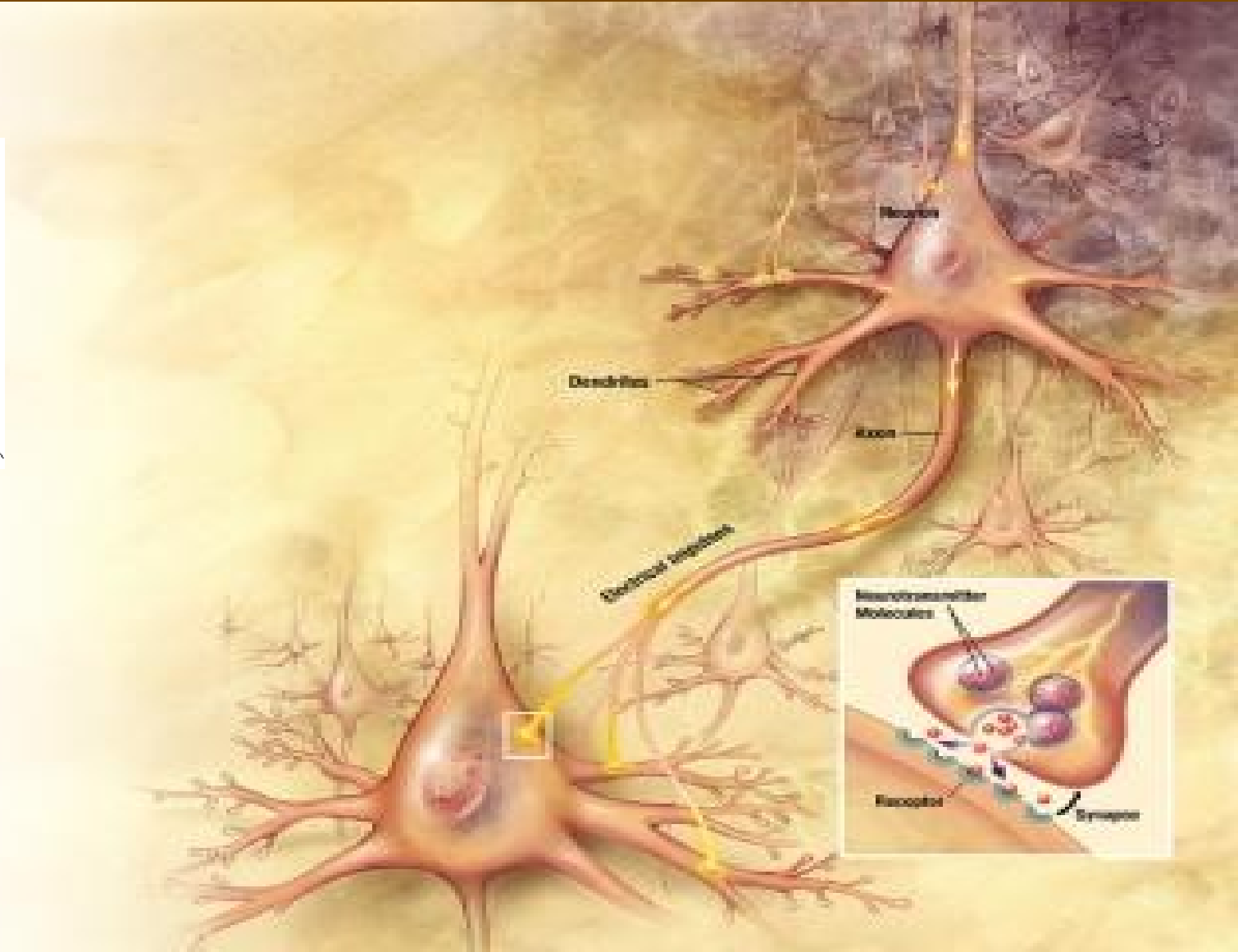
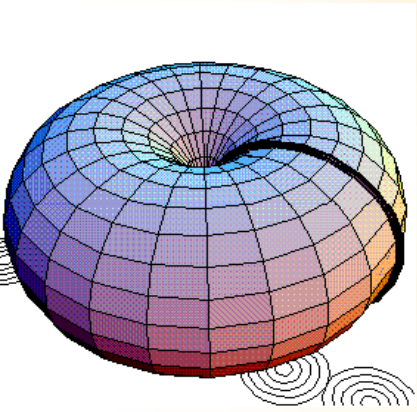
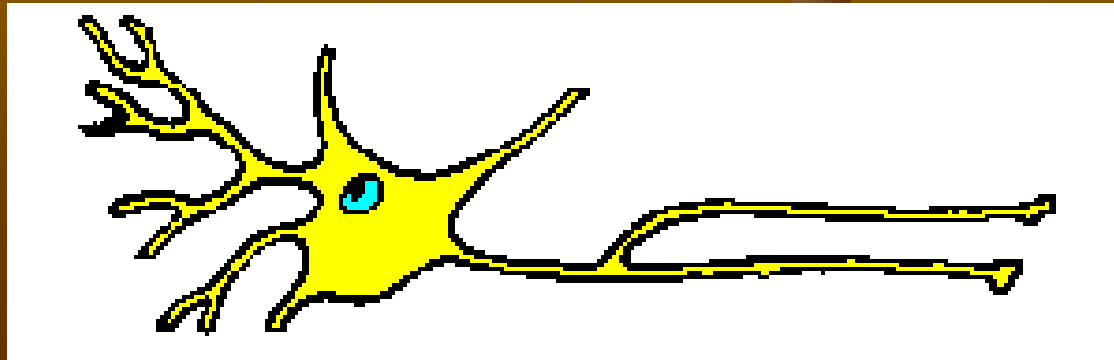


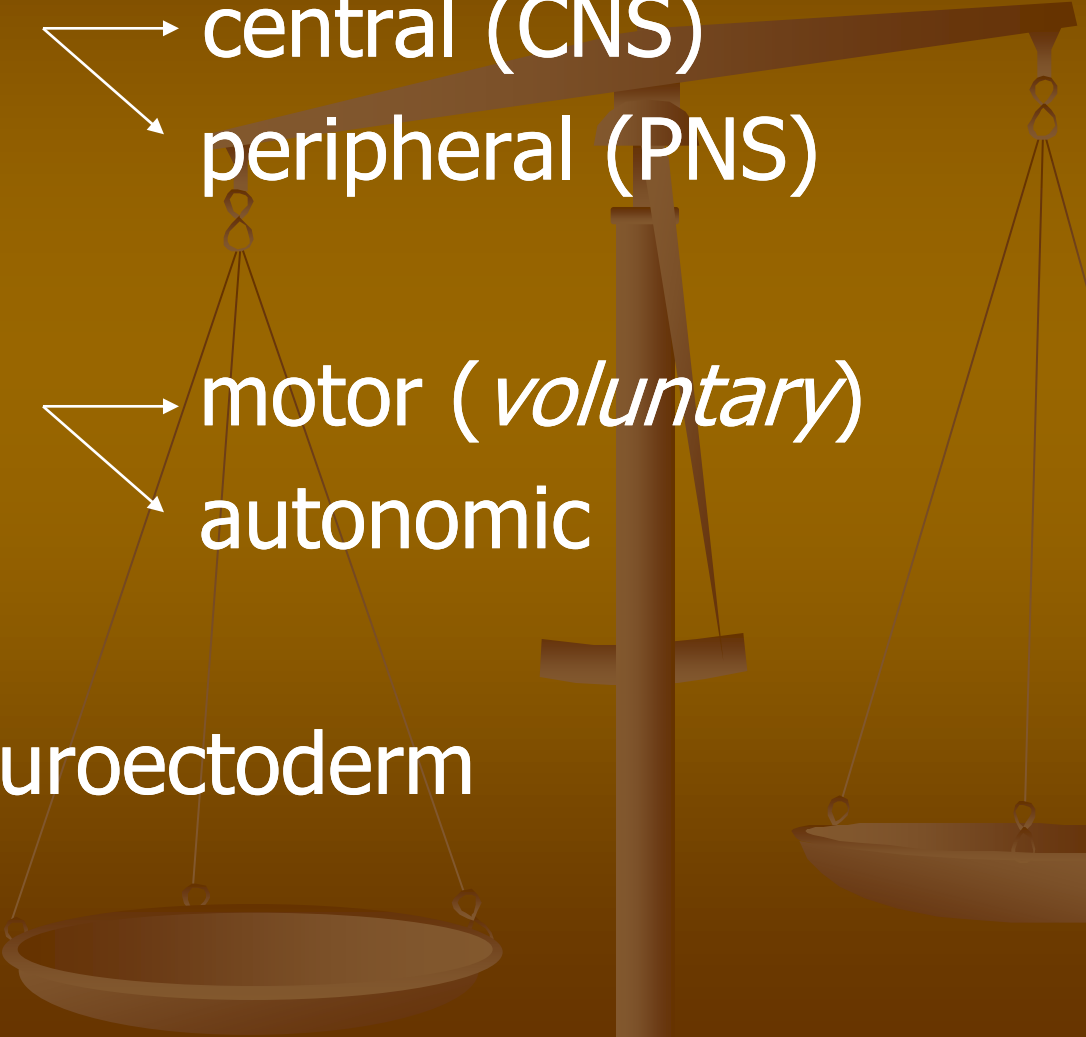
Nervous tissue



Functions of Nerve Tissue

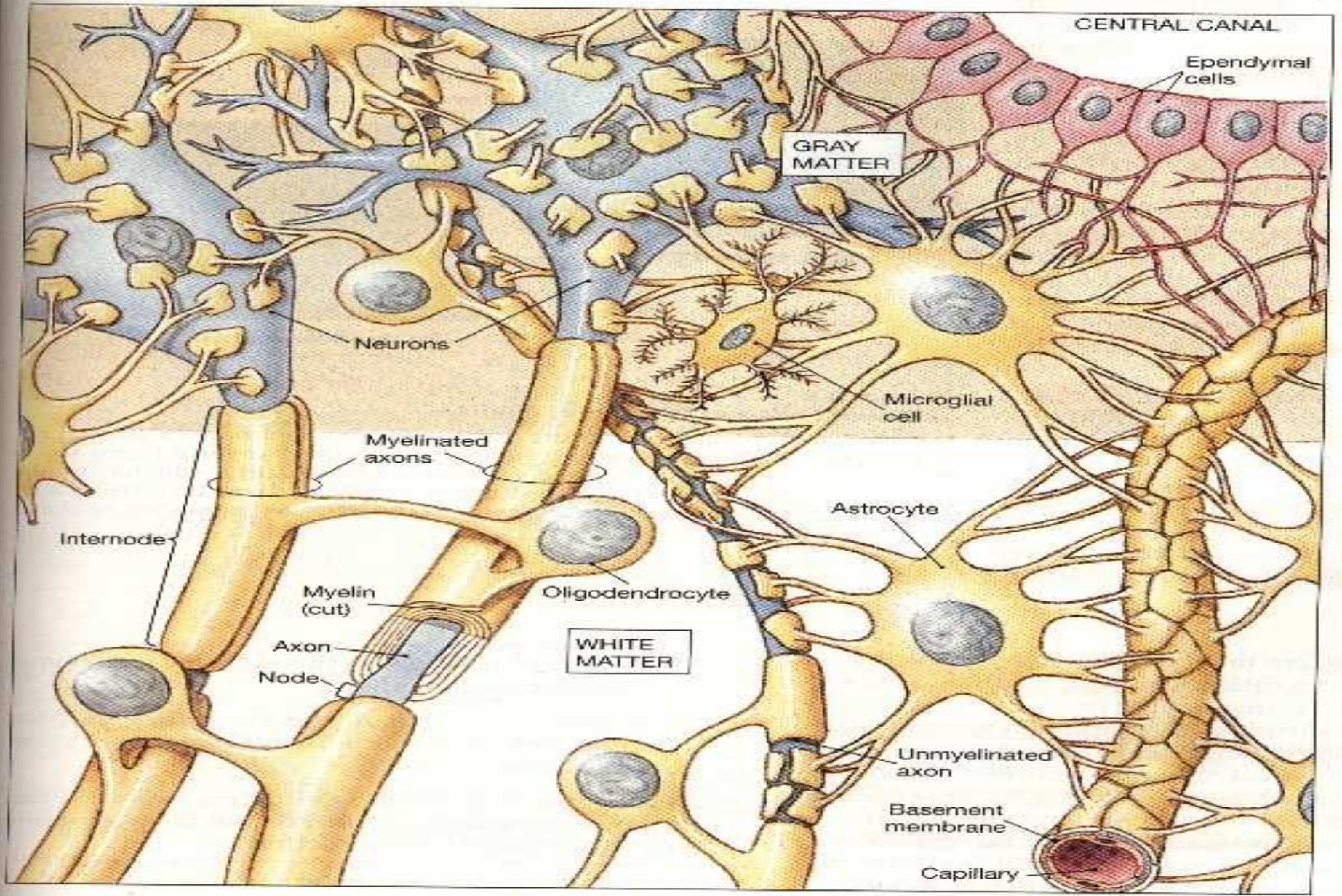
- reacts to stimuli from the internal and external environment and conducts impulses to organs,
- analyses and integrates stimuli to provide appropriate, co-ordinated responses organs,
- conducts impulses from the sense organs and receptors to the central nervous system (CNS),
- transmits impulses from the CNS to the effectors (skeletal muscle, smooth muscles and glands).



- 
- Nervous system
 - central (CNS)
 - peripheral (PNS)
 - motor (*voluntary*)
 - autonomic
 - Origin of NS: neuroectoderm

Nervous tissue structure

nerve cells (neurons) + supporting cells (glia)



Neuron

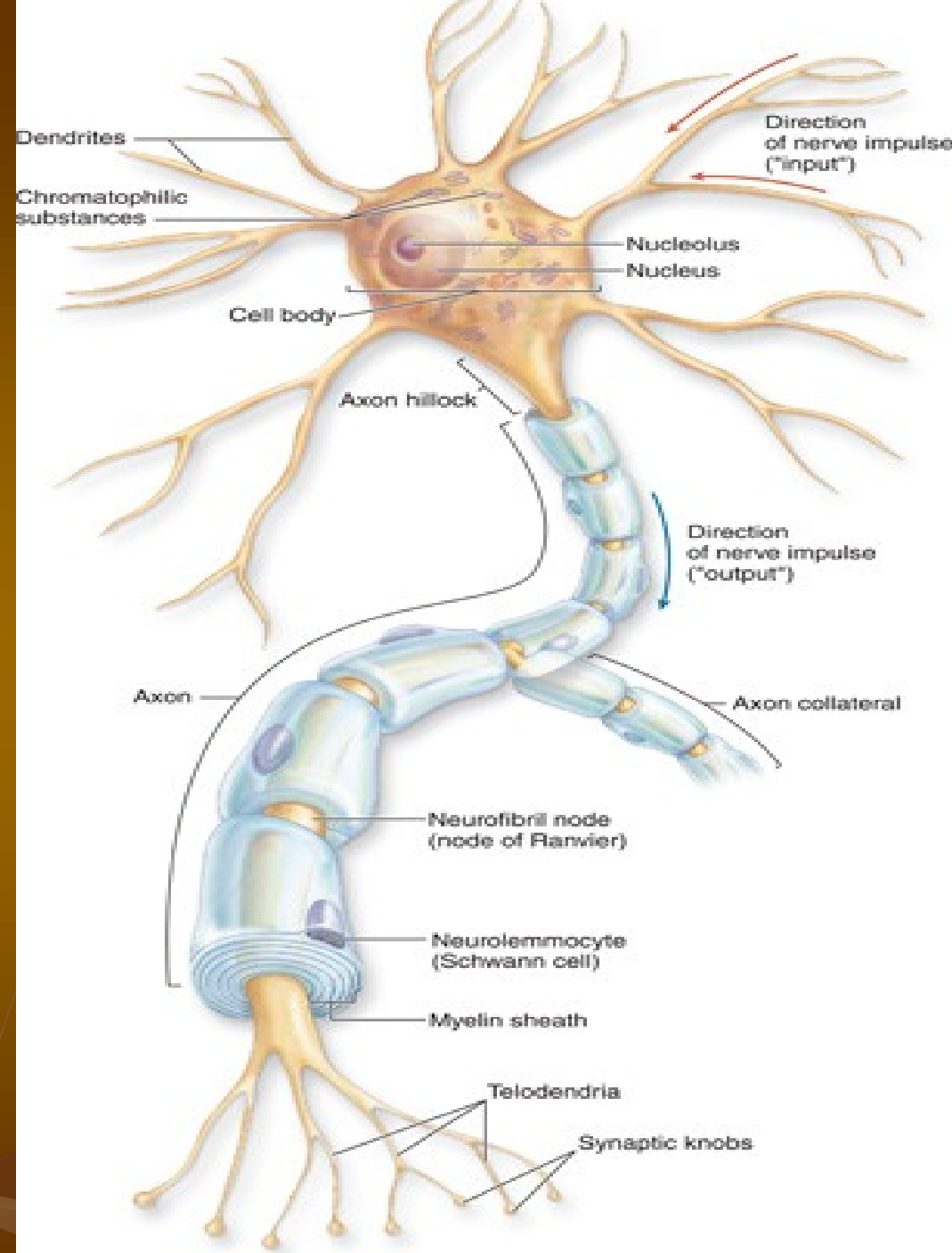
Perikaryon
(cell body)

Dendrite(s)

Axon hillock

Axon – only 1

Telodendria

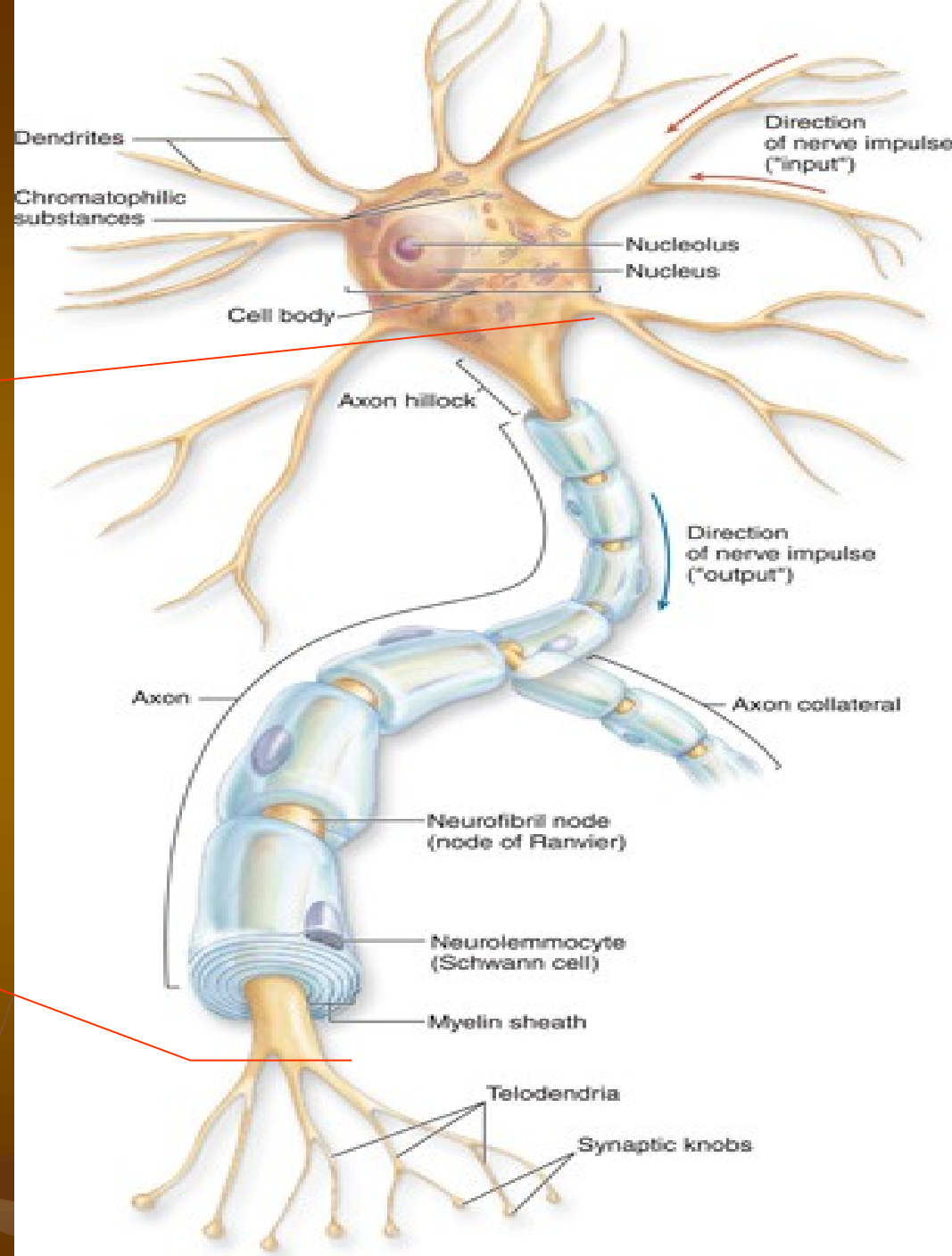


PARTS of NEURON

Receptive portion

Transmission portion

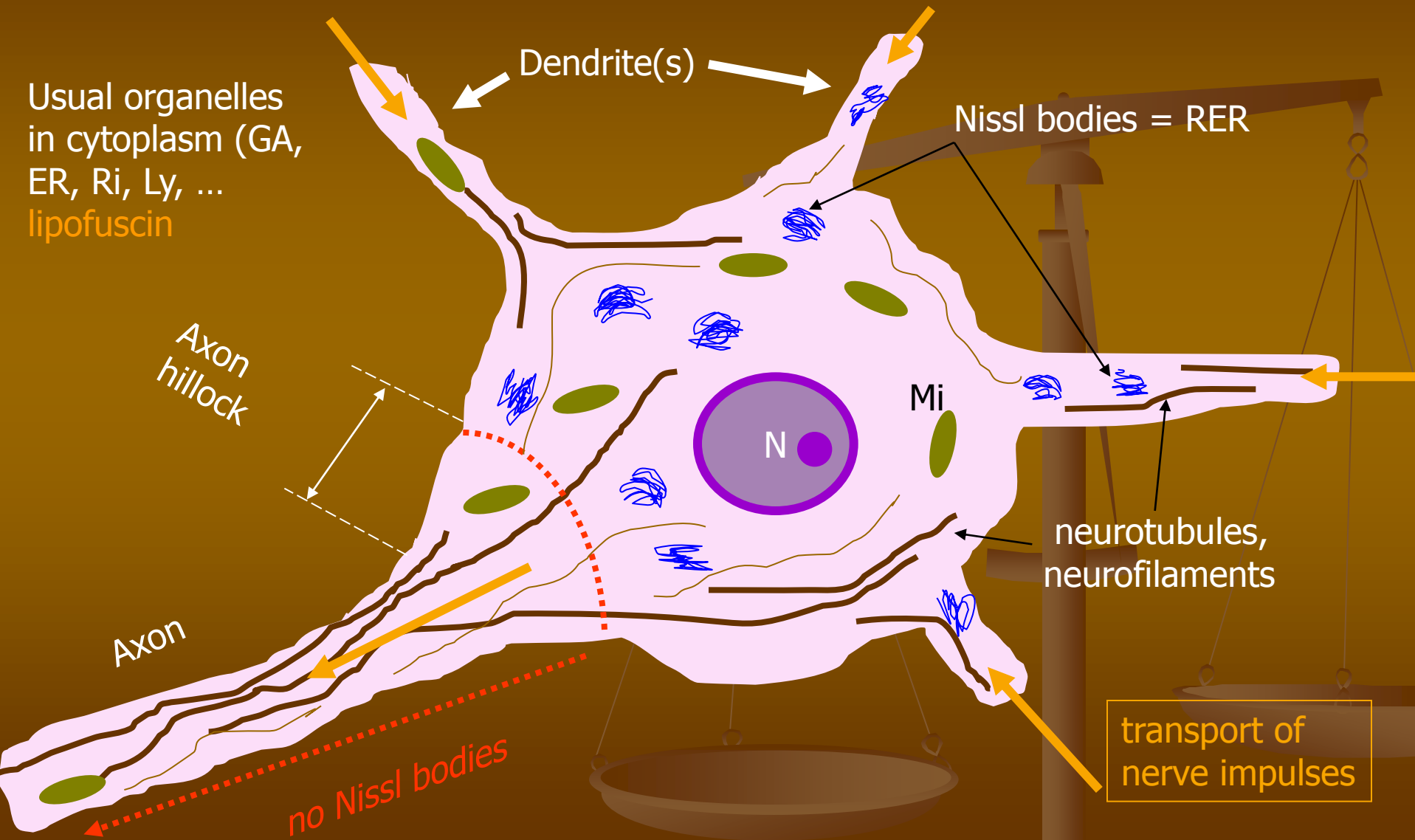
Secretory portion



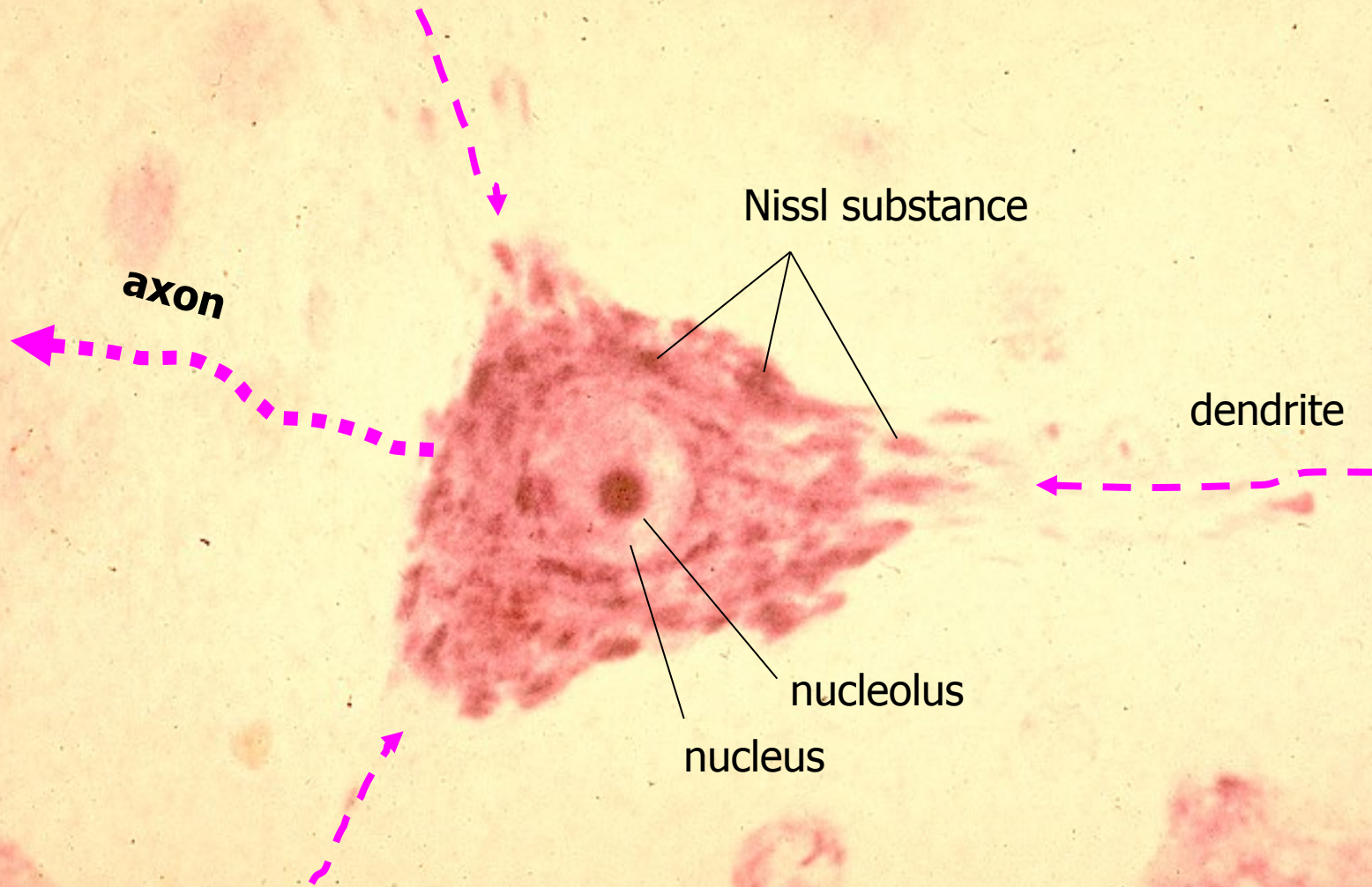
Neuron

4 – 100 μm in \varnothing

Usual organelles
in cytoplasm (GA,
ER, Ri, Ly, ...
lipofuscin

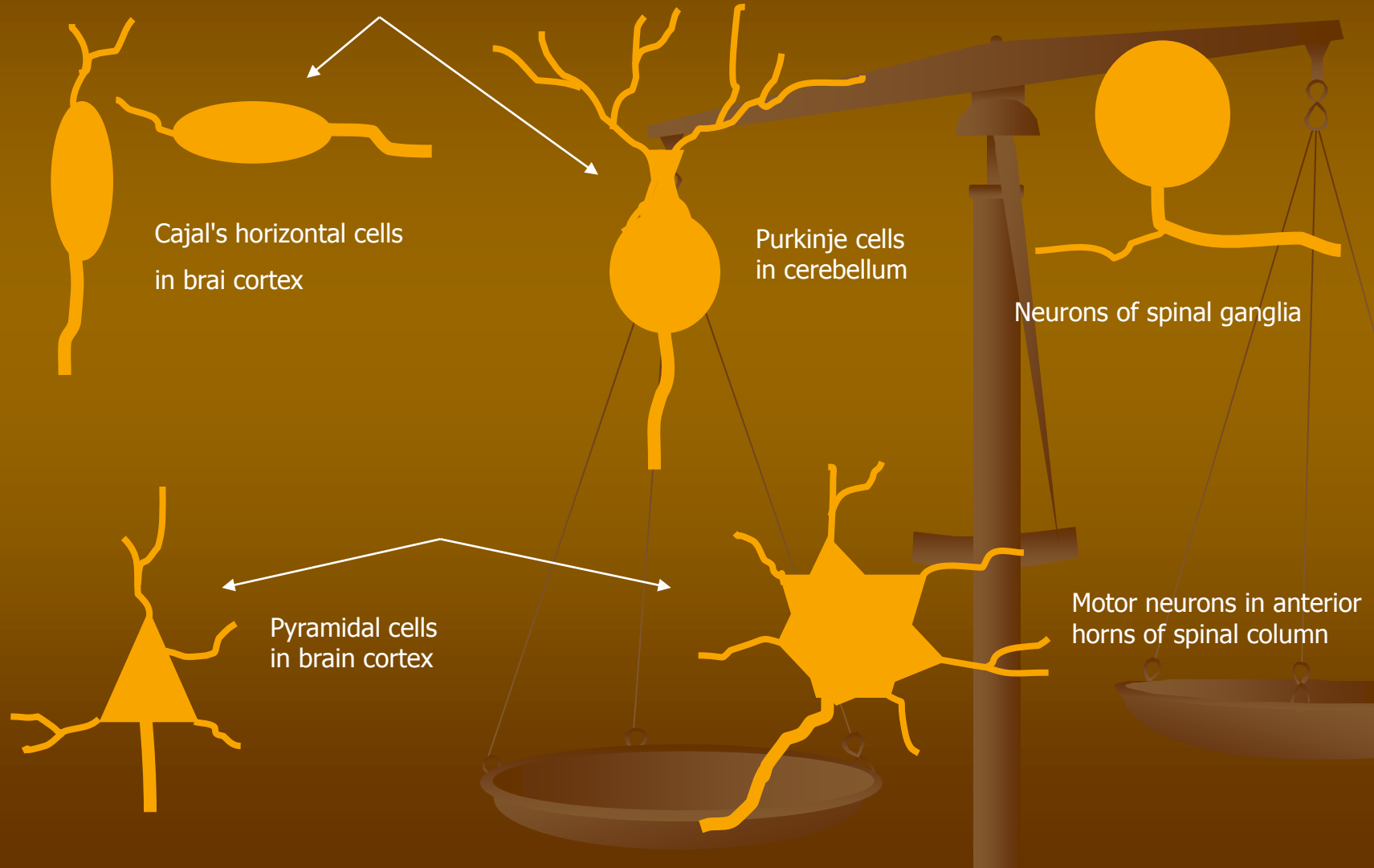


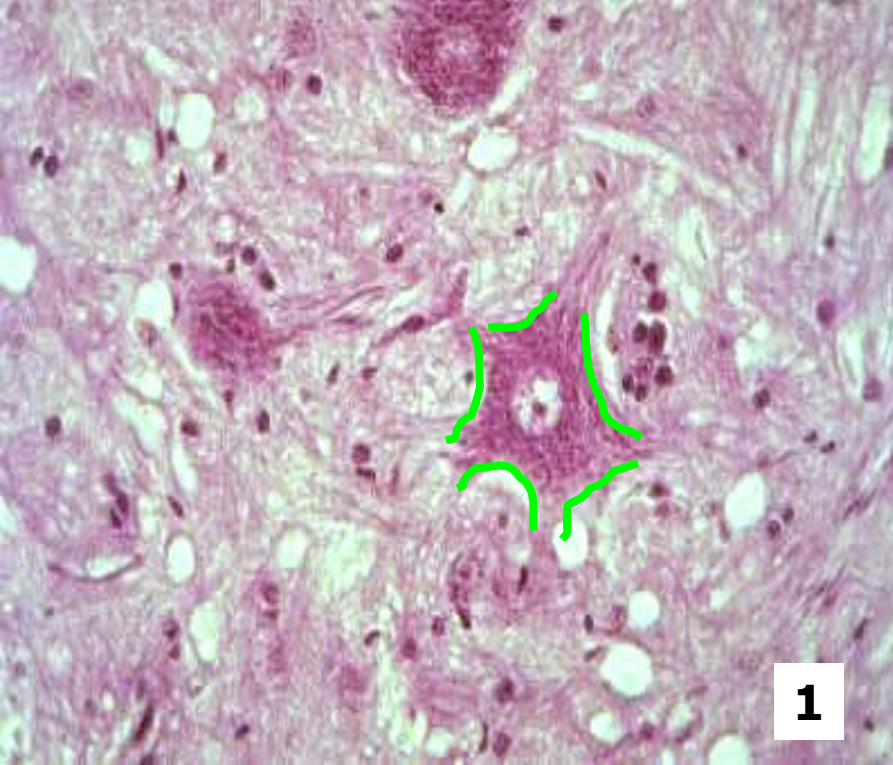
Triangular shape of perikaryon (pyramidal neuron from cerebral cortex)



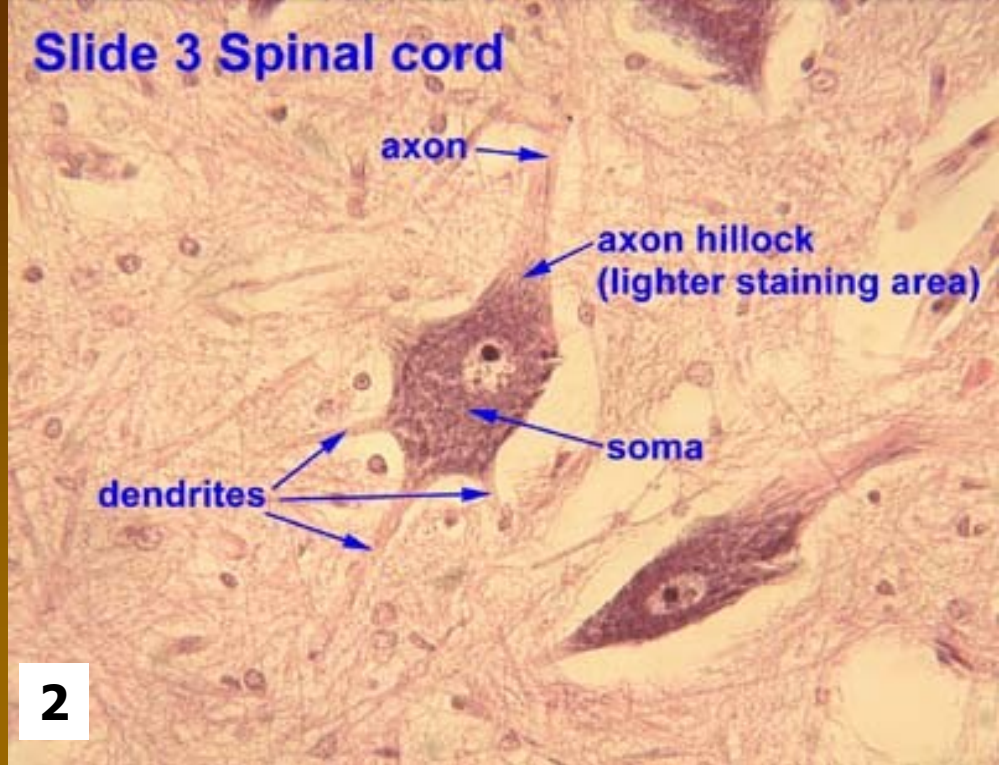
Shape of perikaryon

(usually depends on the number of dendrites)



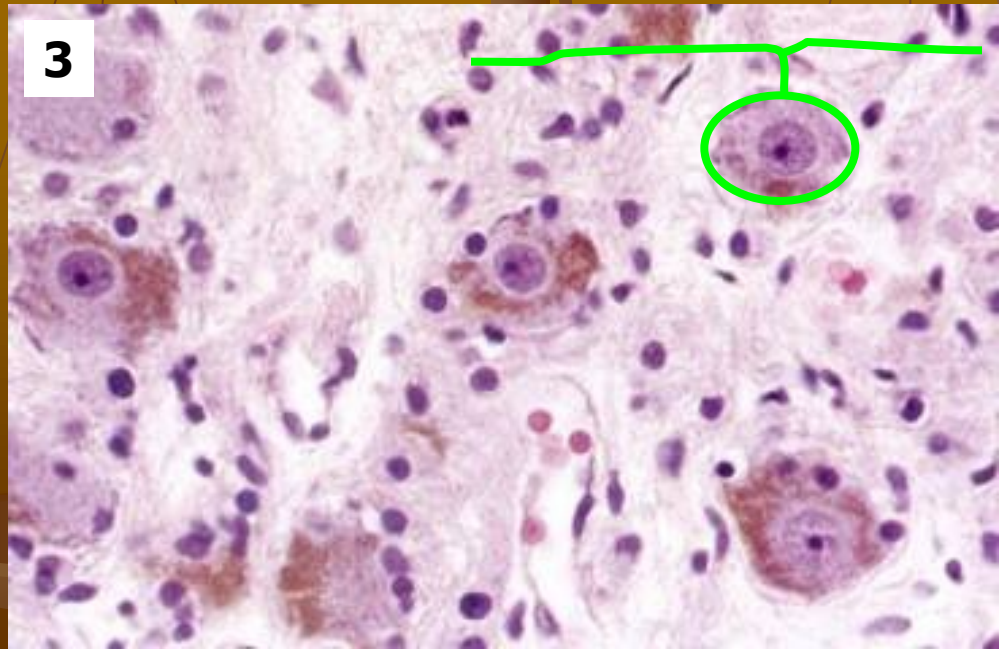


1



2

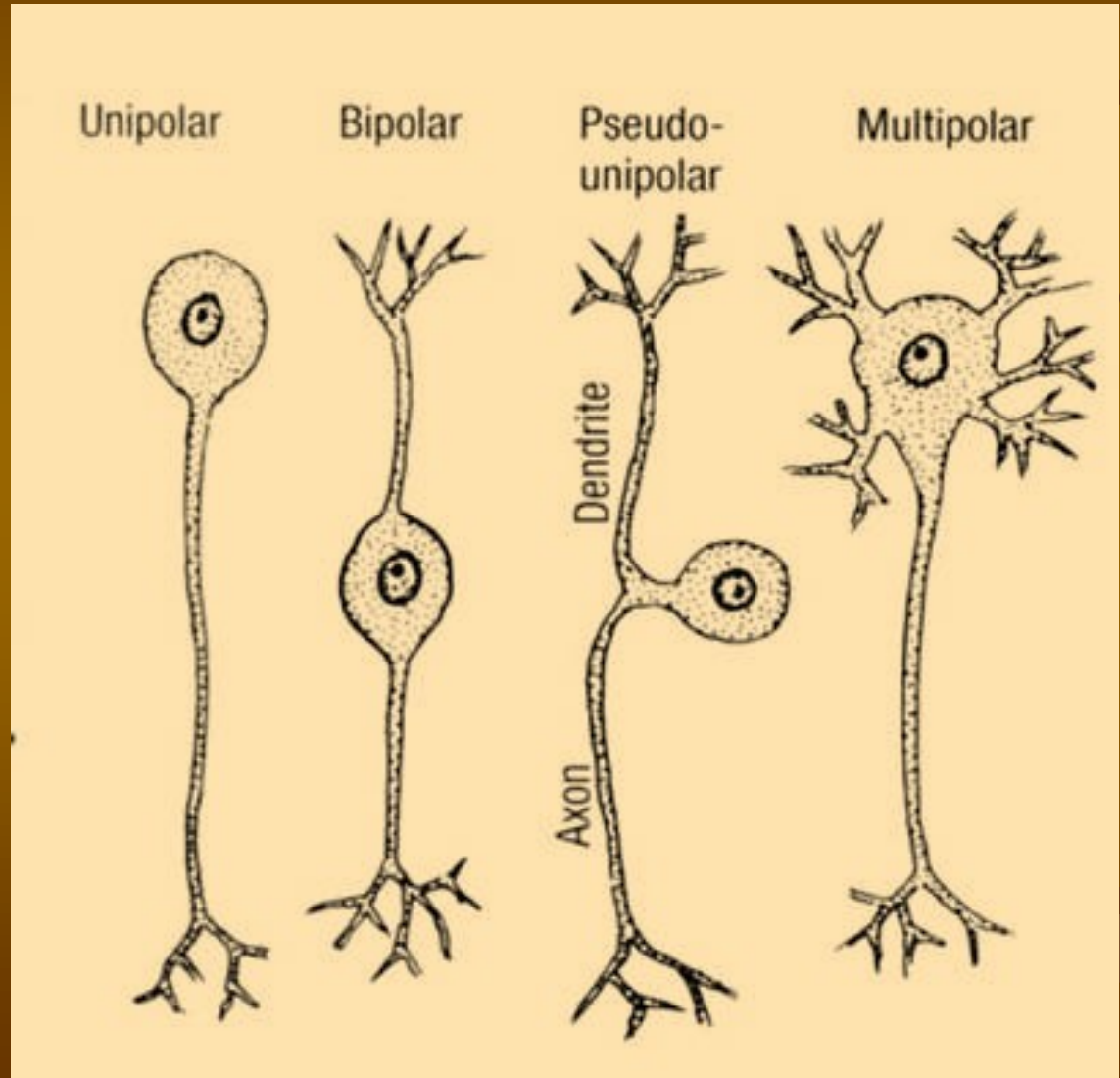
1, 2 – multipolar neurons: Nissl bodies
3 – pseudounipolar neurons: lipofuscin



3

Classification of neurons (according to number of processes)

- (Apolar)
- Unipolar
- Bipolar
- Pseudounipolar
- Multipolar
- (Amacrine)



Classification of neurons

(according to ...)

- the length of axon:

Golgi type I (long axon) – length up to 1 m

Golgi type II (short axon) – length about several 1 cm

- the function:

sensitive neurons (afferent) – conduct impulses from the receptors to CNS

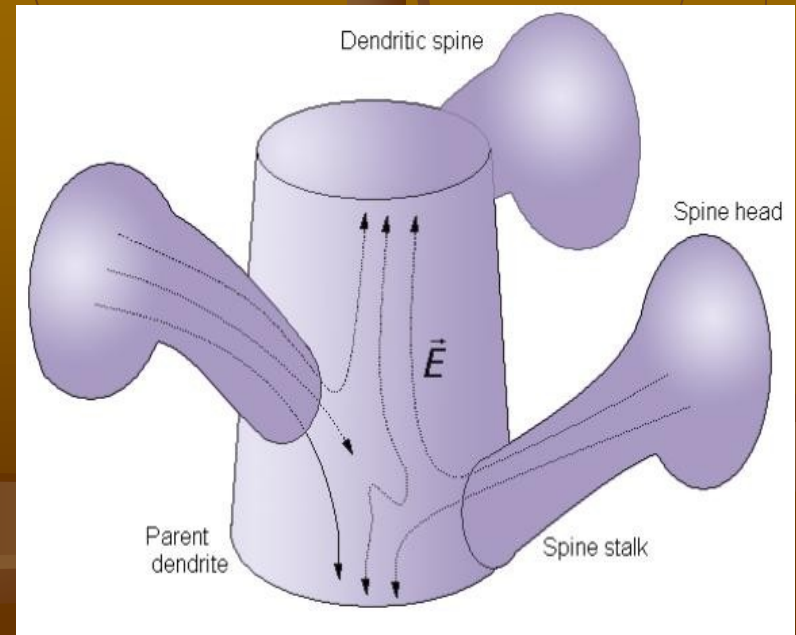
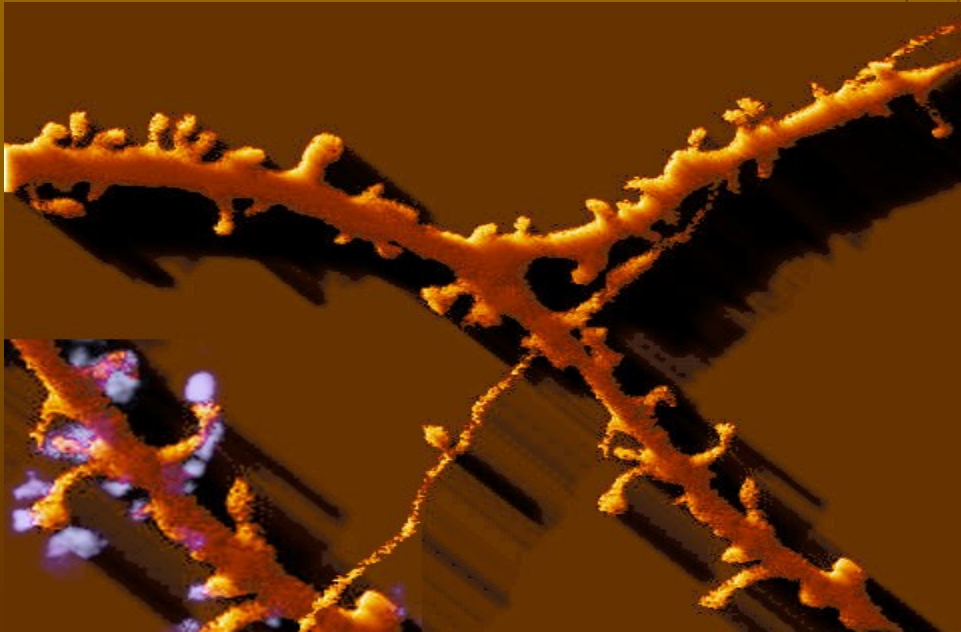
motor neurons (efferent) – conduct impulses from CNS to the effector cells

interneurons – are situated between sensitive and motor neurons; represent 97 % of all neurons

Dendrites

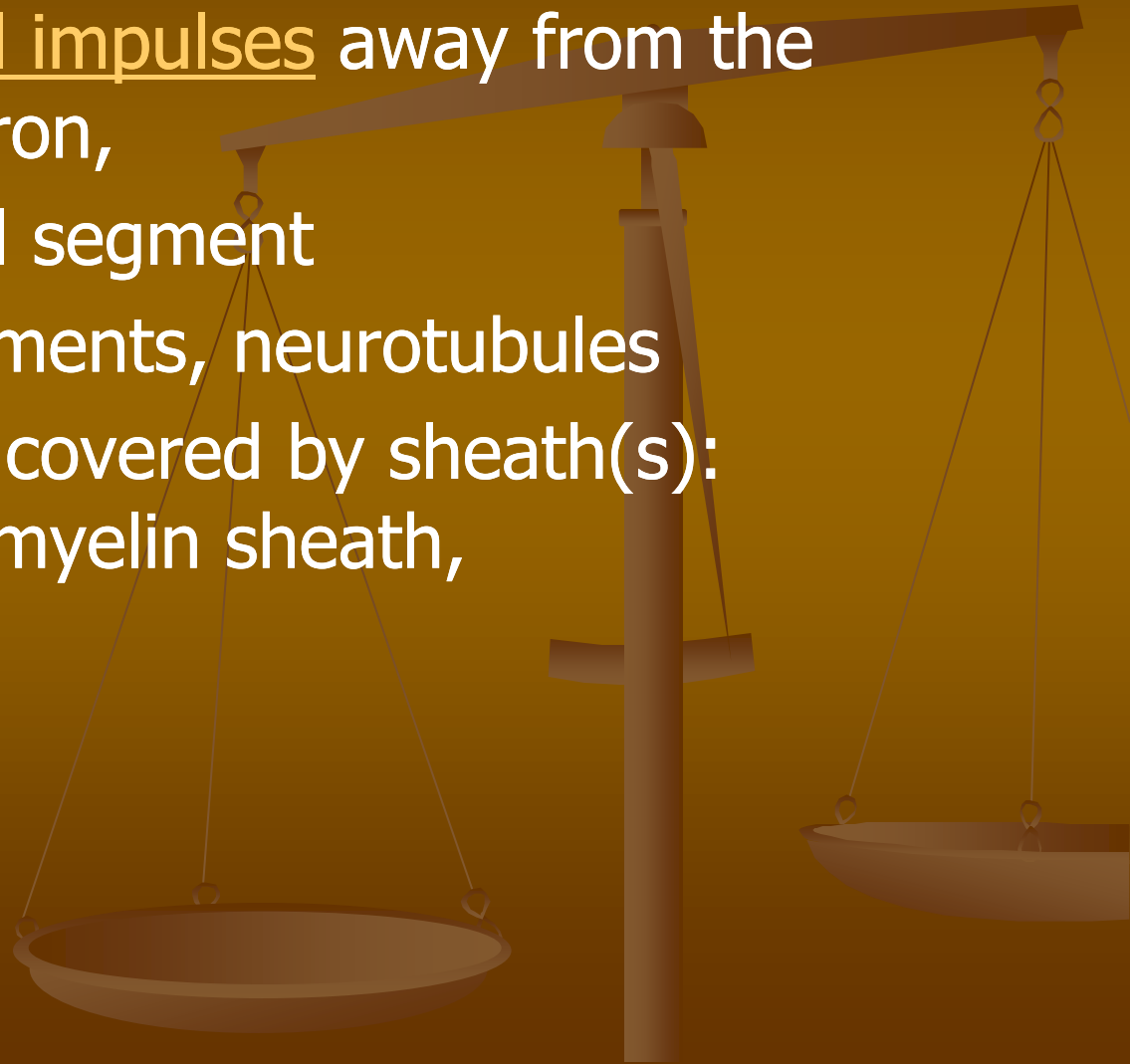
(from Greek *dendron*, “tree”)

- are the branched projections of a neuron that act to conduct the electrical stimulation,
- **dendritic spines** are small membranous protrusions electric intensity vector acts in perpendicular direction to dendrite axis.



Axon (neurite, nerve fibre)

- is a long, slender projection of neuron, that conducts electrical impulses away from the perikaryon of neuron,
- axon hillock, initial segment
- contains neurofilaments, neurotubules
- its surface can be covered by sheath(s): Schwann sheath, myelin sheath,
- telodendria



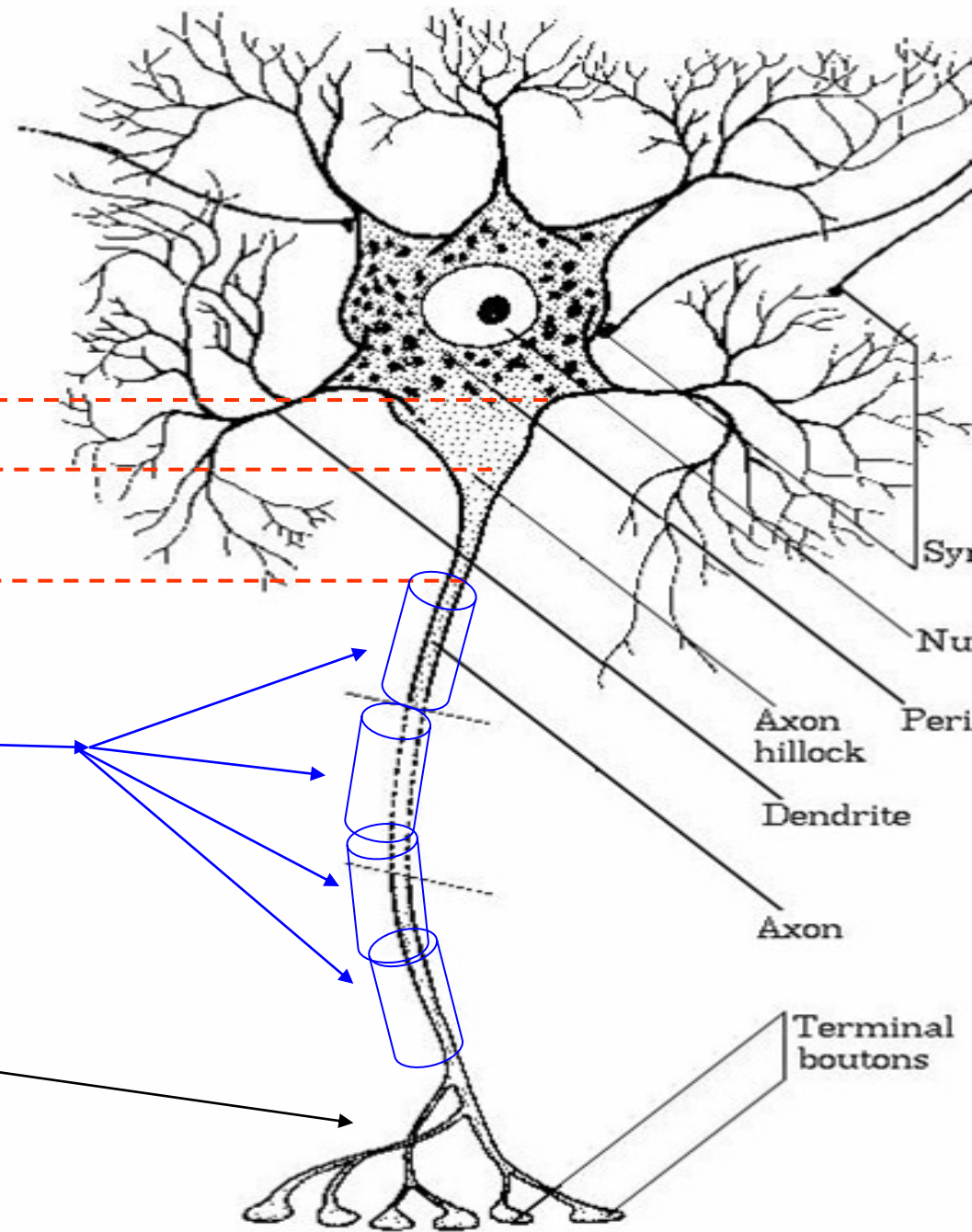
STRUCTURE of AXON

Axon hillock

Initial segment of axon

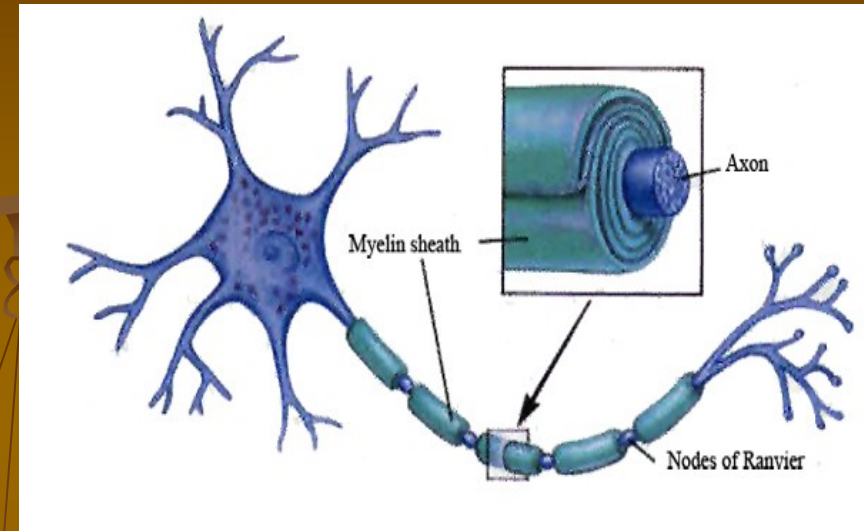
Schwann cells

Axonterminals (telodendrion)



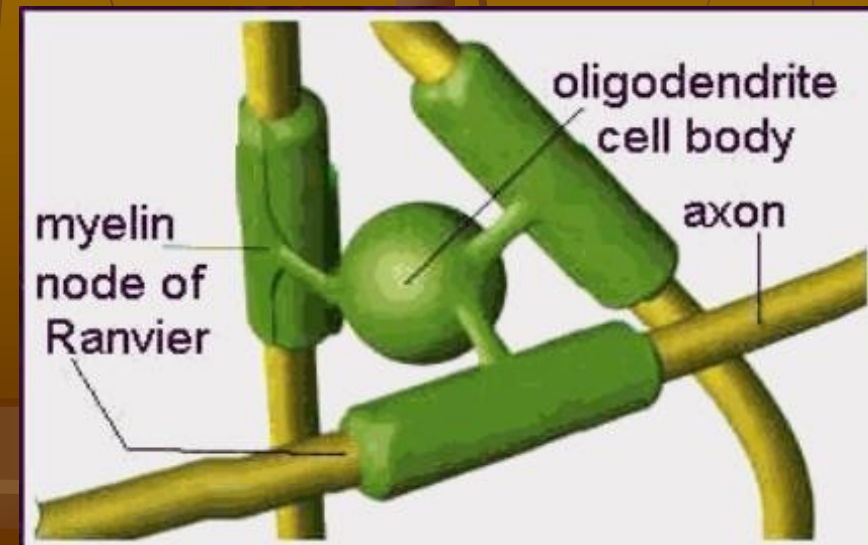
Sheaths of axons (neurites)

Schwann cells (in PNS)



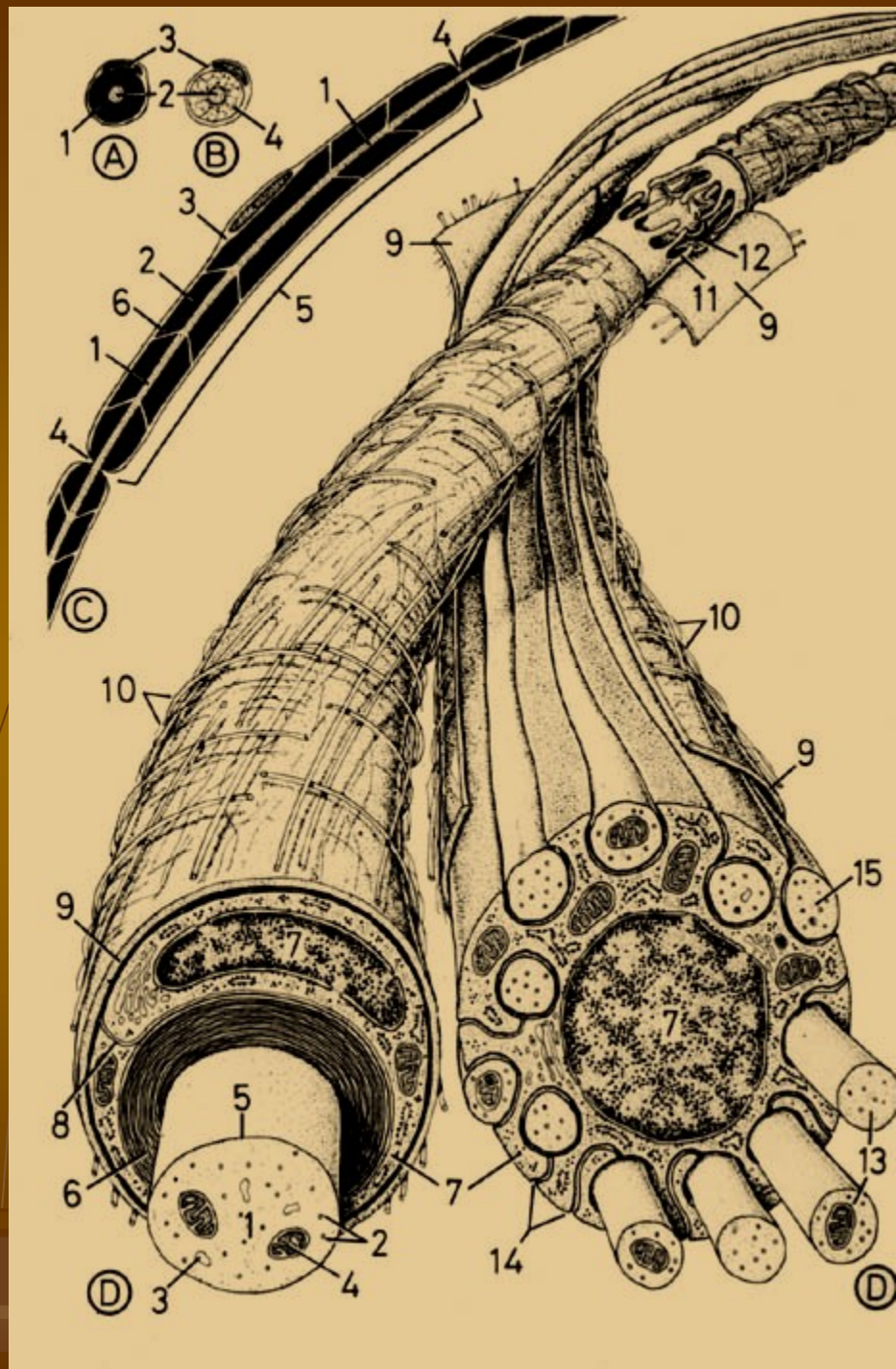
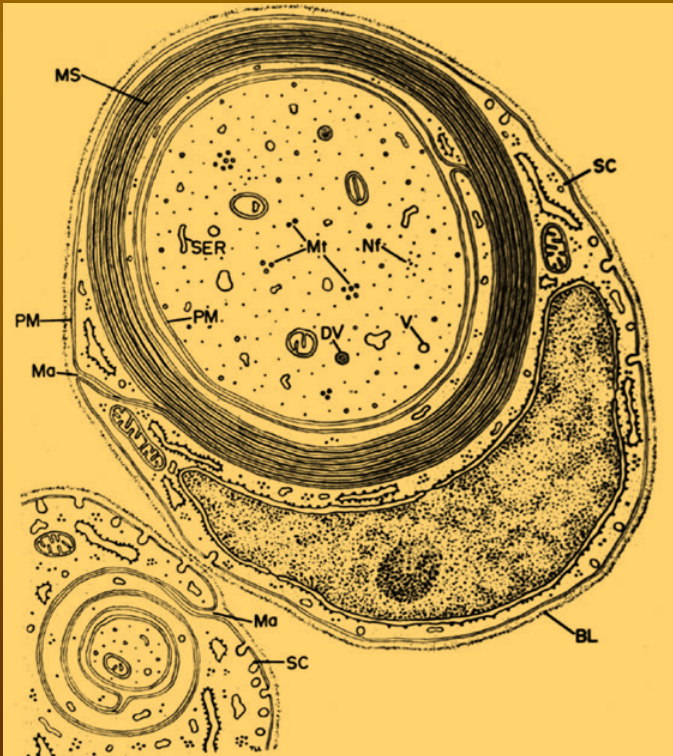
Myeline sheath

Oligodendrocytes (in CNS)



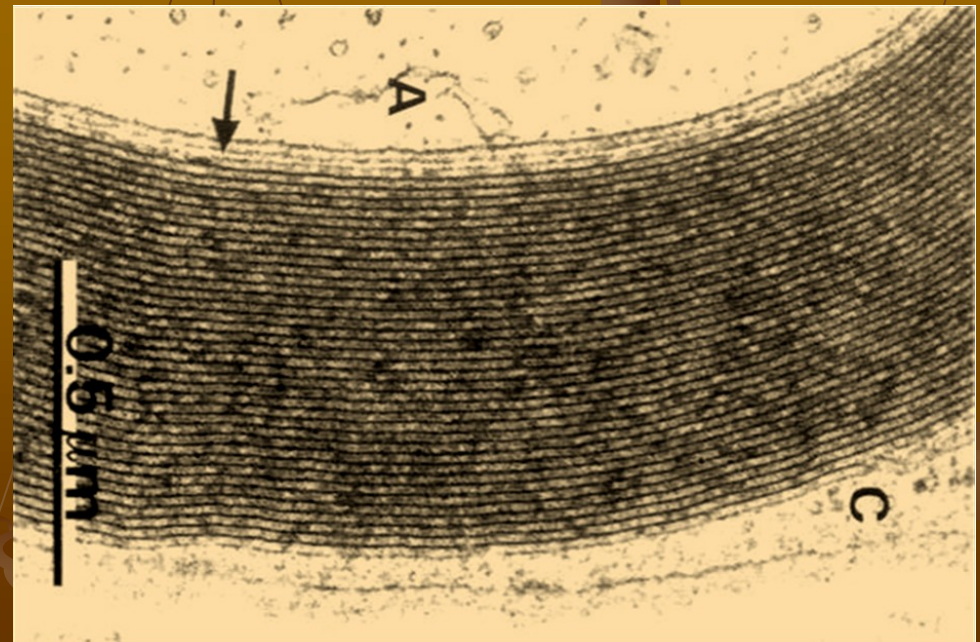
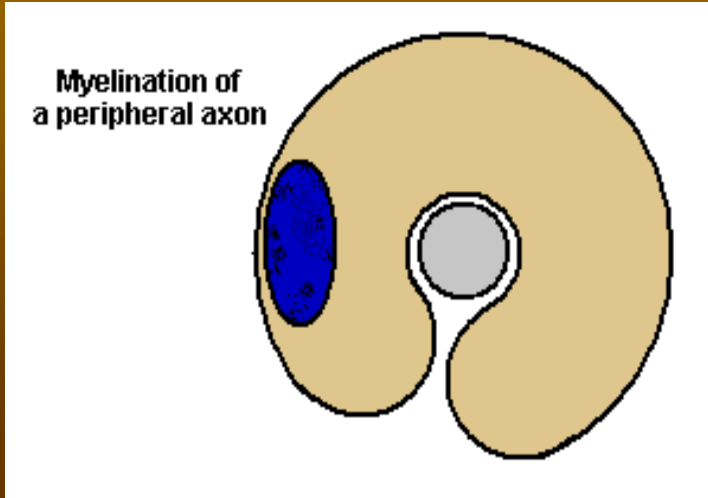
Nerve sheaths

- myelin sheath
- Schwann sheath (in PNS)
- oligodendrocytes (in CNS)

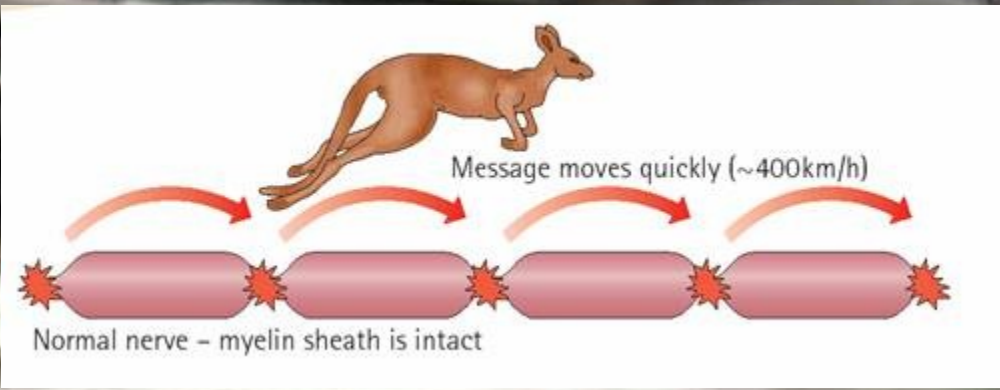


Myelin sheath

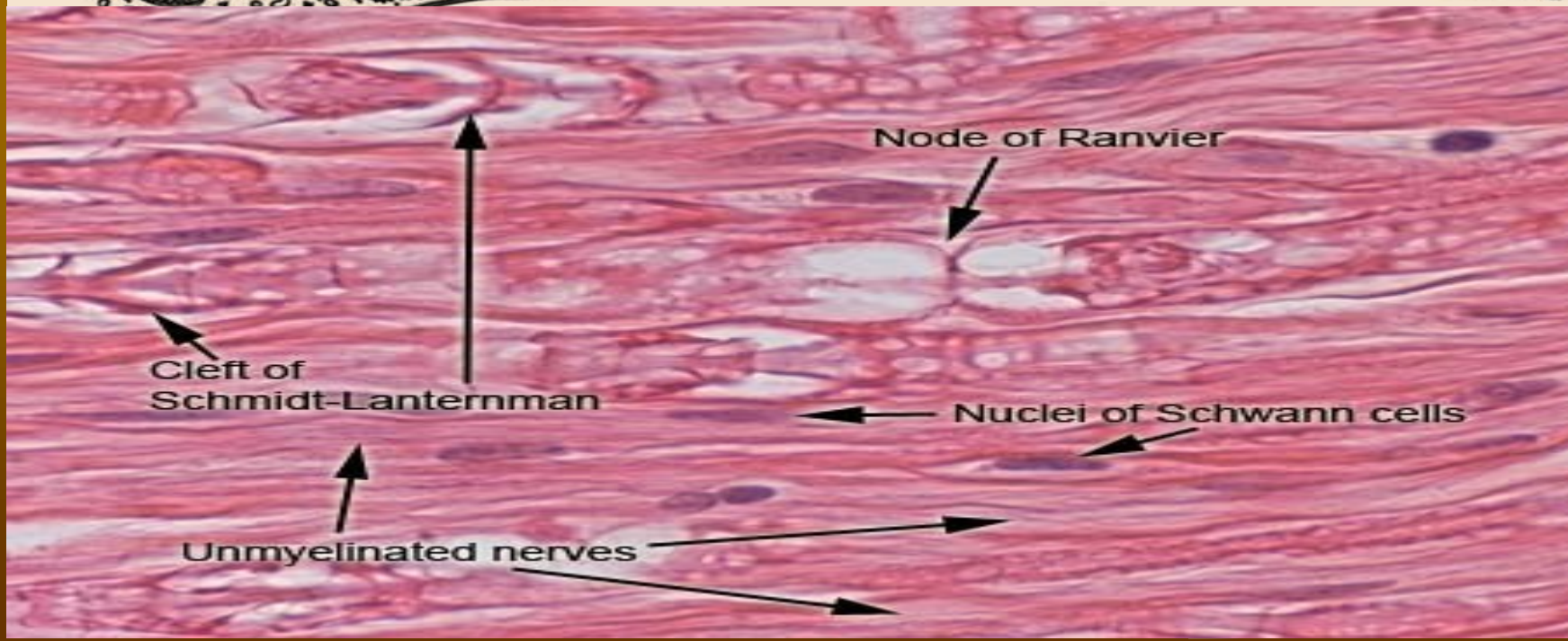
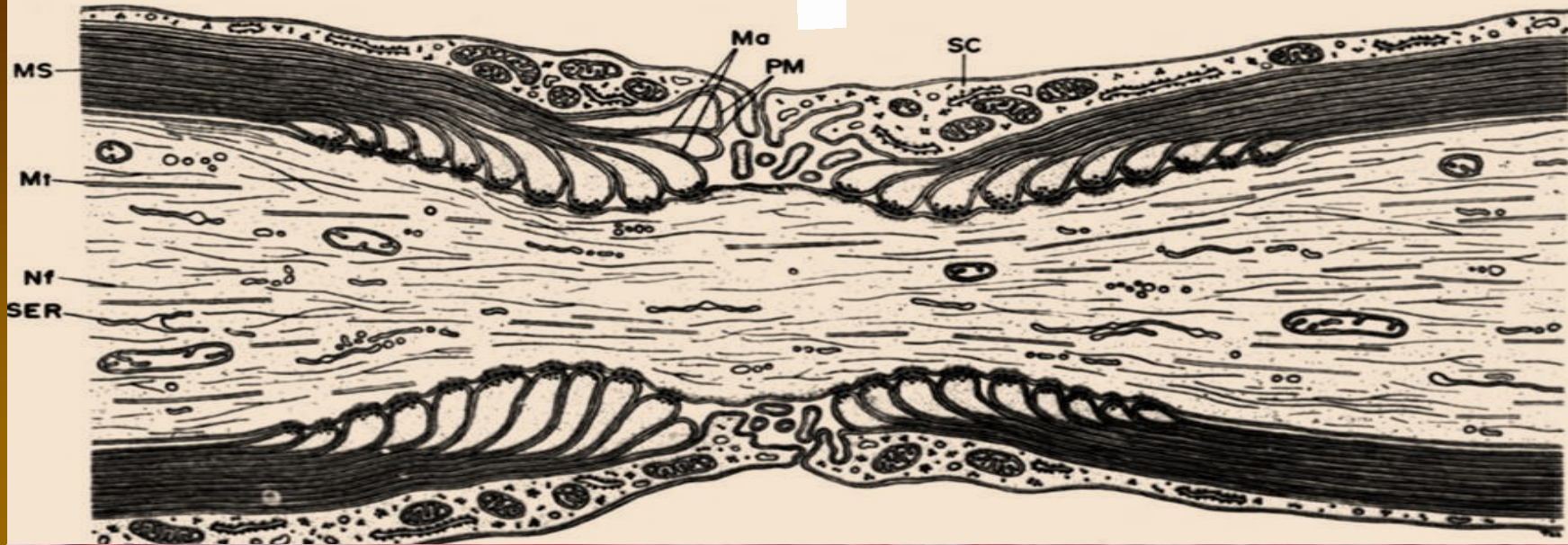
- 1 - 20 μm thick
- 70 % H_2O , lipids, proteins
- spirally arranged lipoprotein lamellae
- by Ranvier nodes is separated into internodia (Ranvier segments, 0,6–2,0 mm long)



Nodes of Ranvier

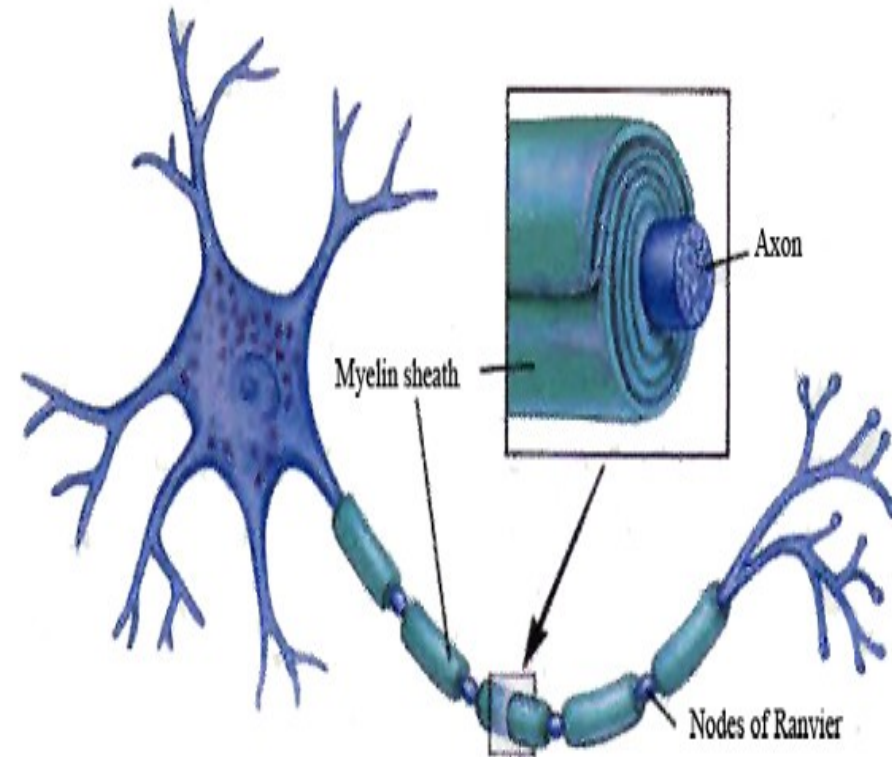
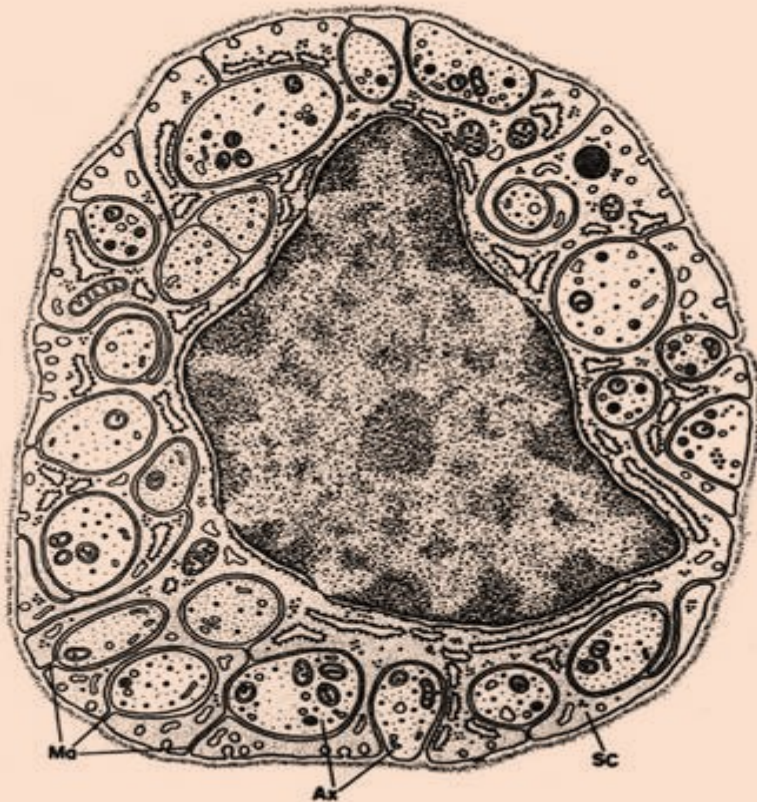


20 μ m

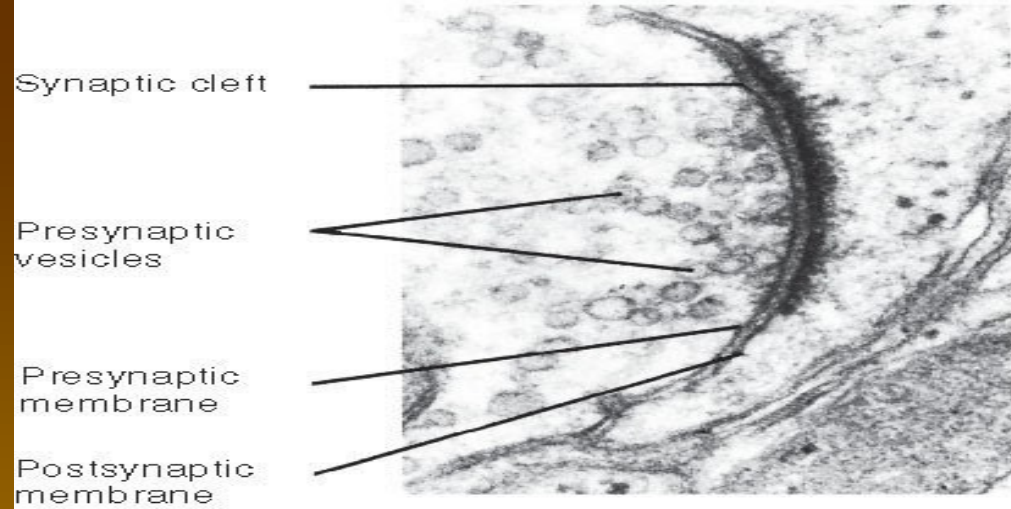


Neurilemma = composed of Schwann cells

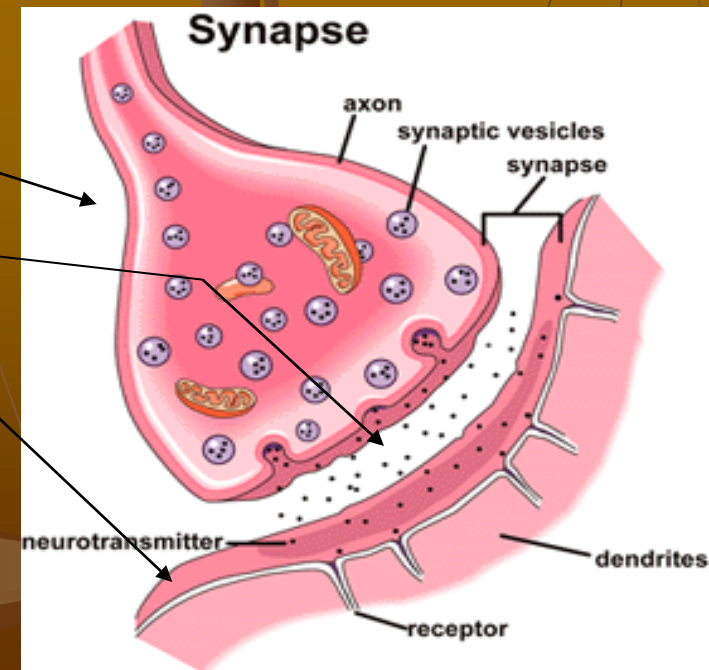
- fibers without myelin sheath - Schwann cell surrounds more axons
- myelinated fibers - each internodium has its own Schwann cell



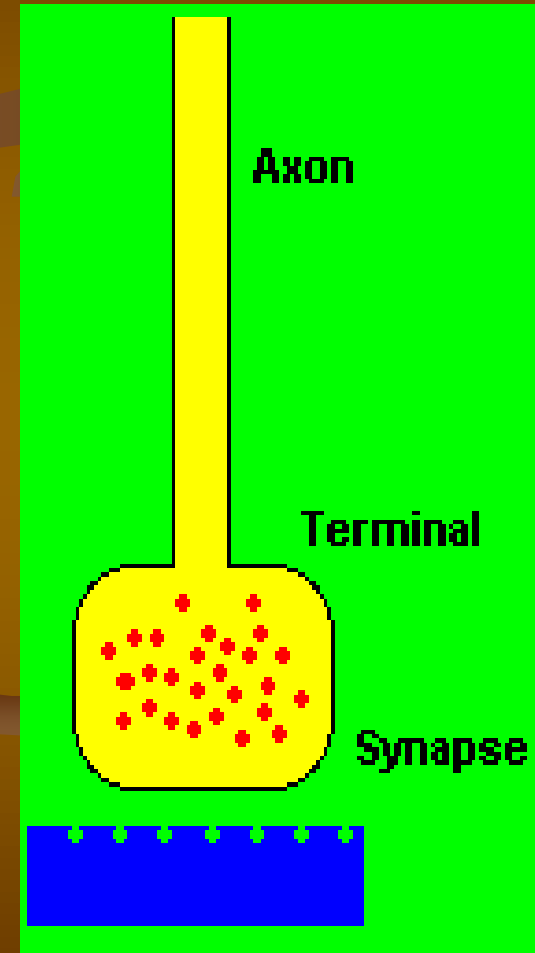
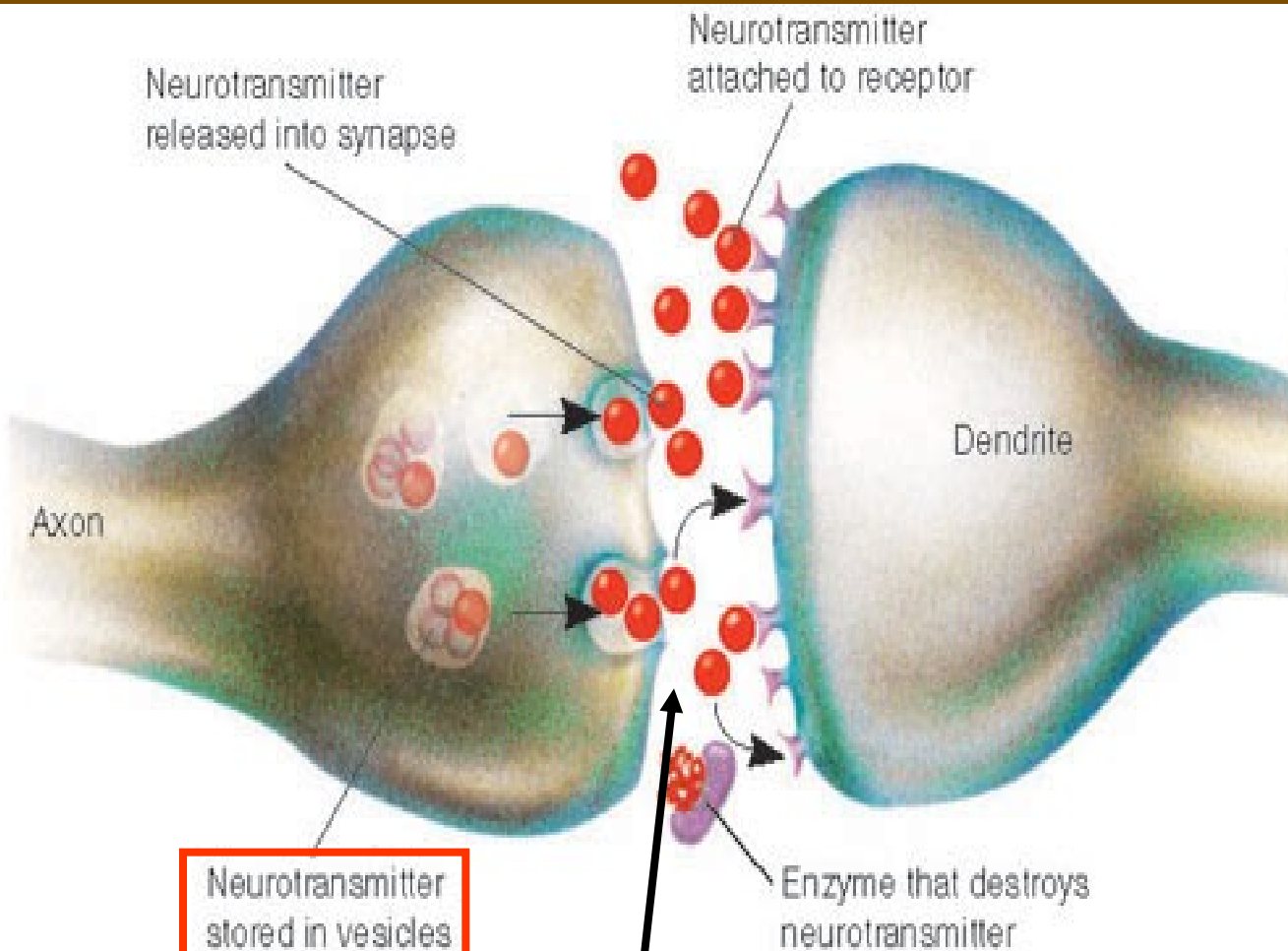
Synapses



- serve for transmission of impulses between neurons or neuron and effector cell,
- chemical or electric synapses,
- three parts of synapse:
 - 1) presynaptic knob
 - 2) synaptic cleft
 - 3) postsynaptic membrane



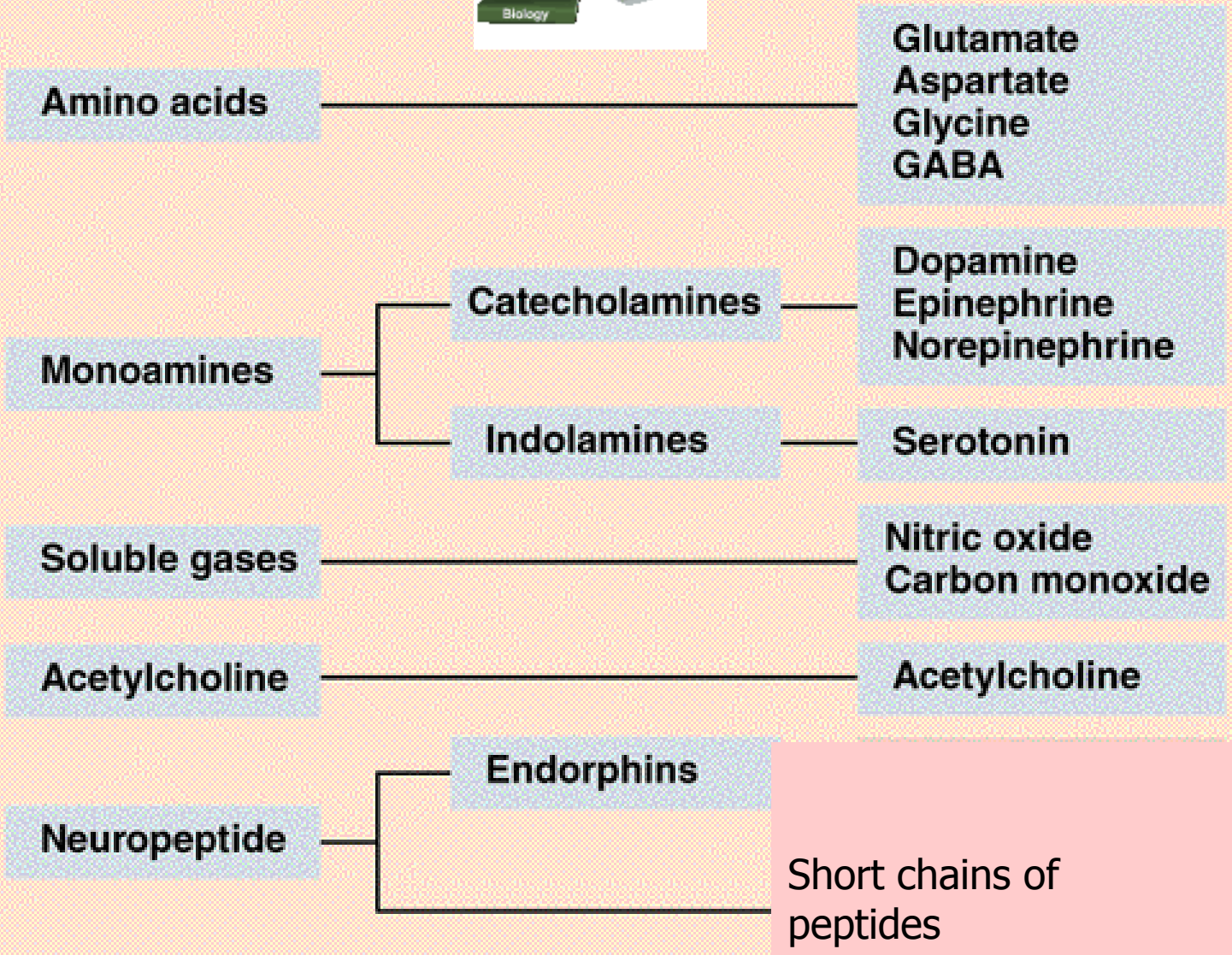
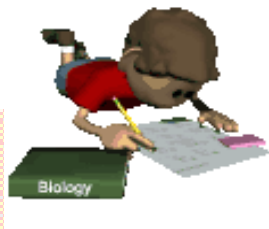
Function of synapse



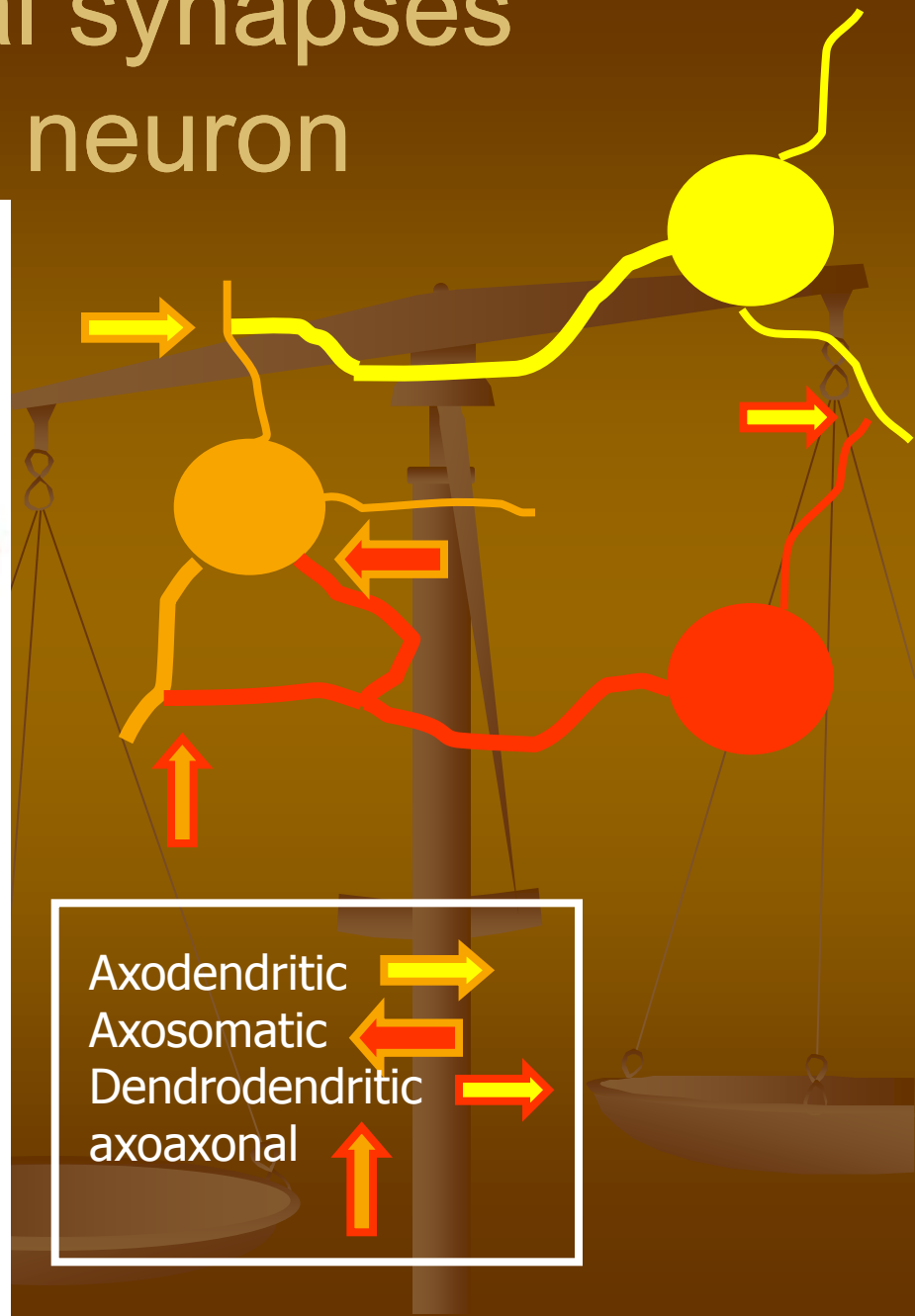
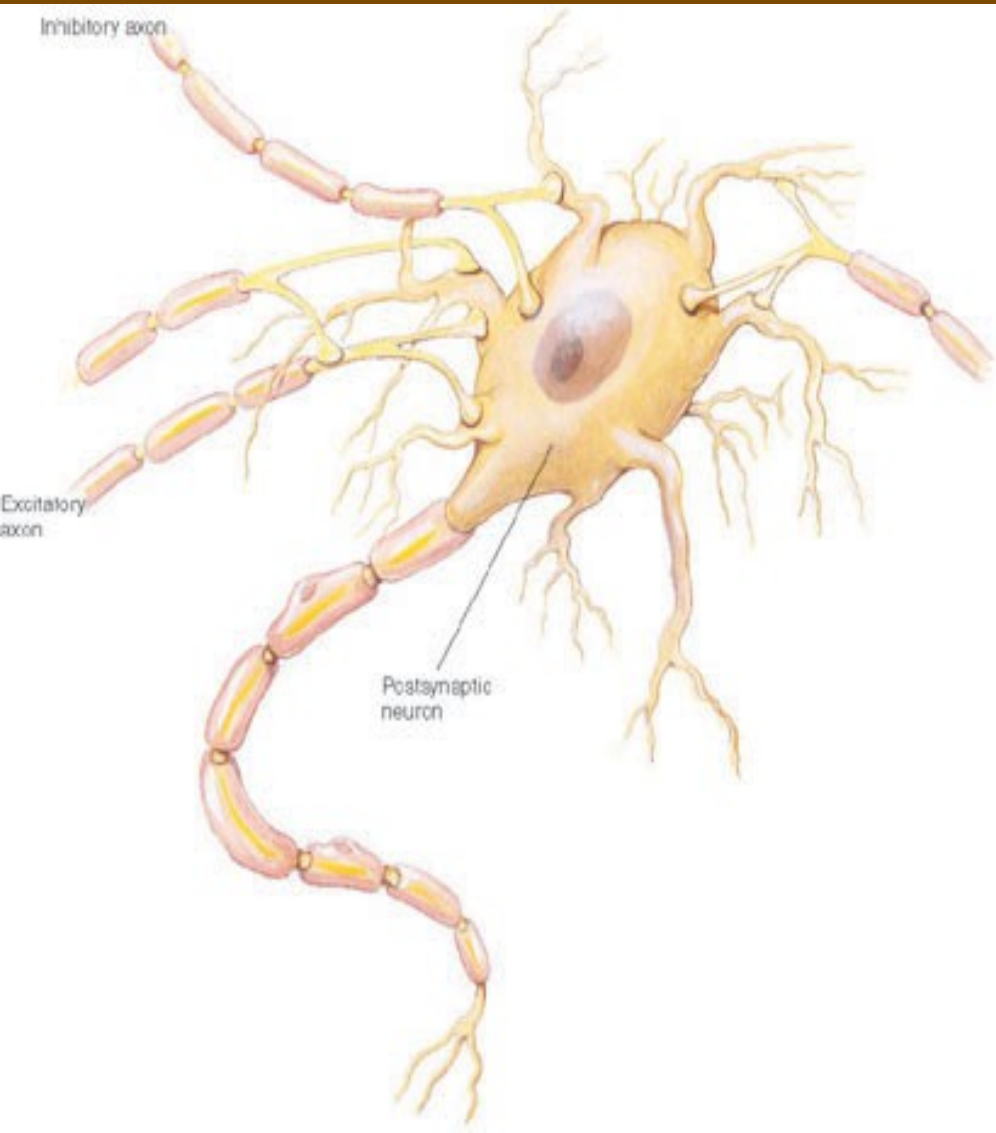
Synaptic vesicles

Synaptic cleft
20 – 30 nm

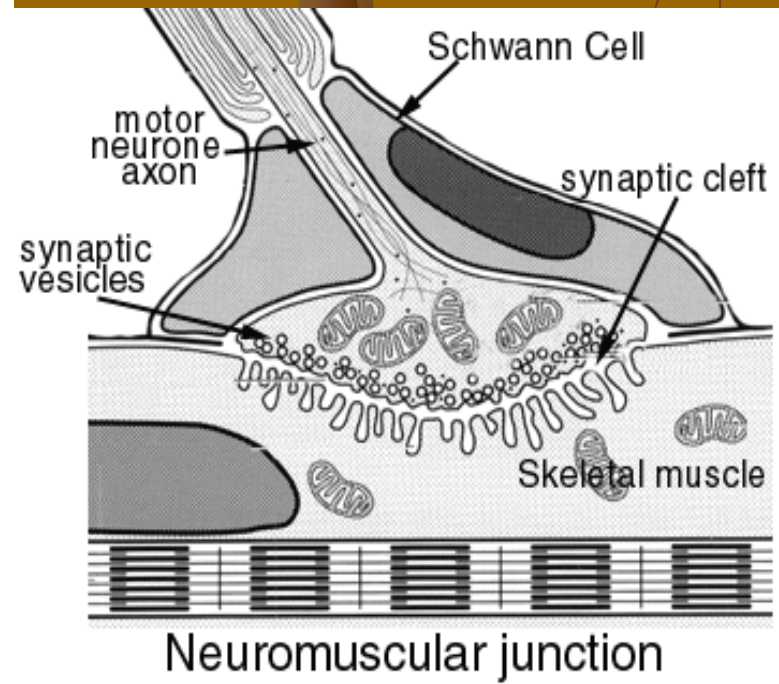
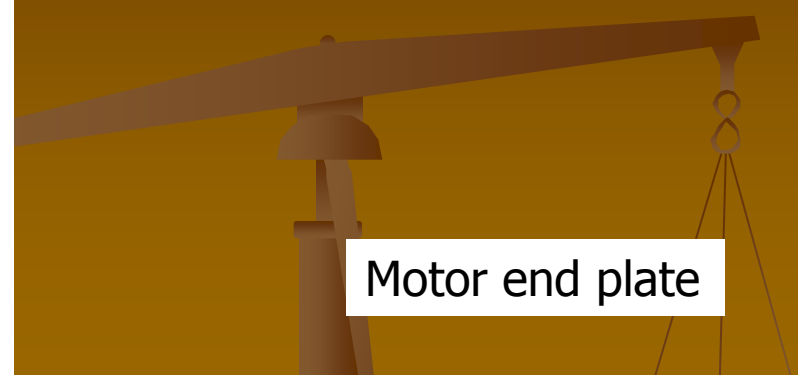
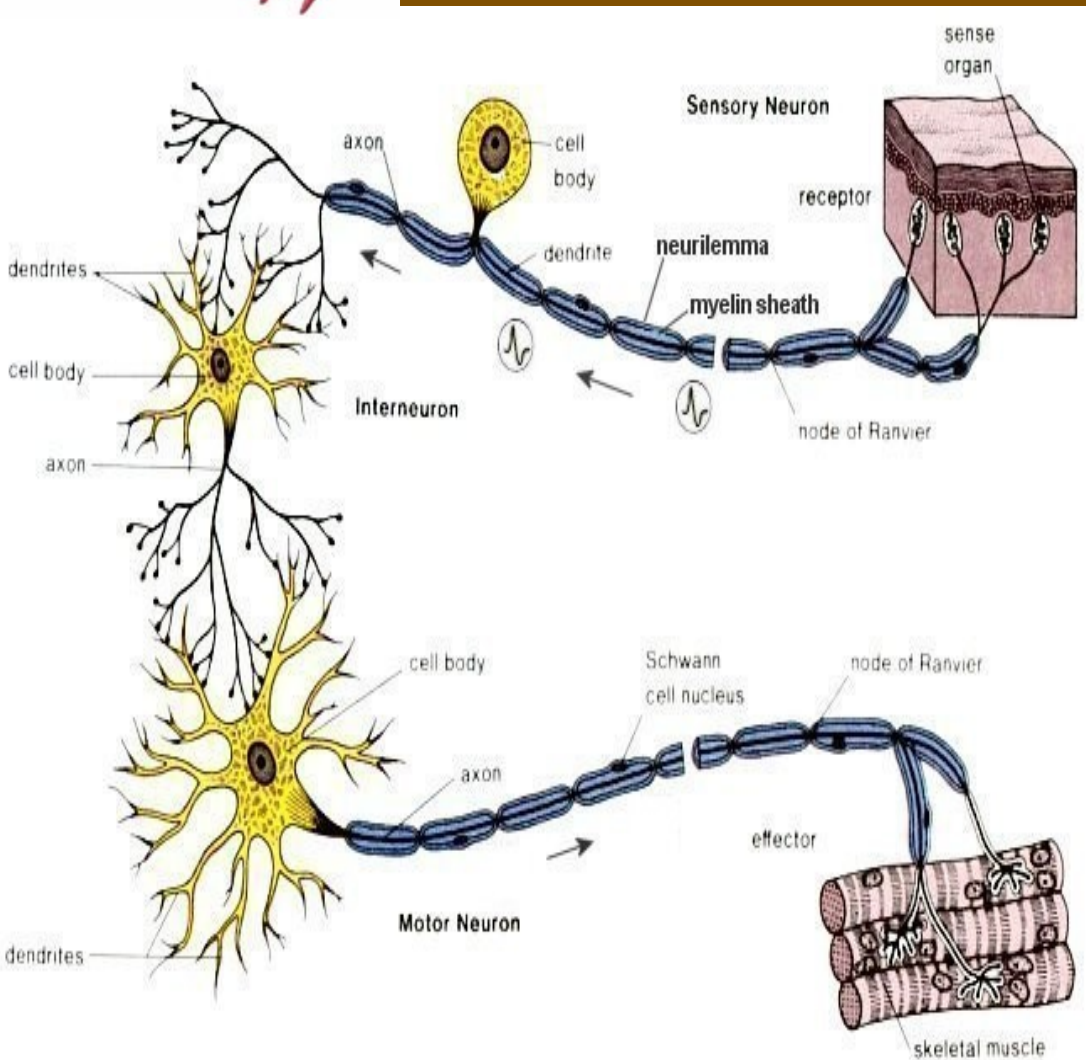
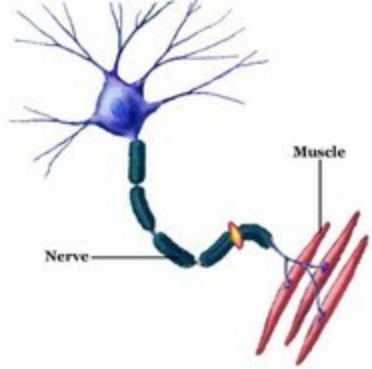
► Classes of Neurotransmitters



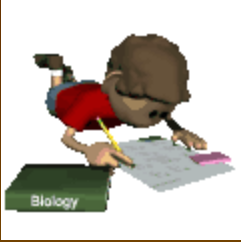
Interneuronal synapses neuron – neuron



Peripheral synapses neuron – effector cell



Neuroglia (glial cells)



- Supporting cells in nerve tissue
- Functions: supportive, nutritive, (immuno)protective

- **Central glia:**

astrocytes

fibrous

protoplasmic

oligodendroglia

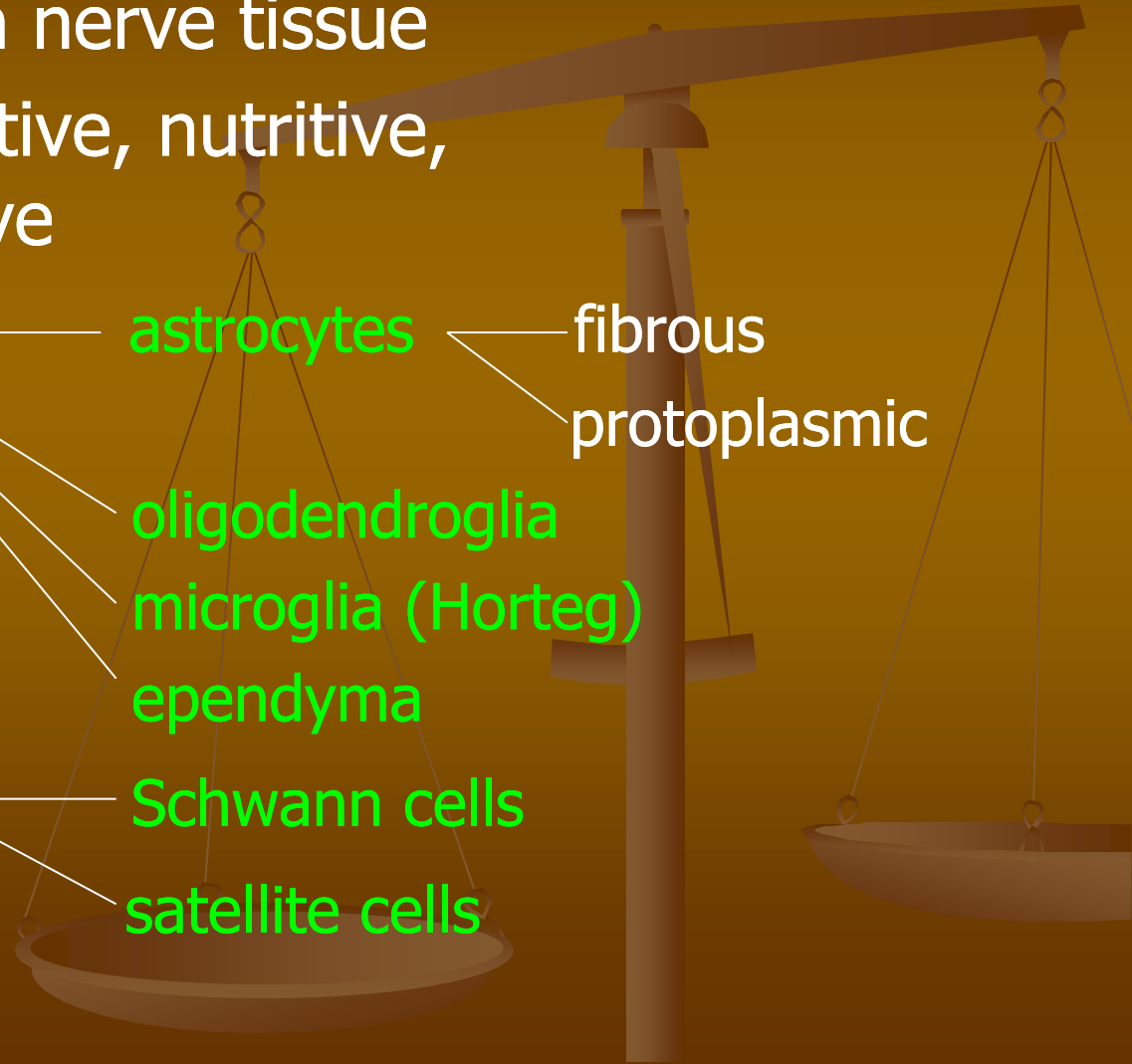
microglia (Horteg)

ependyma

- **Peripheral glia:**

Schwann cells

satellite cells



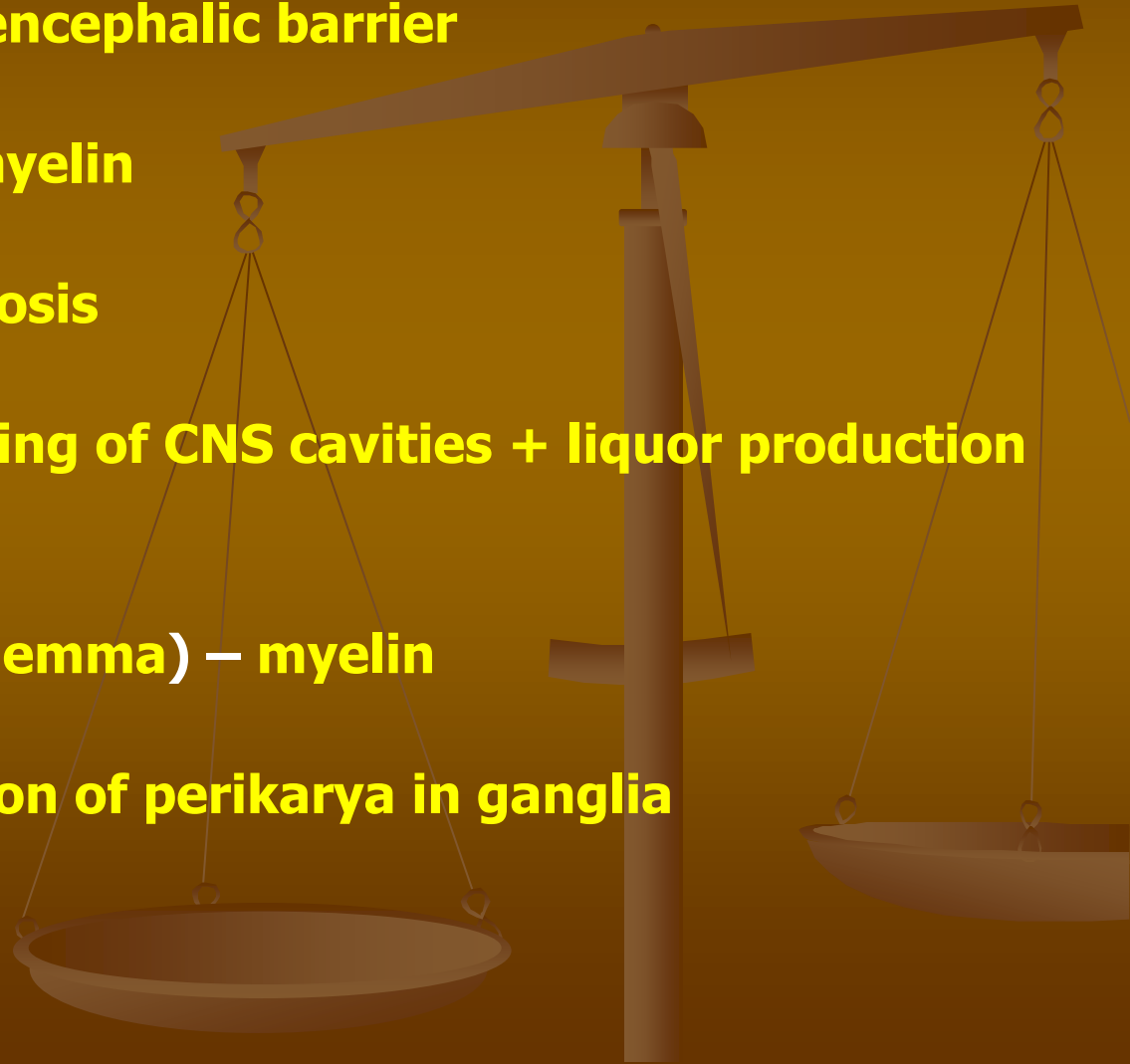
Neuroglia

Central glia

- astrocytes – **hematoencephalic barrier**
- oligodendrocytes – **myelin**
- mikroglia – **phagocytosis**
- ependymocytes – **lining of CNS cavities + liquor production**

Periferal glia

- Schwann cells (**neurilemma**) – **myelin**
- satellite cells – **isolation of perikarya in ganglia**





CENTRAL GLIA

Oligodendrocyte

Myelinated axon

Myelin sheath (cut)

Microglia

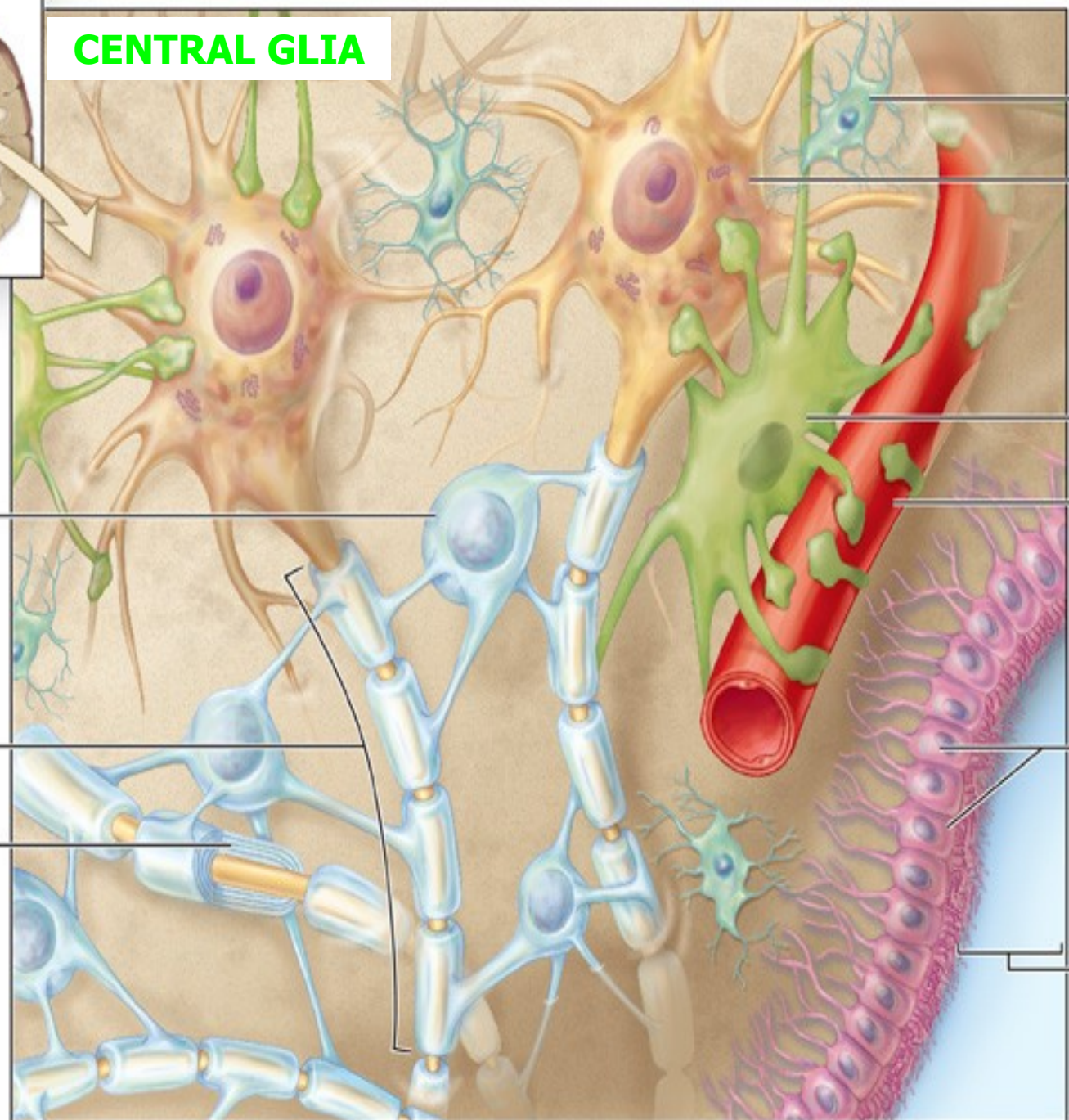
Neuron

Astrocyte

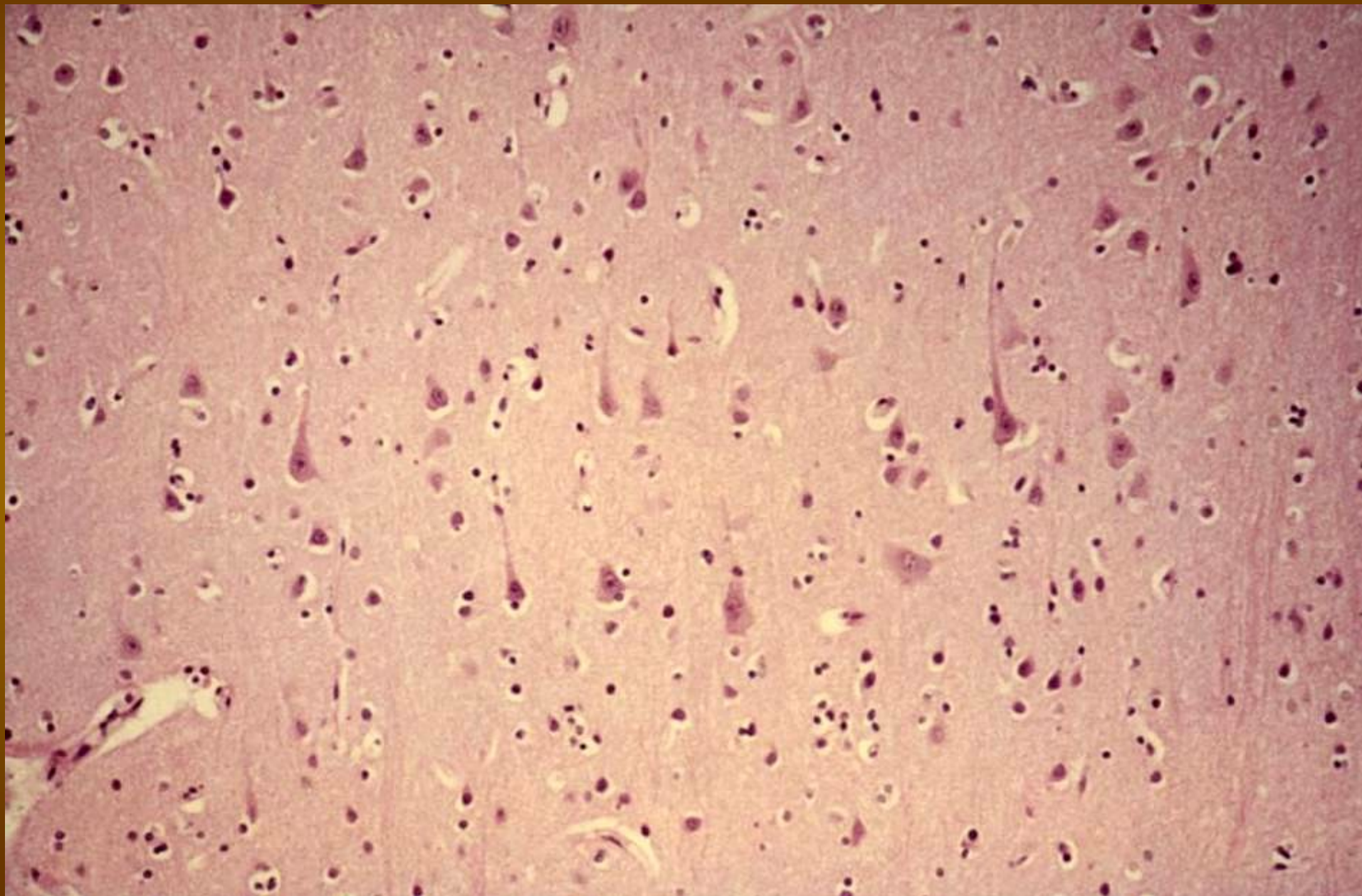
Capillary

Ependyma cells

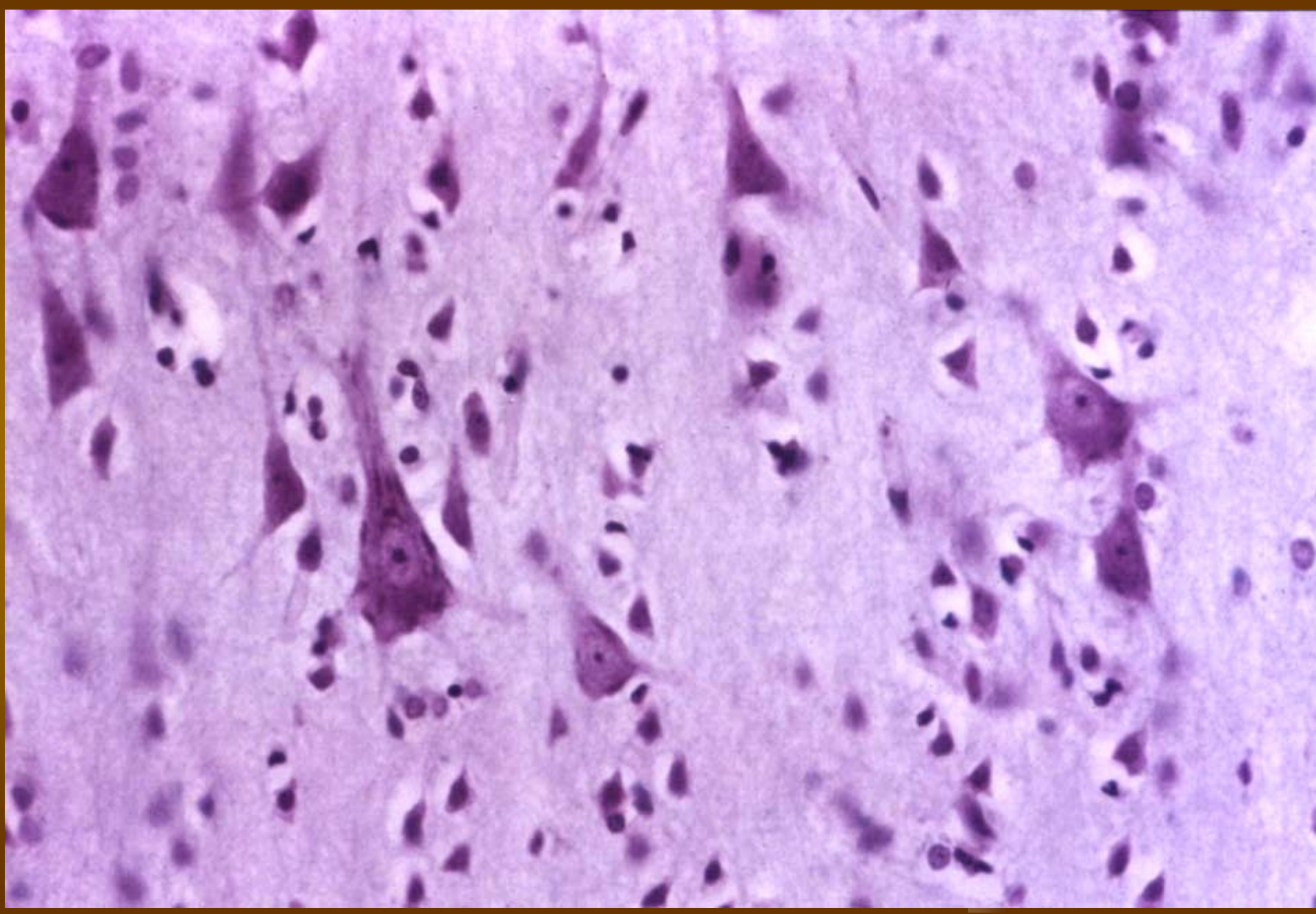
ventricle of brain



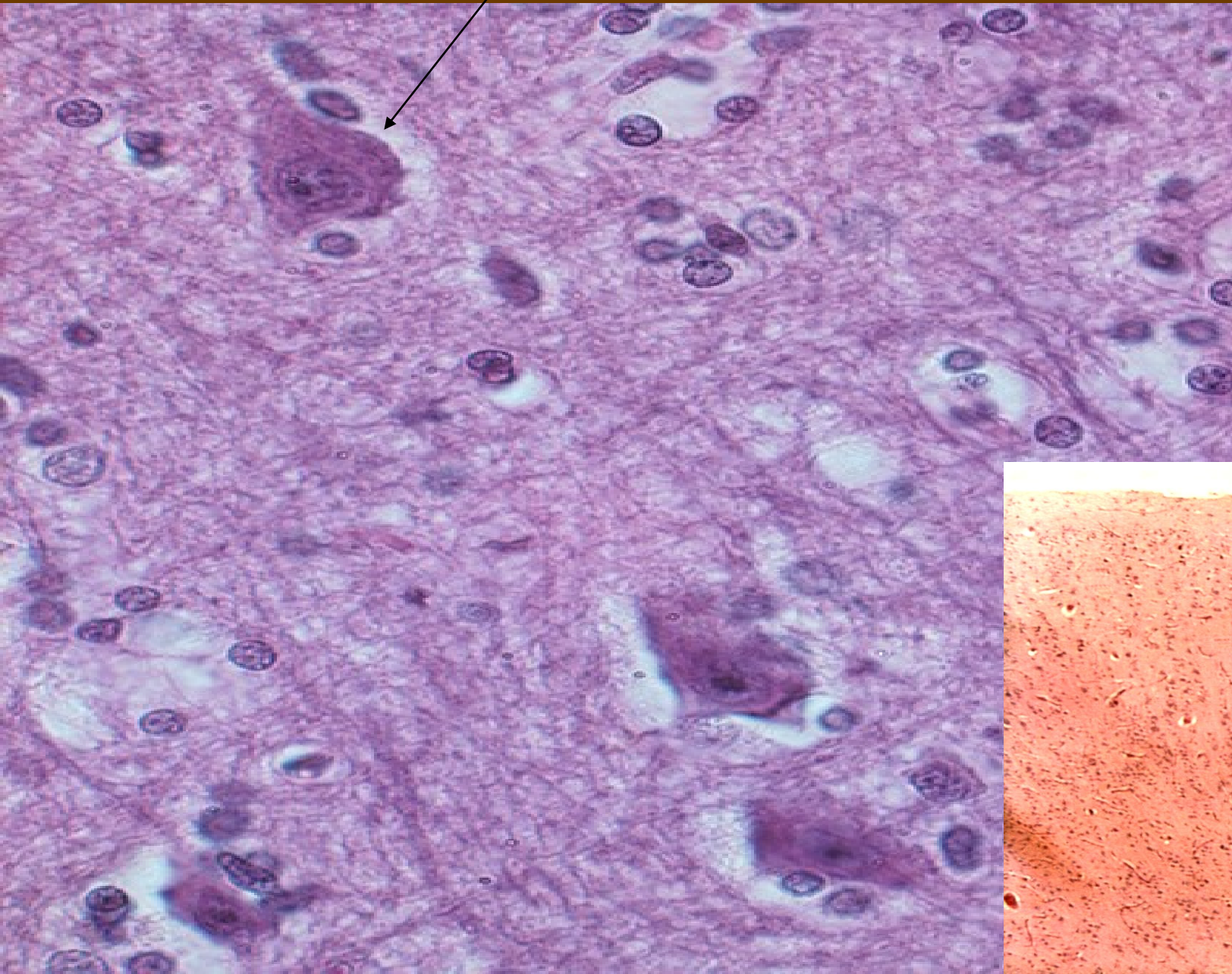
Cortex cerebri (HE) – lamina pyramidalis



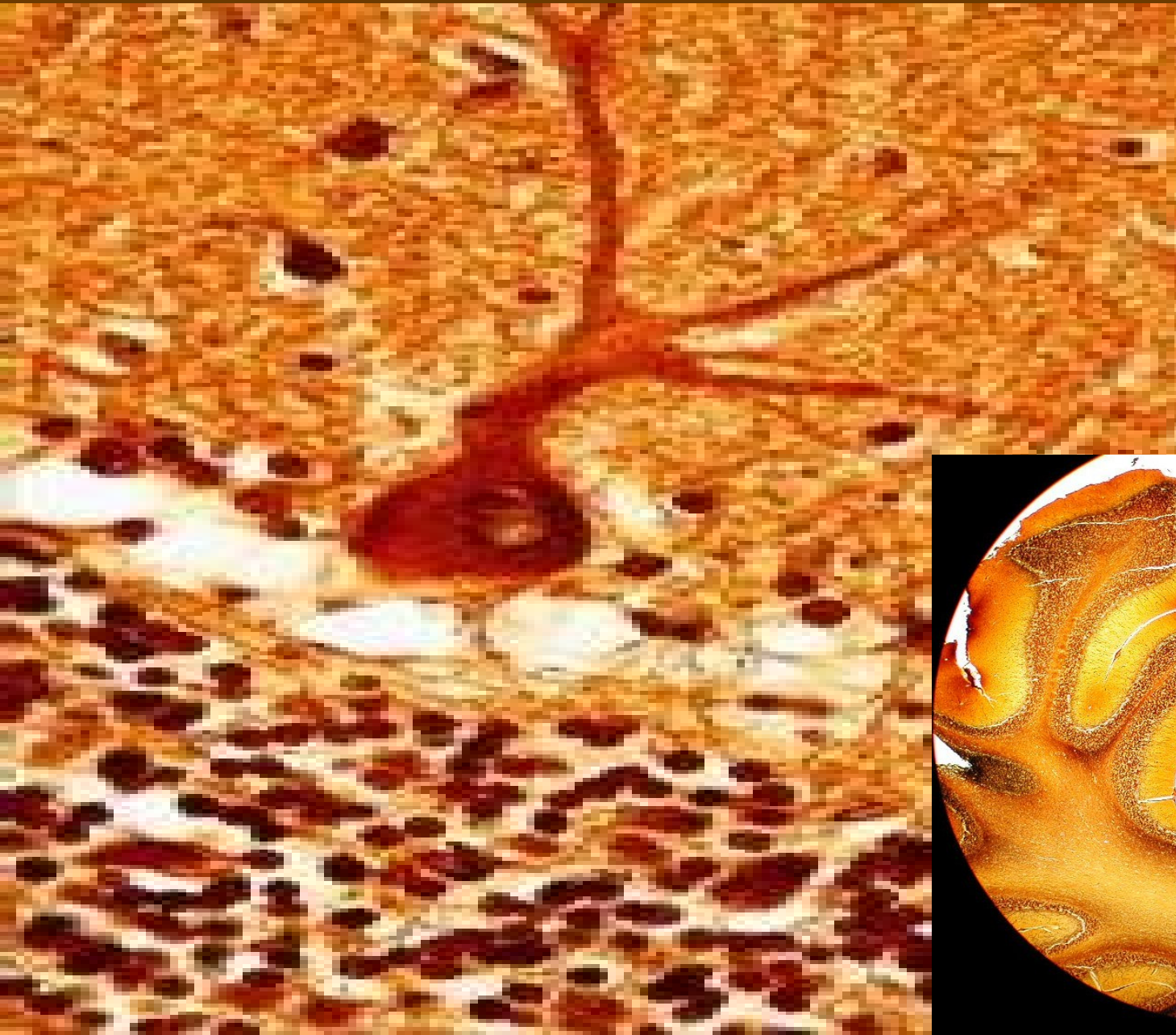
Cortex cerebri (HE) – lamina ganglionaris with large pyramidal cells of Betz



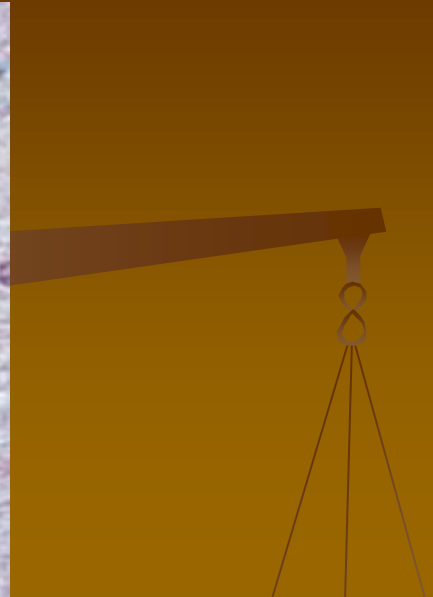
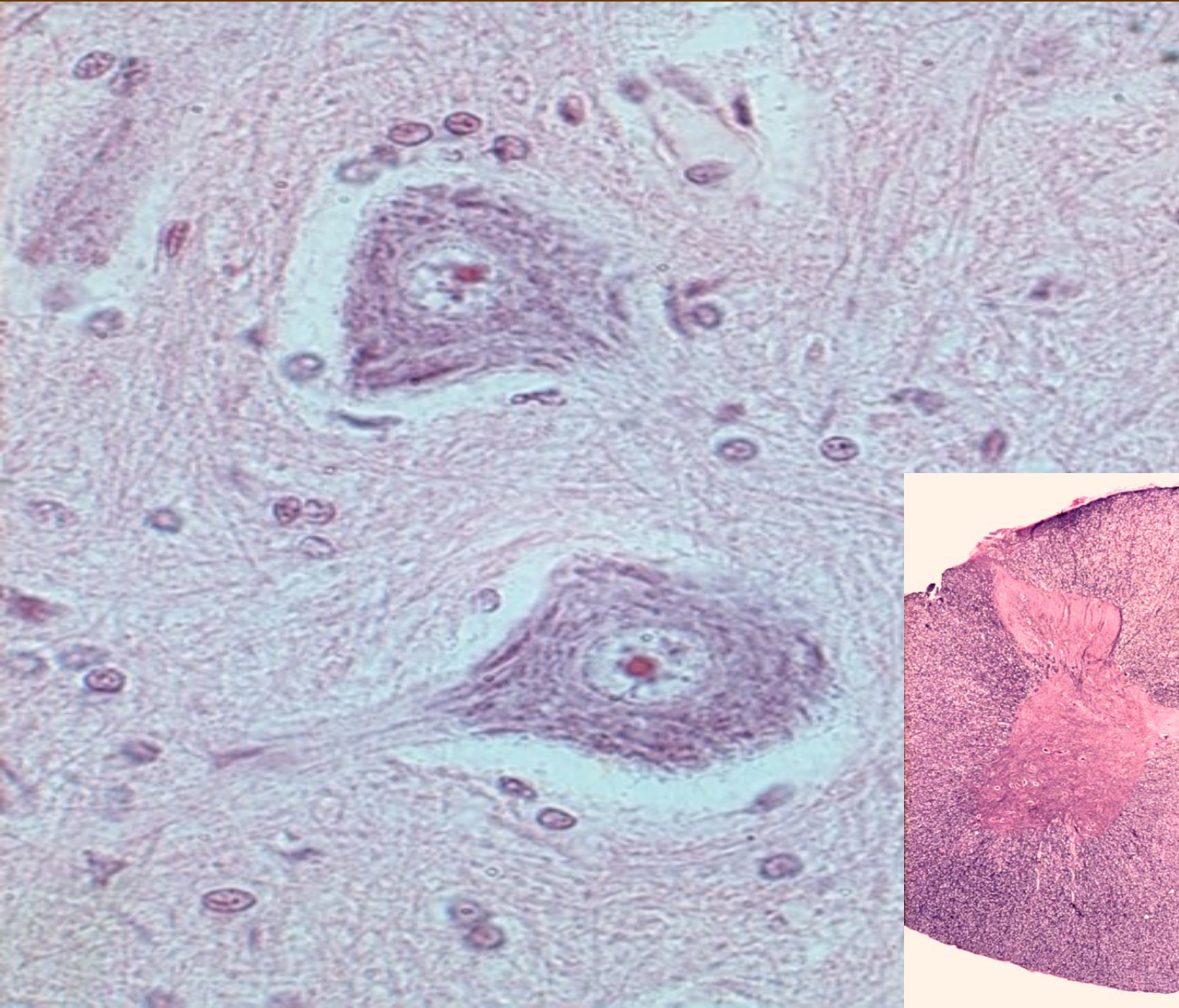
Cortex cerebri (HE) – pyramidal cell



Cerebellum (impregnation) – Purkinje cell



Medulla spinalis (HE) – motor neuron



Spinal ganglion (HE)

pseudounipolar neurons

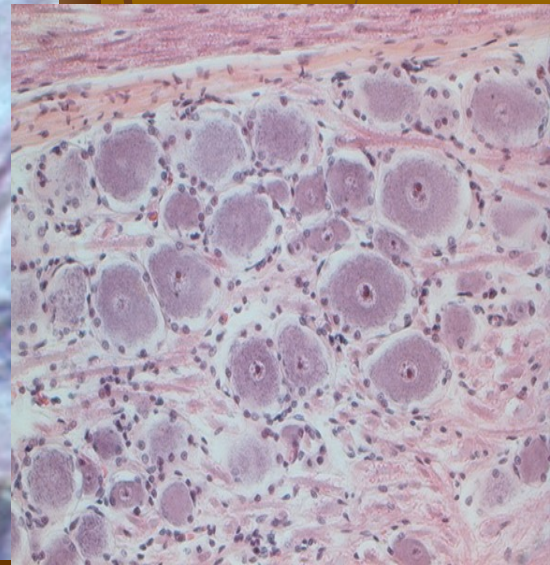
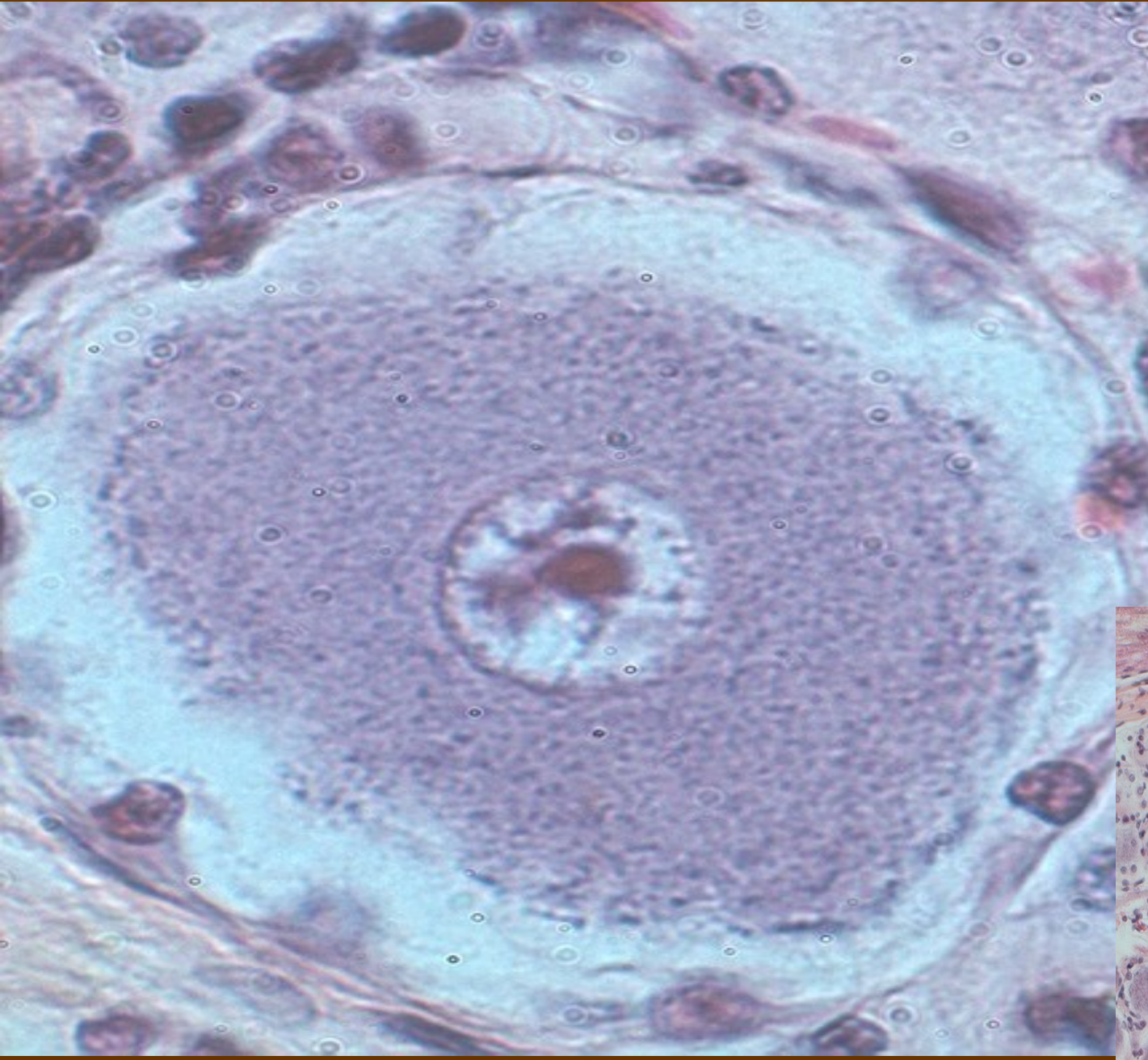


bundles of nerve fibers

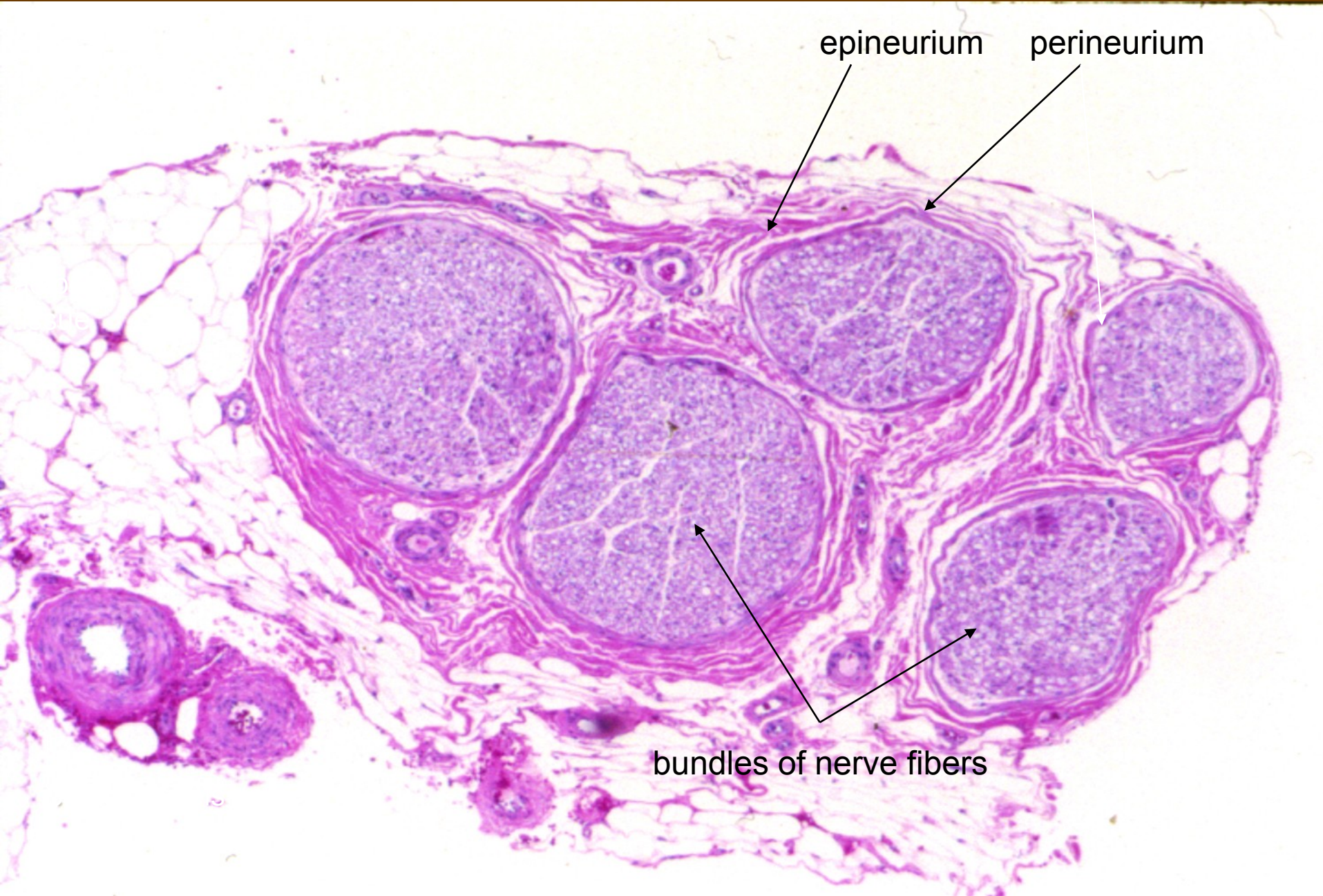
nerve

nerve

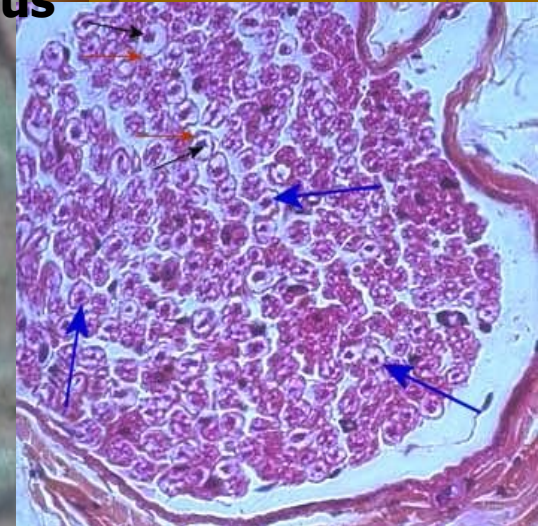
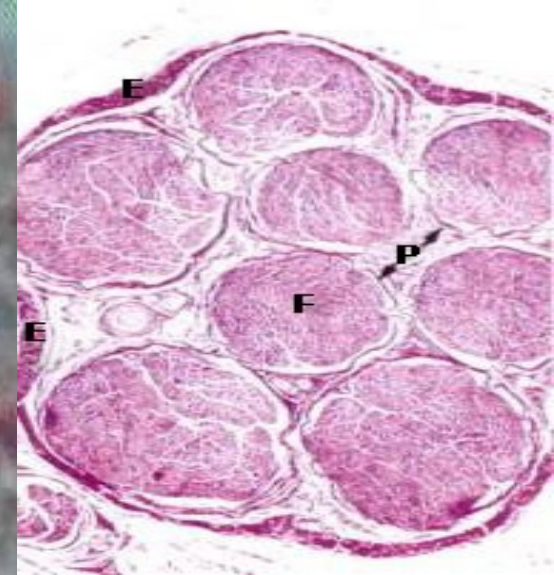
Ganglion cell + satellite cells



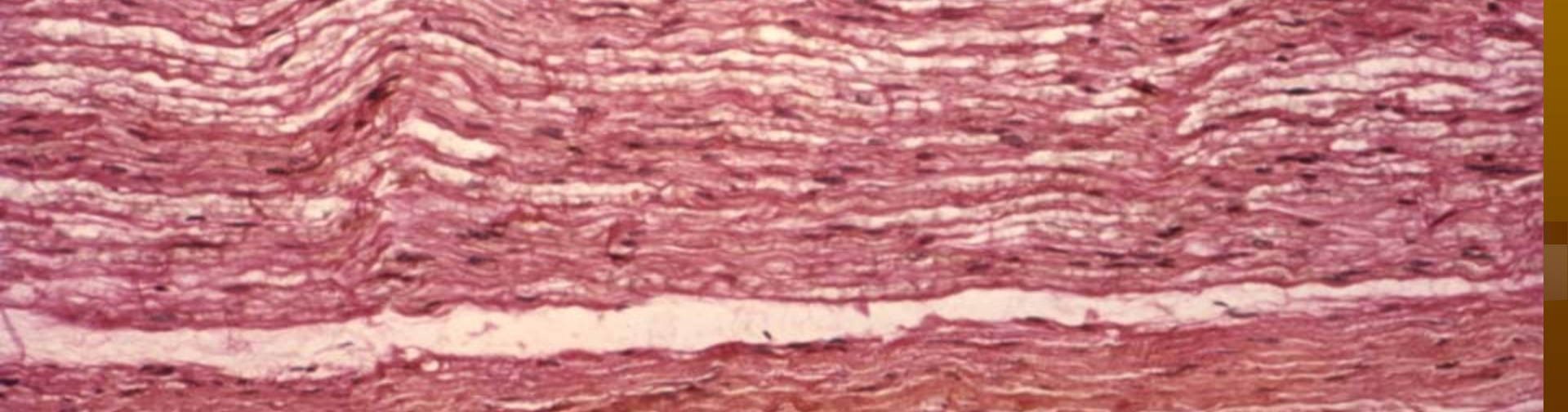
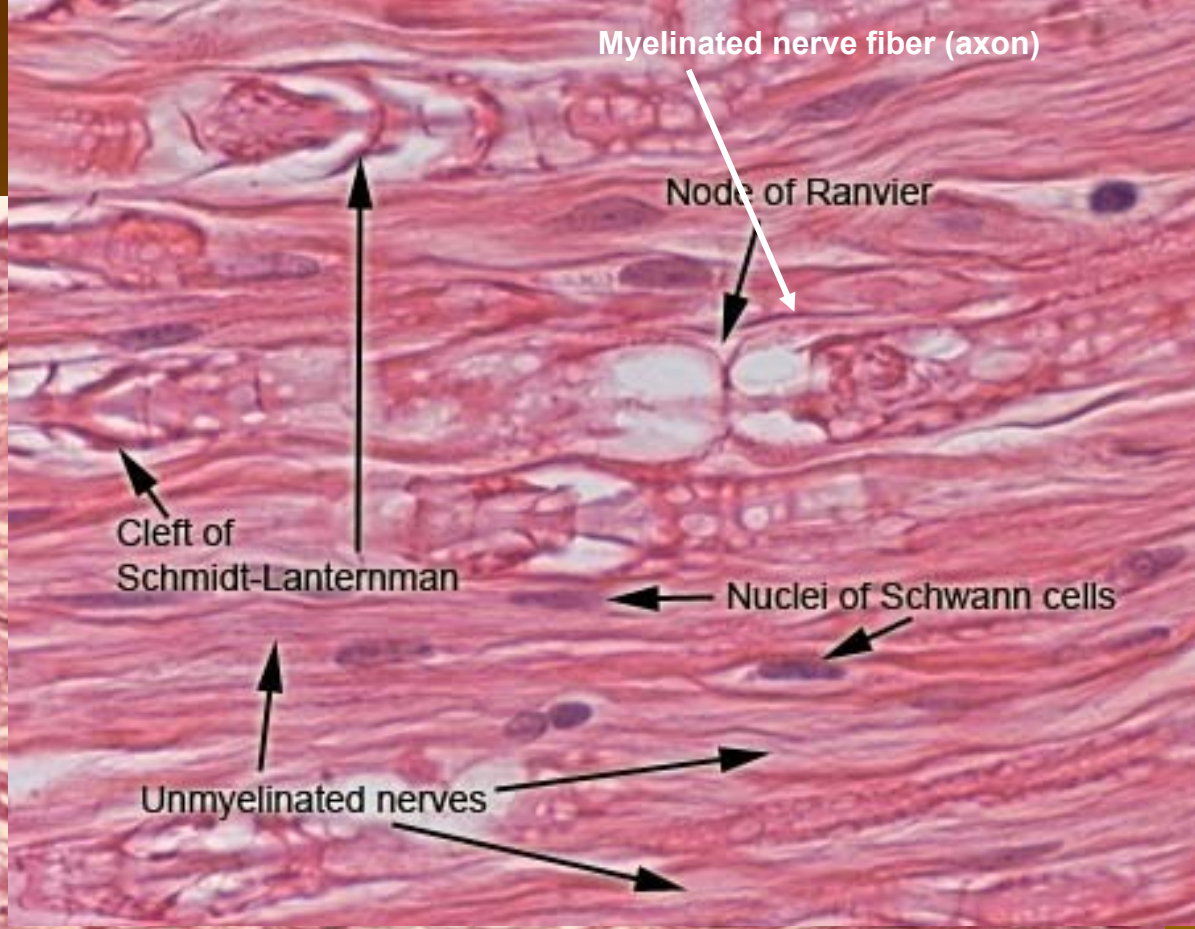
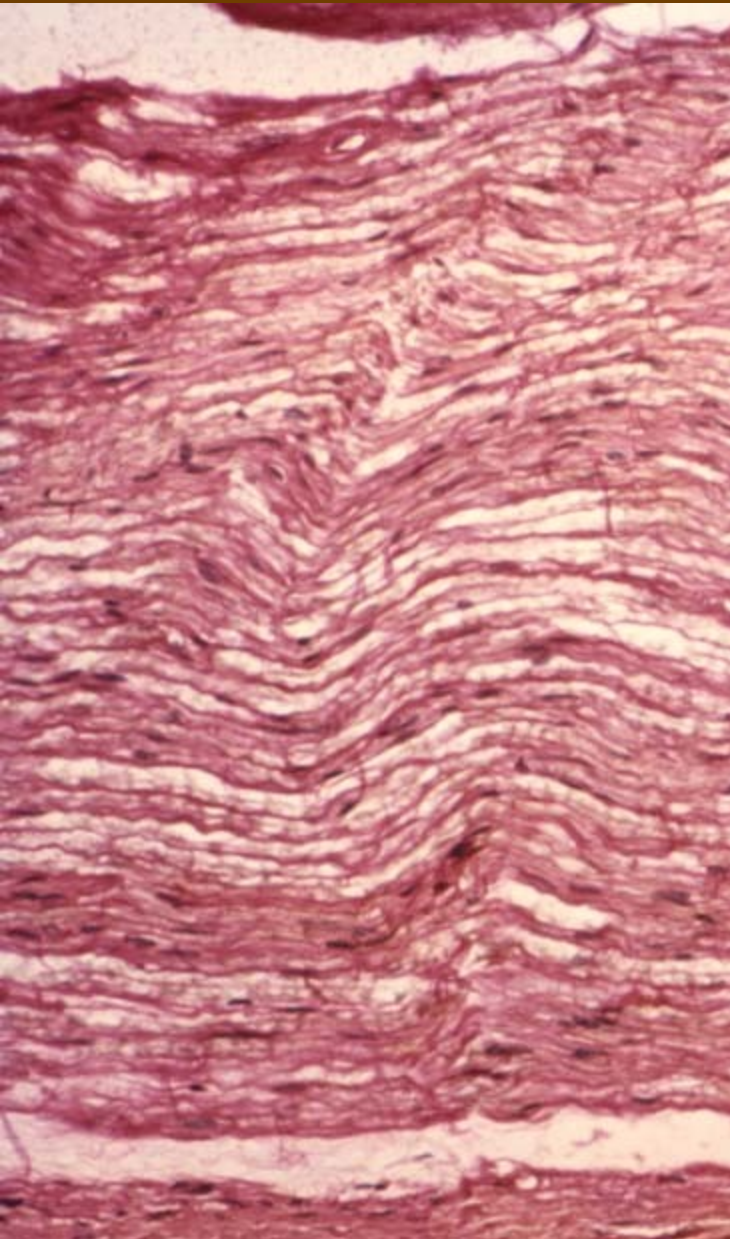
Peripheral nerve (HE) – cross section



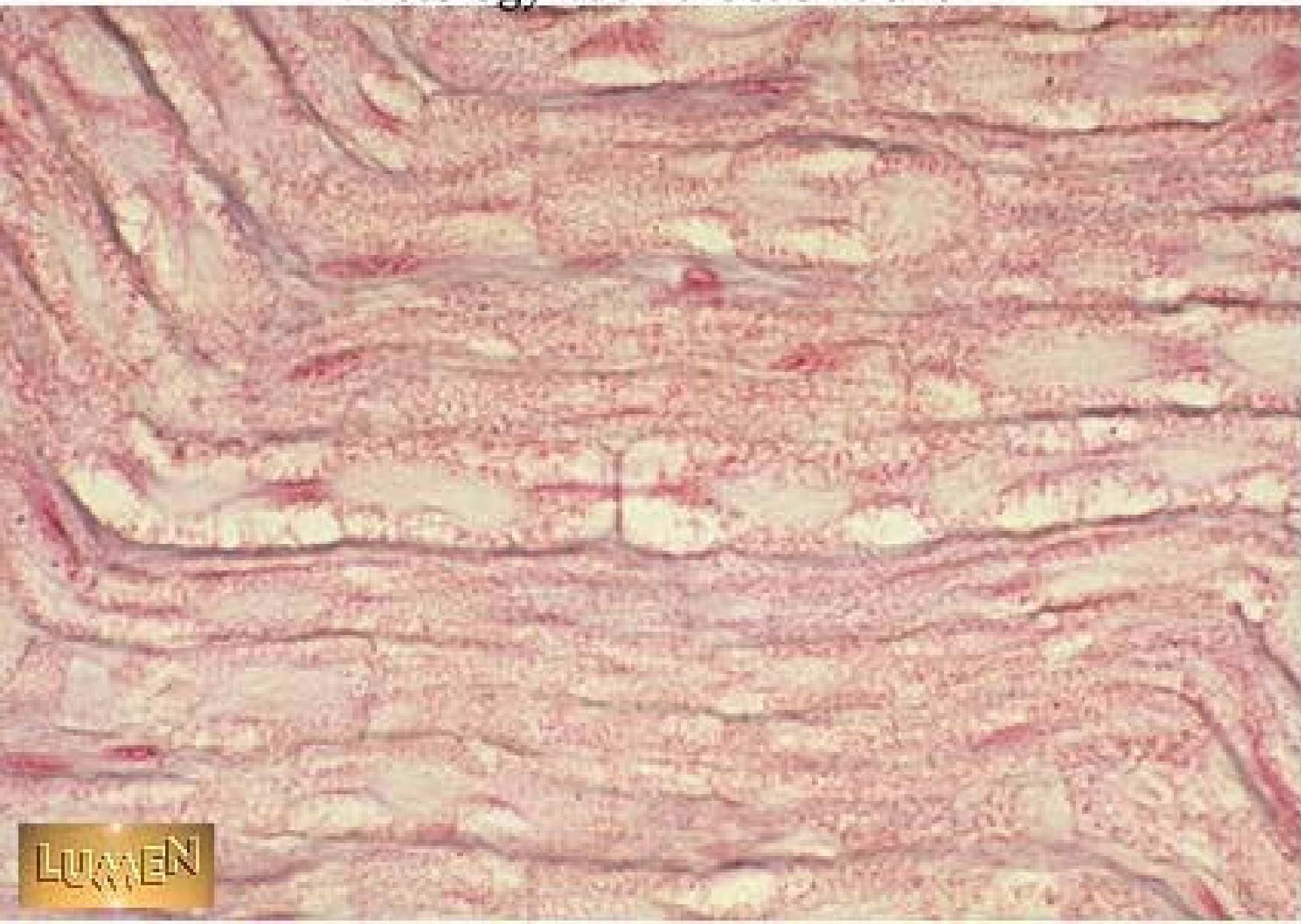
Peripheral nerve (HE) cross section



**Peripheral nerve (HE)
longitudinal section**



Histology Lab Part 6: Slide 15





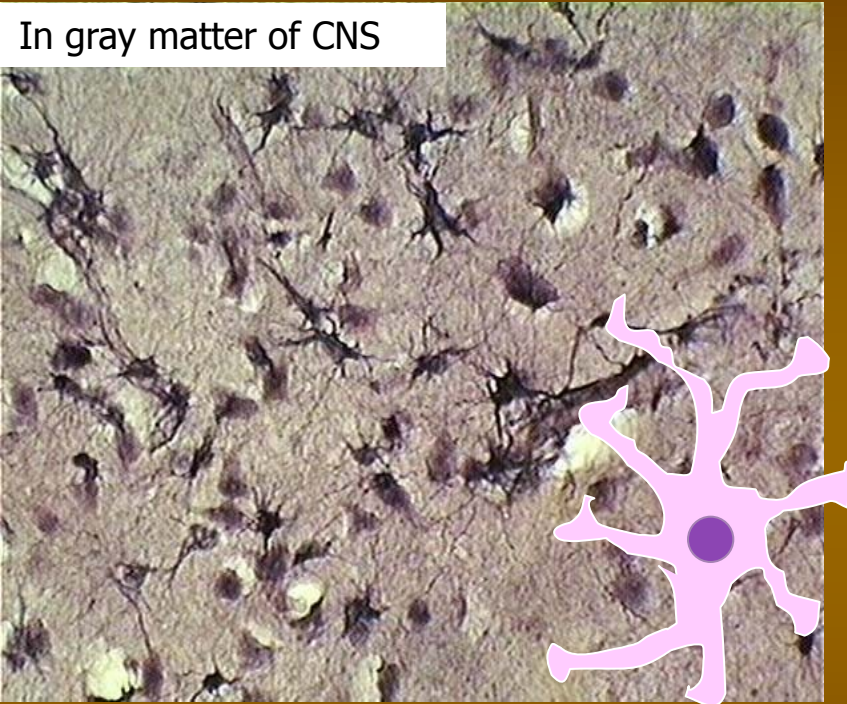
**Thank you for your
attention**



Astrocytes (macroglia)

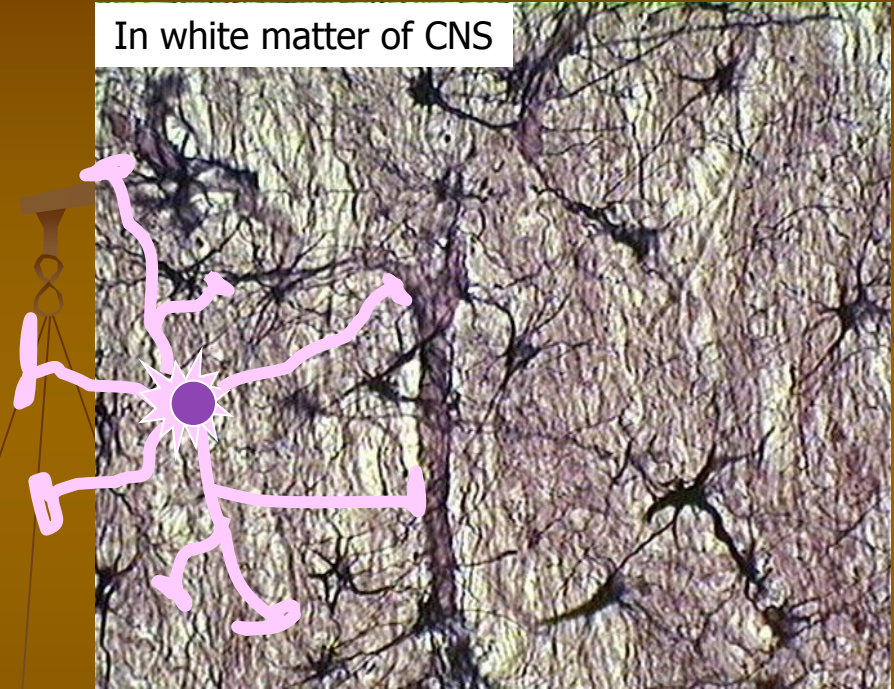
■ Protoplasmic astrocytes

In gray matter of CNS



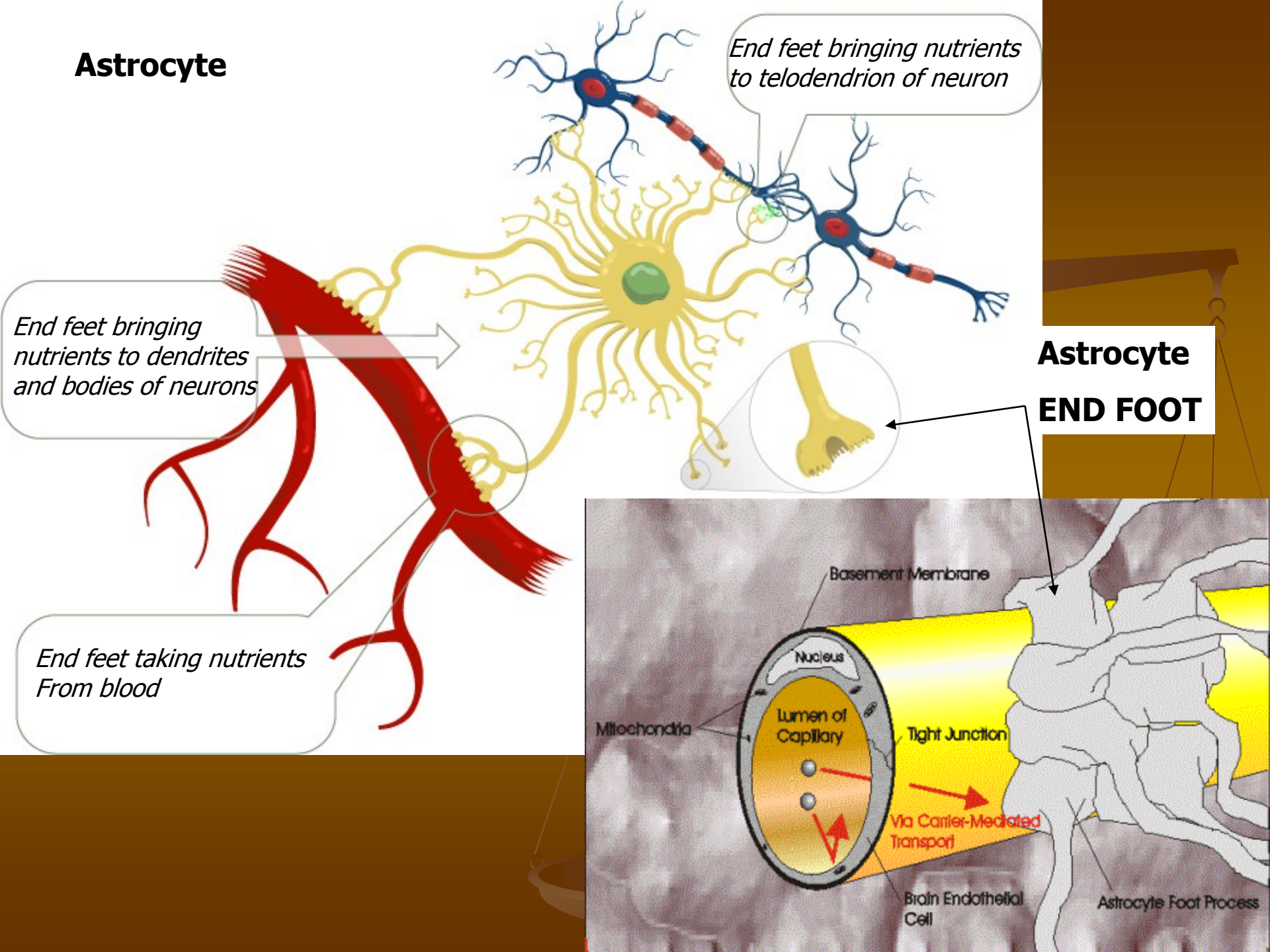
Fibrous astrocytes

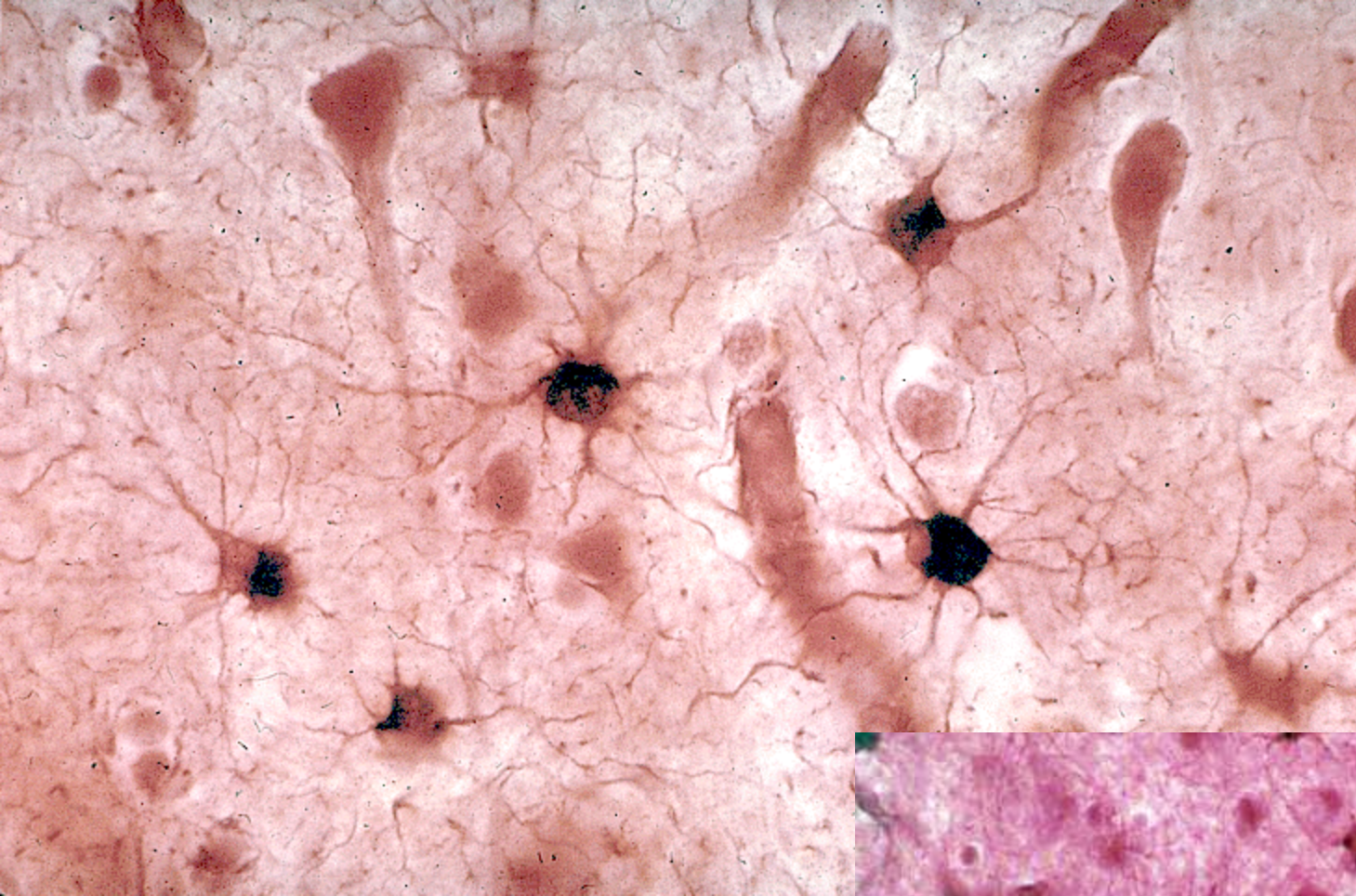
In white matter of CNS



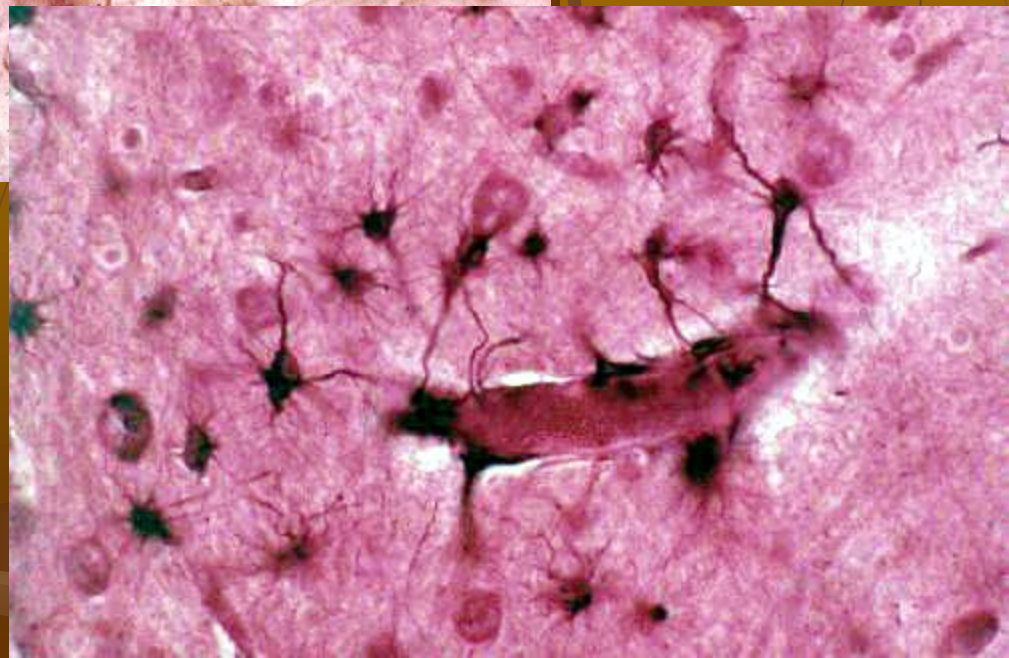
- Functions: cytoplasmic processes are ended by **end feet**, which form continuous layer – limiting membranes on the surface of:
 - 1) blood capillaries (*membrana limitans gliae perivascularis*; together with endothelium it forms **blood-brain barrier**,
 - 2) brain (*membrana limitans gliae superficialis*)Astrocytes have protective and nutritive function

Astrocyte

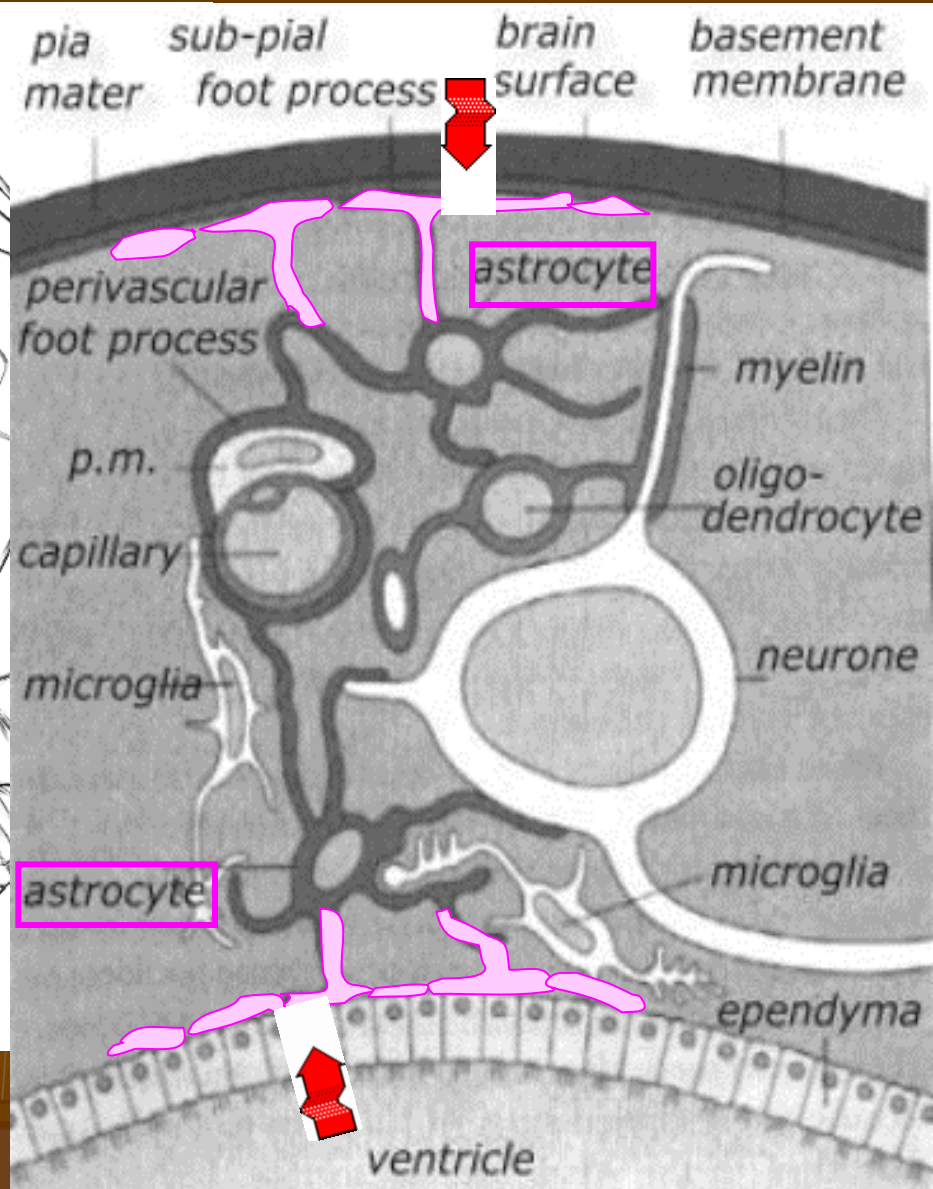
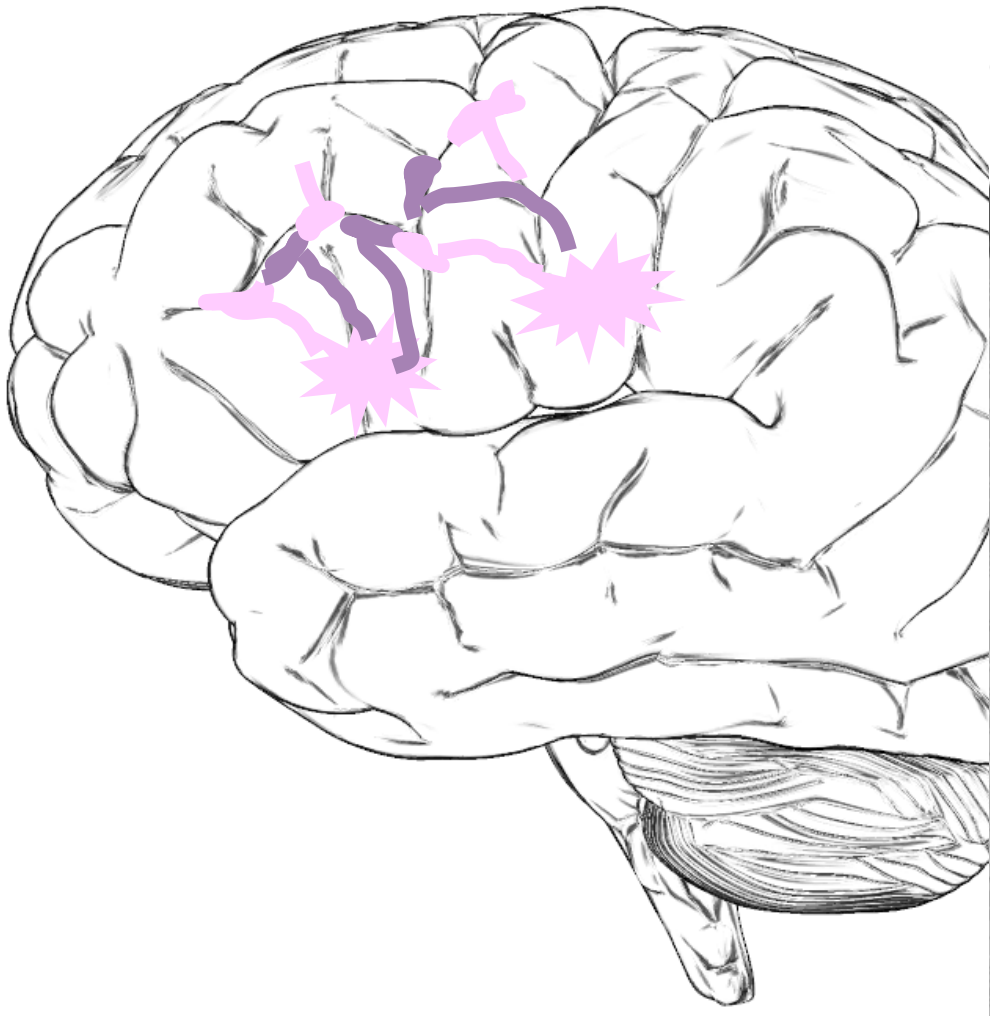


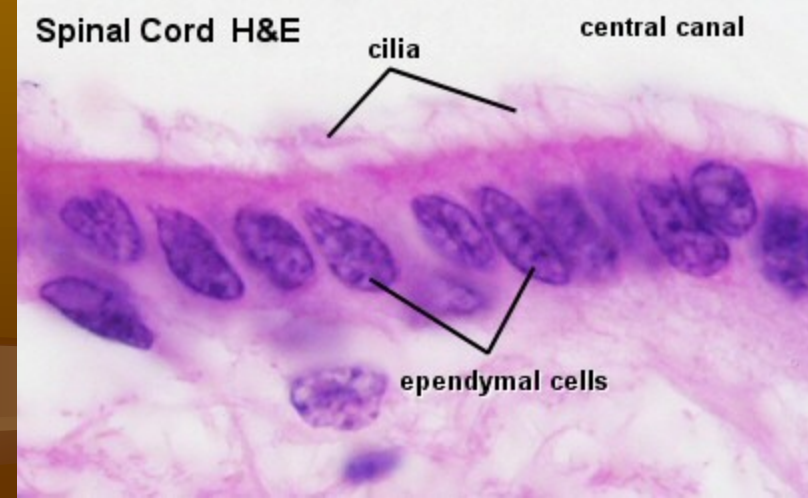
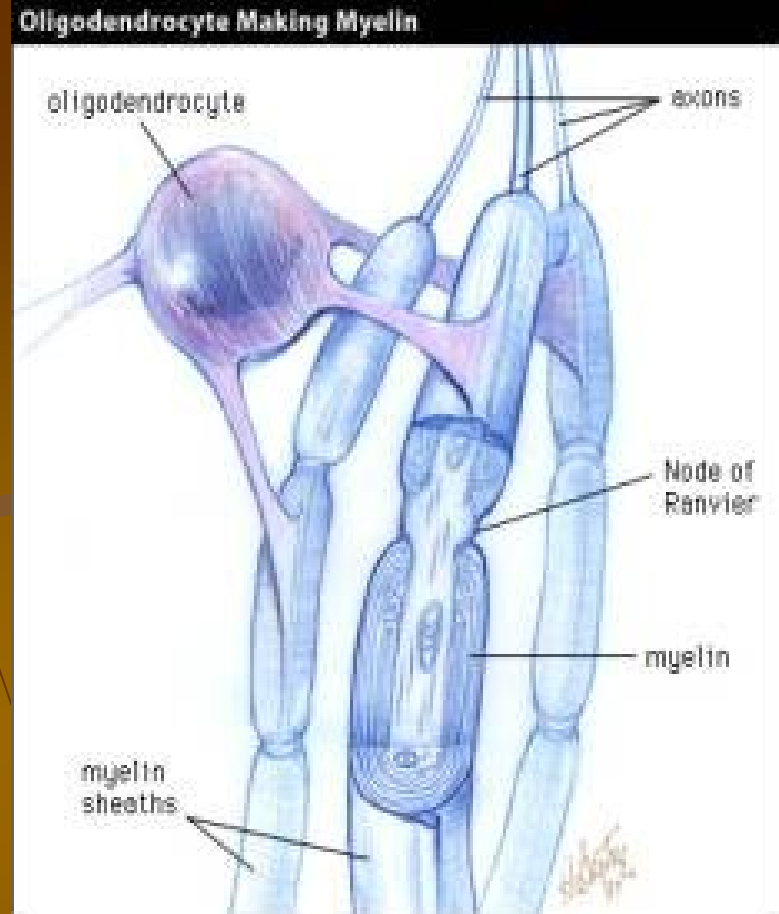
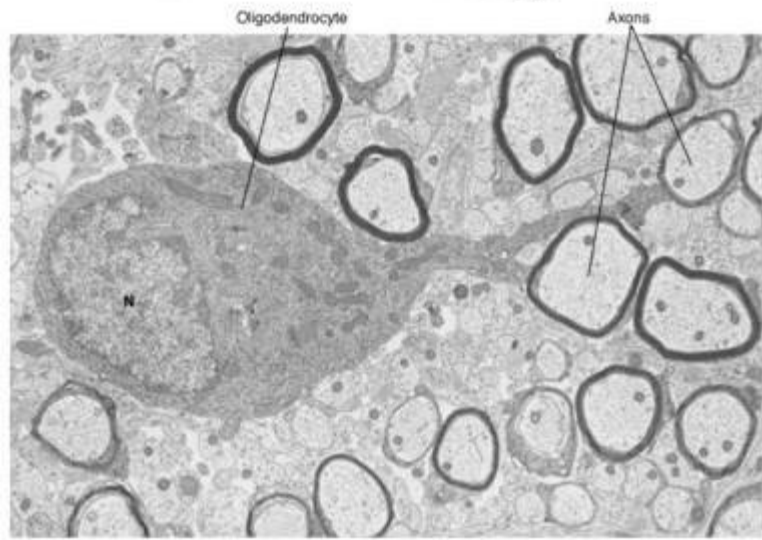
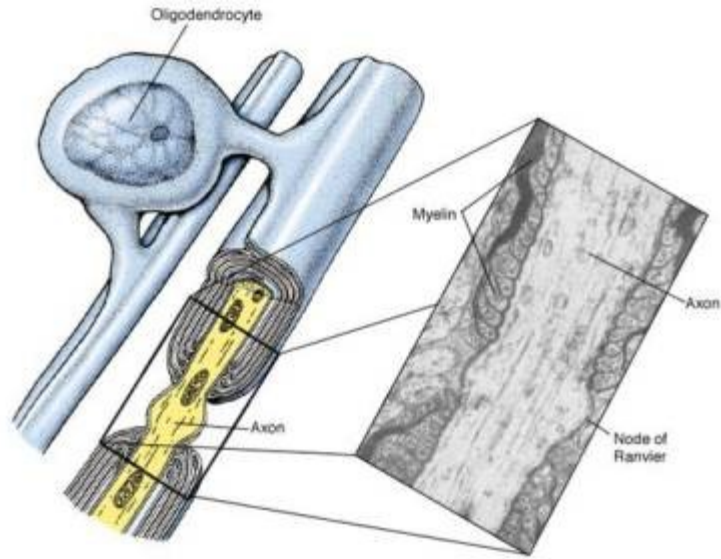


Astrocytes

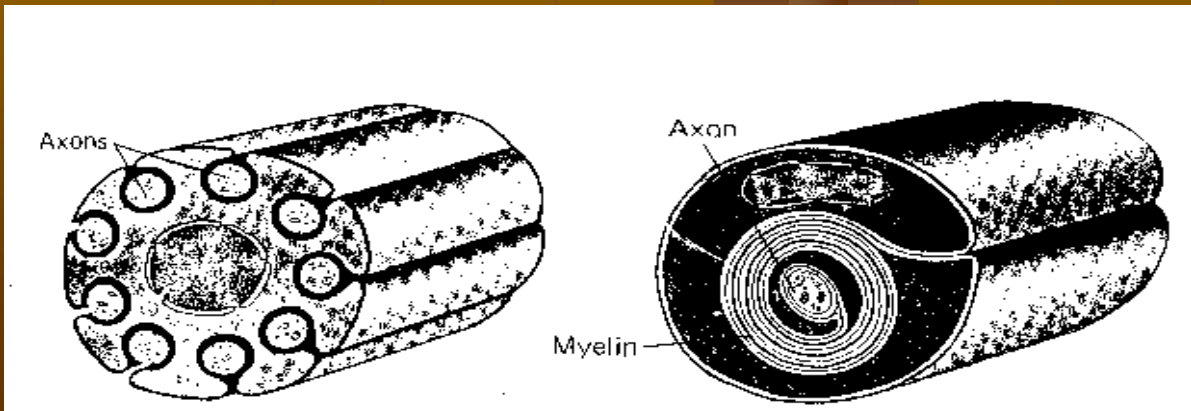
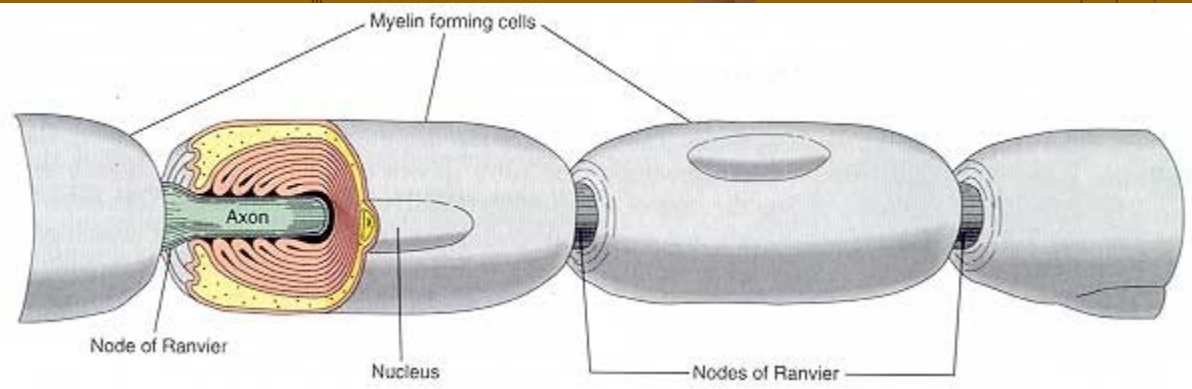
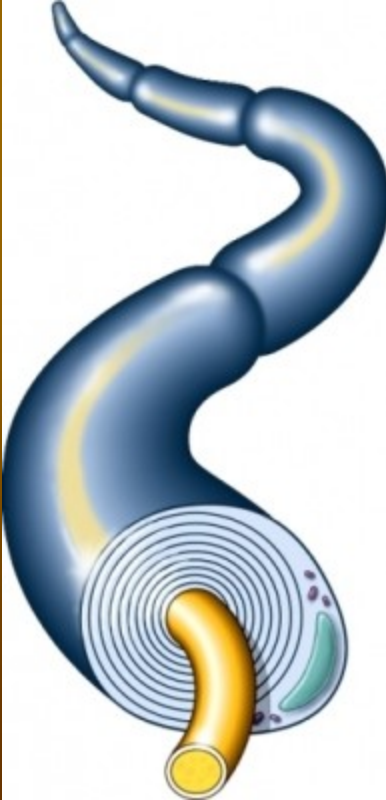
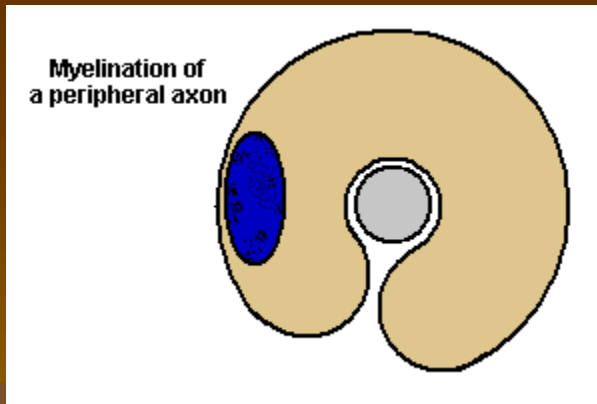
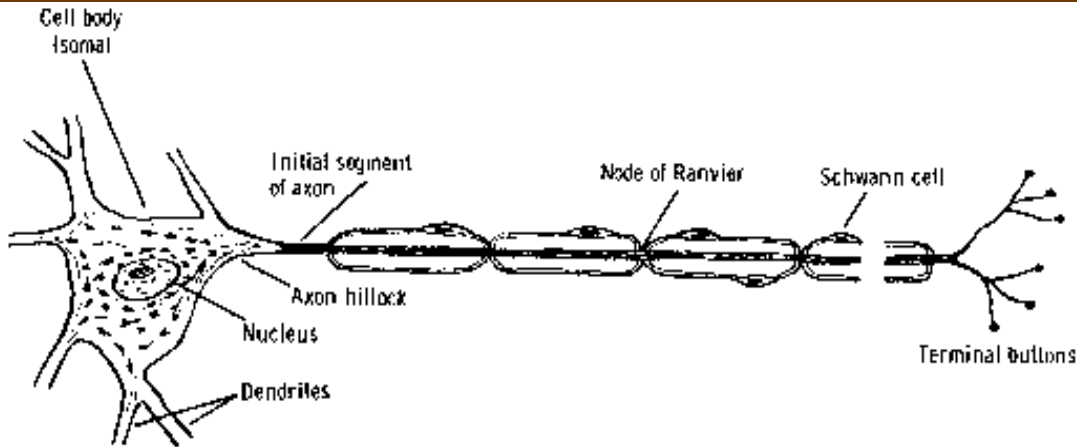


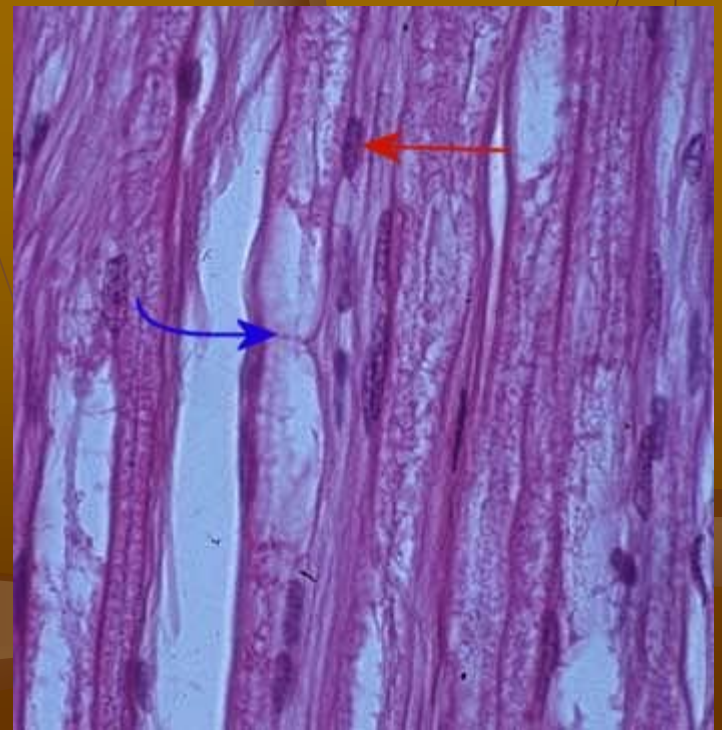
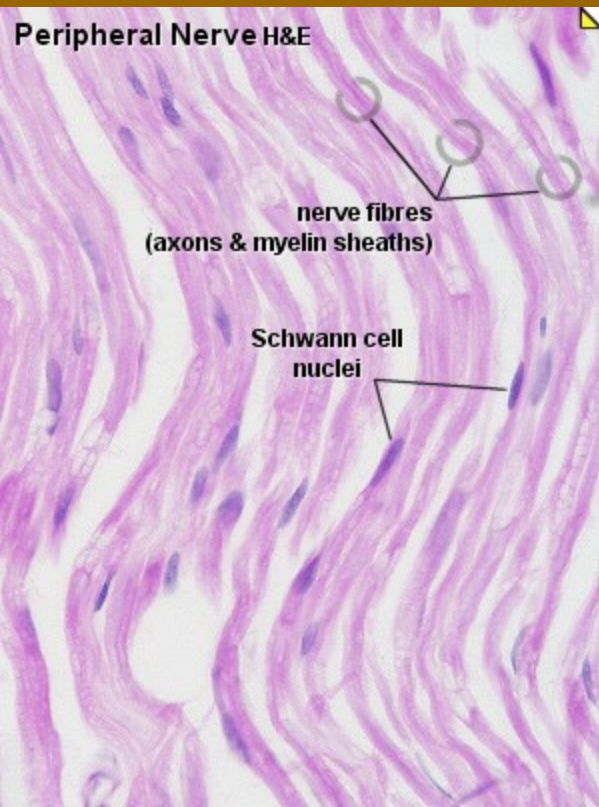
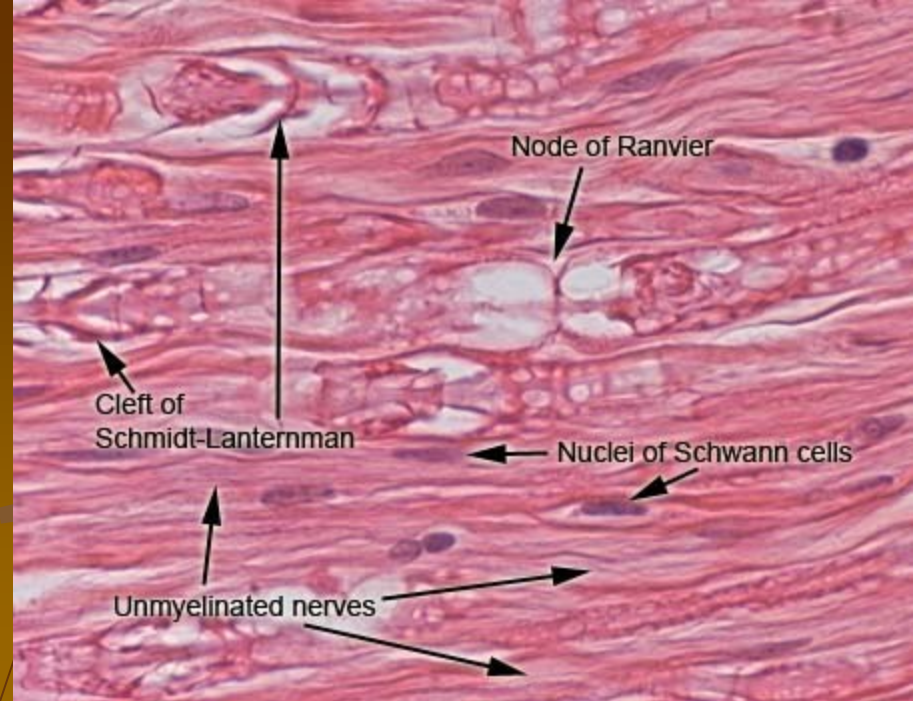
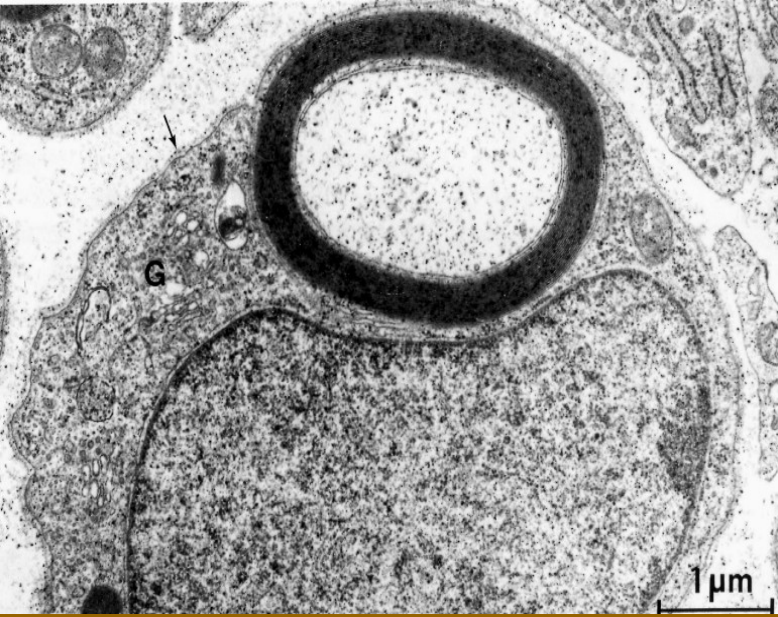
Membrana limitans gliae superficialis





PERIPHERAL GLIA: SCHWANN CELLS





Dorsal Root Ganglion H&E

ganglion cell nuclei

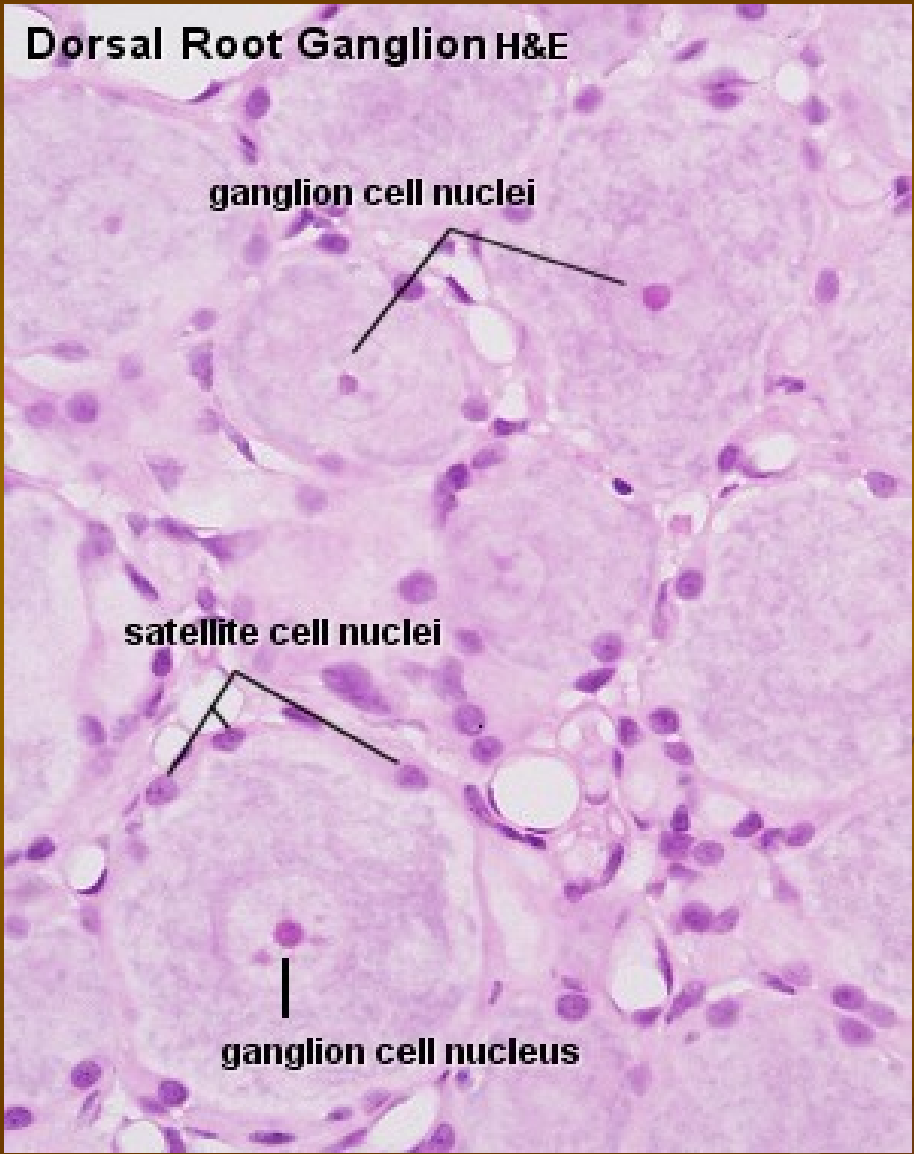
satellite cell nuclei

ganglion cell nucleus

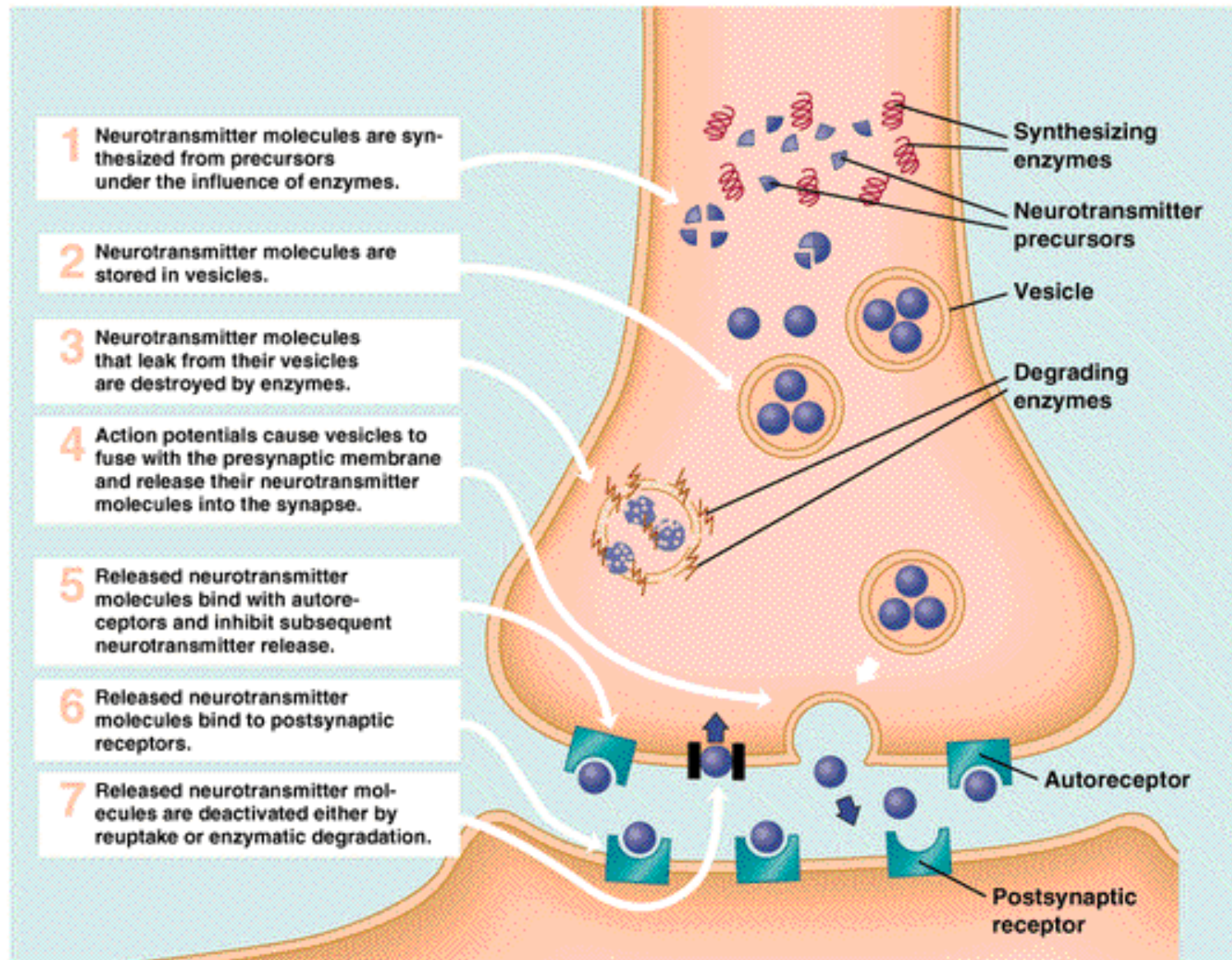
Autonomic Ganglion H&E

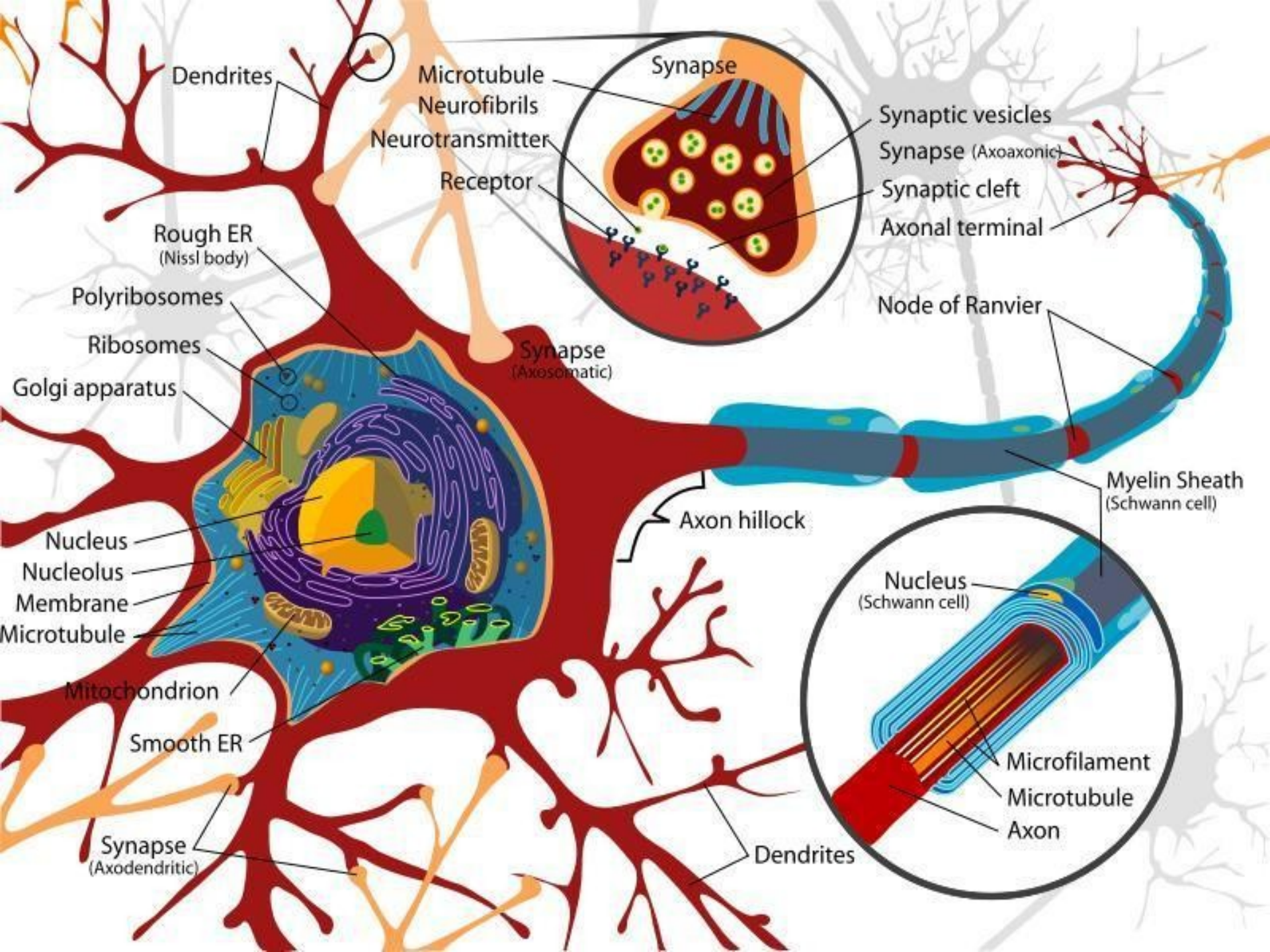
satellite cells

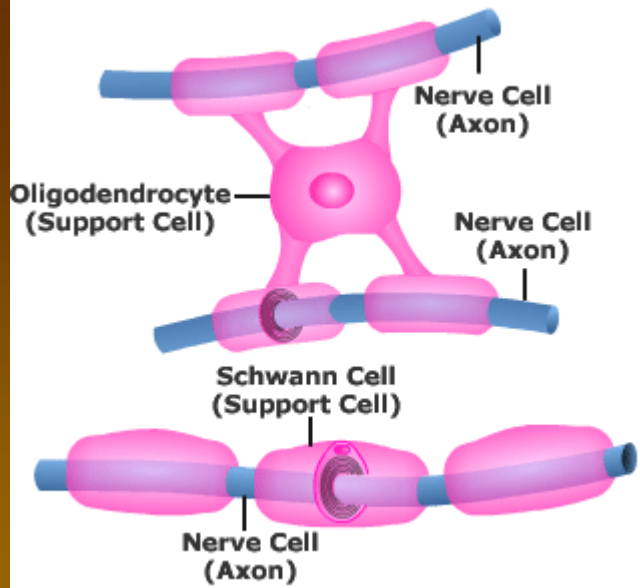
ganglion cells



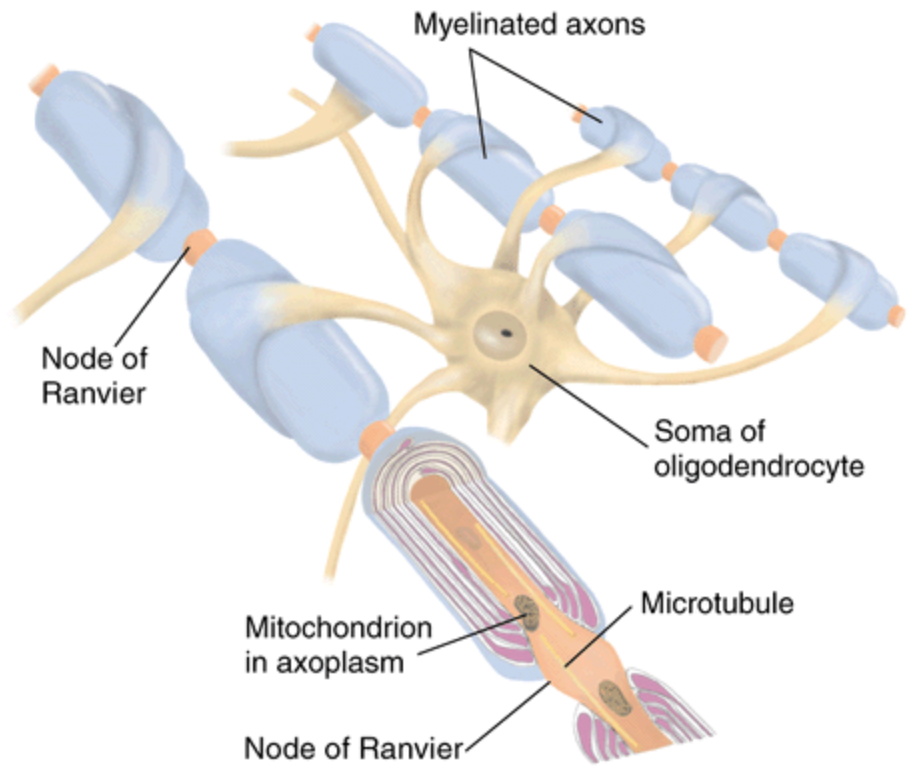
► Seven Processes in Neurotransmitter Action

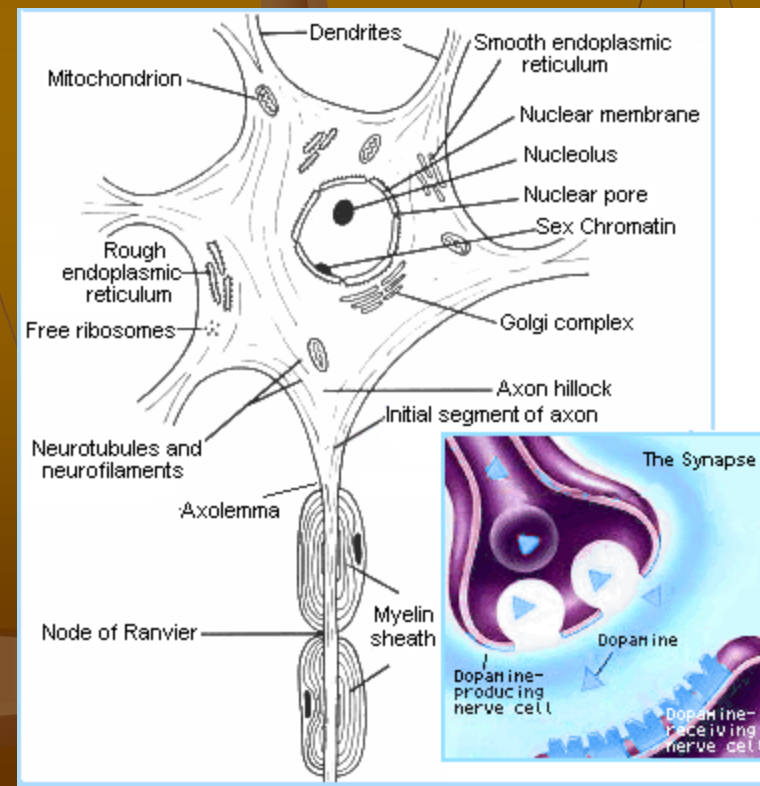
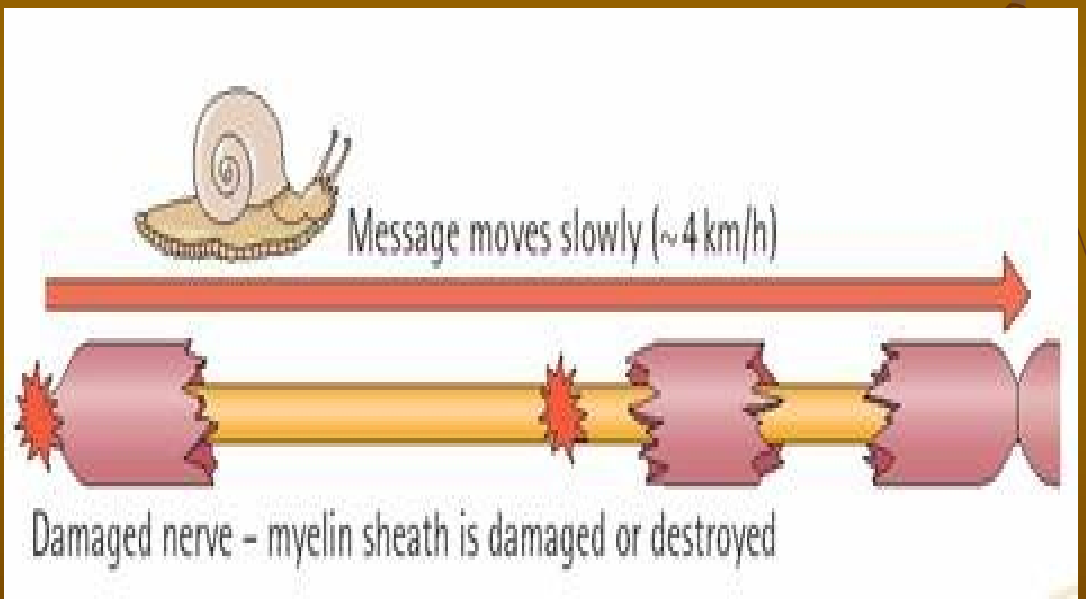
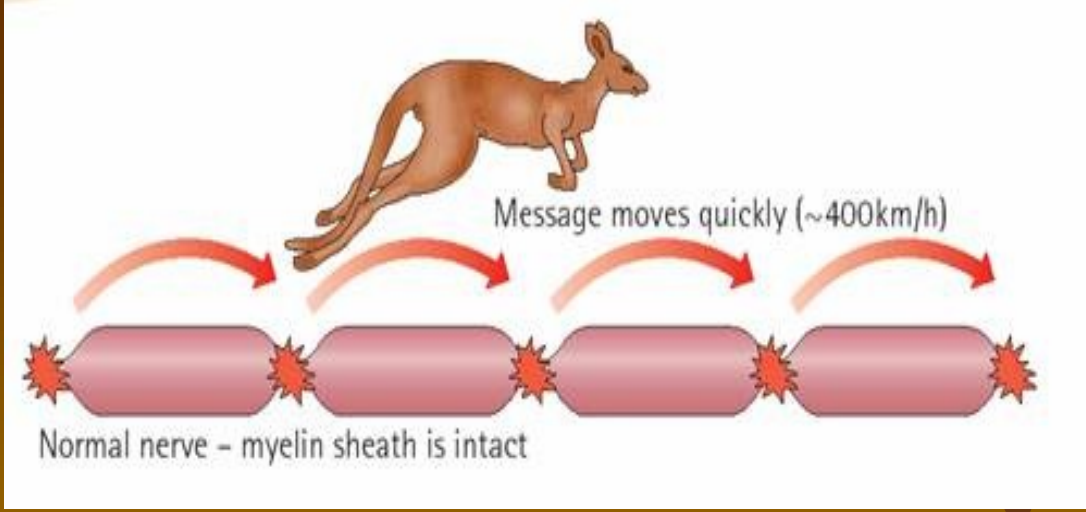






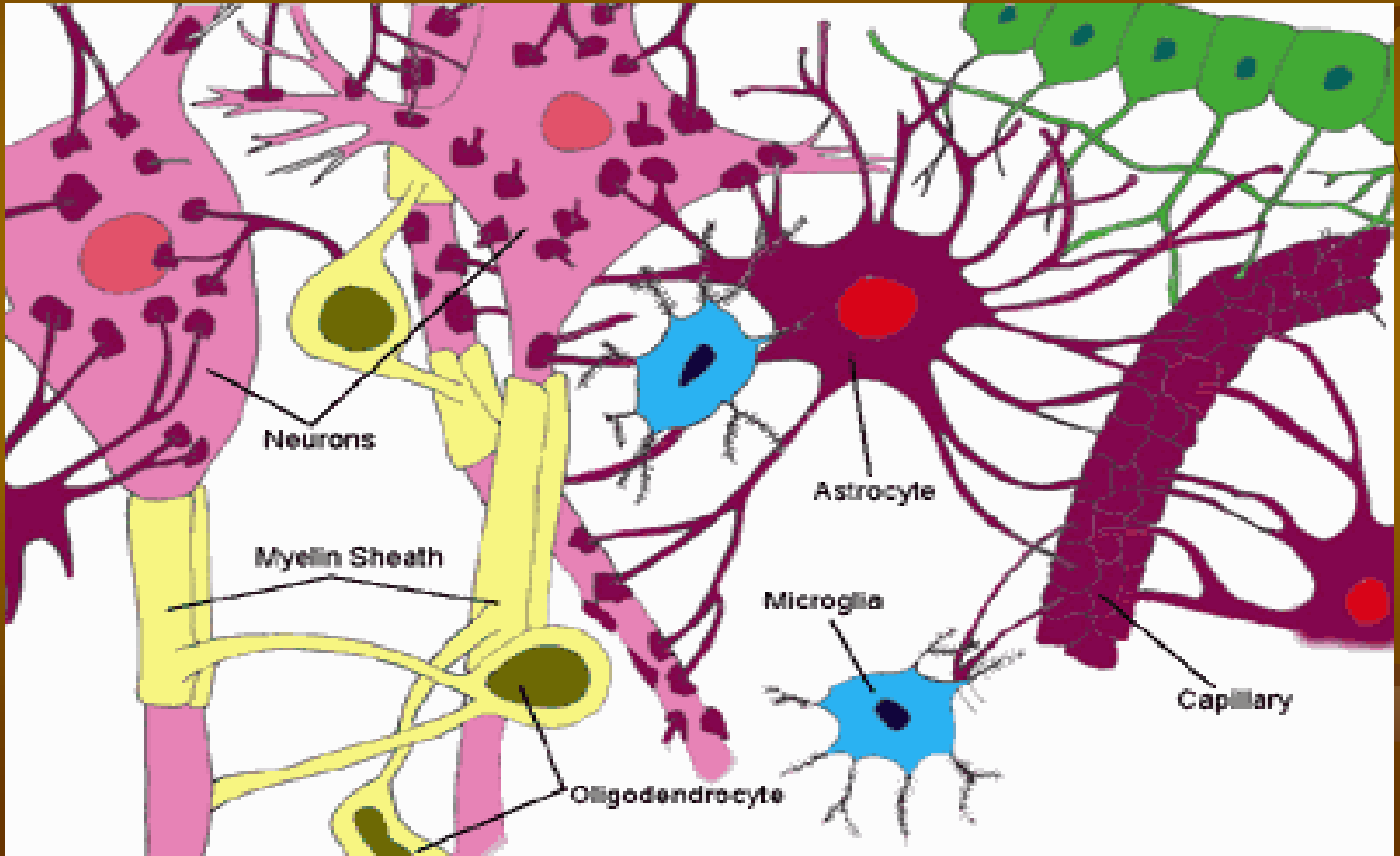
► An Oligodendrocyte

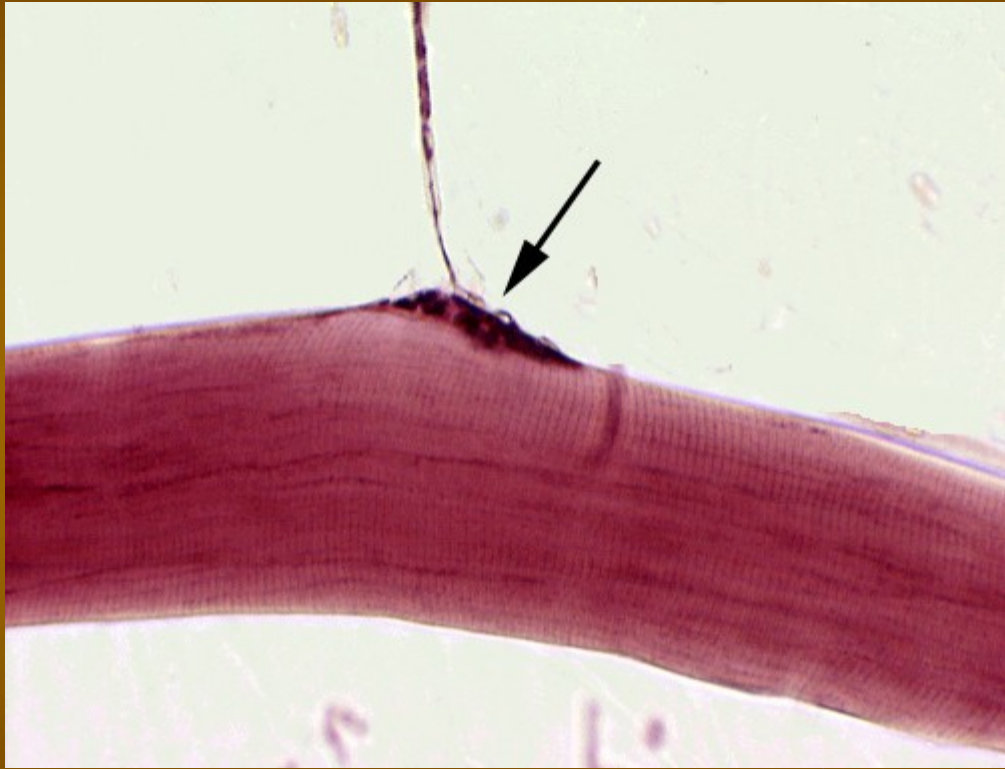




Nervous tissue structure

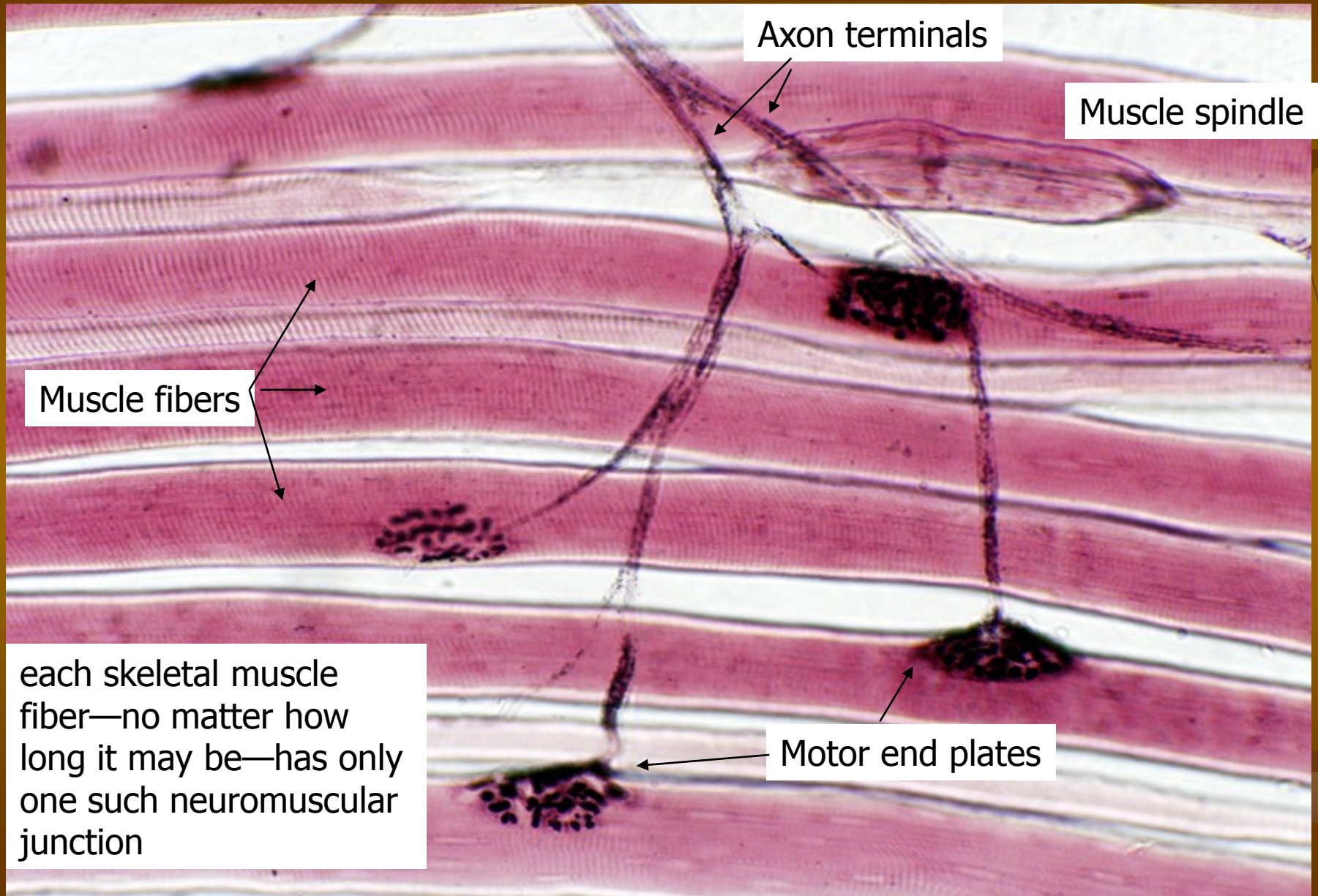
 nerve cells (neurons) + supporting cells (glia)

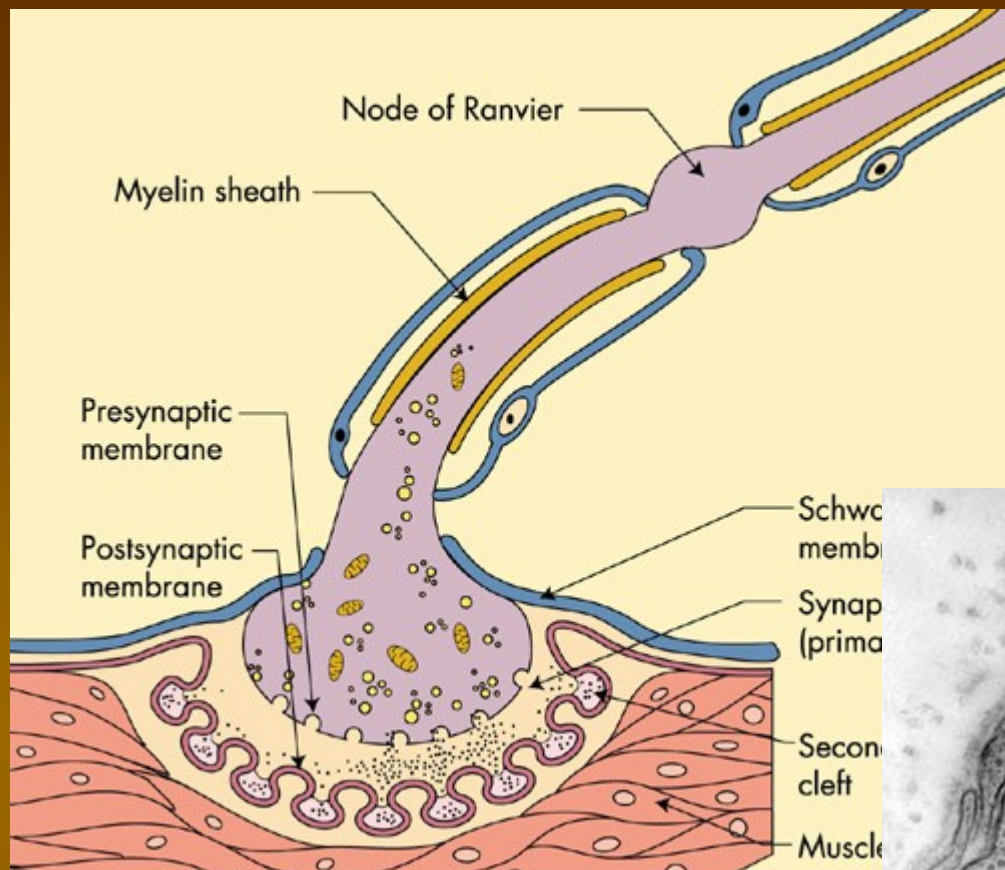


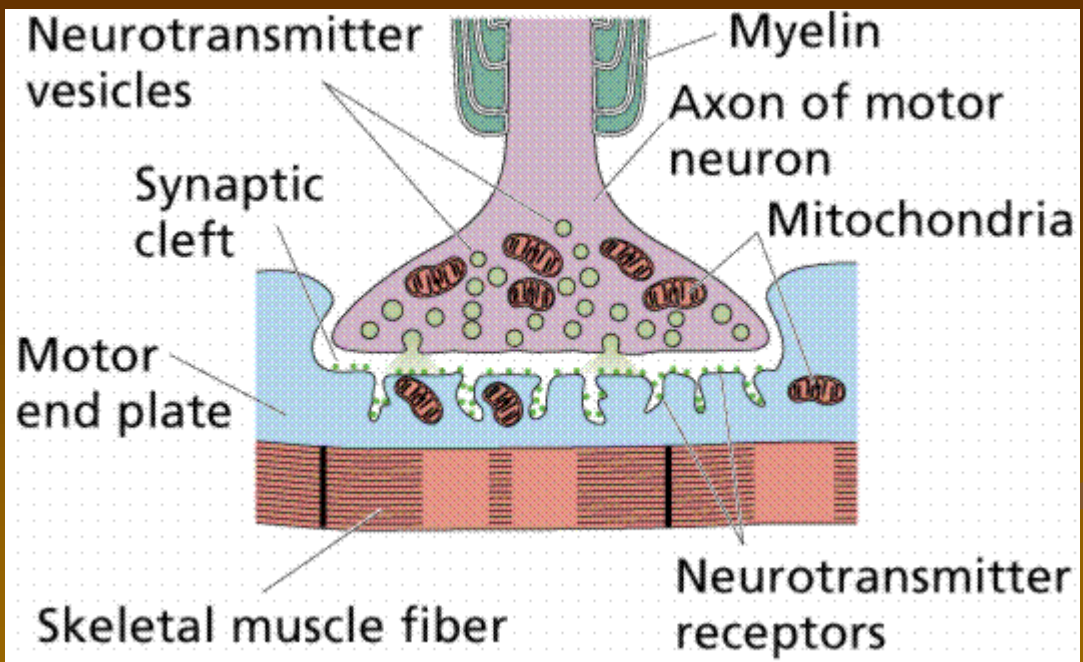


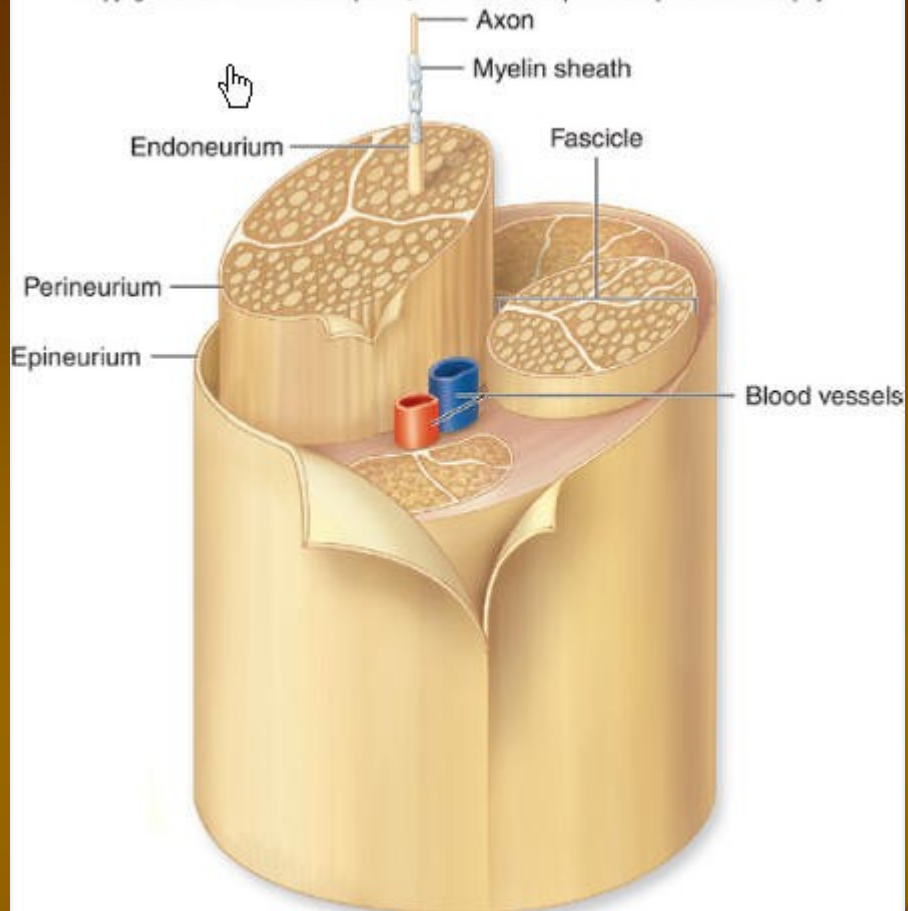
Group of motor end plates

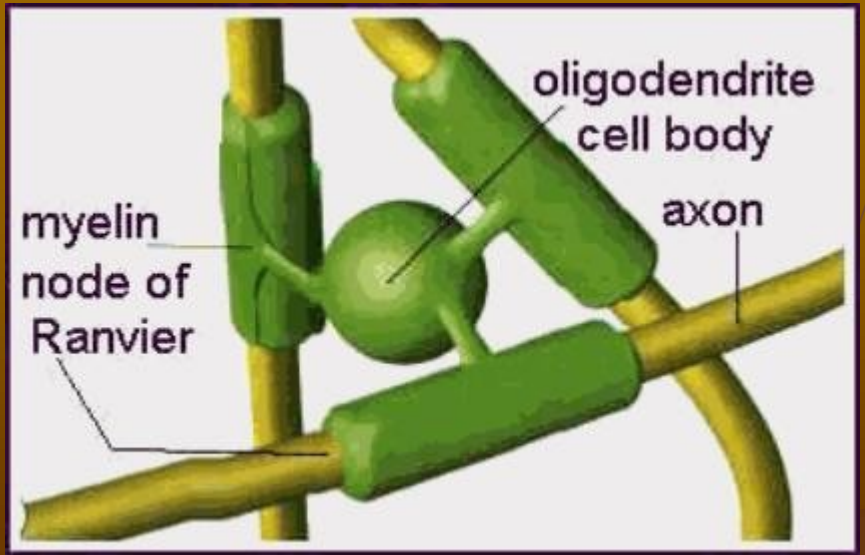
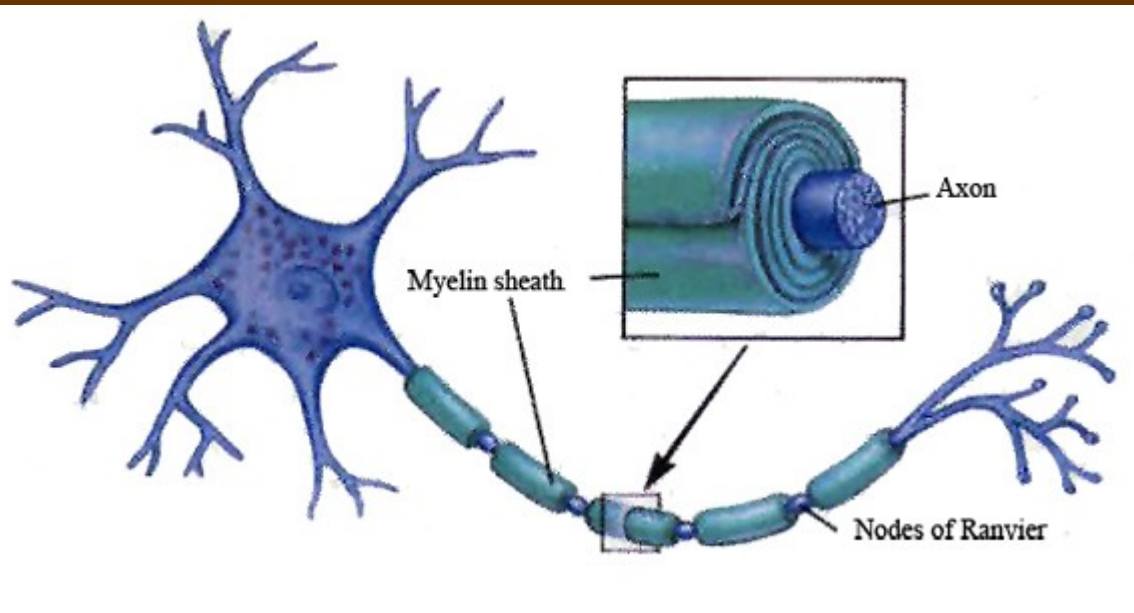
these muscle fibers will contract simultaneously



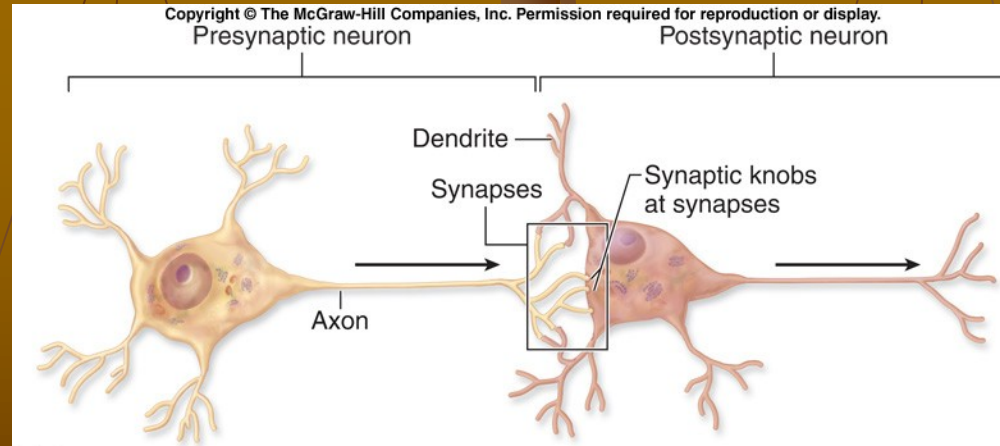




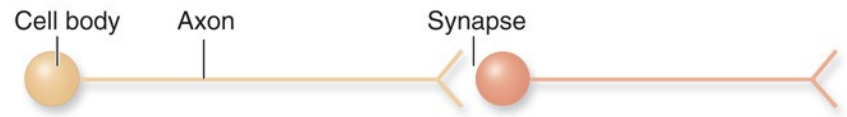




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(a) Synapse



(b) Simplified representation of a synapse

