B.Pharm Semester 1

# Human Anatomy, Physiology and Pathophysiology I

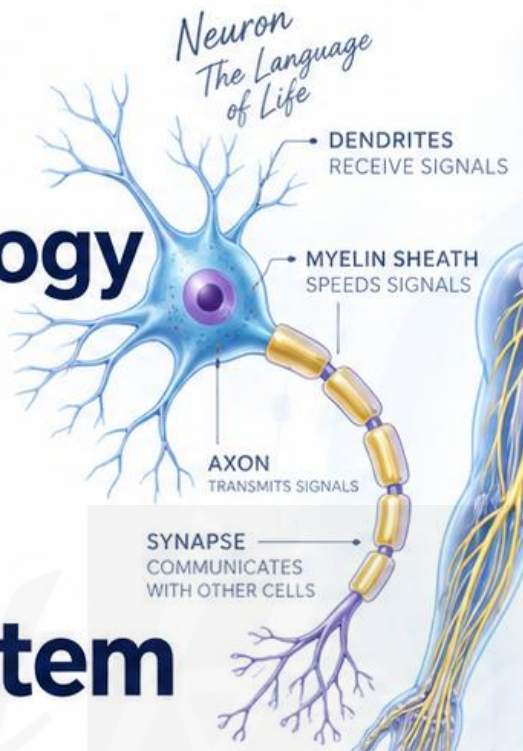
## Unit 04

# Peripheral Nervous System and Special Senses

PPT Notes




*Nerves Connect Life*




*Signals Connect Everything*




SCIENCE
FOR A HEALTHIER
TOMORROW

SPECIAL SENSE ORGANS



EYE
VISION
OPENS HORIZONS



EAR
HEARING
BRINGS
CONNECTION



NOSE
SMELL
DETECTS
A SAFER WORLD



TONGUE
TASTE
ADDS COLOUR
TO LIFE

*Senses Help Us Experience More*

NERVES
TRANSMIT LIFE

SENSES
EXPAND OUR WORLD

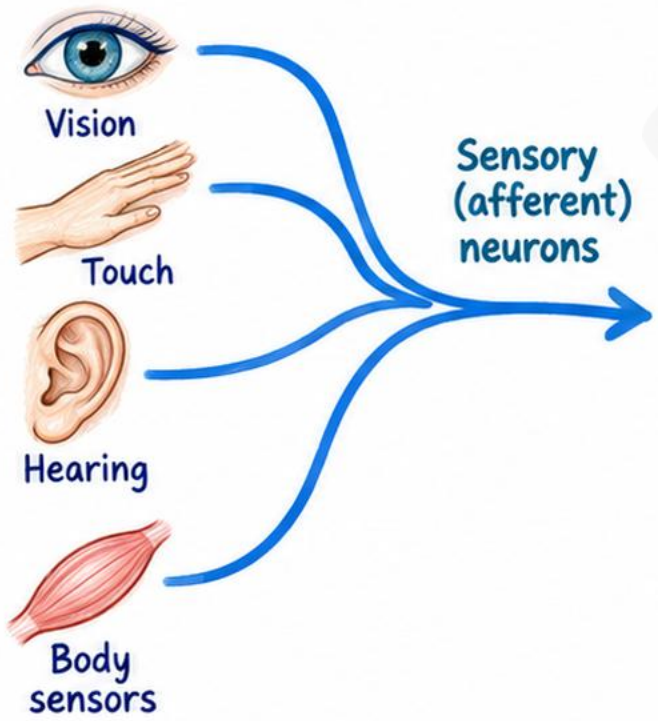
HEALTH
BUILDS BRIGHTER
TOMORROW

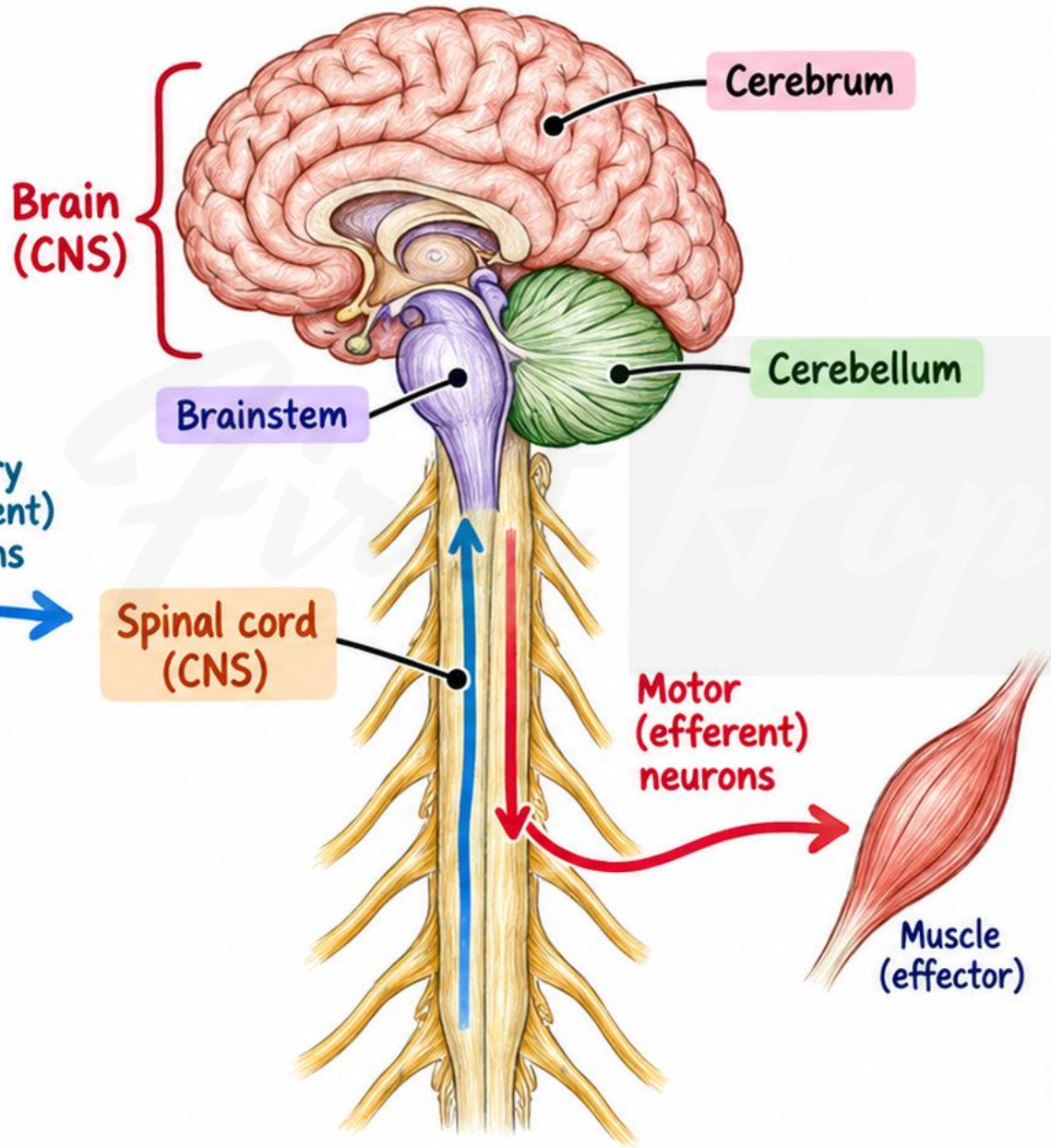
STUDY | UNDERSTAND | APPLY | GROW

# NERVOUS SYSTEM OVERVIEW

## 1 Sensory Input

Receptors detect internal and external stimuli and send signals to the CNS via sensory (afferent) neurons.




## 2 Central Nervous System (CNS)

- Consists of the brain and spinal cord.
- Acts as the body's control center, processing, integrating and coordinating information.

## 3 Peripheral Nervous System (PNS)

- All nerves and neurons outside the CNS.
- Connects the body to the CNS.

## 4 Motor Output

- CNS sends signals to muscles and glands via motor (efferent) neurons, producing a response.

## 5 Function

- Enables the body to sense and respond to stimuli, interact with the environment and maintain homeostasis.

## Remember

- The CNS and PNS work together — sensory input → integration → motor output.

# DIVISIONS OF THE PERIPHERAL NERVOUS SYSTEM

## 1. WHAT IS PNS?

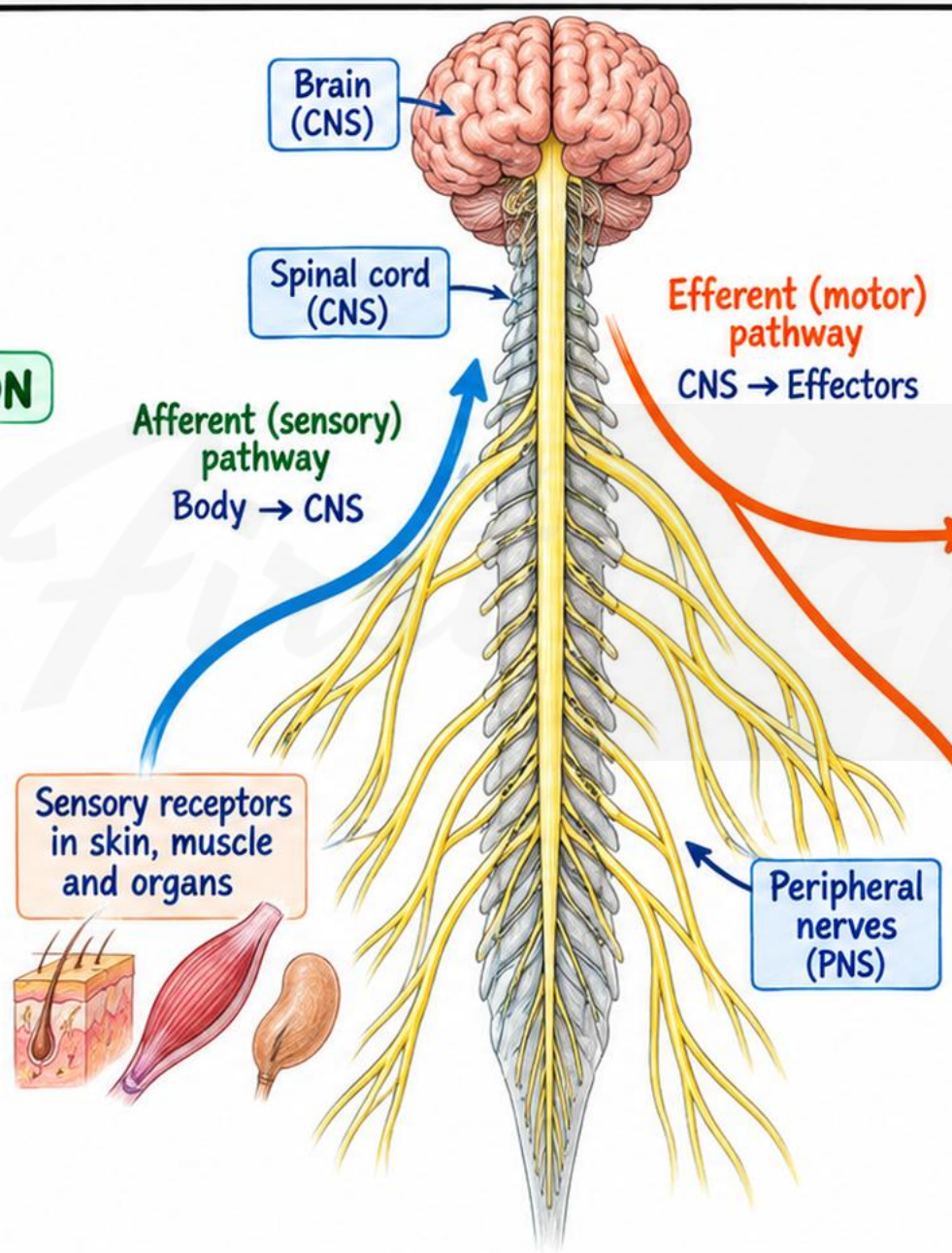
- All nerves and ganglia outside the CNS (brain and spinal cord).
- Connects the CNS with the rest of the body.

## 2. TWO-WAY COMMUNICATION

- **Afferent (sensory):** carry sensory information from the body to the CNS.
- **Efferent (motor):** carry motor commands from the CNS to muscles, glands and organs.

## 3. SUBDIVISIONS OF PNS

- **Somatic nervous system (SNS):** voluntary control of skeletal muscles.
- **Autonomic nervous system (ANS):** involuntary control of smooth muscle, cardiac muscle and glands.
- **Enteric nervous system (ENS):** controls gastrointestinal (GI) tract functions.




### Somatic Nervous System (SNS)

- Voluntary control
- Innervates skeletal muscles



Skeletal muscle (movement)

### Autonomic Nervous System (ANS)

- Involuntary control
- Innervates smooth muscle, cardiac muscle and glands



Cardiac muscle (heart)



Smooth muscle (internal organs)



Glands (secretion)

### Enteric Nervous System (ENS)

- Intrinsic nerve network in the GI tract
- Regulates motility and secretion



Gastrointestinal tract

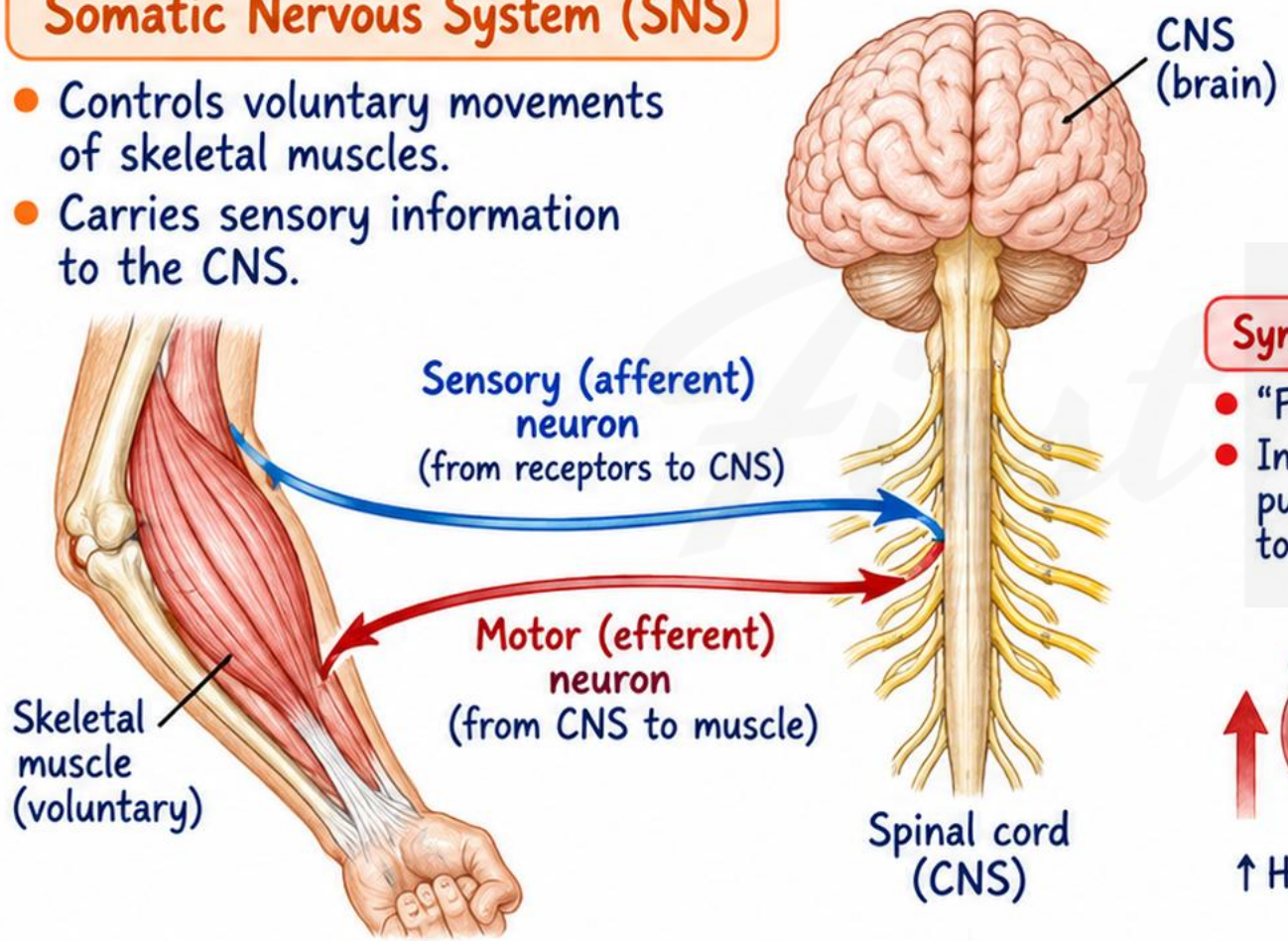
# SOMATIC AND AUTONOMIC SYSTEMS

## Peripheral Nervous System (PNS)

(functional classification)

### Somatic Nervous System (SNS)

- Controls voluntary movements of skeletal muscles.
- Carries sensory information to the CNS.

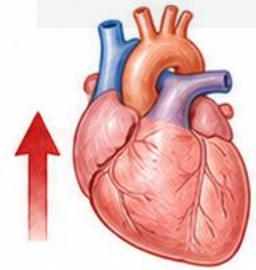


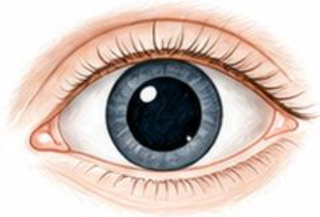

### Autonomic Nervous System (ANS)

- Regulates involuntary functions (heart rate, digestion, respiration, glandular activities).
- Uses a two-neuron chain (preganglionic → ganglion → postganglionic).

#### Sympathetic Nervous System

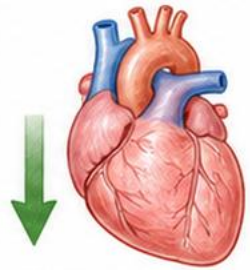
- "Fight or flight" response.
- Increases heart rate, dilates pupils and redirects blood to skeletal muscles.


↑ Heart rate


Pupil dilation

#### Parasympathetic Nervous System

- "Rest and digest" state.
- Slows heart rate, increases digestion and conserves energy during restful states.


↓ Heart rate


Increased digestion

**Key difference:** Somatic system uses a single motor neuron to skeletal muscle (voluntary); Autonomic system uses a two-neuron chain to smooth muscle, cardiac muscle and glands (involuntary).

# SYMPATHETIC NERVOUS SYSTEM: ORGANIZATION

## 1 Thoracolumbar origin

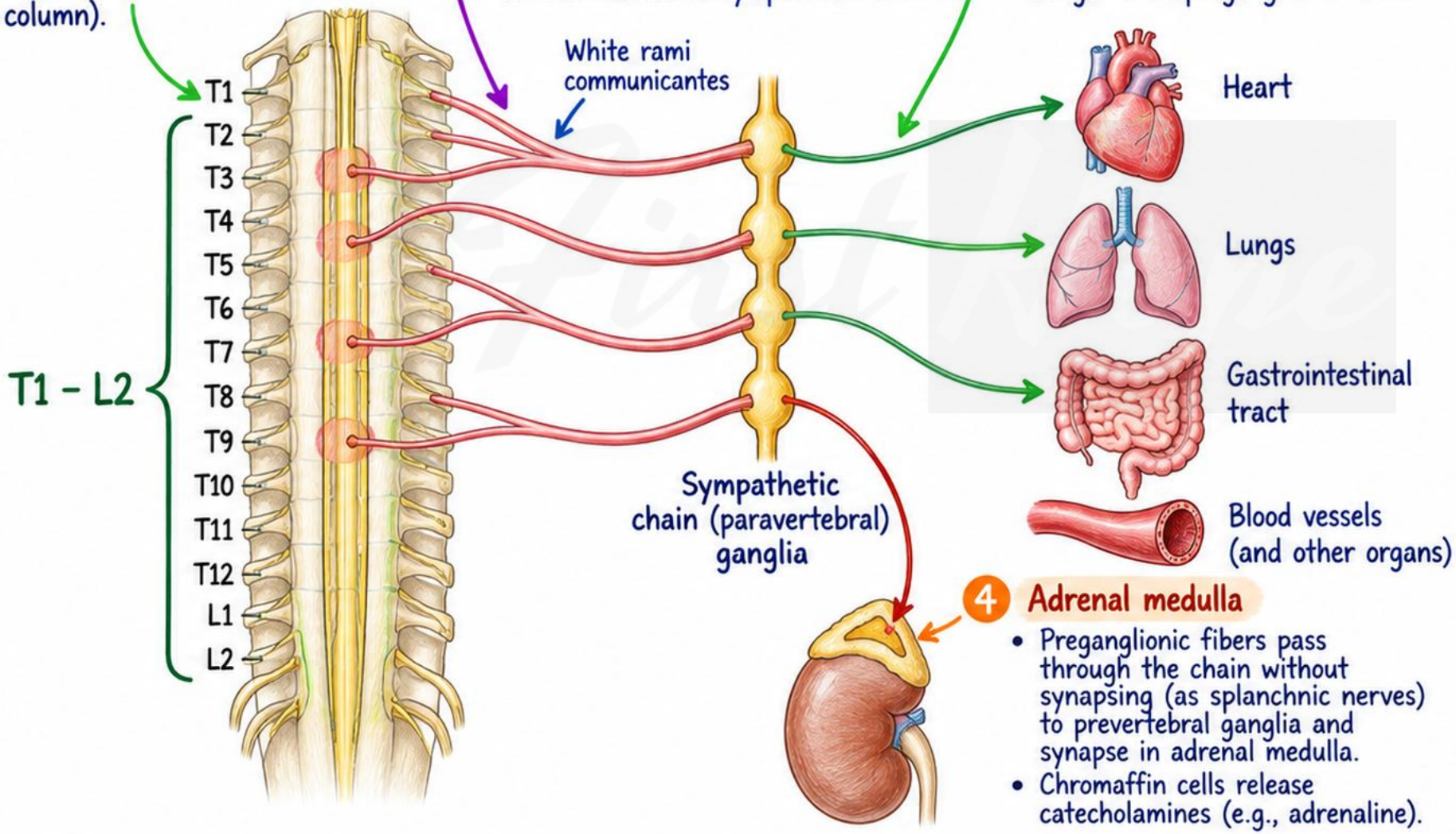
Preganglionic neurons arise from T1 to L2 segments (lateral horn – intermediolateral cell column).

## 2 Preganglionic fibers (short)

- Exit via ventral root
- Enter spinal nerve
- Travel through white rami communicantes to sympathetic chain.

## 3 Postganglionic fibers (long)

- Originate from sympathetic ganglia.
- Travel to target organs.
- Longer than preganglionic fibers.




## 4 Adrenal medulla

- Preganglionic fibers pass through the chain without synapsing (as splanchnic nerves) to prevertebral ganglia and synapse in adrenal medulla.
- Chromaffin cells release catecholamines (e.g., adrenaline).

## 5 Routes of preganglionic fibers

- Synapse at same level → postganglionic fiber exits via gray ramus.
- Ascend or descend in chain to synapse at a different level.
- Pass through without synapsing as splanchnic nerves to prevertebral ganglia (e.g., celiac, superior/inferior mesenteric) or adrenal medulla.

## 6 Target organs

Postganglionic fibers innervate:

- Heart
- Lungs
- Gastrointestinal tract
- Blood vessels
- Sweat glands
- Other visceral organs

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