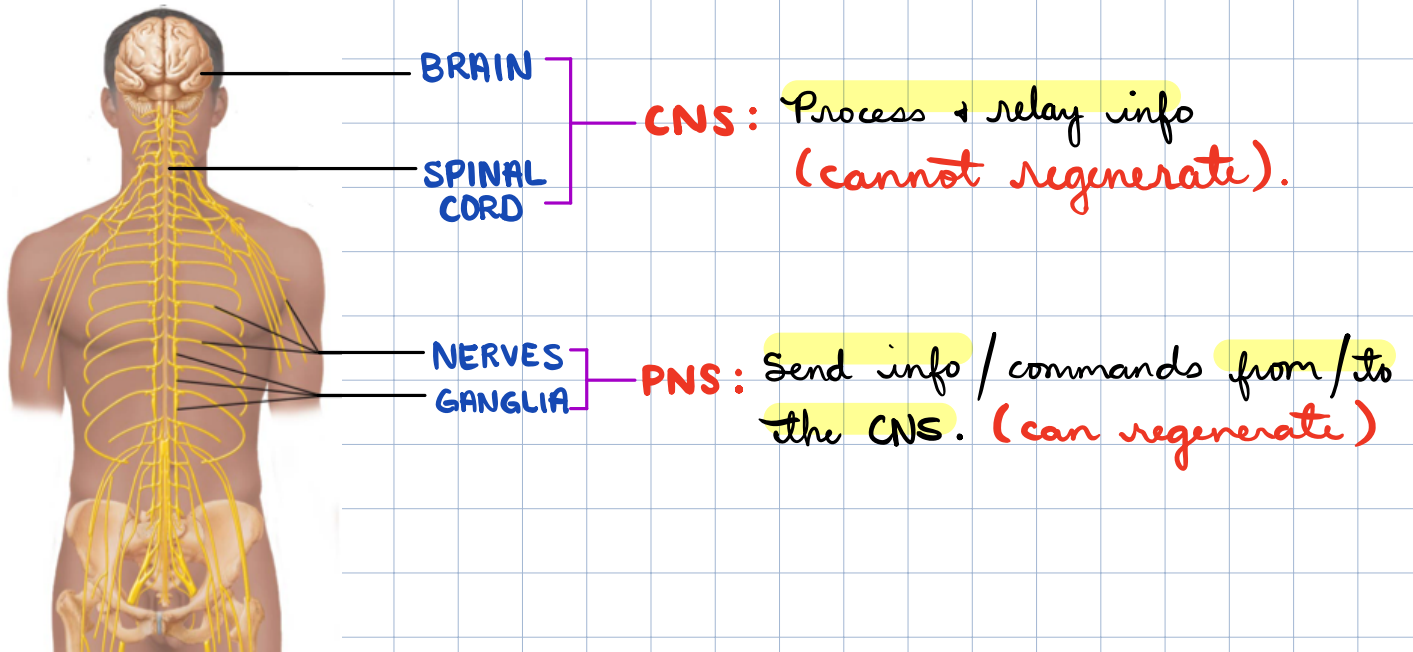
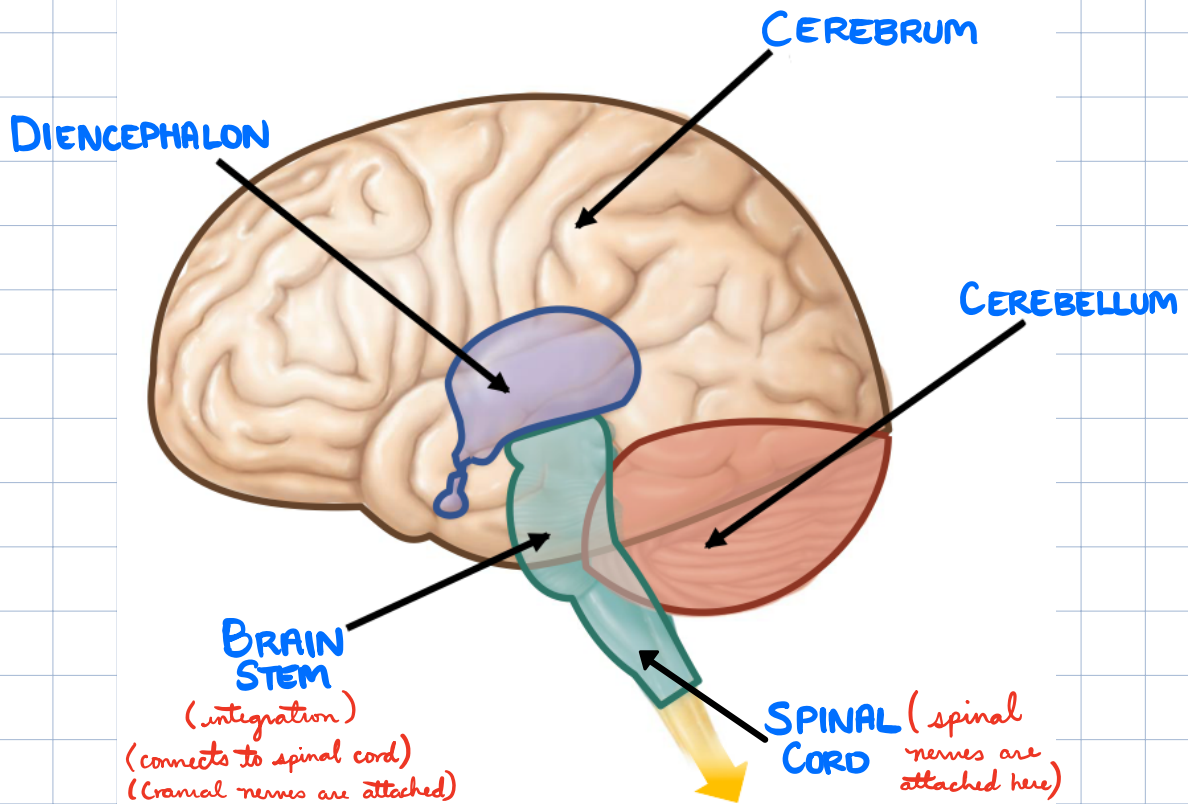


NERVOUS SYSTEM ANATOMY

STRUCTURAL/ANATOMICALLY



BRAIN REGIONS



DEFINE : **NERVE:** Bundle of axons, or fibers found in PNS

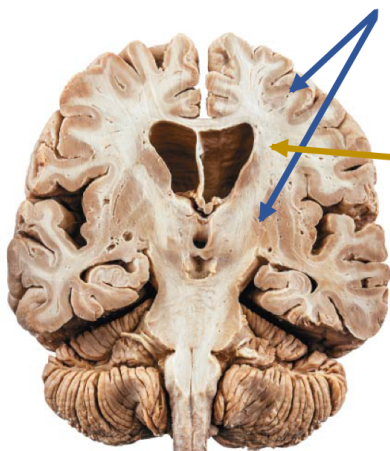
GANGLION: Cluster of neuron cell bodies in PNS

NUCLEUS: localized collection of neuron cell bodies in the CNS

WHITE & GREY MATTER

GREY MATTER: Process info

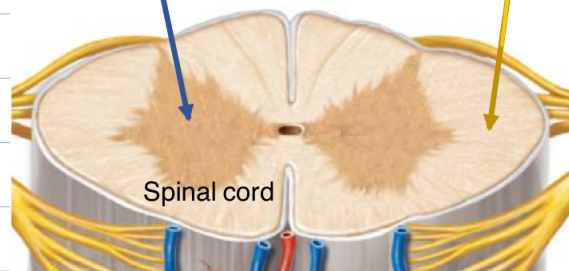
- CELL BODIES (contains synapses)
- NON MYELINATED



Brain

WHITE MATTER: info traveling

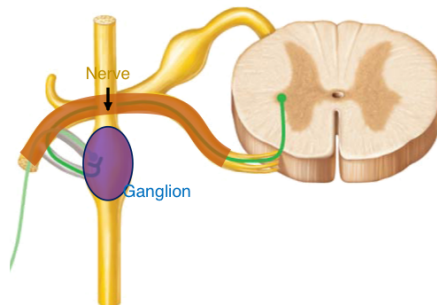
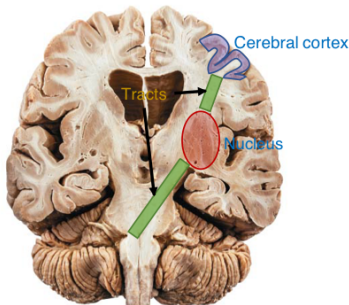
- AXONS
- MYELINATED



Spinal cord

Central nervous system

Peripheral nervous system



GREY MATTER

- CEREBRAL CORTEX
- NUCLEUS
- GANGLION

WHITE MATTER

- NERVE
- TRACTS

Blue text are grey matter
Yellow text is white matter

THE BRAIN

PRECENTRAL GYRUS
control voluntary motor

POSTCENTRAL GYRUS
Process somatosensory info (touch sensation)

PARIETAL LOBE

FRONTAL LOBE

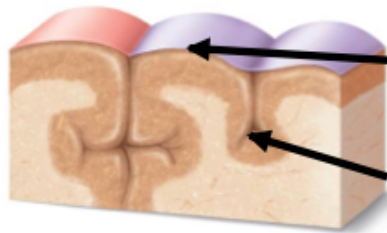
BROCA'S AREA
(Speech Motor)

OCCIPITAL LOBE

• Primary visual cortex

TEMPORAL LOBE

• Primary auditory cortex



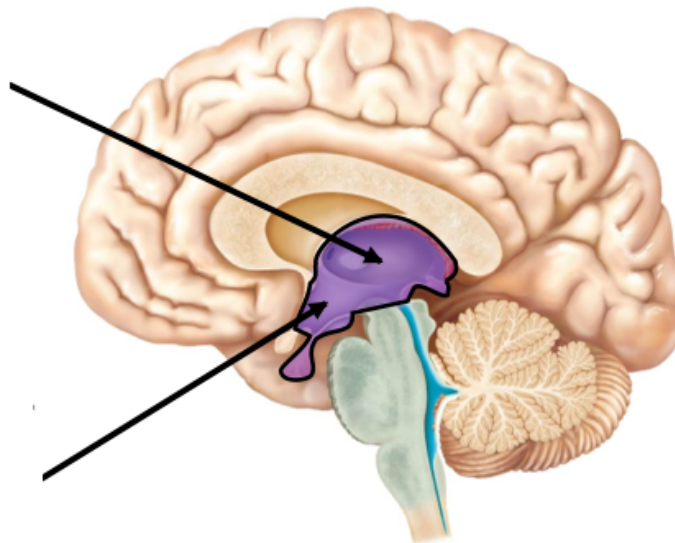
GYRUS
↳ ridge of one of wrinkles

SULCUS
↳ groove between 2 gyri

DIENCEPHALON

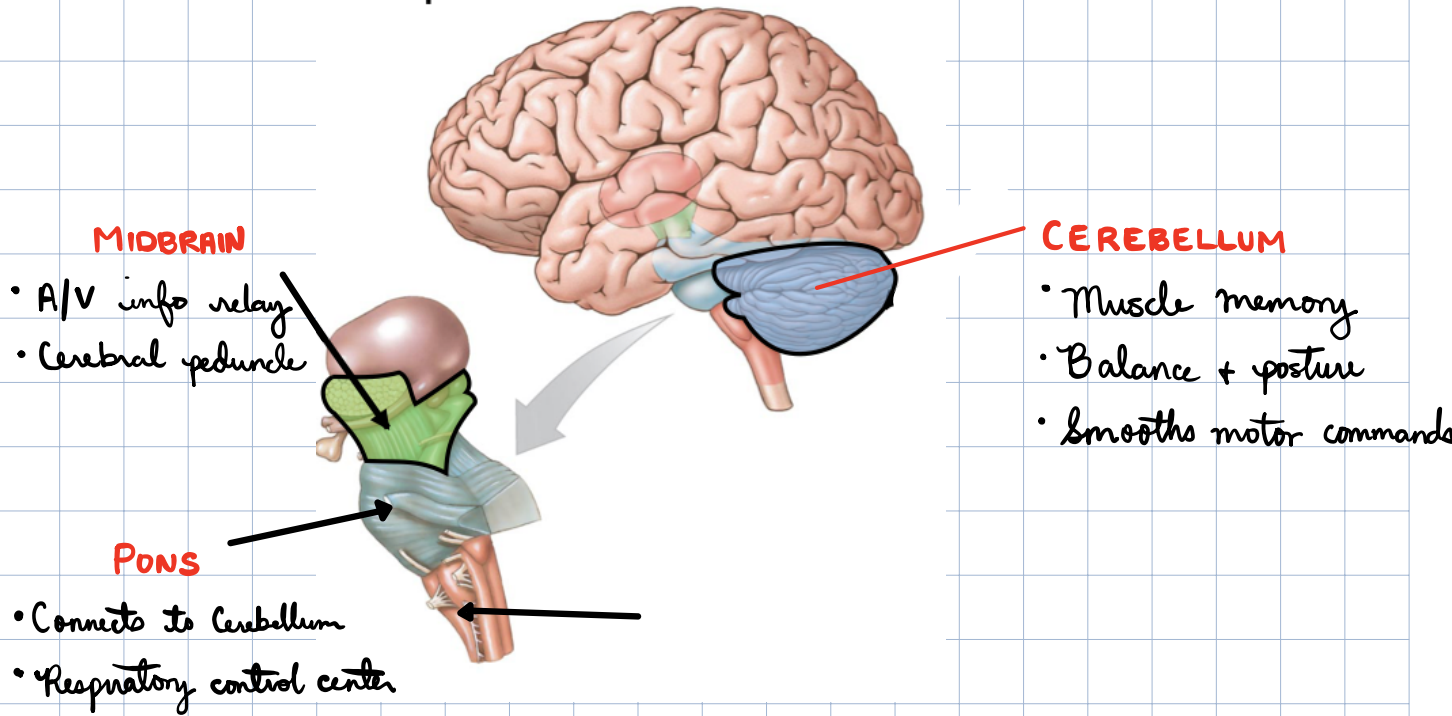
THALAMUS
Relay info

HYPOTHALAMUS
main autonomic control center



BRAINSTEM

controls "PRIMITIVE" functions



MEDULLA OBLONGATA

- Cardiac Control Center
- Connects to spinal cord
- Many neural pathways pass

layer of C.T that wrap around the CNS + S.C.

MENINGES & CSF

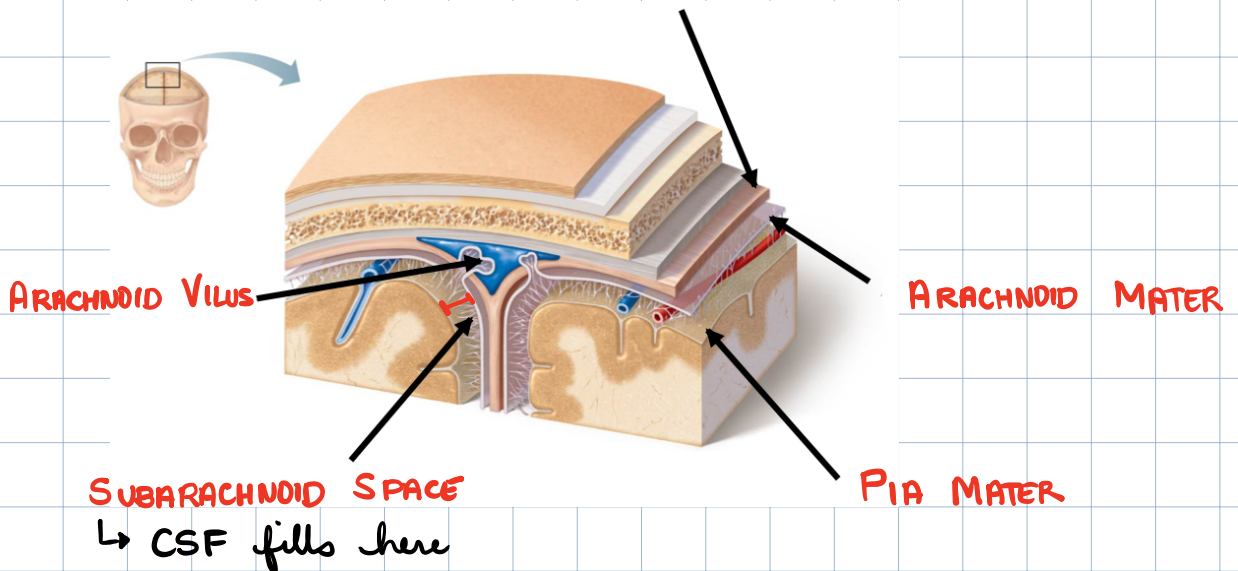
Cerebrospinal fluid. Confers protection + stable environment.

MADE FROM: CHOROID PLEXUS (found in ventricles)
CELLS FOUND: Ependymal cells.

D.A.P.

dura mater
arachnoid
pia mater

DURA MATER



FLOW OF CSF THROUGH BRAIN

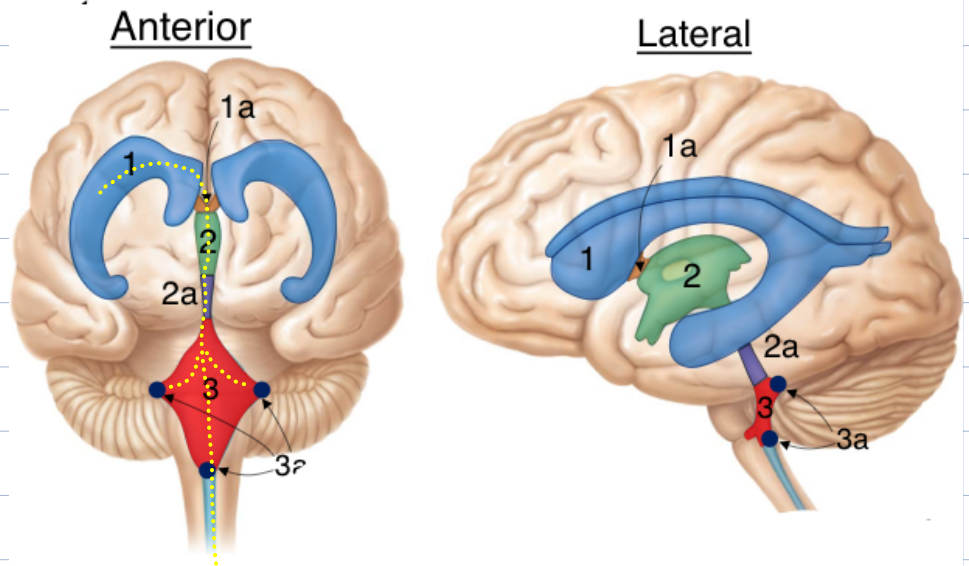
1) Lateral Ventricle
interventricular foramina

2) 3rd Ventricle
Cerebral Aqueduct

3) 4th Ventricle
2 lateral apertures +
1 median aperture

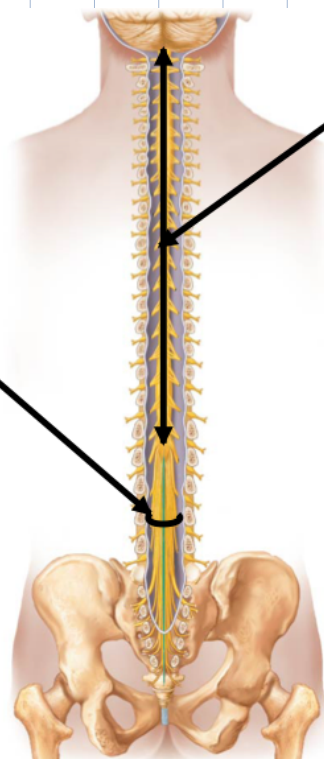
4) Subarachnoid Space

Exit: Arachnoid Vilus to bloodstream

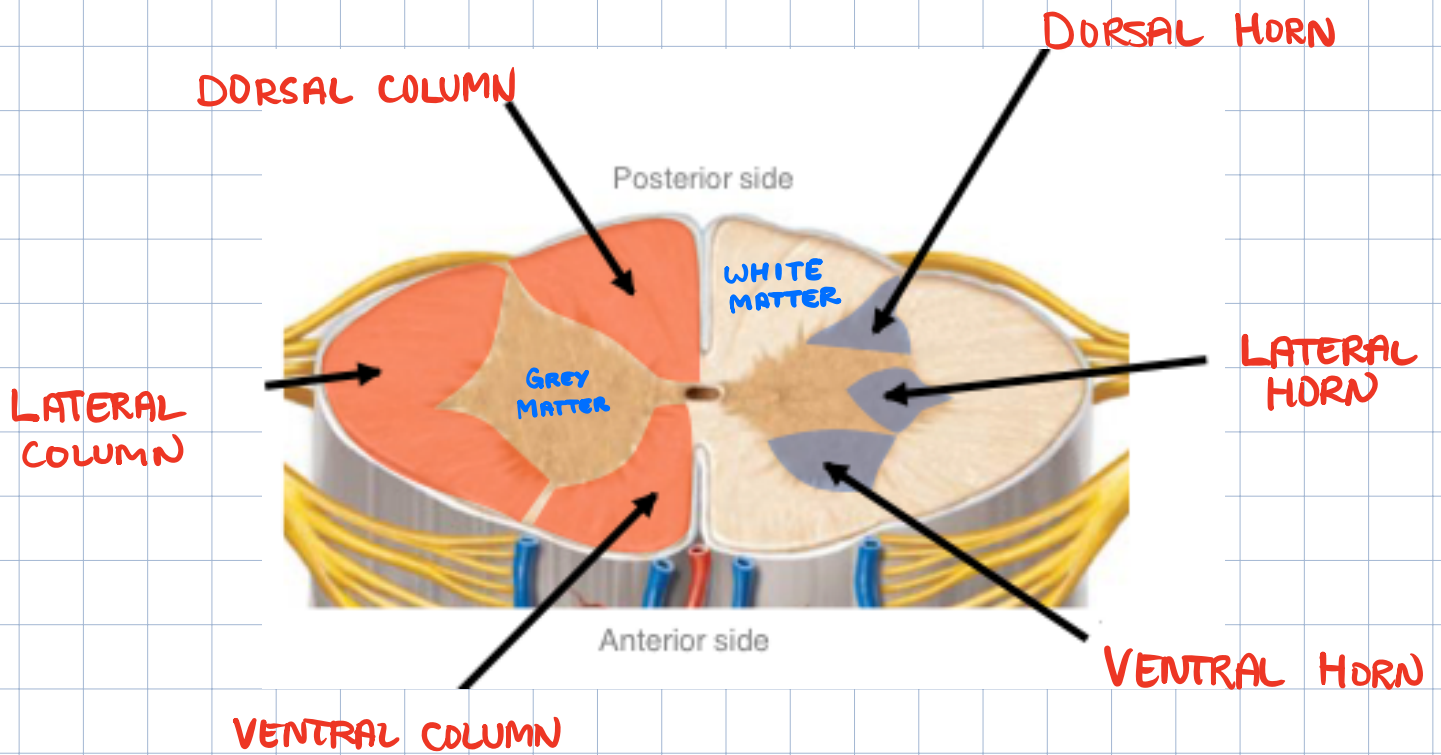


SPINAL CORD

CAUDA EQUINA
Bunch of spinal
nerves (lumban
region)

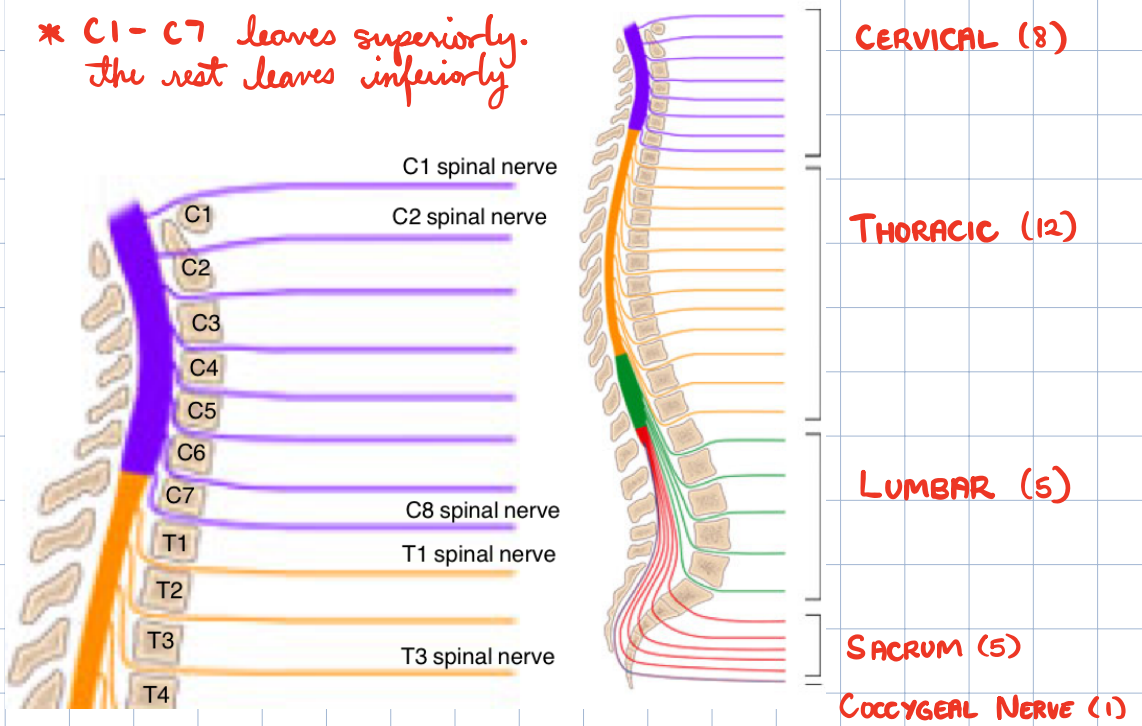


SPINAL CORD



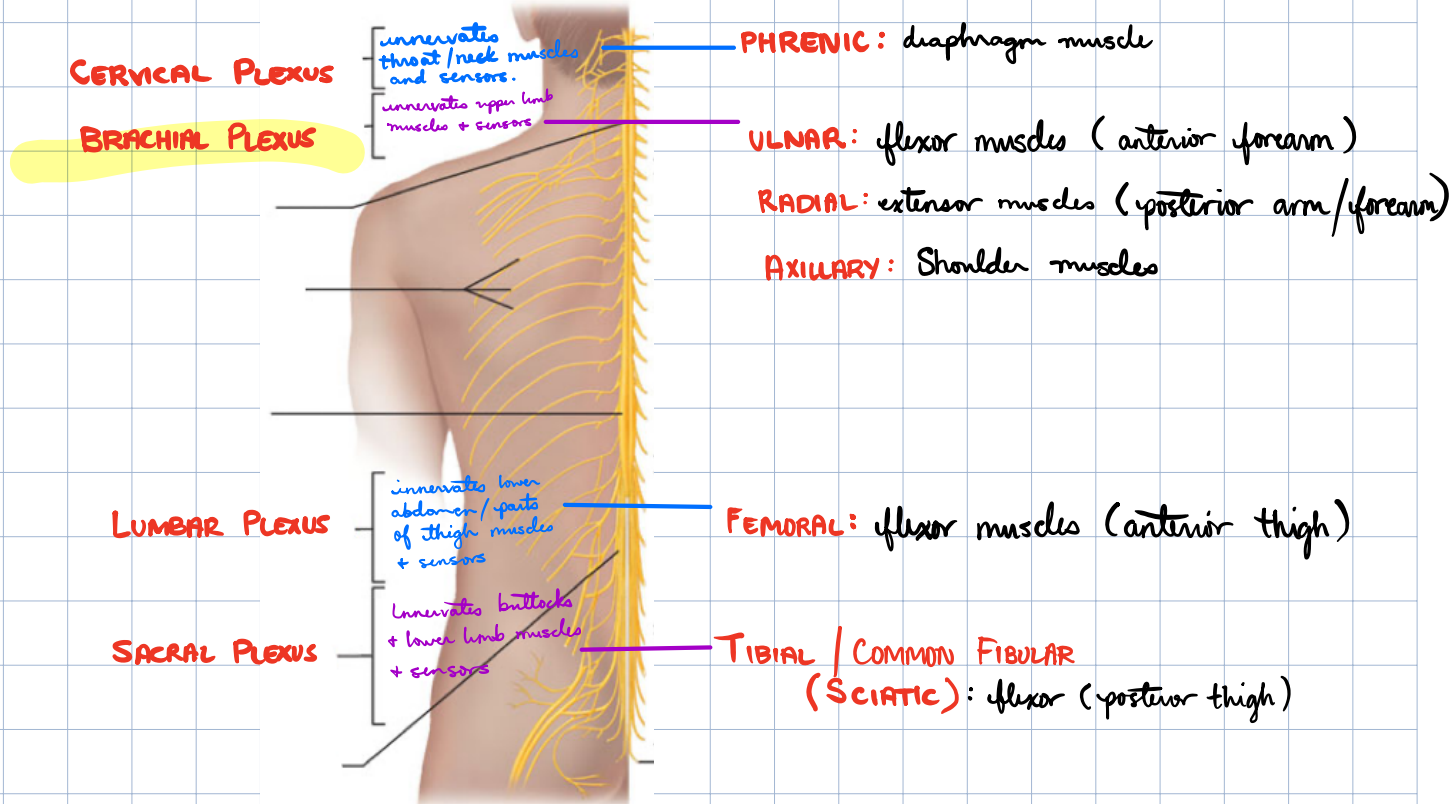
SPINAL NERVES

* C1 - C7 leaves superiorly.
The rest leaves inferiorly



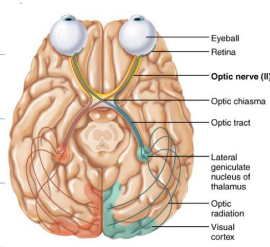
NERVE PLEXUS: network of neurons + nerves (4 PAIRS)

↓ Systemic Nerves ↓



CRANIAL NERVES: nerves extending from brain

CRANIAL NERVE 2: OPTIC

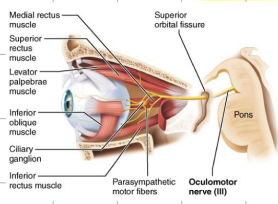


PERIPHERAL CONNECTION: Retina

CENTRAL CONNECTION: Hypothalamus / thalamus / midbrain

FUNCTION: Vision

CRANIAL NERVE 3: OCULOMOTOR

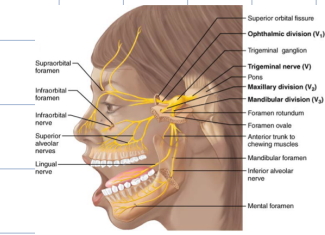


PERIPHERAL CONNECTION: Iris + eye moving muscles

CENTRAL CONNECTION: Oculomotor nucleus in the midbrain of brainstem

FUNCTION: Eye Movements

CRANIAL NERVE 5: TRIGEMINAL

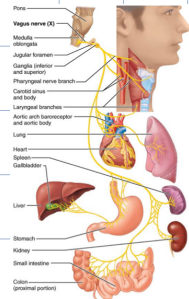


PERIPHERAL CONNECTION: Trigeminal Ganglion

CENTRAL CONNECTION: Trigeminal nuclei in midbrain, pons, medulla

FUNCTION: Relay tactile info from face + control jaw movement

CRANIAL NERVE 10: VAGUS



PERIPHERAL CONNECTION: Terminal ganglia; thoracic + upper abdominal organs (small in.)

CENTRAL CONNECTION: Medulla

FUNCTION: Control all of autonomic motor effects + relays visceral sensory info to + from torso.

SOMATIC N.S.

SENSORY PATHWAYS lead sensory info to the cerebral cortex (Neural pathway)

▶ **NEURAL PATHWAYS:** Pathways take info from part of NS via chain of neurons (synapses)

▶ **SENSORY (AFFERENT) PATHWAYS:** Sensory pathways take info from sensors to Cerebral Cort. (Perception sensation)

SENSOR: create the perceptual info to be taken to CNS

VISION

AUDITION

GUSTATION

OLFACTION

EQUILIBRIUM

SOMATOSENSATION (Touch, pain, temp, vibration, pressure, muscle contract.

Conducted by Cranial Nerve

Conducted by cranial + spinal nerves

SPINAL SENSORY PATHWAY: sensory info travels from sensor towards spinal cord.

1) SYSTEMIC NERVE

2) PLEXUS

3) DORSAL ROOT OF SPINAL NERVE

4) DORSAL HORN OF SPINAL CORD

5) SPINAL COLUMN OF SPINAL CORD

6) BRAIN STEM

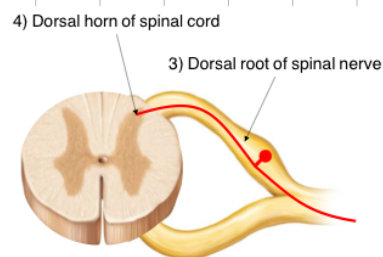
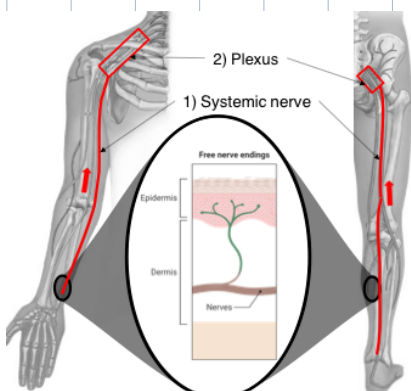
7) THALAMUS

8) POST CENTRAL GYRUS

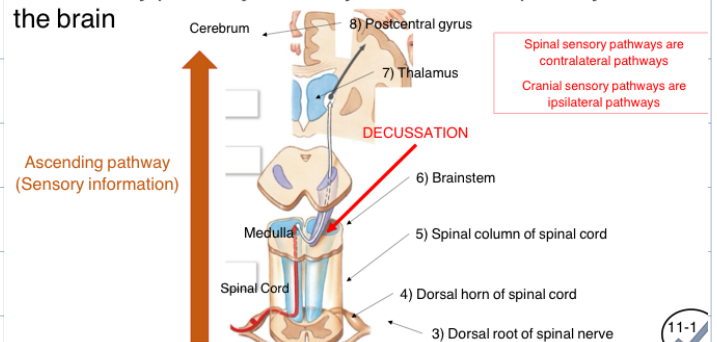
* 3 sensory neurons are usually involved.

* SPINAL SENSORY PATHWAYS are contralateral pathways

* CRANIAL SENSORY PATHWAYS are ipsilateral pathways.



In a sensory pathway, sensory info travels superiorly towards the brain

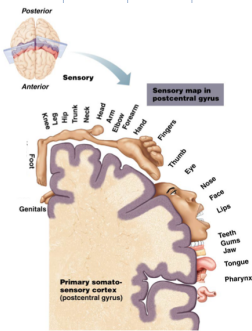


CENTRAL PROCESSING

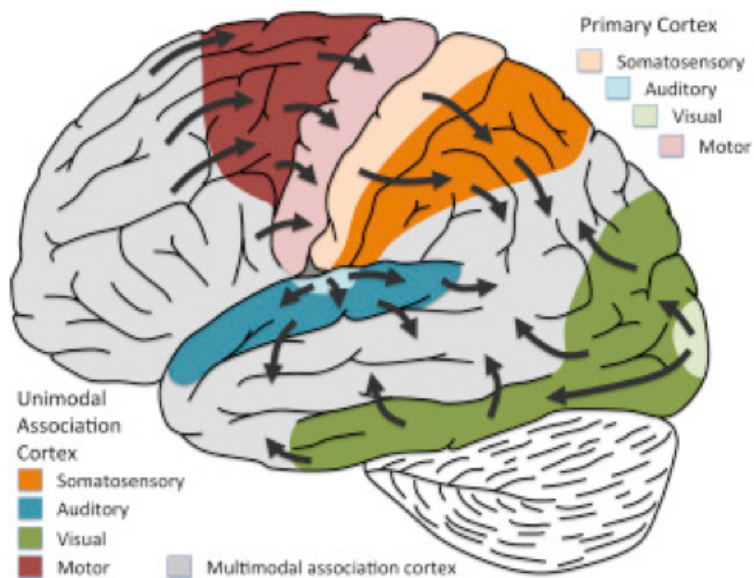
TOPOGRAPHY: the distribution of parts or features on surface of or within an organ / organism

↳ **CAN BE UNEVENLY DISTRIBUTED ACROSS THE CEREBRAL CORTEX**

Uneven matching between sensor arrangement and cerebral cortex surface area leads to uneven sensitivity for a given sensation



Sensory info "flows" from primary cortex to association cortices to multimodal association cortices.



ASSOCIATION AREAS: give meaning to sensations

MULTIMODAL ASSOCIATION AREA: Incorporate mult. diff sensory modalities + make connections (spatial awareness of our body).

- 11-2) Central processing
- What does it mean for pathways to be "topographically" arranged in the cerebral cortex? What does it mean to have uneven matching in the topographical arrangement between the sensors and cortex? Refer to the sensory homunculus. Furthermore, see how the body representation is not proportional to actual body proportions.
 - What are association and multimodal areas, and what do they do? Describe how information is passed from the sensory pathway to primary and then to other cortices.
- 11-3) Motor pathways
- What is a motor (or efferent) pathway?
 - What are effector organs? Which organs of the body are considered effector organs for the somatic nervous system?
 - In a spinal motor pathway, how many neurons does the pathway have, and where do they synapse with each other in the CNS? Is a spinal motor pathway considered an ascending or descending pathway?
 - Describe the general route a motor pathway takes through the nervous system to relay information from the motor cortices to skeletal muscles. Be able to list the following structures in order as information/electricity flows towards the muscles (assume muscle is below the neck):
 - Motor cortices (primary motor cortex, premotor cortex, supplementary motor area, and others)
 - Brainstem (midbrain, pons, medulla)
 - Spinal cord column (anterior or lateral depending on the pathway)
 - Ventral horn
 - Ventral root of spinal nerve
 - Plexus (depends on which systemic nerve)
 - Systemic nerve (depends where the sensor is located)

MOTOR PATHWAYS

MOTOR (EFFERENT) PATHWAYS

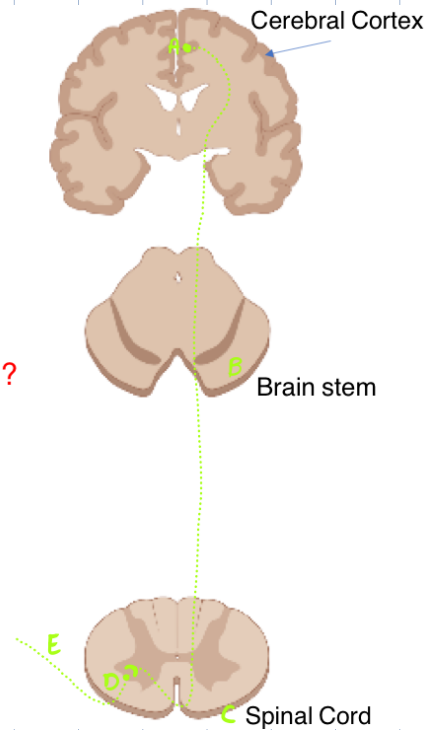
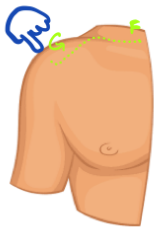
motor commands travel inferiorly from brain to effector organs.

the target of motor (efferent) pathways.
SKELETAL MUSCLES.

Draw and label motor pathway

- 1) MOTOR CORTICES
- 2) BRAIN STEM
- 3) SPINAL CORD
- 4) VENTRAL HORN
- 5) VENTRAL ROOT
- 6) PLEXUS
- 7) SYSTEMIC NERVE

How many neurons? **2** Where are the synapses? **1**



SOMATIC REFLEX: fast pathways that don't involve the cerebral cortex (can use spinal or cranial nerves)

CORTICAL PATHWAY

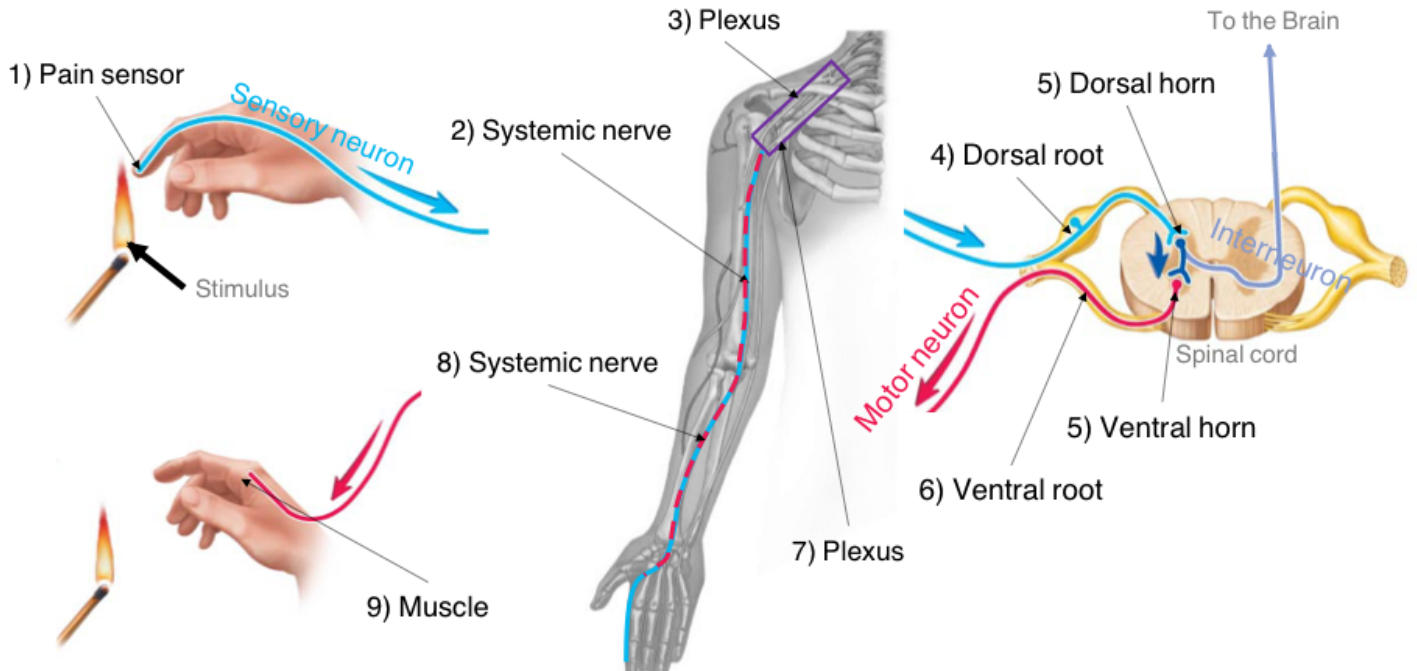
VS

REFLEX

- longer pathway
- use more neuron
- can use Cerebral Cortex

- sensory neuron to motor neuron to muscle
-

WITHDRAW REFLEX relies on spinal cord for processing



AUTONOMIC N.S. Automatic Involuntary

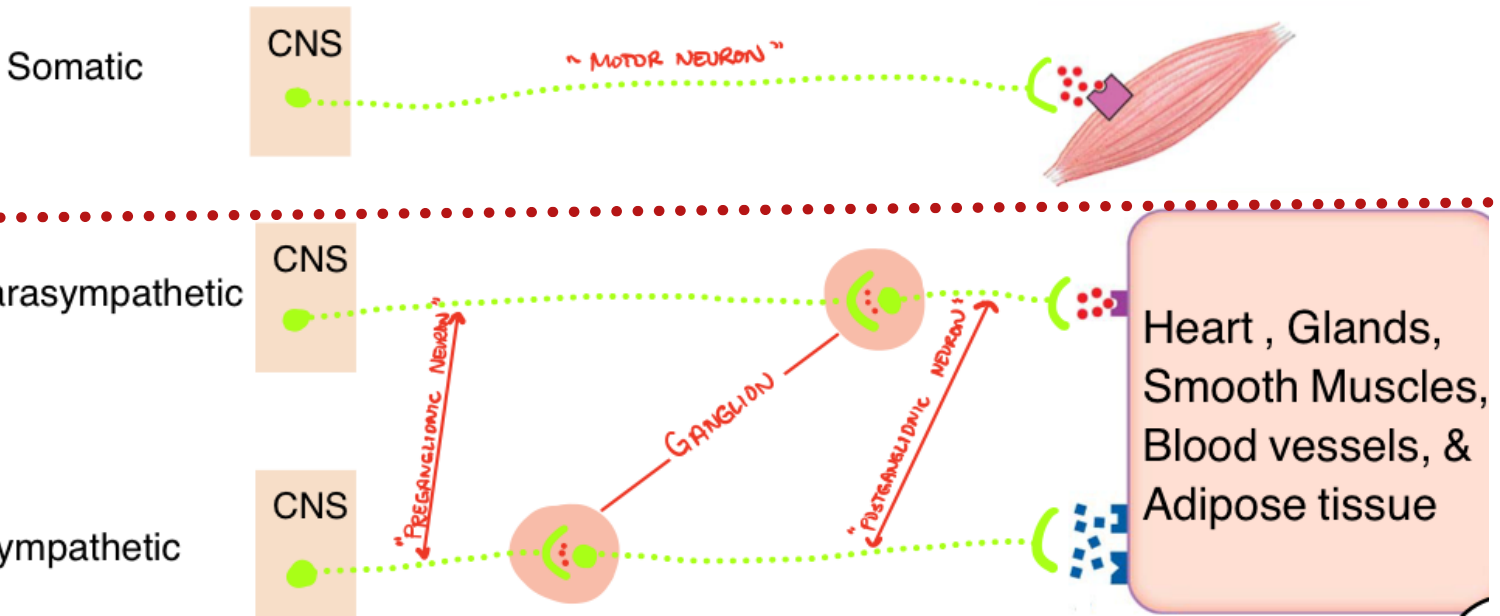
PARASYMPATHETIC : Rest + digest } Antagonistic
 SYMPATHETIC : Fight or flight }

SYMPATHETIC VS. PARASYMPATHETIC RESPONSE

TARGET ORGAN	PARASYMPATHETIC RESPONSE	SYMPATHETIC RESPONSE
	↓ HR	↑ HR
	CONSTRICTS	DILATES
SWEAT GLANDS	∅	STIMULATE SWEATING
	↓ AIR FLOW	↑ AIR FLOW
	↑ MOTILITY + SECRETIONS (RELAX SPHINCTER)	↓ GLAND ACTIVITY (CONSTRICT SPHINCTER)
ADIPOSE TISSUE	∅	STIMULATE LIPOLYSIS (FAT BREAKDOWN)
ARRECTOR PILI MUSCLE	∅	STIMULATE CONTRACTION (ERECTS HAIR)
BLOOD VESSELS	∅	DILATES B.V.
ADRENAL GLAND (MEDULLA)	∅	SECRETE ADRENALINE

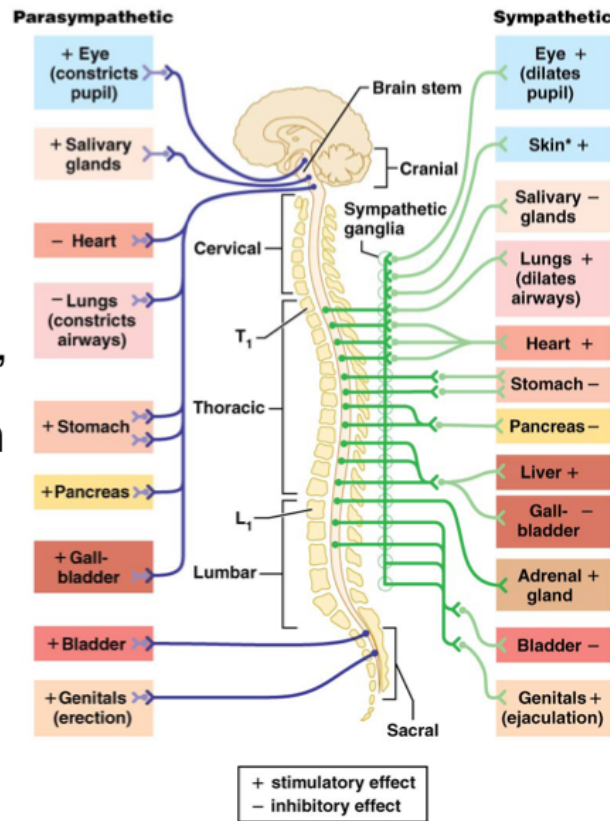
Motor (Efferent) pathways

Draw the neurons for each pathway.
Keep in mind how many neurons are used.



Autonomic nervous System leave the CNS in different regions

"Craniosacral" division



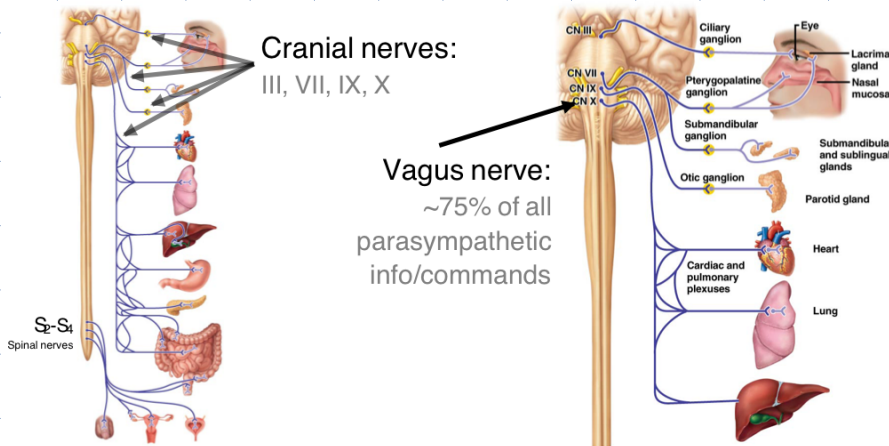
"Thoracolumbar" division

PARASYMPATHIC MOTOR NERVOUS PATHWAY STARTS : Brainstem, Sacral

SYMPATHETIC MOTOR NERVOUS PATHWAY STARTS : Thoracic, Lumbar

PARASYMPATHETIC NERVOUS DIVISION + CRANIAL NERVES

CRANIAL NERVES : 3, 7, 9, 10



VAGUS NERVE (#10)

* 75% of all
parasympathetic
info/commands

?: You can find nuclei in the PNS

A: False

?: Spinal Cord connects to:

A: Brain Stem

?: Synapses is in grey matter of nervous tissue

A: True

?: Main autonomic control center?

A: Hypothalamus

?: Brain structure contains muscle memory, keeps balance + posture + smooth motor command?

A: Cerebellum

?: Which plexus phrenic nerve originates from?

A: Cervical plexus

?: Choroid Plexus creates CSF?

A: True

?: Sensory Pathway takes information from the sensor to Cerebral Cortex

A: Plexus

Spinal Cord Column

Brain Stem

Thalamus

?: In Somatic N.S., what's the only effector organ?

A: Skeletal Muscles.

?: Motor pathway is always descending

A: True

?: Where do most sensory pathways synapse in the brain before reaching the cerebral cortex.

A: Thalamus

?: Info flowing through cortices of brain

A: Primary cortex → Unimodal association → Multimodal association

?: Motor pathways ultimately take commands to

A: Effector organs

?: Route motor pathway takes through N.S. to relay info from motor cortices to skeletal muscles.

A: Brainstem

Spinal Cord

Ventral root

Systemic Nerve

?: Pathway of Withdrawal Reflex

A: Dorsal root
Ventral horn
Systemic nerve
Muscle

?: Sympathetic trunk is found lateral to Spinal Cord?

A: True

?: All autonomic pathways start from

A: Lateral horn

?: Sympathetic reflex arc that \uparrow HR

A: Baroreceptor
Vagus Nerve
Cardiovascular center of medulla
Spinal Cord
Sympathetic trunk
Heart

?: Visual info triggering sympathetic response

A: Hypothalamus

?: Sympathetic pathways will have their synapses close to the effector organ?

A: False

?: Brain structure trigger sympathetic response based on emotions

A: Amygdala