

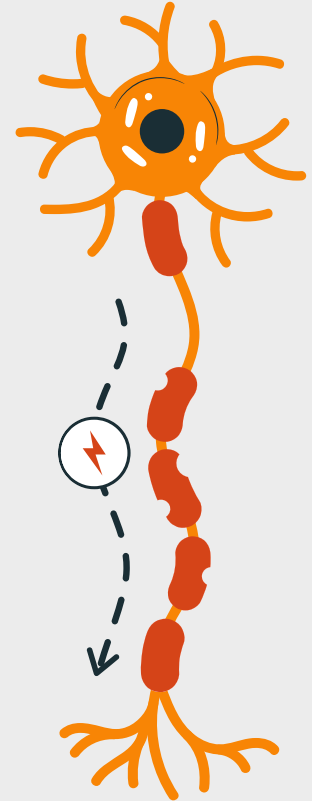
# Normal Cells of CNS

Color index:

- Main text
- important
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Neuropsychiatry Block | Histology

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## Objectives:

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

### 1- Neurons :

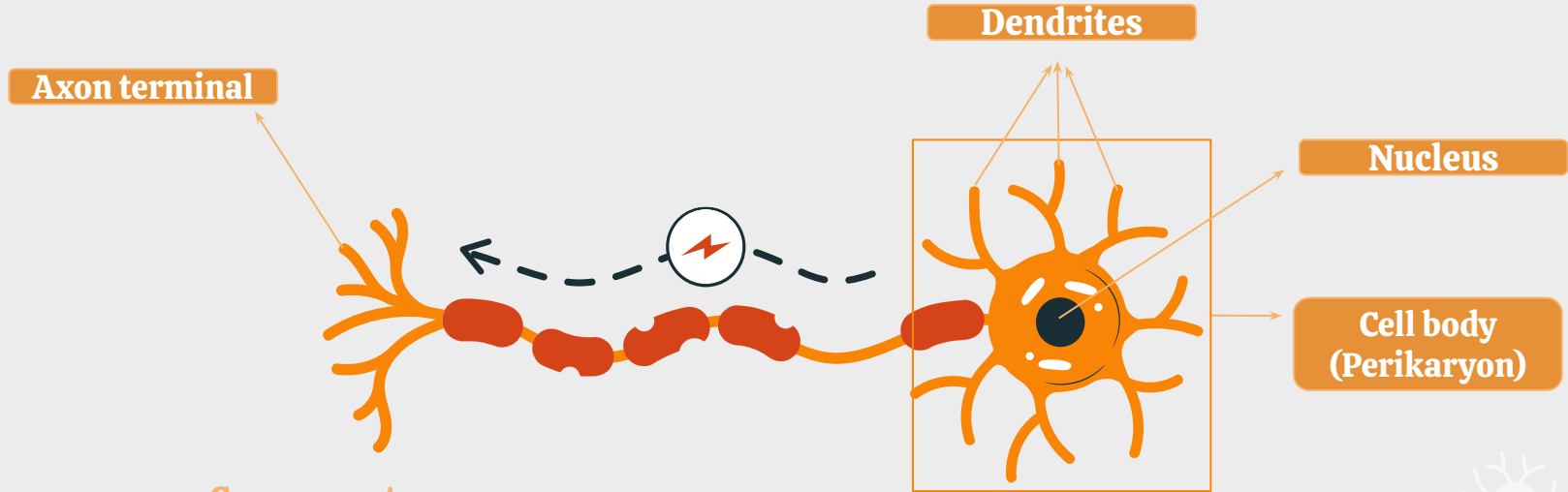
- Cell body (perikaryon)
- Processes : An axon and dendrites

### 2- Neuroglia :

- Astrocytes
- Oligodendrocytes
- Microglia
- Ependymal cells



# NEURON

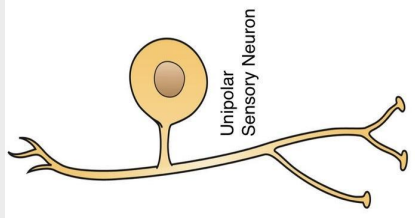


- **Components:**

1. **Cell body (Perikaryon)**
2. **Processes:**
  - 2a. **An axon: ONLY ONE**
  - 2b. **Dendrites: ONE OR MORE**

# Types of Neuron (Based On Number of Processes)

## Unipolar (Pseudounipolar) Neurons

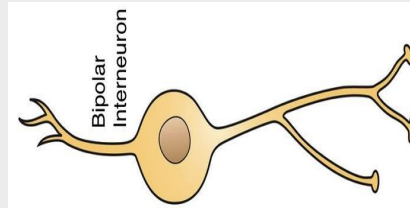


### Rounded neuron

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

e.g. Mesencephalic nucleus of trigeminal nerve and dorsal root (spinal) ganglion.

## Bipolar Neurons

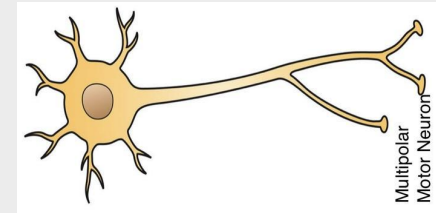


### Spindle-shaped neuron

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

- 1- Retina
- 2- Olfactory Epithelium

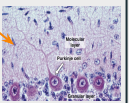
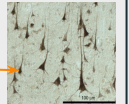
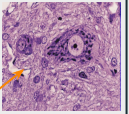
## Multipolar neurons



Has one axon and multiple dendrites.

### Types of Multipolar Neurons:

- 1- Stellate Neuron (looks like star): **The commonest type**, Distributed in most areas of CNS, e.g. Anterior horn cells of the spinal cord.
- 2- Pyramidal Neuron (looks like pyramids): In Motor Area 4 of Cerebral cortex
- 3- Pyriform Neuron: (Pear-Shaped) In 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

### 1- Mitochondria

**Are numerous**

because the neuron is very active so it needs energy. Thanks 438

### 2- Neurofilaments

Are intermediate filaments which are bundled together to form neurofibrils.

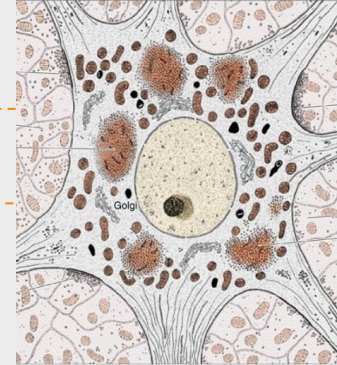
**Are found in the cell body, axon and dendrites.**

### 3- Microtubules

**found in the cell body, axon and dendrites.**

### 4- Golgi apparatus

**Surrounds the nucleus all around.** (Activate proteins secreted by rER. Thanks 438)



# Cell body (perikaryon) Structure of cell body:

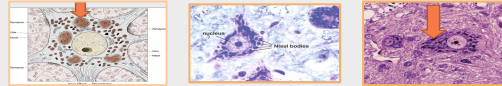


## 2-Cytoplasm

## 5- Nissl bodies

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

no nissl bodies in axoplasm. Thanks 438



6-Some fat and glycogen granules

## 7-Pigments

- a. Lipofuscin pigments (in old age)
- b. Melanin pigments (in neurons of substantia nigra of the midbrain)


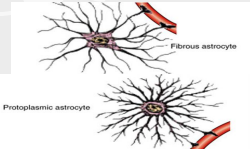
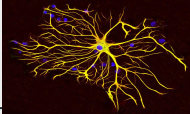
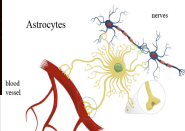
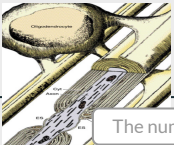


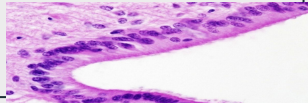
## 8-Centriole

Most adult neurons **have only one rudimentary centriole, so they cannot divide**

That's why nerve cell can't divide (New born have 2 centrioles because of the growth , however, as the baby grows , one of them will undergo atrophy )



# Neuroglia : Are a group of cells that act as the supportive tissue of CNS.

	Astrocytes	Oligodendrocytes	Microglia	Ependymal Cells			
Features	<ul style="list-style-type: none"> <li>• They are the <b>commonest type</b> of neuroglia cells.</li> <li>• They are found in both the grey and white matter.</li> <li>• They are star-shaped cells with numerous long processes.</li> <li>• Some of their processes end as pedicels ( vascular feet ) That come in contact blood vessels.</li> </ul> <p><b>Types:</b></p> <p>1- <b>Protoplasmic astrocytes:</b></p> <ul style="list-style-type: none"> <li>• Are found in the <b>grey</b> matter of CNS.</li> <li>• Their processes branch extensively. (processes are short)</li> </ul> <p>2- <b>Fibrous astrocytes:</b></p> <ul style="list-style-type: none"> <li>• Are found in <b>white</b> matter of CNS.</li> <li>• Their processes have fewer branches but longer.</li> </ul>	<ul style="list-style-type: none"> <li>• Are branching cells with few, short processes.</li> <li>• They are distributed in the grey and white matter of CNS.</li> </ul>	<ul style="list-style-type: none"> <li>• Are spindle-shaped cells with branching processes arising from each pole of the cell.</li> <li>• Are distributed in the grey and white matter of CNS.</li> <li>• Are rich in <b>lysosomes</b>.</li> <li>• Originate from primitive macrophages in the yolk sac.</li> </ul>	<p>Are simple columnar epithelial cells (partially ciliated) lining the brain ventricles and the central canal of spinal cord.</p> 			
Function	<ul style="list-style-type: none"> <li>• <b>Repair</b> of injury of CNS tissue (gliosis = <b>instead of fibrosis</b>).</li> <li>• Supportive and <b>nutritive</b> functions to the neurons.</li> <li>• Participate in the formation of <b>blood-brain barrier</b>.</li> </ul> <p>BBB: is formed by three elements 1-endothelial cells 2- well-developed basal lamina surrounding capillaries 3-pedicels of cytoplasmic process of astrocytes</p>	<ul style="list-style-type: none"> <li>• <b>Formation of myelin sheath in the CNS.</b></li> <li>• <b>Insulation</b> of nerve fibers.</li> </ul>	<p>Main function is <b>Phagocytosis</b>.</p>	<p>Participate in the <b>CSF</b> production</p>			
Picture							

The number of neuroglia is always more than neurons, why? Because neuroglia have the ability to divide and proliferate.

# SUMMARY

## Neuron Components:

- Cell Body ( perikaryon)
- Processes ( Axon & Dendrites )

## Structure of cell body:

- nucleus
- cytoplasm:
  - 1-Mitochondria
  - 2-Neurofilaments
  - 3-Microtubules
  - 4-Golgi apparatus
  - 5-Nissl bodies
  - 6-Some fat and glycogen granules
  - 7-Pigments
  - 8-Centriole



## Types:

### 1- Types of Neurons:

- Unipolar, 1 process  
ex: **1- Mesencephalic Nucleus of Trigeminal Nerve 2- (DRG)**
- Bipolar, 2 processes  
ex: **1-Retina 2-Olfactory Epithelium**
- Multipolar, multiple processes

### 2- Types of Multipolar Neurons:

- Stellar Neurons (Horn)  
ex: **Anterior Horn cells of Spinal Cord**
- Pyramidal Neurons (M4)  
ex: **Motor Area 4 of Cerebral cortex**
- Pyriform Neurons (Purkinje)  
ex: **Purkinje cells of cerebellar cortex**



### 3- Types of Neuroglia:

- Astrocytes
- Oligodendrocyte
- Microglia
- Ependyma

### 4- Types of Astrocytes:

- Protoplasmic astrocytes (G)
- Fibrous astrocytes (W)





# MCQs :

**1. Which of the following is a basophilic structure in the neuron?**

**a. Nissl bodies**

**b. Neurofilaments**

**c. Lysosomes**

**d. Centeriols**

**2. Which of the following is found in the retina and olfactory epithelium?**

**a.Pseudounipolar  
neurons**

**b.Bipolar neurons**

**c. Microglia**

**d.Multipolar  
neurons**

**3. Its main function is phagocytosis**

**a. Ependymal  
cell**

**b. Microglia**

**c. Astrocyte**

**d. None of any**

**4. Its main function is gliosis**

**a. Ependymal  
cell**

**b. Microglia**

**c. Astrocyte**

**d. Oligodendrocytes**

**1.a, 2.b, 3.b, 4.c**

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**Omar Banjar**

**Salman Almane**

Histology.443@gmail.com