



Faculty of Biological Science and Technology
Zoology and Botanical Department
Practical Histology

Nervous Tissue

Part 1

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Nervous tissue

- ▶ Nervous tissue is the main component of nervous system
- ▶ It consists of two major cell types:

neurons

which transmit electrical impulses and are responsible for communication

glial cells

which provide metabolic support for nerve cells and help them to transmit impulses

- ▶ There are different types of neuron and glia

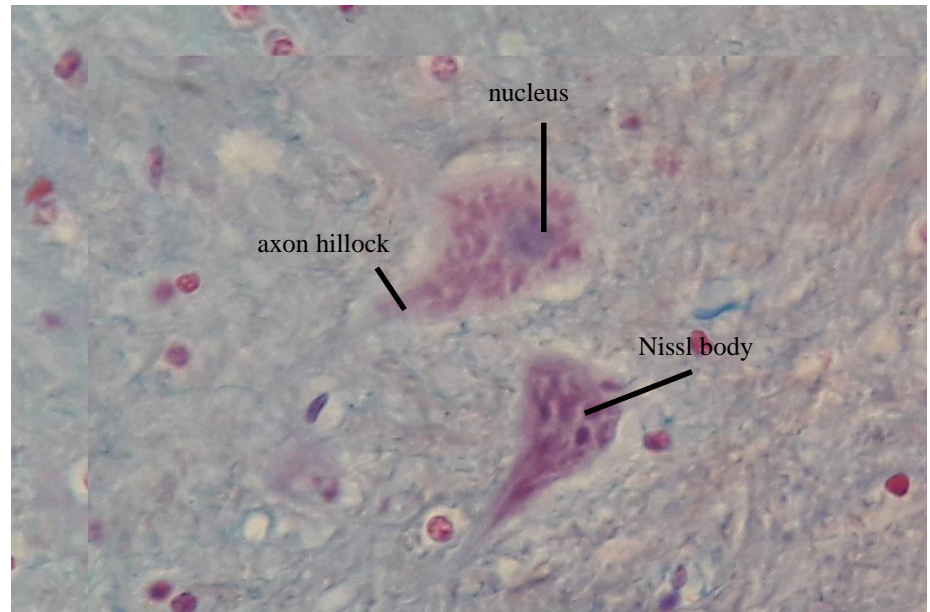


General structure of neurons

- ▶ Each neuron is composed of cell body (or perikaryon), dendrites and axon
- ▶ Nucleus and many other organelles are located in perikaryon
- ▶ Dendrites are short process which usually heavily branched, while axon is a long, single process
- ▶ Neurons are classified into different types based on morphology or function

Axon hillock is a cone-shaped region that connects neuron cell body with axon

Nissl bodies are subcellular structure found in perikaryon and dendrites. They are composed of rough endoplasmic reticulum and ribosomes

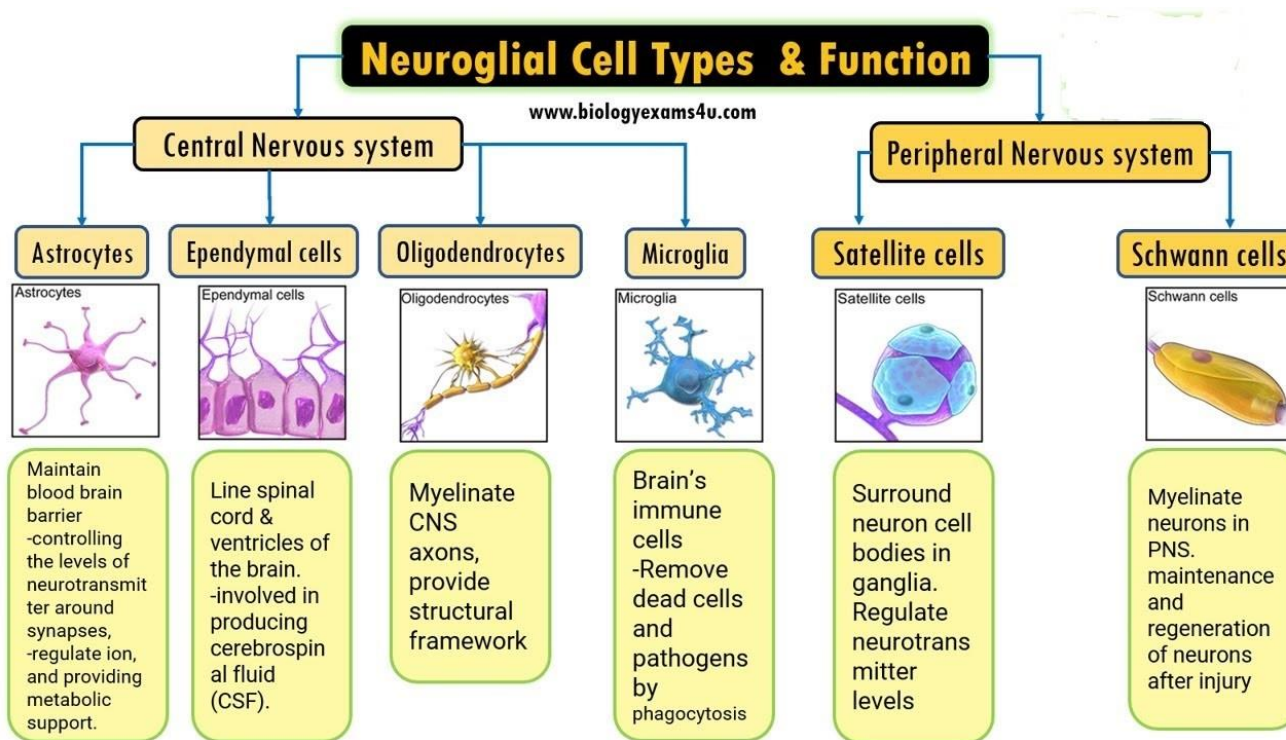


Two nerve cell perikaryon in spinal cord, H&E, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University



Glial cells

- ▶ Different types of glial cells are present in both central and peripheral nervous system
- ▶ Glial cells in CNS include astrocytes, oligodendrocytes, microglia and ependymal cells. Schwann cells and satellite cells are located just in PNS



Different types of glial cells and their function. From [www.biologyexams 4u.com](http://www.biologyexams4u.com)

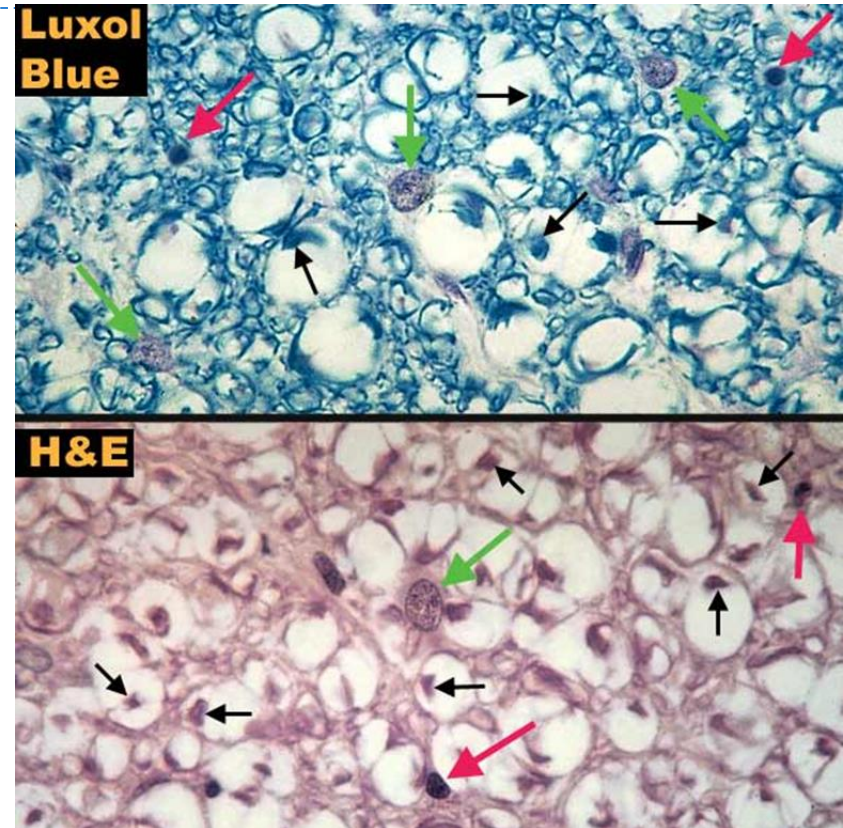


Astrocytes and Oligodendrocytes

- ▶ Astrocytes are the most abundant glia in central nervous system
- ▶ They are star-shaped, along with large, oval, pale nucleus and very little cytoplasm
- ▶ There are two types of astrocytes: 1) fibrous astrocytes that characterize with relatively little but long processes. They are usually found in white matter; and 2) protoplasmic astrocytes which have small and highly branched processes. They exist mainly in gray matter
- ▶ Oligodendrocytes are smaller than astrocytes. They are polygonal shaped cell with dense, round nucleus and possess a few short process. They exist only in white matter

Pay attention:

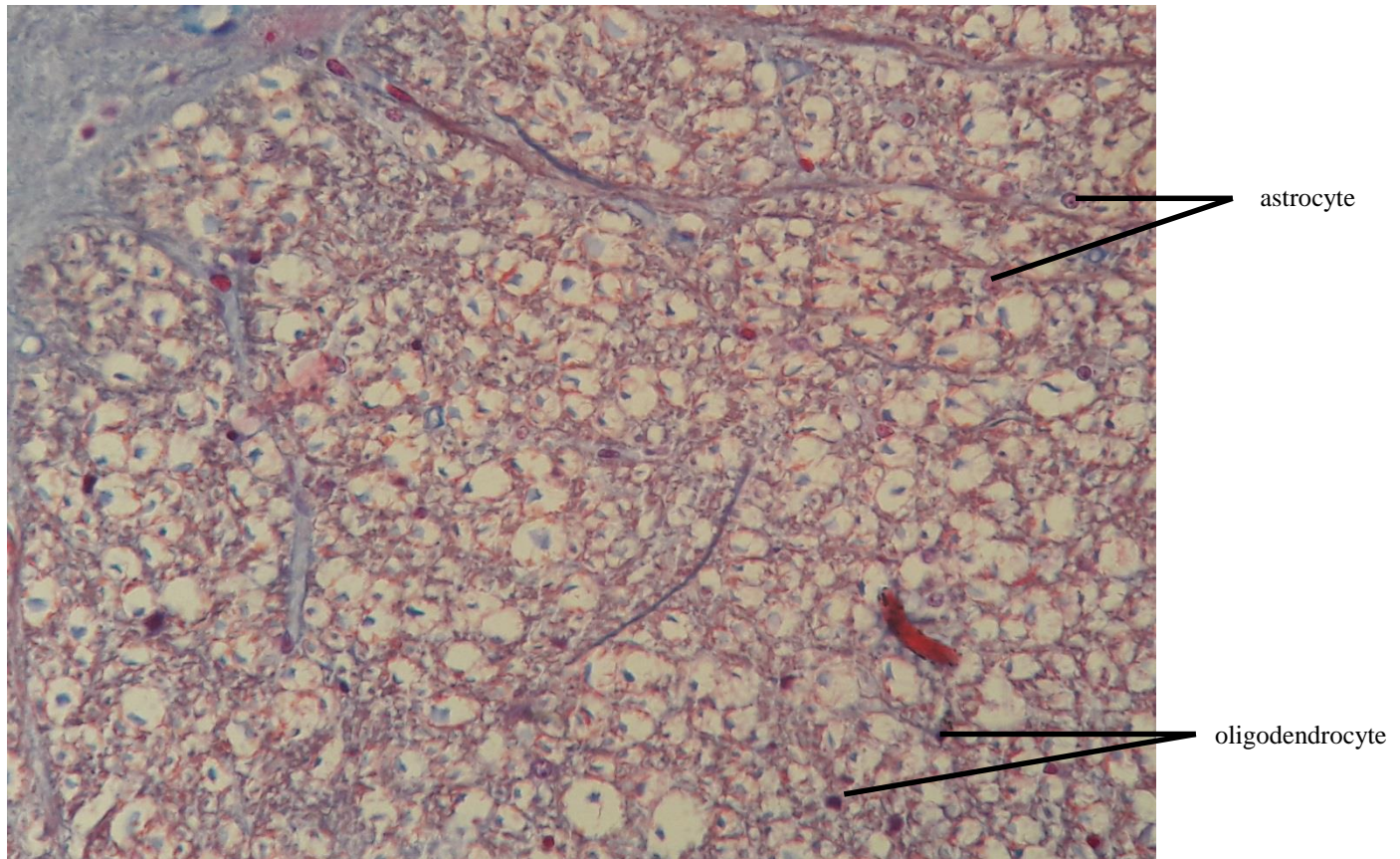
The glia processes are not visible separately in routine staining for light microscopy studying



Luxol blue (top) and H&E (bottom) stains of spinal white matter. Cell bodies in white matter belong to glial cells (or blood vessels) not to neurons. An **astrocyte** cell body (green arrow) can be recognized by its relatively large, oval, leptochromatic nucleus. An **oligodendrocyte** cell body (red arrow) features a small, round, pachychromatic nucleus. (Small black arrows point to axon profiles within vacuoles left by myelin lipid extraction during tissue processing); From <http://vanat.cvm.umn.edu/neurLab1/glia.html>



Astrocytes and oligodendrocytes

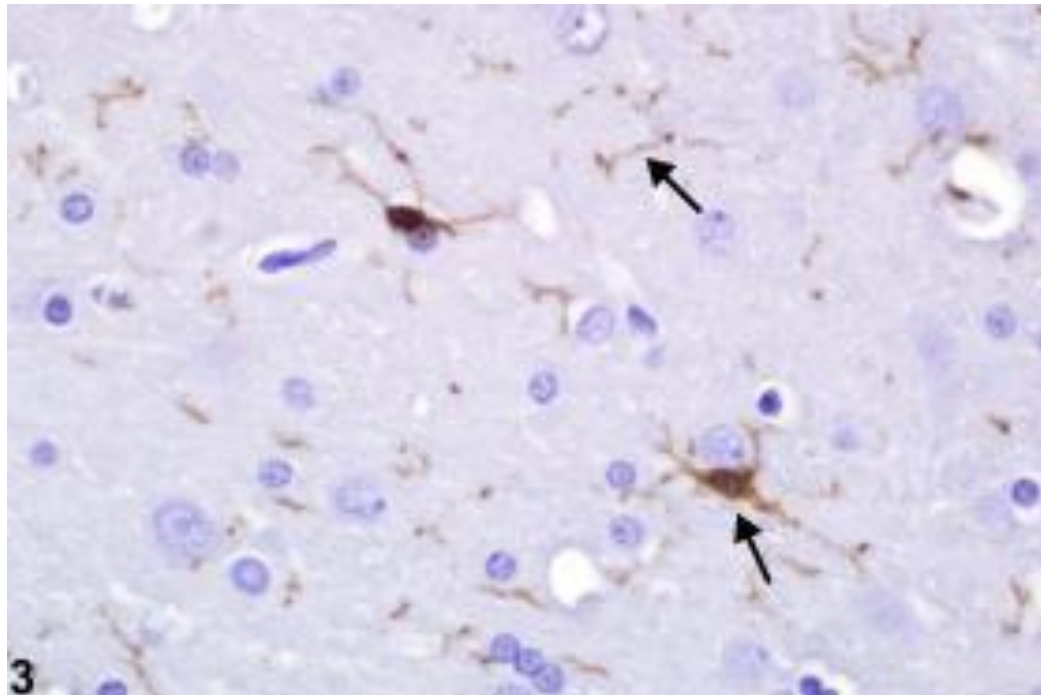


Astrocyte and oligodendrocyte in spinal cord white matter , H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



Microglia

- ▶ Microglia morphology is characterized by a small cell body which heavily stainable, and long, branched process



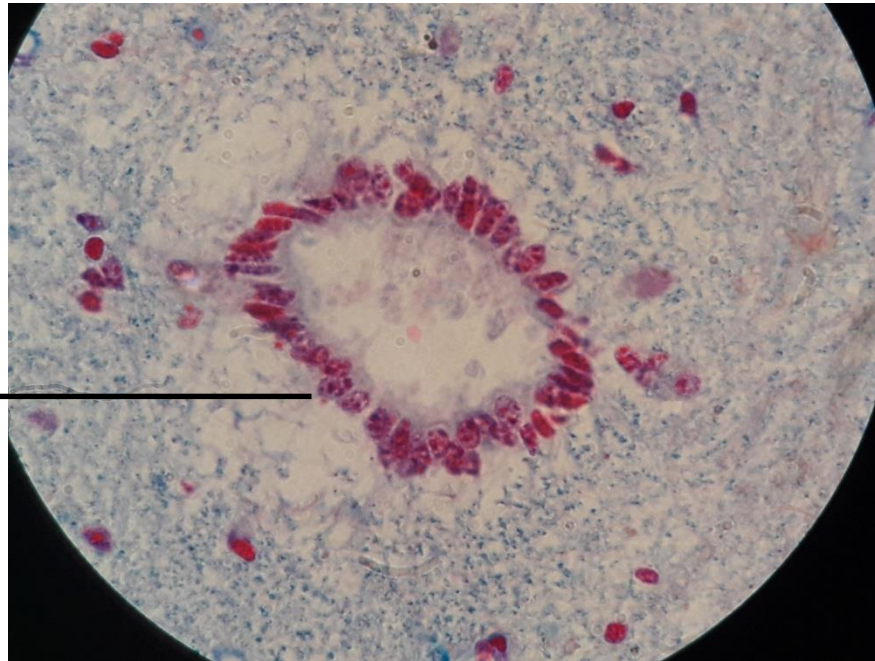
Immunohistochemical stain using the Iba-1 antibody to detect microglia (arrows) in the rat brain; from <https://ntp.niehs.nih.gov/atlas/nml/nervous-system/brain/Microgliosis>



Ependymal cells

- ▶ Ependymal cells are cuboid to columnar cells that line brain ventricles and central canal of spinal cord
- ▶ These cells belong to glial lineage, however they have many epithelial features including cell to cell junction, and motile cilia in apical surface
- ▶ At the basal pole, they have some process directed to adjacent nervous tissue
- ▶ Cilia and basal process are not clearly visible in light microscopy

Ependymal cell

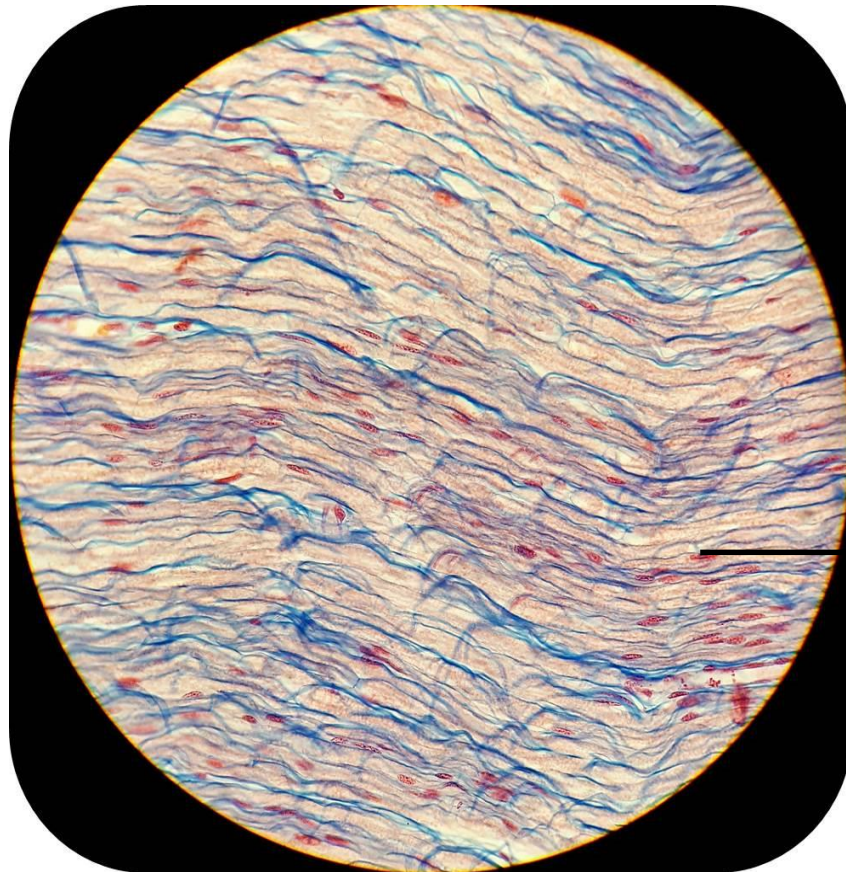


Ependymal cells in cross section of spinal cord. Red, ependymal nucleus; H&E, 40X;
This picture is taken from histological slide in histology laboratory of Isfahan University



Schwann cells

- ▶ Schwann cells are a type of glial cells in peripheral nervous system, where they cover nerve fibers. Some of the Schwann cells can produce myelin sheath
- ▶ They are bipolar or tripolar morphology and contain a single oval nucleus



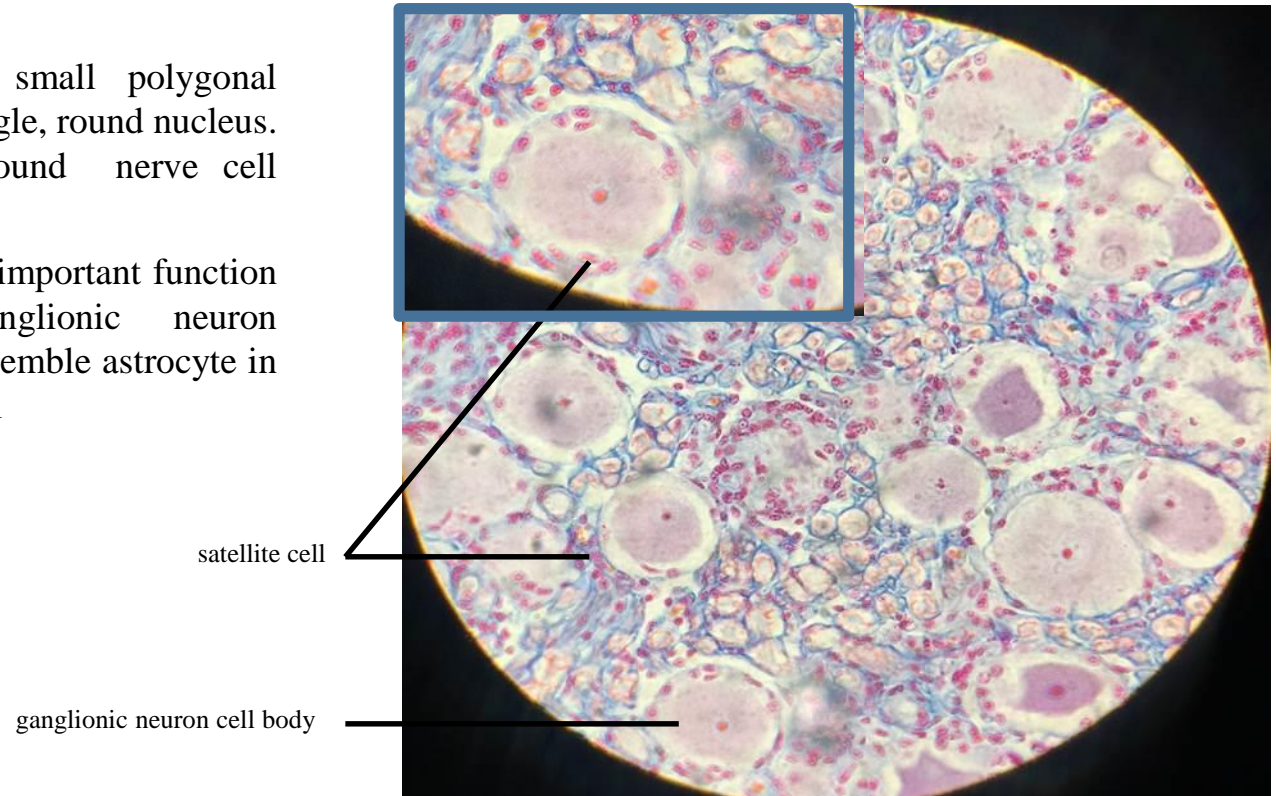
Schwann cell
nucleus

Schwann cells in longitudinal section of a nerve; H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



Satellite cells

- ▶ Satellite cells have small polygonal shape along with a single, round nucleus. They are located around nerve cell bodies in ganglions
- ▶ Satellite cells play an important function in modulation ganglionic neuron environment; They resemble astrocyte in central nervous system



Satellite cells in cross section of dorsal root ganglion; H&E, 40X; top box: 100X. This picture is taken from histological slide in histology laboratory of Isfahan University