NORMAL CELLS OF CNS

OBJECTIVES:

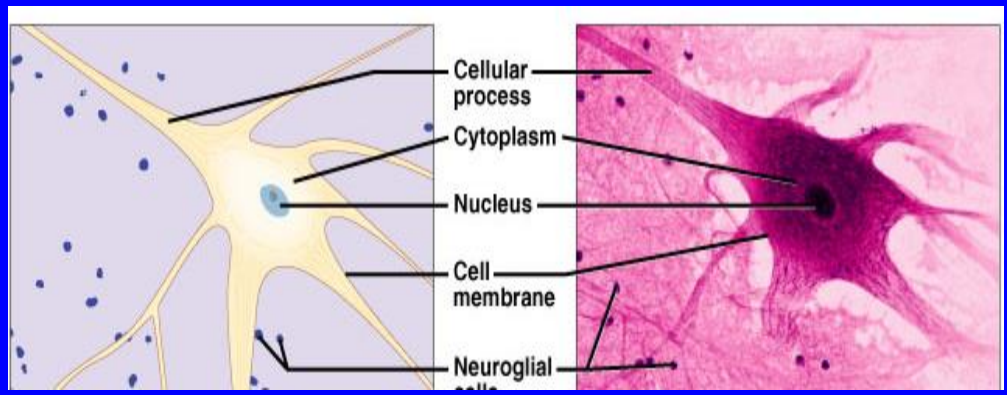
At the end of this lecture, you should describe the microscopic structure and the function of:

1- Neurons:

- **Cell body (perikaryon).**
- **Processes: An axon and dendrites.**

2- Neuroglia:

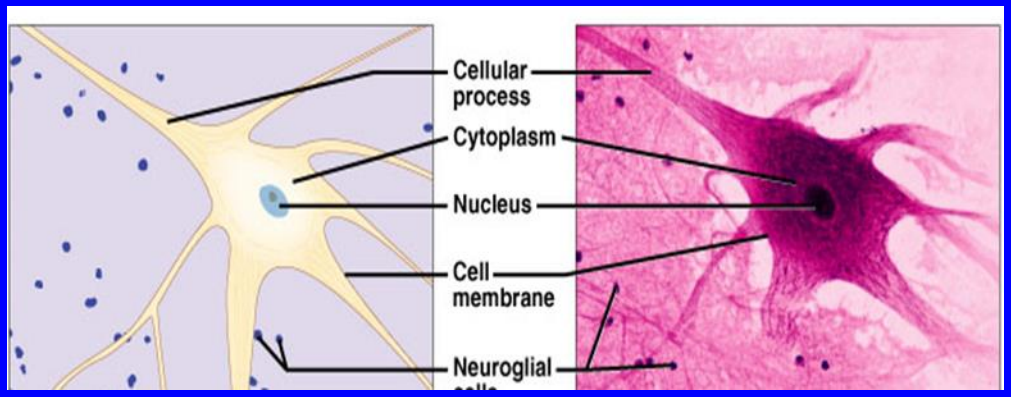
- **Astrocytes.**
- **Oligodendrocytes.**
- **Microglia.**
- **Ependymal cells.**

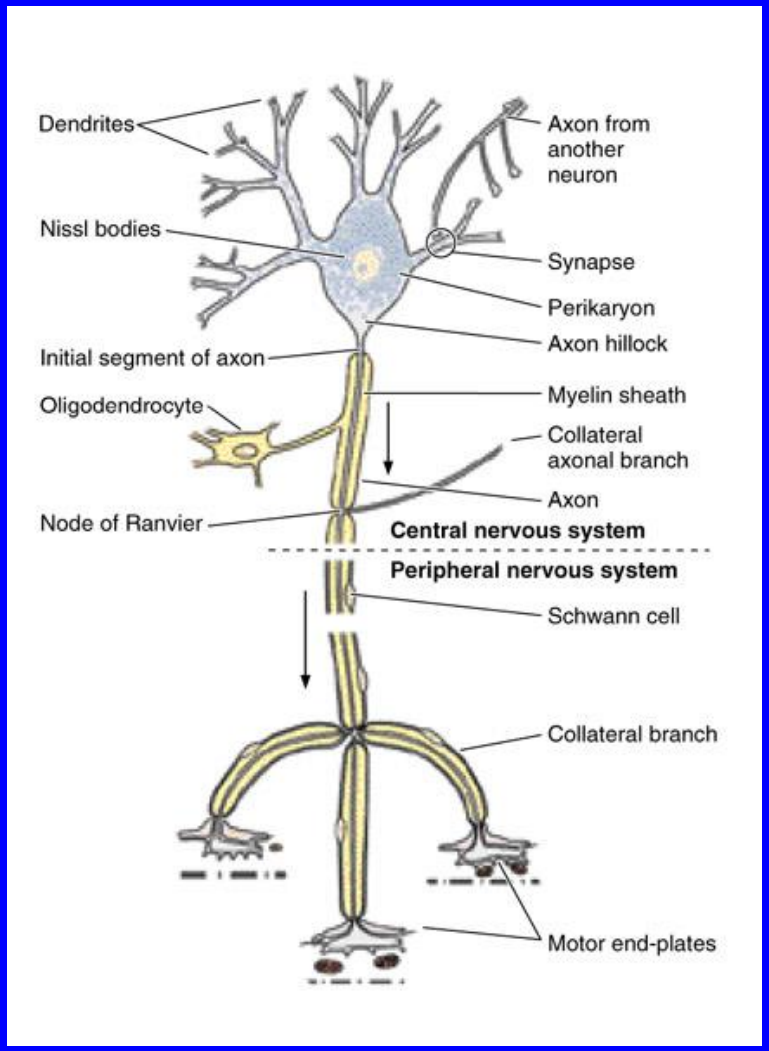


Neuron

Components:

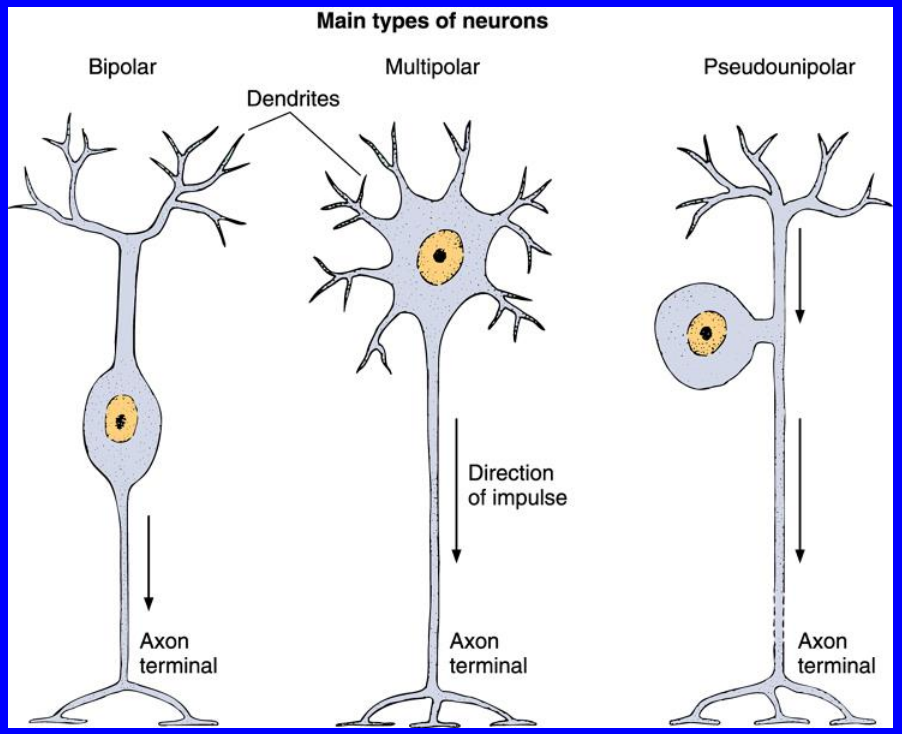
1. **Cell body** (Perikaryon)
2. **Processes** :
   - *a. An axon*: only one
   - *b. Dendrites*: one or more





TYPES OF NEURONS
Based on number of processes

1. Pseudounipolar neurons.
2. Bipolar neurons.
3. Multipolar neurons.



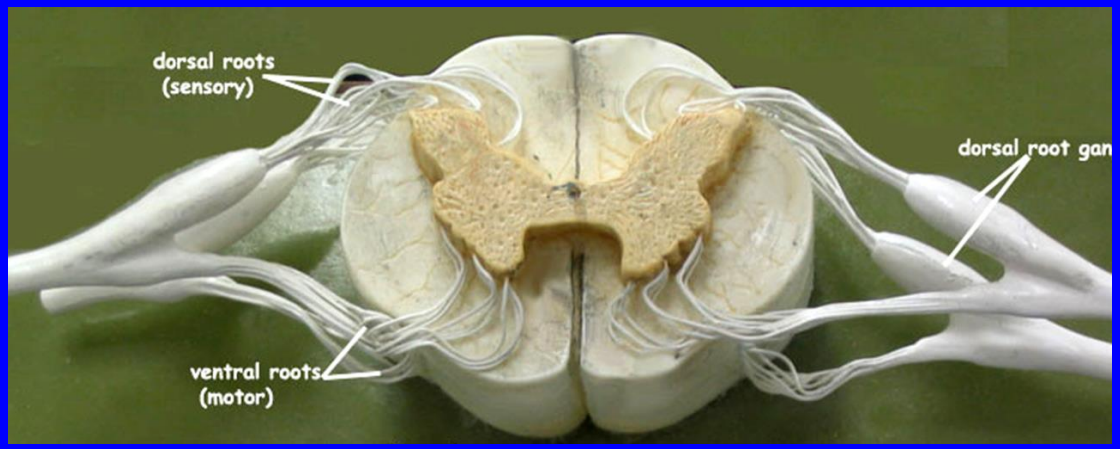
TYPES OF NEURONS

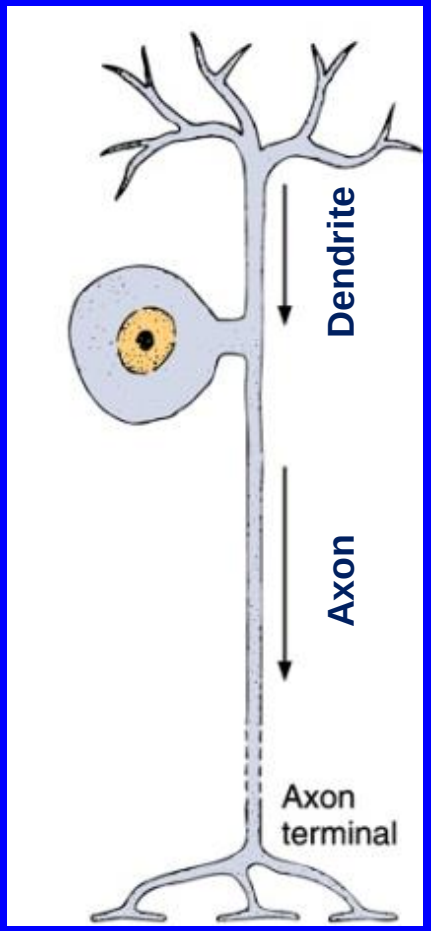
Based on number of processes

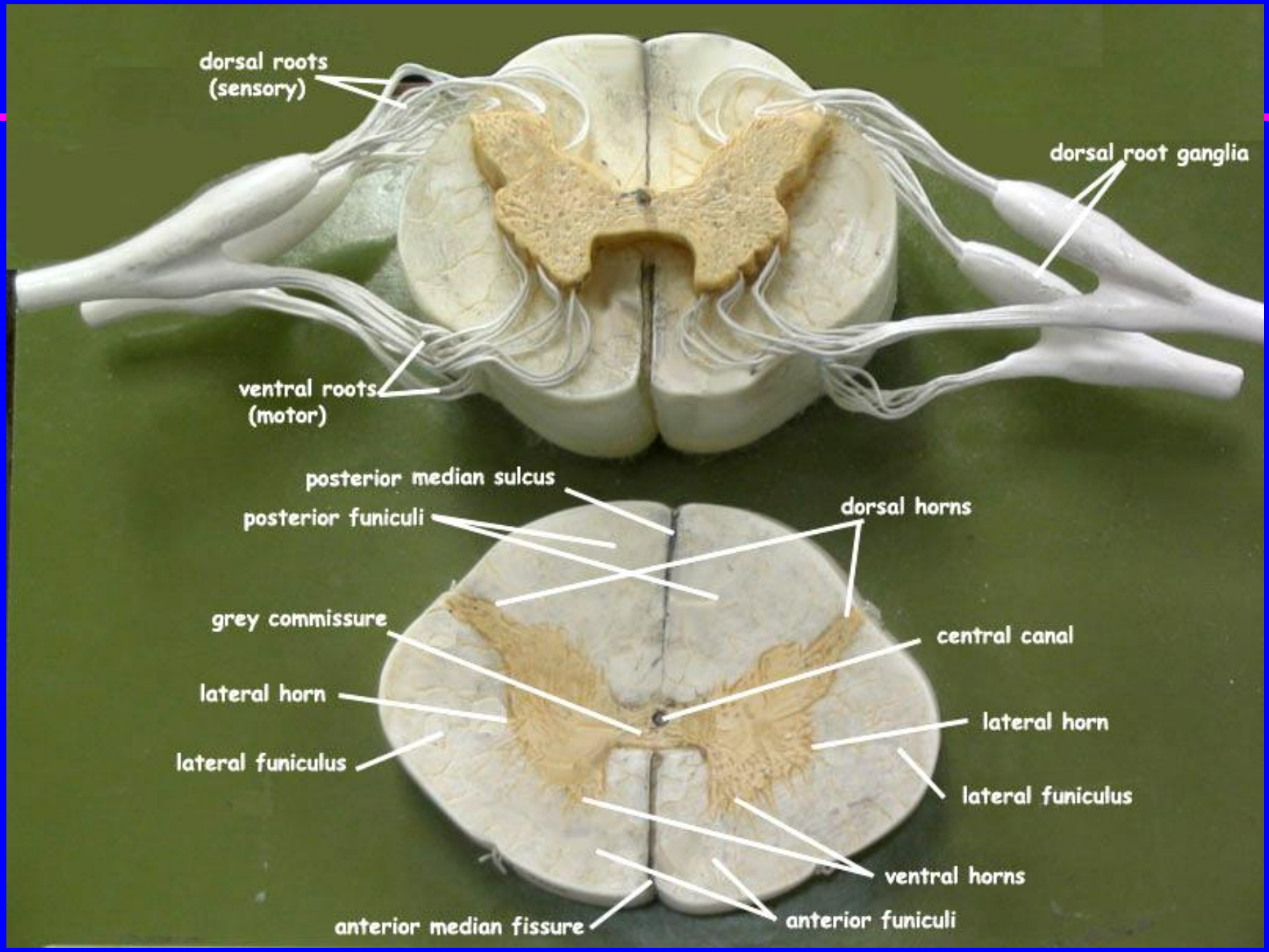
1. Unipolar (Pseudounipolar) neuron (rounded neuron):

Has one process only, that divides into two branches; one acts as a dendrite and the other as an axon.

Example: Mesencephalic nucleus of trigeminal nerve and dorsal root (spinal) ganglion.





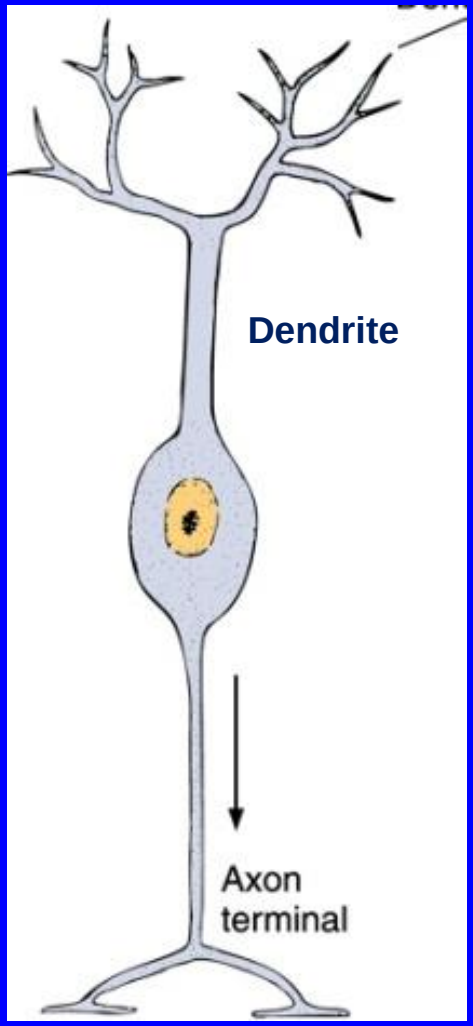

dorsal roots
(sensory)
dorsal root ganglia
ventral roots
(motor)
posterior median sulcus
posterior funiculi
dorsal horns
grey commissure
central canal
lateral horn
lateral horn
lateral funiculus
lateral funiculus
ventral horns
anterior median fissure
anterior funiculi

TYPES OF NEURONS
Based on number of processes

2. Bipolar Neuron (spindle-shaped neuron):

Has two processes (one arising from each pole of the cell body). One of them is the dendrite and the other is the axon.

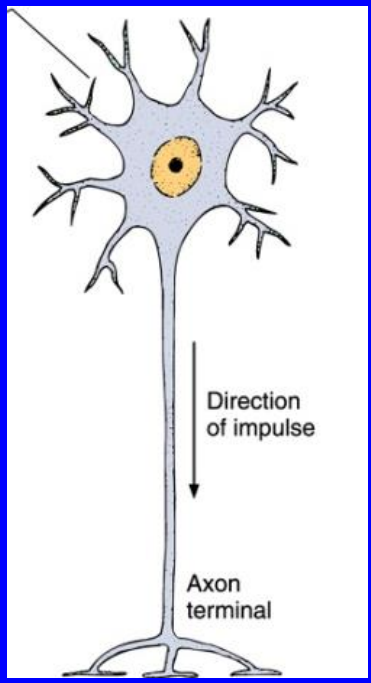
Example: retina & olfactory epithelium.



TYPES OF NEURONS
Based on number of processes

3. Multipolar neuron:

Has one axon and multiple dendrites.

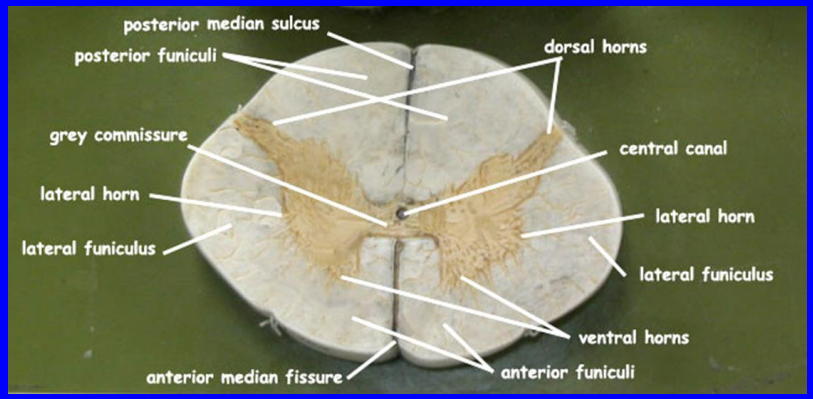


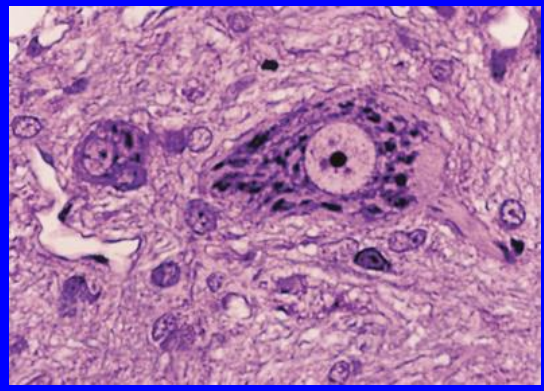
Types of multipolar neurons:

A. Stellate neuron:

- The commonest type.
- Distributed in most areas of CNS;

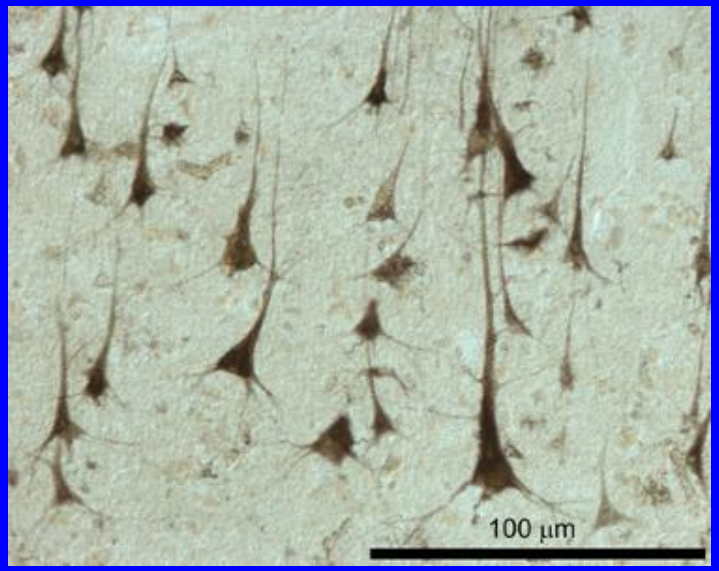
Example: anterior horn cells of the spinal cord



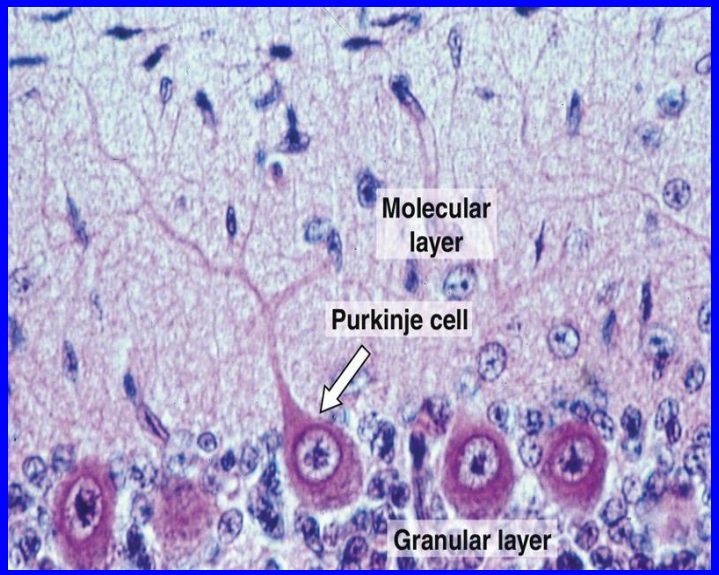


TYPES OF NEURONS
Based on number of processes

B. *Pyramidal neurons*:
- Distributed in motor area 4 of the cerebral cortex.



C. *Pyriform neurons:*
- Pear-shaped, e.g. Purkinje cells of cerebellar cortex



CELL BODY (Perikaryon)

Structure of cell body:

1. Nucleus:

- Single, usually central, rounded and vesicular with prominent nucleolus.

2. Cytoplasm.

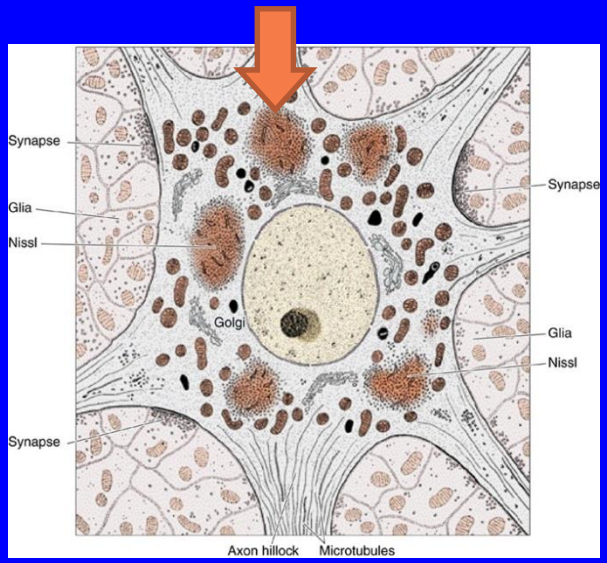
CELL BODY (Perikaryon)

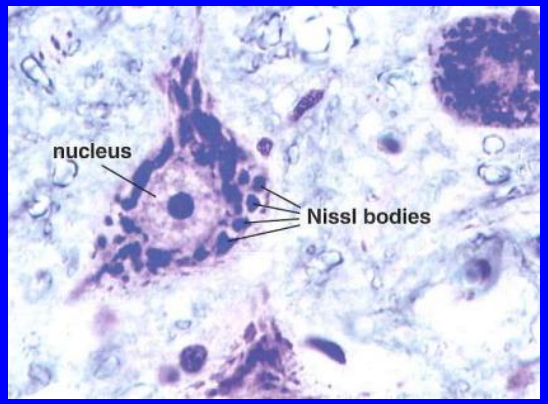
Cytoplasm:

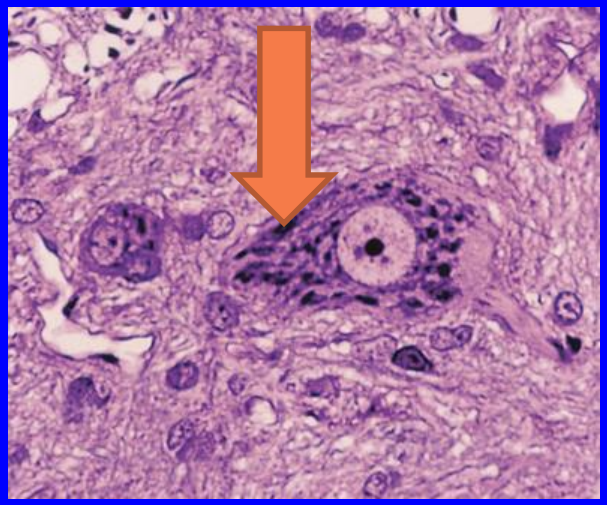
Its main components include:

1. Nissl bodies:

Are basophilic patches of rER and free ribosomes in the cell body and bases of wide dendrites.







CELL BODY (Perikaryon)

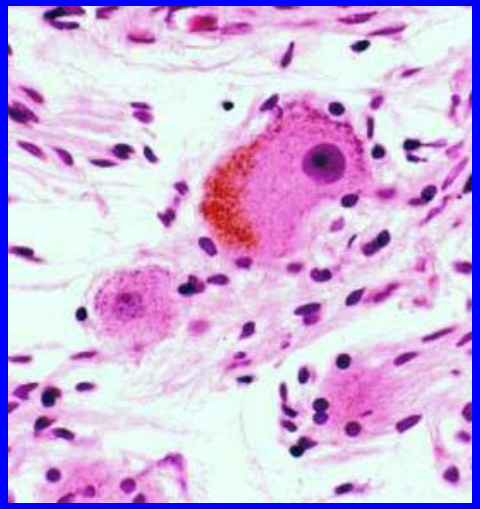
Cytoplasm:

2. ***Neurofilaments:***
   Are intermediate filaments which are bundled together to form neurofibrils. Are found in the cell body, axon and dendrites.
3. ***Microtubles:***
   Are found in the cell body, axon and dendrites.
4. ***Golgi apparatus:***
   Surrounds the nucleus all around.
5. ***Mitochondria:***
   Are numerous.

CELL BODY (Perikaryon)

Cytoplasm:

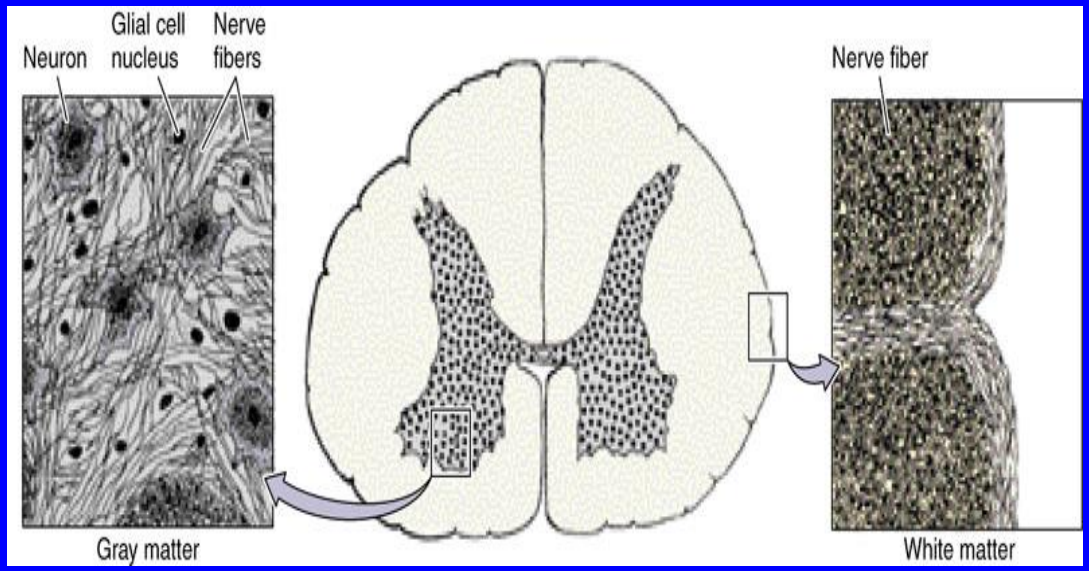
6. ***Centriole:*** Most adult neurons have only one rudimentary centriole, so they cannot divide.
7. ***Some fat and glycogen granules.***
8. ***Pigments:***
   - Lipofuscin pigments (in old age).
   - Melanin pigments (in neurons of substantia nigra of the midbrain).

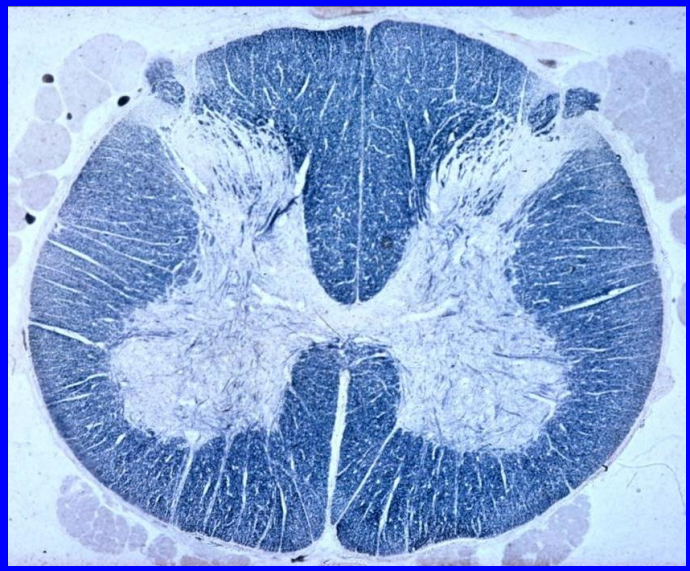


TYPES OF NERVE FIBERS IN CNS

1- Unmyelinated without neurilemmal sheath (in grey matter).

2- Myelinated without neurilemmal sheath (in white matter).





NEUROGLIA

Definition:

Are group of cells that act as the supportive tissue of CNS.

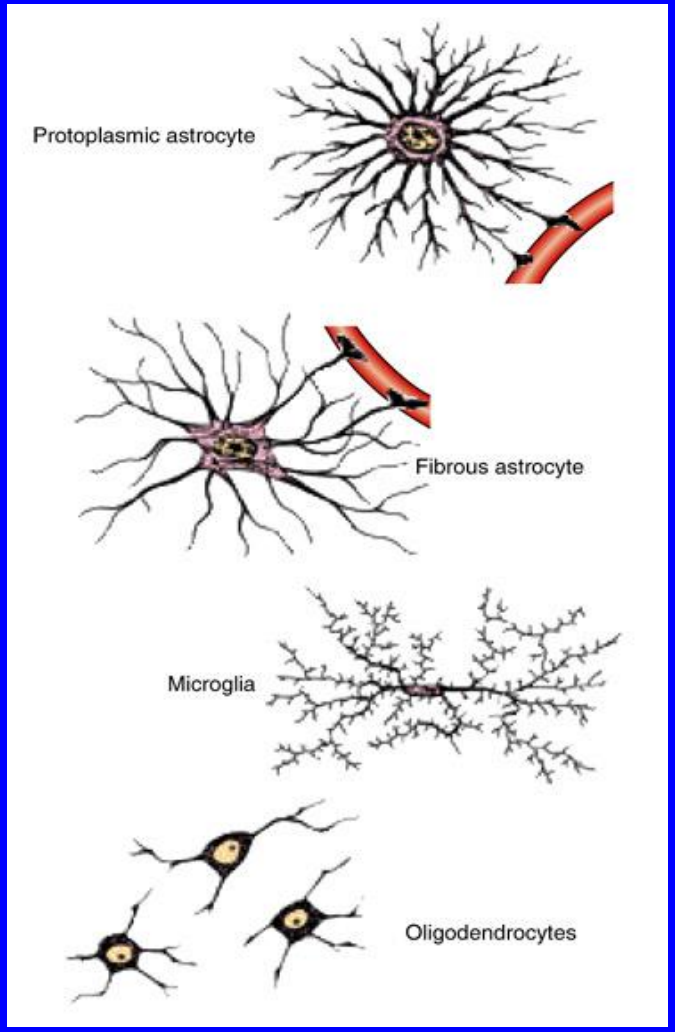
Types:

1- Astrocytes.

2- Oligodendrocytes.

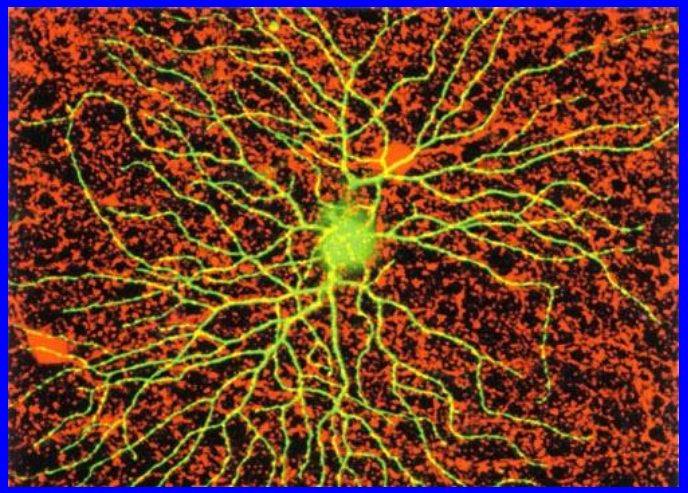
3- Microglia.

4- Ependyma.



1. Astrocytes

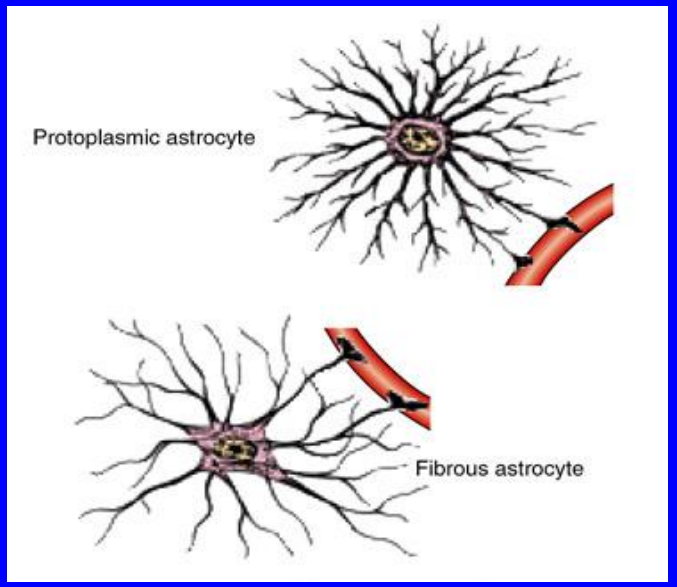
- They are the commonest type of neuroglia cells.
- They are found in both the grey and white matter.
- They are star-shaped cells with numerous long processes.



1. Astrocytes

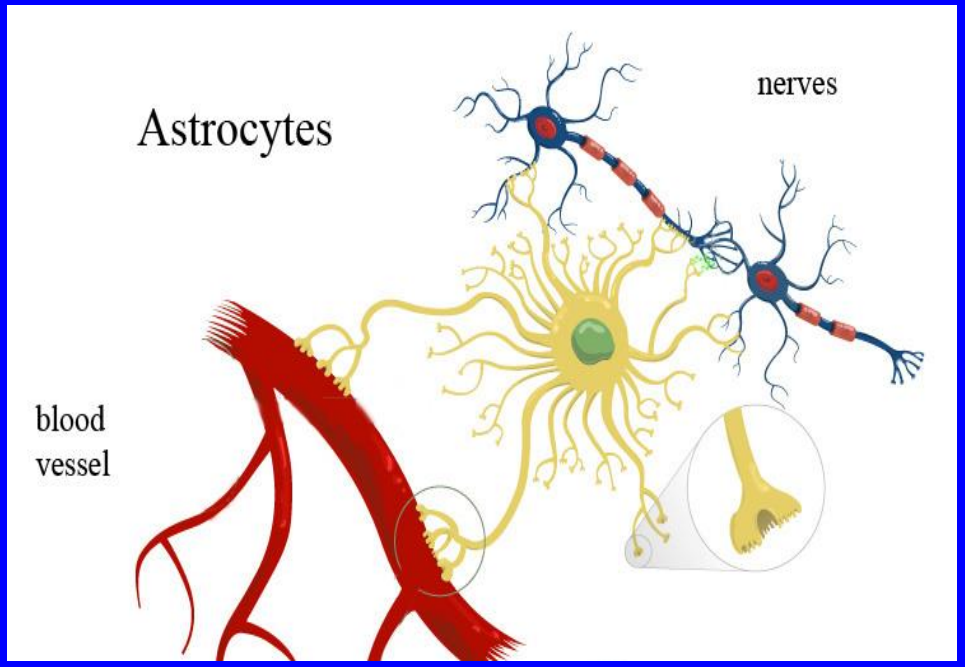
Types:

1. **Protoplasmic astrocytes:**
   - Are found in the grey matter of CNS.
   - Their processes branch extensively.
2. **Fibrous astrocytes:**
   - Are found in white matter of CNS.
   - Their processes have fewer branches but longer.



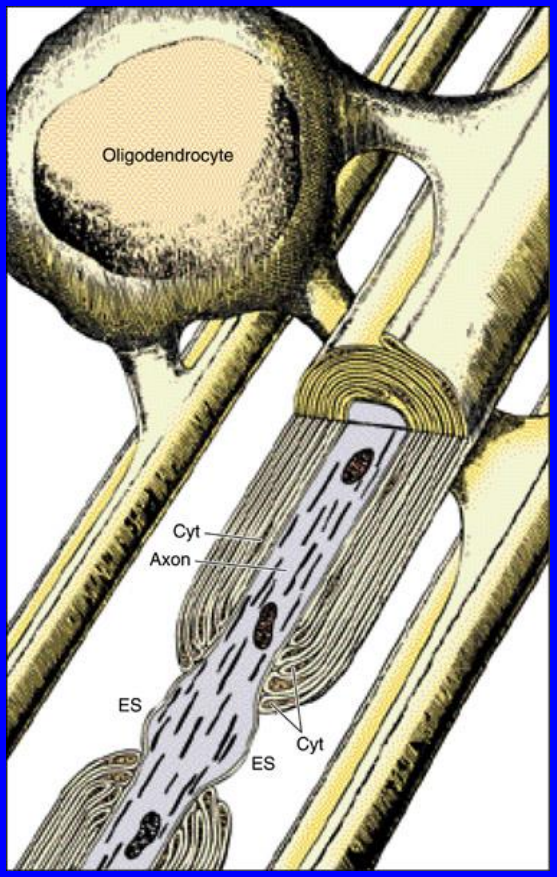
Functions of Astrocytes

1. Repair of injury of CNS tissue (gliosis).
2. Supportive and nutritive functions to the neurons.
3. Participate in the formation of blood-brain barrier.



2. Oligodendrocytes

- Are branching cells with few, short processes.
- They are distributed in the grey and white matter of CNS.

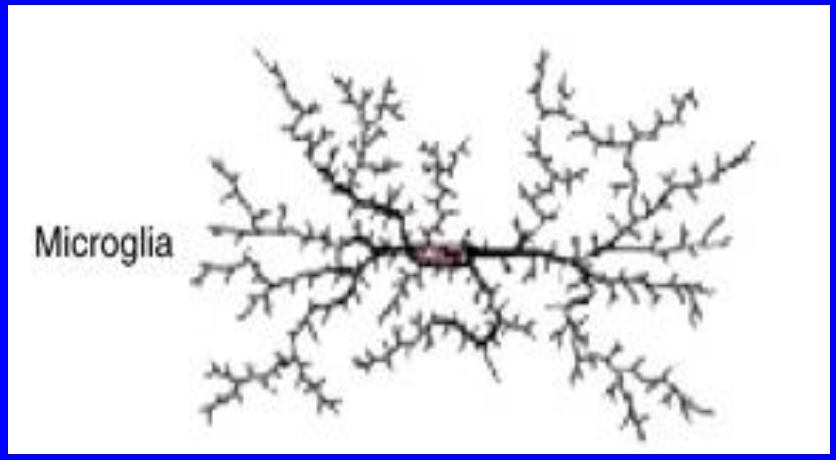


Functions:

1. Formation of myelin sheath in the CNS.
2. Insulation of nerve fibers.

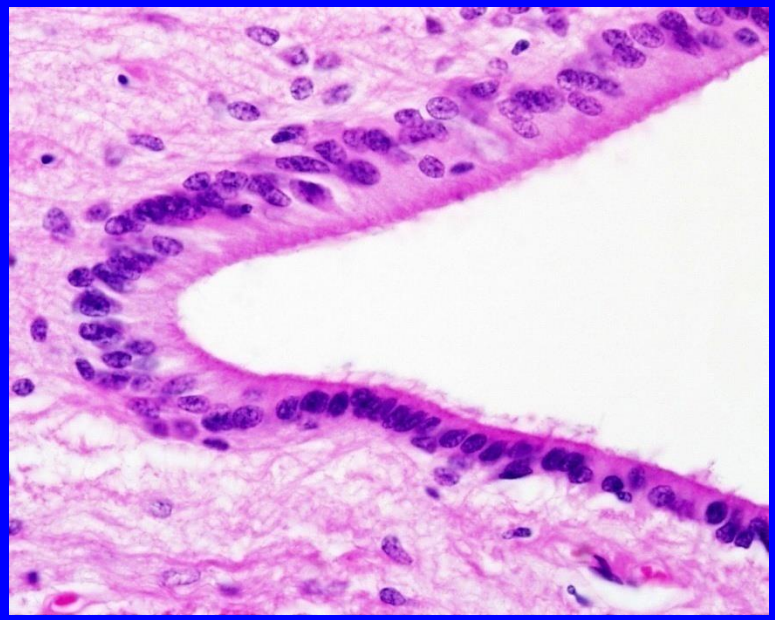
3. Microglia

- Are spindle-shaped cells with branching processes raise from each pole of the cell.
- Are distributed in the grey and white matter of CNS.
- Are rich in lysosomes.
- Their main function is phagocytosis.



4. Ependymal cells

Are simple columnar epithelial cells (partially ciliated) lining the brain ventricles and the central canal of spinal cord.



Summary / Key words

- **Neurons:**

  Types of neurons:

  pseudounipolar

  bipolar

  multipolar: stellate, Pyramidal, Pyriform.

  Components:

  Cell body

  Processes: Axon and dendrites.

  Types of nerve fibers in CNS: Unmyelinated, Myelinated.

Neuroglia:

1- Astrocytes.

2- Oligodendrocytes.

3- Microglia.

4- Ependyma.

Good Luck