

Pharmacology of Drugs Acting on the Peripheral Nervous System (PNS)

What is the Peripheral Nervous System?

- The **Peripheral Nervous System (PNS)** includes all nerves located **outside the brain and spinal cord**.
- It connects the **central nervous system (CNS)** to the rest of the body and allows communication between the brain, spinal cord, and body organs.
- It is divided into:
 - Somatic Nervous System – controls voluntary movements.
 - Autonomic Nervous System (ANS) – controls involuntary body functions (heart rate, digestion, respiration, etc.).
- Drugs that act on the PNS are mainly targeted at modulating nerve transmission. These drugs are typically classified based on the system they act upon:

Broad Classifications:

A. Drugs affecting the Somatic Nervous System:

- These affect neuromuscular transmission.
- Examples:
 - Neuromuscular blockers: e.g., *succinylcholine*, *pancuronium*.
 - Cholinesterase inhibitors (increase ACh): e.g., *neostigmine*.

B. Drugs affecting the Autonomic Nervous System:

- Divided into Sympathetic (Adrenergic) and Parasympathetic (Cholinergic).

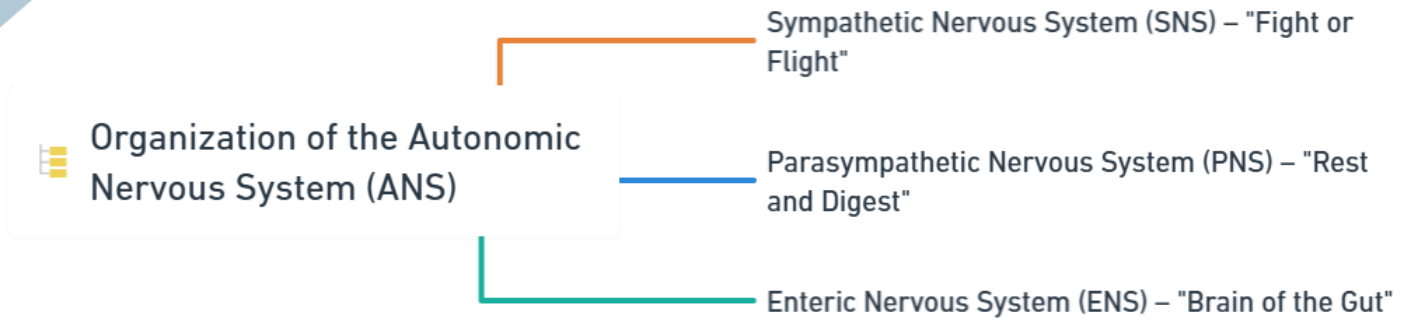
Organization of the ANS

What is the Autonomic Nervous System (ANS)?

- The Autonomic Nervous System (ANS) is a part of the Peripheral Nervous System (PNS) that controls involuntary body functions—those that happen without conscious thought.
- It regulates:
 - Heart rate, Breathing rate, Digestion, Pupillary response, Urination, sexual arousal, and more
- It ensures that the internal environment of the body remains stable, a state called homeostasis.

Organization of the ANS

The ANS is divided into **three main components**:



1. Sympathetic Nervous System (SNS) – "Fight or Flight"

- **Origin:** Thoracolumbar region (T1–L2) of the spinal cord
- **Function:** Prepares the body for stressful or emergency situations

Key Effects:

- Increases heart rate and blood pressure
- Dilates pupils
- Inhibits digestion
- Dilates bronchioles (for more oxygen)
- Mobilizes energy (glucose release)

2. Parasympathetic Nervous System (PNS) – "Rest and Digest"

- **Origin:** Craniosacral region (brainstem and sacral spinal cord)
- **Function:** Promotes relaxation and conserves energy

Key Effects:

- Slows heart rate
- Stimulates digestion
- Constricts pupils
- Promotes urination and defecation
- Encourages sexual arousal

3. Enteric Nervous System (ENS) – "Brain of the Gut"

- **Location:** Embedded in the lining of the gastrointestinal tract
- **Function:** Controls gastrointestinal functions independently but is influenced by both sympathetic and parasympathetic systems

Key Effects:

- Regulates enzyme secretion
- Controls peristalsis (movement of food)
- Manages blood flow in the gut

Sympathetic vs. Parasympathetic – Key Differences

Feature	Sympathetic	Parasympathetic
Function	Fight or flight	Rest and digest
Origin	Thoracolumbar	Craniosacral
Ganglia Location	Close to spinal cord	Near or within target organ
Neurotransmitter	NE (mostly)	ACh
Effect on Heart	Increases rate	Decreases rate
Effect on Digestion	Inhibits	Stimulates

Function of ANS (Autonomic Nervous System)

Sympathetic Nervous System (Fight or Flight)

Prepares the body for emergency or stressful situations.

Physiological effects:

- **Heart:** ↑ heart rate and force of contraction (β_1)
- **Blood vessels:** Vasoconstriction (α_1) in skin and viscera; vasodilation (β_2) in skeletal muscle
- **Lungs:** Bronchodilation (β_2)
- **Pupils:** Dilation (mydriasis) via radial muscle contraction (α_1)
- **GI tract:** ↓ motility and secretions (α , β)
- **Urinary bladder:** Relaxation of detrusor (β_3), contraction of sphincter (α_1)
- **Liver:** ↑ glycogenolysis and gluconeogenesis (β_2)
- **Adrenal medulla:** Releases epinephrine and norepinephrine into circulation (via chromaffin cells activated by ACh on nicotinic receptors)

Parasympathetic Nervous System (Rest and Digest)

Promotes maintenance activities and conserves energy.

Physiological effects:

- **Heart:** ↓ heart rate (M2)
- **Lungs:** Bronchoconstriction and ↑ secretions (M3)
- **GI tract:** ↑ motility and secretions (M3)
- **Urinary bladder:** Contraction of detrusor, relaxation of sphincter (M3)
- **Pupils:** Constriction (miosis) via circular muscle (M3)



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