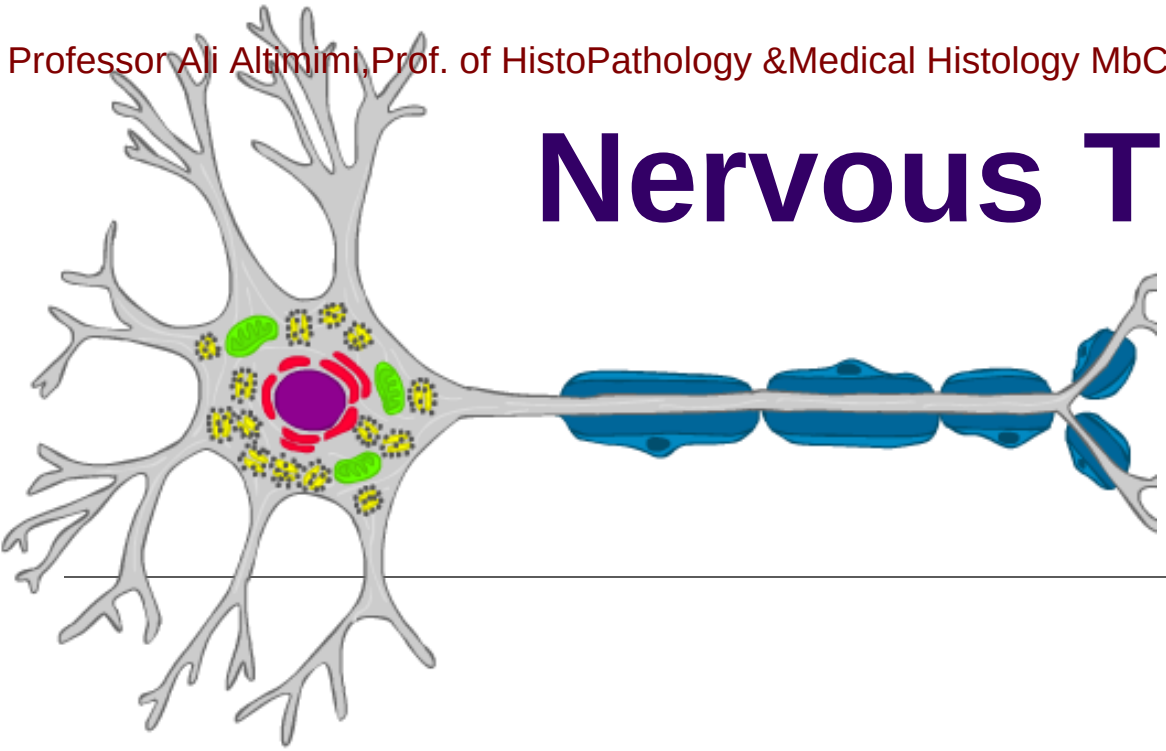
Nervous Tissue



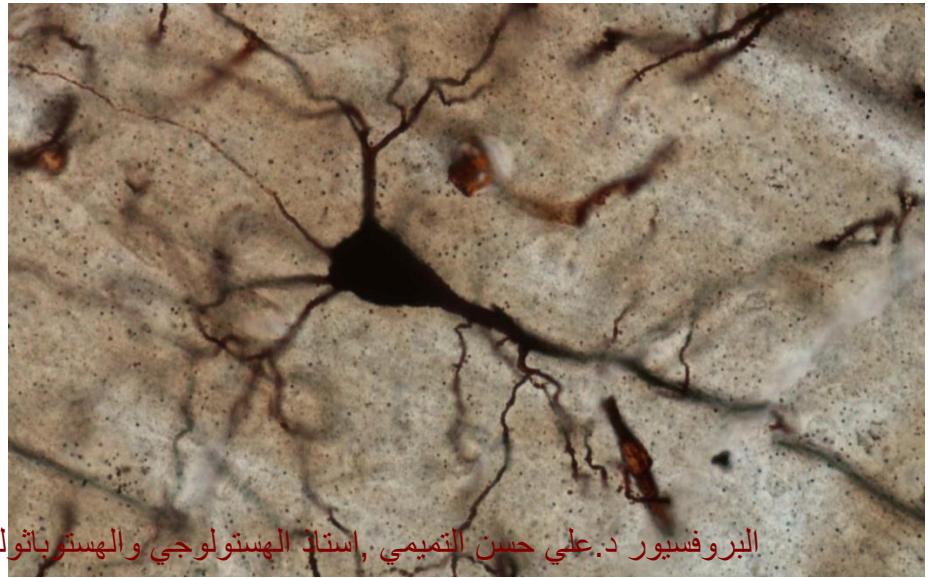
Professor Ali Altimimi,Prof. of HistoPathology & Medical Histology MbCHB, MSC, PHD, MD. Royal College England.

Histology Lecture

البروفسيور د.علي حسن التميمي ,استاذ الهستولوجي والهستوباثولوحي , دكتوراة الكلية الملكية انكلترا,وزميل كليةالامراض الامريكية

Nervous system - curiosities

- 90 billion neurons in nervous system
- Most neurons make synaptic connection to 1000 or more neurons and receive up to 10,000 connections from other neurons
- 10 million billions impulses per second

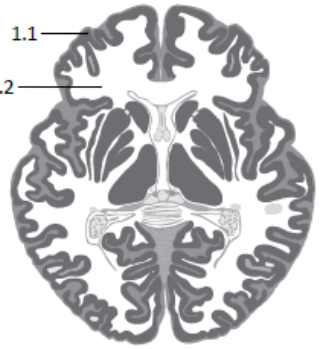


Repetition of principal terms

- Neurons and neuroglial (supporting) cells
- Central and peripheral nervous system
- *Substantia grisea et alba*
- Cortex of brain, little brain and basal ganglia
- Ganglion (ganglia)
- Cranial, spinal and autonomic nerves (conduct impulses from and to CNS)



Spinal cord ou



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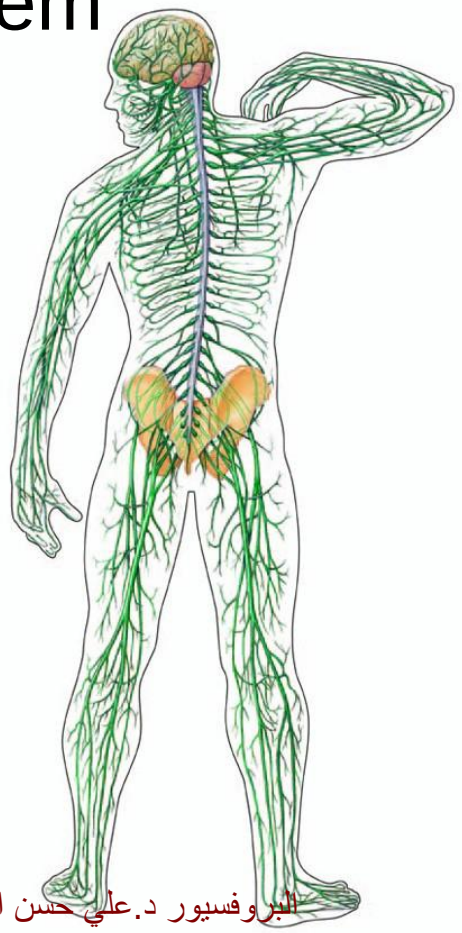
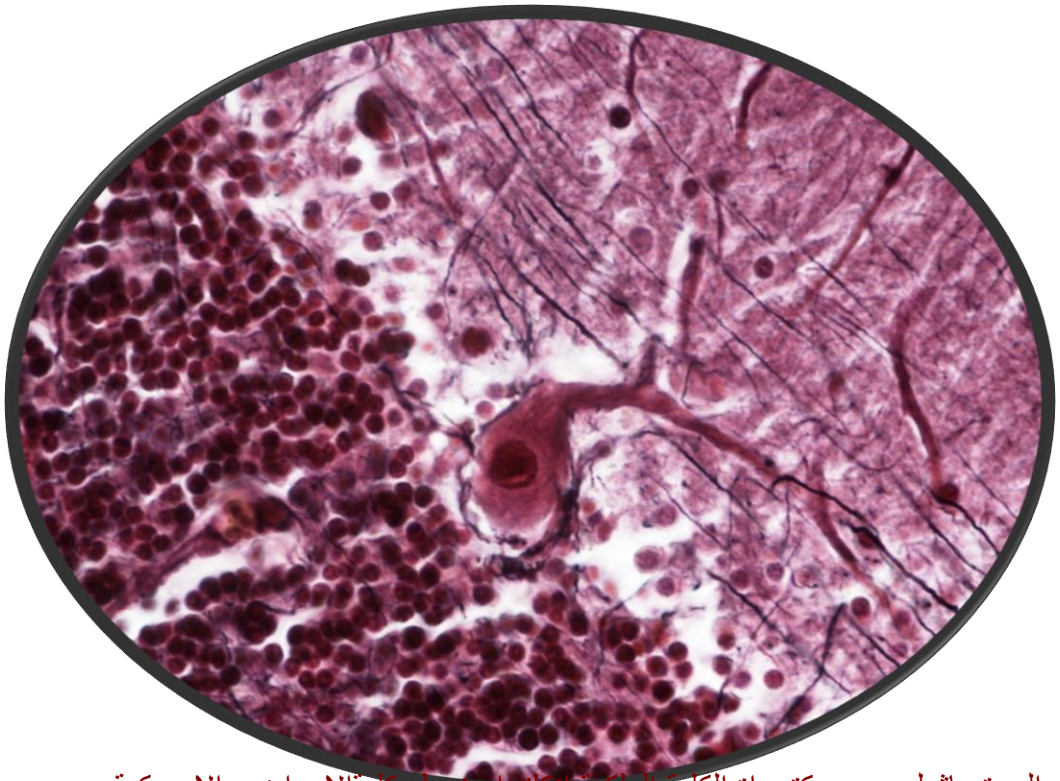


Short history of neurohistology...

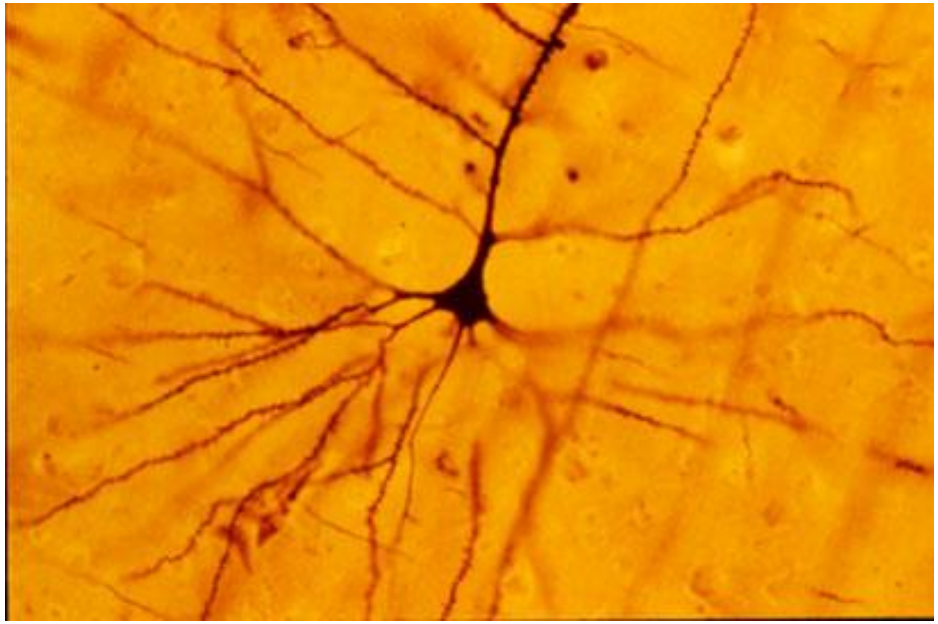
Ján Evangelista Purkyně (1838) – the first histologist, who draw nerve cells





Short history of neurohistology...

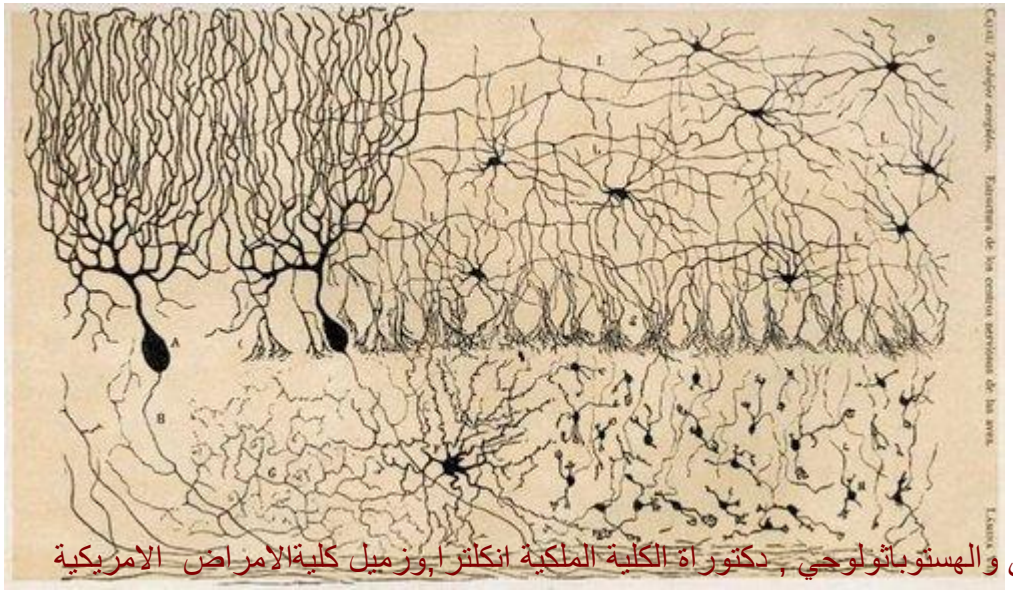
- **Camillo Golgi** (1873) – visualization of nerve cells and their processes after impregnation method *(„la reazione nera“)*





Short history of neurohistology...

Santiago Ramón y Cajal (1852-1934) – the "neuron doctrine“ – the nervous system is made up of discrete individual cells; information flows along the neuron in one direction (dendrites ➡ cell body ➡ axon)





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Nervous tissue consist of 2 principal type of cells:

- **Neurons (nerve cells)** – the structural and functional units of the nervous system, which transmit electrochemical impulses
- **Supporting (neuroglial) cells** – non-conducting, morphologically diverse cells

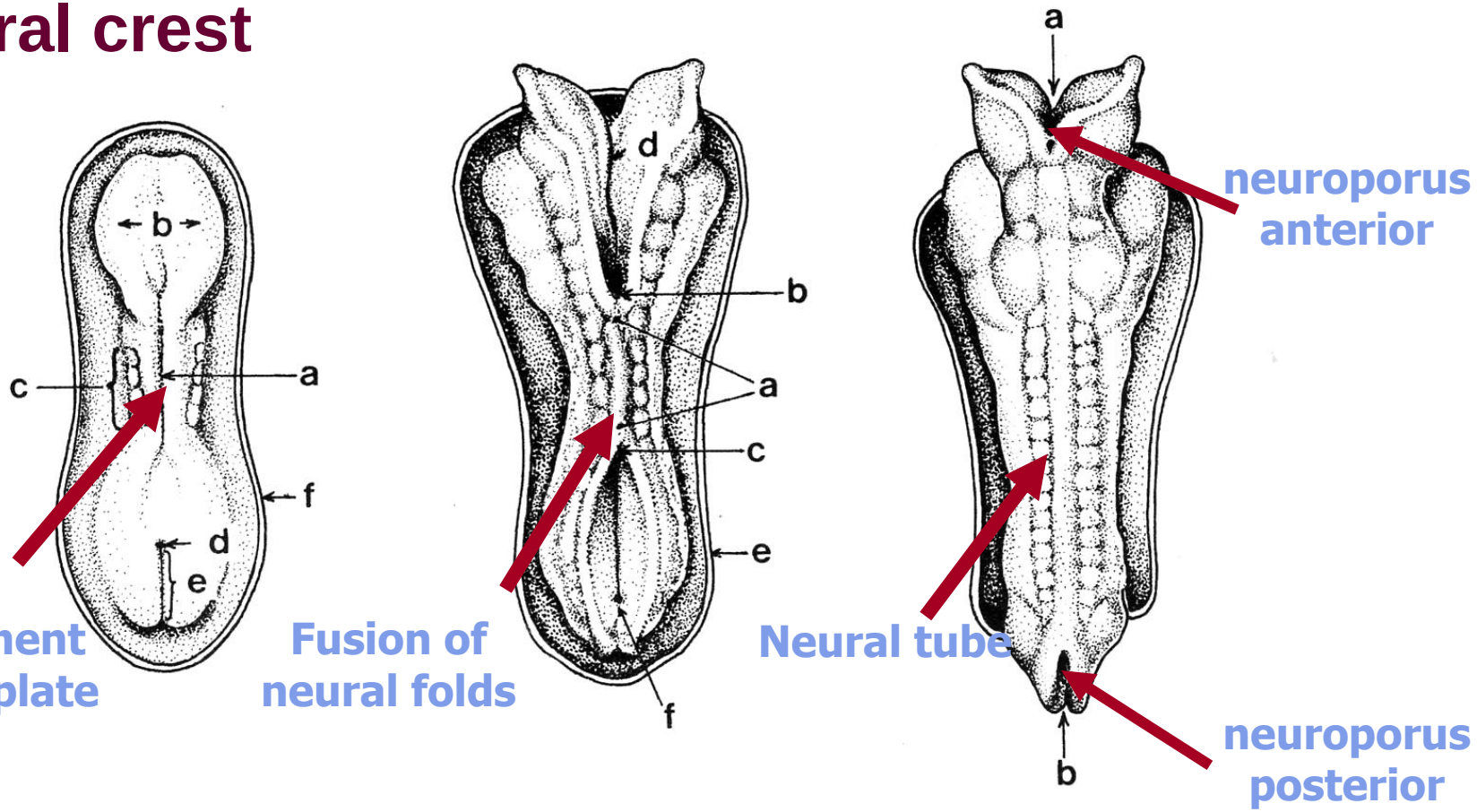
NEURONS < **NEUROGLIA**

10 - 20-times more abundant

What is neuron?

- Excitable cell specialized for reception of stimuli and conduction of impulses
- No division – no replication
- Neurons are post mitotic cells therefore they not divide (stop reproducing shortly after birth, with one exception – olfactory mucosa)

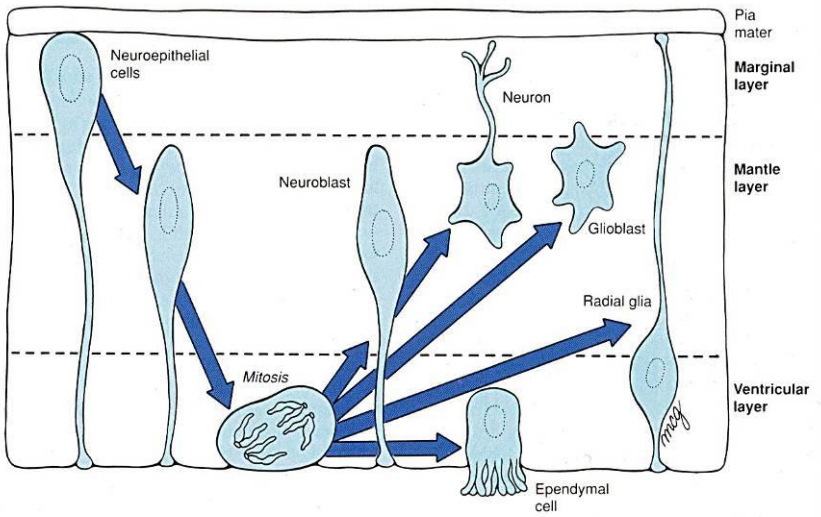
Development of the nervous system – first step: ectoderm, the neural tube and neural crest

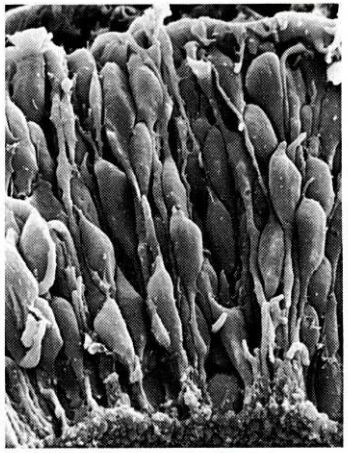


Neural folds approach each other in the midline, where they fuse. Fusion begin in the cervical region and proceeds cranially and caudally

Neural tube

future neurons and neuroglial cells of CNS

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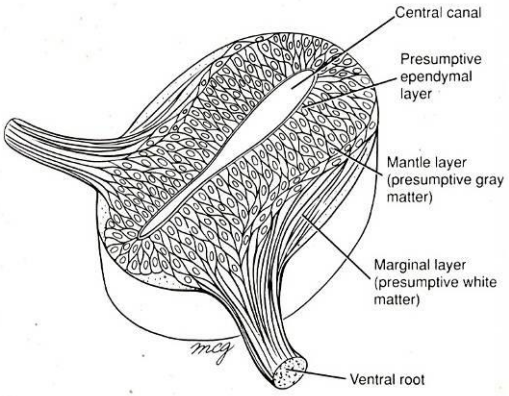




Nerve cells = neurons

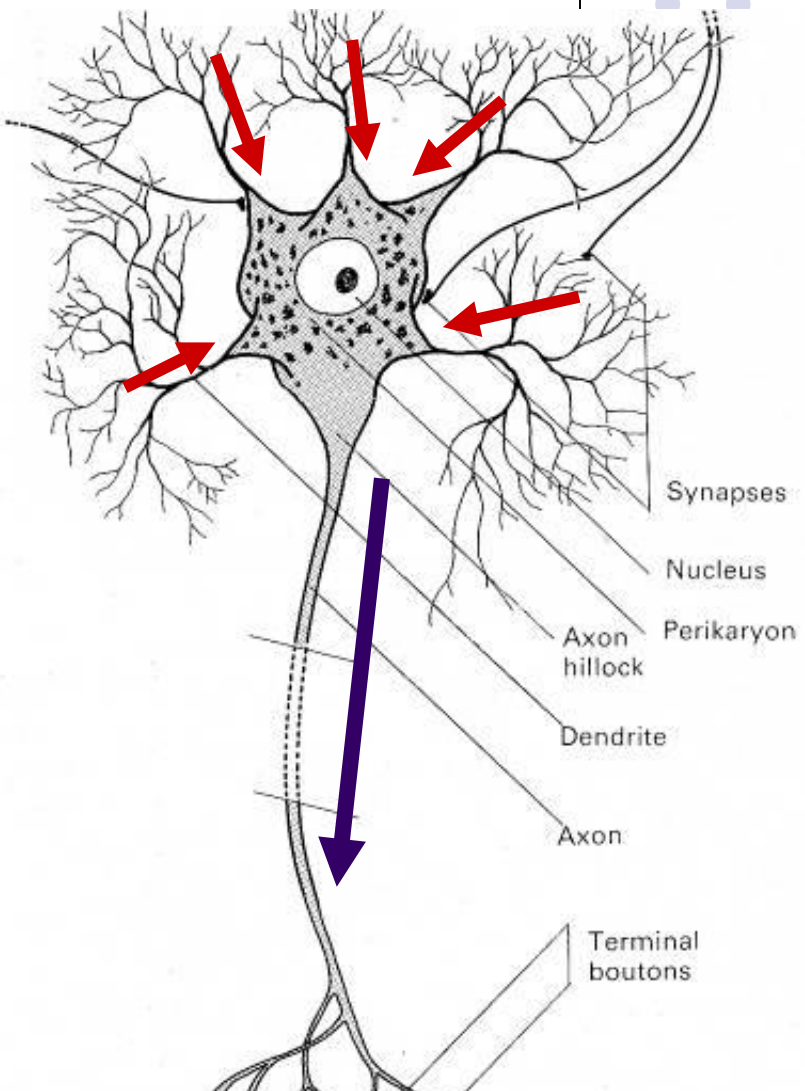
- Independent functional units of nervous system
- Are specialized to receive stimuli from other cells and to conduct electrical impulses to other parts of the system via their processes
- Are arranged as a communications network



Nerve cells – neurons

great variation in size and shape

- **Cell body** (perikaryon)
- Processes (extensions)
  - **Dendrites** – shorter processes that transmit impulses from the periphery toward the cells body, usually many dendrites
  - **Axon** – usually one longest process, which transmit impulses away from the cell body



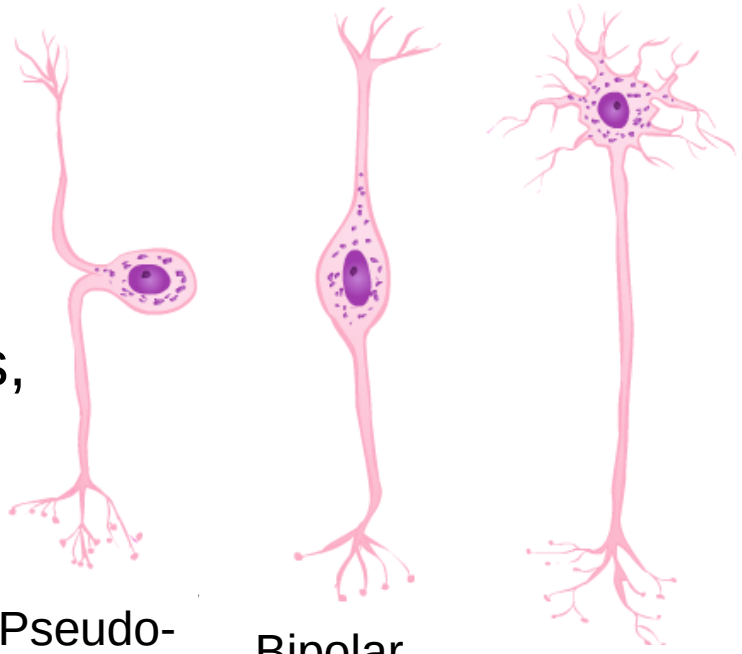
Types of neurons – classified according to 3 criteria

- Morphology
- Size
- Function

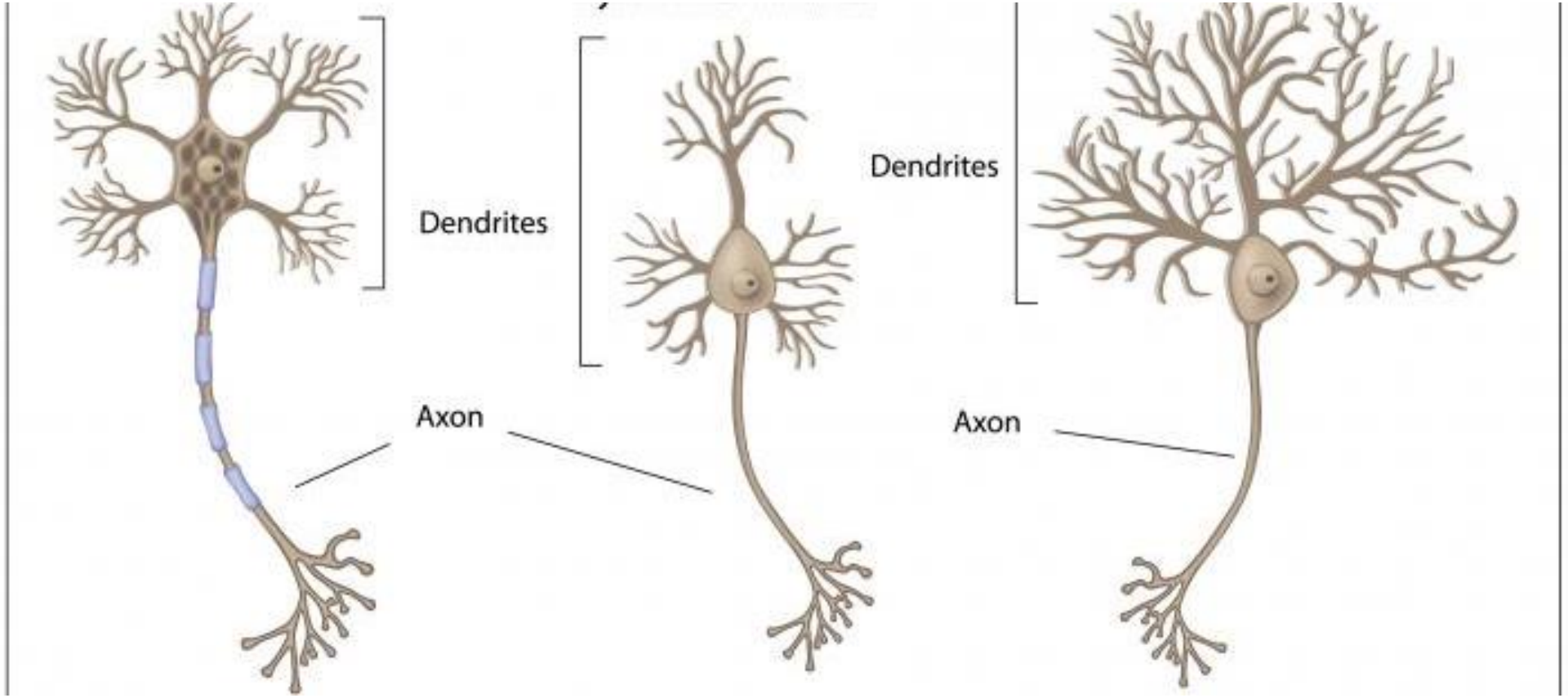
Morphology of nerve cells

Neurons are classified on the basis of the number of processes extending from the cell body:

- **Multipolar –** 1 axon and 2 or more dendrites
- **Bipolar –** 1 axon and 1 dendrite (site: special sense organs)
- **Pseudounipolar –** one process, the axon, which divides close to the cell body into two long processes (site: spinal sensory ganglia)



Types of multipolar neurons



motor neurons from spinal cord

pyramidal neurons from brain cortex

Purkinje neurons (pear-shaped) from cerebellum

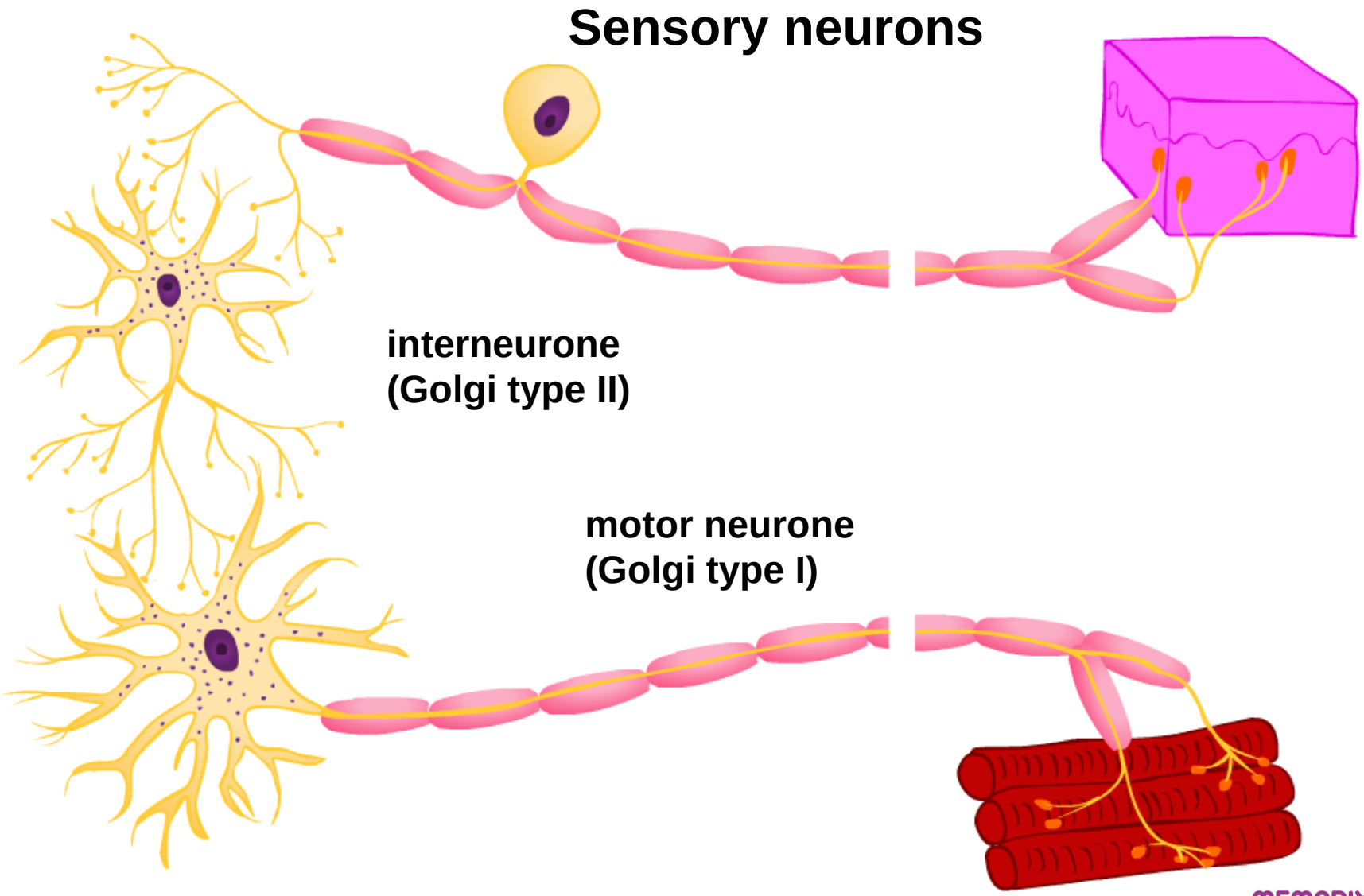
Types of neurons according to size

- **Golgi type I** – long axon ranging from few milimeters to a meter (site: pyramidal neurons of cerebral cortex, motor neurons of spinal cord)
- **Golgi type II** – very short axon, that terminates near the cell body (very numerous in cerebral and cerebellar cortex)

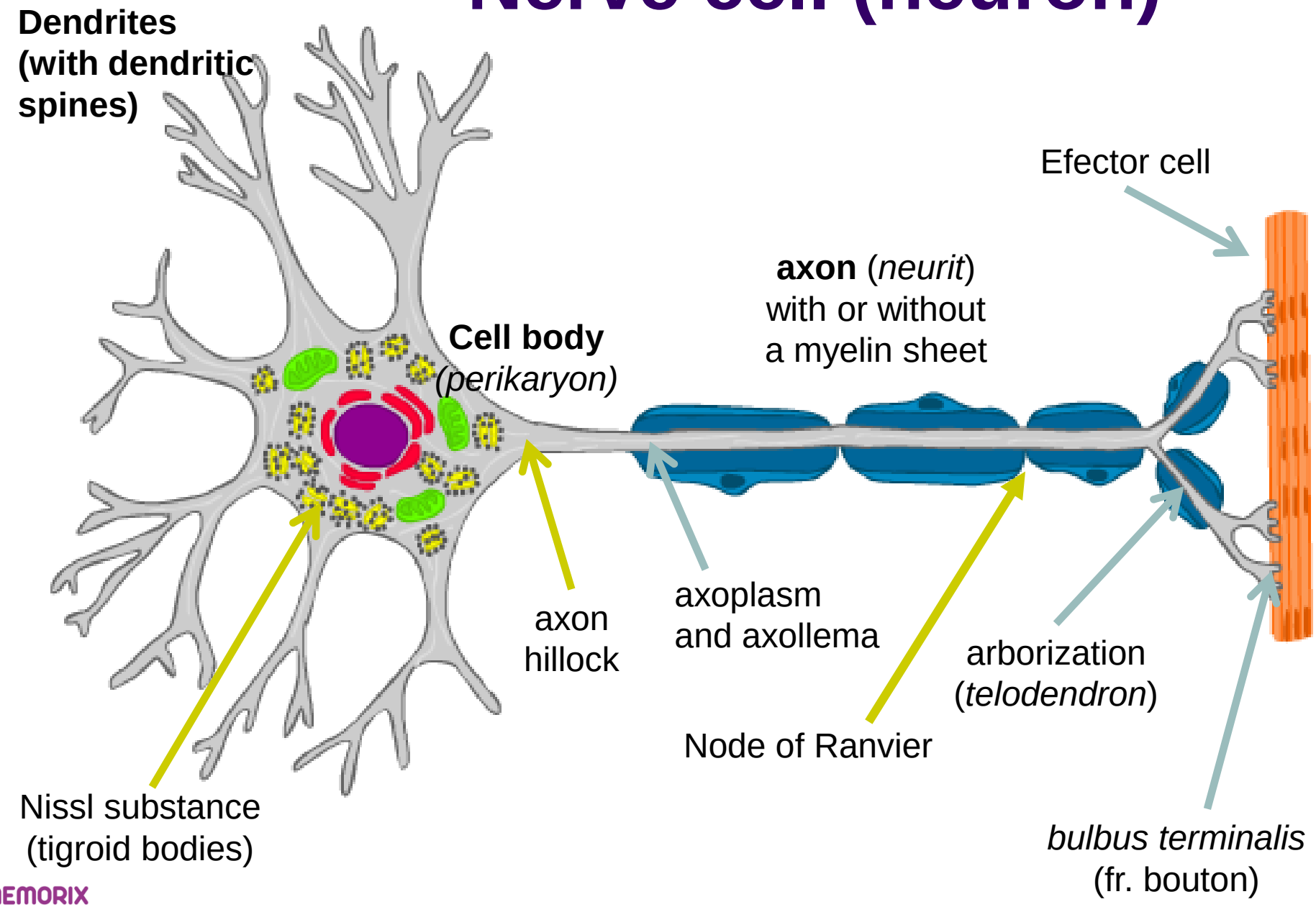
Types of neurons according to functions

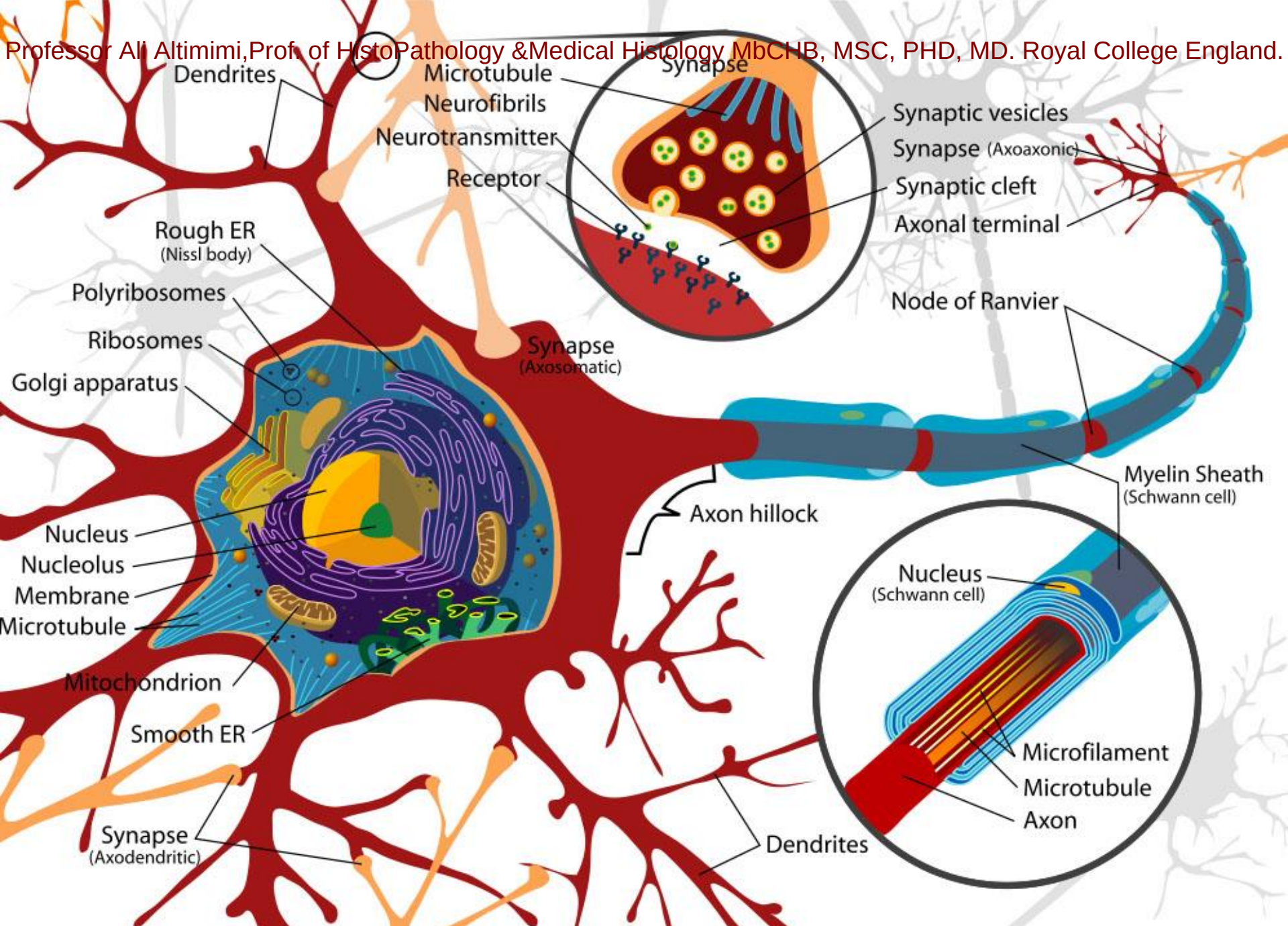
- Motor (efferent) neurons – carry motor impulses from CNS to peripheral end organs (site: anterior horn of the spinal cord)
- Sensory (afferent) neurons – receive impulses from peripheral sensory cells and carry them toward CNS (site: sensory spinal ganglia)
- Interneurons (association neurons) – they are short neurons that connect a sensorys and a motor neuron

Types of neurons



Nerve cell (neuron)




Dendrites
Microtubule
Neurofibrils
Neurotransmitter
Receptor
Synapse
Synaptic vesicles
Synapse (Axoaxonic)
Synaptic cleft
Axonal terminal
Rough ER
(Nissl body)
Polyribosomes
Ribosomes
Golgi apparatus
Synapse
(Axosomatic)
Node of Ranvier
Myelin Sheath
(Schwann cell)
Axon hillock
Nucleus
Nucleolus
Membrane
Microtubule
Mitochondrion
Smooth ER
Nucleus
(Schwann cell)
Microfilament
Microtubule
Axon
Synapse
(Axodendritic)
Dendrites