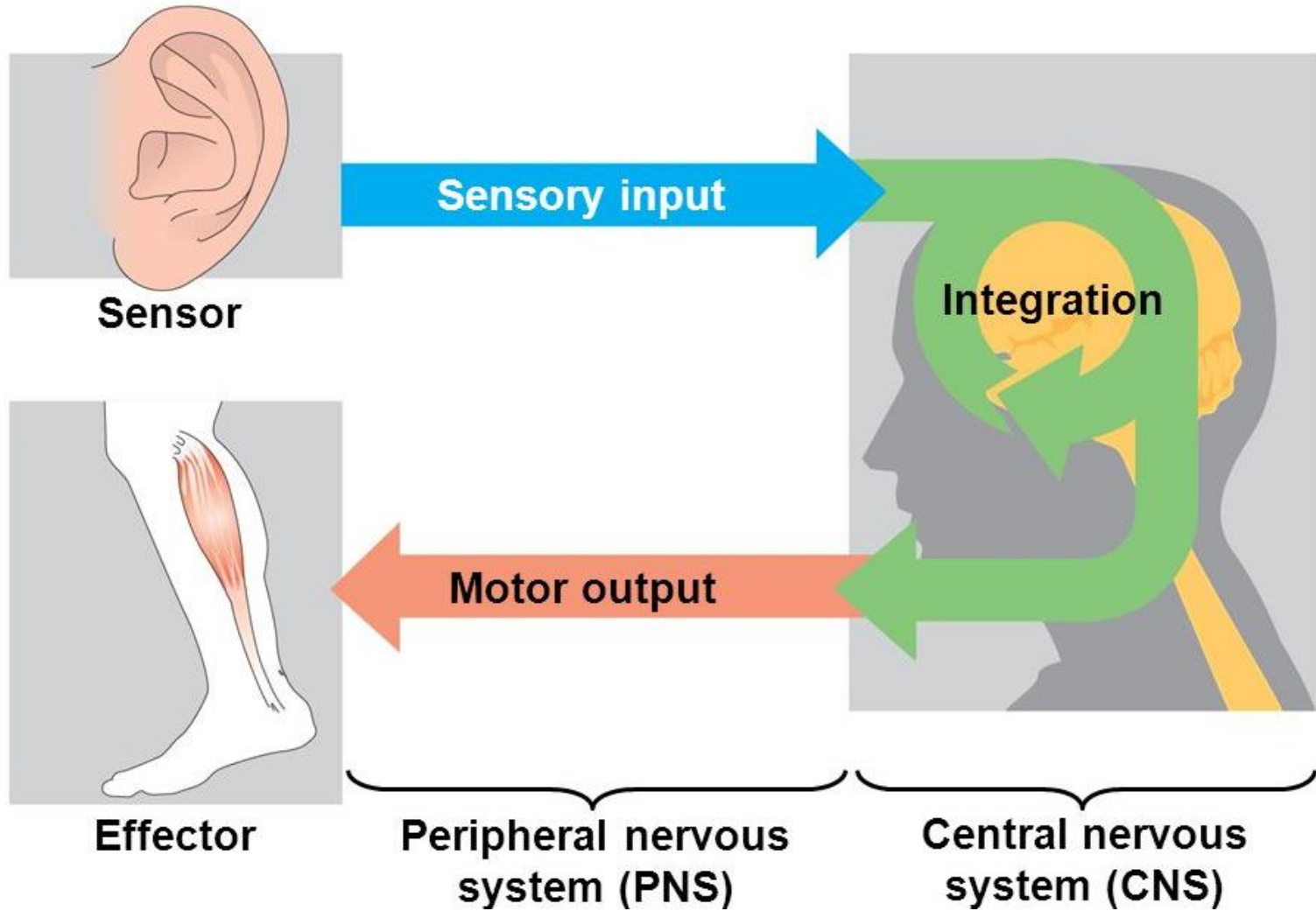




جامعة المستنقب
كلية العلوم
قسم الفيزياء الطبية



HUMAN ANATOMY
Lec. 3
CENTRAL NERVOUS SYSTEM
STAGE 3
BY
DR. MOHAMMED AL-MURIB



Divisions of the Nervous System

- Anatomical divisions are:
 - The **central nervous system (CNS)**
 - Made up of the brain and spinal cord
 - Integrates and coordinates input and output
 - The **peripheral nervous system (PNS)**
 - All the neural tissues outside of the CNS
 - The connection between the CNS and the organs

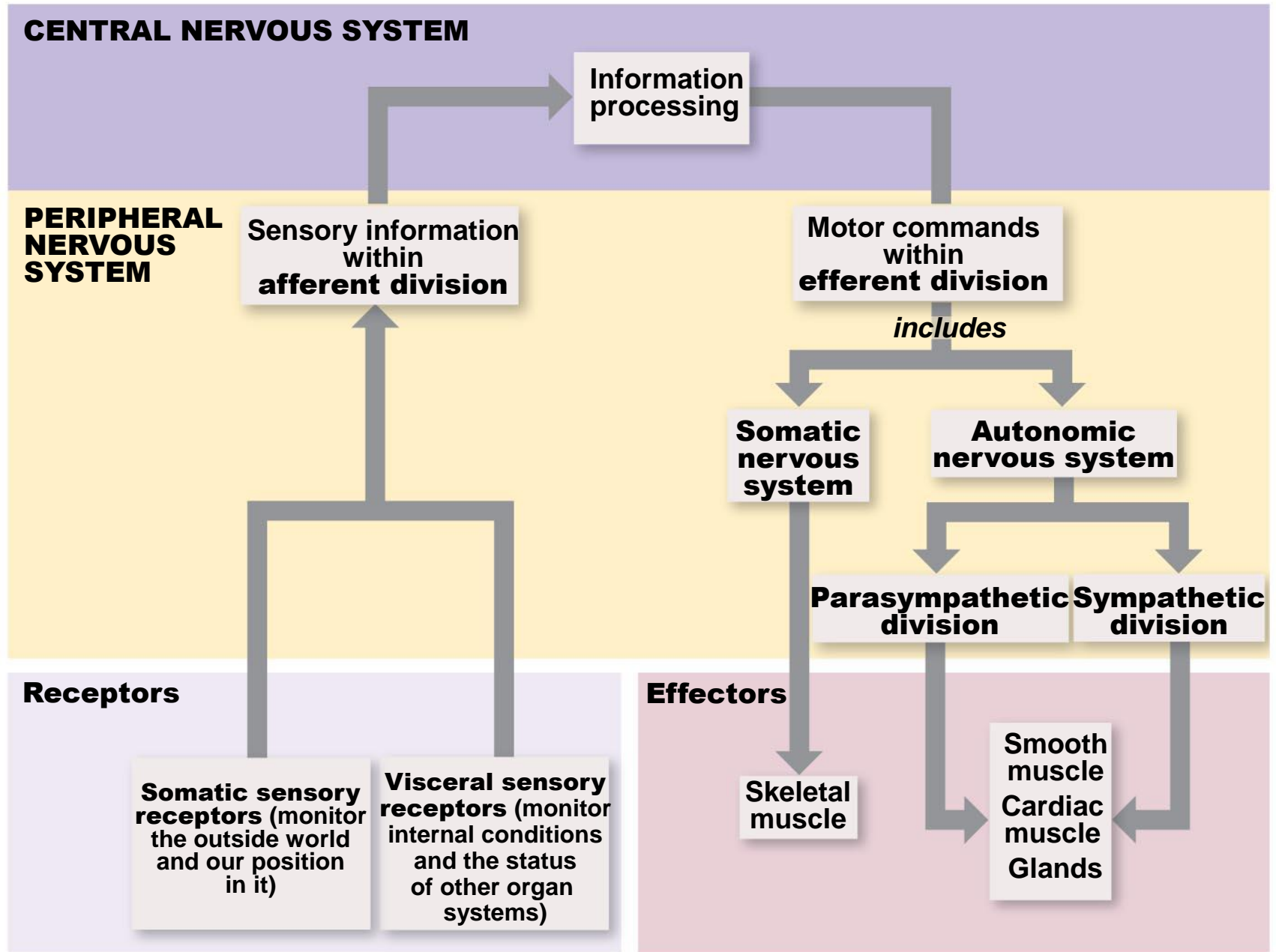
Divisions of the Nervous System

- Functional divisions are:
 - The **afferent division**
 - Includes sensory receptors and neurons that send information to the CNS
 - The **efferent division**
 - Includes neurons that send information to the effectors, which are the muscles and glands

Efferent Division of the Nervous System

- Further divided into:
 - The **somatic nervous system (SNS)**
 - Controls skeletal muscle
 - The **autonomic nervous system (ANS)**
 - Controls smooth and cardiac muscle, and glands
 - Has two parts
 1. *Sympathetic division*
 2. *Parasympathetic division*

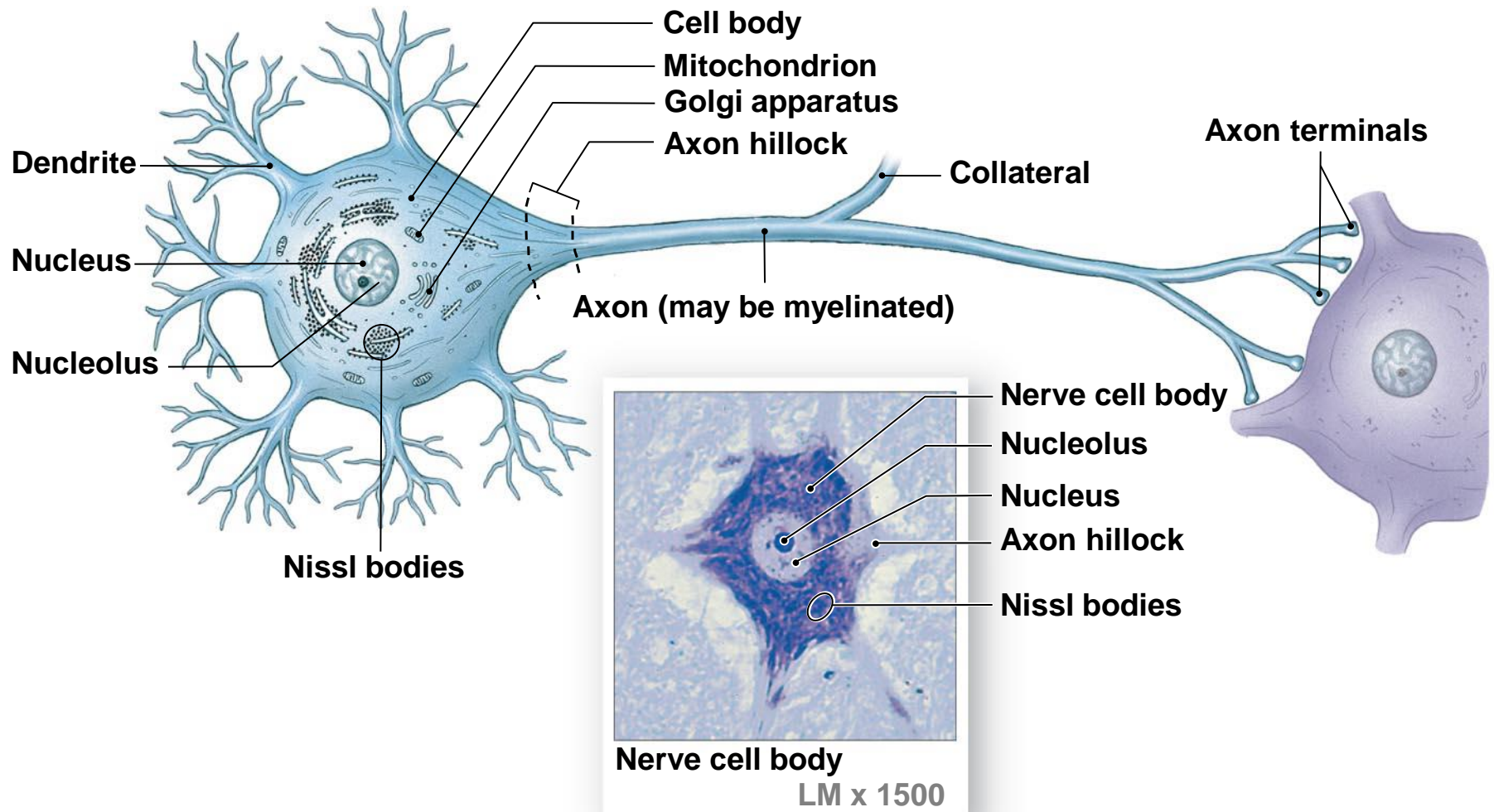
Functional Overview of the Nervous System.



Neurons

- Cells that communicate with one another and other cells
- Associated with neuroglia – regulate environment around the neurons
- Basic structure of a neuron includes:
 - **Cell body**
 - **Dendrites**
 - Which receive signals
 - **Axons**
 - Which carry signals to the next cell
 - **Axon terminals**
 - Bulb-shaped endings that form a **synapse** with the next cell

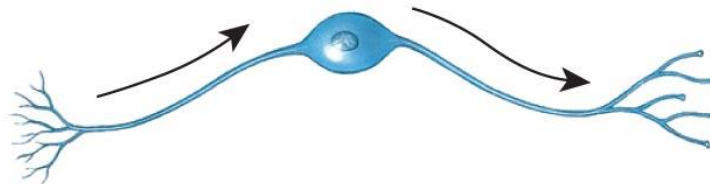
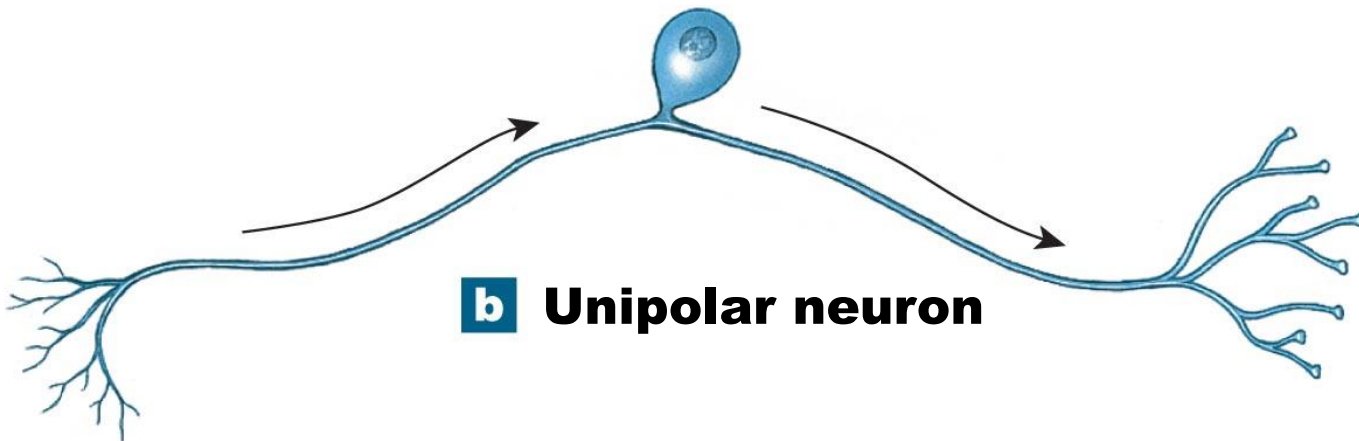
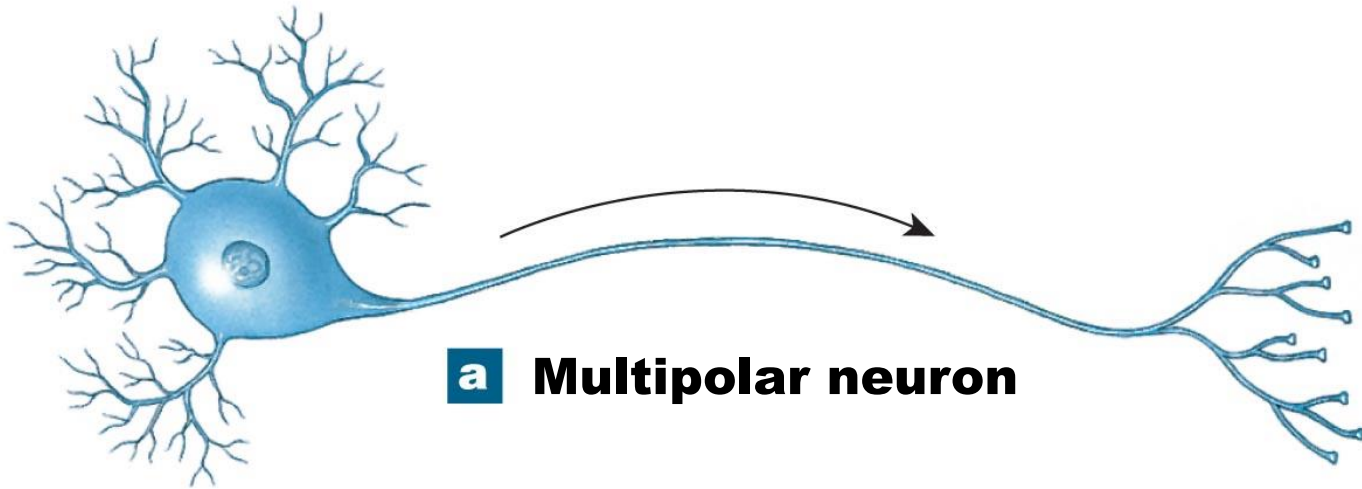
The Anatomy of a Representative Neuron.



Structural Classification of Neurons

- Based on the relationship of the dendrites to the cell body
 - **Multipolar neurons**
 - Are the most common in the CNS and have two or more dendrites and one axon
 - **Unipolar neurons**
 - Have the cell body off to one side, most abundant in the afferent division
 - **Bipolar neurons**
 - Have one dendrite and one axon with the cell body in the middle, and are rare

Structural Classification of Neurons.



c Bipolar neuron

The Brain

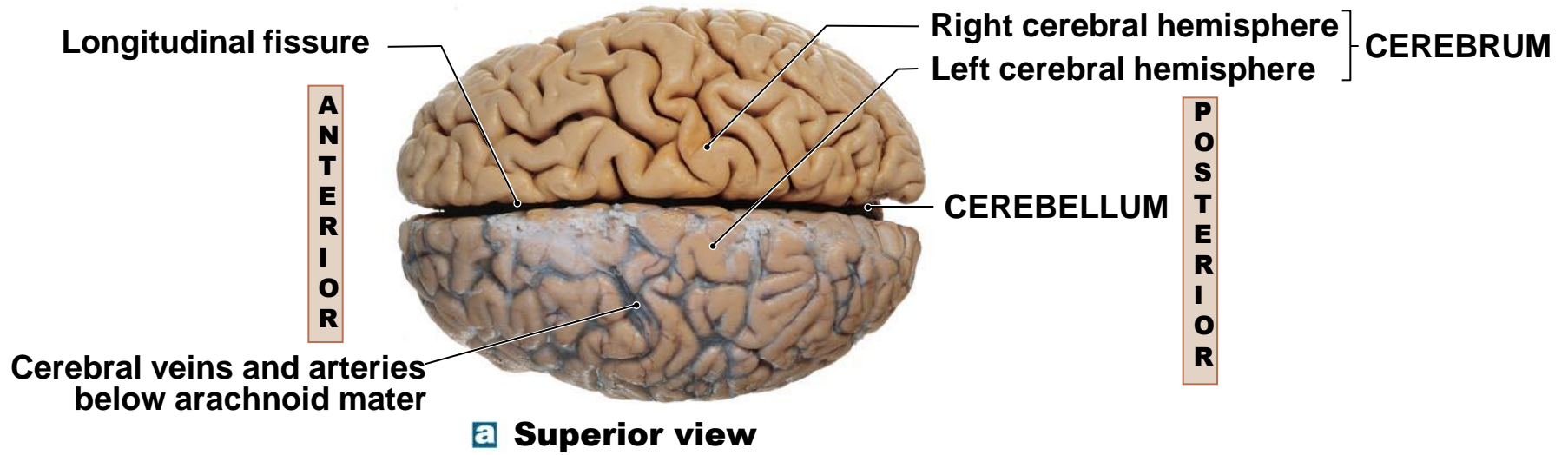
There are six major regions of the brain

1. The *cerebrum*
2. The *diencephalon*
3. The *midbrain*
4. The *pons*
5. The *medulla oblongata*
6. The *cerebellum*

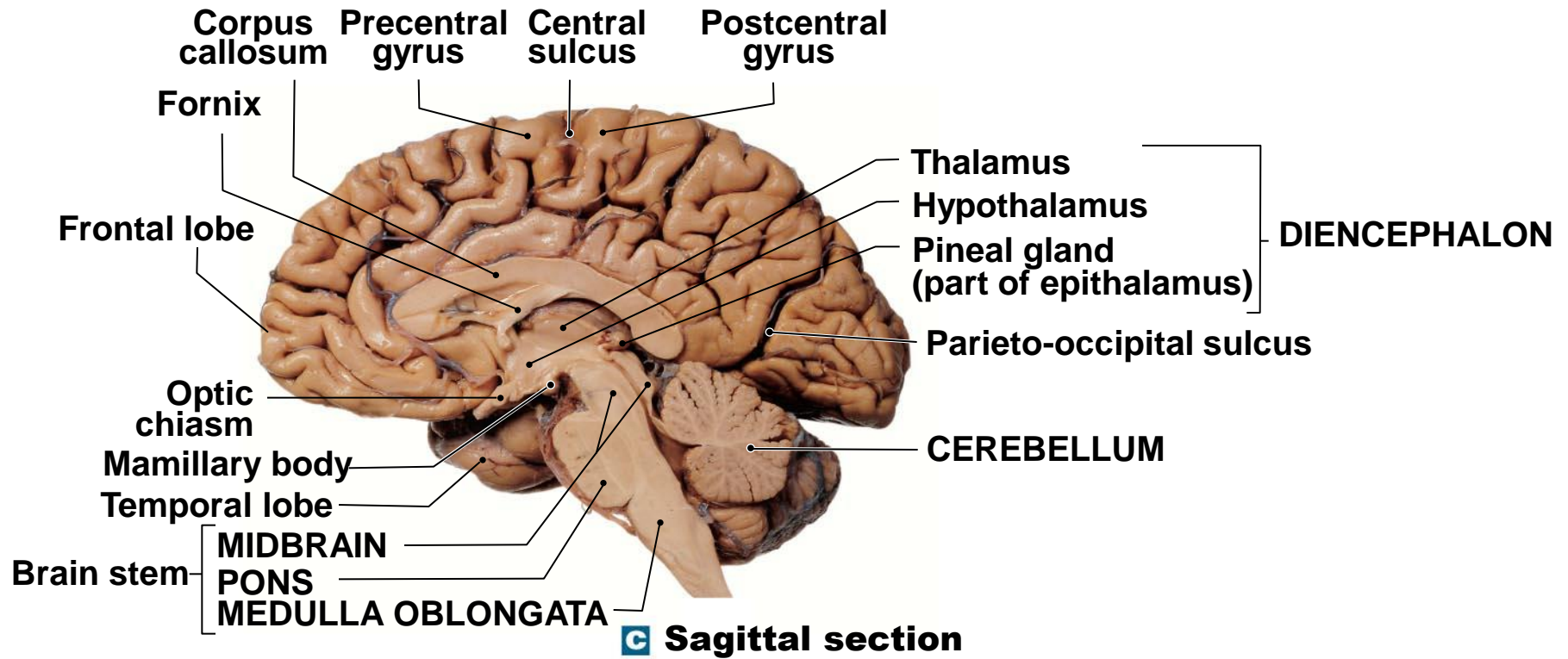
Major Structures of the Brain

- The **cerebrum**
 - Is divided into paired **left & right cerebral hemispheres**
- **diencephalon**
 - Which is divided into the **thalamus**, the **hypothalamus**, and the **epithalamus**
- The **brain stem**
 - Contains the **midbrain**, **pons**, and **medulla oblongata**
- The **cerebellum**
 - Is the most inferior/posterior part

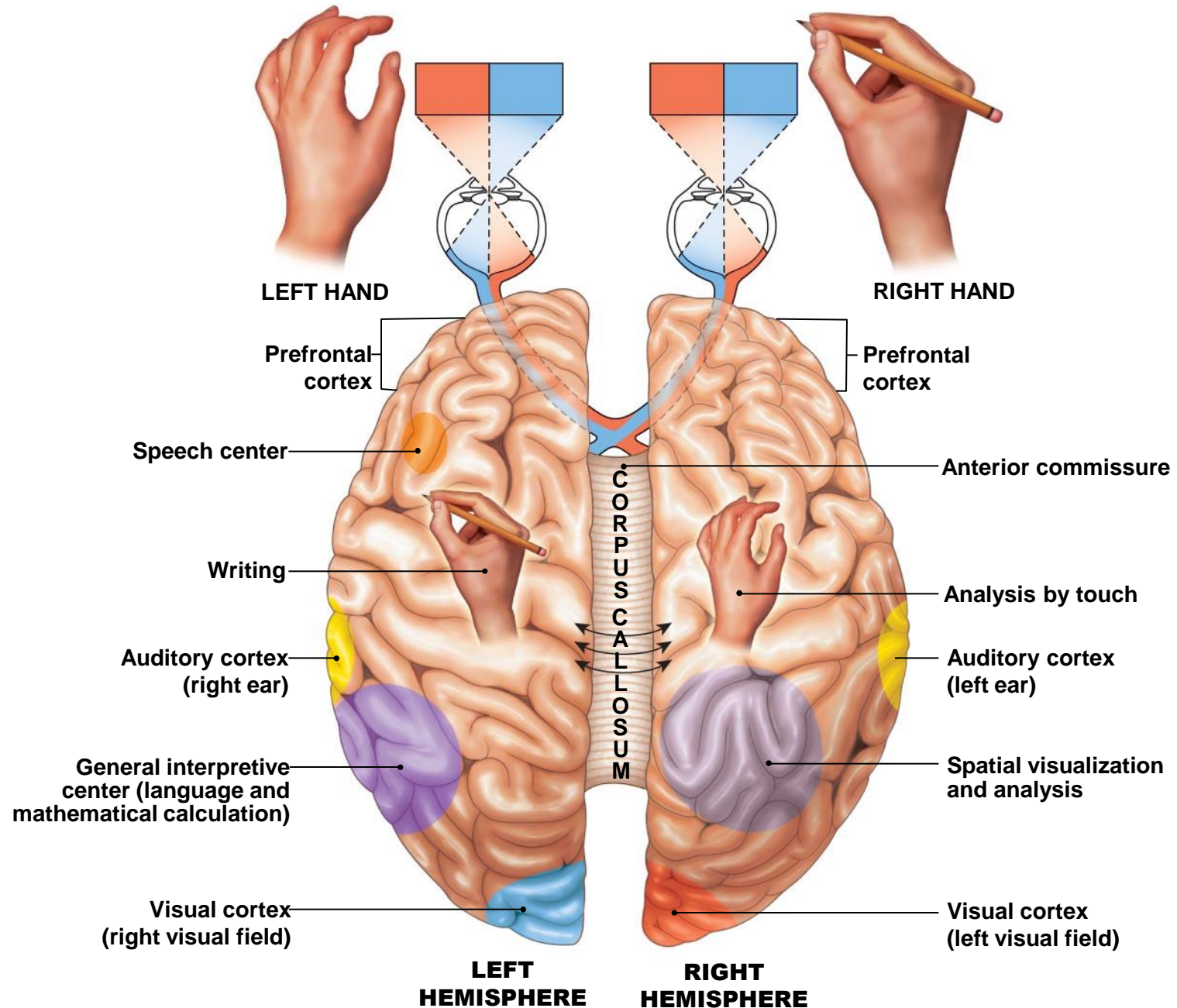
The Brain.



The Brain.



Hemispheric Lateralization.



Spinal Cord Structure

- The major neural pathway between the brain and the PNS
 - Involving the 31 pairs of spinal nerves
- Consistent in diameter except for the **cervical** enlargement and **lumbar** enlargement
 - Where numerous nerves supply upper and lower limbs

Spinal Cord Structure

- **Central canal**

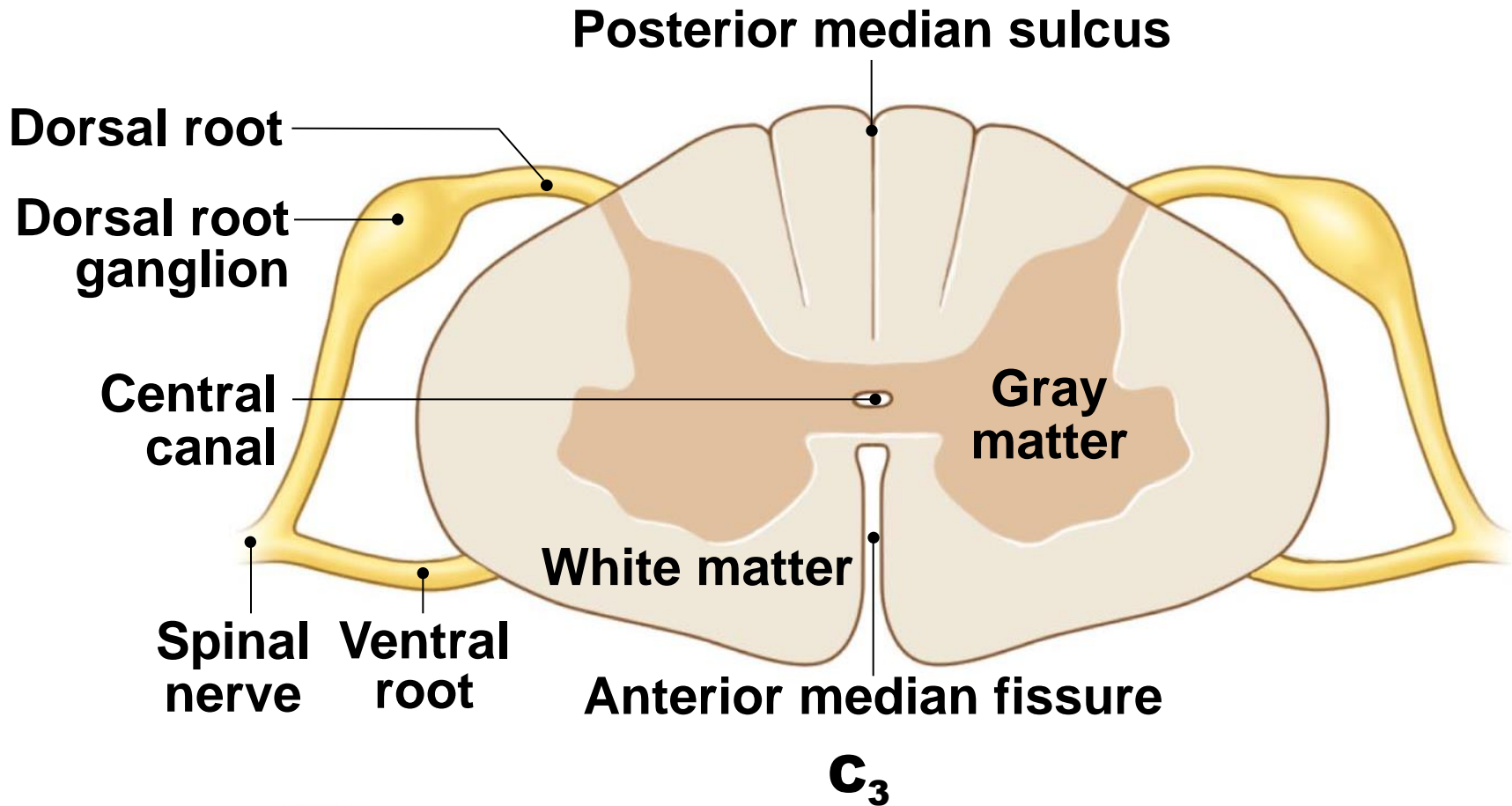
A narrow passage containing cerebrospinal fluid (**CSF**)

- **31 Spinal Segments**

Identified by a letter and number relating to the nearby vertebrae, each has a pair of

1. **dorsal root ganglia**

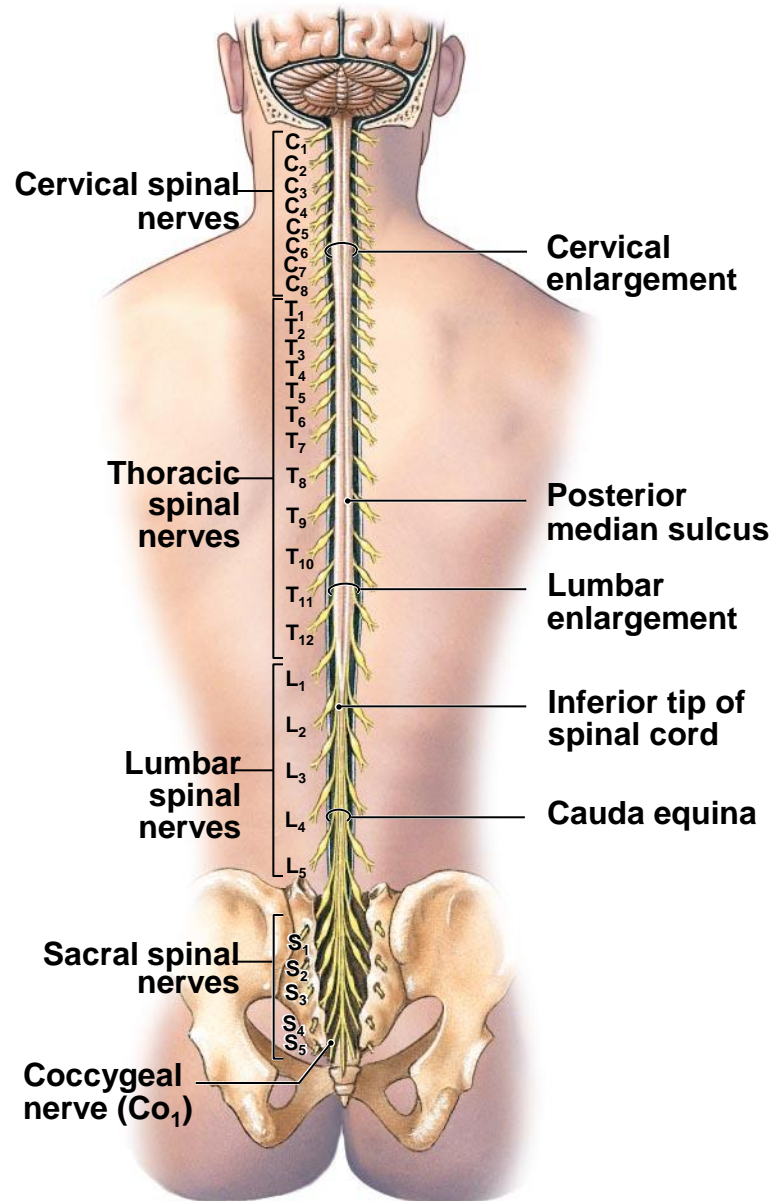
2. **Ventral roots**



b

This cross section through the cervical region of the spinal cord shows some prominent features and the arrangement of gray matter and white matter.

Gross Anatomy of the Spinal Cord.



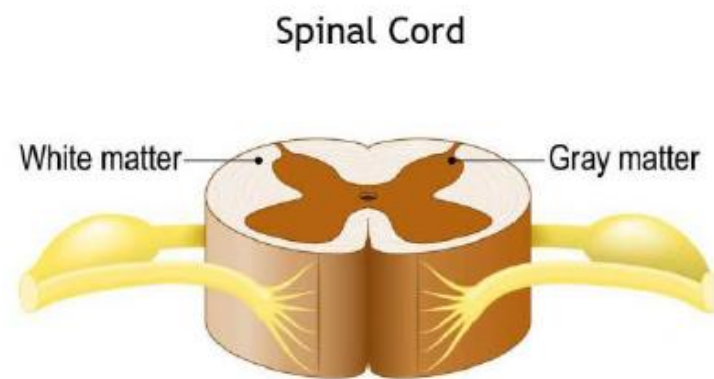
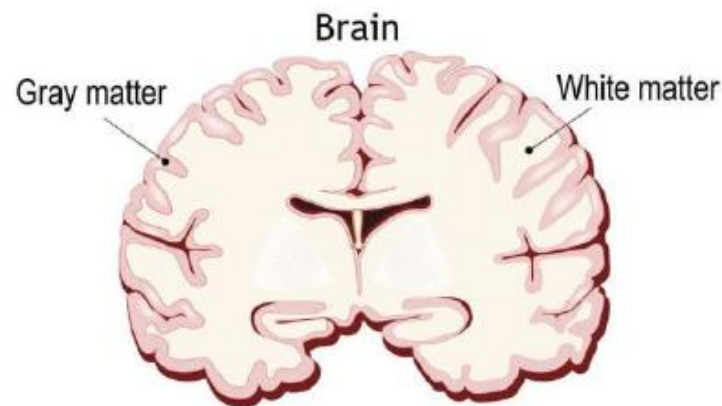
a In this superficial view of the adult spinal cord, the designations to the left identify the spinal nerves.

Sectional Anatomy of the Spinal Cord

- The central *gray matter* is made up of glial cells and nerve cell bodies
- White matter is myelinated and unmyelinated axons

What is the gray matter and white matter?

Gray and white matter are two different regions of the central nervous system.



Gray matter	white matter
1- refers to the darker.	1- describes the lighter.
2- outer portion.	2- inner section underneath.
3- primarily composed of neuron.	3- mostly made of axons.
4- In the spinal cord sits within.	4-In the spinal cord the white matter is on the outside.



جامعة المستنقب
كلية العلوم
قسم الفيزياء الطبية



HUMAN ANATOMY
Lec. 4
PERIPHERAL NERVOUS SYSTEM
STAGE 3
BY
DR. MOHAMMED AL-MURIB

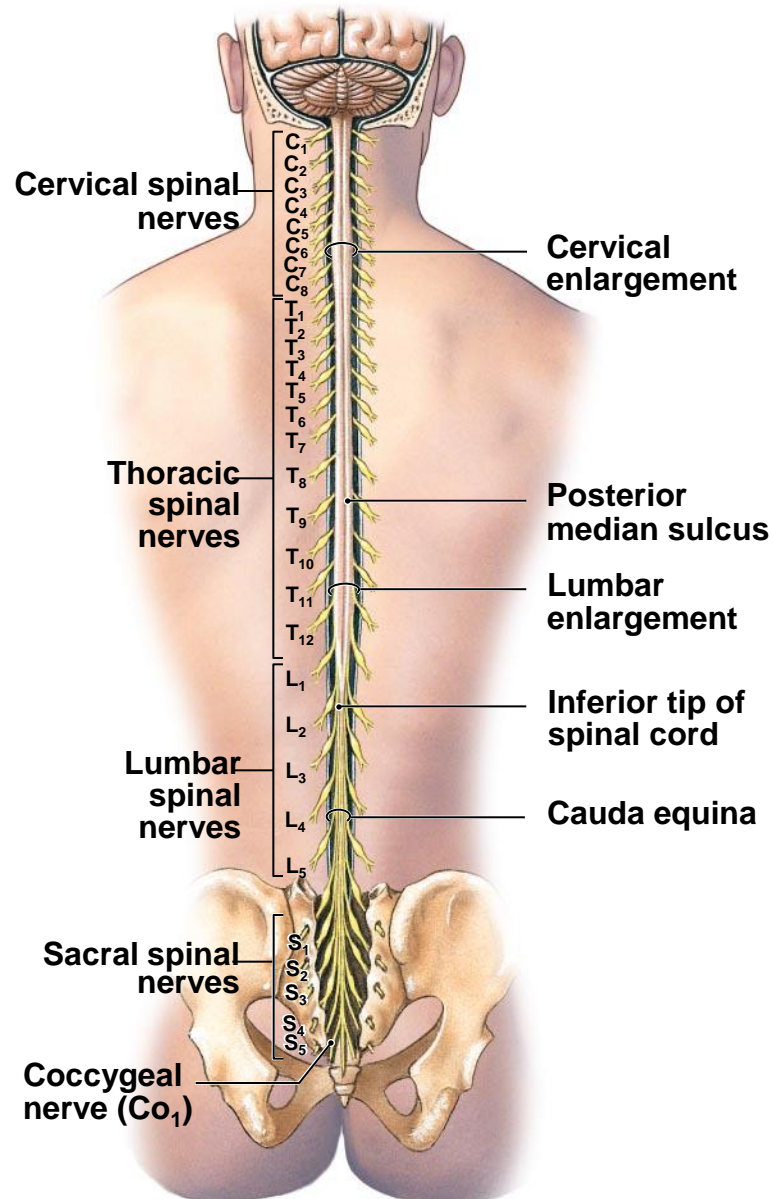
Peripheral Nervous System

- Links the CNS to the rest of the body through **peripheral nerves**
- They include the **cranial nerves** and the **spinal nerves**
- The cell bodies of sensory and motor neurons are contained in the **ganglia**

The Spinal Nerves

- Found in 31 pairs grouped according to the region of the vertebral column
 - 8 pairs of cervical nerves, C_1 – C_8
 - 12 pairs of thoracic nerves, T_1 – T_{12}
 - 5 pairs of lumbar nerves, L_1 – L_5
 - 5 pairs of sacral nerves, S_1 – S_5
 - 1 pair of coccygeal nerves, Co_1

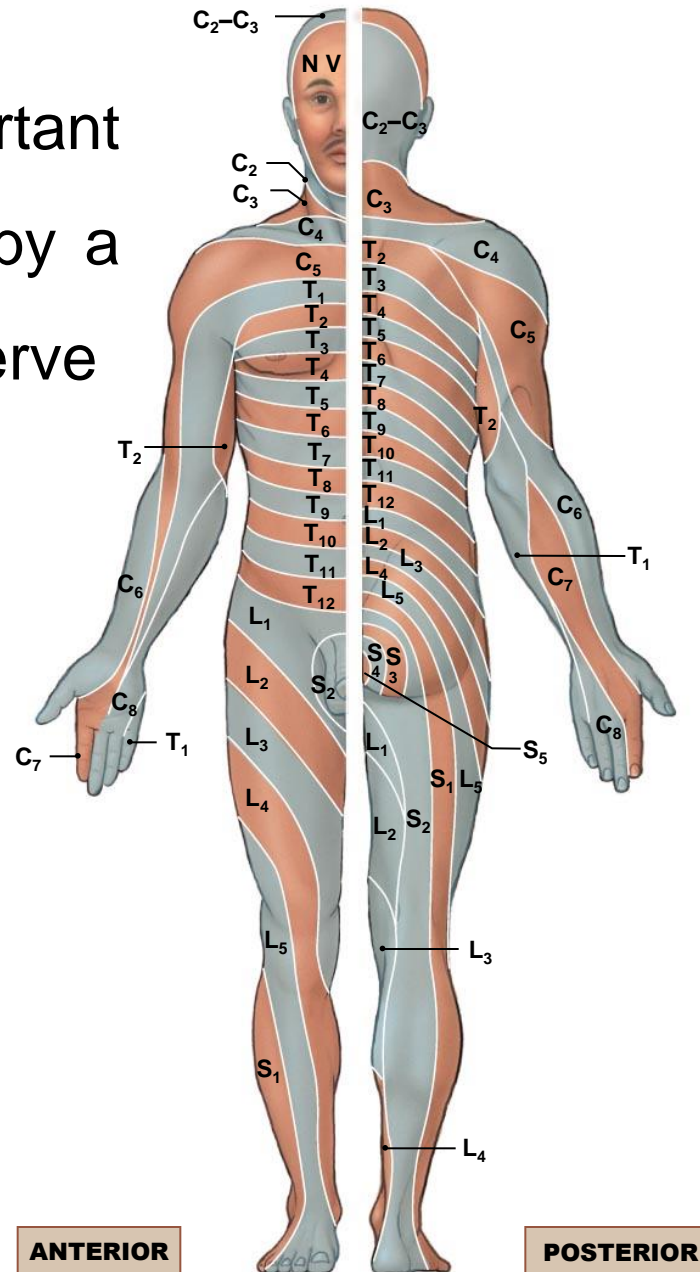
Gross Anatomy of the Spinal Cord.



a In this superficial view of the adult spinal cord, the designations to the left identify the spinal nerves.

Dermatomes

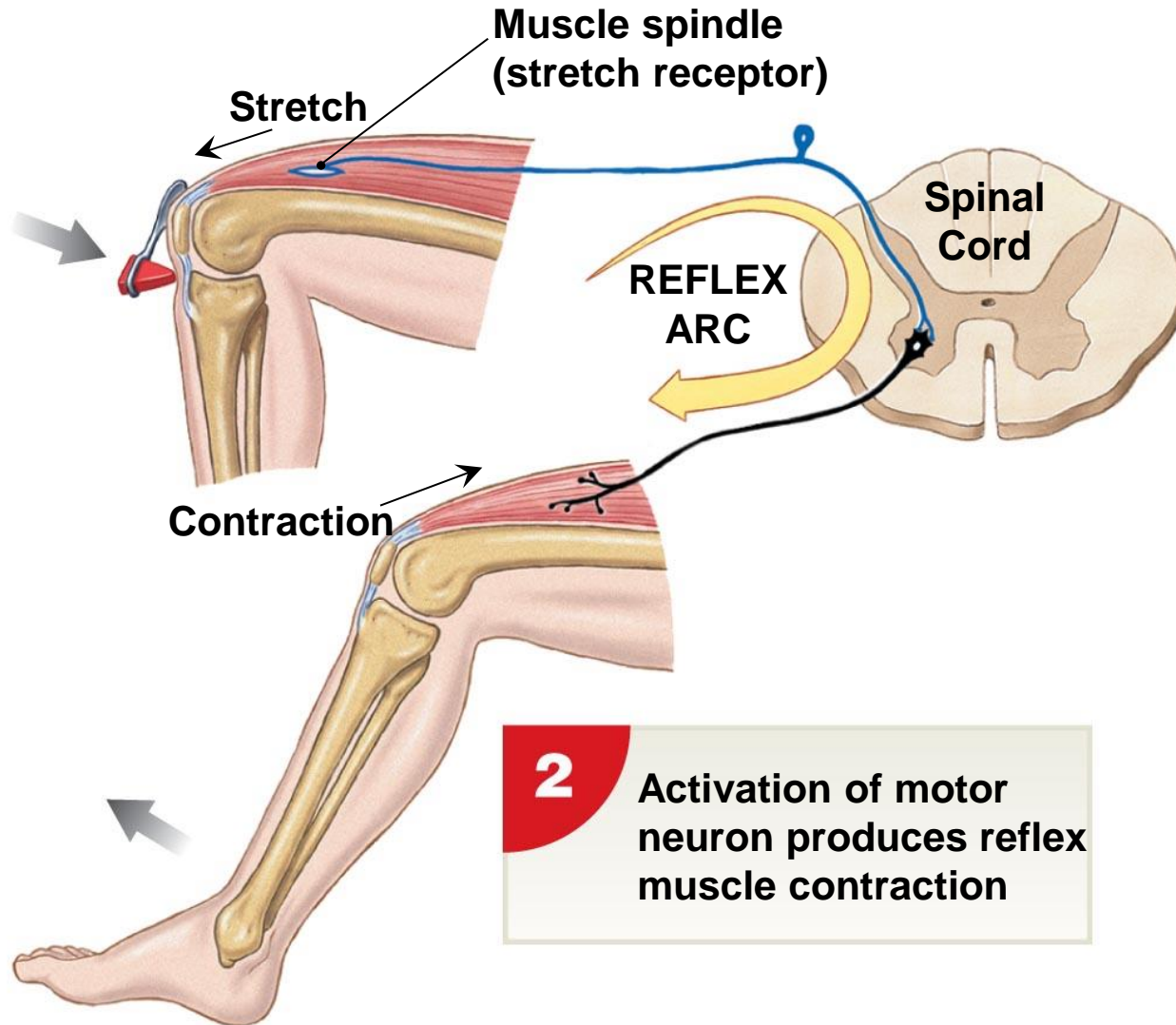
- A clinically important area monitored by a specific spinal nerve



A Stretch Reflex.

1

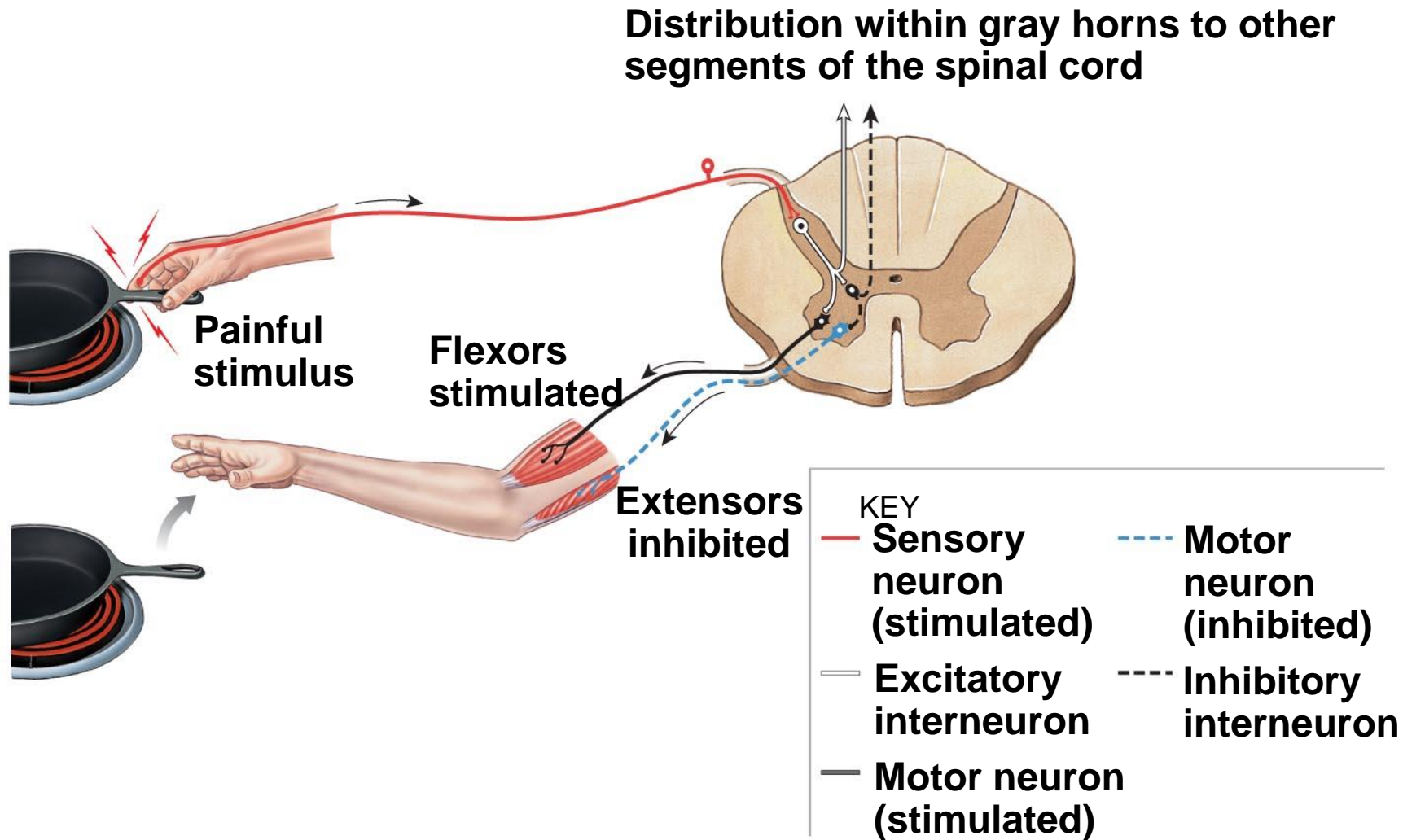
Stretching of muscle tendon stimulates muscle spindles



2

Activation of motor neuron produces reflex muscle contraction

Figure 8-30 The Flexor Reflex, a Type of Withdrawal Reflex.



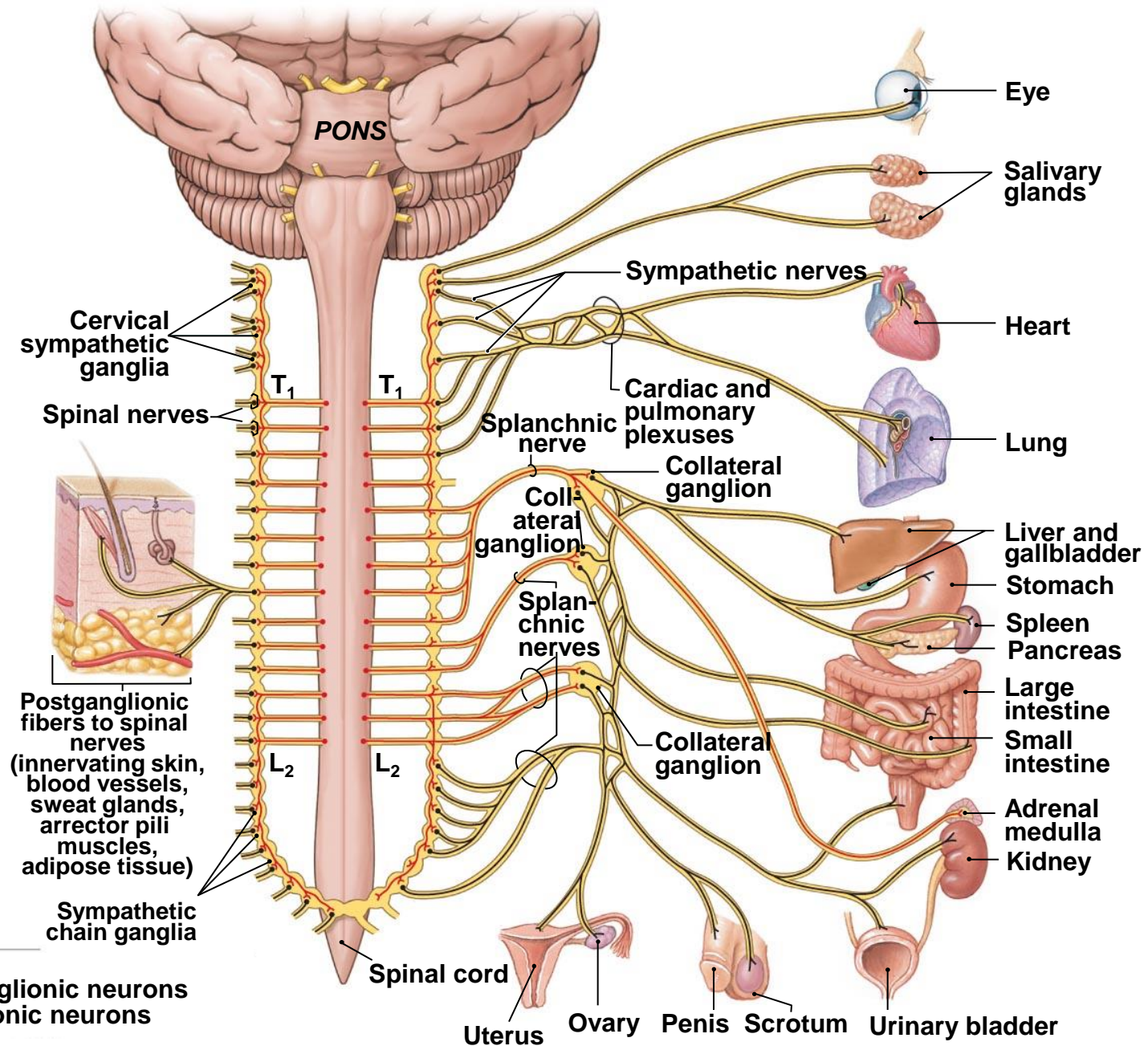
The Autonomic Nervous System (ANS)

- The somatic Nervous System and Autonomic Nervous System are anatomically different
 - SNS: one neuron to skeletal muscle
 - ANS: two neurons to cardiac and smooth muscle, glands, and fat cells and divided to:
 - **Sympathetic division**
 - **Parasympathetic division**

The Sympathetic Division

- Also called the "fight-or-flight" division
- **Sympathetic chain**
 - Arises from spinal segments T_1-L_2
- **Effects**
 - Increase in alertness, metabolic rate, sweating, heart rate, blood flow to skeletal muscle
 - Dilates the respiratory bronchioles
 - Decreased blood flow to the digestive organs

The Sympathetic Division.

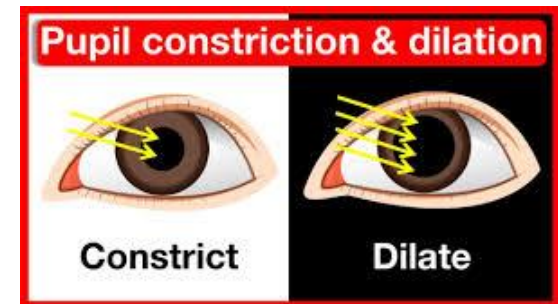


KEY

- Preganglionic neurons
- Ganglionic neurons

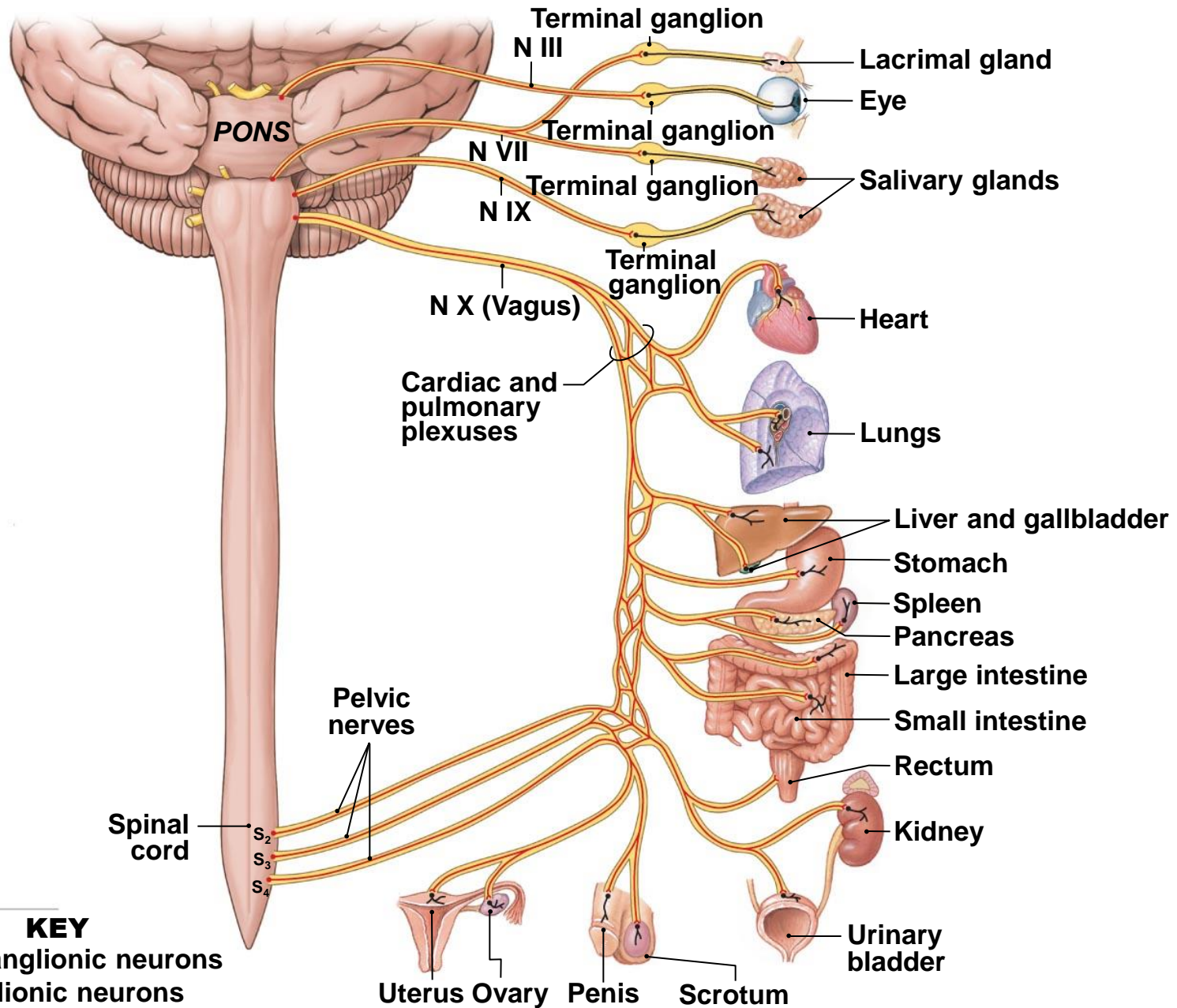
The Parasympathetic Division

- Also called "rest-and digest" division
- Include cranial nerves III, VII, IX, and X, a major parasympathetic nerve
- Include fibers of the sacral areas form the **pelvic nerves**



- Effects
 - Constriction of the pupils, increase in digestive secretions, increase in digestive tract smooth muscle activity
 - Stimulates urination and defecation
 - Constricts bronchioles, decreases heart rate

The Parasympathetic Division.



Aging and the Nervous System

- Common changes
 - Reduction in brain size and weight and reduction in number of neurons
 - Reduction in blood flow to the brain
 - Change in synaptic organization of the brain
 - **Senility** can be a result of all these changes