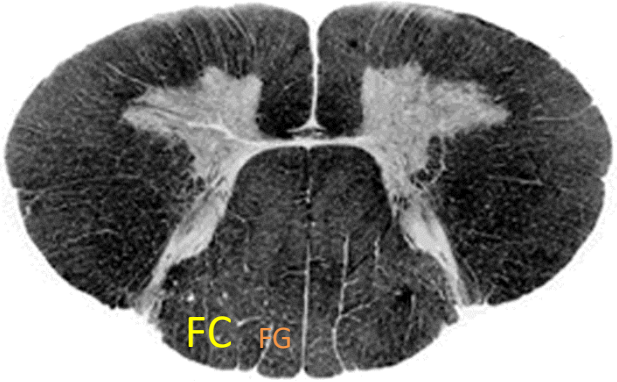
Lower half of the body
T7 – Co1 nerves

Haines diagram:

Posterior columns/Medial lemniscus pathway=
Relays discriminative touch, vibration, position sense from the body

Fasciculus cuneatus =
Ipsilateral loss of discriminative touch, vibration, position sense from the upper half of the body



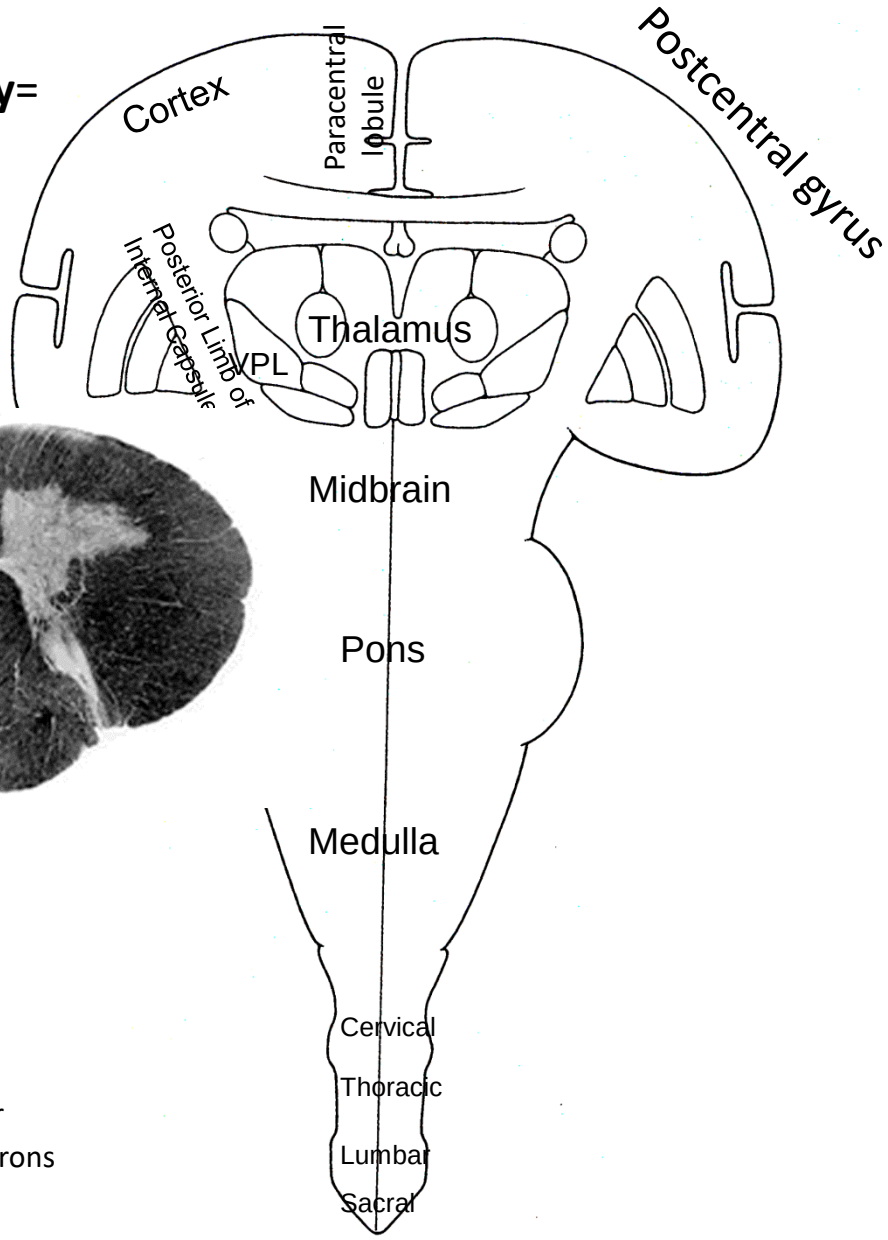


Fasciculus gracilus =
Ipsilateral loss of discriminative touch, vibration, position sense from the lower half of the body

Upper half of the body
C1 – T6 nerves

Pseudounipolar
1st order sensory neurons

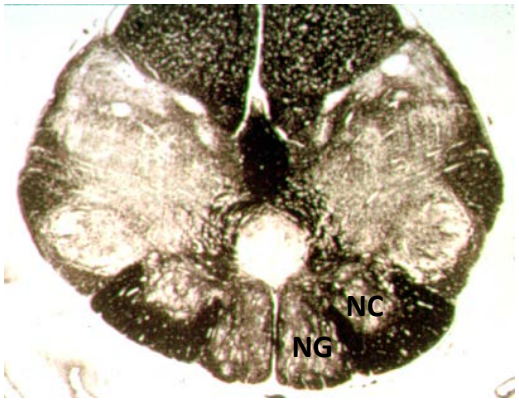
Lower half of the body
T7 – Co1 nerves



Haines diagram:

Posterior columns/Medial lemniscus pathway=
Relays discriminative touch, vibration, position sense from the body

Nucleus cuneatus =
Ipsilateral loss of discriminative touch, vibration, position sense from the upper half of the body

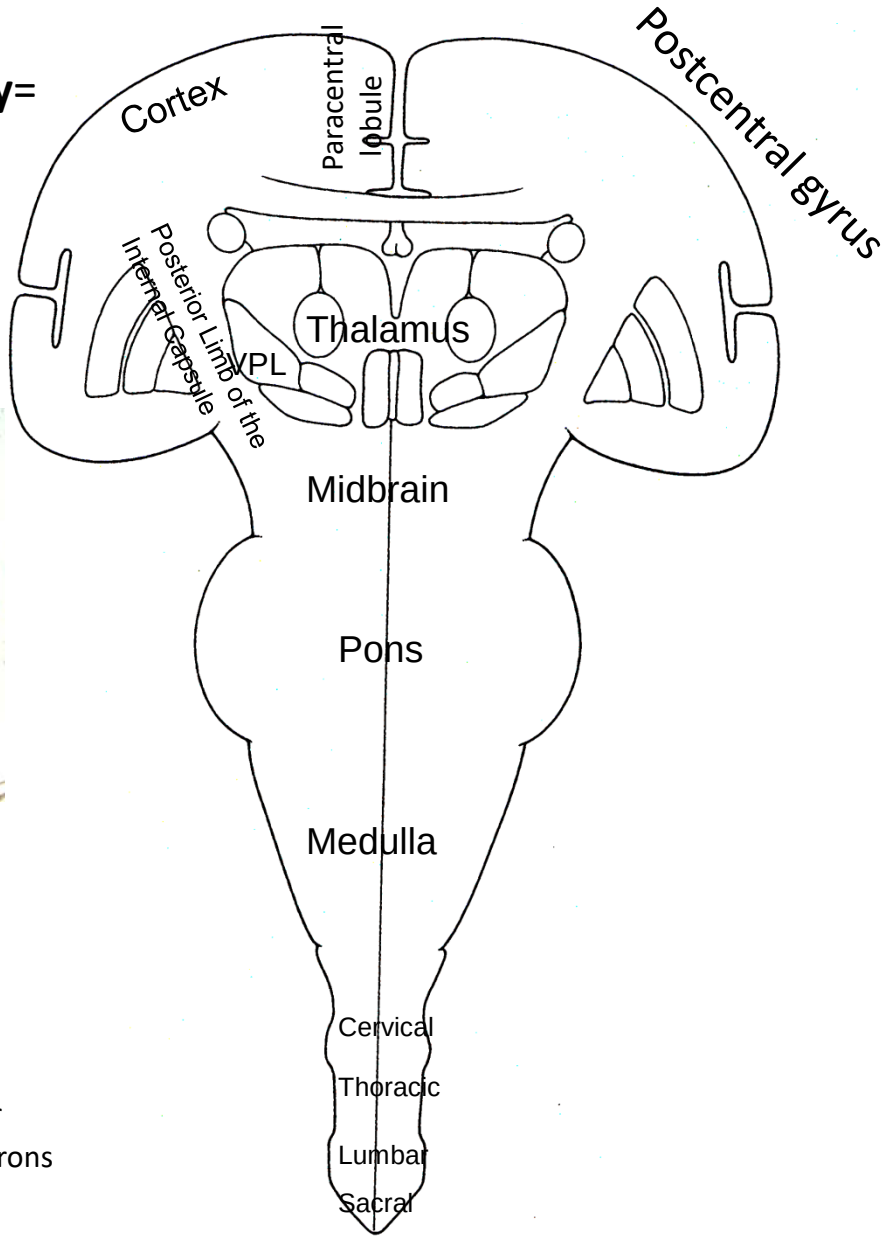


Nucleus gracilus =
Ipsilateral loss of discriminative touch, vibration, position sense from the lower half of the body

Upper half of the body
C1 – T6 nerves

Pseudounipolar
1st order sensory neurons

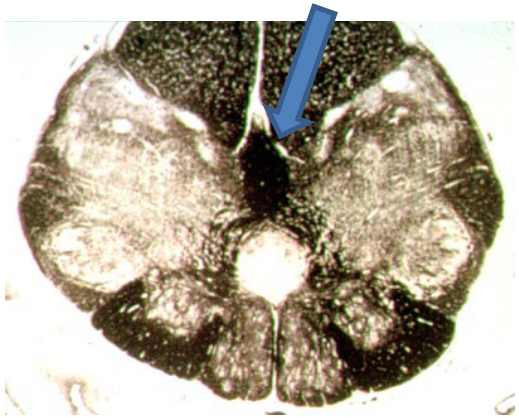
Lower half of the body
T7 – Co1 nerves



Haines diagram:

Posterior columns/Medial lemniscus pathway=
Relays discriminative touch, vibration, position sense from the body

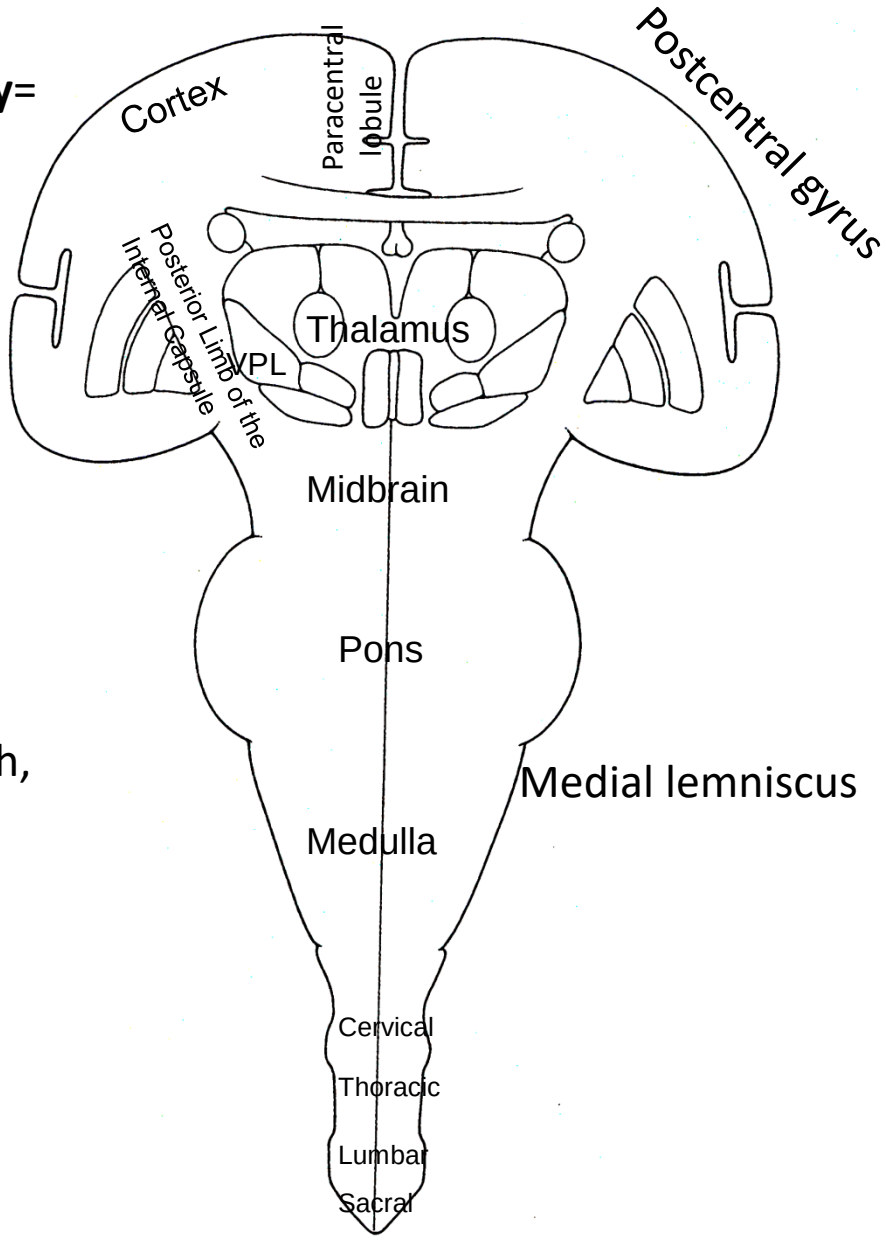
Medial lemniscus



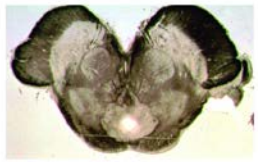
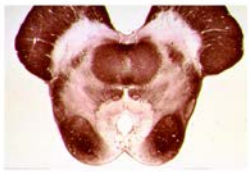
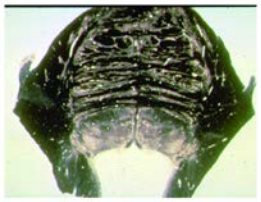
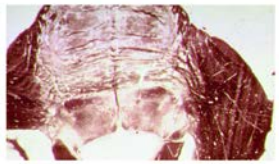
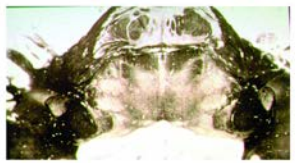
Contralateral loss of discriminative touch, vibration, position sense from the body (neck and below)

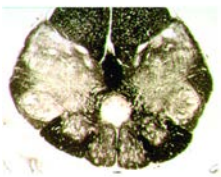
Upper half of the body
C1 – T6 nerves

Lower half of the body
T7 – Co1 nerves



Posterior columns/Medial lemniscus pathway=
Relays discriminative touch, vibration, position sense from the body

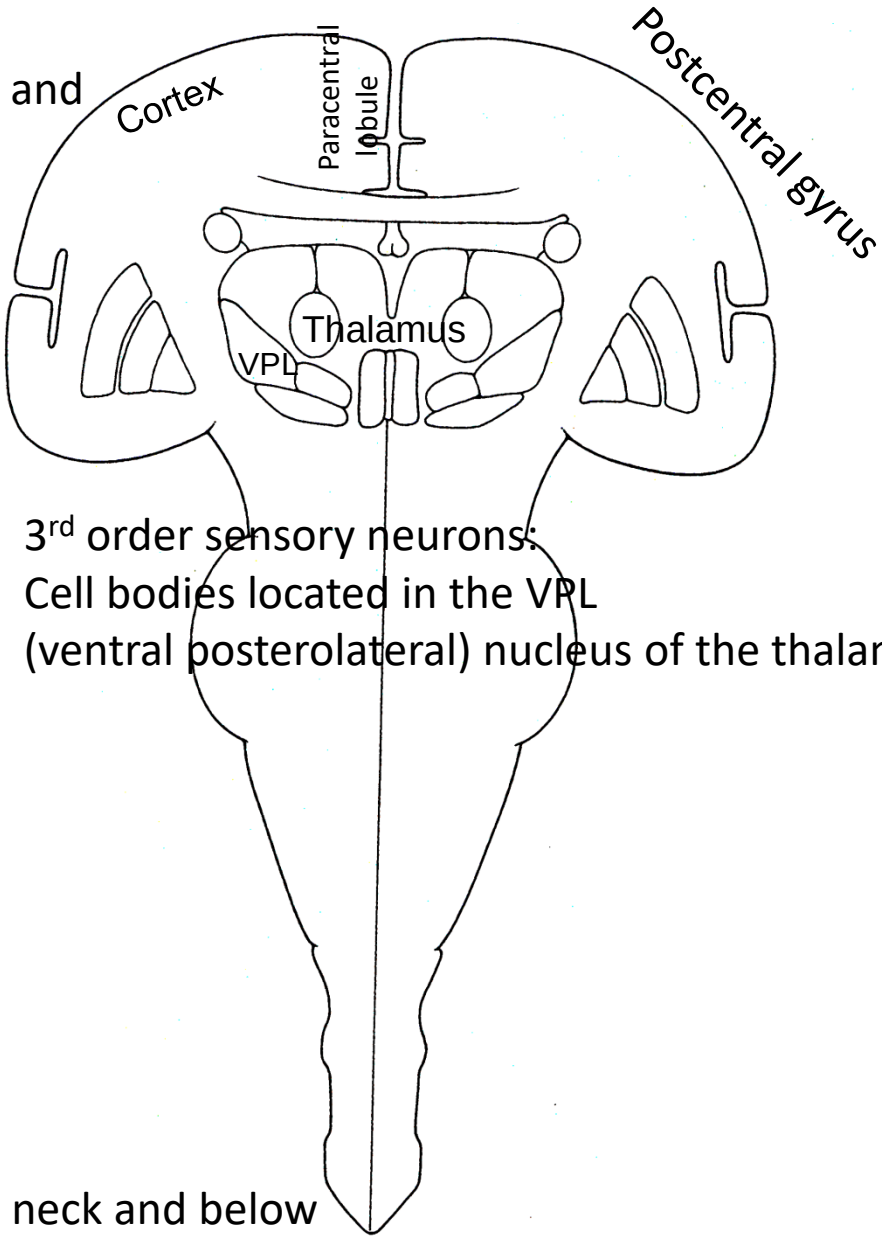



Lesion to 1 side of the medial lemniscus =
Contralateral loss of discriminative touch, vibration, position sense from the body (neck and below)

Haines diagram :

Anterolateral system = Relays nociception (pain) and Thermoception (temperature) from the body

Posterior columns/Medial lemniscus pathway= Relays discriminative touch, vibration, position sense from the body



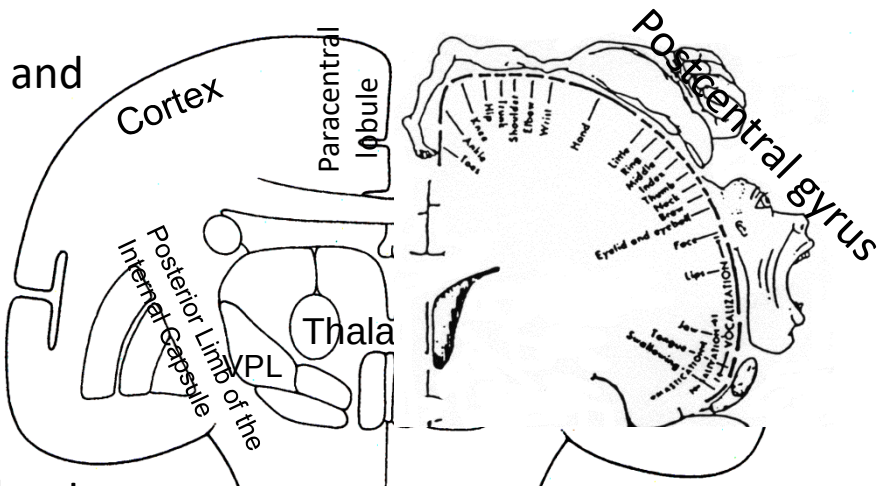
3rd order sensory neurons:
Cell bodies located in the VPL (ventral posterolateral) nucleus of the thalamus

Lesion to the VPL of the thalamus =
Contralateral loss of somatosensation from the neck and below (loss of pain/temperature: {ALS pathway}; and loss of discriminative touch, vibration, position sense: { PC/ML pathway})

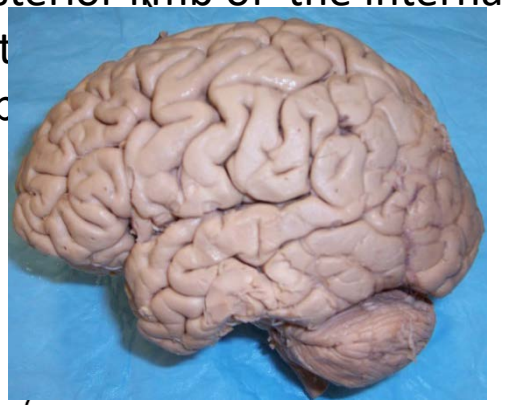
Haines diagram :

Anterolateral system = Relays nociception (pain) and Thermoception (temperature) from the body

Posterior columns/Medial lemniscus pathway = Relays discriminative touch, vibration, position sense from the body



3rd order sensory neurons:
Axons ascend in the posterior limb of the internal capsule and synapse in t
paracentral lobule – dep
represented.



Lesion to the postcentral gyrus =
Contralateral loss of somatosensation from the neck to hip
(loss of pain/temperature: {ALS pathway}; and loss of discriminative touch, vibration, position sense: { PC/ML pathway})
*** contra somatosensation to the head/face will also be lost but this is carried in the trigeminal sensory pathways – not ALS and PC/ML

Lesion to the posterior aspect of the paracentral lobule=
Contralateral loss of somatosensation from the knee to foot
(loss of pain/temperature: {ALS pathway}; and loss of discriminative touch, vibration, position sense: { PC/ML pathway})

Haines diagram :

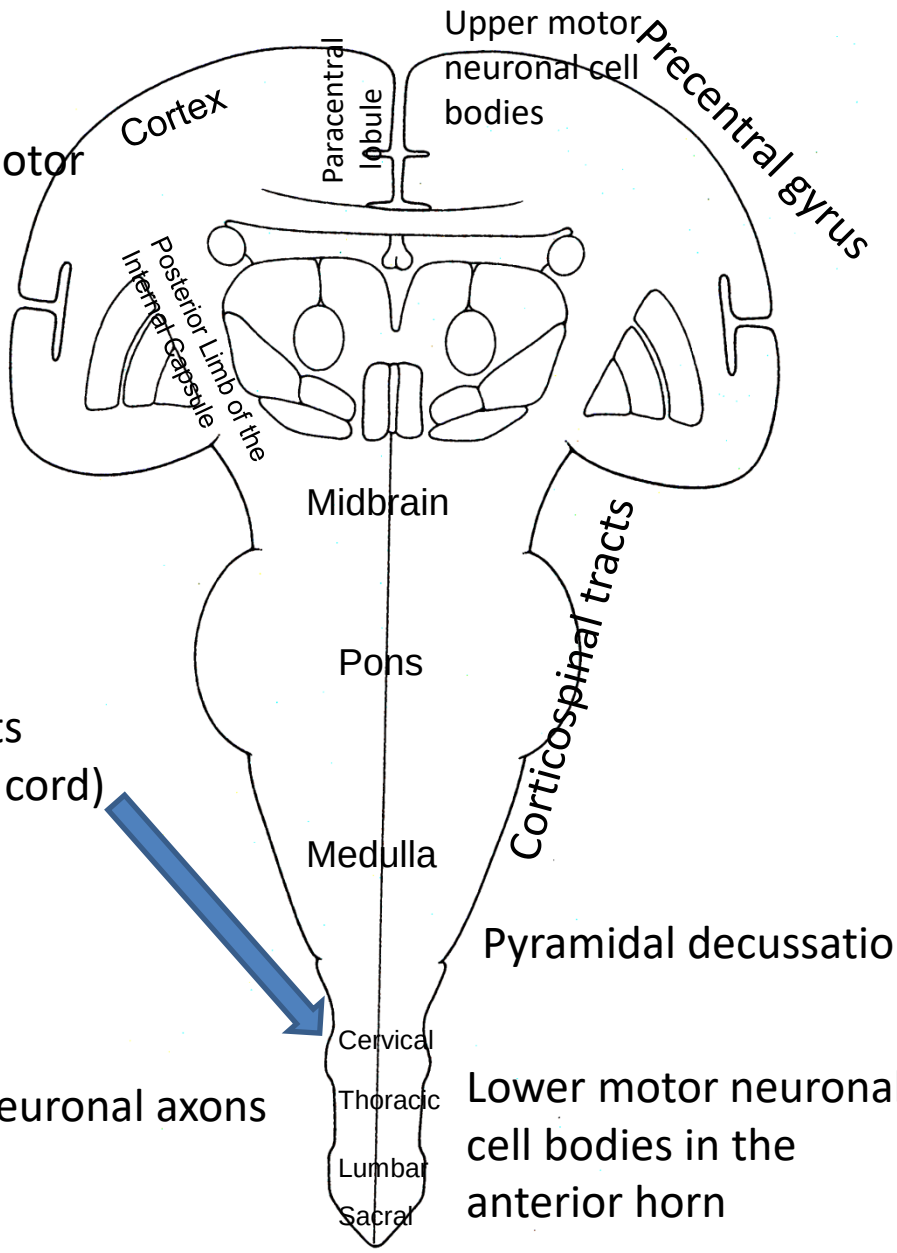
Voluntary Motor Pathway =

Consists of a 2 neuron chain: upper and lower motor neurons that innervate skeletal muscle

Key points to remember:

Upper motor neuron lesion = spastic paresis, hypertonia hyperreflexia, Babinski sign

Lower motor neuron lesion = flaccid paralysis, hypotonia, hyporeflexia, atrophy



Lateral Corticospinal tracts
(UMN axons in the spinal cord)

Upper extremity

Peripheral lower motor neuronal axons

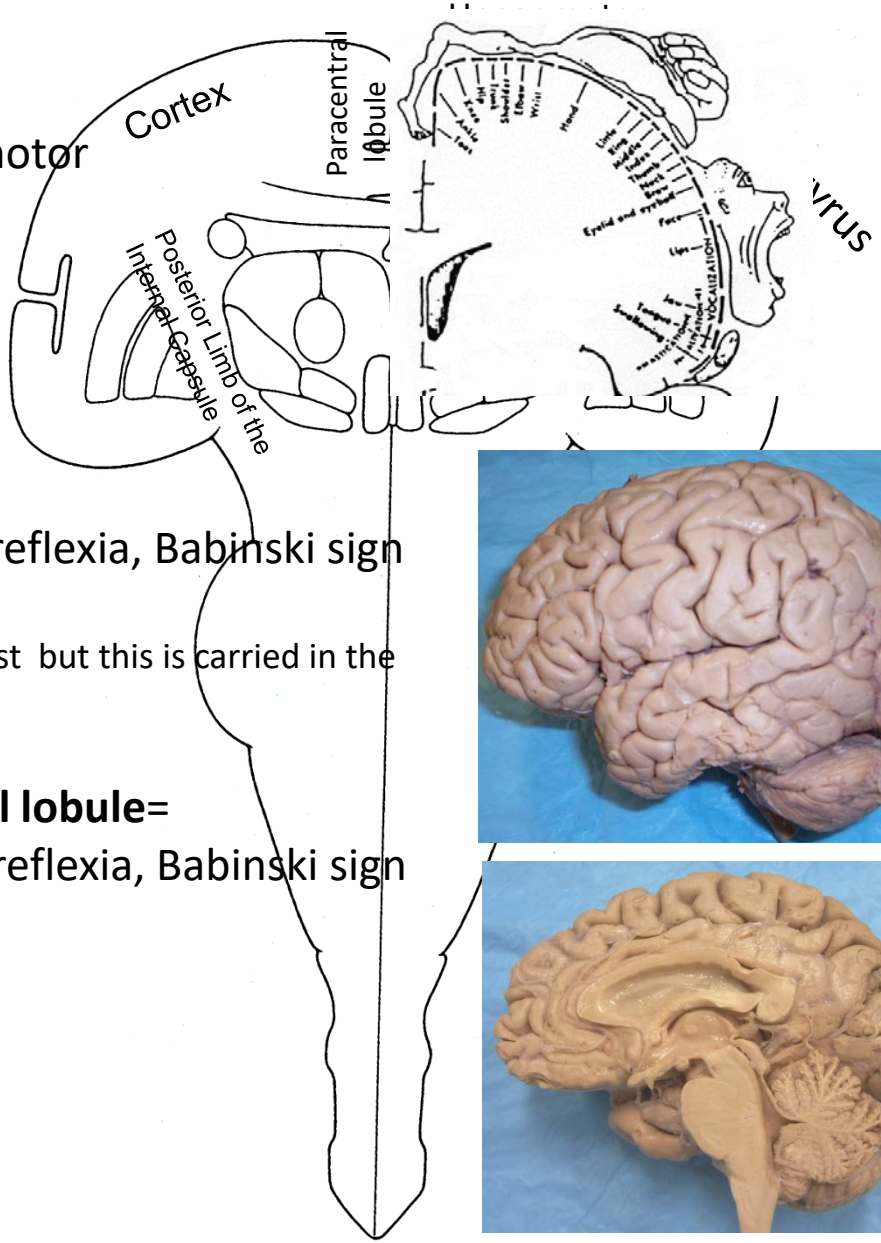
Trunk

Knee, leg, foot

Haines diagram :

Voluntary Motor Pathway =

Consists of a 2 neuron chain: upper and lower motor neurons that innervate skeletal muscle



Lesion to the postcentral gyrus =

Contralateral spastic paresis, hypertonia, hyperreflexia, Babinski sign from the neck to hip

*** contra upper motor signs to the head/face will also be lost but this is carried in the trigeminal motor (corticobulbar) pathways

Lesion to the anterior aspect of the paracentral lobule=

Contralateral spastic paresis, hypertonia, hyperreflexia, Babinski sign from the knee to foot

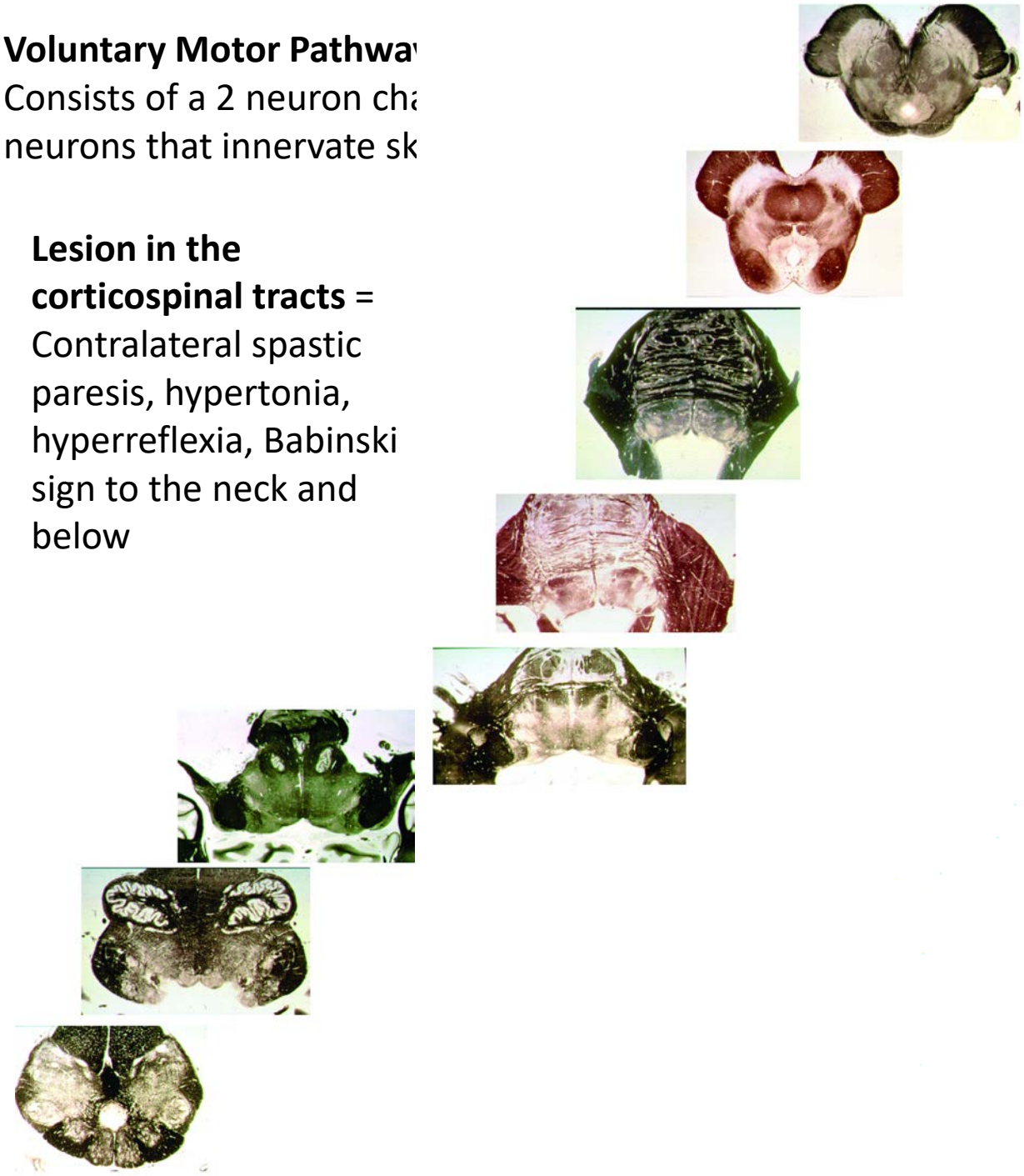
Upper extremity

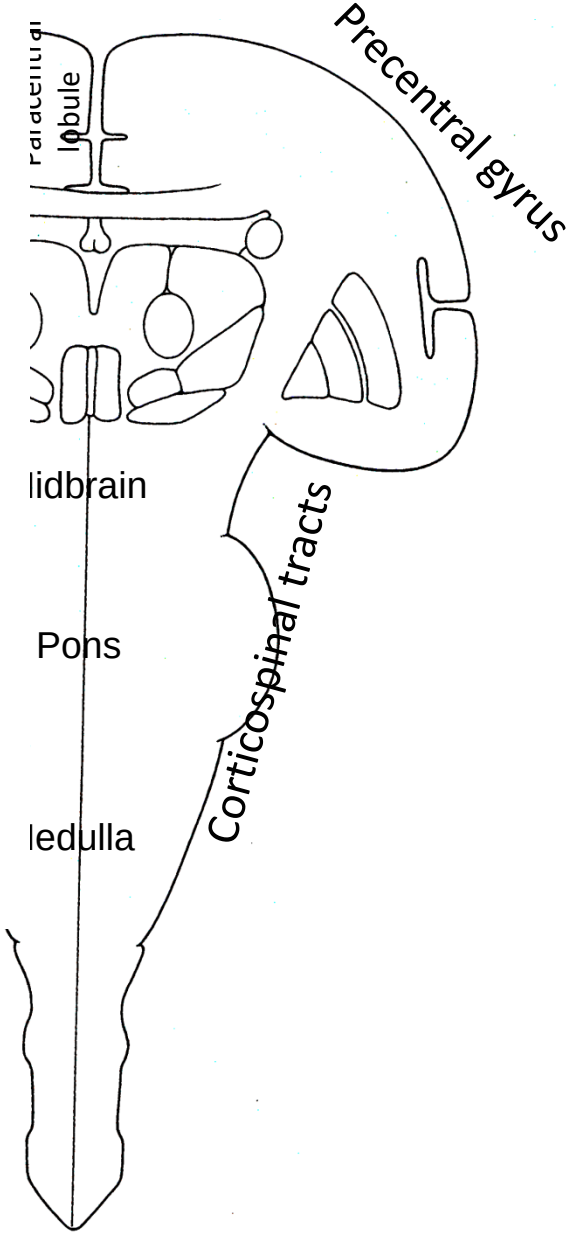
Trunk

Knee, leg, foot

Voluntary Motor Pathwa
Consists of a 2 neuron cha
neurons that innervate sk

Lesion in the corticospinal tracts = Contralateral spastic paresis, hypertonia, hyperreflexia, Babinski sign to the neck and below





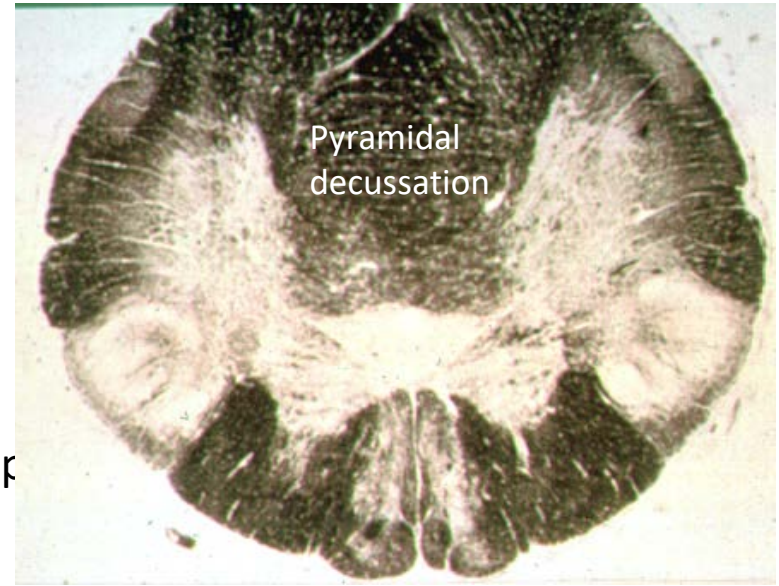
Haines diagram :

Voluntary Motor Pathway =

Consists of a 2 neuron chain: upper and lower motor neurons that innervate skeletal muscle

Lesion in the pyramidal decussation =

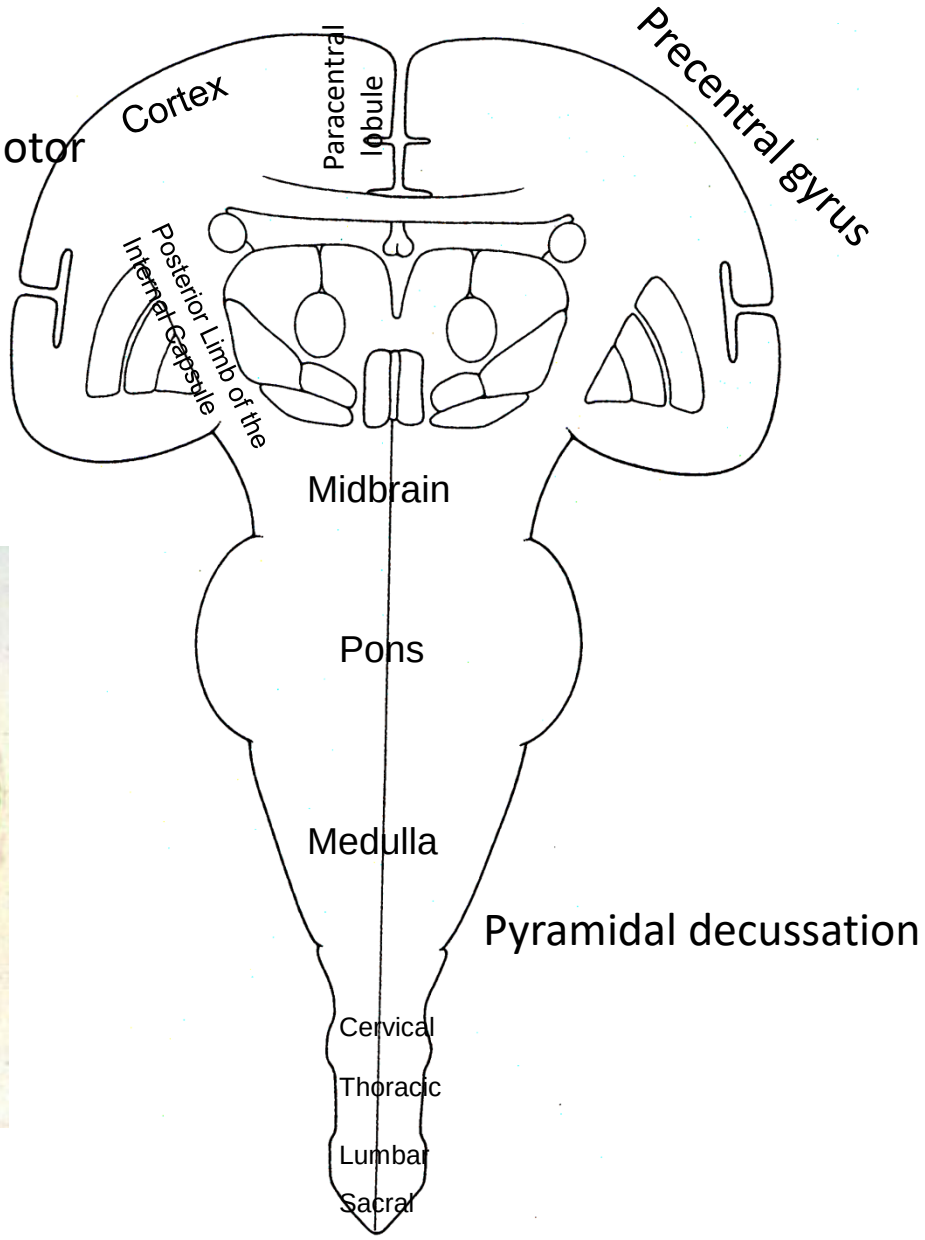
Bilateral spastic paresis, hypertonia, hyperreflexia, Babinski sign to the neck and below (body)



Up

Trunk

Knee, leg, foot



Haines diagram :

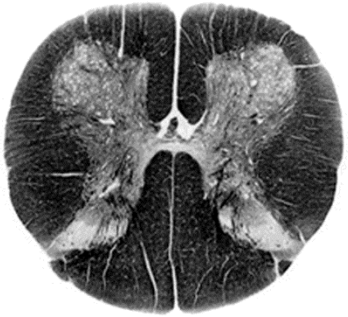
Voluntary Motor Pathway =

Consists of a 2 neuron chain: upper and lower motor neurons that innervate skeletal muscle

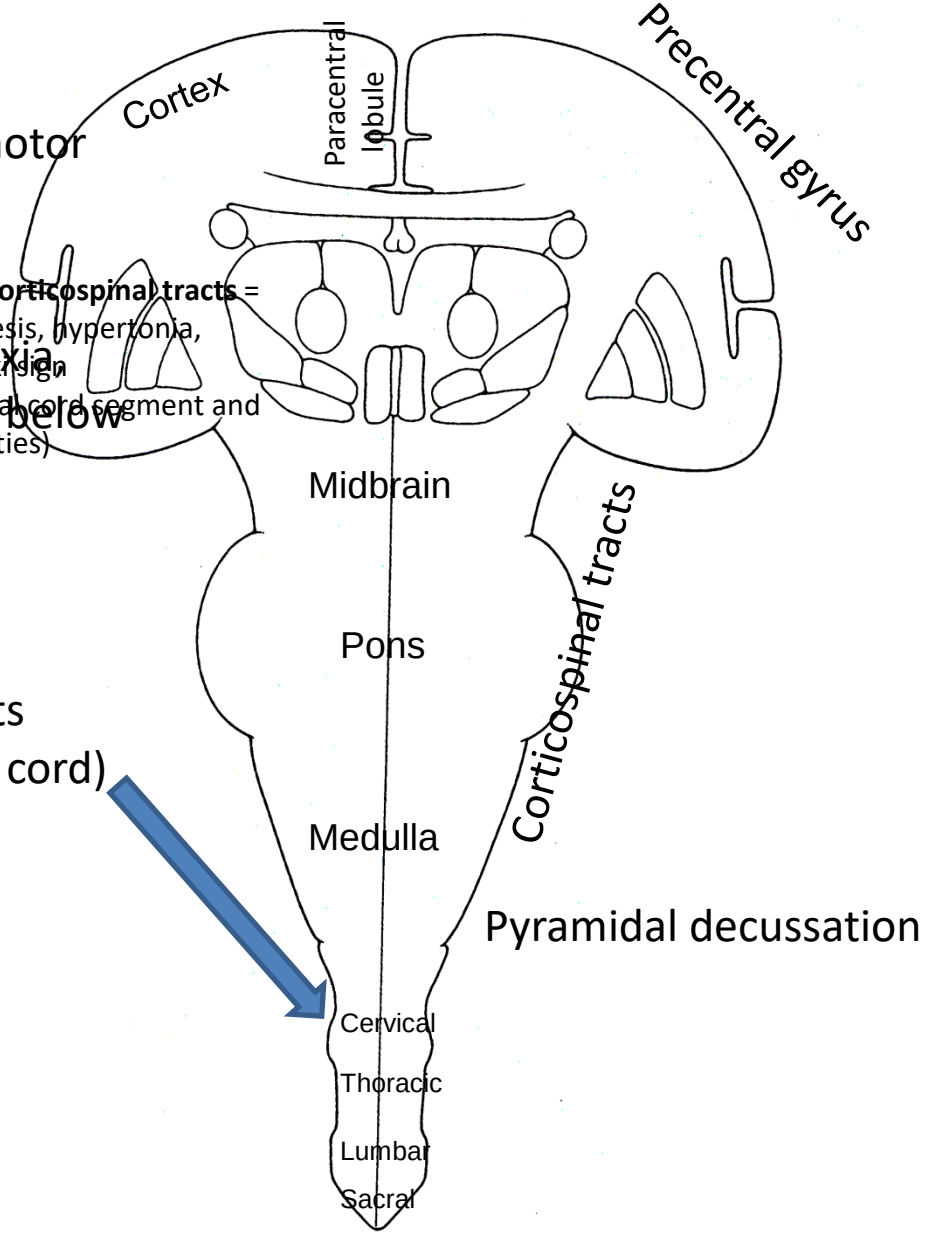
Lesion in the lateral corticospinal tracts =
Ipsilateral spastic paresis, hypertonia, hyperreflexia, Babinski sign from this **thoracic** spinal cord segment and below (trunk and below)

Lesion in the lateral corticospinal tracts =
Ipsilateral spastic paresis, hypertonia, hyperreflexia, Babinski sign from this **lumbar** spinal cord segment and below (lower extremities)

Lesion in the lateral corticospinal tracts =
Ipsilateral spastic paresis, hypertonia, hyperreflexia, Babinski sign from that spinal cord segment and below



ateral ts
JMN l cord)



Lesion in the lateral corticospinal tracts =
Ipsilateral spastic paresis, hypertonia, hyperreflexia, Babinski sign from this **cervical** spinal cord segment and below (neck and below)

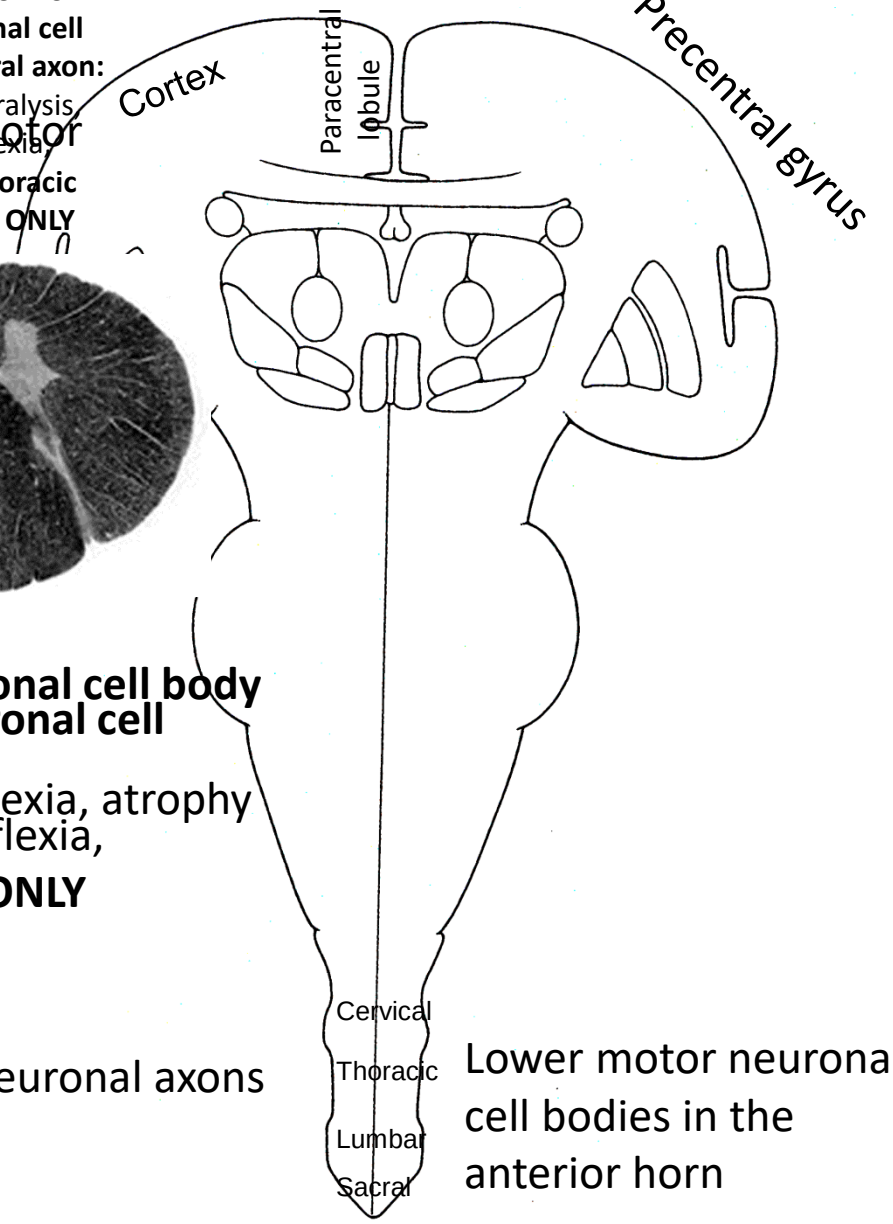
Haines diagram :

Voluntary Motor Pathway =

Consists of a 2 neuron chain: upper and lower motor neurons that innervate skeletal muscle

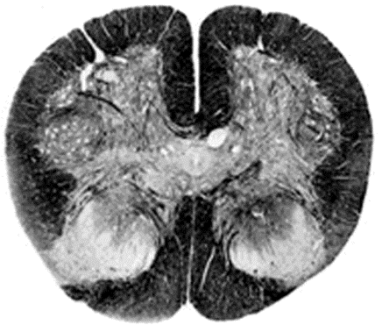
Lesion to the anterior horn lower motor neuronal cell body or its peripheral axon:
Ipsilateral flaccid paralysis, hypotonia, hyporeflexia, atrophy from this **cervical** spinal cord segment **ONLY**

Lesion to the anterior horn lower motor neuronal cell body or its peripheral axon:
Ipsilateral flaccid paralysis, hypotonia, hyporeflexia, atrophy from this **thoracic** spinal cord segment **ONLY**



Lesion to the anterior horn lower motor neuronal cell body or its peripheral axon:
Ipsilateral flaccid paralysis, hypotonia, hyporeflexia, atrophy from this spinal cord segment **ONLY**

Lesion to the anterior horn lower motor neuronal cell body or its peripheral axon:
Ipsilateral flaccid paralysis, hypotonia, hyporeflexia, atrophy from this **sacral** spinal cord segment **ONLY**



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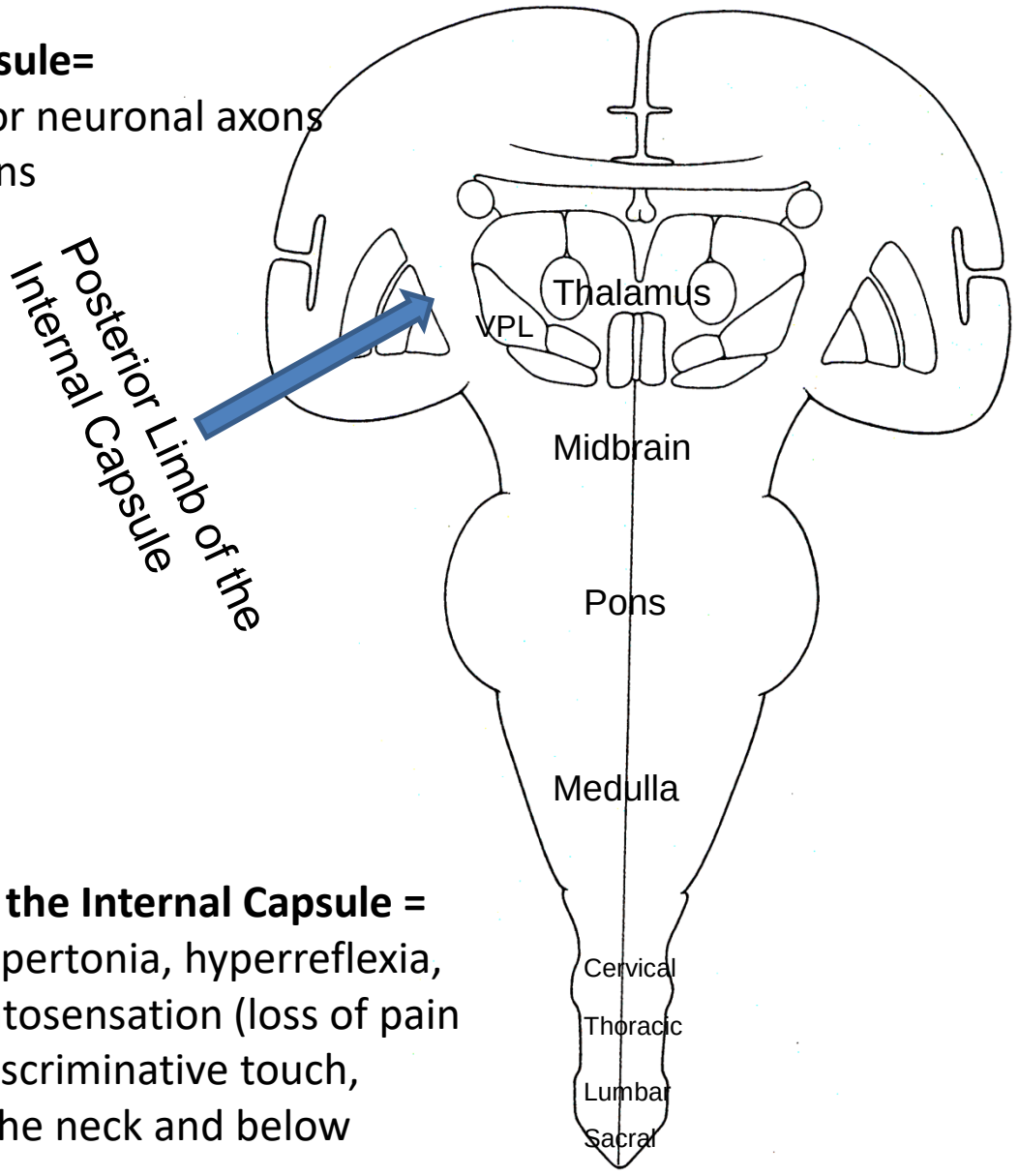
Peripheral lower motor neuronal axons

Lower motor neuronal cell bodies in the anterior horn

Haines diagram :

Posterior Limb of the Internal Capsule=

Consists of descending upper motor neuronal axons
And ascending somatosensory axons



Lesion to the Posterior Limb of the Internal Capsule =
Contralateral spastic paresis, hypertonia, hyperreflexia, Babinski sign **AND** loss of somatosensation (loss of pain and temperature AND loss of discriminative touch, vibration, position sense from the neck and below (body)