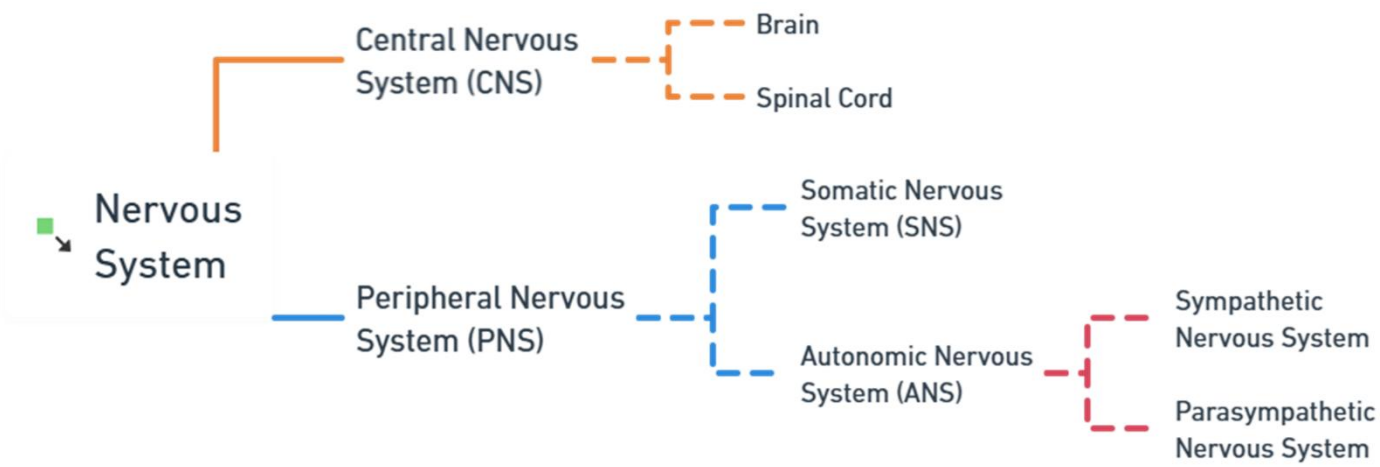
Peripheral Nervous System

The Nervous System: Introduction

- The nervous system is a complex network of nerves, neurons, and supporting cells that coordinate and transmit information throughout the body.
- It is responsible for sensing and responding to various internal and external stimuli, enabling organisms to interact with their environment and maintain homeostasis.
- The nervous system can be divided into **two** main parts:
    1. Central Nervous System (CNS)
    2. Peripheral Nervous System (PNS)



Central Nervous System (CNS)

- The CNS consists of the brain and spinal cord.
- It acts as the body's control center and is responsible for processing, integrating, and coordinating sensory information, motor commands, and higher cognitive functions.

A. Brain

- The brain is the primary organ of the CNS and is responsible for higher cognitive functions, such as perception, reasoning, decision-making, learning, and memory.
- It has several distinct regions, including the **cerebrum, cerebellum, and brainstem**, each with specific functions.

B. Spinal Cord

- The spinal cord is a long, tubular structure that extends from the brainstem and runs down the vertebral column.
- It serves as a communication pathway between the brain and the PNS, transmitting sensory information to the brain and motor commands from the brain to the body.

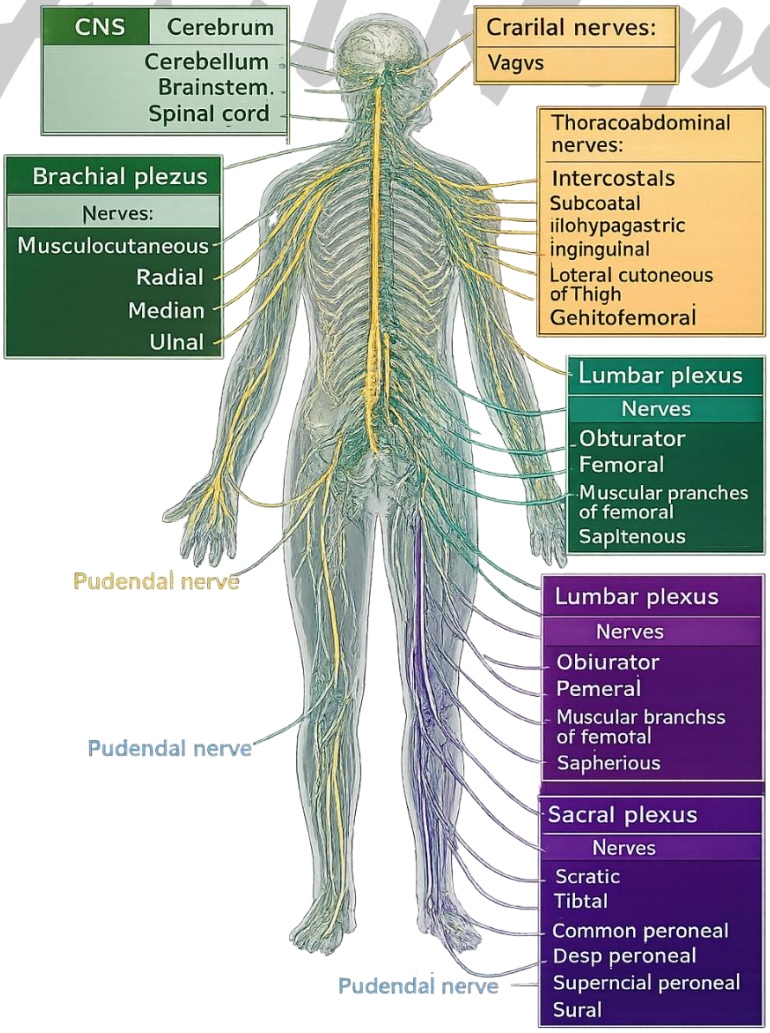
Peripheral Nervous System (PNS)

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- The PNS includes all the nerves and ganglia (clusters of nerve cell bodies) outside the CNS.
- It connects the CNS to the rest of the body, transmitting sensory information from the body to the CNS and motor commands from the CNS to the muscles, glands, and organs.
- The PNS can be further divided into **two** main subsystems:
    A. Somatic Nervous System (SNS)
    B. Autonomic Nervous System (ANS)
        I. Sympathetic Nervous System (SNS)
        II. Parasympathetic Nervous System (PNS)

Classification of the Peripheral nervous system

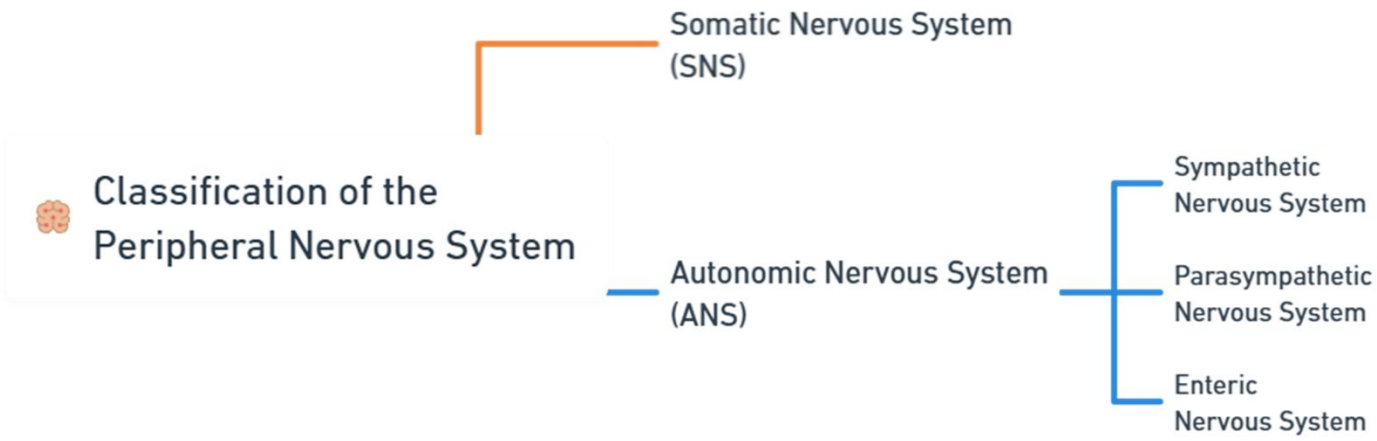
- The peripheral nervous system (PNS) is the part of the nervous system that lies outside the brain and spinal cord.
- It connects the central nervous system (CNS) with different parts of the body.
- It carries sensory information from the body to the CNS and carries motor commands from the CNS to muscles and glands.
- The peripheral nervous system consists of cranial nerves, spinal nerves, ganglia, and peripheral nerve fibers.



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Classification of the Peripheral Nervous System:

The PNS is classified into **two** main parts based on their function:



1. Somatic Nervous System (SNS)

Function:

- Controls voluntary movements and transmits sensory information to the CNS.

Components:

A. Sensory (Afferent) Neurons:

- Carry sensory information from sensory receptors (skin, muscles, joints, etc.) to the CNS.

B. Motor (Efferent) Neurons:

- Transmit motor signals from the CNS to skeletal muscles, controlling voluntary movement.

2. Autonomic Nervous System (ANS)

Function:

- Regulates involuntary functions such as heart rate, digestion, respiratory rate, and glandular activities.

Components:

- The ANS is further subdivided into three branches:

A. Sympathetic Nervous System:

- Prepares the body for "fight or flight" responses.
- It increases heart rate, dilates pupils, and redirects blood to muscles during stressful or emergency situations.

B. Parasympathetic Nervous System:

- Promotes the "rest and digest" state.
- It slows heart rate, increases digestion, and conserves energy by maintaining bodily functions during restful states.

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C. Enteric Nervous System:

- Often called the "second brain," it regulates the functions of the gastrointestinal system.
- It operates semi-independently but communicates with the CNS through the sympathetic and parasympathetic branches.

Sympathetic Nervous System (SNS): Structure & Functions

Anatomy (Structure)

Origin:

- **Thoracolumbar outflow**: Arises from T1 to L2 segments of the spinal cord.
- Preganglionic neurons reside in the lateral horn (intermediolateral cell column).

Pathway of Sympathetic Fibers:

1. Preganglionic neurons (short):
   - Exit spinal cord via **ventral root**
   - Enter **spinal nerve**
   - Travel through **white rami communicantes**
   - Enter **sympathetic chain (paravertebral) ganglia**
2. Possible Routes from Sympathetic Chain:
   - **Synapse at same level** → Postganglionic fiber exits via **gray ramus** → joins spinal nerve to target
   - **Ascend or descend** to synapse at a different level
   - **Pass through without synapsing** → Continue as splanchnic nerve to prevertebral ganglia (e.g., celiac, superior/inferior mesenteric)
3. Postganglionic neurons (long):
   - Originate from the sympathetic ganglia.
   - Extend to the target organs, including:
     - Heart
     - Lungs
     - Gastrointestinal tract
     - Blood vessels
     - Sweat glands
     - Other visceral organs

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Sympathetic Ganglia

1. Paravertebral (Sympathetic Chain) Ganglia

- Run parallel to the spinal cord on both sides
- Includes:
  - 3 cervical
  - 11 thoracic
  - 4 lumbar
  - 4 sacral
  - 1 coccygeal

2. Prevertebral Ganglia

- Located near large arteries in the abdomen:
  - Celiac ganglion
  - Superior mesenteric ganglion
  - Inferior mesenteric ganglion
  - Aorticorenal ganglia

Neurotransmitters

Neuron Type	Neurotransmitter
Preganglionic	Acetylcholine (ACh)
Postganglionic	Norepinephrine (NE) *(except sweat glands – ACh)*

Functions of the Sympathetic Nervous System ("Fight or Flight")

- The **sympathetic system** prepares the body for **stressful or emergency** situations.

Target	Effect
Heart	↑ Heart rate and force (β_1 receptors)
Bronchi	Bronchodilation (β_2)
Blood vessels	Vasoconstriction in skin/GIT, vasodilation in muscles (α_1, β_2)
Eyes	Pupil dilation (mydriasis via α_1)
GIT	↓ Motility and secretion
Sweat glands	↑ Secretion (only sympathetic cholinergic fibers)
Adrenal medulla	Releases **epinephrine and norepinephrine** into bloodstream (via preganglionic input)

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