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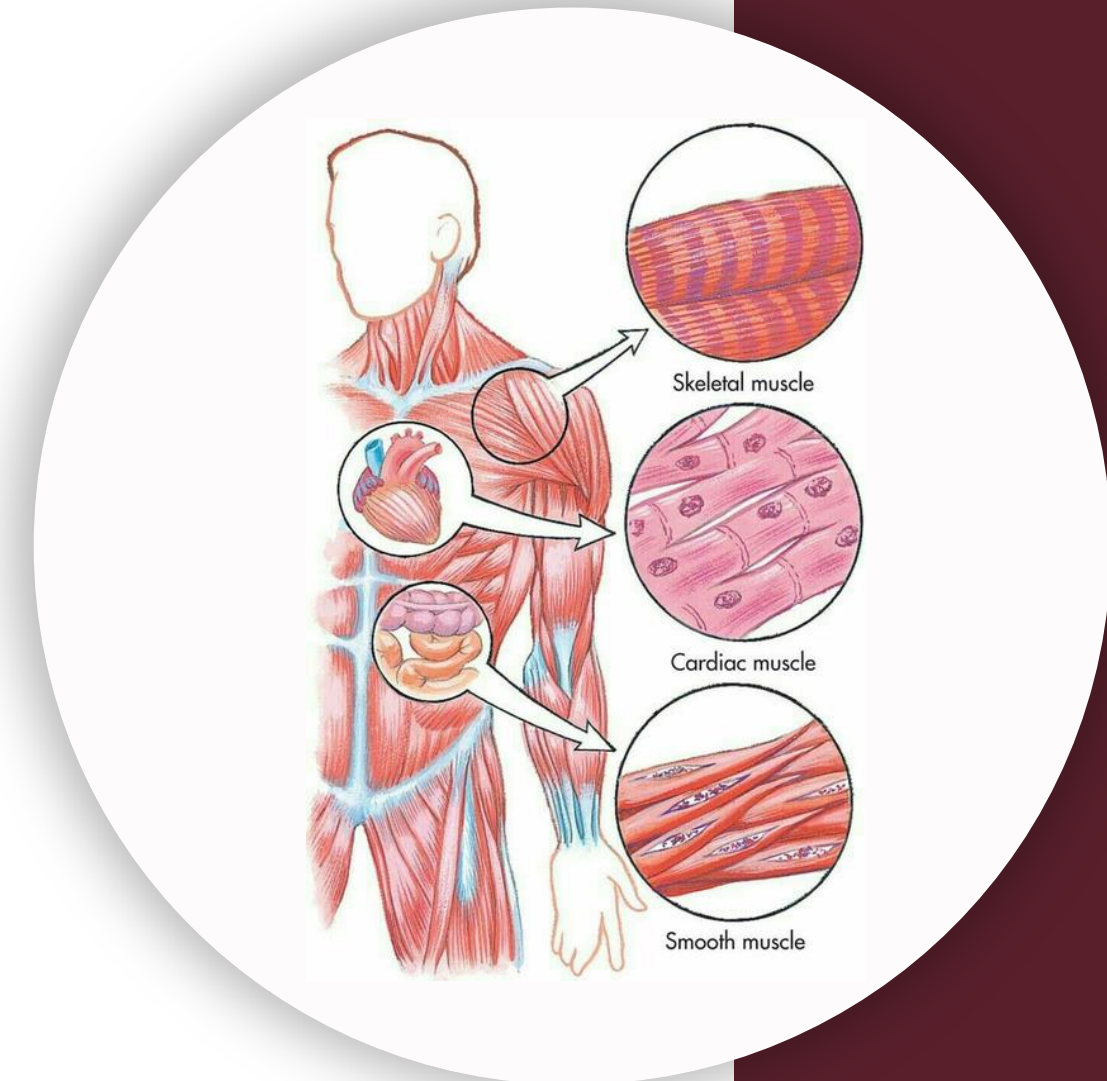


Histology – Final 6

Nervous Tissue

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NERVOUS TISSUE

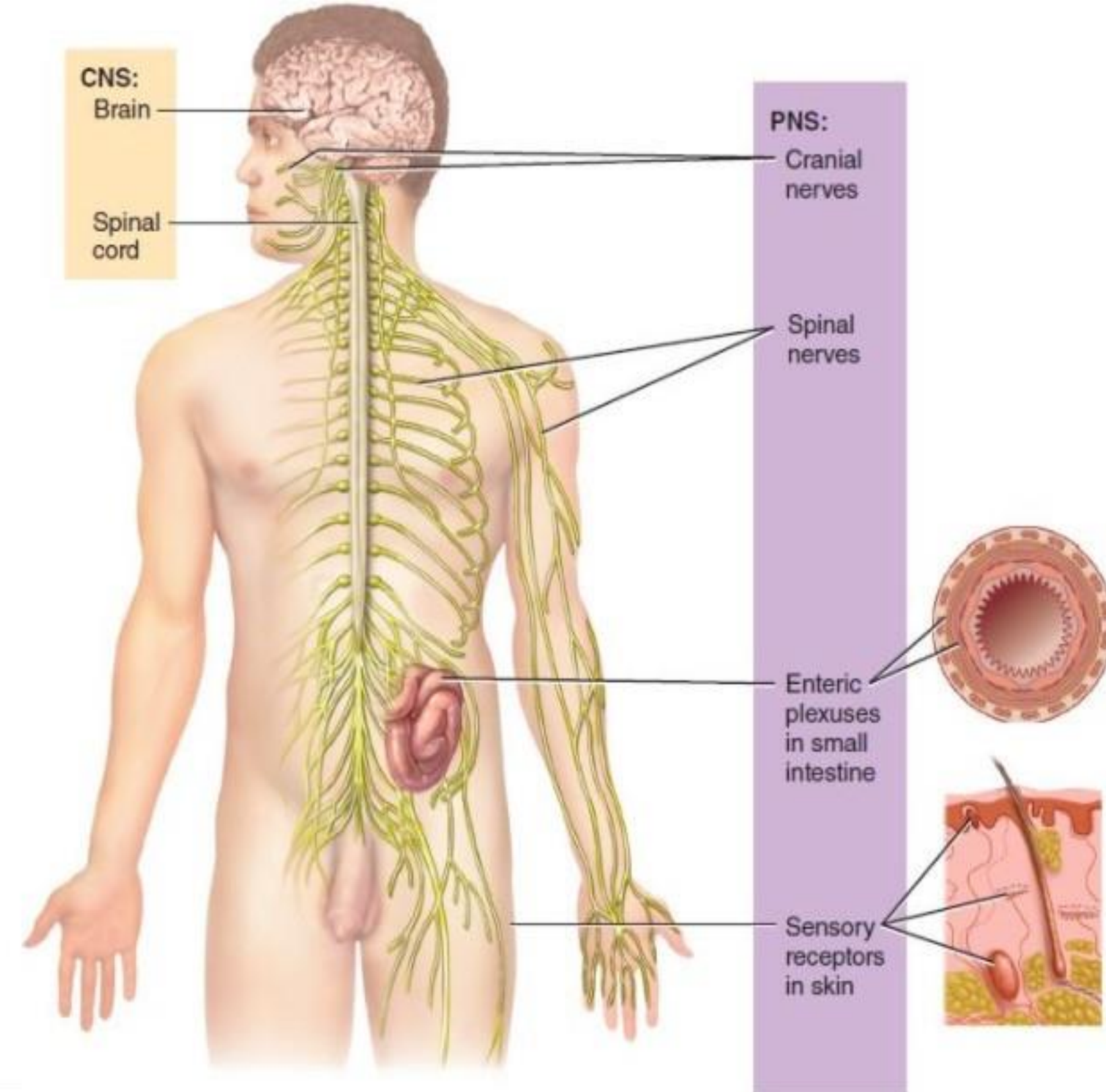
JANQUEIRA'S BASIC HISTOLOGY

STRUCTURE AND ORGANIZATION

1. **Central nervous system (CNS):** brain and spinal cord
2. **Peripheral nervous system (PNS):** cranial, spinal, and Ganglia: small aggregates of nerve cells outside the CNS.

Those are the elements of the nervous tissue that they are protected and contained within bony cavities.

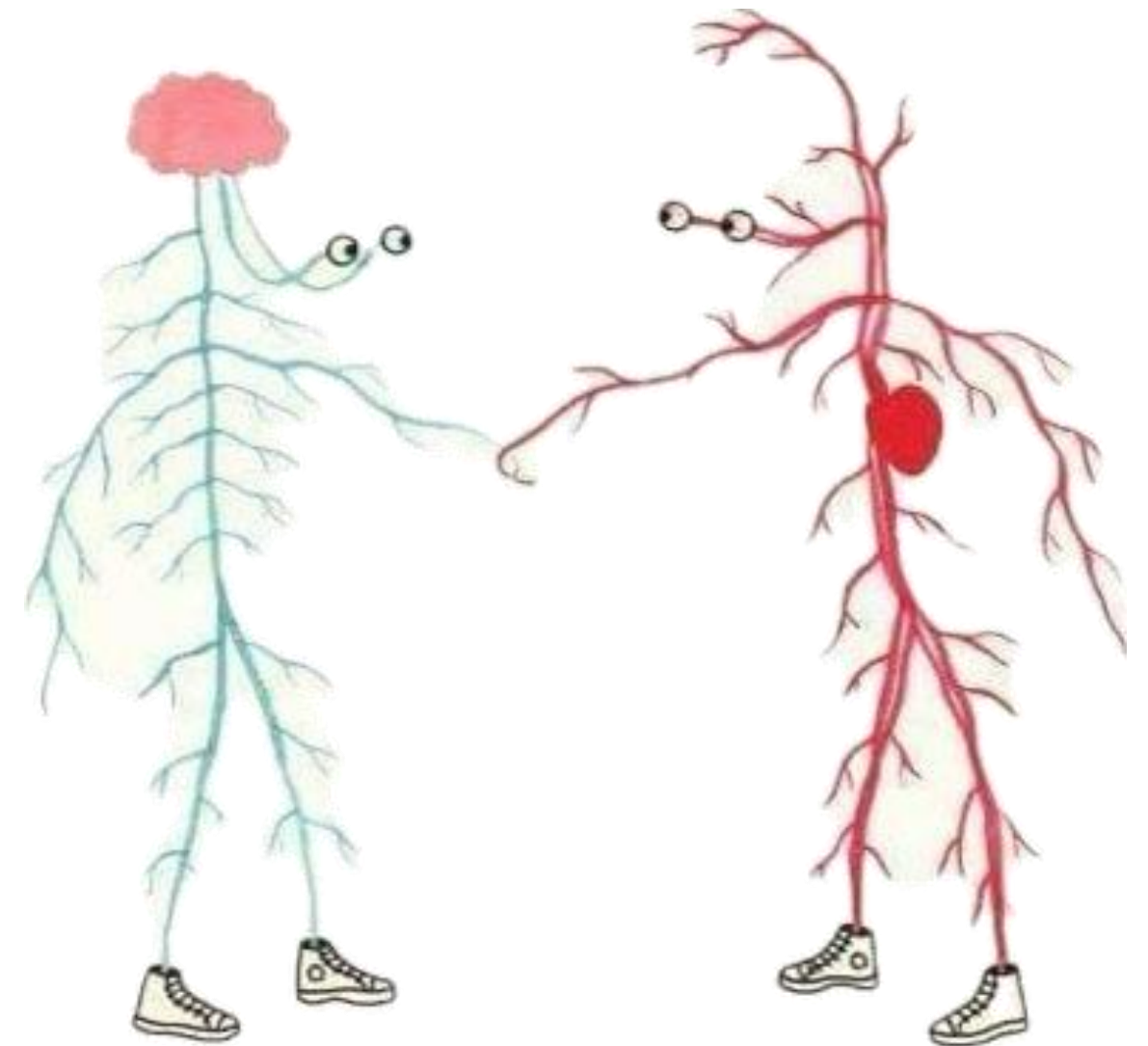
- Neurons: have numerous long processes, responsible for neural synapses (the building blocks and functional units of the nervous tissue)
- Glial cells: short processes: support and protect neurons. (Not involved in the neurons activity but they support and protect them)



Dr's notes about the previous slide

- **Cranial nerves** : (peripheral) nerves that *exit* the brain.
- **Spinal nerves** : (peripheral) nerves that *exit* the spinal cord.
- Whatever is attached to the CNS and is outside of the **Brain** and **Spinal cord**, whatever is leaving these two organs, whatever is coming back to these two organs is called the **Peripheral Nervous System**.

CNS and peripheral nervous system
Are the anatomical division (in terms of location)



SENSORY AND MOTOR

Functionally the nervous system consists of:

1. Sensory division (afferent) (has to do with information sent toward the CNS)

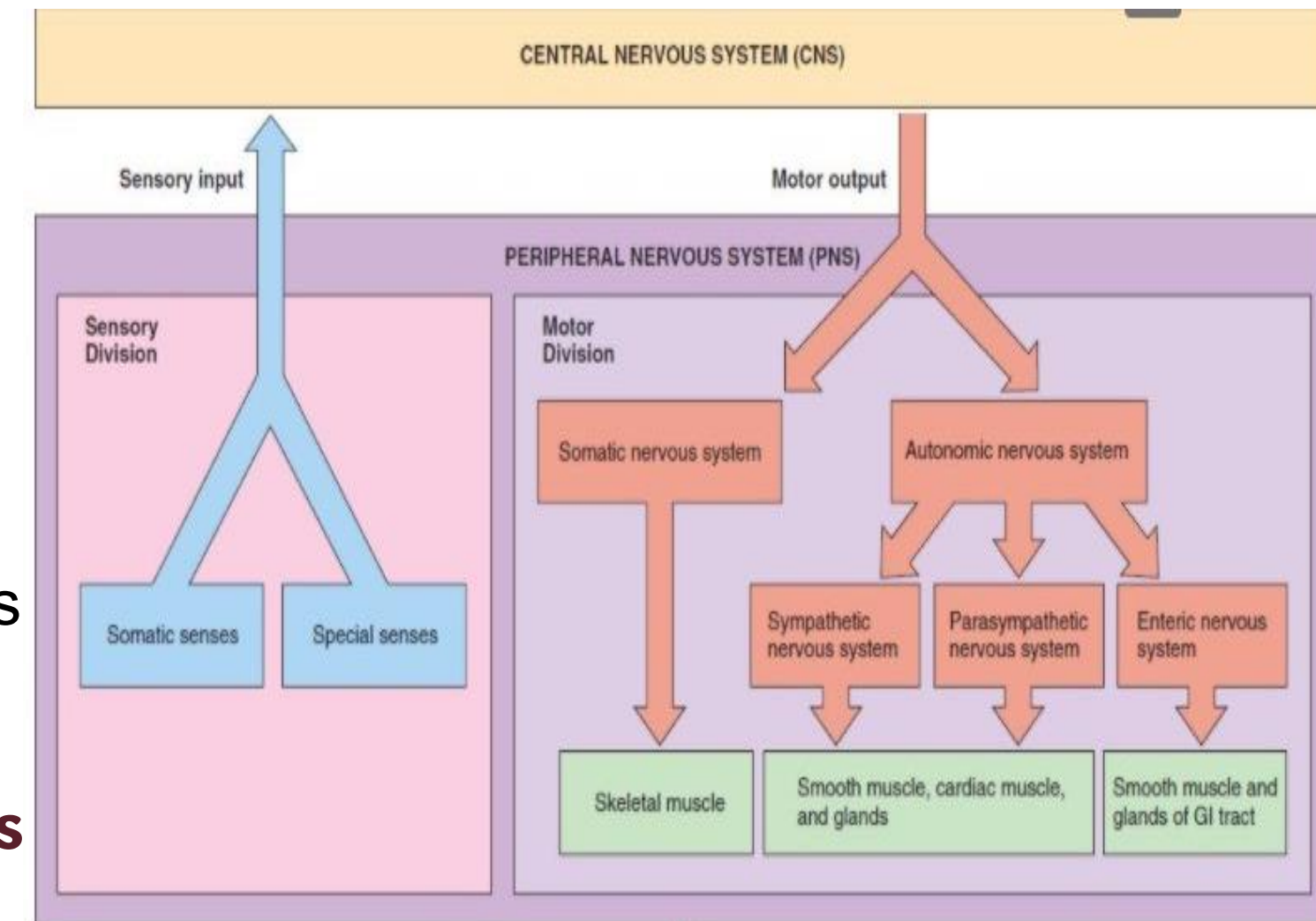
A. Somatic – sensory input perceived consciously (eg, from eyes ears, skin, musculoskeletal structures) (**sensation we feel it, we know it**)

B. Visceral – sensory input not perceived consciously (eg, from Internal organs and cardiovascular structures) (**we are not aware of**)

2. Motor division (efferent) (has to do with the information/orders leaving the CNS toward the periphery)

A. Somatic – motor output controlled consciously or voluntarily (eg, by skeletal muscle effectors)

B. Autonomic – motor output not controlled consciously (eg, by heart or gland effectors)

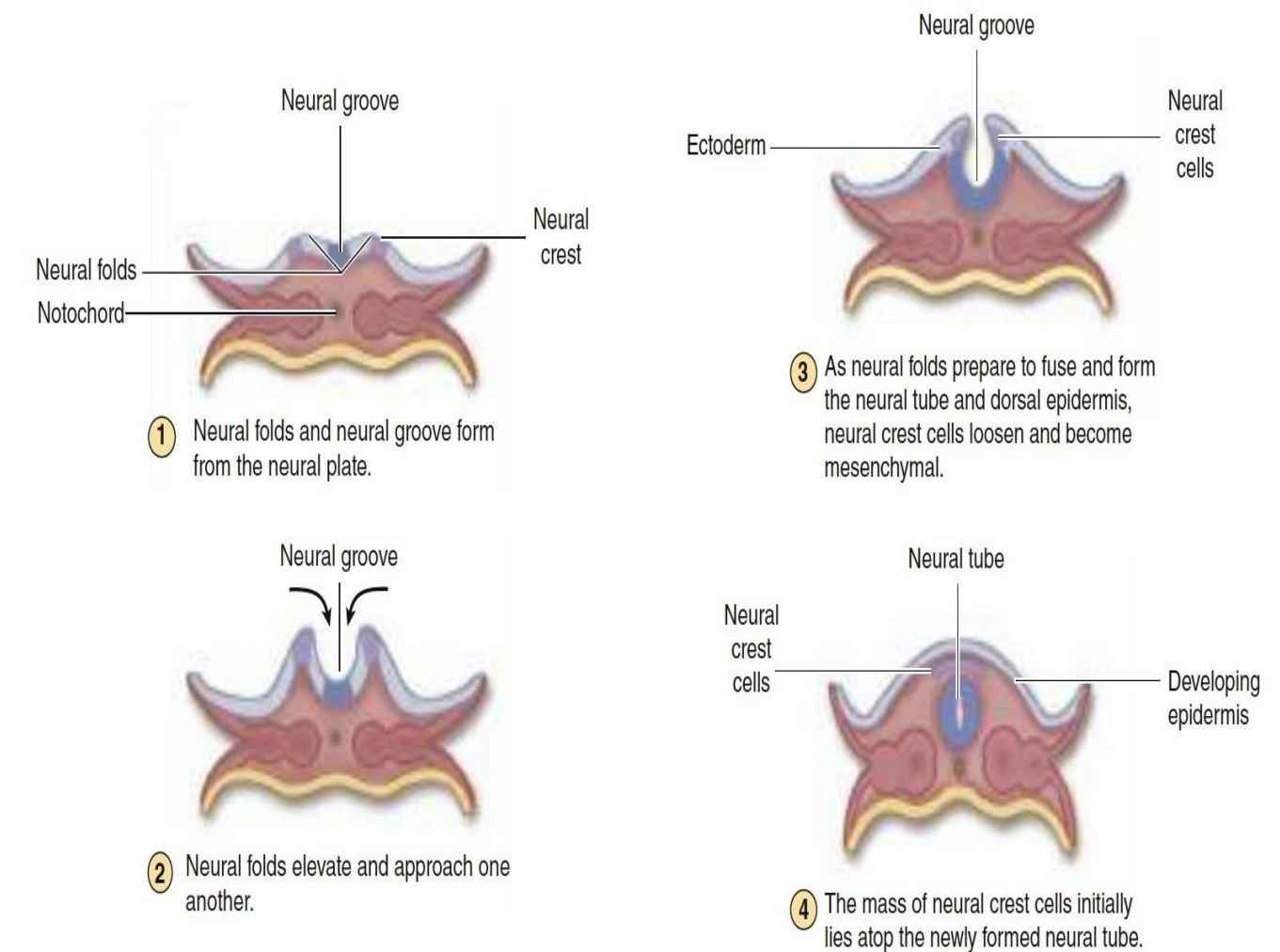


Sensory : to deal with sth that we are aware of such as heat, temperature, pressure or the sensation that comes from the joints and muscles.
Also the other sensations that we're not aware of like the blood pressure..

DEVELOPMENT OF NERVE TISSUE

- Nervous tissue develops from the **ectoderm**.
- Beginning in the third week of development.
- Ectoderm--thickening--epithelial neural plate--folds and forms the **Neural tube**— gives rise to entire CNS (neurons and most glial cells). **neural tube will separate from the remainder of the ectoderm and it will grow inside whereas the two edges of the ectoderm touch each other and it will later form the epidermis .**
- **Neural crest**--migrate--- gives rise to cells of PNS and several other tissues.

FIGURE 9-2 Neurulation in the early embryo.



NEURONS

- The functional unit in both the CNS and PNS

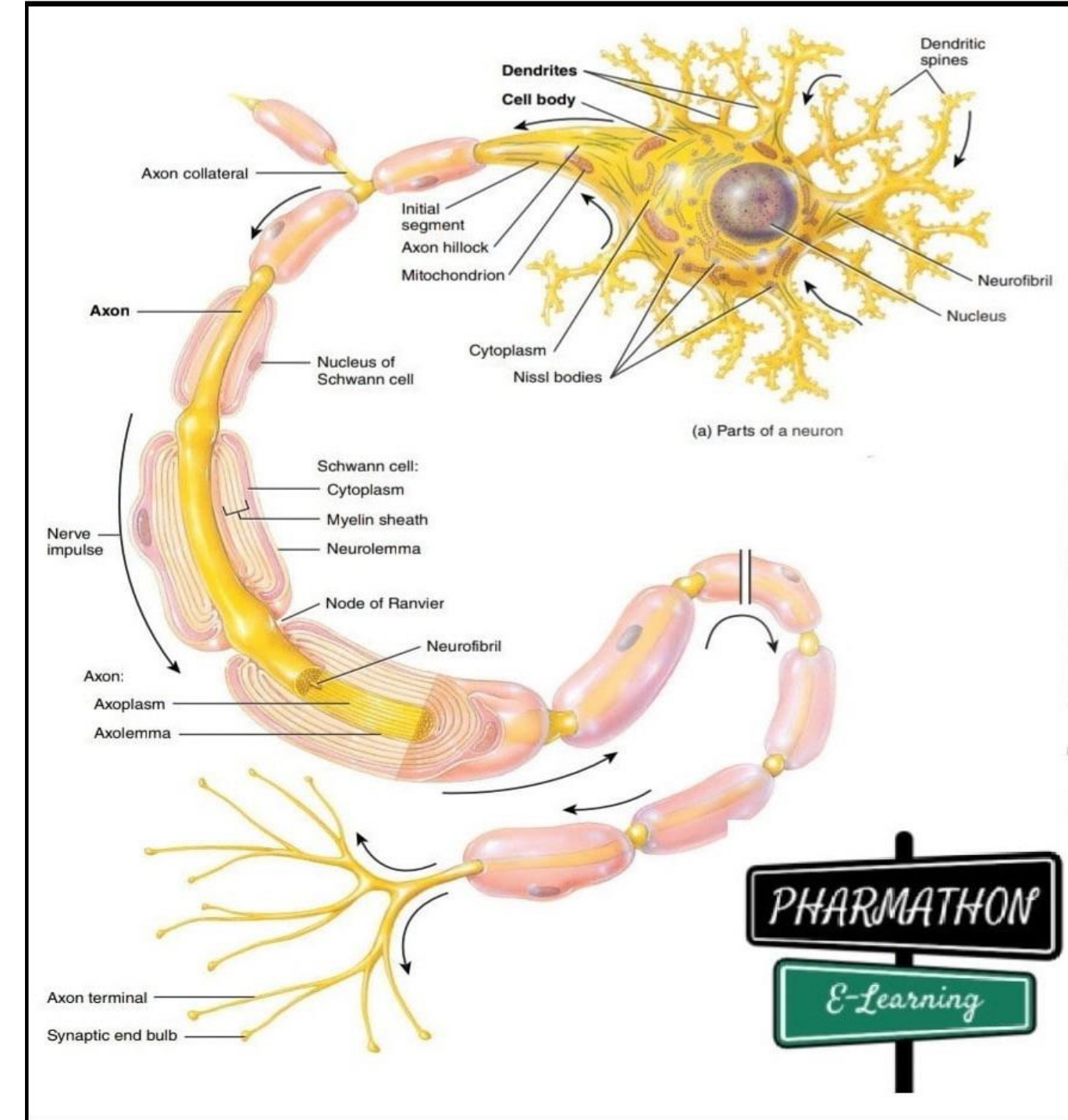
Parts of a neuron:

1. Cell body (perikaryon or soma)

- Contains the nucleus and most of the cell's organelles
- The synthetic or trophic center for the entire neuron.

2. **Dendrites:** *numerous* elongated processes extending from the perikaryon and specialized to receive stimuli from other neurons. **(Numbers depend on the type of the neuron)**

3. **Axon:** a *single* long process ending at synapses specialized to generate and conduct nerve impulses to other cells (nerve, muscle, and gland cells).



NEURON CLASSIFICATION-STRUCTURALLY

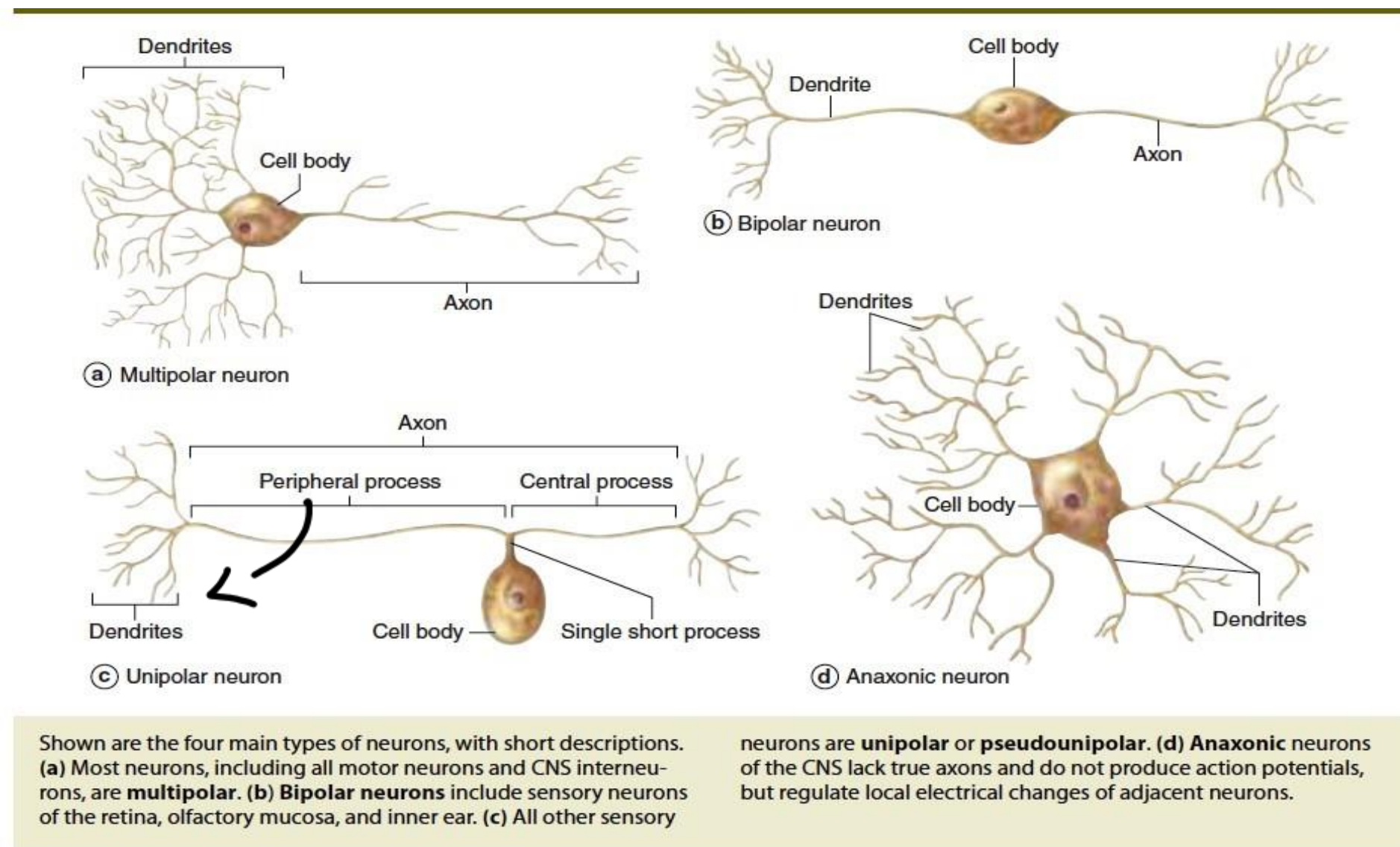
- Neurons are classified based on the structure and function.
- Structurally : how many processes are attached to the cell body, how many dendrites, how many axons do we have , based on that there are 4 types as u can see in the picture :

1. **Multipolar neurons:** one axon and two or more dendrites, **most common**. Usually the motor neurons are in this type.

2. **Bipolar neurons:** one dendrite and one axon, sensory neurons of the retina, the olfactory epithelium, and the inner ear.

3. **Unipolar or pseudounipolar neurons:** single process that bifurcates close to the perikaryon; longer branch extending to a peripheral ending and the other toward the CNS; all other sensory neurons.

4. **Anaxonic neurons:** many dendrites but no true axon, do not produce action potentials, but regulate electrical changes of adjacent CNS neurons. (Very unique type and it's not fully understood or explored)



NEURON CLASSIFICATION-FUNCTIONALLY

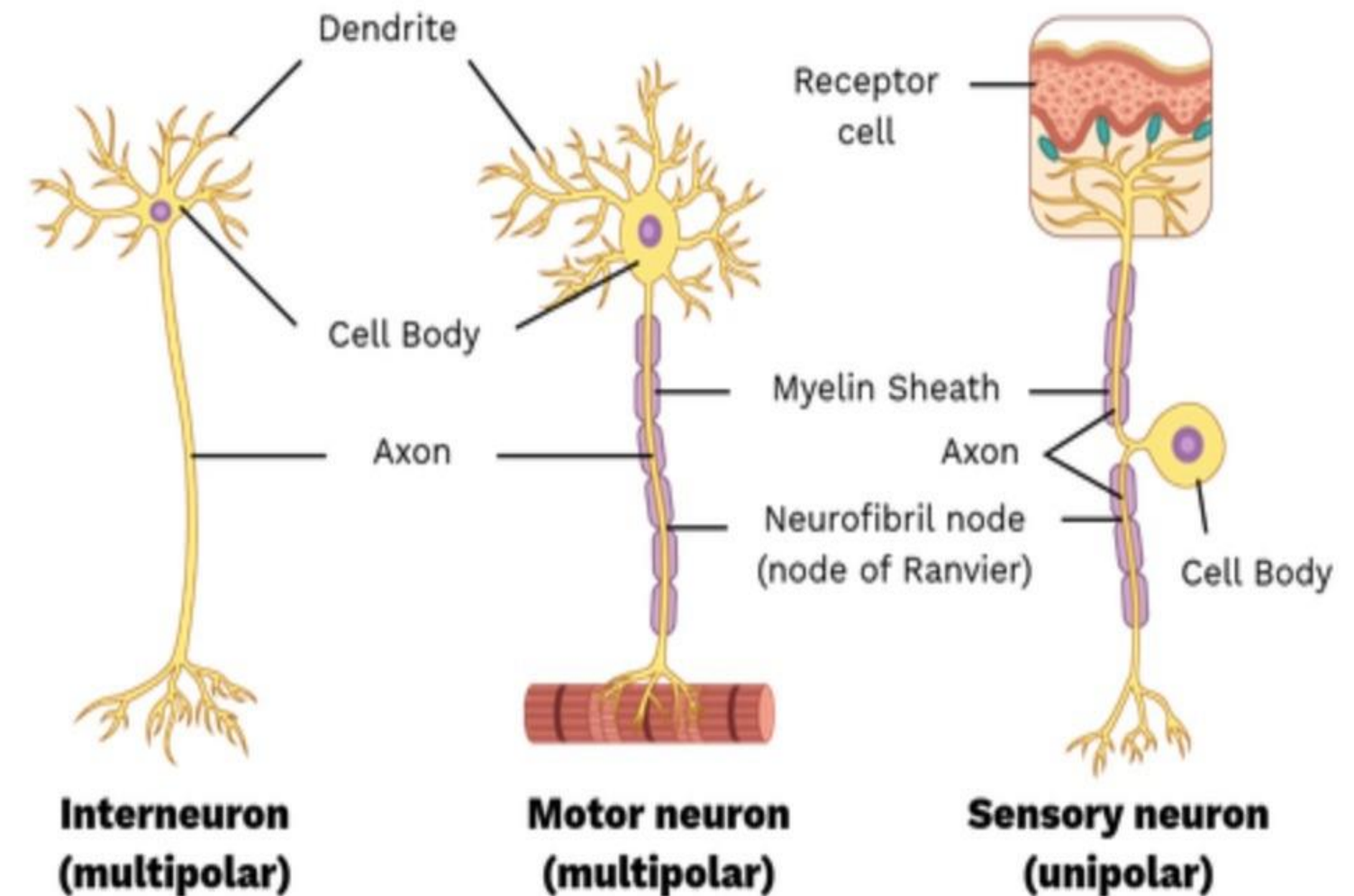
We have discussed it in slide 6

➤ **Sensory** neurons (afferent):

1. Sensory input perceived consciously (eyes ears, skin, musculoskeletal structures).
2. Visceral – sensory input NOT perceived consciously (Internal organs and cardiovascular structures). *We're not aware of, we don't know it*

➤ **Motor** neurons(efferent): sending impulses to effector organs muscle fibers and glands.

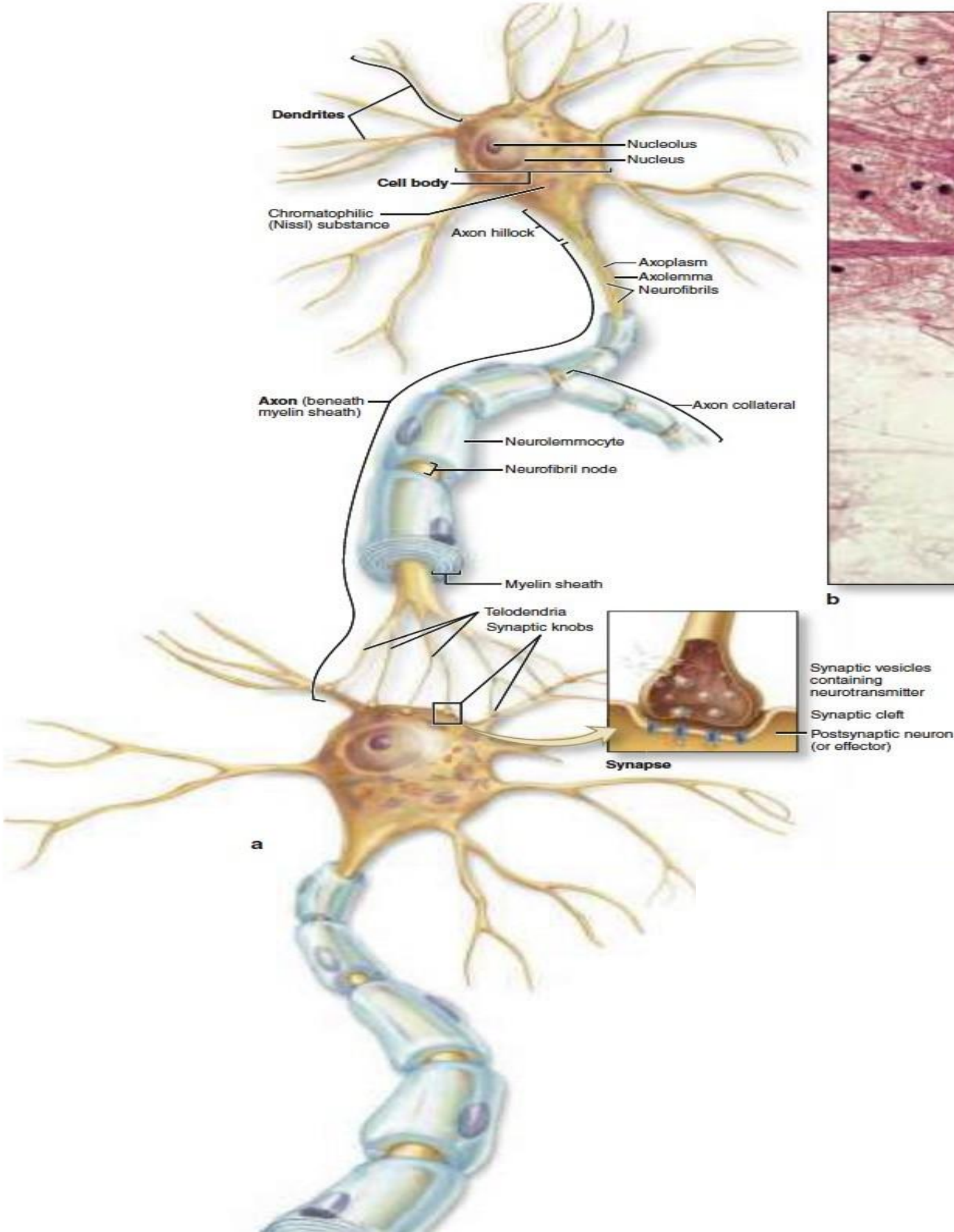
3. Somatic motor nerves-- voluntary -- skeletal muscle.
4. Autonomic motor nerves-- involuntary or unconscious-- glands, cardiac muscle, and smooth muscle. *We don't have control over this*



Surprisingly, we have a third type !!

- **Interneurons** establish relationships among other neurons (*connect other types together*) forming complex functional networks or circuits in the CNS. Interneurons are either **multipolar** or anaxonic and comprise 99% of all neurons in adults.

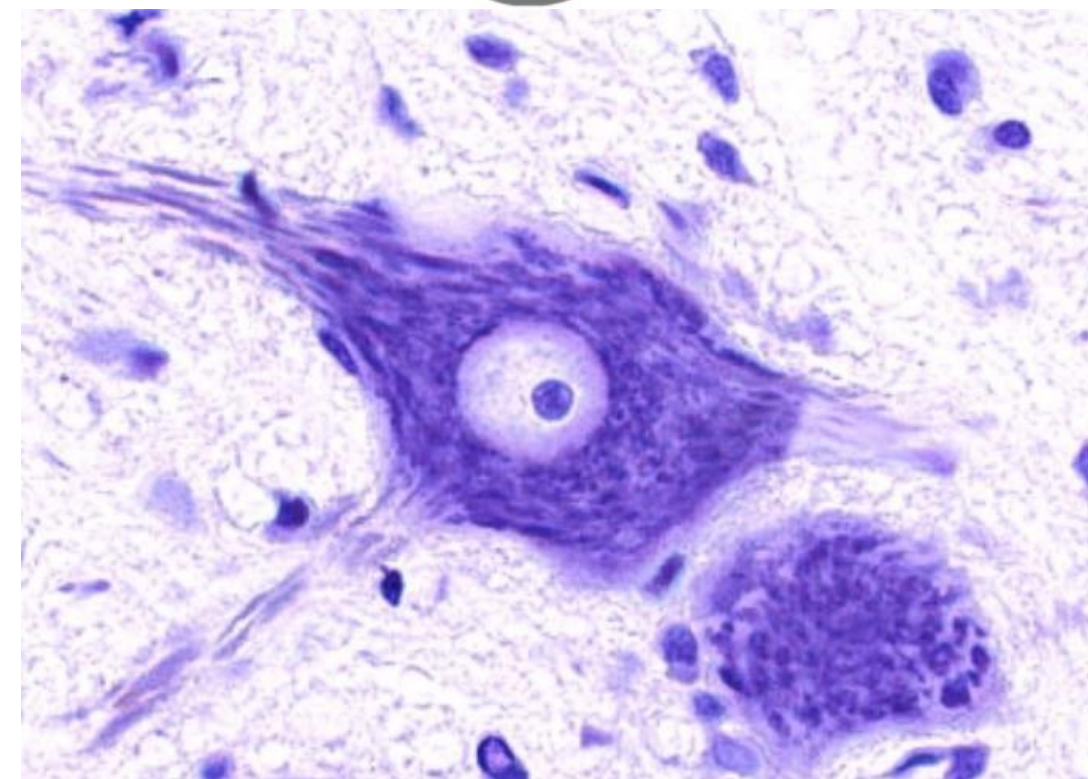
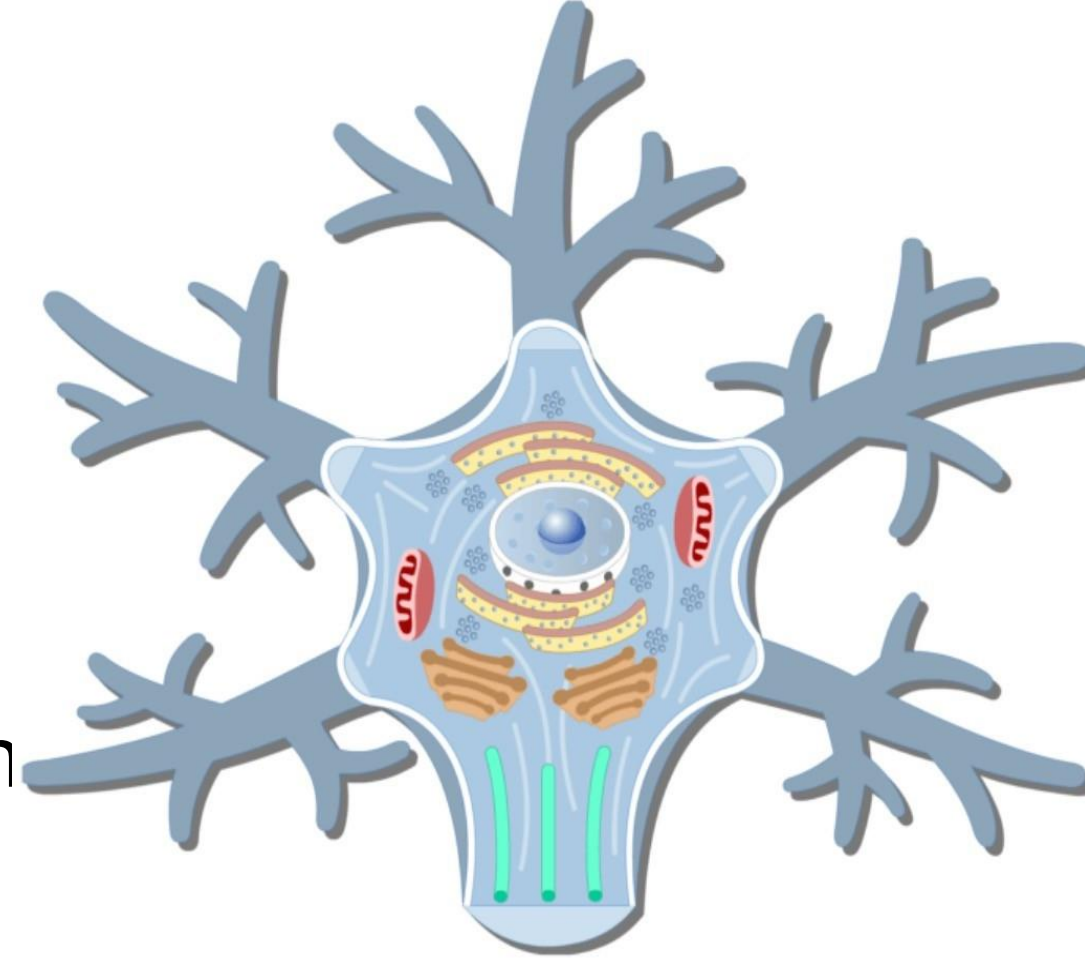
NEURON PARTS



CELL BODY (PERIKARYON OR SOMA)

The most important part

- Contains the nucleus and surrounding cytoplasm.
- It acts as a trophic center. which means that's involve in synthesis and regeneration
- Most are in contact with a great number of nerve endings conveying excitatory or inhibitory stimuli.
- Large, euchromatic nucleus with a prominent nucleolus (intense synthetic activity) looking like an eye looking at you

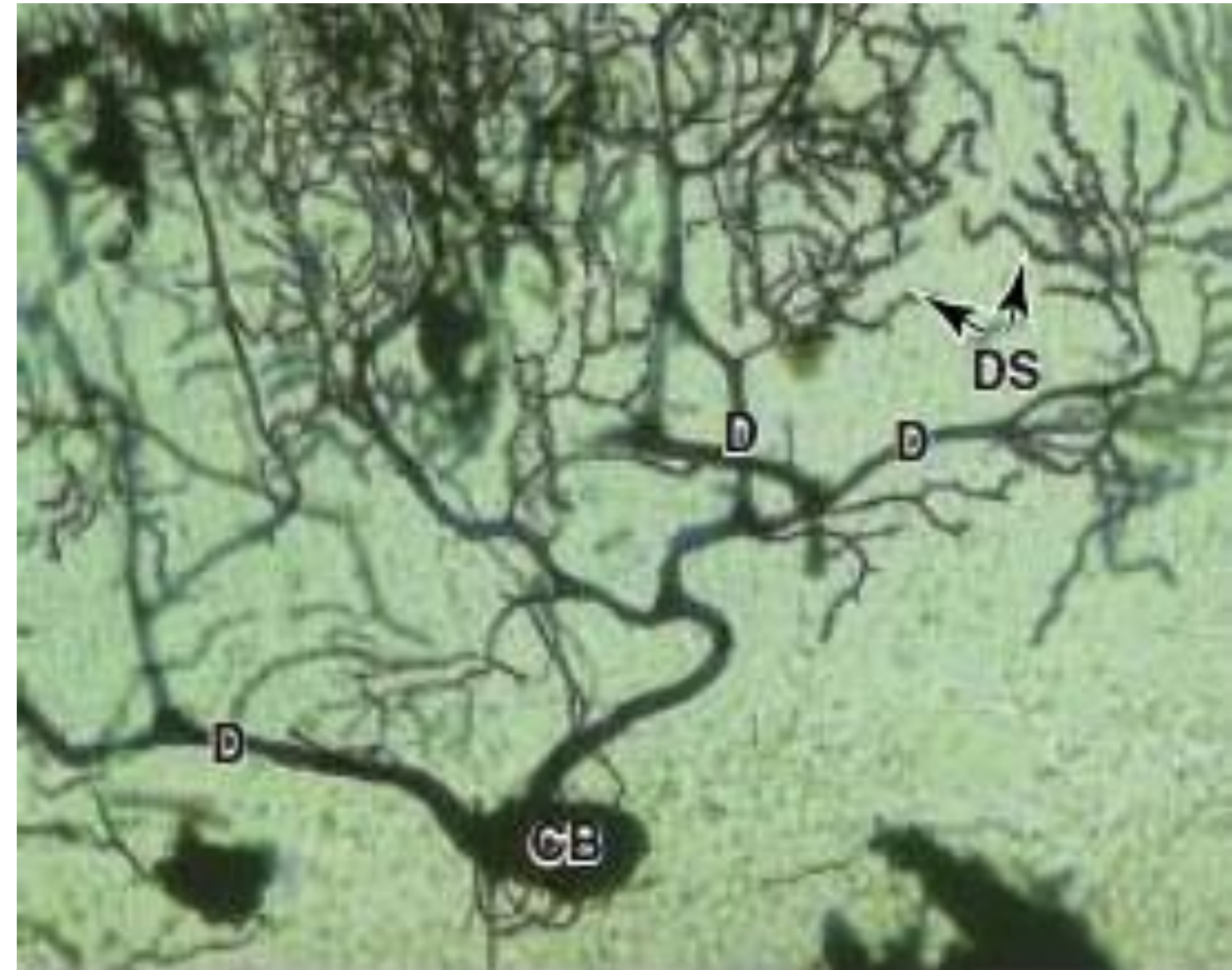


we take this image from the motor area in the spinal cord so it has a good amount of Nissl bodies

- **Nissl bodies** NB (Nissl substance, chromatophilic substance): numerous free polyribosomes and highly developed RER the amount depends on the type
- The amount of NB varies with the type and functional state of the neuron--abundant in large motor neurons.
- The Golgi apparatus is located only in the cell body.
- Mitochondria can be found throughout the cell and are usually abundant in the axon terminals.

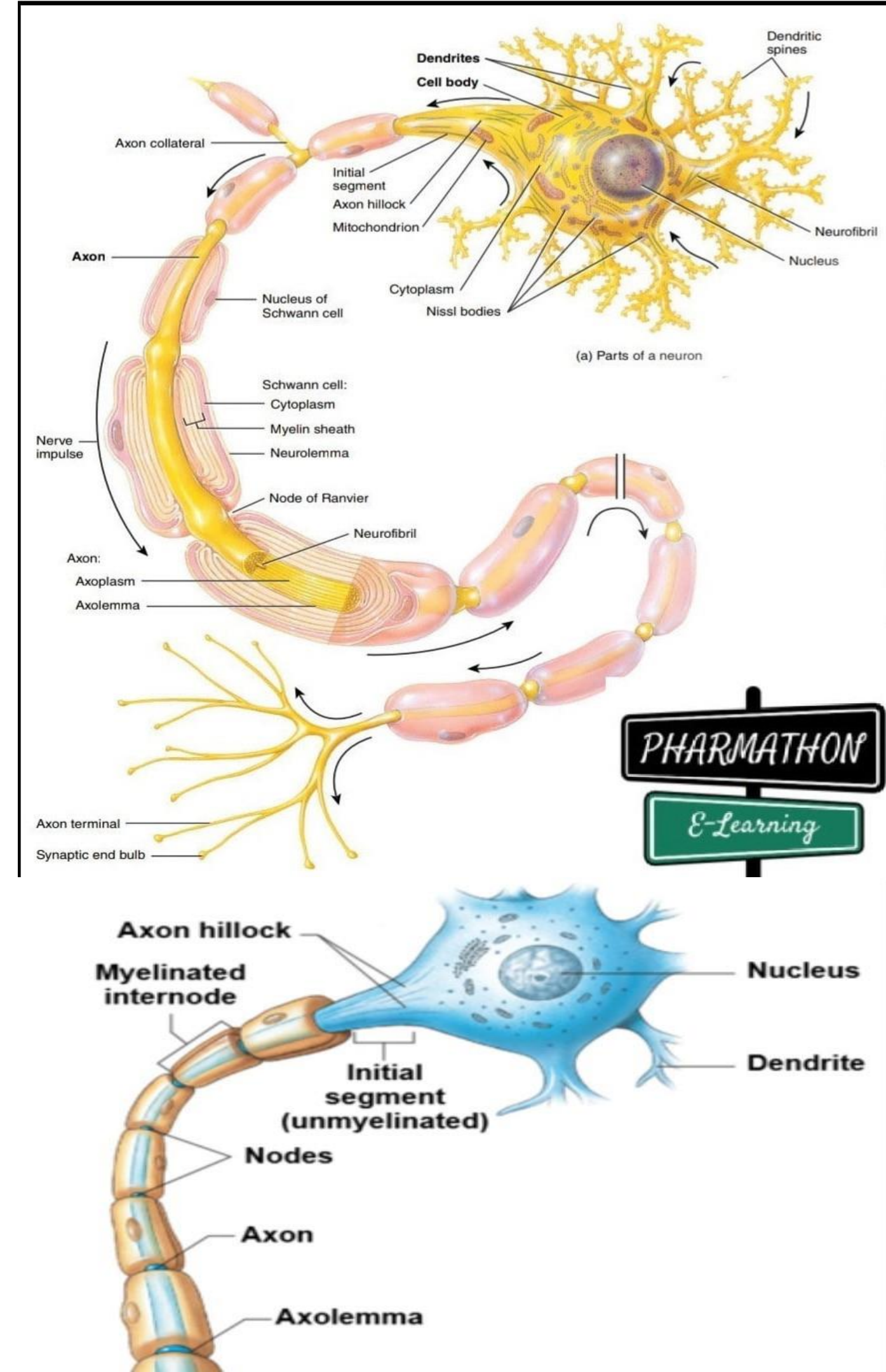
DENDRITES

- Short, small processes emerging and branching off the soma. **There number depend on the type, in motor neuron we have many of them .**
- Covered with many synapses.
- Are the principal signal reception and processing sites on neurons.
- The large number and extensive arborization---signals from many other nerve cells.
- Dendrites become much thinner as they branch.
- Dendritic spines: dynamic membrane protrusions along the dendritic branches



AXONS

- Most neurons have only one axon.
- Axonal processes vary in length and diameter ---type of neuron.
- Axolemma: plasma membrane.
- Axoplasm: contents of axon.
- Axon hillock: pyramid-shaped region of the perikaryon where axons originate from.
- Initial segment: concentrated ion channels which generate the action potential
- Axons branch less than dendrites---but undergo terminal arborization.



AXONS

- Axons of interneurons and some motor neurons also have major branches called collaterals that end at smaller branches with synapses influencing the activity of many other neurons.
- Terminal bouton: Small axonal branch ends with a dilation-- contacts another neuron or non-nerve cell **such as muscles or glands** .
- **Axoplasm** contains mitochondria, microtubules, neurofilaments, and transport vesicles, but very few polyribosomes or cisternae of RER (dependence of axoplasm on the perikaryon). **It does not have nissl bodies , they only concentrated in the cell body** .

Additional Resources:

رسالة من الفريق العلمي:

Extra References for the Reader to Use:

1. <https://youtu.be/eToiPPc6ZzU?si=LnRZW-SPb4jRWAYp>



For any feedback, scan the code or click on it.



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			