

Chapter 2

Nervous System



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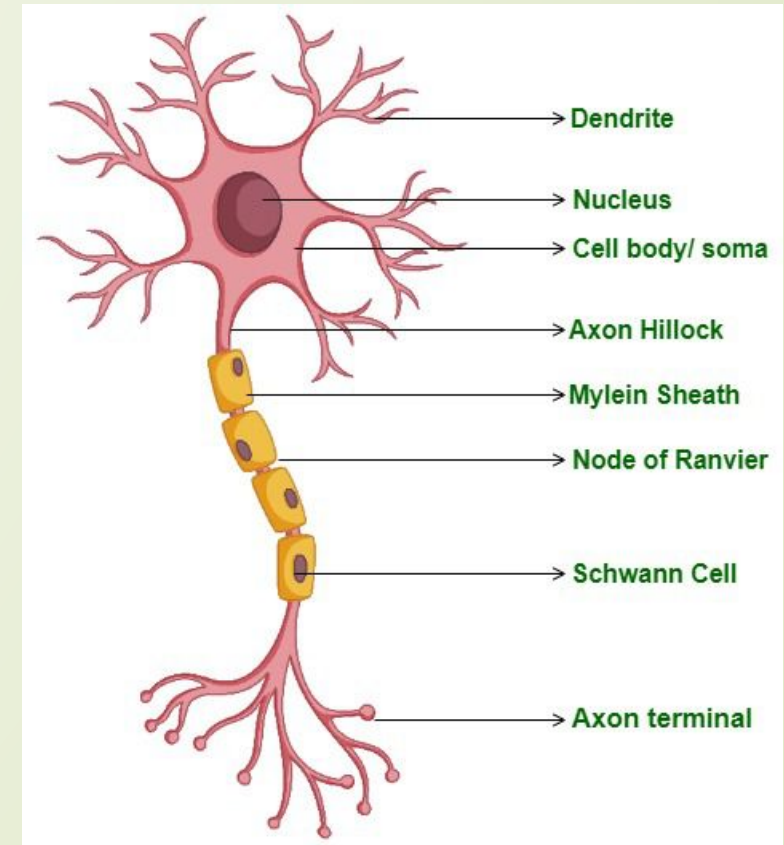
Structure and function of the Neuron

Neuron (nerve cell)

- Information-processing and information transmitting element of the nervous system
- **Types:** Sensory, Motor, Interneuron

Five structures

1. **Cell body (Soma):** contains Nucleus which provides life to the cell
2. **Dendrites:** Treelike structure attached to soma, receives information from the terminal buttons of other neurons



Structure and function of the Neuron

3. Axon: Long, thin, cylindrical structure, conveys information from the soma of a neuron to its terminal buttons

The axon ends in a cluster of *Terminal buttons*, which are small knobs secrete chemicals called *Neurotransmitters*.

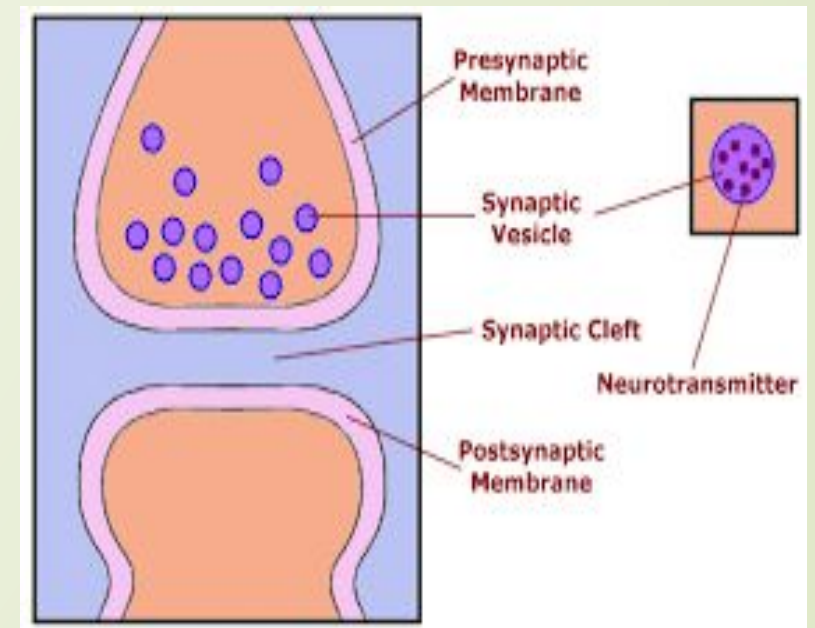
4. Myelin Sheath:

An insulating (protecting) material that encases some axons

5. Synapse: A junction between the terminal button of an axon and the membrane of another neuron.

For transmission of information

Synapse (structure)





Neurotransmitters

Definition:

A neurotransmitter is defined as a chemical that is released by a terminal button; has an excitatory or inhibitory effect on another neuron

Important Neurotransmitters:

- Dopamine
- Serotonin
- Endorphins
- Acetylcholine

Functions & malfunctions of Neurotransmitters

(Some) Neurotransmitters

Neurotransmitter	Function	Examples of malfunctions
Acetylcholine (ACh)	Enables muscle action, learning & memory	Alzheimer's disease <input checked="" type="checkbox"/> less ACh production
Dopamine	Influences movement, learning, attention, & emotion	Excess <input checked="" type="checkbox"/> schizophrenia Undersupply <input checked="" type="checkbox"/> Parkinson's disease
Serotonin	Affects mood, hunger, sleep, and arousal	Undersupply <input checked="" type="checkbox"/> depression
Norepinephrine	Helps control alertness & arousal	Undersupply <input checked="" type="checkbox"/> depressed mood
Glutamate	Excitatory neurotransmitter involved in memory	Excess <input checked="" type="checkbox"/> overstimulation of brain, seizures

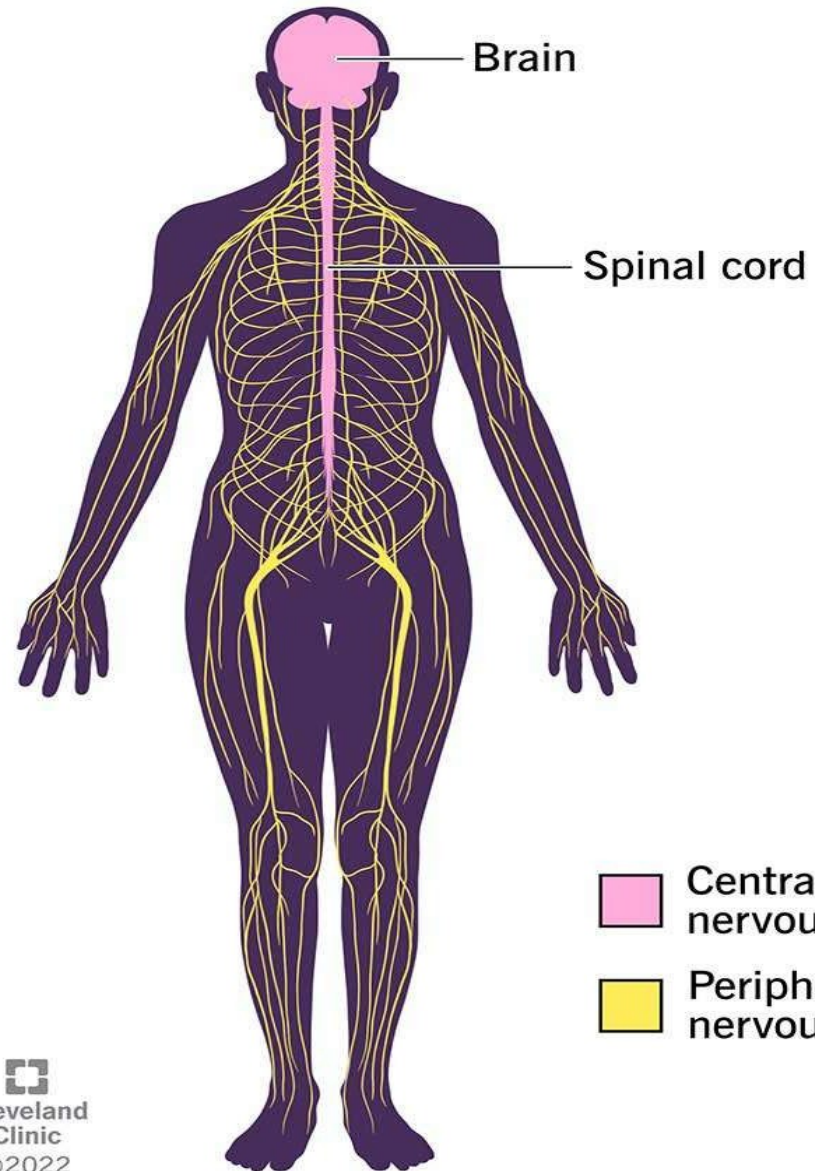
Table 3.1 Common Neurotransmitters and Some of Their Relations to Behavior



Neurotransmitter	Characteristics and Relations to Behavior	Disorders Associated with Dysregulation
Acetylcholine (ACh)	Released by motor neurons controlling skeletal muscles Contributes to the regulation of attention, arousal, and memory Some ACh receptors stimulated by nicotine	Alzheimer's disease
Dopamine (DA)	Contributes to control of voluntary movement Cocaine and amphetamines elevate activity at DA synapses Dopamine circuits in medial forebrain bundle characterized as "reward pathway"	Parkinsonism Schizophrenic disorders Addictive disorders
Norepinephrine (NE)	Contributes to modulation of mood and arousal Cocaine and amphetamines elevate activity at NE synapses	Depressive disorders
Serotonin	Involved in regulation of sleep and wakefulness, eating, aggression Prozac and similar antidepressant drugs affect serotonin circuits	Depressive disorders Obsessive-compulsive disorders Eating disorders
GABA	Serves as widely distributed inhibitory transmitter, contributing to regulation of anxiety and sleep/arousal Valium and similar antianxiety drugs work at GABA synapses	Anxiety disorders
Glutamate	Serves as widely distributed excitatory transmitter Involved in learning and memory	Schizophrenia
Endorphins	Resemble opiate drugs in structure and effects Play role in pain relief and response to stress Contribute to regulation of eating behavior	

Table 3.1 Common Neurotransmitters and Some of their Functions

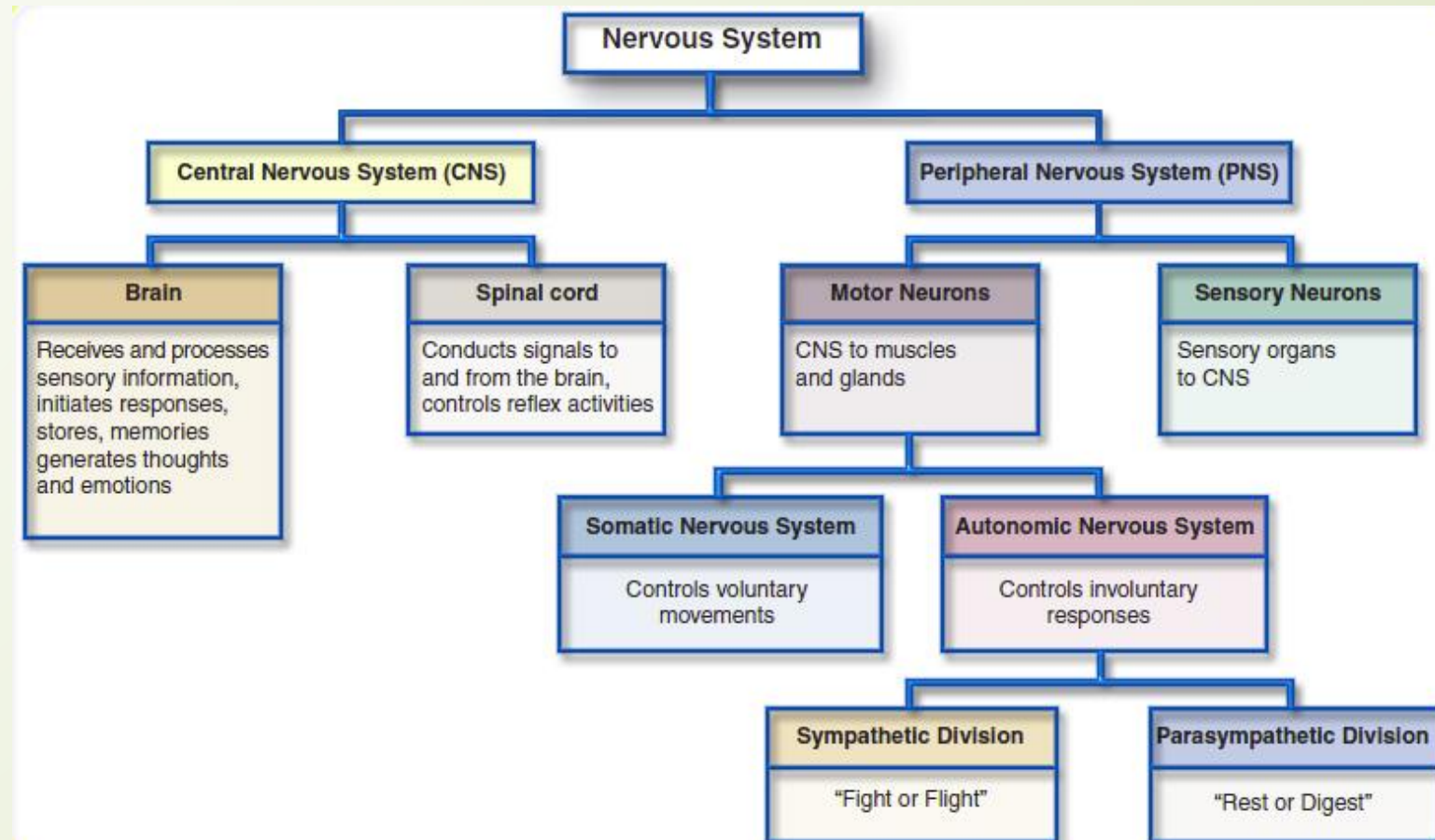
Nervous System

Peripheral nervous system

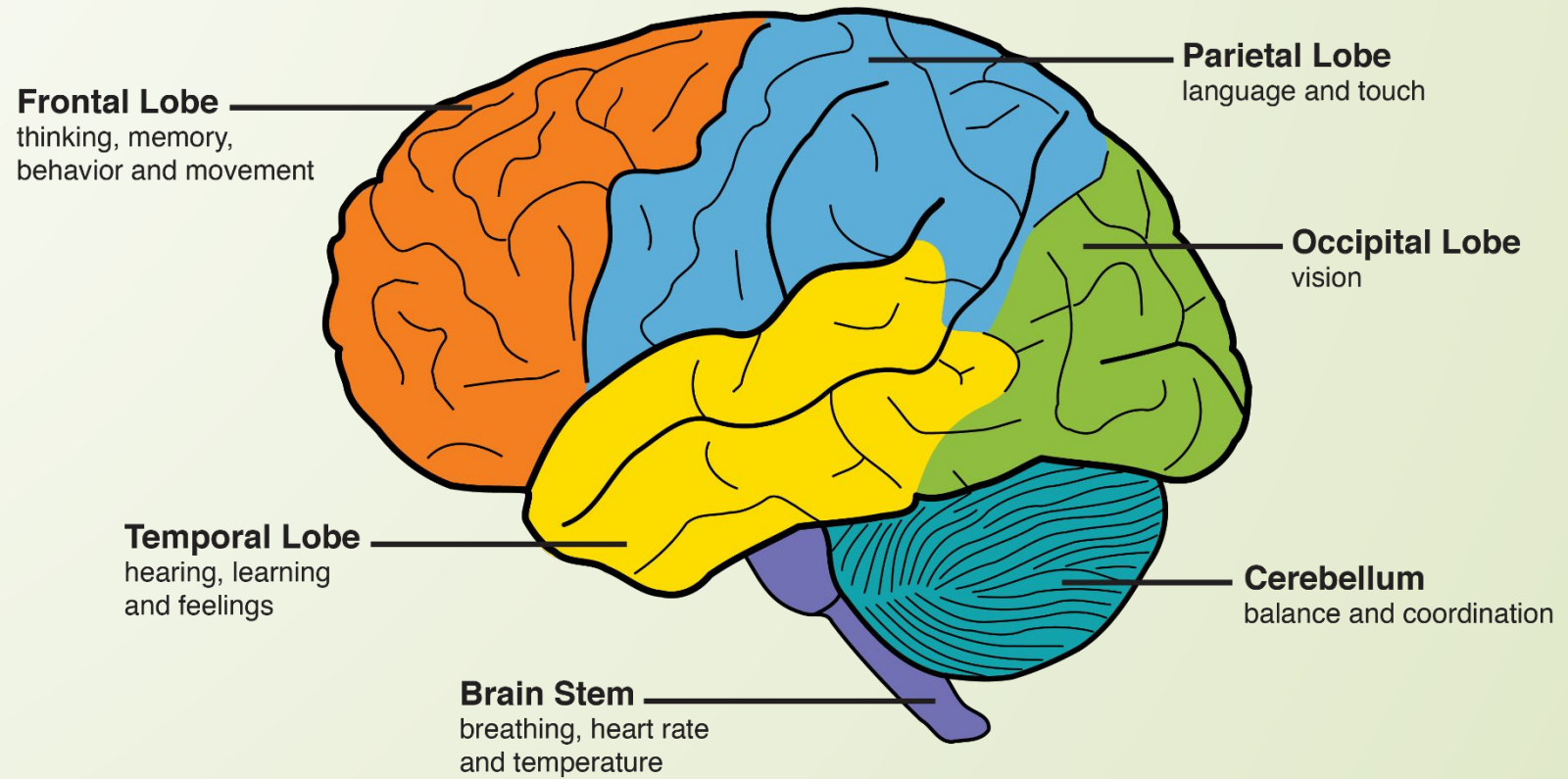


-  Central nervous system
-  Peripheral nervous system

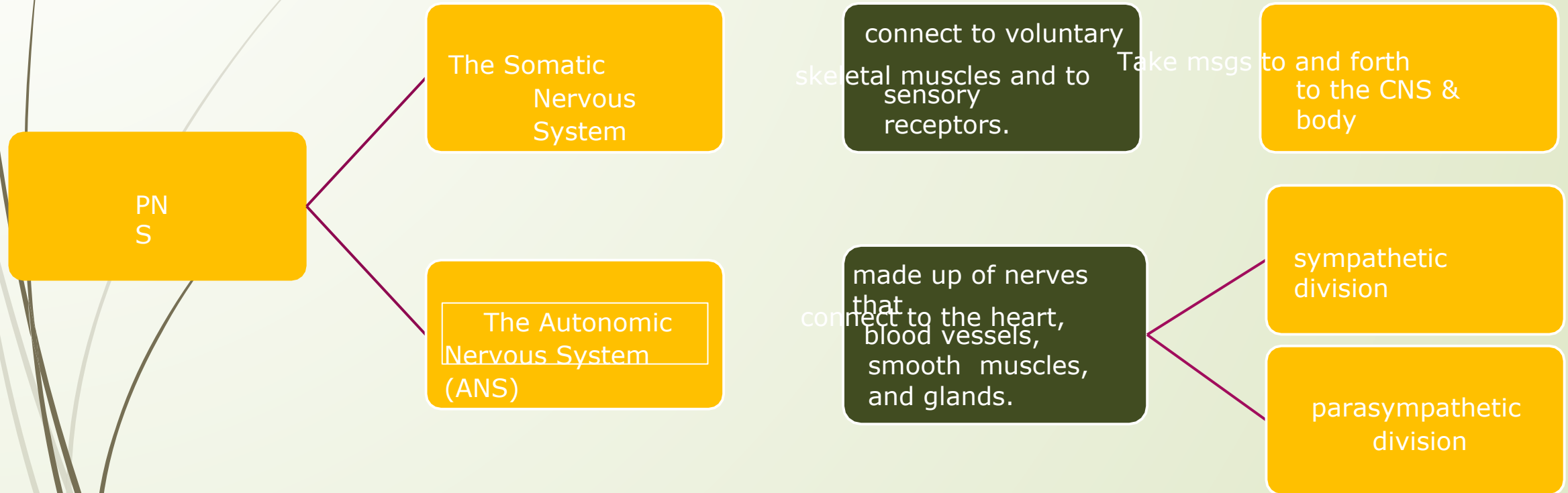
Division of Nervous System



Cerebrum (slide not included in Mid-1)

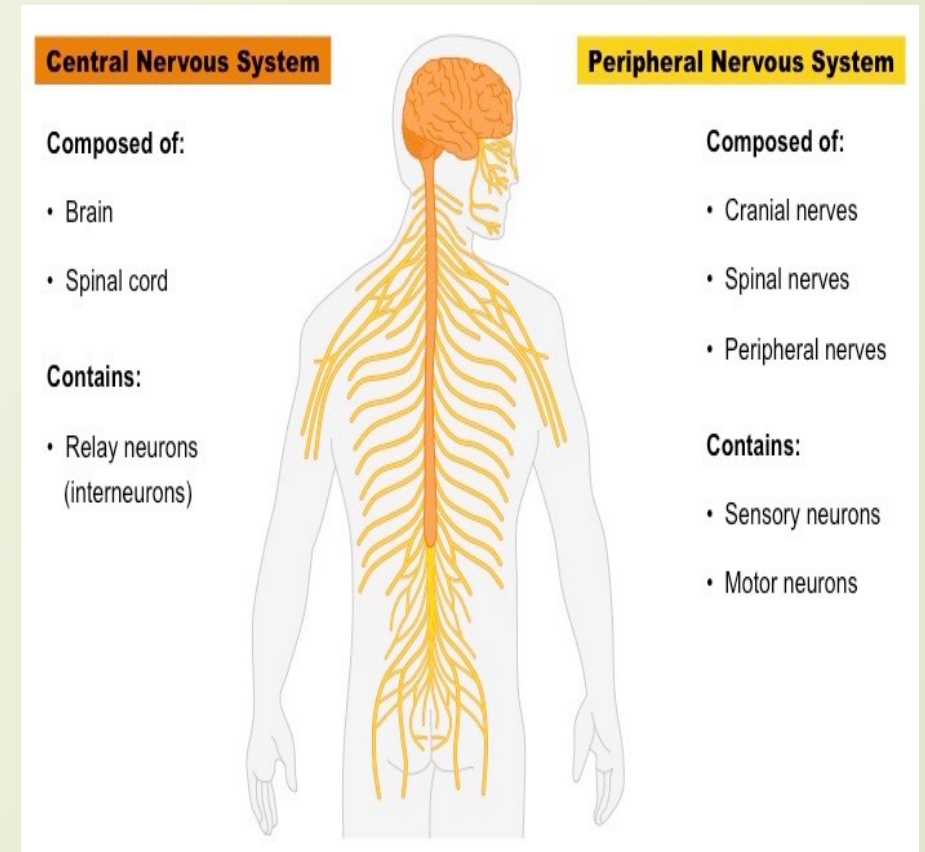


Peripheral Nervous system



Peripheral Nervous System

- Periphery means (the outside)
- The Peripheral Nervous System is made up of all those nerves that lie **outside the brain** and **spinal cord**.
- PNS has 2 subdivisions:
 1. Somatic Nervous System
 2. Autonomic Nervous System



Peripheral Nervous System

1. Somatic Nervous System

- The Somatic Nervous System is made up of nerves that connect to voluntary skeletal muscles and to sensory receptors.
- Carries information from **skin, muscles and joints** to CNS and carry commands from CNS to muscles.

2. Autonomic Nervous System

- The Autonomic Nervous System (ANS) is made up of nerves that connect to the **heart, blood vessels, smooth muscles, and glands**.
- performs involuntary functions such as heart rate, digestion, and perspiration.
- **Divisions of ANS :**
 1. **Sympathetic**: Mobilizes body's resources in emergencies
 2. **Parasympathetic**: conserves bodily resources



Divisions of Autonomic Nervous System



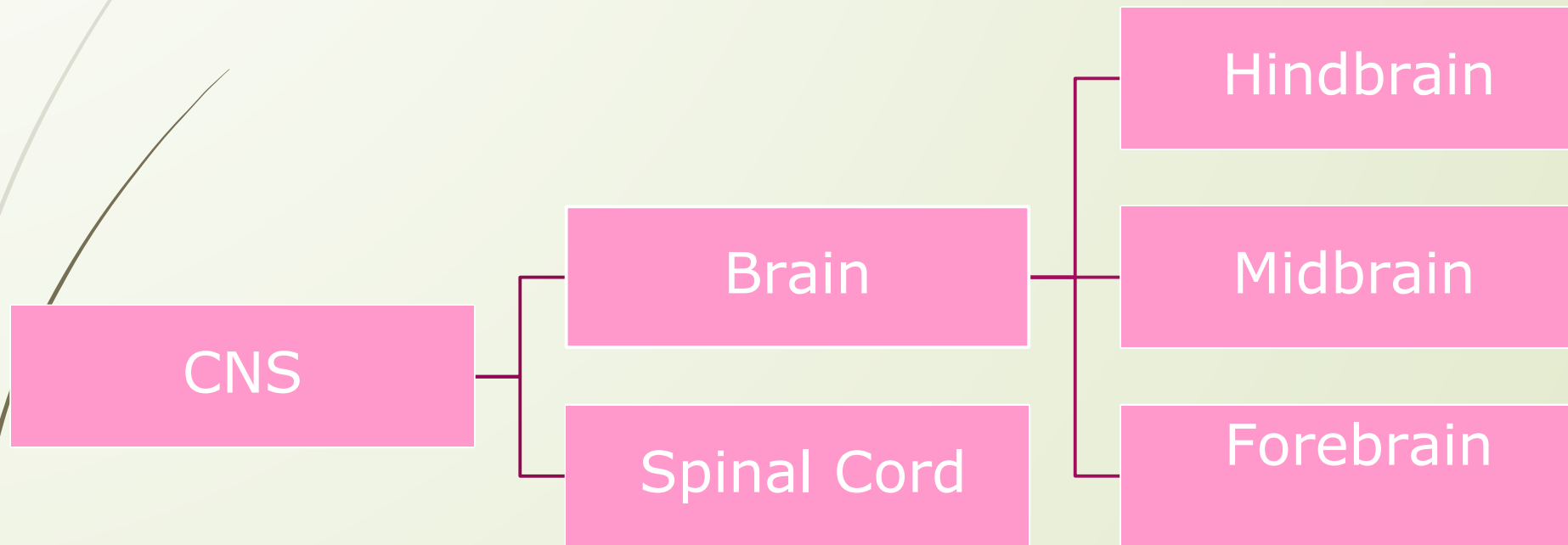
i. The sympathetic division

- The sympathetic division is the branch of ANS that **mobilizes the body's resources for emergencies.**
- It creates the Fight-or-Flight Response
- Slows digestive processes
- Drains blood

ii. The parasympathetic division

- The parasympathetic division is the branch of ANS that **conserves bodily resources**
- It activates processes that allow the body to save and store energy
- E.g. promotes digestion
- slows heart rate
- Reduces blood pressure

The Central Nervous System





Spinal cord

The spinal cord connects the brain to the rest of the body through the peripheral nervous system

Bundles of axons carry the brain's commands to peripheral nerves and that relay sensations from the periphery of the body to the brain

Brain

The crowning glory of the CNS is the Brain, weighs about 3 pounds. Contains billions of interacting cells that integrate information from inside and outside the body

Coordinates the body's actions. Enables human beings to talk, think, remember, plan, create, and dream

Division of Brain

1. The Hindbrain	2. The Midbrain
<ul style="list-style-type: none">• Controls largely unconscious• Controls breathing, maintaining muscle tone• Involved in sleep and arousal• Coordination of movement, sense of equilibrium/ physical balance	<ul style="list-style-type: none">• Integration of sensory processes such as vision and hearing• System of dopamine-releasing neurons• Voluntary movements• Modulation of muscle reflexes• Breathing & pain perception
Damage to this brain part disrupts fine motor skills involved in writing, typing, or playing a musical instruments	Decline in dopamine synthesis causes Parkinson's Disease

3. The Forebrain

- The forebrain is the largest and most complex region of the brain
- All sensory information must pass sensing touch, hearing
- A Regulator of Biological Needs, hunger, thirst, sexual motivation, and temperature regulation
- One such function is to control the autonomic nervous system
- A vital link between the brain and the endocrine system
- Basic biological drives related to survival, including the so-called “four F’s”: fighting, fleeing, feeding, and mating.
- Emotion, memory, and motivation
- Pleasure centers
- Central role in the learning of fear responses
- Learning, remembering, thinking,
 - Control over, such as fingers, lips, and the tongue
 - Acquisition of new motor skills
 - Imitation of others
 - The understanding of others’ intentions and the ability to feel empathy
 - Reasoning about relations between objects and events
- Decision making
- executive control system,” which is thought to monitor, organize, integrate, and direct thought