

Nerve Tissue

Descriptive Histology 222

Introduction to Nerve system

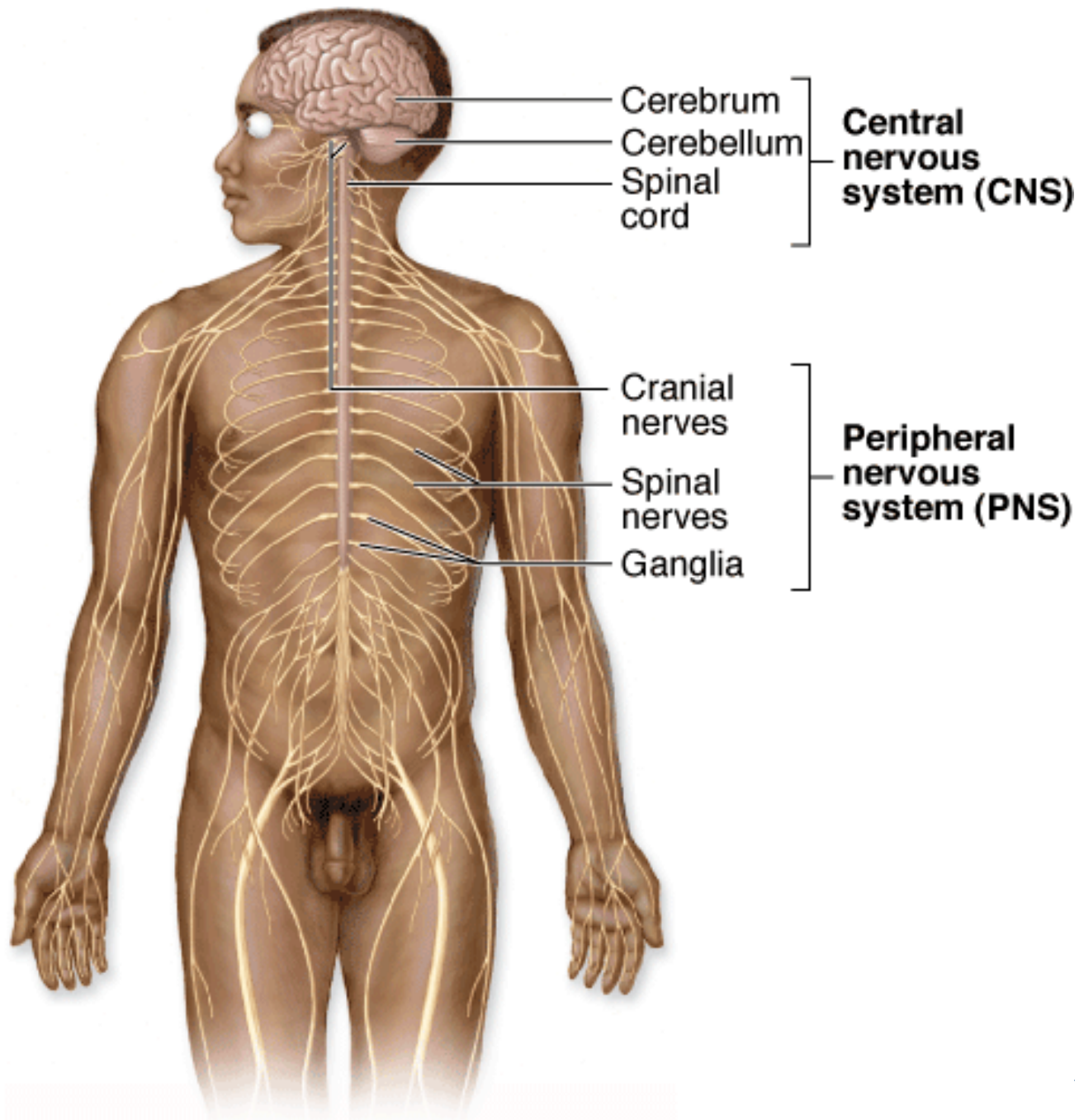
- ▶ The human nervous system is the most complex system in the body histologically and physiologically
- ▶ Formed by a network of many billion nerve cells (**neurons**), all assisted by many more supporting **glial cells**.
- ▶ Each neuron has hundreds of interconnections with other neurons forming the body integrated communications network



The nervous system divide into

- ▶ **Central nervous system (CNS)**, consisting of the brain and spinal cord.
- ▶ **Peripheral nervous system (PNS)**, composed of the cranial, spinal, and peripheral nerves conducting impulses to and from the CNS (motor and sensory nerves respectively) and **ganglia** which are small groups of nerve cells outside the CNS





Nerve tissue

Nerve tissue consists of two cell types:

- ▶ **Nerve cells, or neurons**, which usually show numerous long processes; and various
- ▶ **Glial cells** (Gr. *glia*, glue), which have short processes, support and protect neurons, and participate in neural activity, neural nutrition, and defense of cells in the central nervous system.



Development of Nerve Tissue

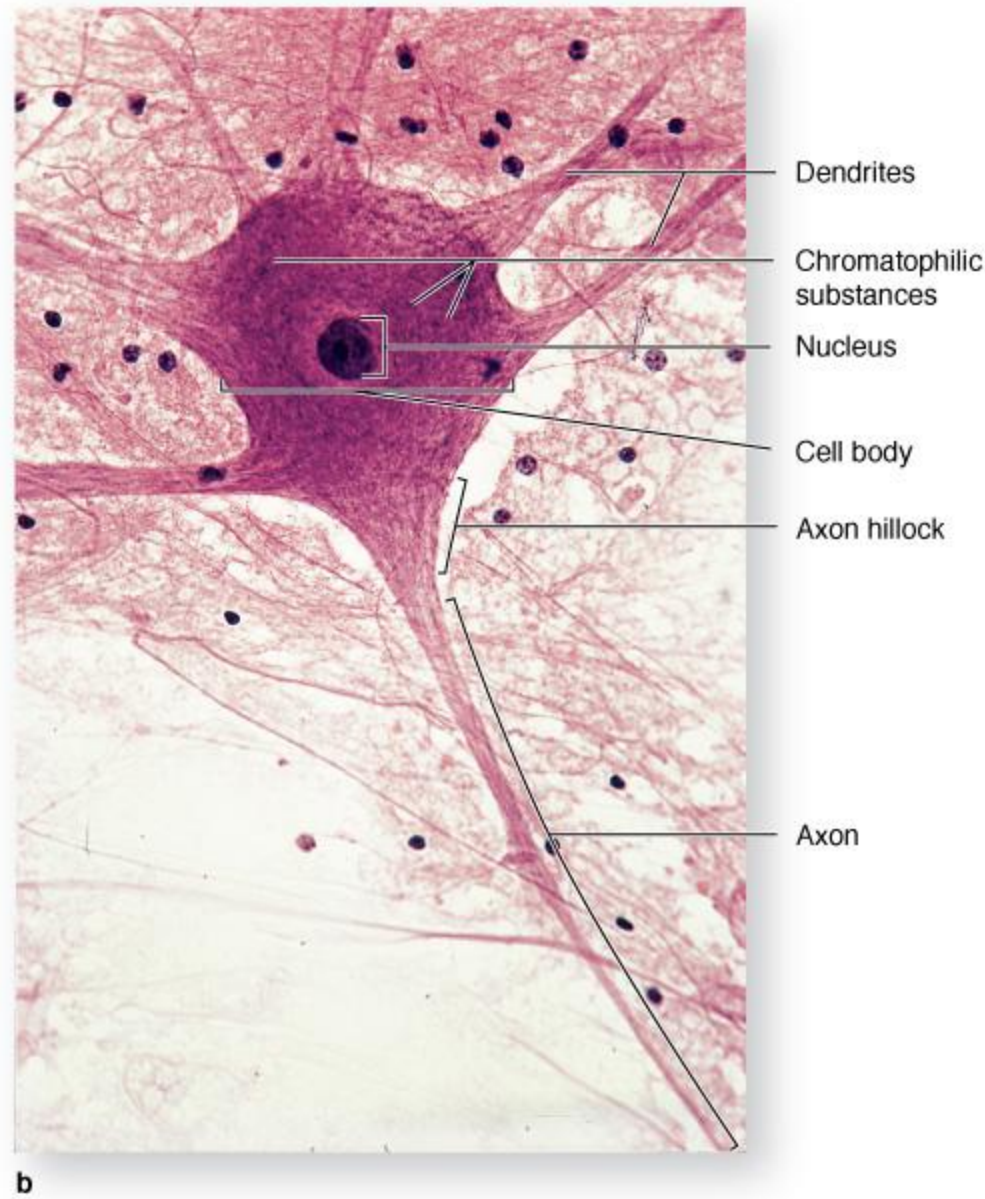
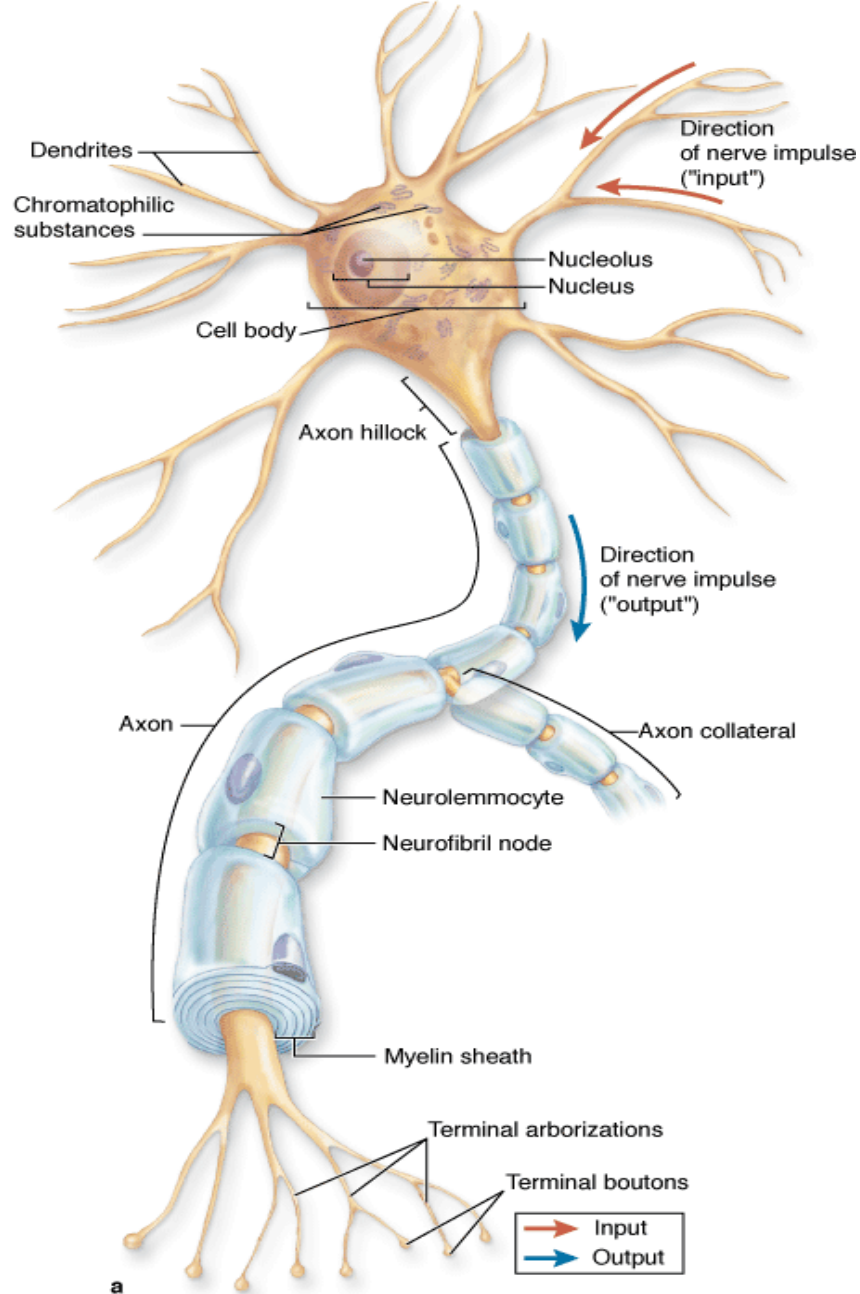
- ▶ The nervous system develops from the outer embryonic layer, the **Ectoderm**, beginning in the third week of human embryonic life



Neurons

- ▶ The functional unit in both the CNS and PNS is the **neuron or nerve cell**
- ▶ Neuron consist of:
 - ▶ **Cell Body or Perikaryon**
 - ▶ **Dendrites**
 - ▶ **Axon**



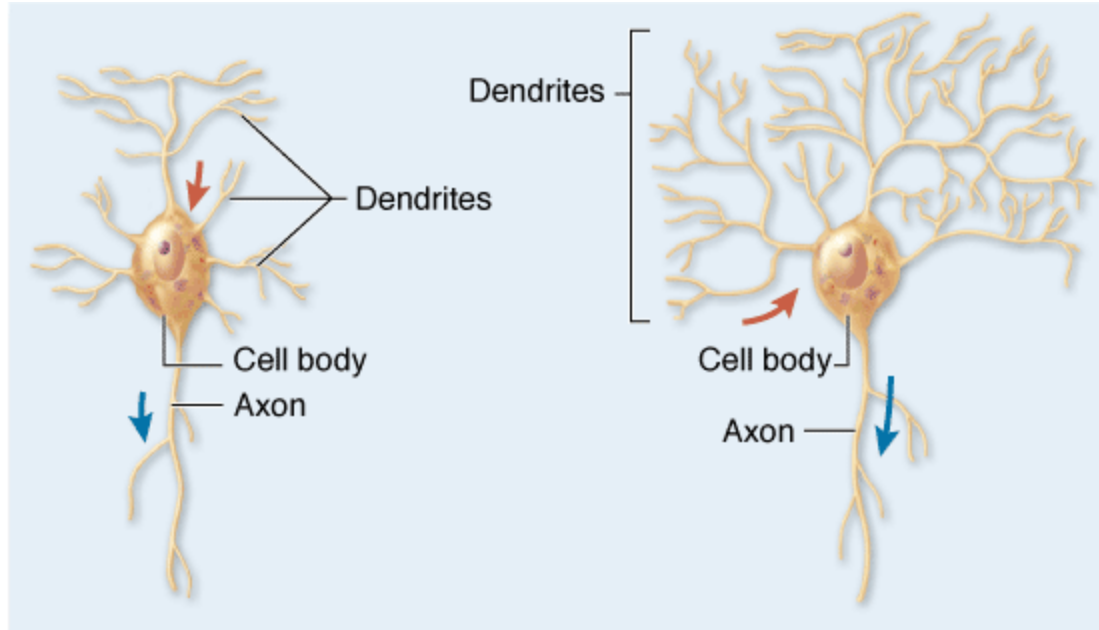


Neurons Classification

Neurons can be classified according to the number of processes extending from the cell body:

- ▶ **Multipolar neurons**, which have one axon and two or many dendrites;
 - ▶ **Bipolar neurons**, with one dendrite and one axon; and
 - ▶ **Unipolar or pseudounipolar neurons**, which have a single process that bifurcates close to the perikaryon, with the longer branch extending to a peripheral ending and the other toward the CNS.
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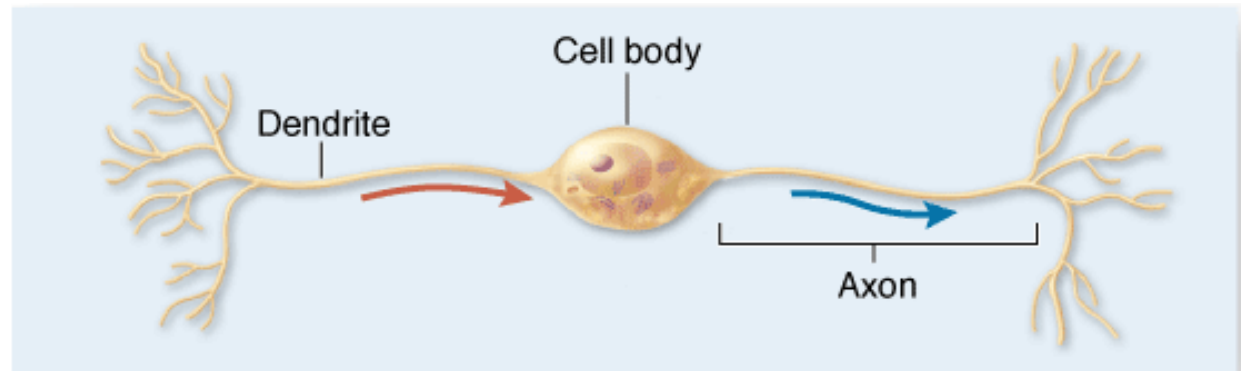




a Multipolar neurons



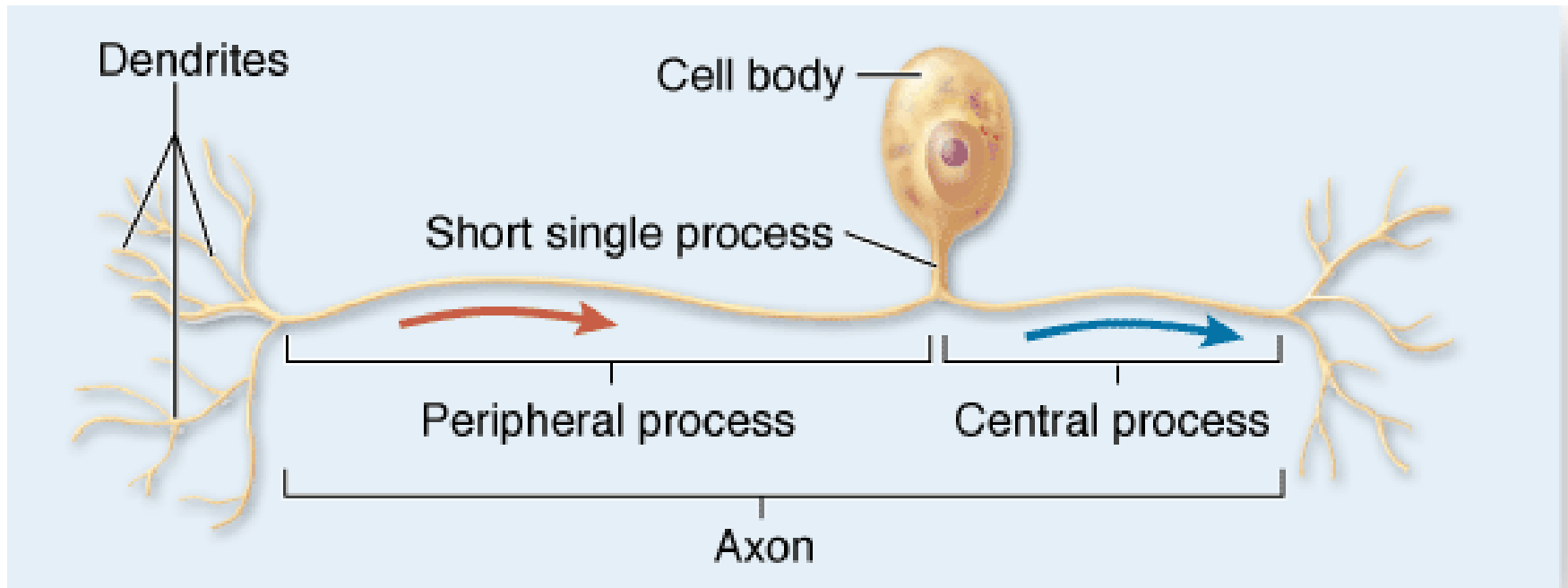
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b Bipolar neuron



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c Unipolar neuron



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Neurons Classification con.

Neurons can also be subdivided according to their functional roles

- ▶ **Motor (efferent) neurons** control effector organs such as muscle fibers and exocrine and endocrine glands.
- ▶ **Sensory (afferent) neurons** are involved in the reception of sensory stimuli from the environment and from within the body.
- ▶ **Interneurons** establish relationships among other neurons, forming complex functional networks or circuits (as in the retina).



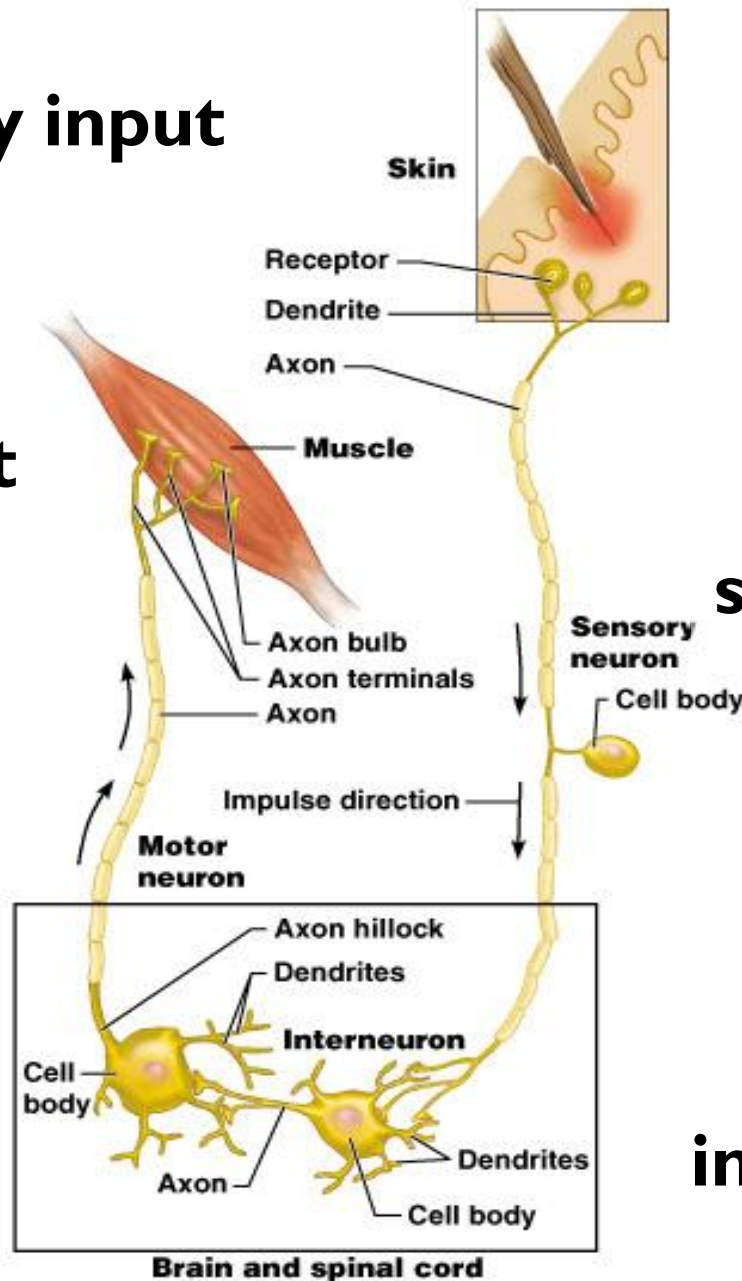
sensory input

motor input

effector

sensory receptor

integration



Structure of the Neuron

Myelin Sheath

- ▶ a white, multi layered, fatty covering for some nerve processes.
- ▶ arranged in segments, separated by Nodes of Ranvier (enables salutatory conduction)

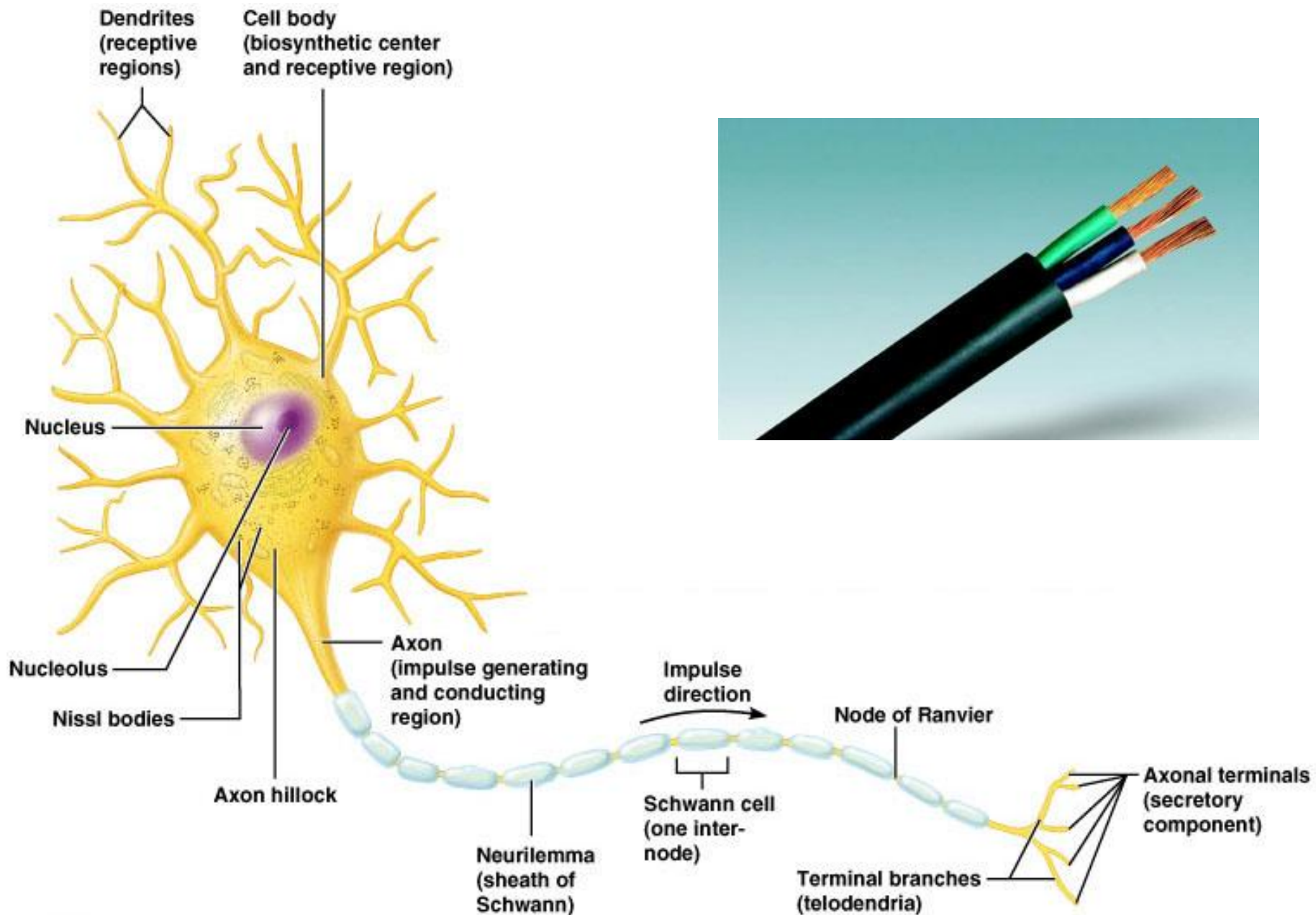
Function

- ▶ Insulation of nerve process
- ▶ Increased speed of conduction

Neurilemma

- ▶ outer layer of myelin sheath
- ▶ essential for regeneration



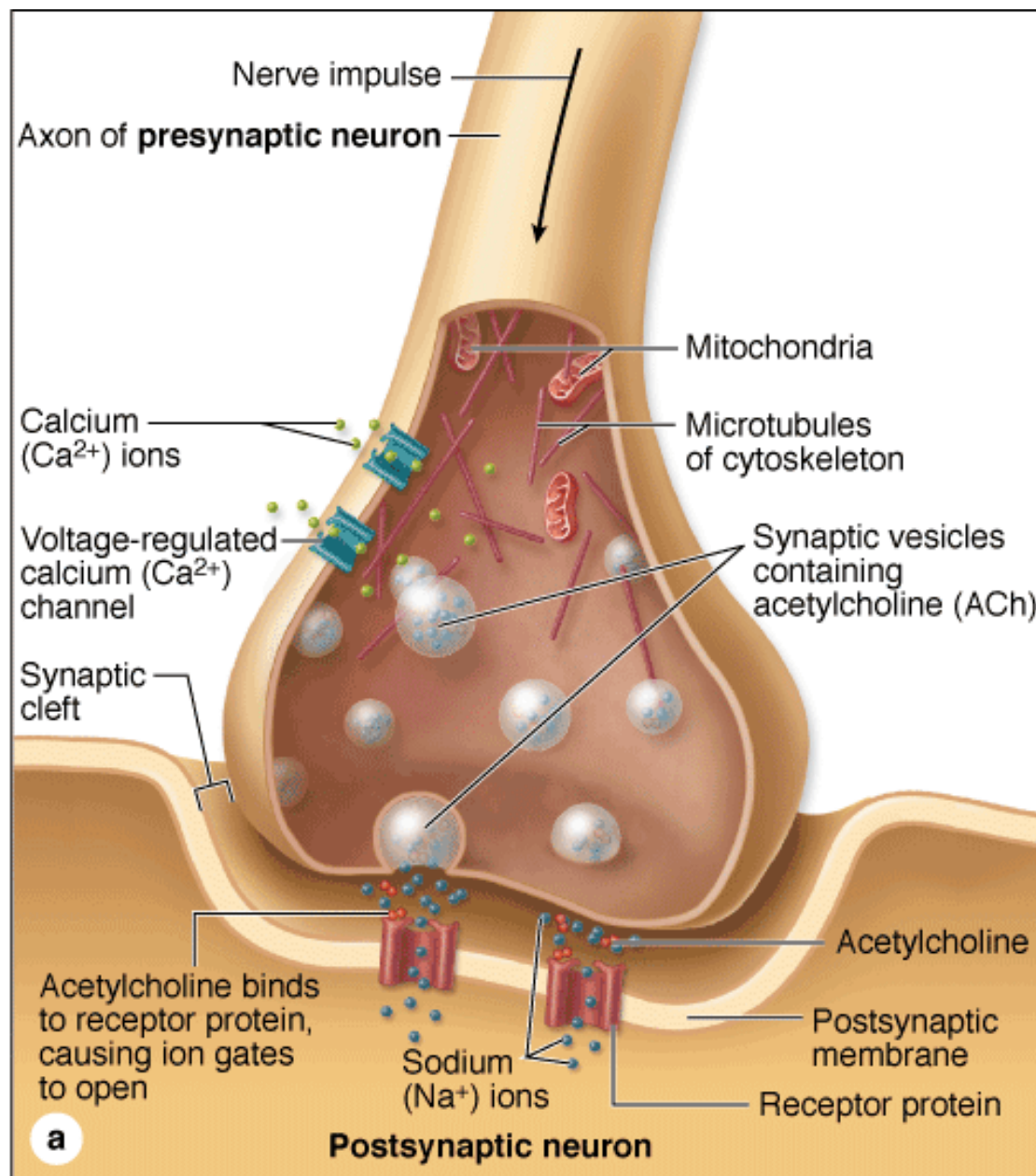


Synaptic Communication

Synapse has the following structure:

- ▶ Presynaptic axon terminal (**terminal bouton**) from which neurotransmitter is released,
- ▶ Postsynaptic cell membrane with receptors for the transmitter and ion channels or other mechanisms to initiate a new impulse,
- ▶ 20–30 nm wide intercellular space called the **synaptic cleft** separating the presynaptic and postsynaptic membranes.





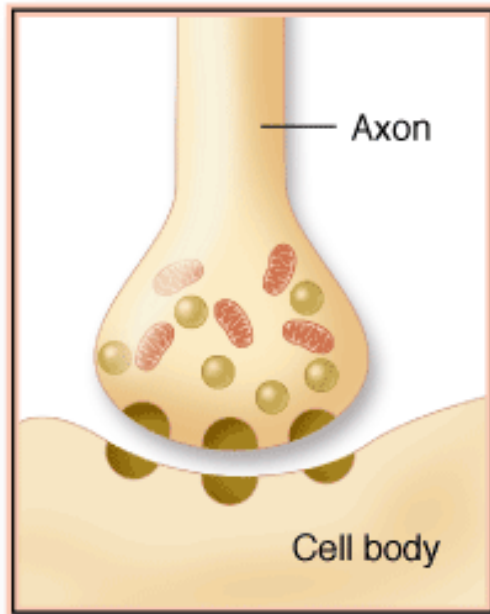
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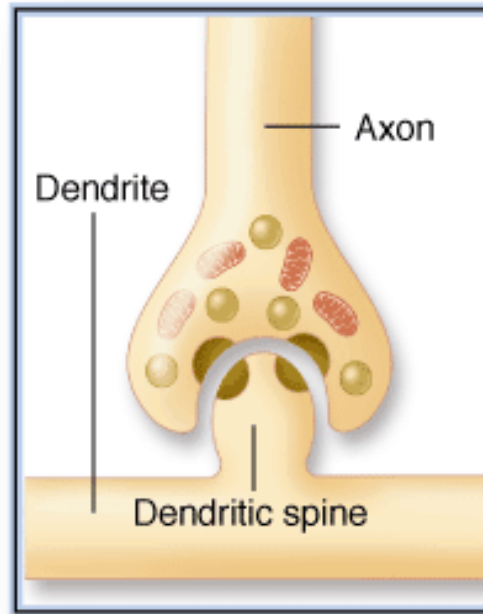
<http://www.youtube.com/watch?v=LT3VKAr4roo>



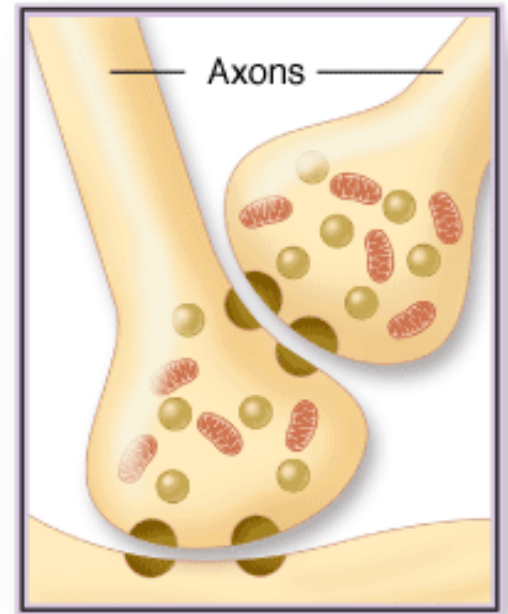
Axosomatic synapse



Axodendritic synapse

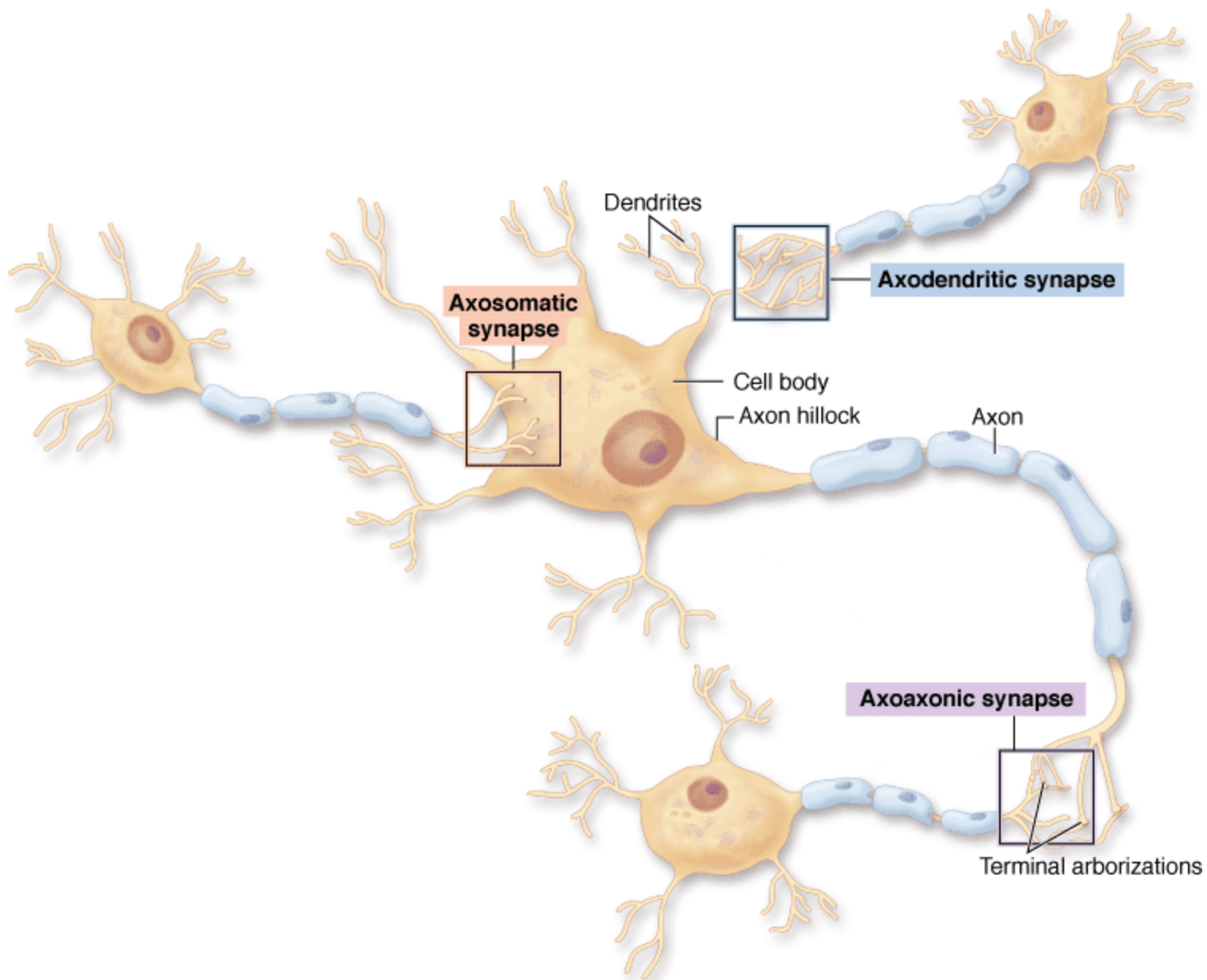


Axoaxonic synapse



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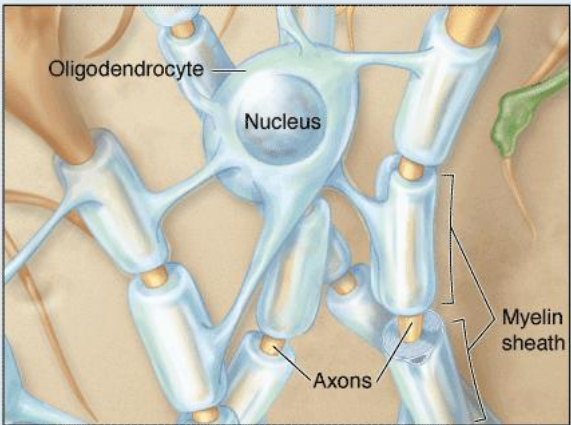
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Glial Cells & Neuronal Activity

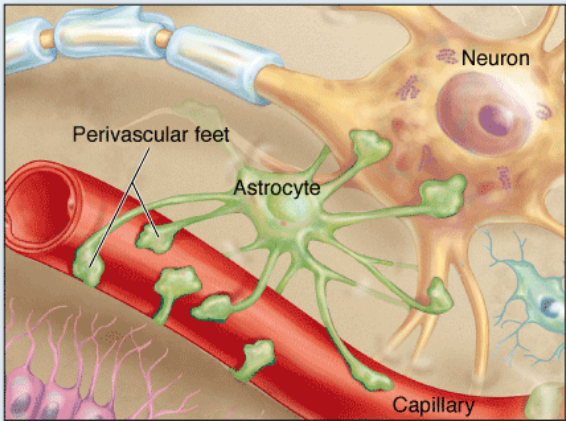
Origin and principal functions of neuroglial cells.

Glial Cell Type	Origin	Location	Main Functions
Oligodendrocyte	Neural tube	Central nervous system	Myelin production, electric insulation
Neurolemmocyte	Neural crest	Peripheral nerves	Myelin production, electric insulation
Astrocyte	Neural tube	Central nervous system	Structural support, repair processes Blood-brain barrier, metabolic exchanges
Ependymal cell	Neural tube	Central nervous system	Lining cavities of central nervous system
Microglia	Bone marrow	Central nervous system	Immune-related activity

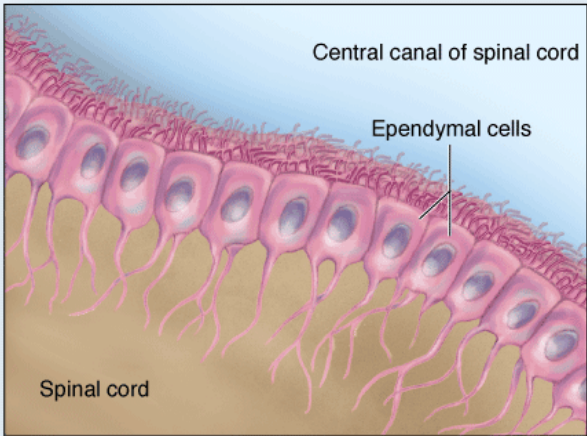
CNS Glial Cells



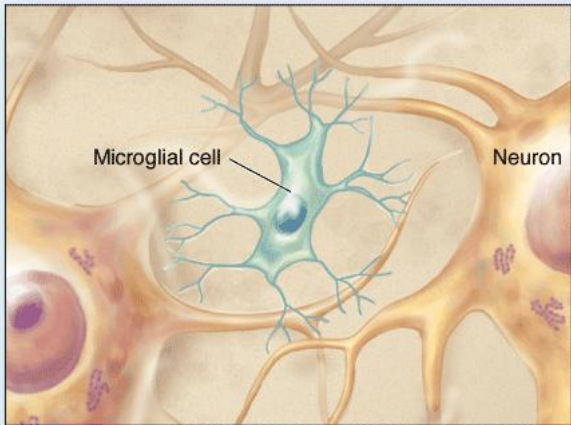
a Oligodendrocyte



b Astrocyte

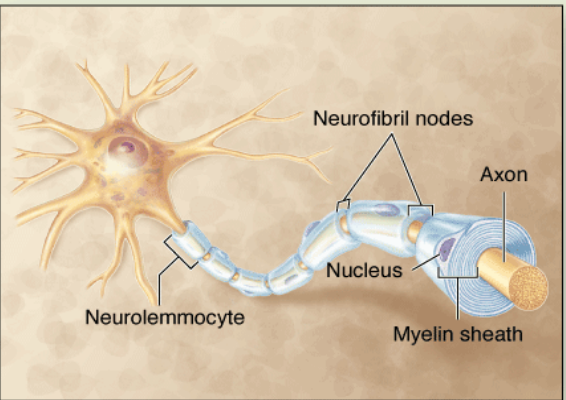


c Ependymal cells

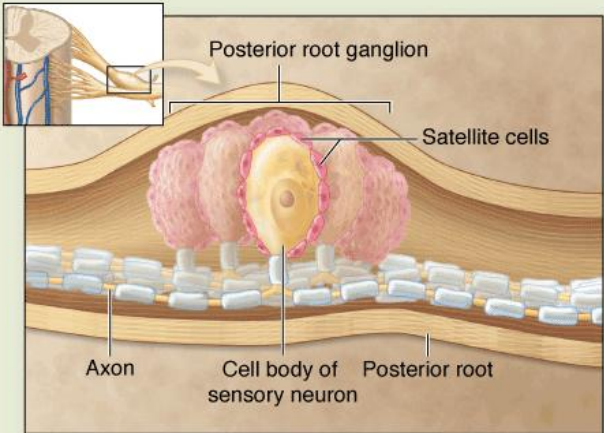


d Microglial cell

PNS Glial Cells



e Neurolemmocytes



f Satellite cells