Ask Weber

Nervous System 1 (Topic 10)

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Central Nervous System

THE UNIVERSITY OF
SYDNEY

Organisation of the nervous system

What are the two systems which can be considered 'motor pathways'?

- Autonomic nervous system
- Somatic nervous system

What is the difference between these two systems?

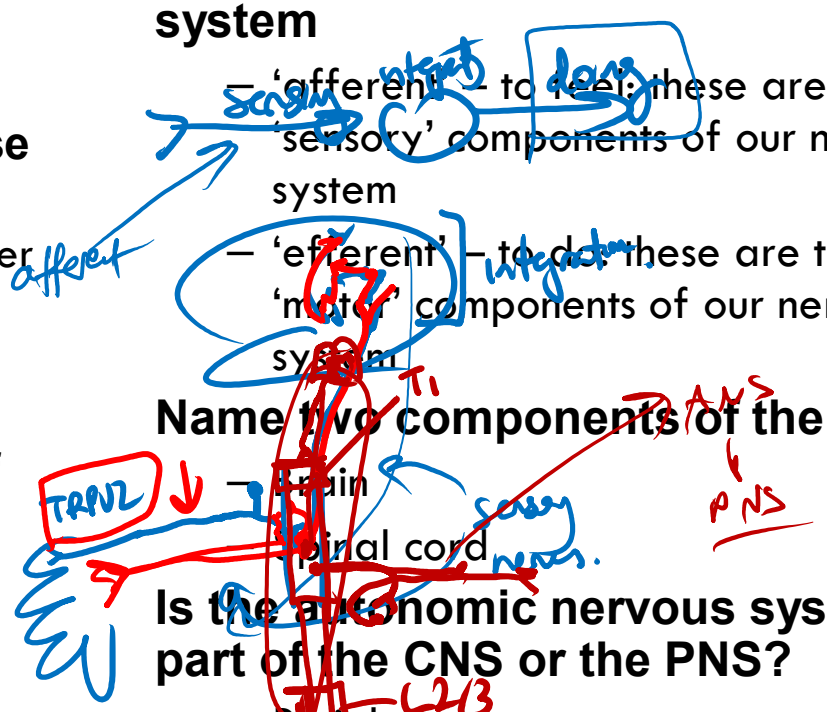
- Autonomic nervous system is not under conscious control
- Somatic nervous system is under conscious control

What is the difference in the type of muscles each nervous system innervates?

- Autonomic nervous system – smooth muscle and cardiac muscle
- Somatic nervous system – skeletal muscle

What is an 'afferent' pathway and an 'efferent' pathway in a nervous system

- 'afferent' – to feel: these are the 'sensory' components of our nervous system
- 'efferent' – to act: these are the 'motor' components of our nervous system



Name two components of the CNS

- Brain
- Spinal cord

Is the autonomic nervous system part of the CNS or the PNS?

- Peripheral nervous system

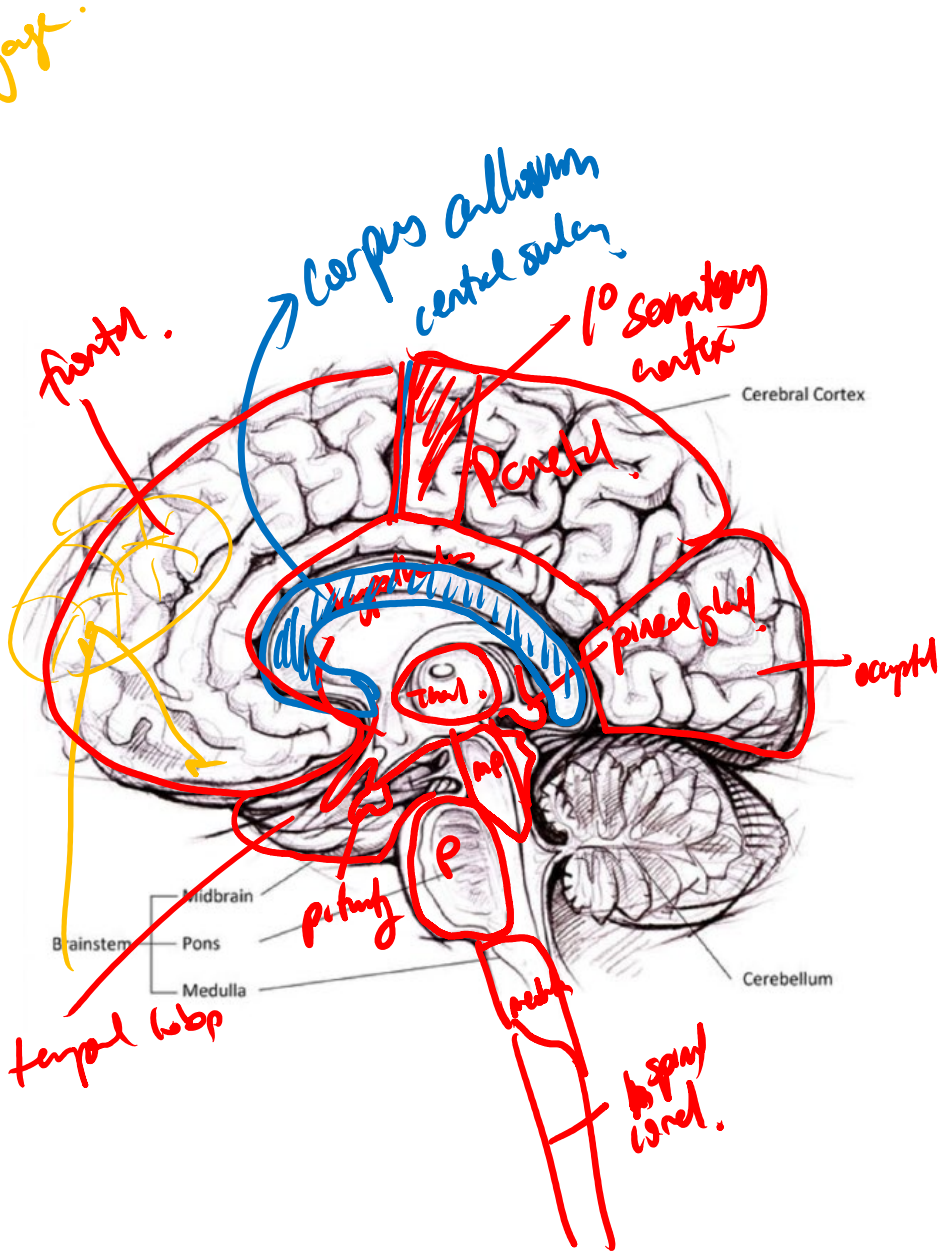
The brain

Components of the forebrain

- Cerebrum
- Thalamus
- Hypothalamus
- Pineal gland, pituitary gland
- Limbic system

Components of the hindbrain

- Midbrain
- Brainstem
  - Pons
  - Medulla oblongata
- cerebellum



The cerebrum (cerebral cortex)

What structure joins the hemispheres?

- Corpus callosum

What does the corpus callosum actually join?

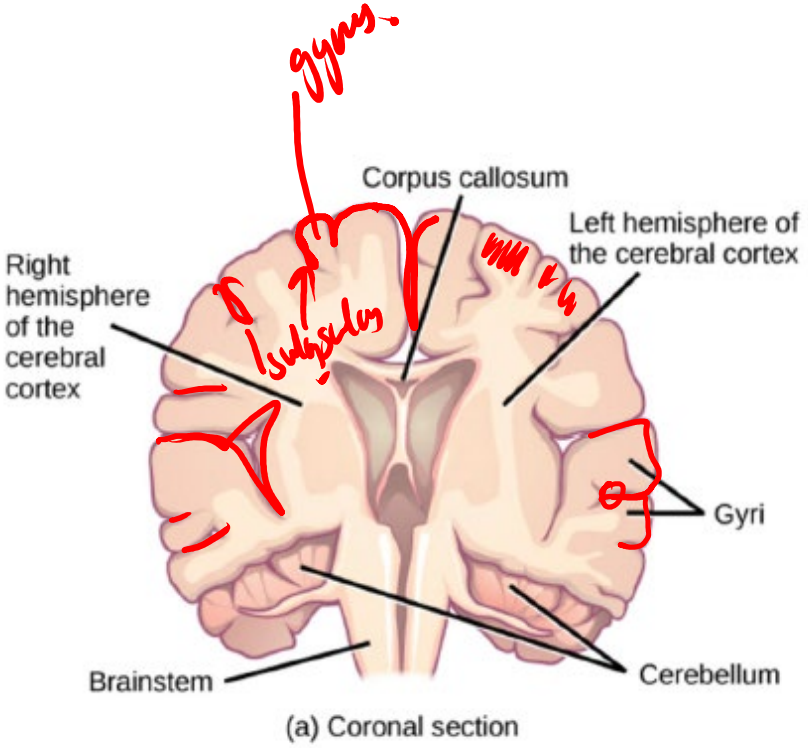
- The cerebral cortex (cell bodies) via the internal capsule

What *actually* is gray matter and white matter

- Gray matter – cell bodies
- White matter – axons

Does the inside or the outside of the cerebrum consist of the cell bodies/soma?

Define sulci and gyri



(a) Coronal section

Lobes of the brain

What are the lobes of the cerebral cortex? What do they do?

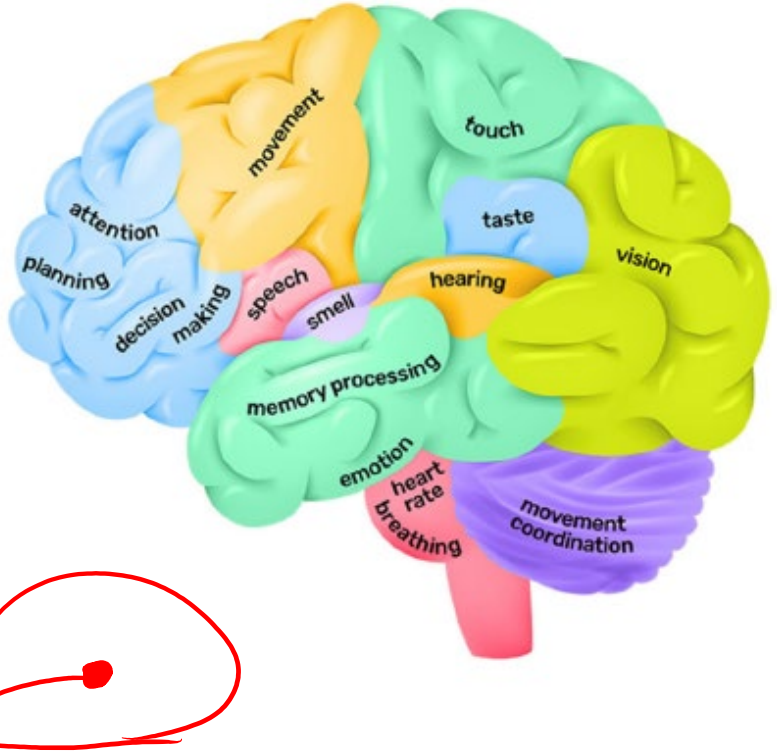
- Frontal cortex
- Parietal lobe – integration of sensory information
- Temporal lobe
- Occipital lobe - vision

Which area of the brain controls speech?

What side of the brain is involved in processing of verbal language and speaking?

- Left – Wernicke and Broca's areas respectively are responsible for this

What is a stroke?



What lobe is responsible for this?

Following a hyperacute stroke with thrombolysis, John underwent a medical assessment. On general inspection, John demonstrated truncal ataxia. When examining him, he was past-pointing on the finger-to-nose test and had dysdiadochokinesia. When asked to stand, he demonstrated titubation. What area of the brain would you expect to see the stroke on MRI?

Cerebellum

- Responsible for gait and posture
  - Truncal ataxia (i.e. he cant keep himself upright and still)
  - Titubation (i.e. cant keep himself upright and still when standing)
- Responsible for muscle tone and voluntary muscle activity (and fine movement controls)
  - Finger-to-nose involves use of fine and complex muscle groups
  - Dysdiadochokinesia does the same

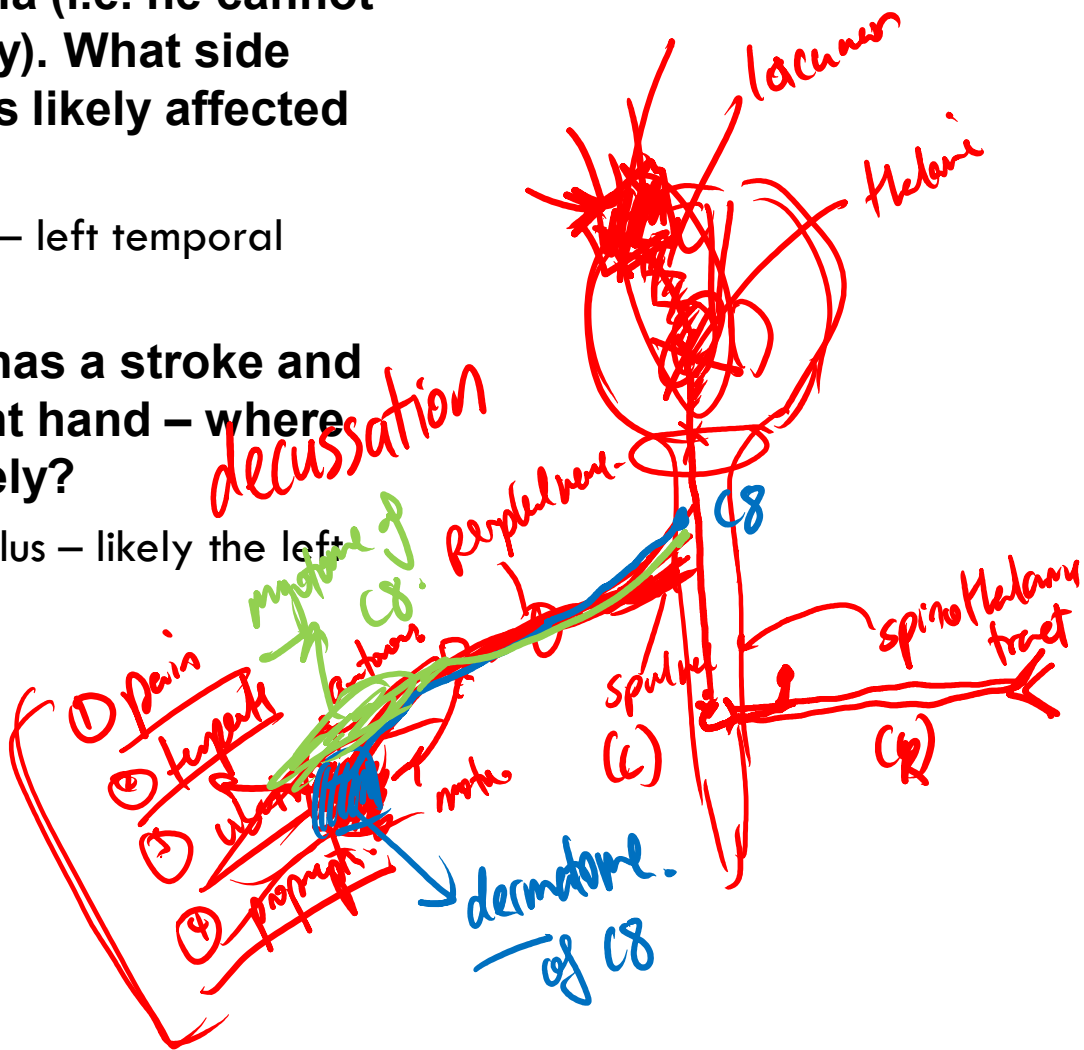
What lobe is responsible for this?

An elderly patient has a stroke and develops an aphasia (i.e. he cannot speak appropriately). What side and which lobe was likely affected by this?

- Broca's aphasia – left temporal lobe

An elderly patient has a stroke and cannot feel his right hand – where was this stroke likely?

- Look at homunculus – likely the left parietal lobe



Forebrain functions

In the CT brain scans of many elderly patients, you will tend to find a calcified pineal gland. What hormone is primarily regulated by this gland and what does it do?

- Melatonin – regulates sleep/wake cycle

Which structure in the brain is responsible for regulating hormone release from the pituitary glands?

- Hypothalamus

Which hormones are released by the hypothalamic neurons into the posterior pituitary?

- Oxytocin and ADH

Forebrain functions

When you are casually doing something and then something extremely scary happens (e.g. a car crashes in front of you), you tend to develop a very strong memory of the event. This is due to a behavioural response to the situation (most typically fear). Which component of the brain is responsible for the (a) emotional response, (b) memory formation and (c) the name of the system that links this together

- A – amygdala
- B – hippocampus
- C – limbic system

- The thalamus processes sensory information.
- The hypothalamus is the major control centre of the autonomic motor system. It is involved in some hormonal activity and connects the hormonal and nervous systems. The hypothalamus also helps regulate homeostasis.
- The pineal gland produces the hormone melatonin, which regulates our sleep-wake cycles. Just like the hypothalamus, it is also involved in regulating hormonal functions.
- The limbic system regulates behavioural and emotional responses. Most important parts are the hippocampus and the amygdala.
- The basal ganglia are involved in including control of voluntary motor movements, habit learning, eye movements, cognition and emotion.

When Stephen curry trains for his games, he needs to shoot many (MANY) shots. Each time he misses, he corrects himself based on the feedback (seeing himself miss) and his experience of shooting (from his muscles, joint positions, etc.). What brain component is responsible for this?

- Cerebellum

Cerebellar regions

Vermix controls:

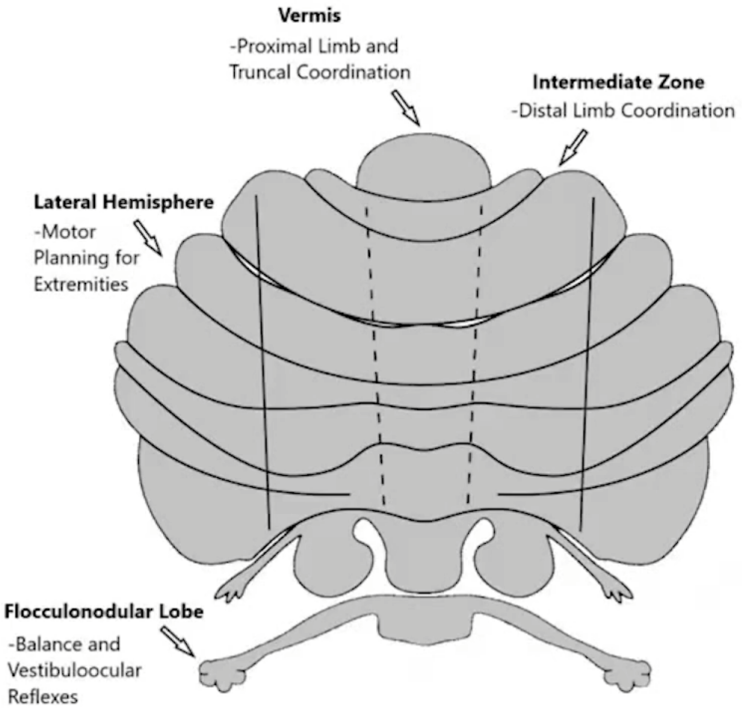
- Proximal limb and truncal coordination

Lateral hemispheres for

- Motor planning for extremities

Flocculonodular lobe

- Balance and vestibuloocular reflex

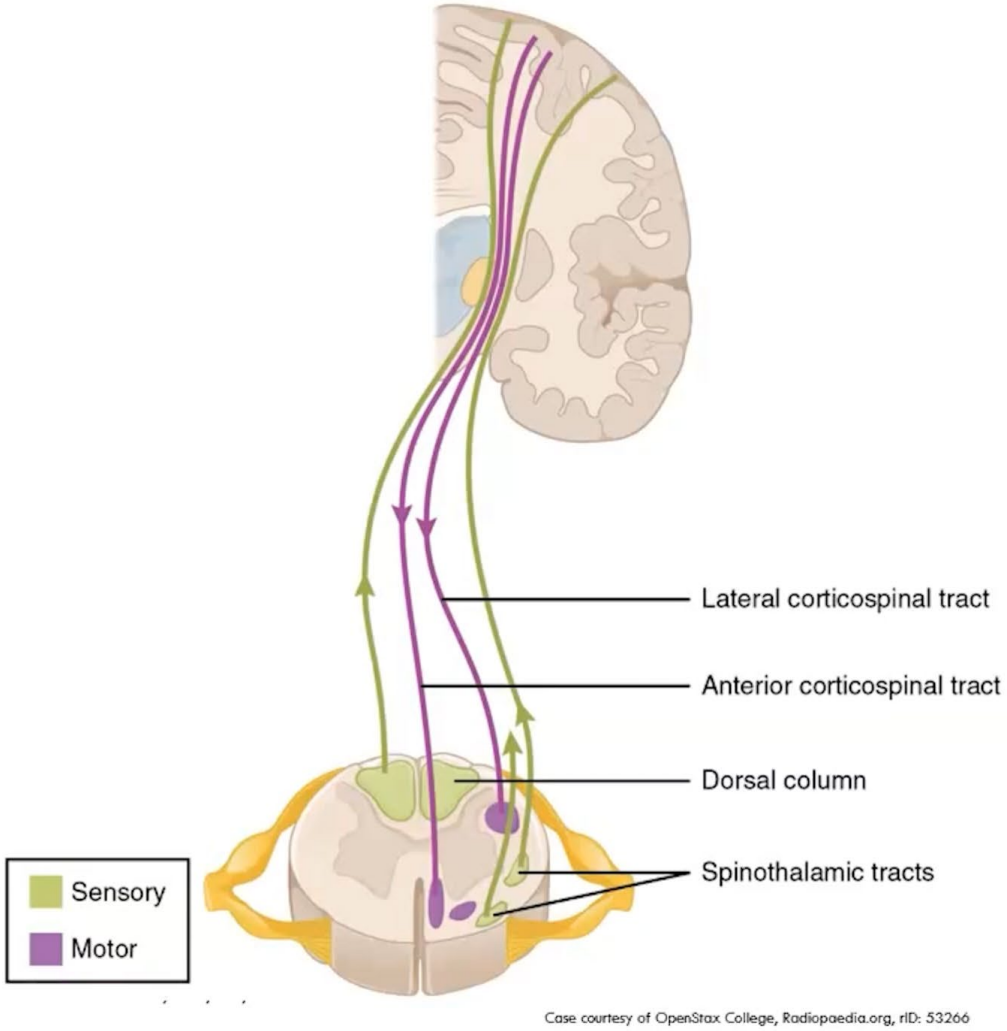


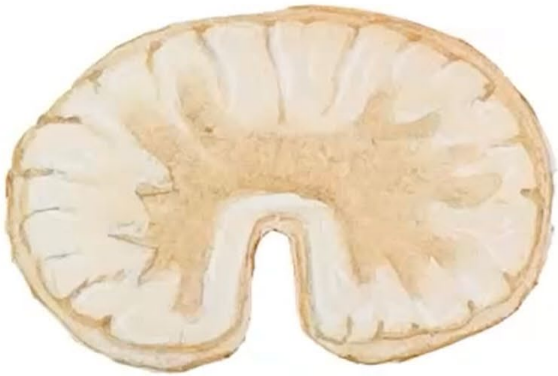
Brainstem anatomy

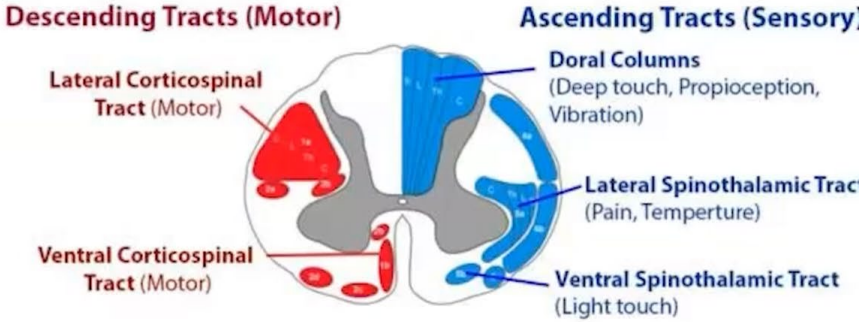
The medulla's relation to the pons (anatomically) is:

a) Anterior
b) Posterior
c) Superior
d) Inferior
e) Lateral
f) Medial

Spinal cord


Lateral corticospinal tract
Anterior corticospinal tract
Dorsal column
Spinothalamic tracts
Sensory
Motor
Case courtesy of OpenStax College, Radiopaedia.org, rID: 53266




Descending Tracts (Motor)
Ascending Tracts (Sensory)
Lateral Corticospinal Tract (Motor)
Doral Columns (Deep touch, Propioception, Vibration)
Lateral Spinothalamic Tract (Pain, Temperture)
Ventral Corticospinal Tract (Motor)
Ventral Spinothalamic Tract (Light touch)

Spinal cord continued

Is the peripheral or central component of the spinal cord made up of cell bodies?

- Central spinal cord made of cell bodies – this is opposite to what you see in the cerebrum

Name the tract responsible for carrying motor fibres for voluntary muscle control

- Cortic(al) to spinal – this is the corticospinal tract

What is the function of the lateral spinothalamic tract?

- Pain and temperature

Name the sensory modalities

- Pain + Temperature
- Fine touch
- Deep touch, vibration + proprioception (Dorsal columns)

Do lateral corticospinal tract neurons carry upper or lower motor neurons?

Decussation

Where does decussation occur?

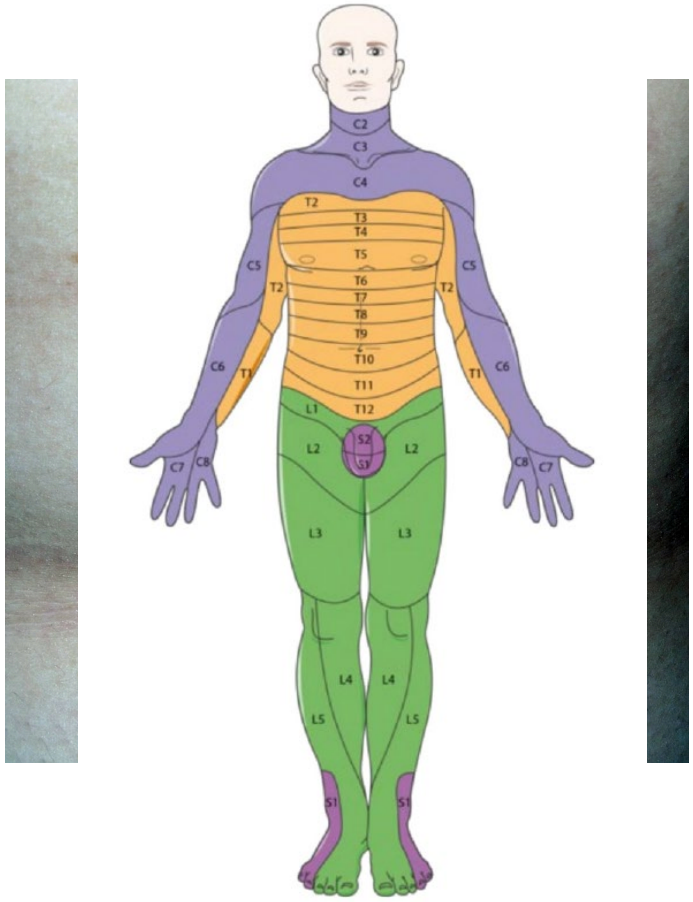
The dermatome

Shingles is an infective disorder involving reactivation of Varicella Zoster Virus (VZV) which lies dormant within the ganglia of sensory nerves following chicken pox. VZV will reactivate under certain conditions (e.g. immunosuppression, stress) and will reactivate in a single dermatomal distribution.

- The following is a reddit user's photo regarding a shingles flare – what dermatomal distribution is responsible for this?

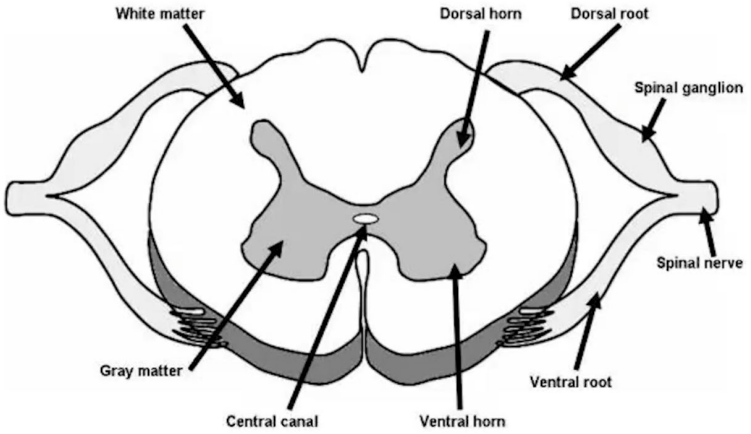
Which spinal nerve supplies sensory innervation to the nipples and the belly button?

- T4 for nipple
- T10 to belly button



Spinal nerves

Draw a section of the spinal cord with the lateral-most included point being the spinal nerve



Cranial nerves

Name the 12 cranial nerves