Introduction of Neuroanatomy

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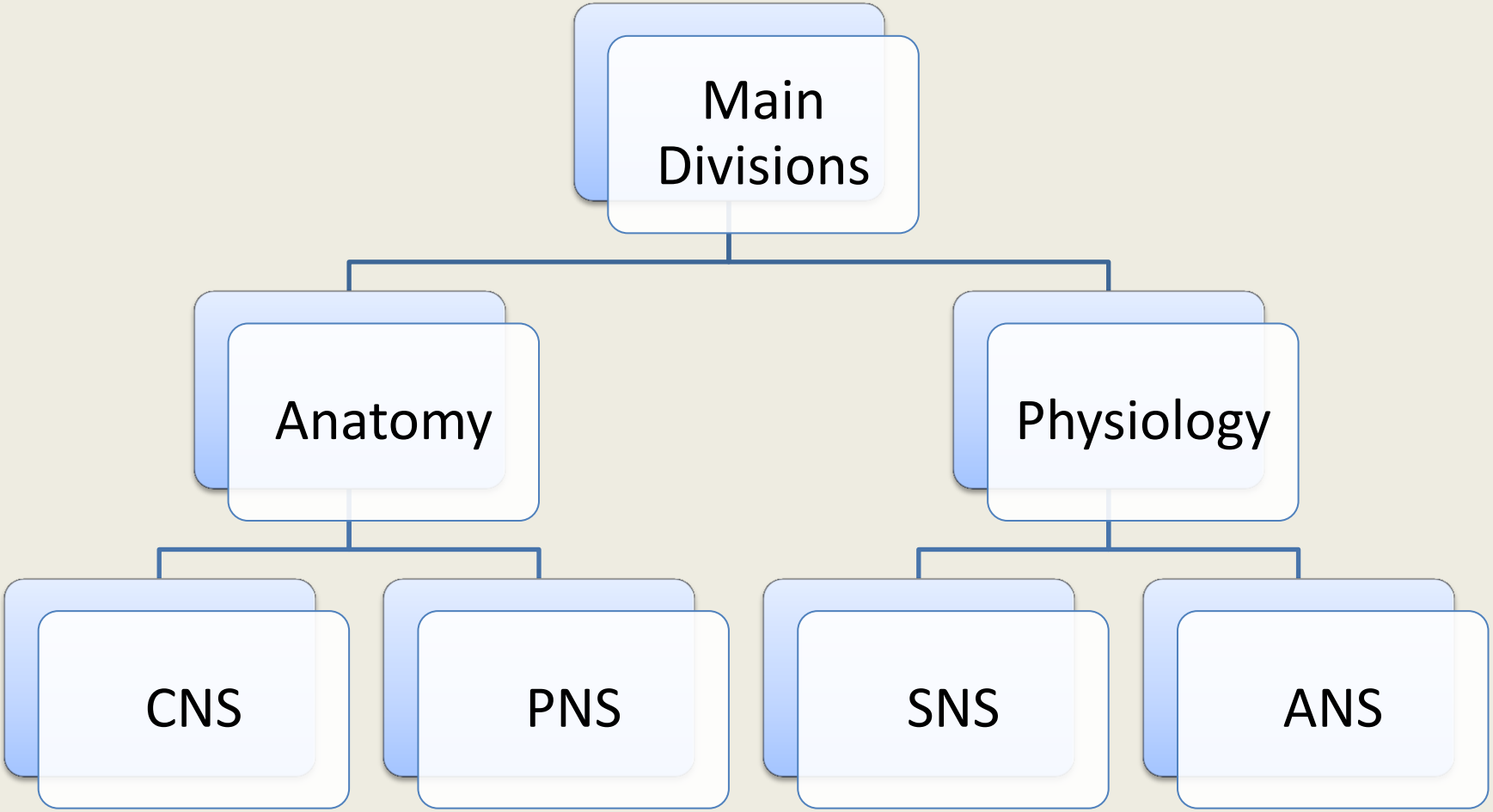
Introduction to Neuroanatomy

- The study of the structure and organization of the nervous system.
- Essential for understanding the functioning of the nervous system and diagnosing neurological disorders.
- Comprises the central nervous system (CNS) and peripheral nervous system (PNS)

Plan of Nervous System



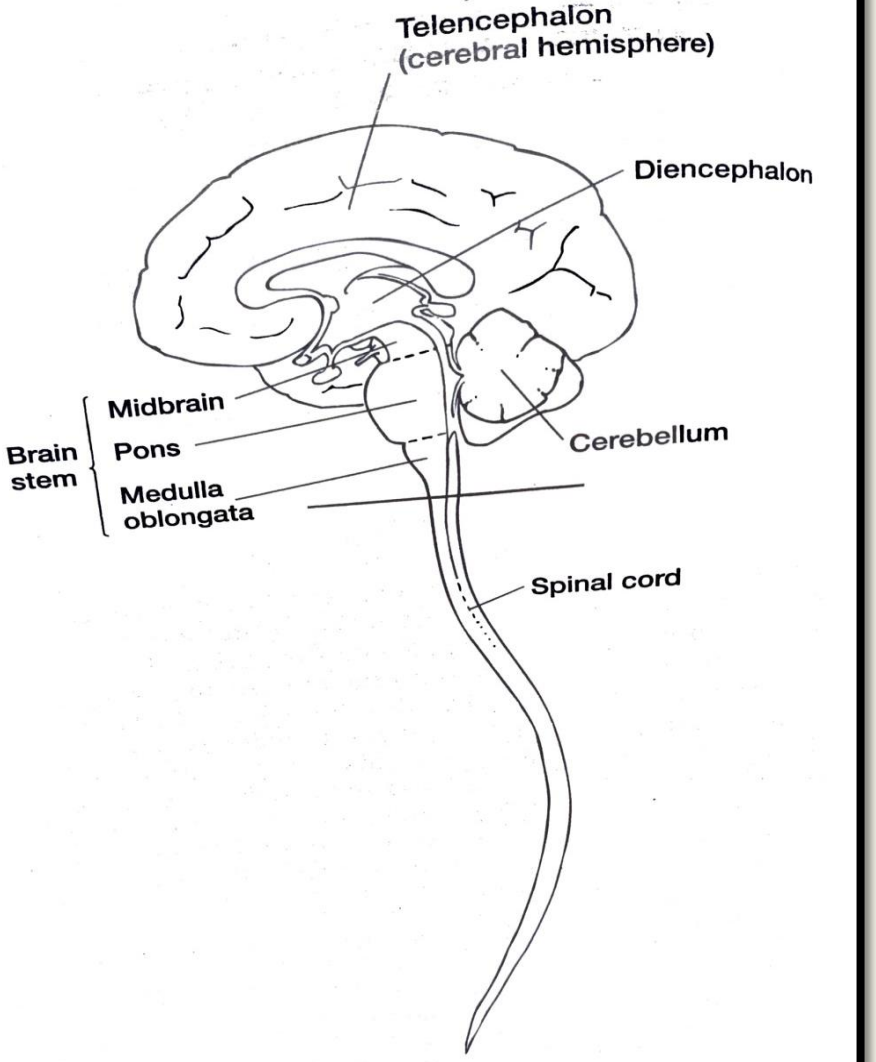


Figure 1–2. The two major divisions of the central nervous system, the brain and the spinal cord, as seen in the midsagittal plane.

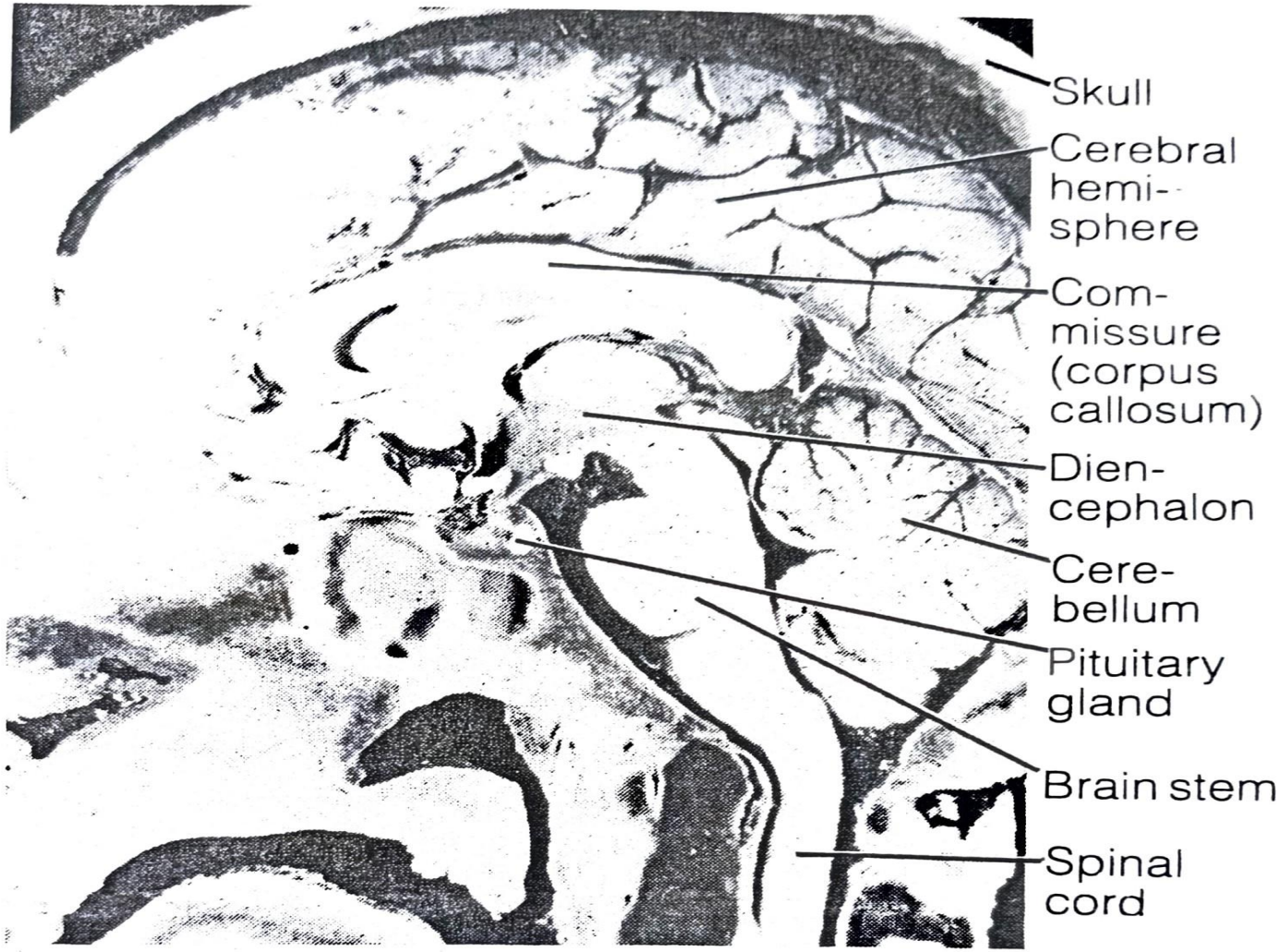


Figure 1–4. Photograph of a midsagittal section through the head and upper neck, showing the major divisions of the central nervous system. (Reproduced, with permission, from de Groot J: *Correlative Neuroanatomy of Computed Tomography and Magnetic Resonance Imagery.* Lea & Febiger, 1984.)

Table 1–2. Terms used in neuroanatomy.

Ventral, anterior	On the front (belly) side
Dorsal, posterior	On the back side
Superior, cranial	On the top (skull) side
Inferior	On the lower side
Caudal	In the lowermost position (at the tail end)
Rostral	On the forward side (at the nose end)
Medial	Close to or toward the middle
Median	In the middle, the midplane (midsagittal)
Lateral	Toward the side (away from the midline)
Ipsilateral	On the same side
Contralateral	On the opposite side
Bilateral	On both sides

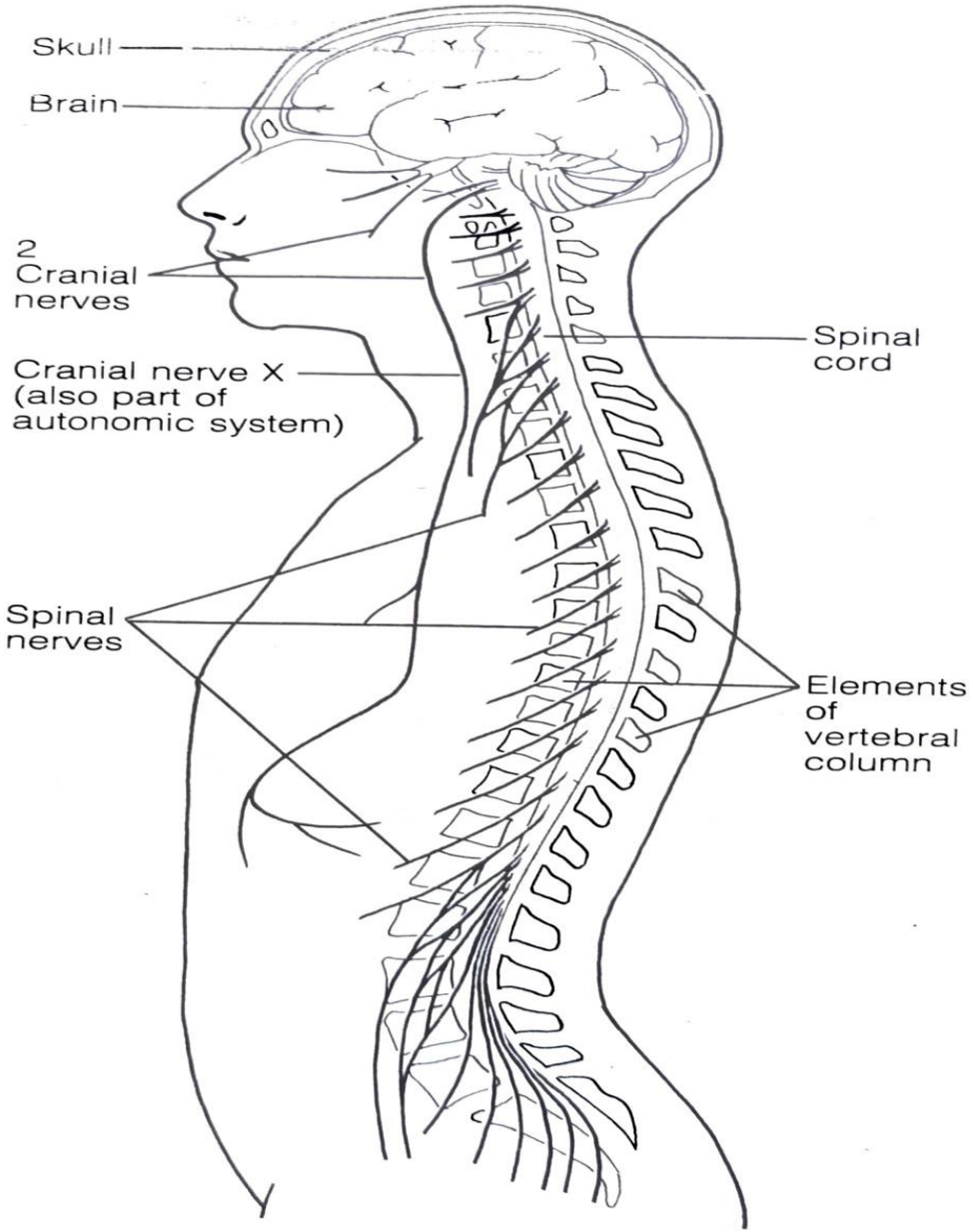


Figure 1–1. The structure of the central nervous system and the peripheral nervous system, showing the relationship between the CNS and its bony coverings.

Central Nervous System (CNS)

- Components:
  - Brain: Control center for the body's functions and activities.
  - Spinal Cord: Pathway for messages sent by the brain to the body and from the body to the brain.
- Functions of the CNS:
  - Processes sensory information
  - controls movements
  - responsible for cognition and emotions

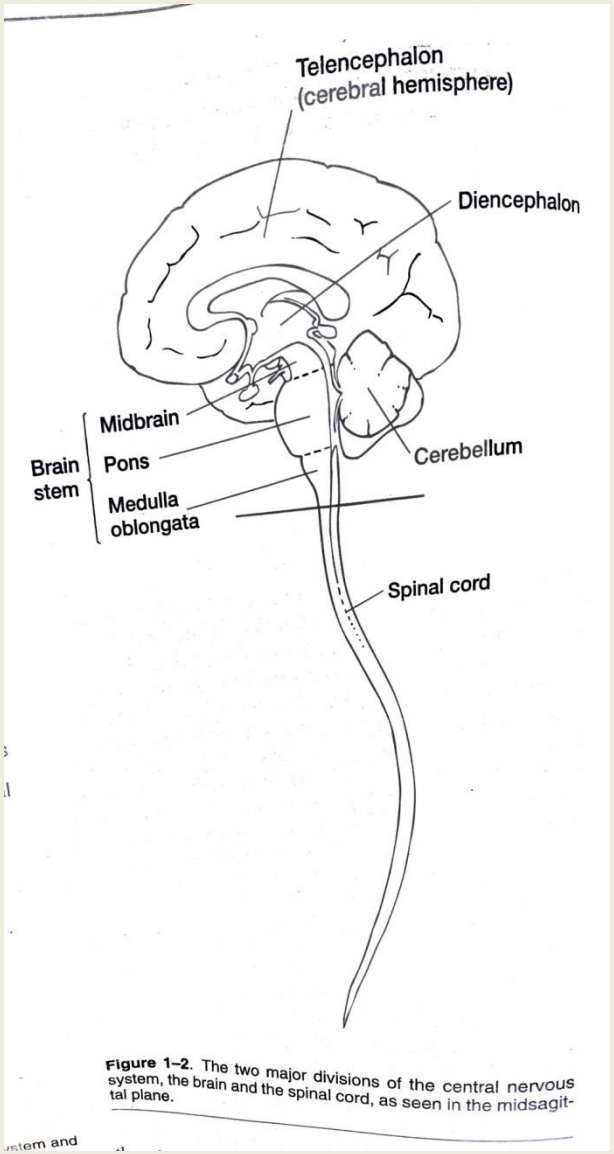


Figure 1–2. The two major divisions of the central nervous system, the brain and the spinal cord, as seen in the midsagittal plane.

Table 1–1. Major divisions of the central nervous system.

Brain (encephalon)	Cerebrum (forebrain)	Telencephalon	Cerebral cortex Subcortical white matter Commissures Basal ganglia
		Diencephalon	Thalamus Hypothalamus Epithalamus Subthalamus
	Cerebellum		Cerebellar cortex Cerebellar nuclei
	Brain stem		Midbrain (mesencephalon) Pons Medulla oblongata
Spinal cord	White matter		Dorsal columns Lateral columns Anterior columns
	Gray matter		

Brain Structure

- Major parts:
  - Cerebrum: Responsible for higher brain functions like thought, action, and sensory processing.
  - Cerebellum: Coordinates voluntary movements such as posture, balance, and coordination.
  - Brainstem: Controls basic body functions such as breathing, heartbeat, and blood pressure.

Cerebrum

- Lobes of the cerebrum:
  - Frontal: Associated with reasoning, planning, movement, emotions, and problem-solving.
  - Parietal: Processes sensory information regarding location of parts of the body and interpreting visual information and processing language and mathematics.
  - Temporal: Involved in perception and recognition of auditory stimuli, memory, and speech.
  - Occipital: Primarily responsible for vision.

Cerebellum

- Located under the cerebrum and has two hemispheres
- Functions of the cerebellum:
  - Coordinates voluntary movements such as posture, balance, coordination, and speech
  - resulting in smooth and balanced muscular activity

Brainstem

- Components:
  - Midbrain: Involved in functions such as vision
    - Hearing
    - eye movement
    - body movement
  - Pons: Connects upper and lower parts of the brain and plays a key role in **sleep and dreaming**
  - Medulla oblongata: Controls autonomic functions such as breathing,
    - Digestion
    - heart and blood vessel function
    - Swallowing
    - sneezing

Spinal Cord

- Structure and segments:
  - Cervical: 8 pairs of nerves.
  - Thoracic: 12 pairs of nerves.
  - Lumbar: 5 pairs of nerves.
  - Sacral: 5 pairs of nerves.
  - Coccygeal: 1 pair of nerves.
- Functions of the spinal cord: Transmits neural signals between the brain and the rest of the body and coordinates reflexes

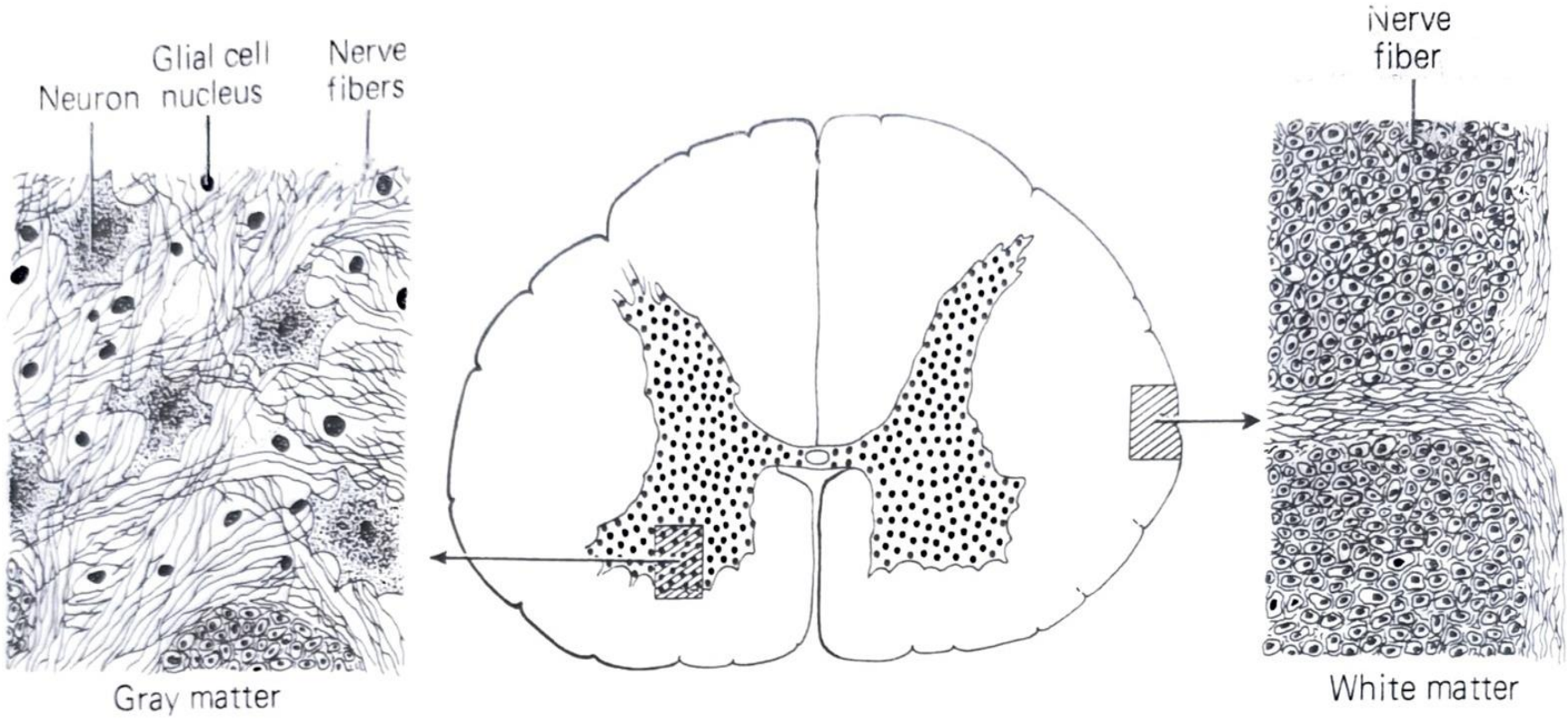


Figure 1–3. Cross section through the spinal cord, showing gray matter (which contains neuronal and glial cell bodies, axons, dendrites, and synapses) and white matter (which contains myelinated axons and associated glial cells). (Reproduced, with permission, from Junqueira LC et al: *Basic Histology,* 7th ed. Appleton & Lange, 1992.)

Peripheral Nervous System (PNS)

- Components:
  - Nerves: Bundles of axons that transmit signals to and from the CNS
  - Ganglia: Collections of neuron cell bodies located outside the CNS
- Functions of the PNS: Connects the CNS to limbs and organs, essentially serving as a communication relay

Cranial Nerves

- 12 cranial nerves: Each has a specific function such as **sensory, motor, or both.**
- Functions of each cranial nerve:
  - Olfactory: Smell.
  - Optic: Vision.
  - Oculomotor: Eye movement and pupil reflex.
  - Trochlear: Eye movement.
  - Trigeminal: Face sensation and chewing.
  - Abducens: Eye movement.
  - Facial: Face movement and taste.
  - Vestibulocochlear: Hearing and balance.
  - Glossopharyngeal: Taste and swallowing.
  - Vagus: Heart rate, digestion.
  - Accessory: Shoulder and neck muscles.
  - Hypoglossal: Tongue movement.

Spinal Nerves

- Structure and function of spinal nerves:
  - Each spinal nerve connects to the spinal cord by a dorsal root (sensory) and a ventral root (motor)
- Number and regions:
  - Cervical: 8 pairs.
  - Thoracic: 12 pairs.
  - Lumbar: 5 pairs.
  - Sacral: 5 pairs.
  - Coccygeal: 1 pair.

Autonomic Nervous System (ANS)

- Divisions:
  - Sympathetic: Prepares the body for stressful or emergency situations **(fight or flight)**
  - Parasympathetic: Conserves energy and resources during relaxed states **(rest and digest)**

Neurotransmitters

- Definition and importance: Chemical messengers that transmit signals across synapses from one neuron to another
- Examples:
  - Dopamine: Involved in reward, motivation, and motor control.
  - Serotonin: Affects mood, appetite, and sleep.
  - Acetylcholine: Involved in muscle action, learning, and memory.
- Essential for the functioning of the nervous system and in the regulation of various physiological processes

To be Continued.....