ISHIK UNIVERSITY

FACULTY OF EDUCATION
Department of BIOLOGY EDUCATION

Lecture series in Histology for undergraduate students

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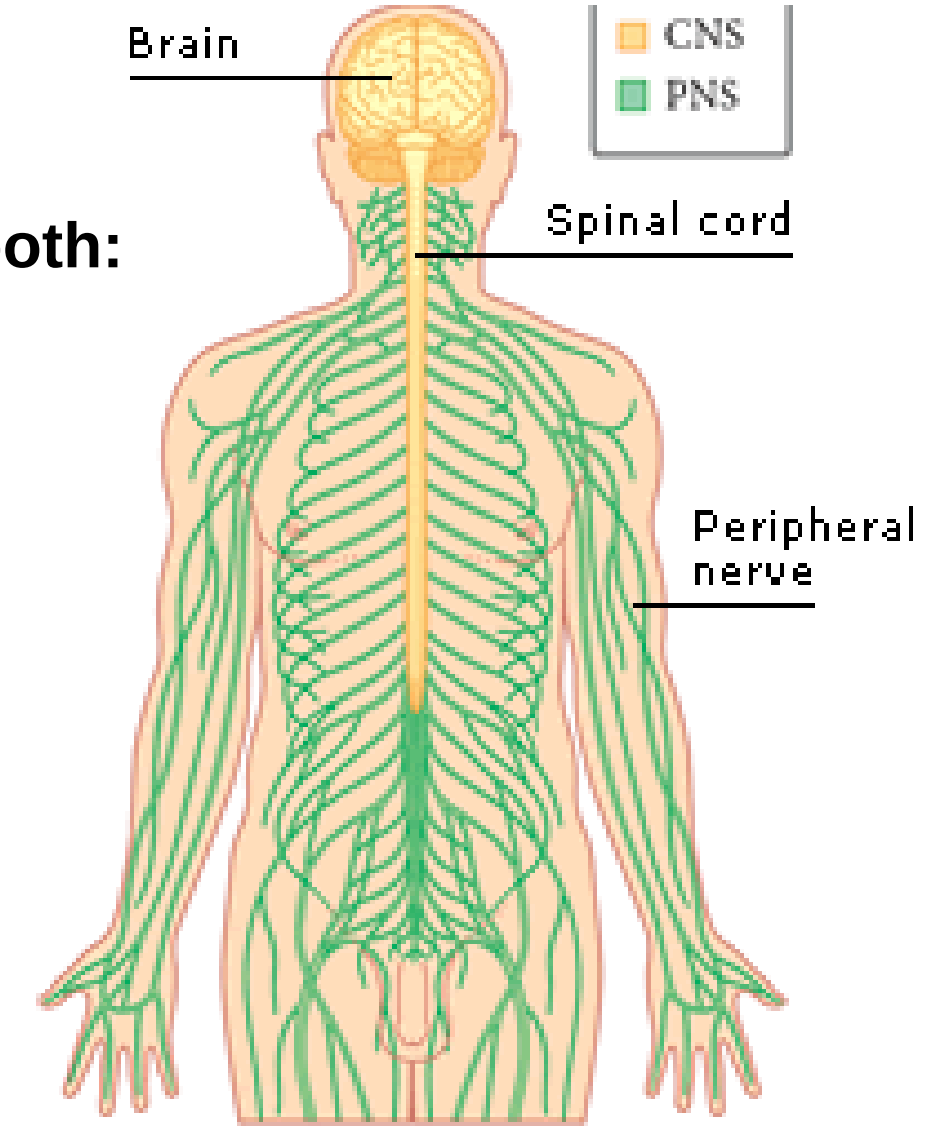
4- The Nervous Tissues

Nervous Tissue make up the nervous system both:
CNS= central nervous system(yellow) and
PNS= peripheral nervous system(green)



Introduction

1- Nervous tissues are groups of organized cells distributed throughout the body as an integrated communications network forming the nervous system.

2-Nervous system is the master controlling system of the body, it constantly and rapidly adjust and respond to **stimuli** received by the body.

3- Anatomically, the nervous system is divided into the :

a- central nervous system, consisting of the brain and the spinal cord, and

b-peripheral nervous system, composed of peripheral nerve fibers and small aggregates of nerve cells called **Nerve Ganglion.**

4-Histologically nervous tissue is composed of two principle types of cells: neurons and neuroglia cells.

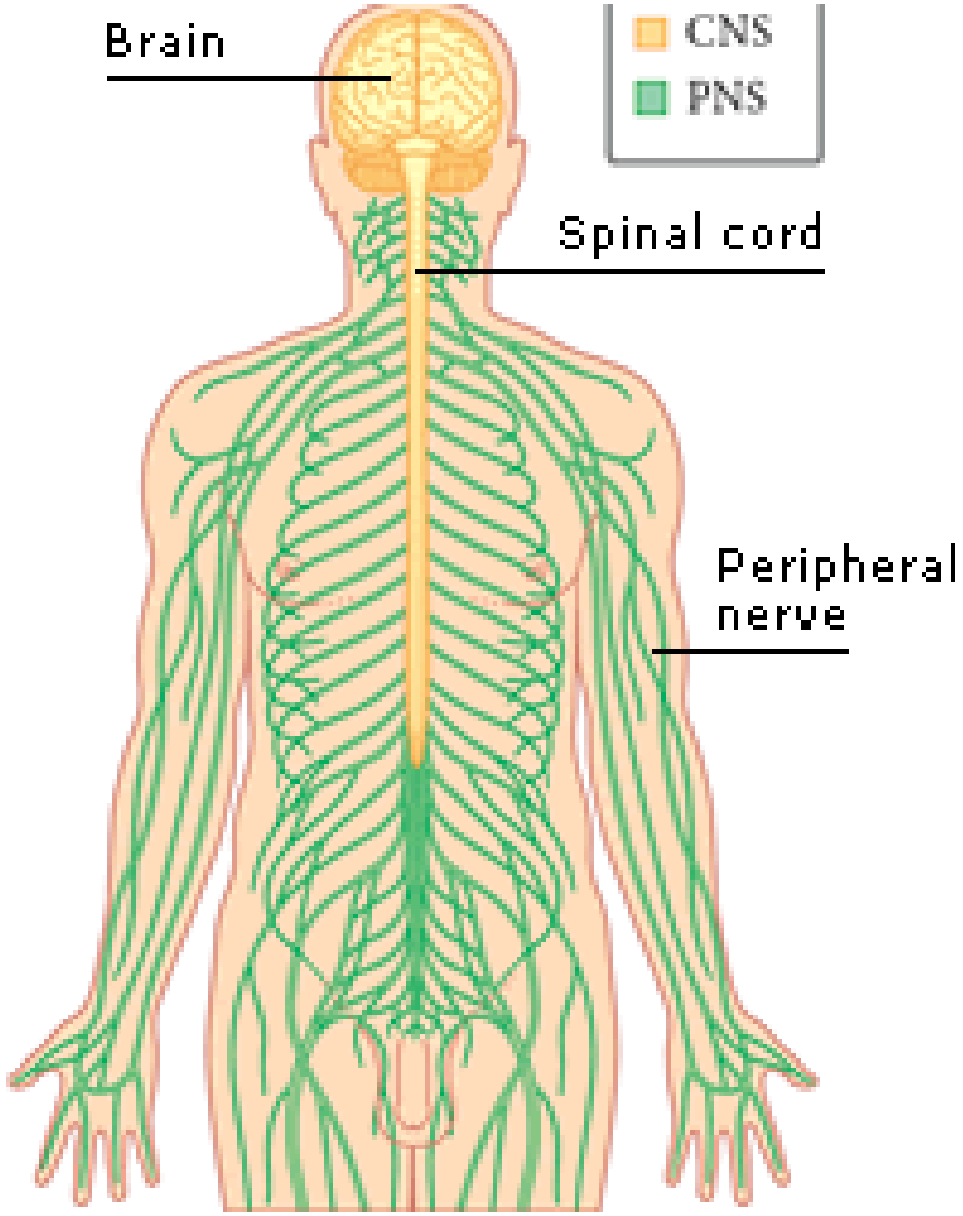
a-Neuron , (Nerve cell) : basic functional and structural unit of **nervous system** that receive, process. store, and transmit information to and from other neurons, muscle cells or glands.

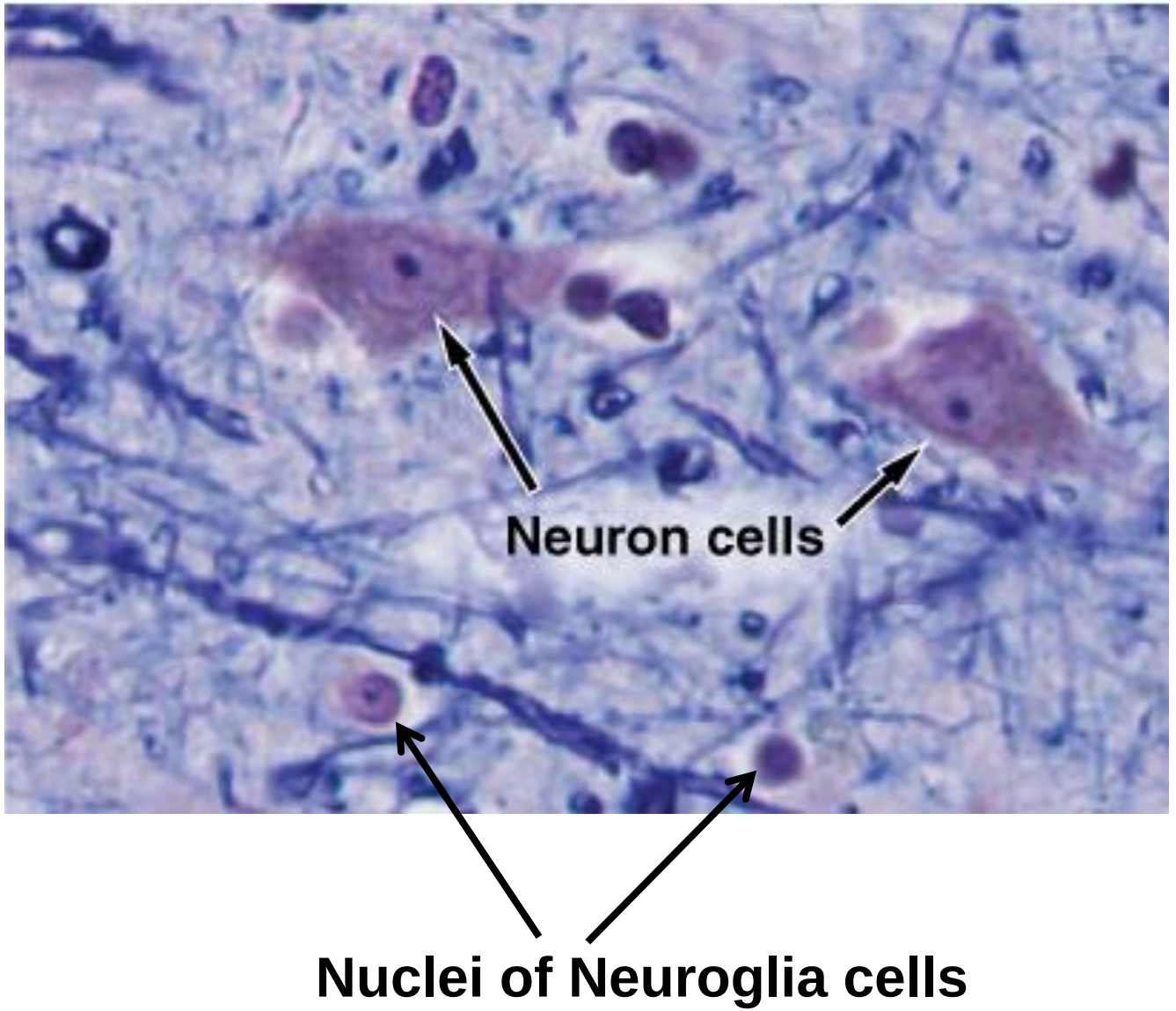
b-Neuroglia, are smaller and more abundant do not transmit impulses but have many other functions including support , protection and nourishment of neurons.

Nervous tissue carries a fundamental property of living tissue which are;

1-irritability, being highly specialized to receive and transmit internal as well as external **stimuli ?(**any change in the environment that causes an organism to react).

2- conductivity. means the ability to transmit impulses .


Brain
CNS
PNS
Spinal cord
Peripheral nerve


Neuron cells
Nuclei of Neuroglia cells

Objectives

1. Understand the basic structure of the nervous tissues.

2. Know the types of nerve tissue cells both Neurons including their processes and supporting glia cells.

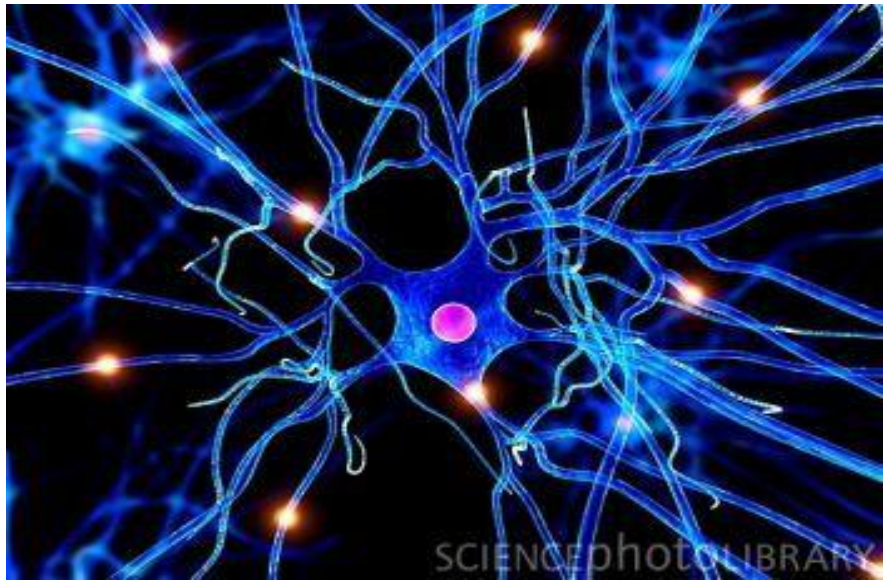
3. Recognize the microscopic structure of nervous tissues in relation to function.

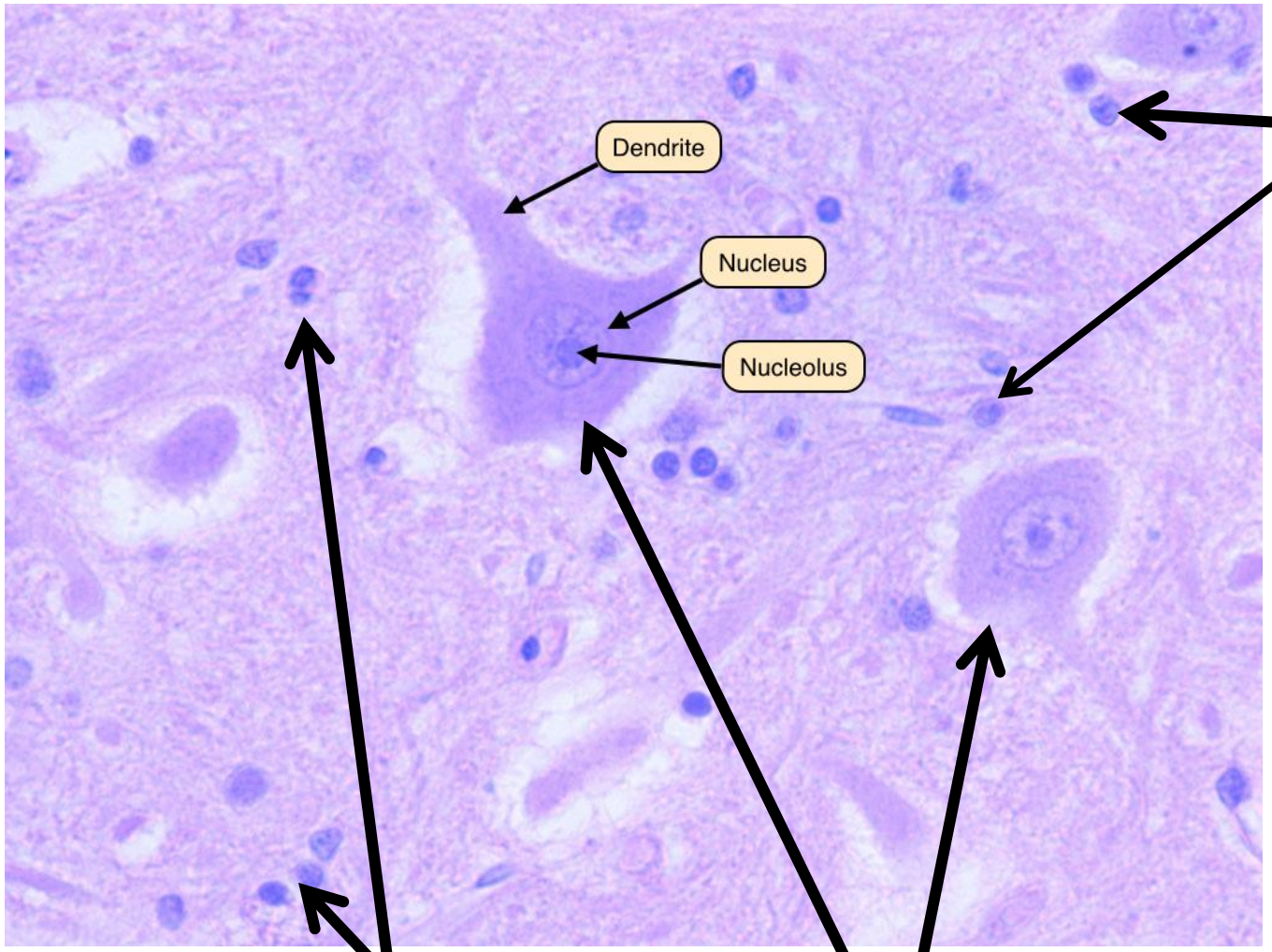
Features of The Nervous Tissues:

1. **Excitable(irritable)** tissues and fast acting control system.
2. Composed of neurons and supporting glia cells
3. It triggers contraction of muscle and gland secretion
4. It shares muscle in one feature and that is (irritability) excitability
5. It has another unique feature which is **conductivity.**
6. It senses stimuli and transmits signals from one part of the body to another
7. It allows the body to respond to the environment (external stimuli).
8. **No connective tissue** within C N S, only in P NS and superficial aspects of brain and spinal cord**(the three layers of Meninges).**
9- Neurons have no Centrioles, **why?**

The Neuron

Neurons are the nerve cells considered to be the basis of nervous tissue. They are responsible for the electrical signals that **communicate information** about sensations, and that produce movements in **response to those stimuli**, along with inducing **thought processes** **within the brain**. An important part of the function of neurons is in their structure, or shape. The three-dimensional shape of these cells makes the immense numbers of connections within the nervous system possible.

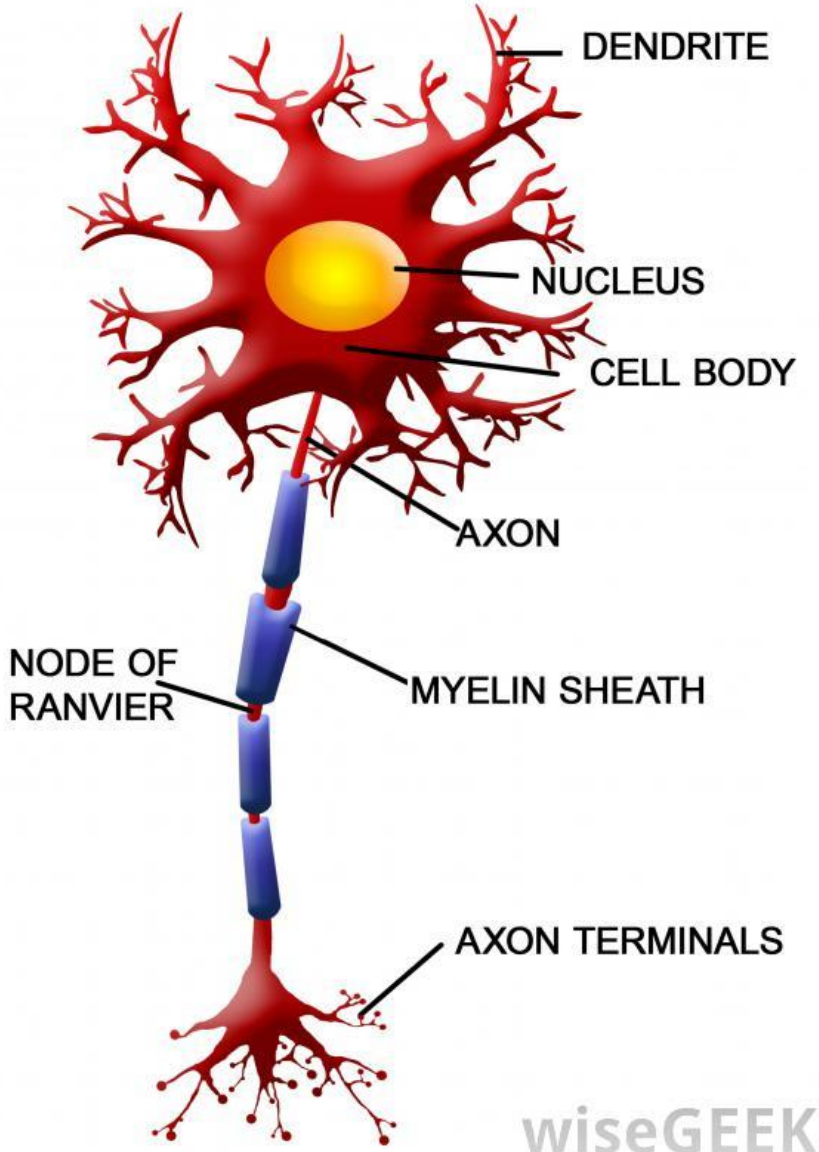




Neuroglia

Neuroglia

Neurons

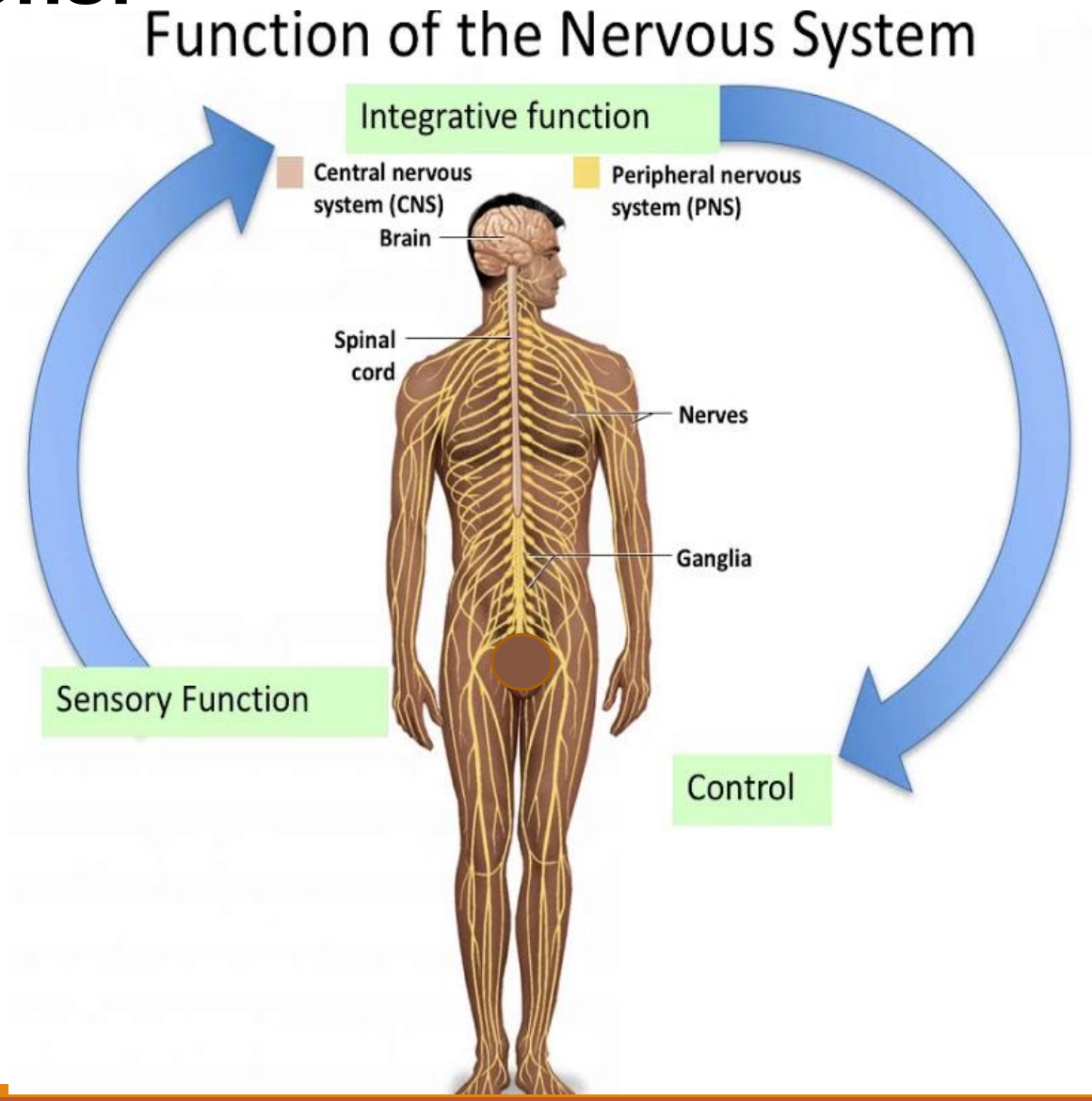


Functional classification of neurons:

1-Sensory or afferent towards CNS. from inside or outside of body.

2- Motor or efferent from CNS towards other tissues.

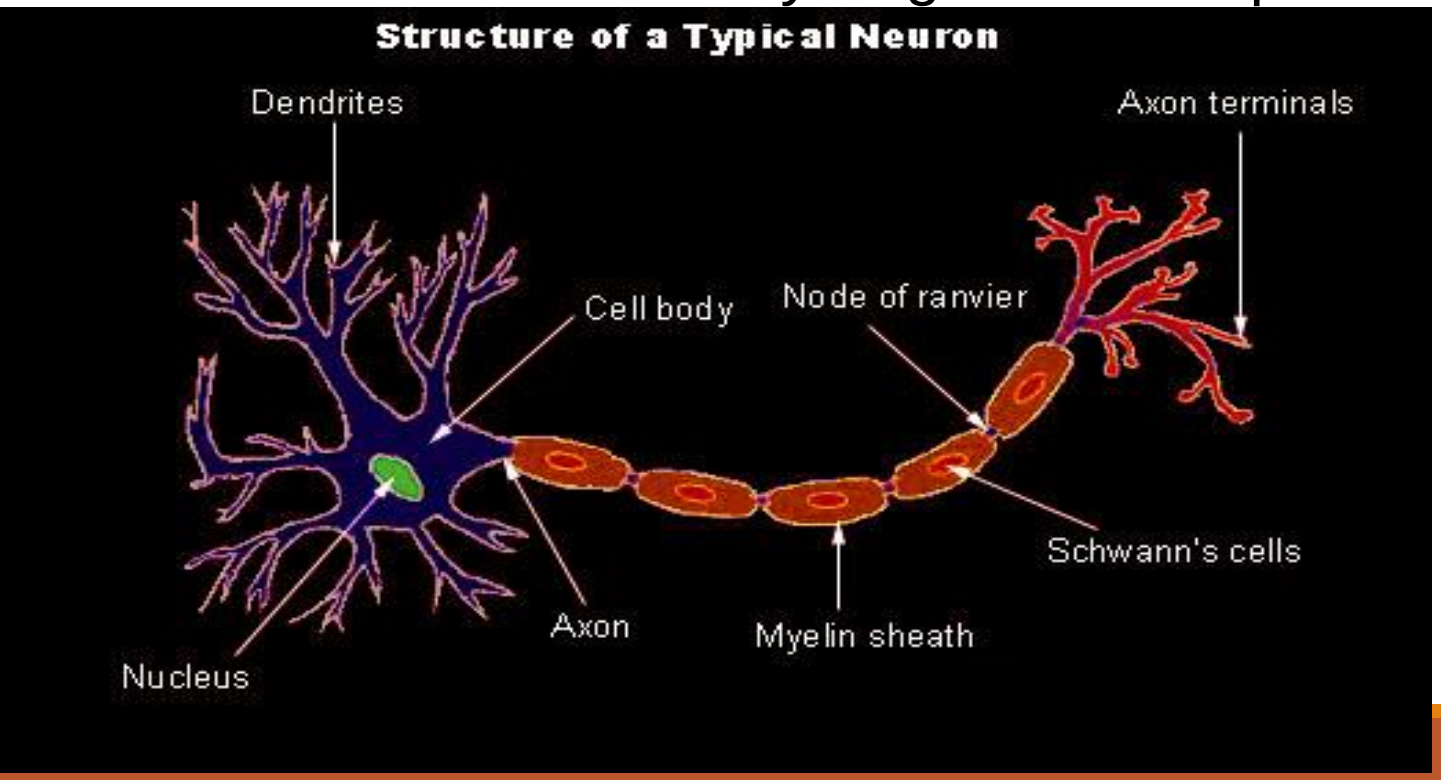
3- Interneuron – connects between sensory and motor.

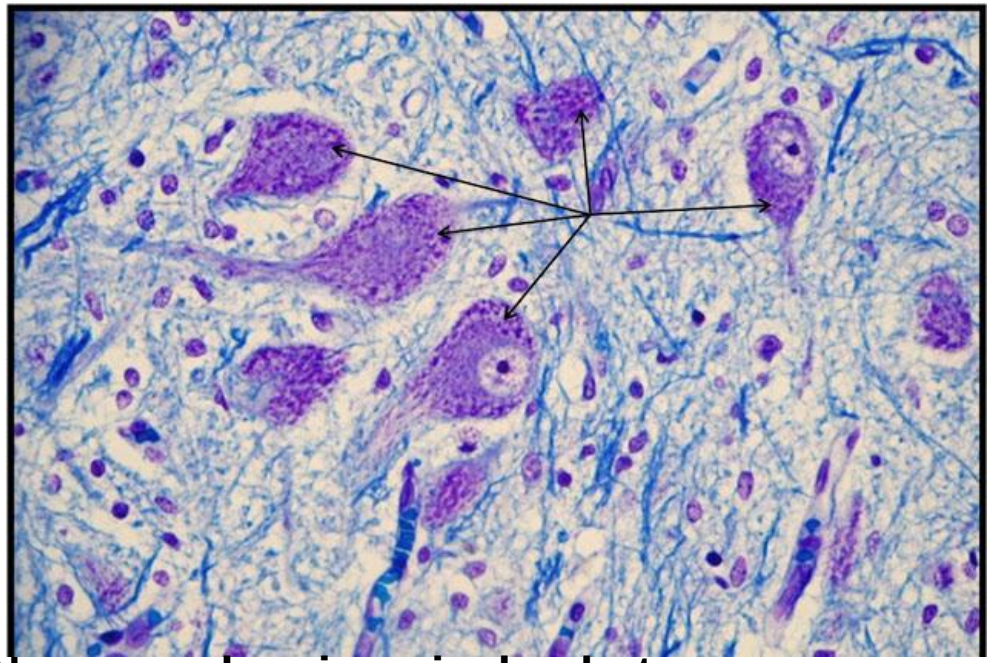


Structure of the Neuron and its processes (axon and dendrites)

1-The main part of a neuron is the cell body, which is also known as the soma (soma = “body”). The cell body contains the nucleus and most of the major organelles. (Aggregations of RER inside cytoplasm is called **Nissl substance)**

2-Neurons have one, axon—a fiber that emerges from the cell body and projects to target cells. That single axon can branch repeatedly at their terminal end to communicate with many target cells. Explain

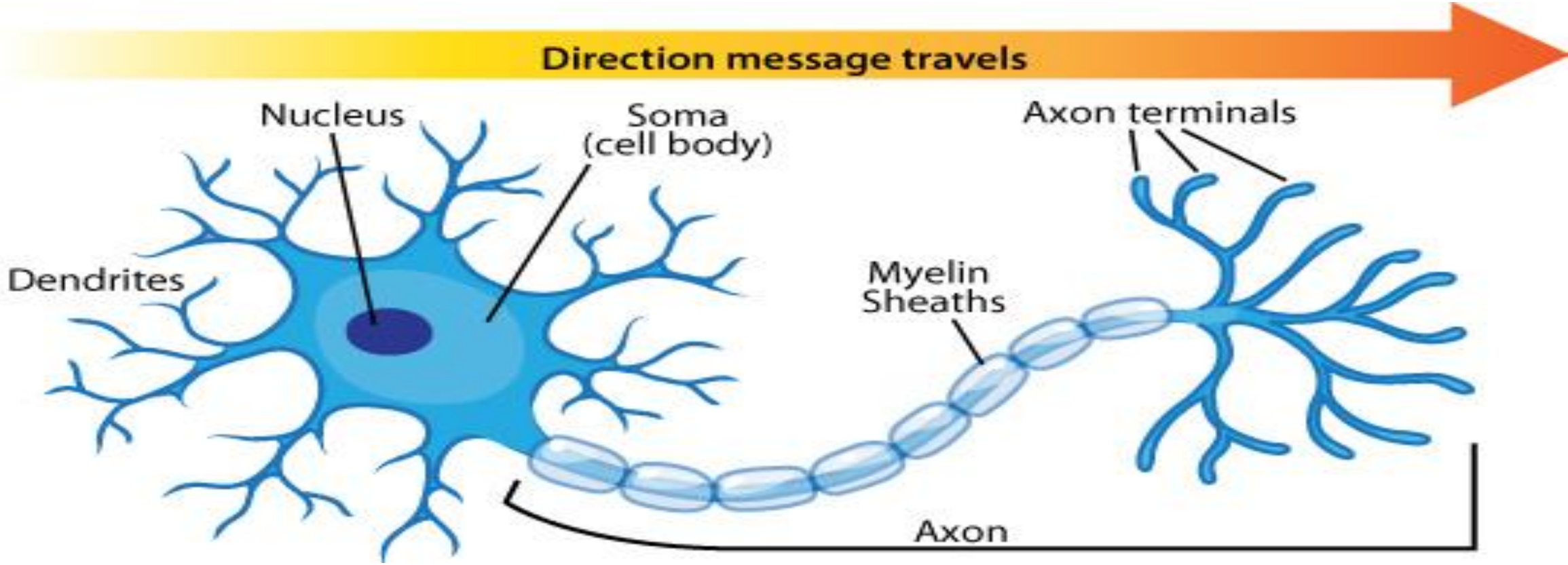




Neurons showing nissl substance in their cytoplasm+ many glia cells

Structure of the Neuron and its processes (axon and dendrites)

3-The other processes of the neuron are heavily branched dendrites, which receive information from other neurons at specialized areas of contact called **synapses**.
4- Information flows in this one direction from dendrites which are highly branched to the cell soma and from cell soma away to target tissues through the unbranched axon .

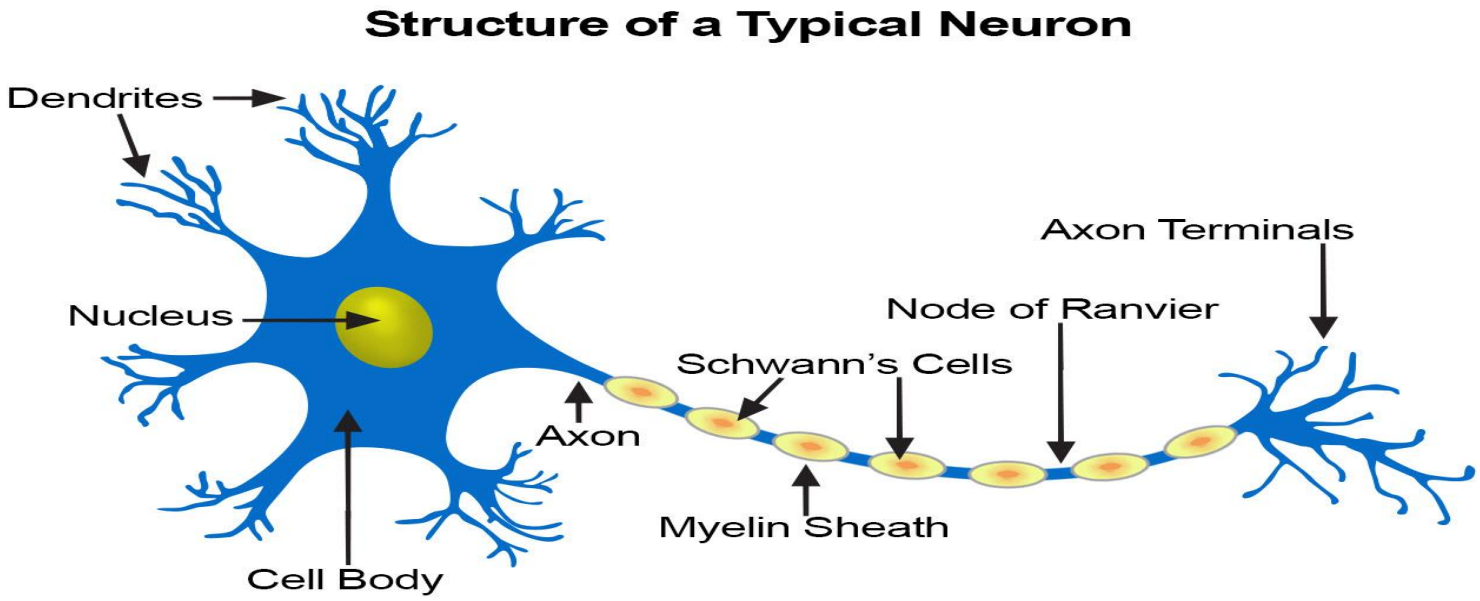


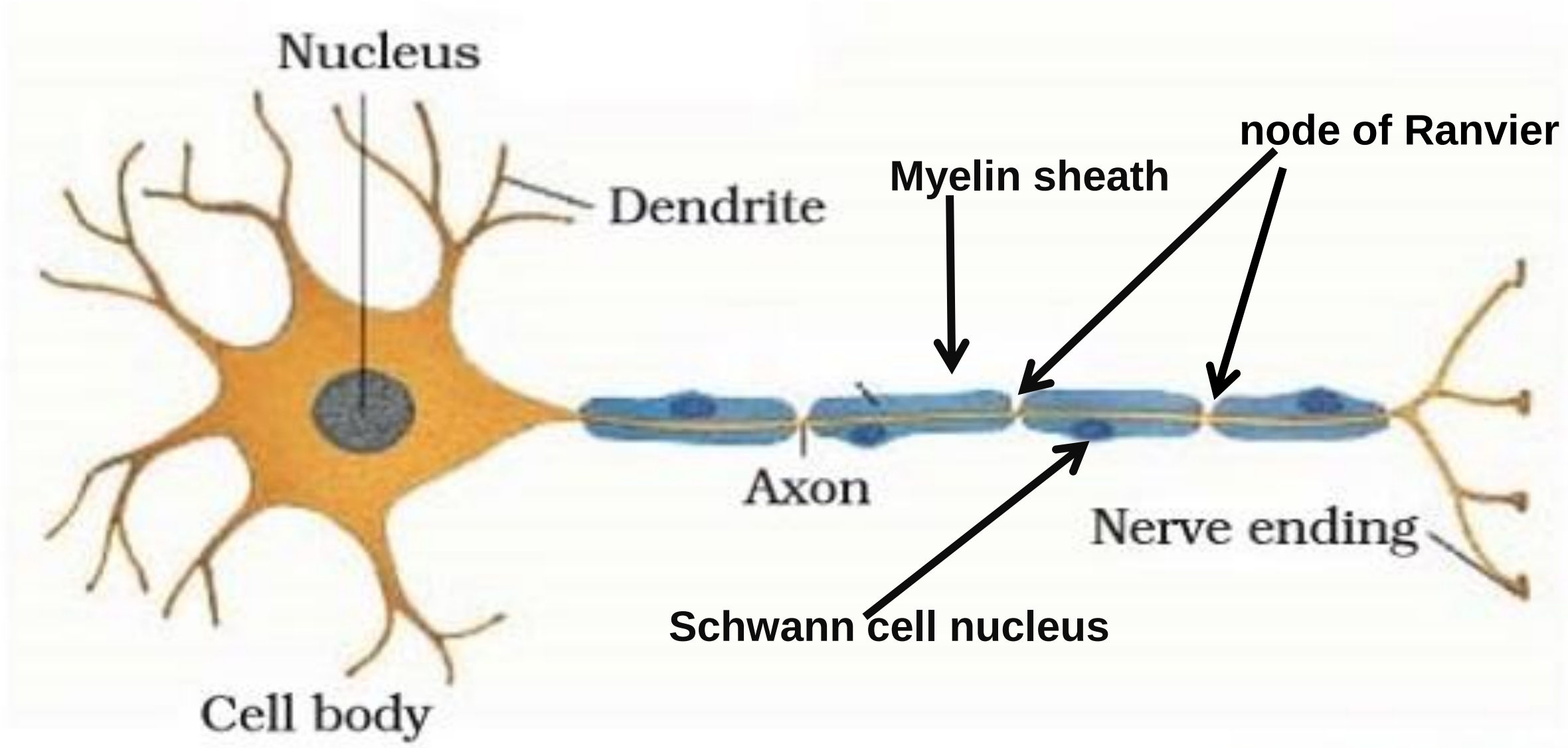
A nerve cell (Neuron)

5- Axons are wrapped by an **insulating lipid** substance **called myelin**, which is made by neuroglia cells. Most of smaller nerve fibers are not myelinated.

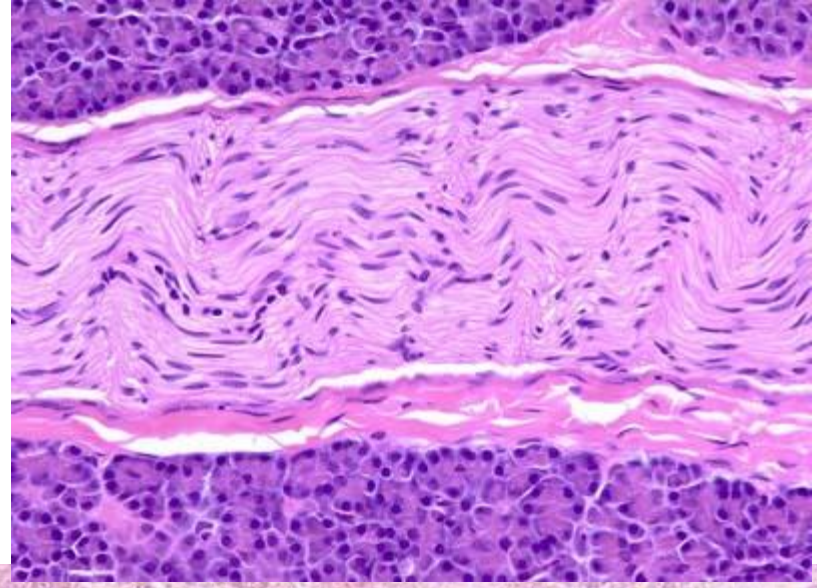
6-There are gaps in the myelin covering of an axon. Each gap is called a **node of Ranvier** ..

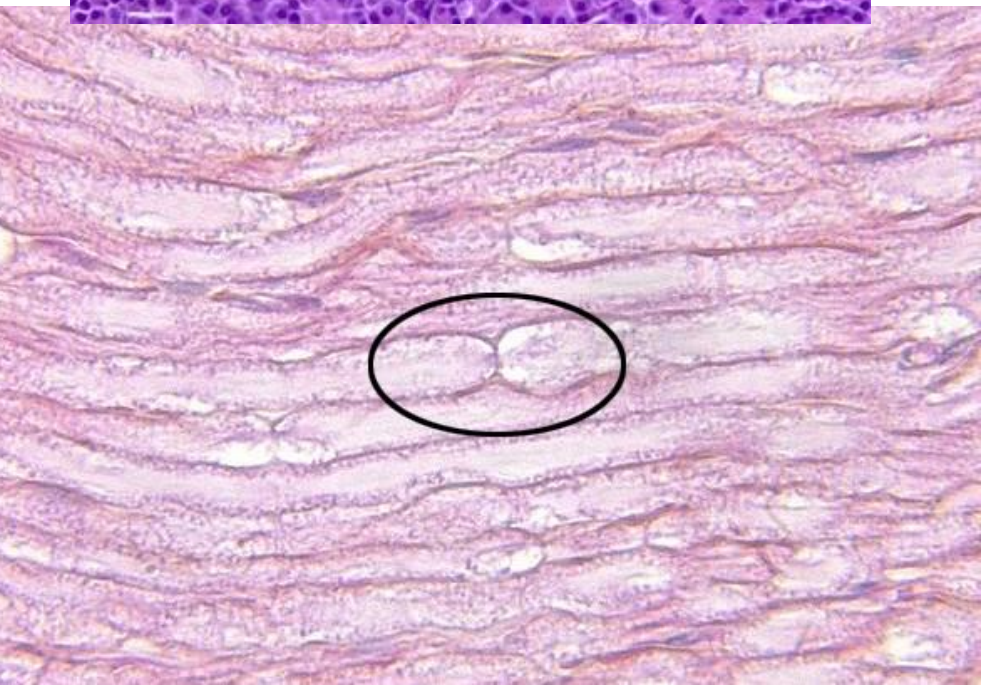
7-At the end of the axon is the **axon terminal**, where there are usually several branches extending toward the target cell.

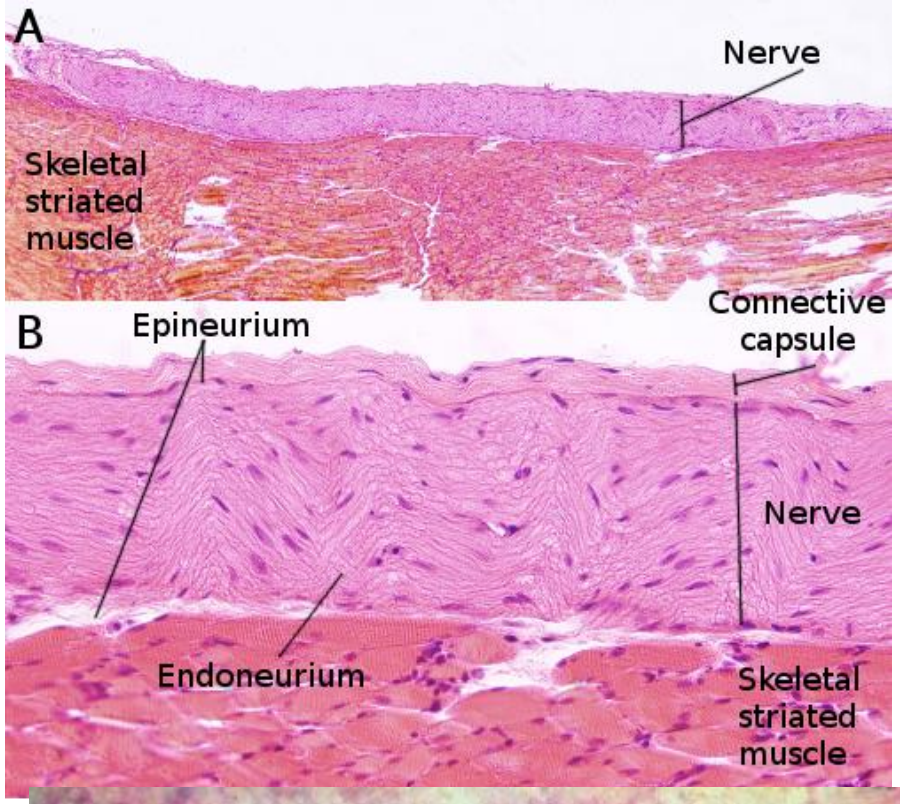


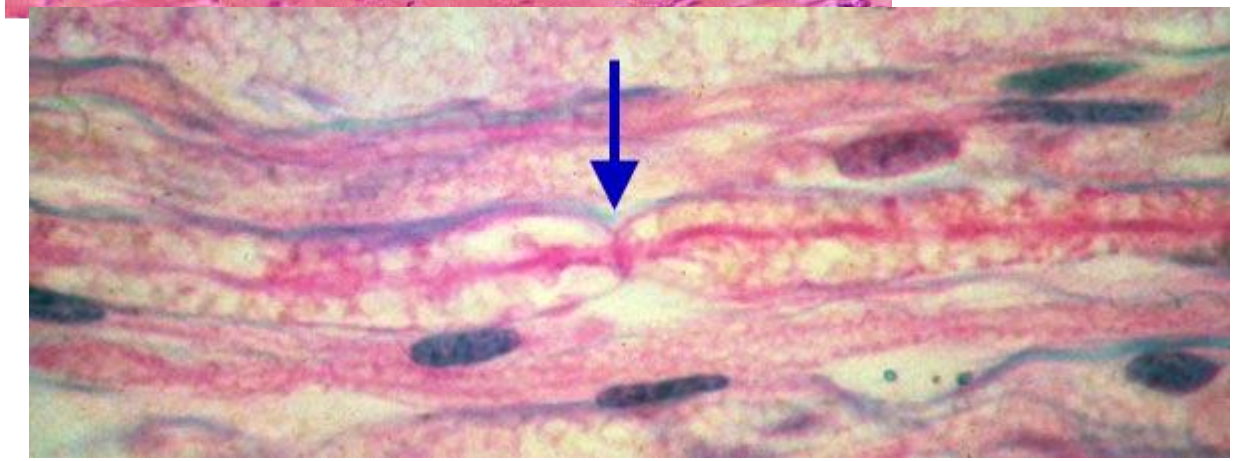


Nervous Tissue









Sections from Peripheral nerve fiber

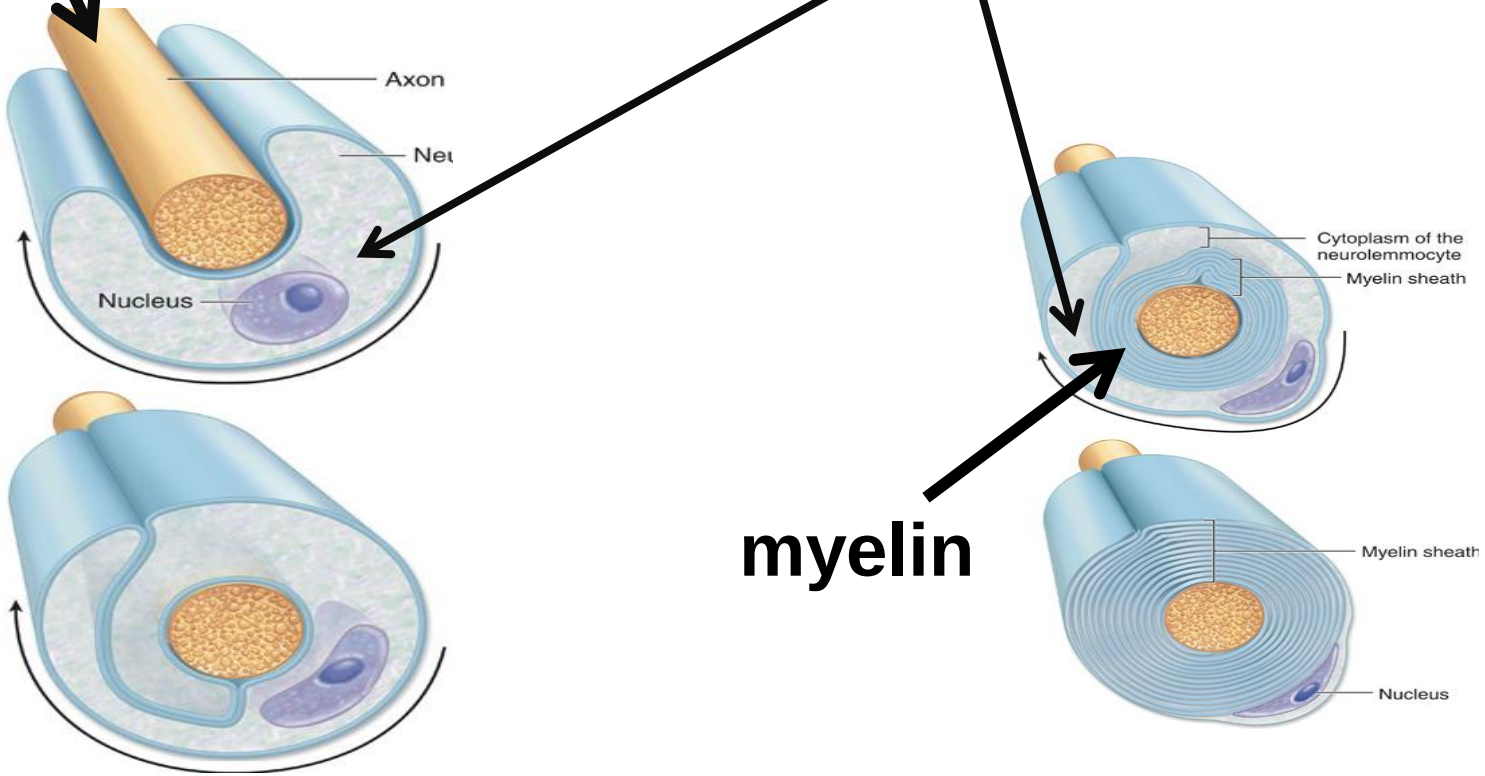
node of Ranvier

Schwann cells- PNS

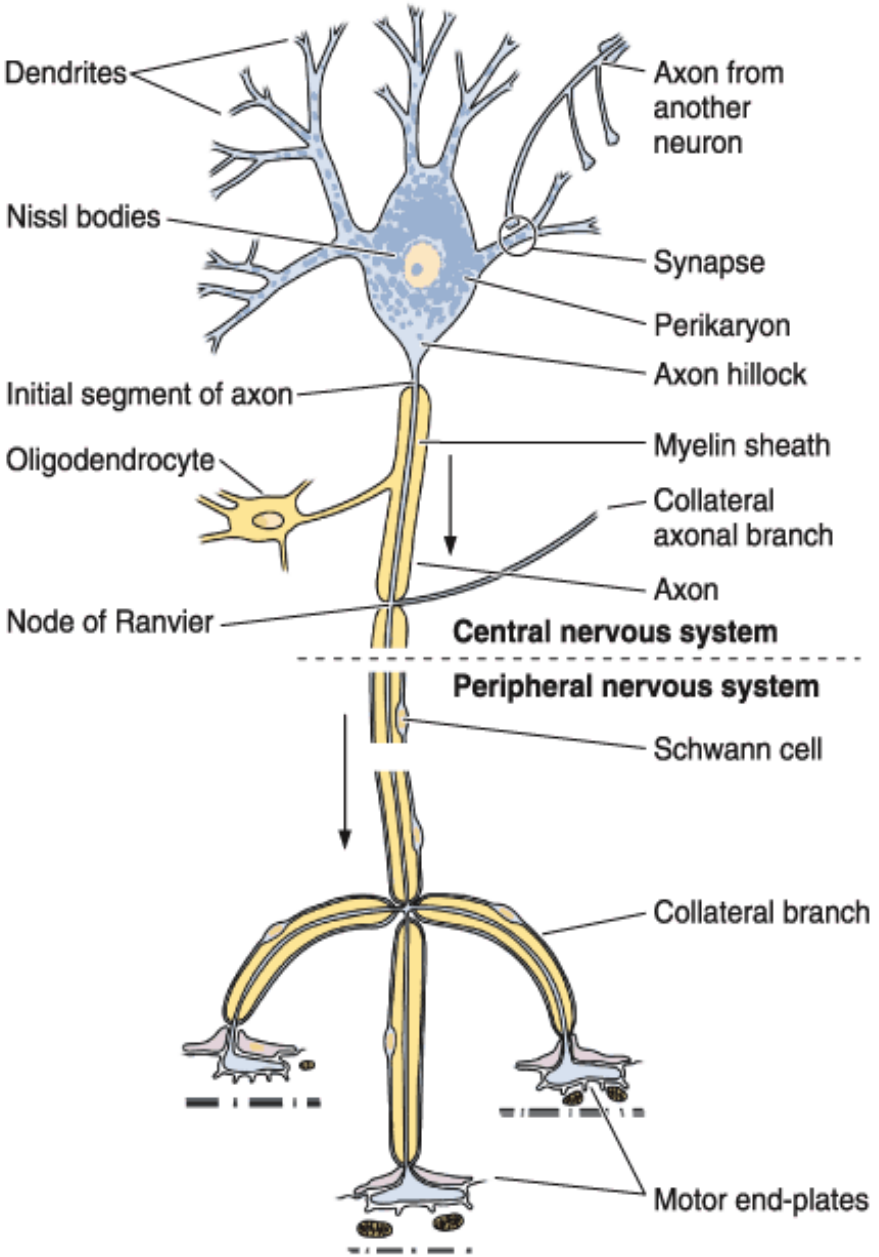
Form myelin sheath around peripheral axons

Axon

Schwann cell



myelin



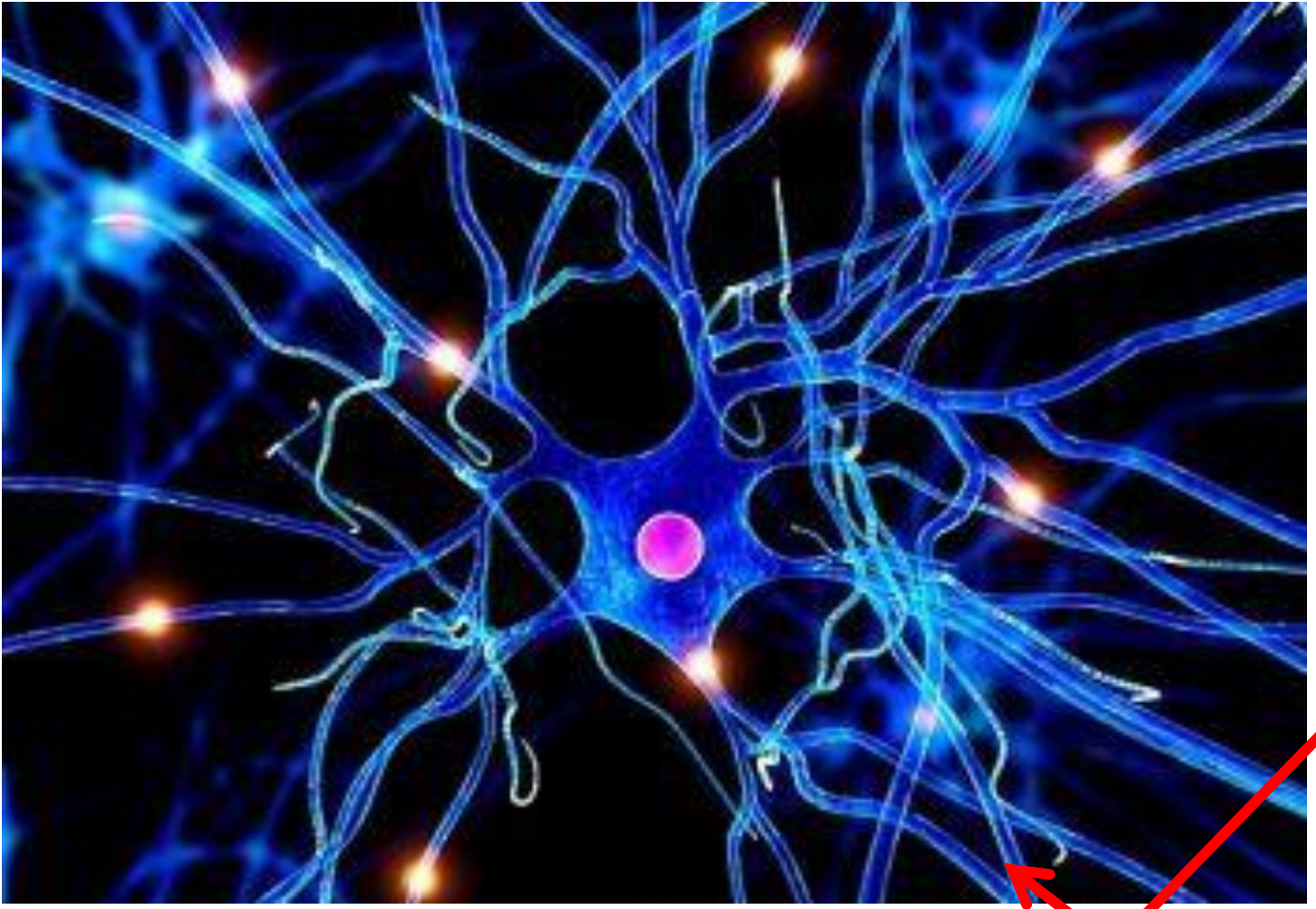
2-Neuroglia : provide metabolic and structural support for neurons, insulation for nerve fibers(myelin sheath),nutrition, homeostasis and phagocytic activities. There are six types of neuroglia cells:

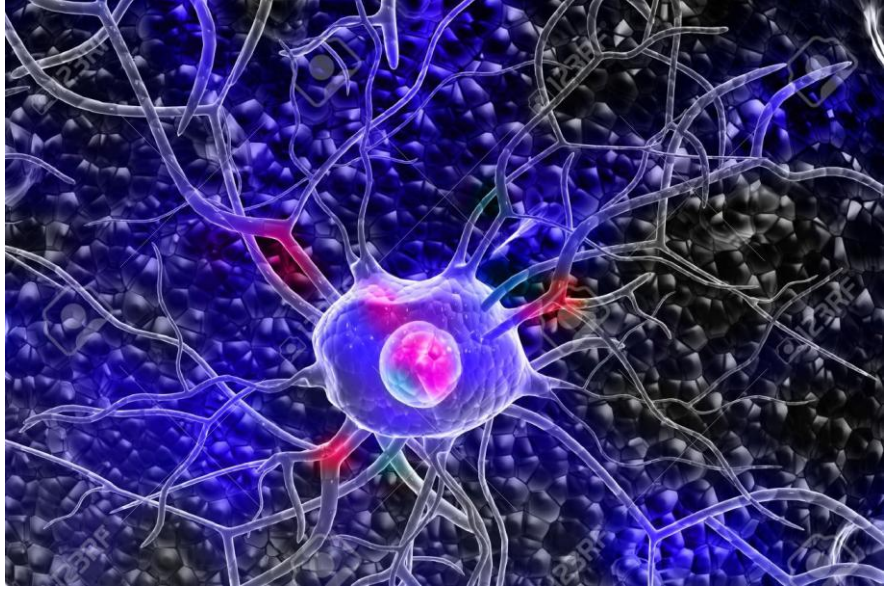
Neuroglia in CNS are:

1-Astrocytes,
2-Microglia,
3-Oligodendrocyte ,(produce myelin)
4-Ependymal cells

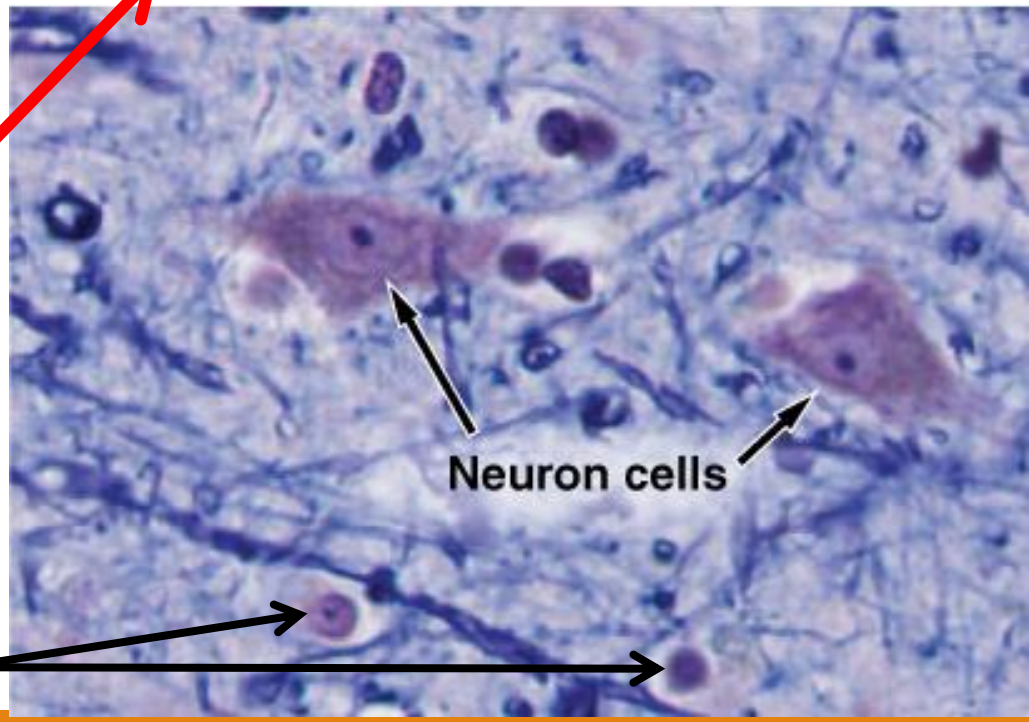
In PNS:

1-Satellite cells (supporting ganglion cells)
2-Schwan cells (produce myelin)





Neurons and their processes



Nuclei of Neuroglia

Types of neurons

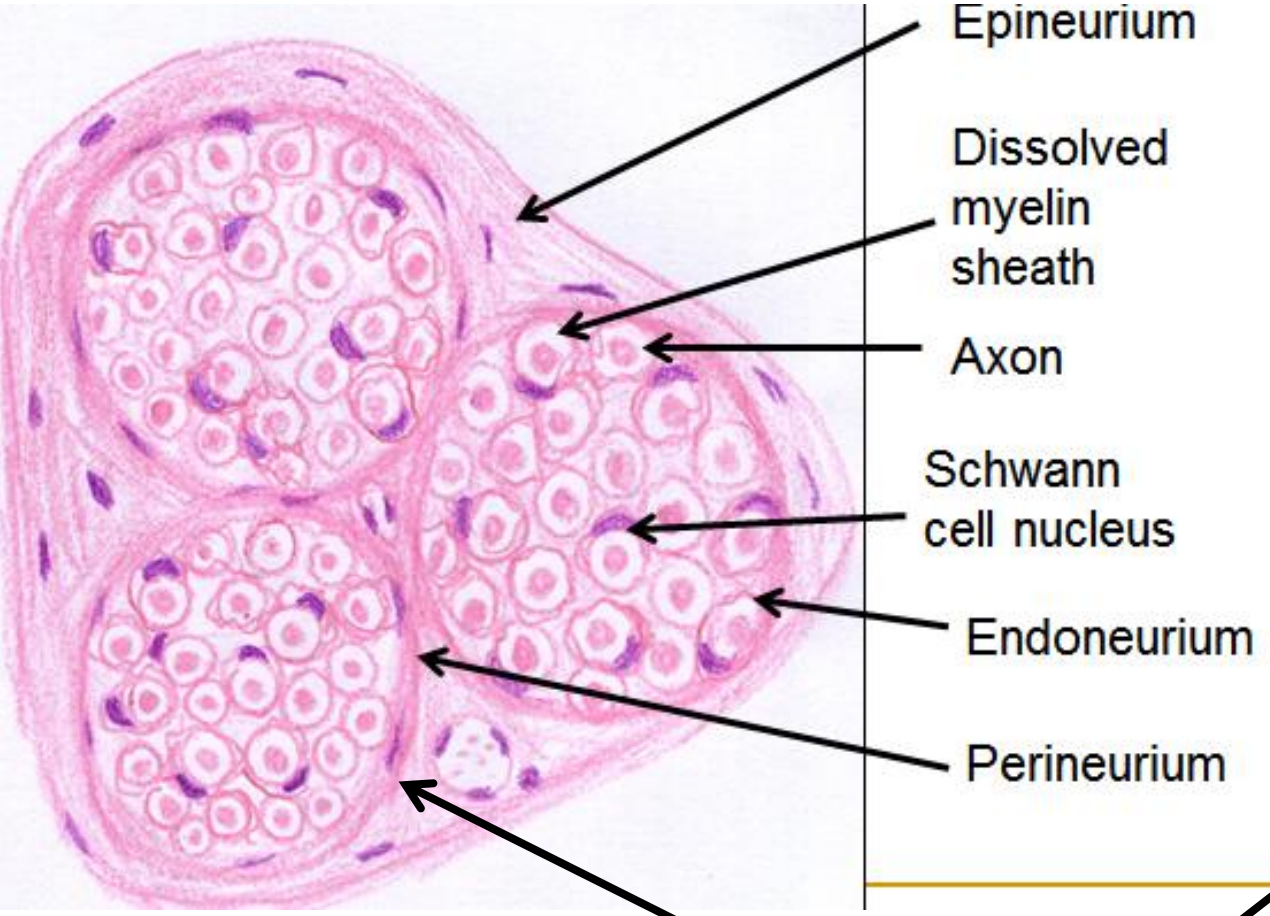
Neurons are classified according to a variety of criteria:
The most abundant and important type is Multipolar neurons present in both CNS and PNS such as :
Pyramidal neurons and Purkinje neurons in the brain and Stellate star shaped neurons in spinal cord.

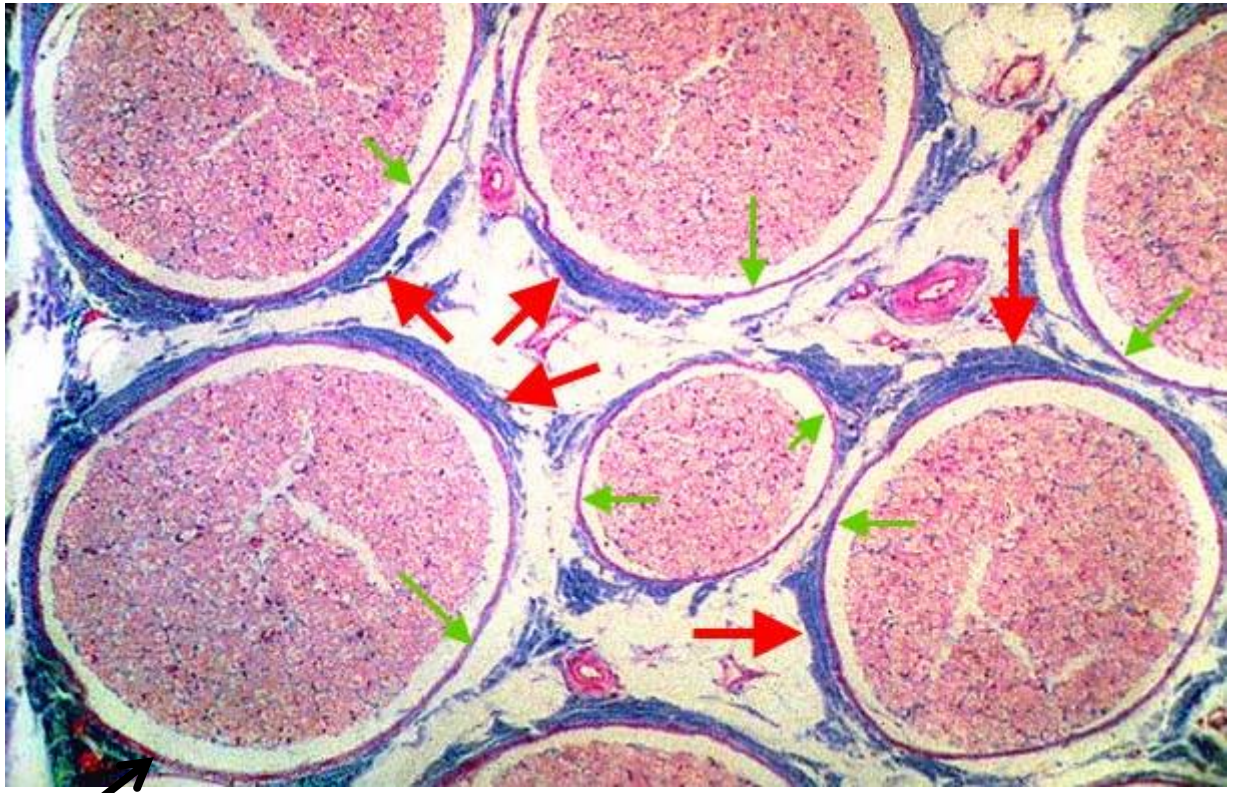
Connective tissue-c.t- coverings of peripheral nerve fibers

1- Each single axon(nerve fiber)is covered by a thin layer of c.t called **endoneurium.**

2- Groups of nerve fibers(fascicle) are covered by another c.t layer called **perineurium.**

3- The whole big nerve is wrapped by an outer thick layer of c.t containing arteries , veins ,called **epineurium.**





Red arrow epineurium. Green arrow perineurium.

Summary of Nervous Tissue

1- Two types of cells (neurons& neuroglia) and their processes form the basis of nervous system.

2- Neurons have both axon and numerous dendrites, bundles of myelinated axons are called **tracts** in the CNS and **nerves** in the PNS.

3- Two most important characteristic features of nervous tissue are: irritability(excitability) and conductivity.

4-Neurons cannot divide and for survival they need a continuous supply of oxygen and glucose.

5- Schwan cells which produce myelin in peripheral nerve fibers help regeneration of injured nerve fibers.

3-Unlike many other cells , neurons can synthesize chemical energy (ATP) only from glucose .

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