

Nerve Tissue

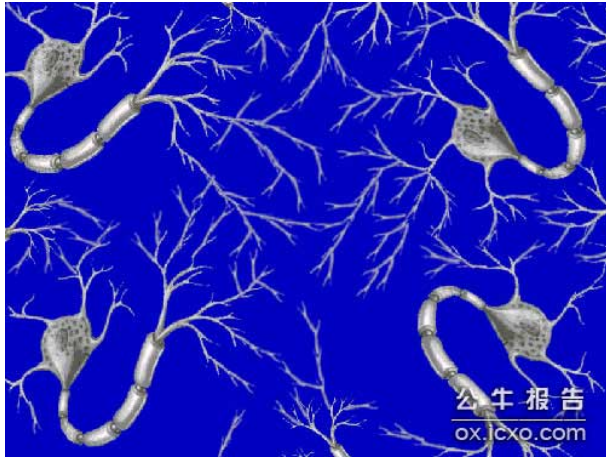
赵慧

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Jilin University

General Description

Nerve tissue



Nerve Tissue

Nerve Cell (Neuron)

- Receive stimulation
- Integrate message
- Conduct the nerve impulse

Neuroglial Cell (Neuroglia)

- Support
- Nourish
- Insulate
- Protect
- Repair

Contents

Nerve tissue



Neuron



Synapse



Neuroglia



Nerve Fiber and Nerve

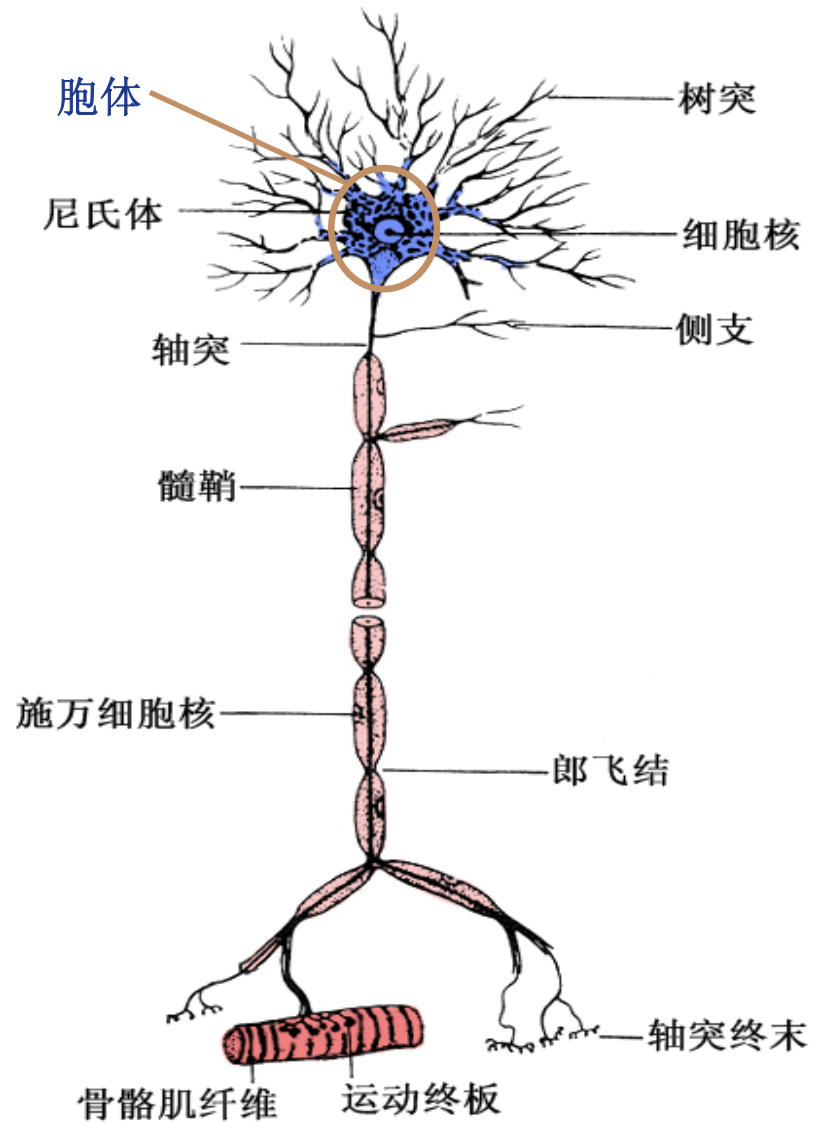


Nerve Ending

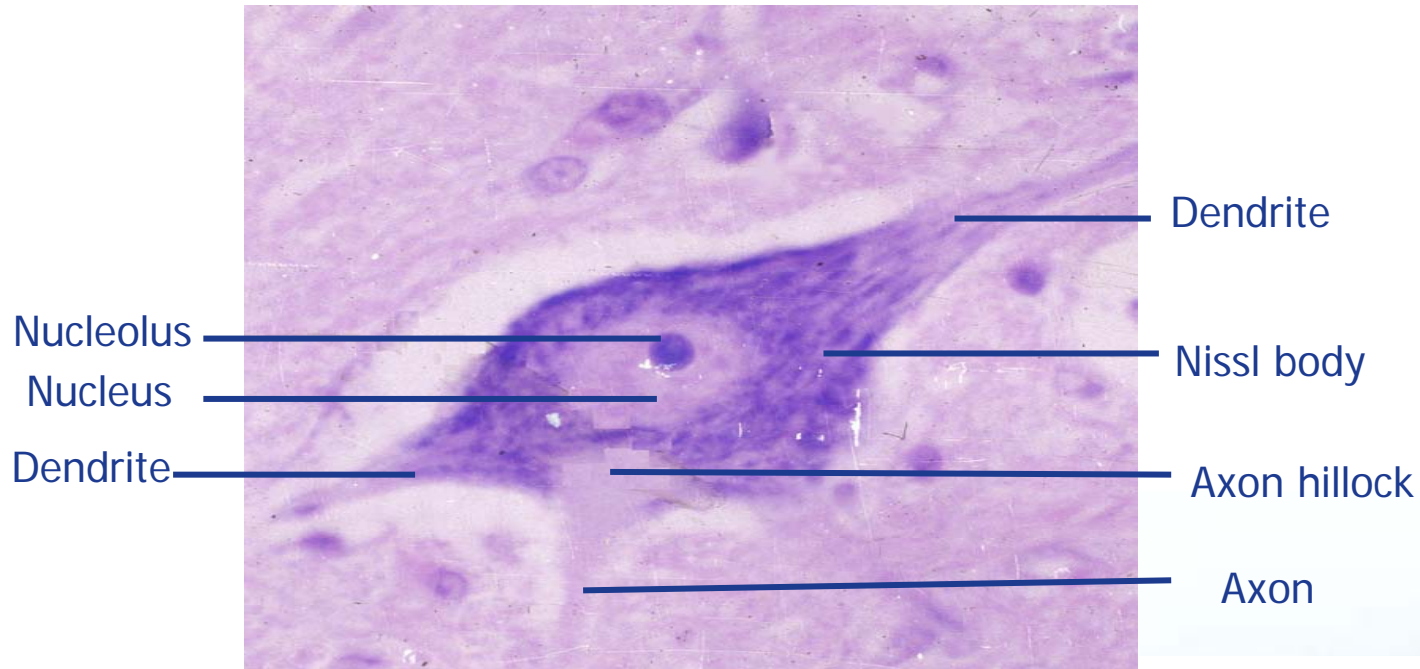
I. Neuron

Nerve tissue

- ❖ 1. Soma
 - Cell membrane
 - Nucleus
 - Cytoplasm
- ❖ 2. Process
 - Dendrite
 - Axon



1. Soma



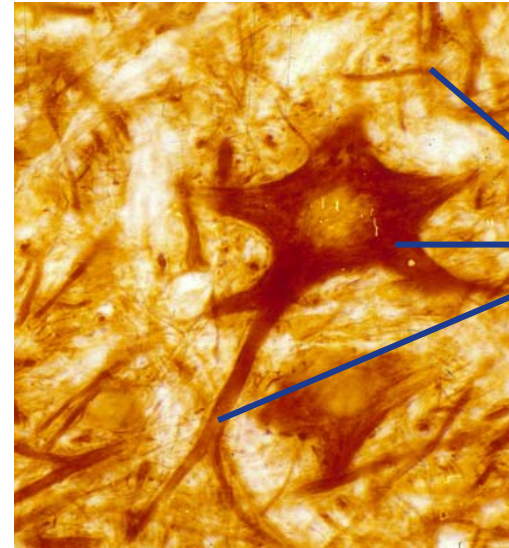
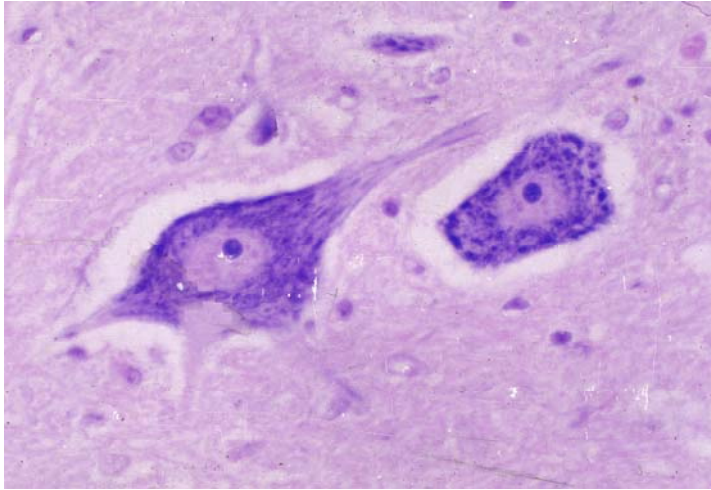
❖ Cell membrane

- Excitable membrane, receiving stimulation, forming and conducting nerve impulses
- Receptor; Voltage-gated channel; Chemically-gated channel

❖ **Nucleus:** spherical, large, centrally-located, pale-staining

❖ **Cytoplasm (Perikaryon):** Nissl body; Neurofibril; Lipofuscin

1. Soma



Neurofibrils

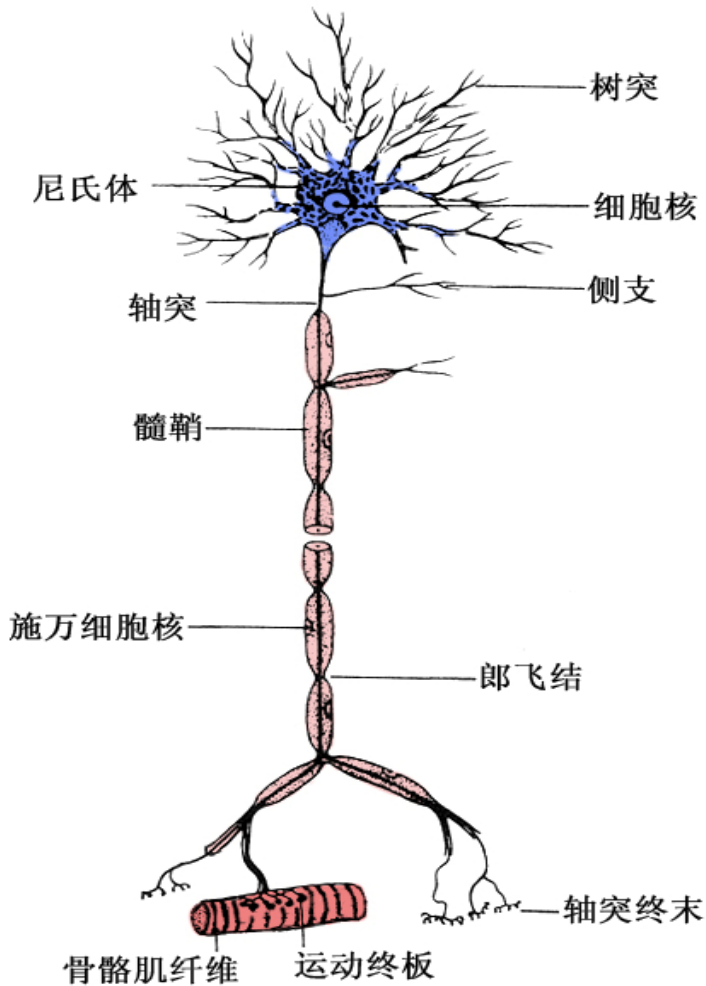
❖ Nissl body (Chromophil substance, tigroid body)

- LM: basophilic mass or granules
- EM: RER, free ribosome
- Function: produce protein, enzyme and neurotransmitter

❖ Neurofibril

- LM: thread-like dark brown network
- EM: microfilament, neurofilament, neurotubule
- Function: cytoskeleton, participate in substance transport

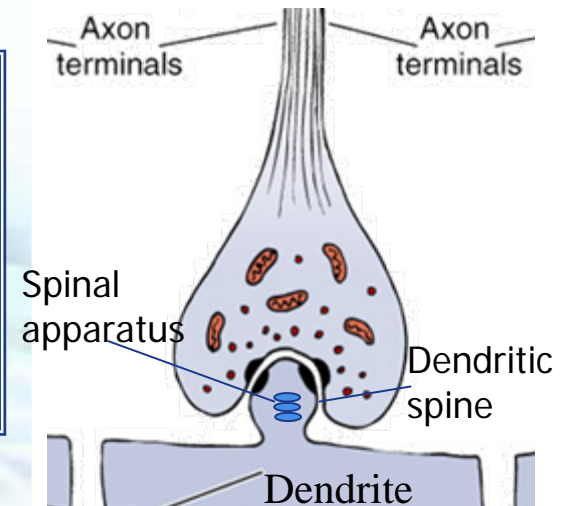
2. Process



❖ Axon

- Axon hillock, axon terminal
- Axolemma, axoplasm
- No Nissl body and Golgi complex
- Function: passes messages away from the cell body to other neurons, muscles, or glands)

- ❖ Dendrite
- ❖ Dendritic spine
- ❖ Spine apparatus
- ❖ Function: receive stimulation and conduct impulse into soma



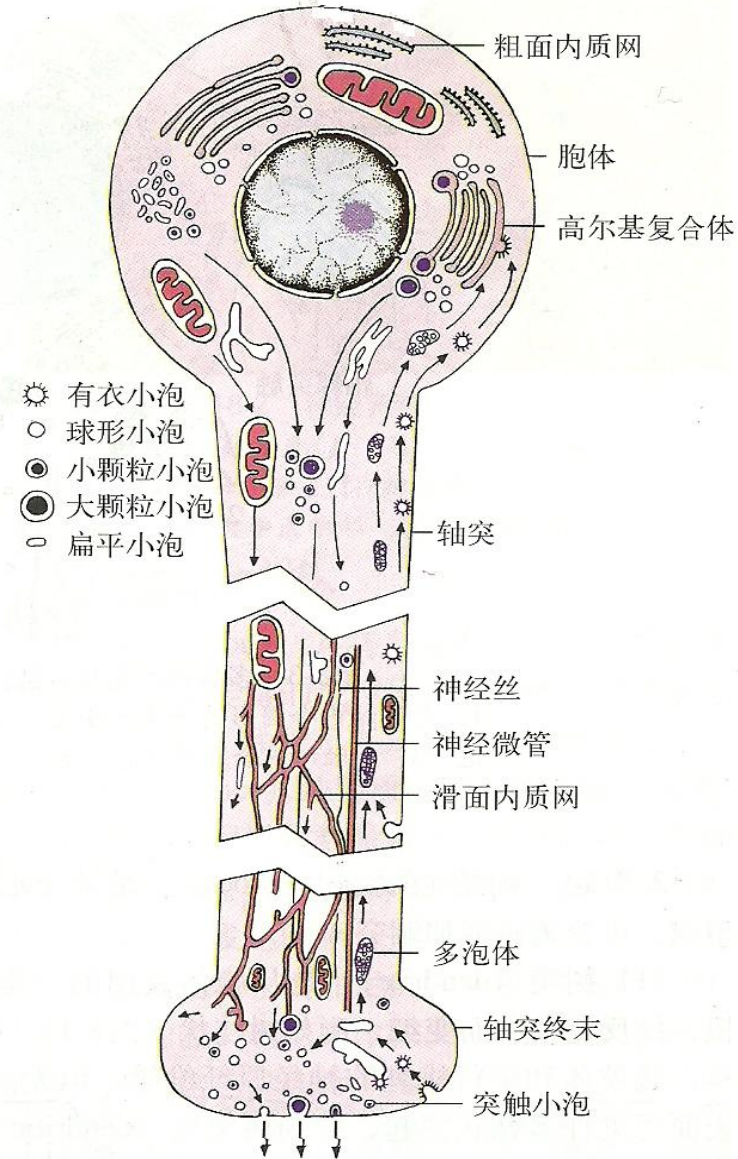
2. Process

❖ Axonal transport

- Anterograde axonal transport

- Fast transport
- Slow transport

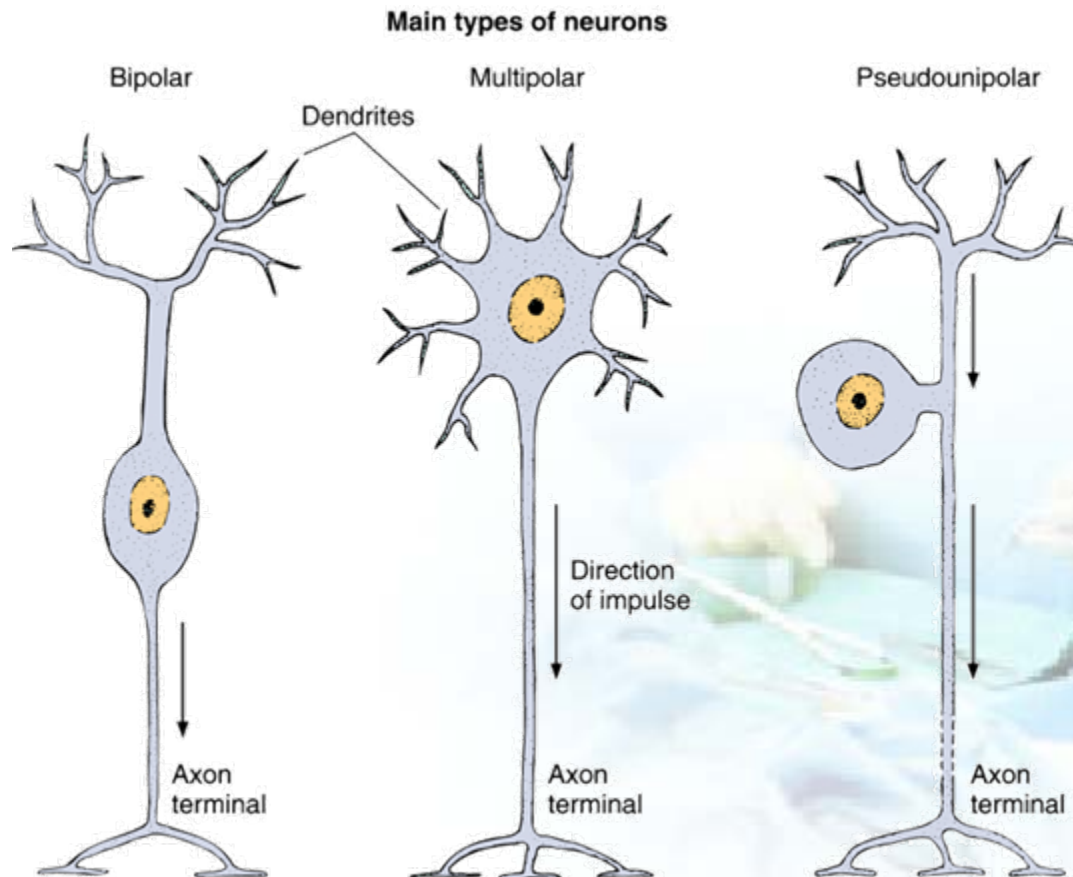
- Retrograde axonal transport



Classification of neurons

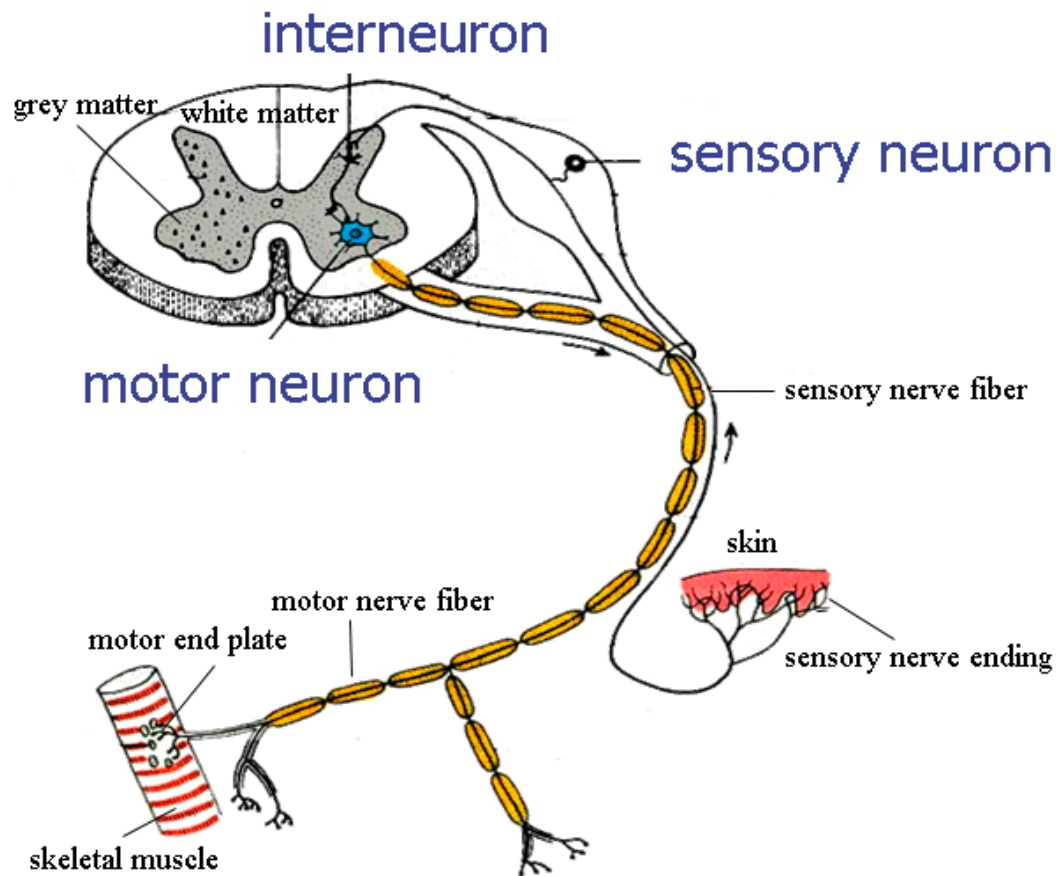
❖ According to number of processes

- multipolar; bipolar; pseudounipolar neuron



❖ According to functions

- sensory neuron; motor neuron; interneuron



❖ According to neurotransmitter

- Cholinergic neurons 胆碱能神经元
- Aminergic neurons 胺能神经元
- Amino acidergic neurons 氨基酸能神经元
- Peptidergic neurons 肽能神经元



Contents



Neuron



Synapse



Neuroglia



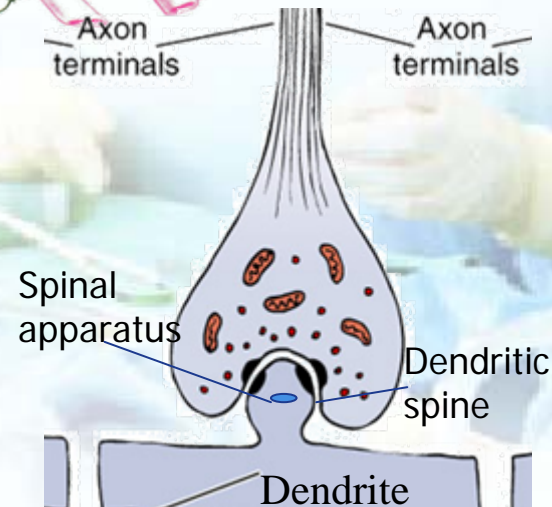
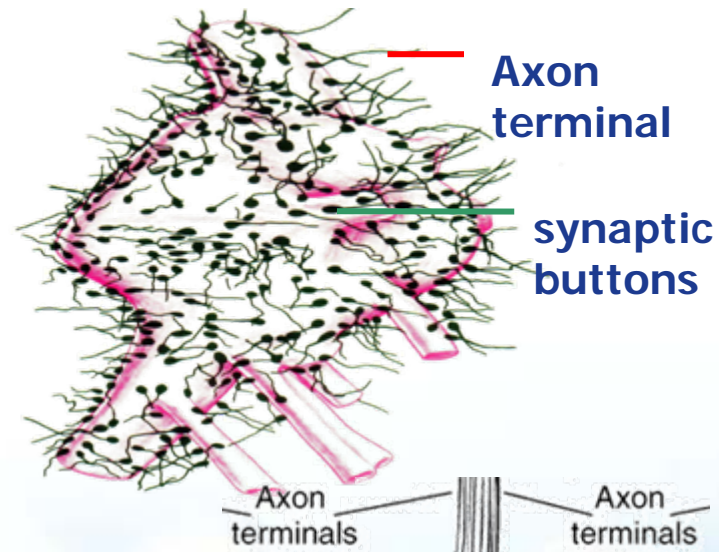
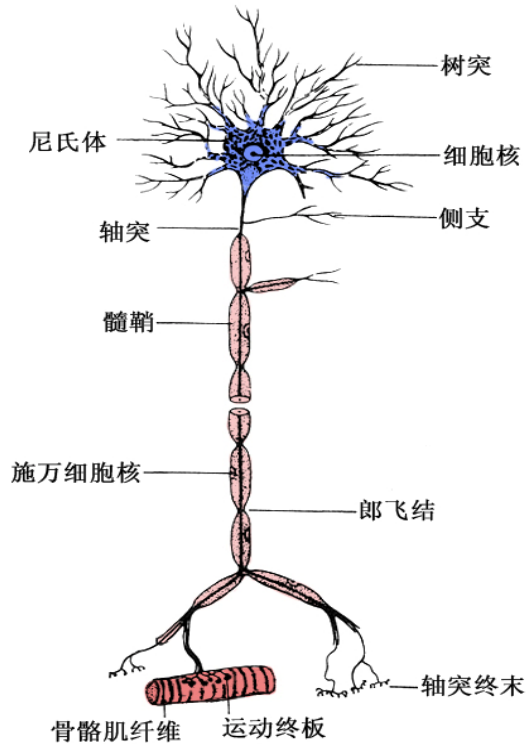
Nerve Fiber and Nerve



Nerve Ending

II Synapse

❖ A specialized junctions between neurons or neuron and non-nerve cells

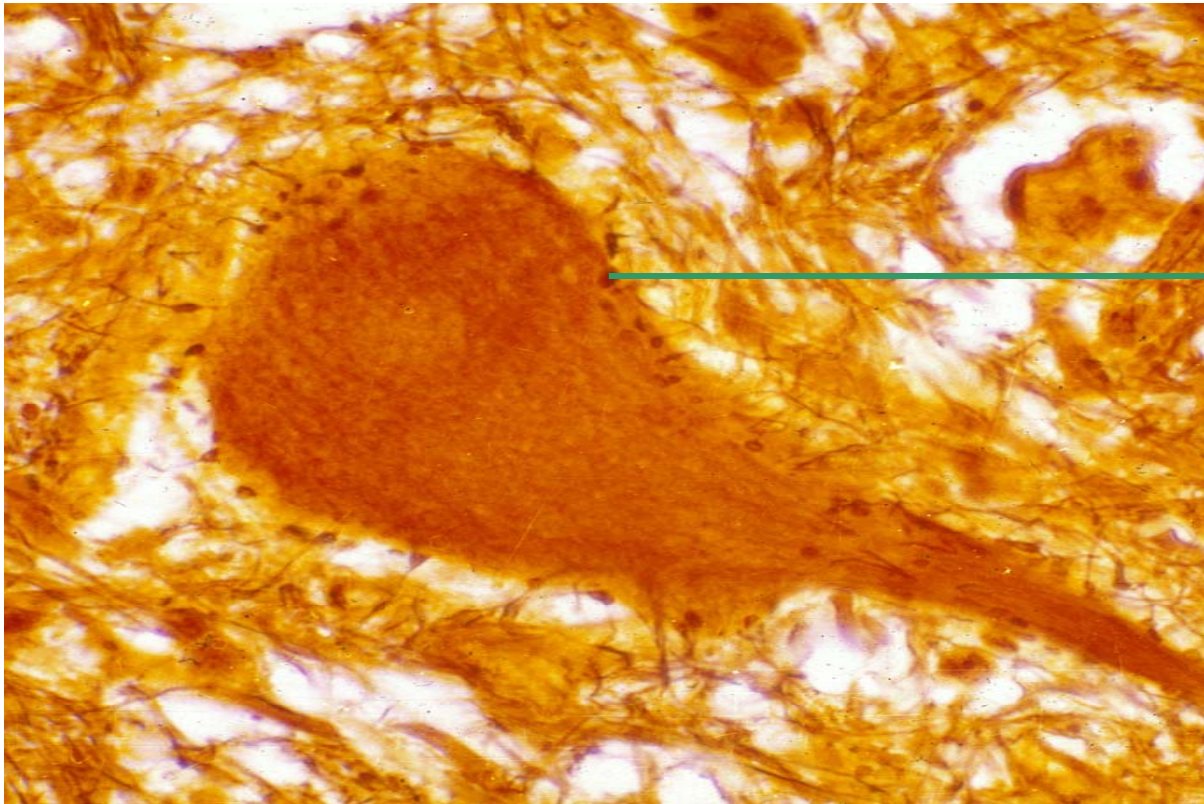


❖ Classification

- Chemical synapse
- Electrical synapse

❖ LM

- Synaptic corpuscle or synaptic button

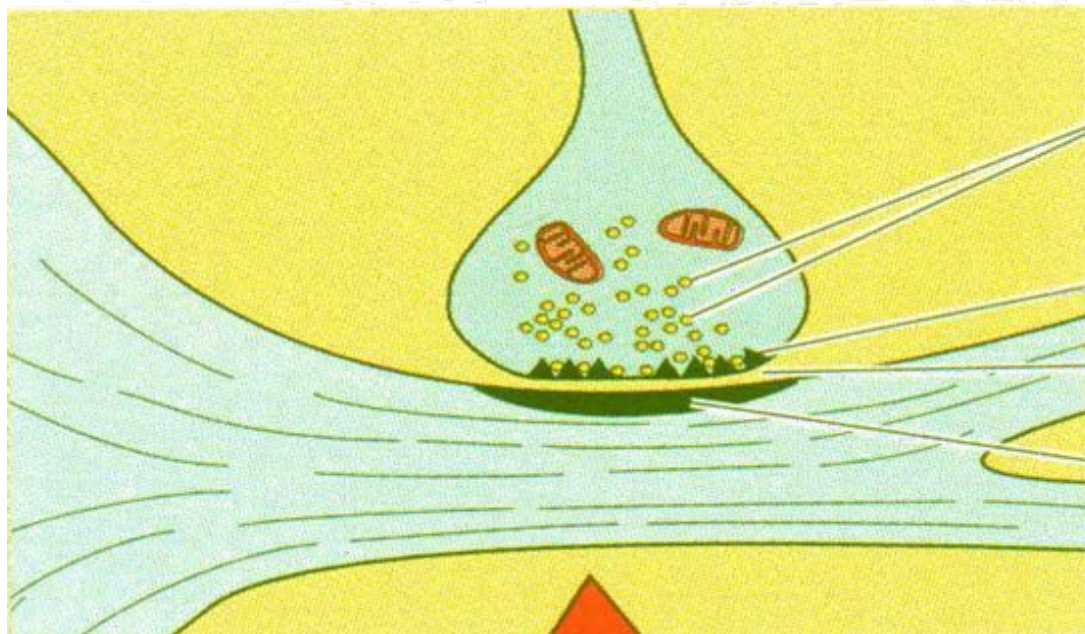


synaptic button



❖ EM:

- Presynaptic element: presynaptic membrane, synaptic vesicles
- Synaptic cleft
- Postsynaptic element: postsynaptic membrane



synapse vesicle

presynaptic
membrane

synaptic cleft

postsynaptic
membrane

Classification of Chemical synapse

Nerve tissue

1

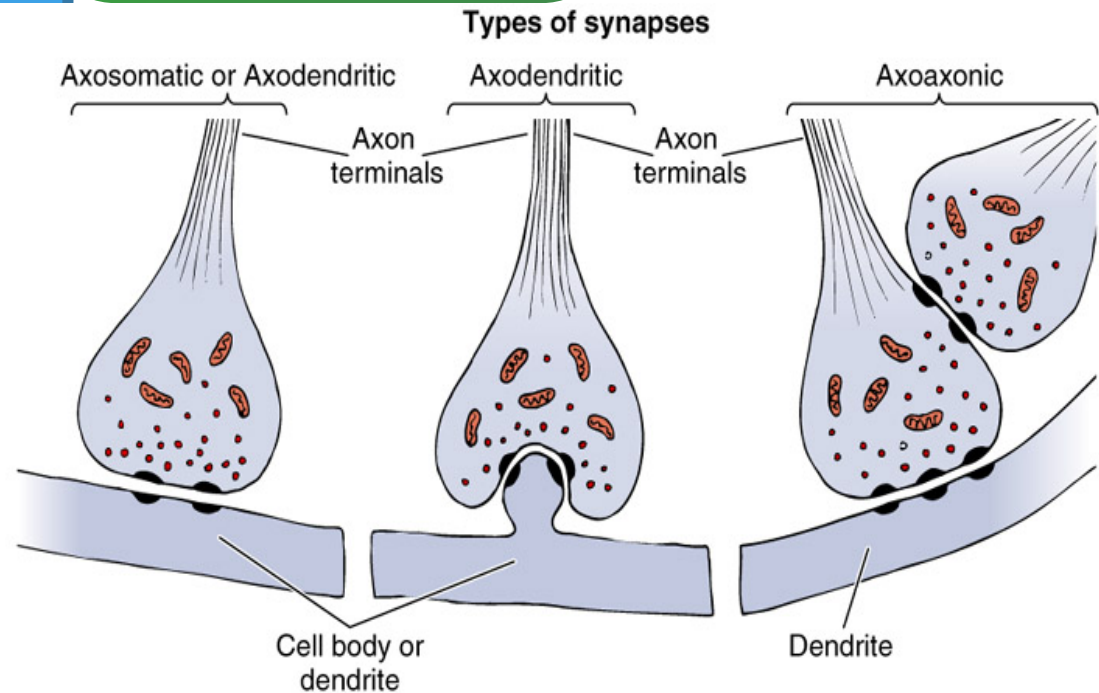
Axodendritic synapse
Axospinous synapse
Axosomatic synapse
Axoaxonal synapse
Dendrodendritic synapse

2

Type I synapse
Type II synapse

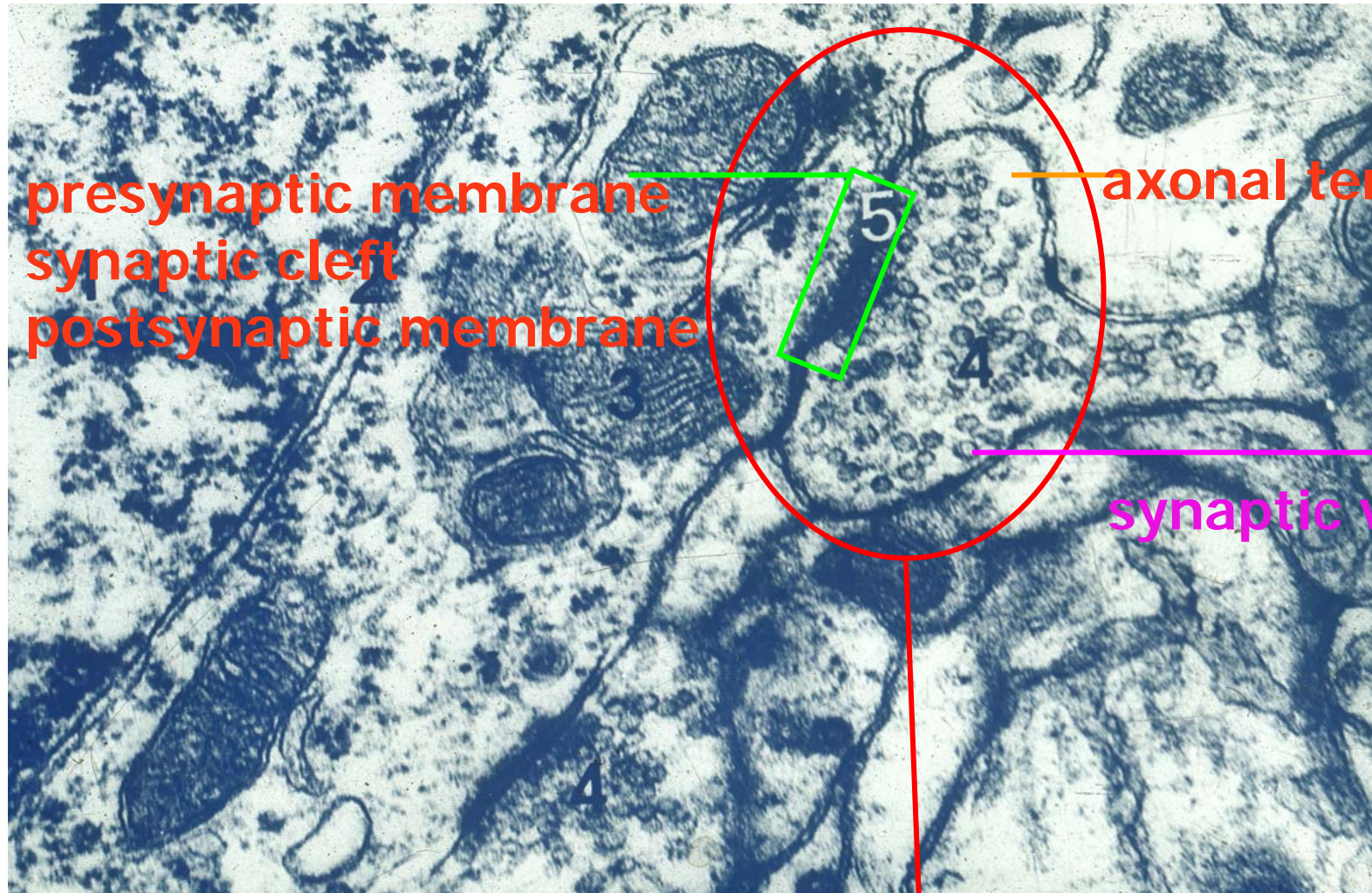
3

Excitatory synapse
Inhibitory synapse



Synapse, EM.

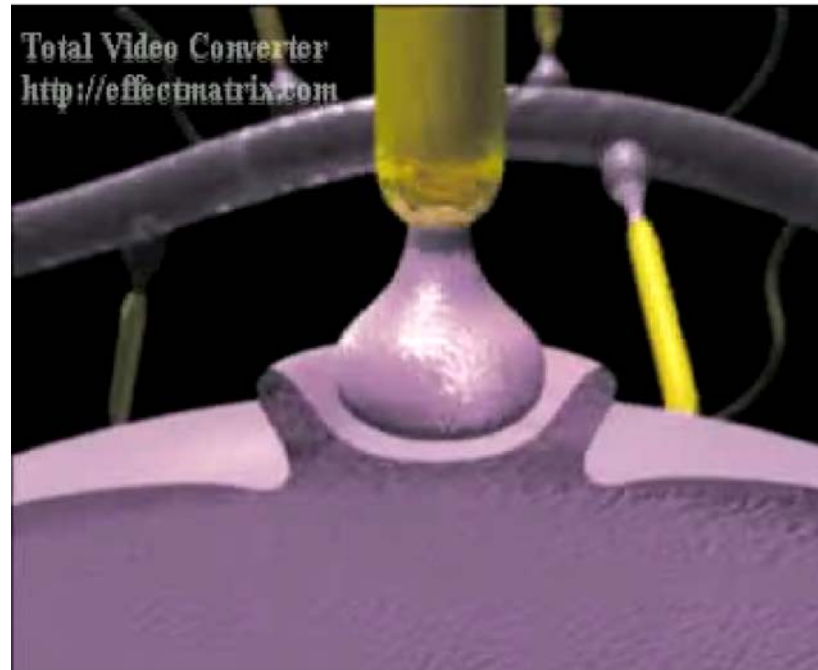
Nerve tissue



Synapse

Synapse

Nerve tissue



Contents

Nerve tissue



Neuron



Synapse



Neuroglia



Nerve Fiber and Nerve



Nerve Ending

❖ 1. Central nervous system :

- Astrocyte
- Oligodendrocyte
- Microglia
- Ependymal cell

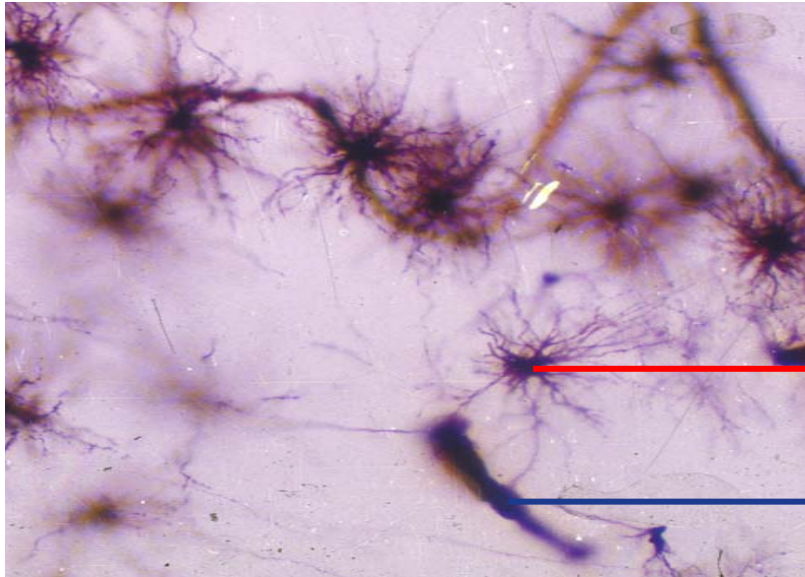
❖ 2. Peripheral nervous system:

- Schwann cell (Neurolemmal cell)
- satellite cell (capsular cell)

❖ 3. Functions

- support, nourish, protect, insulate , repair
- regulate the environment and movement of neuron
- secret neurotrophic factor

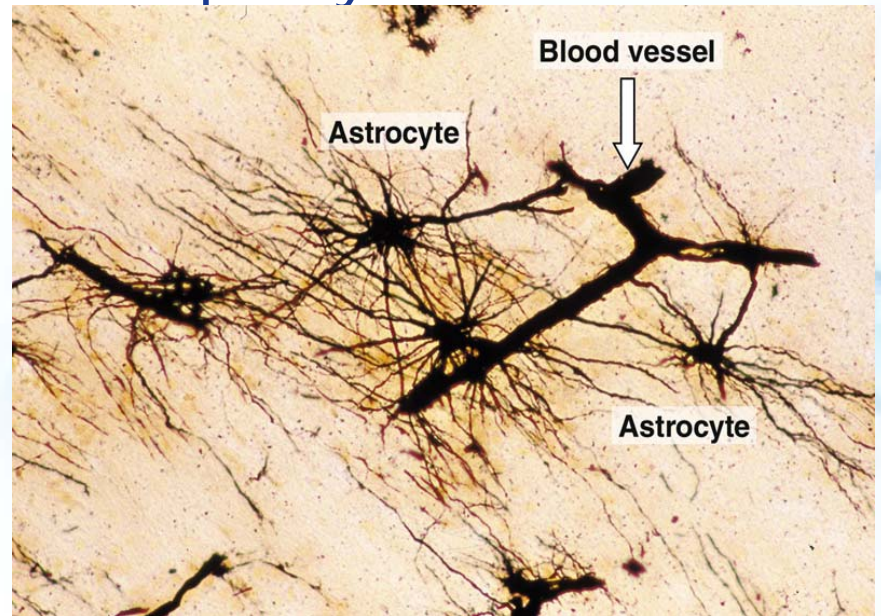
Astrocytes



Neuroglial filament

Astrocyte

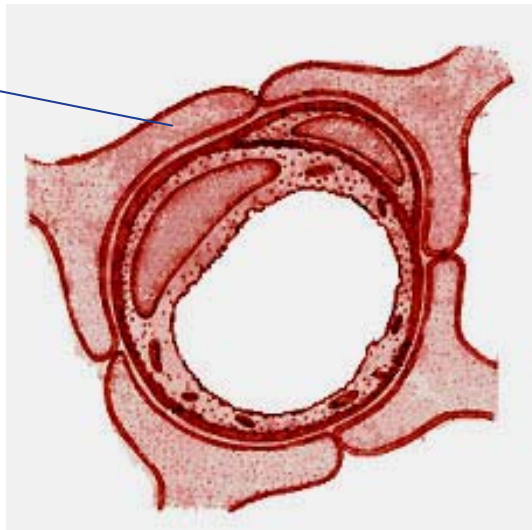
Capillary



Blood vessel

Astrocyte

Astrocyte

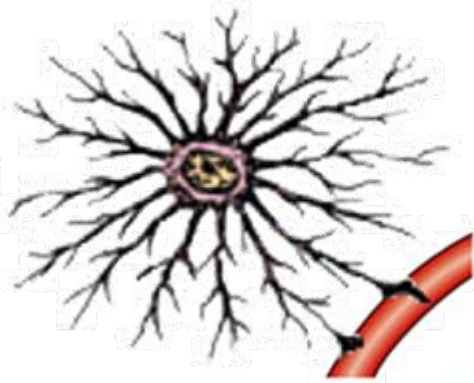


End foot

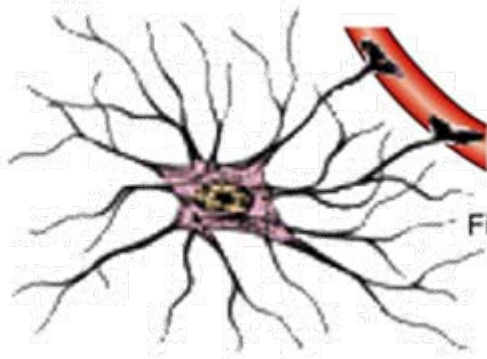
❖ Classification

- Protoplasmic astrocyte
- Fibrous astrocytes

Protoplasmic astrocyte



Fibrous astrocyte



❖ Functions:

- ❖ Form blood-brain barrier
- ❖ Produce the neurotrophic factors (NGF)
- ❖ Repair nerve tissue

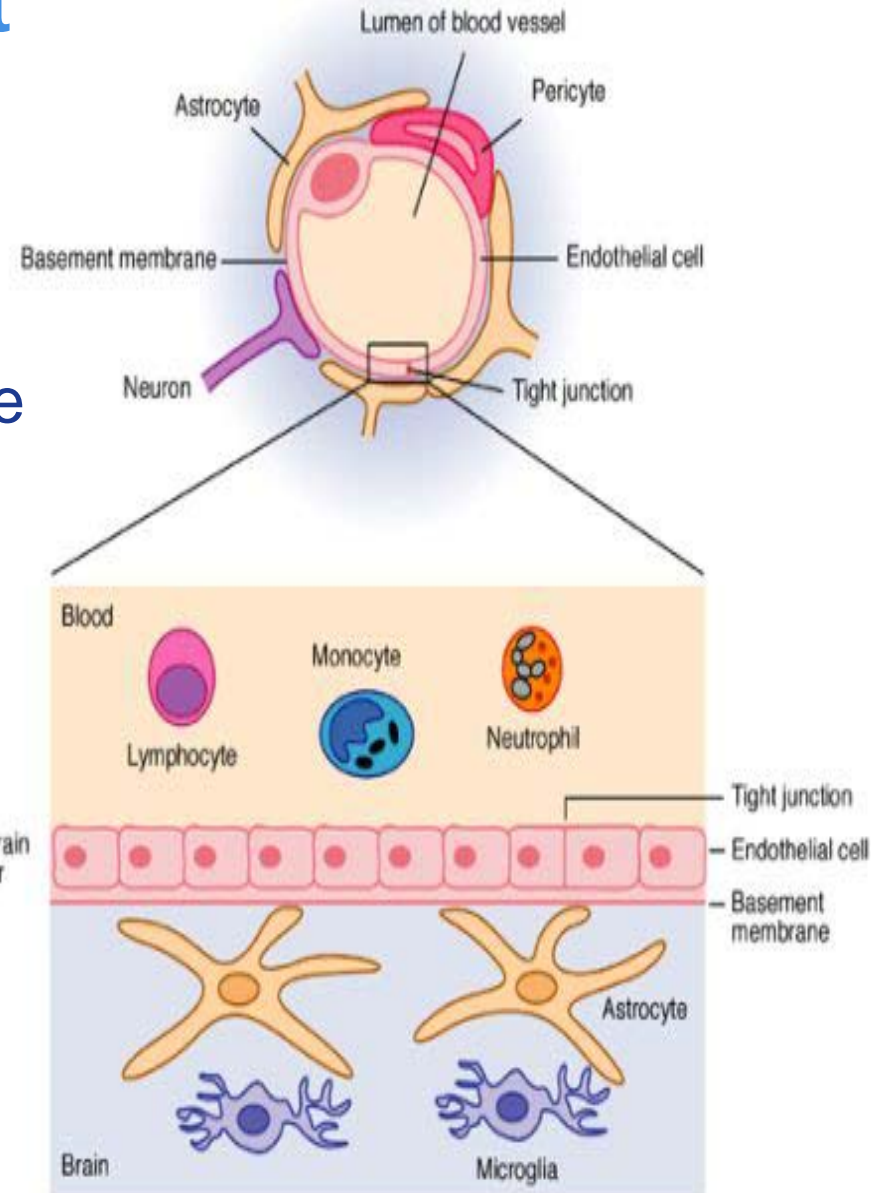


❖ Structure component

- Continuous endothelium of capillary
- Tight junctions between endothelial cells
- Continuous basal membrane around endothelium
- The end feet of astrocytes surrounding the capillary

❖ Function

- Prevent the passage of certain substances from the blood to nerve tissue
- (P111)

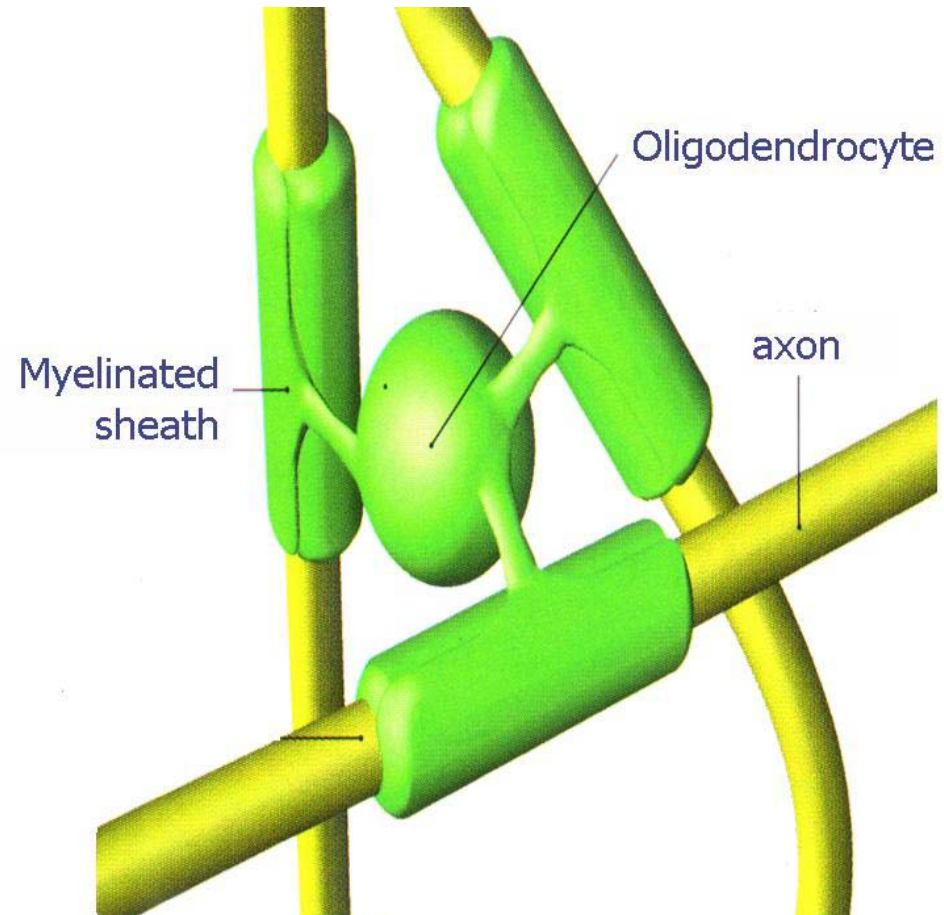
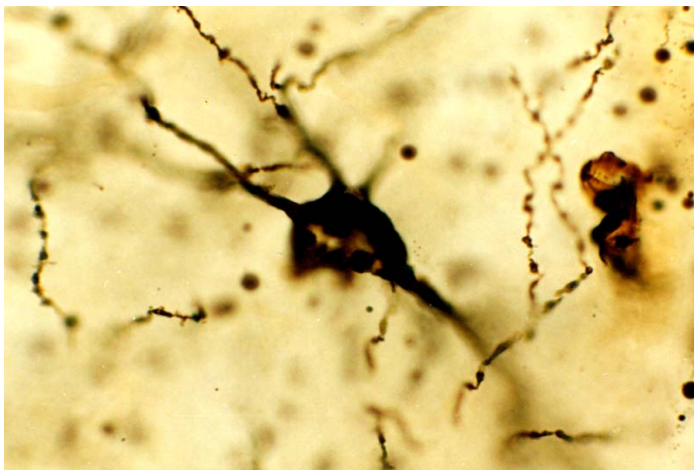
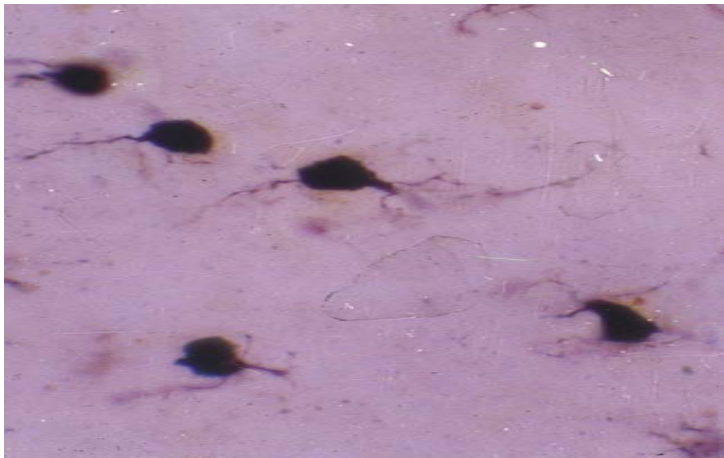


Oligodendrocyte

Nerve tissue

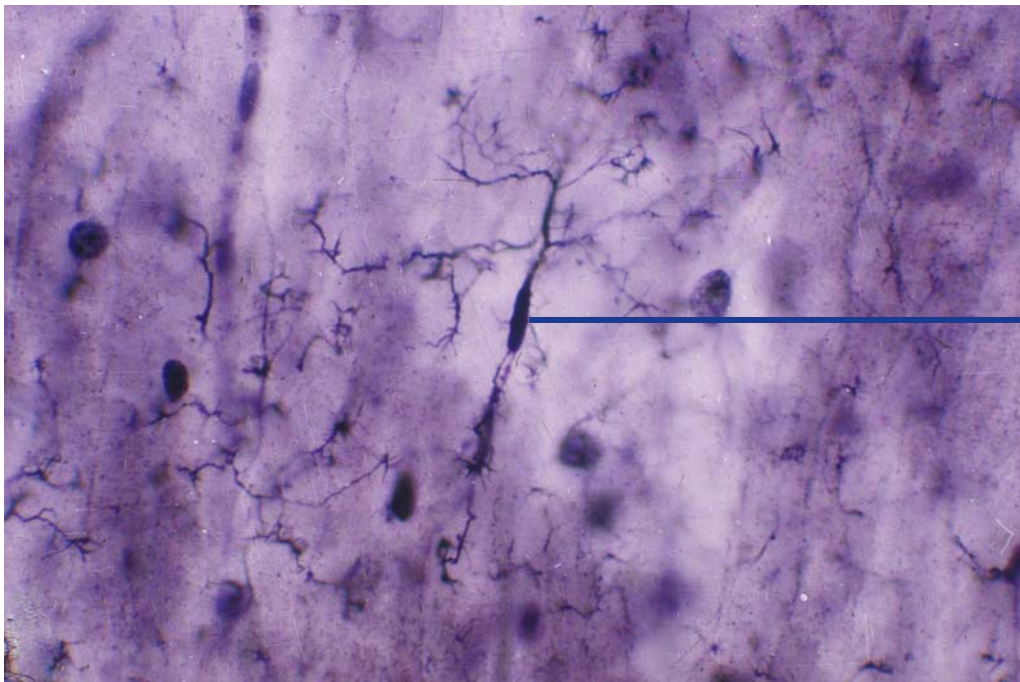
❖ Function

- Forming myelin sheath of nerve fibers in CNS
- Nourishment, protection.



❖ Function

- Amoeboid movement , phagocytosis.
- Stem cell, differentiation.



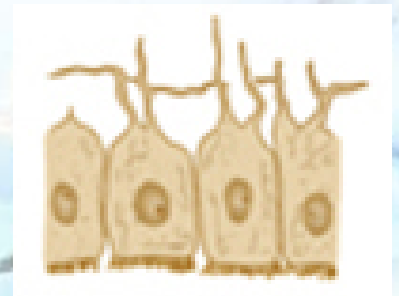
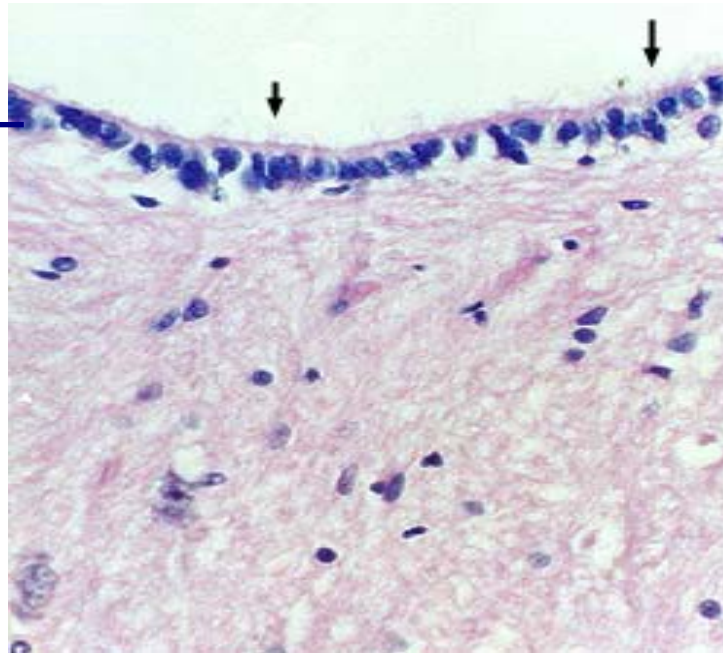
Microglia

Ependymal cell

Nerve tissue

- ❖ Simple cuboidal or columnar epithilium
- ❖ Microvilli or cilia
- ❖ Function
 - Produce cerebrospinal fluid
 - Nourish and protect neuron

Ependymal cells



❖ 1. Central nervous system :

- Astrocyte
- Oligodendrocyte
- Microglia
- Ependymal cell

❖ 2. Peripheral nervous system:

- Schwann cell (Neurolemmal cell)
- Satellite cell (capsular cell)

❖ 3. Functions

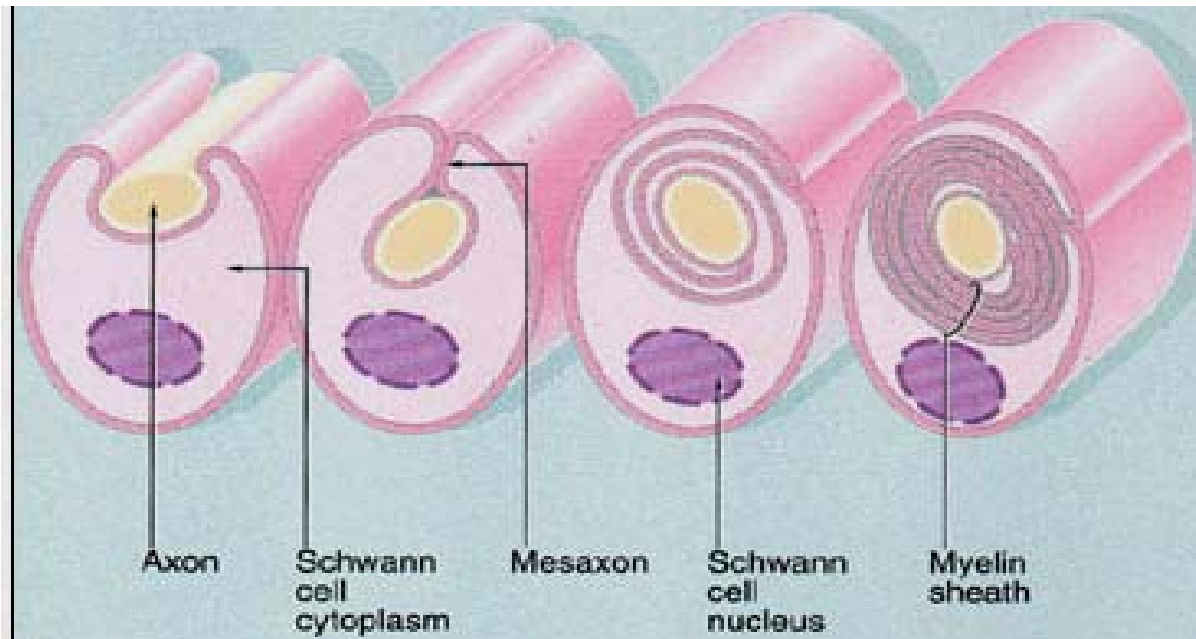
- supporting, insulating , repairing
- regulate the environment and movement of neuron
- secret neurotrophic factor

Schwann cell (Neurolemmal cell)

Nerve tissue

❖ Function

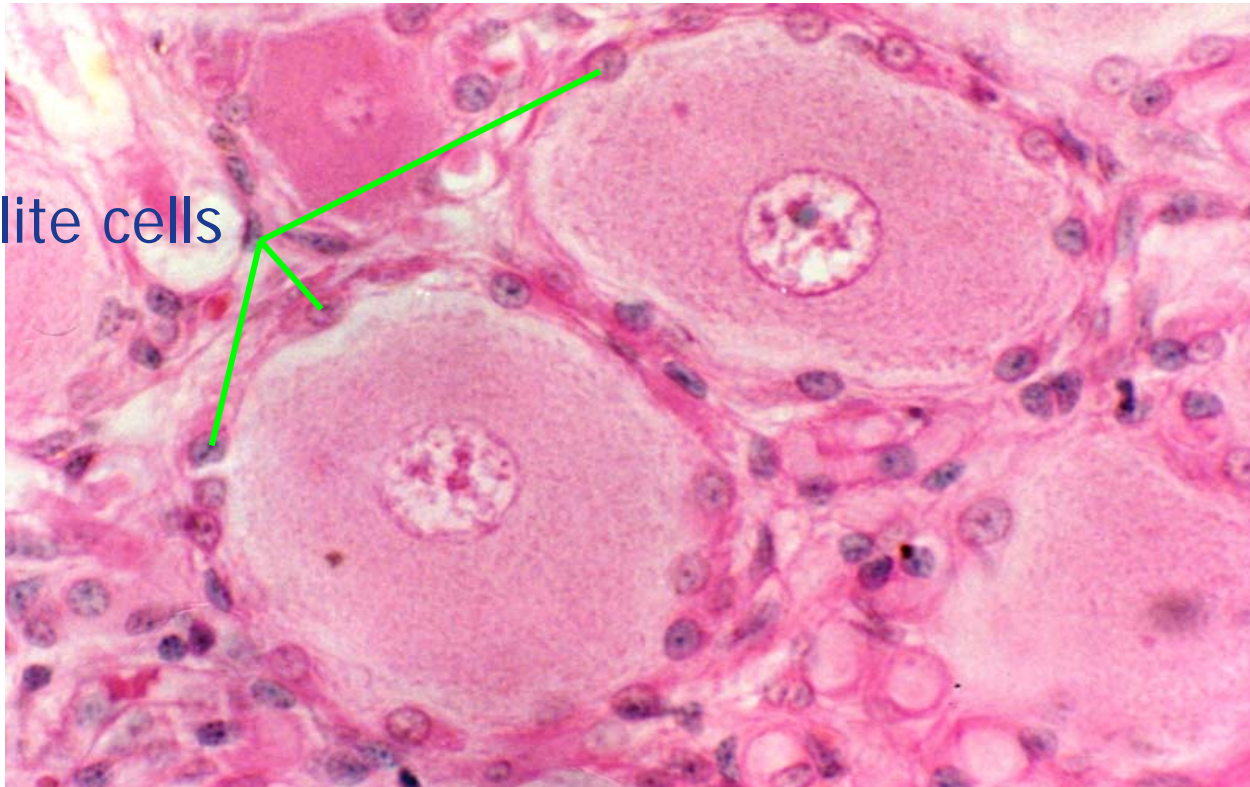
- Forming myelin sheath of nerve fibers in PNS
- Repair nerve tissue
- Producing NGF



Satellite cell (capsular cell)

- ❖ Surrounding the neuron in ganglion
- ❖ Function: protect and support neuron

Satellite cells



Contents

Nerve tissue



Neuron



Synapse



Neuroglia



Nerve Fiber and Nerve



Nerve Ending

❖ Definition:

- Nerve fiber: axon enveloped by neuroglial cells

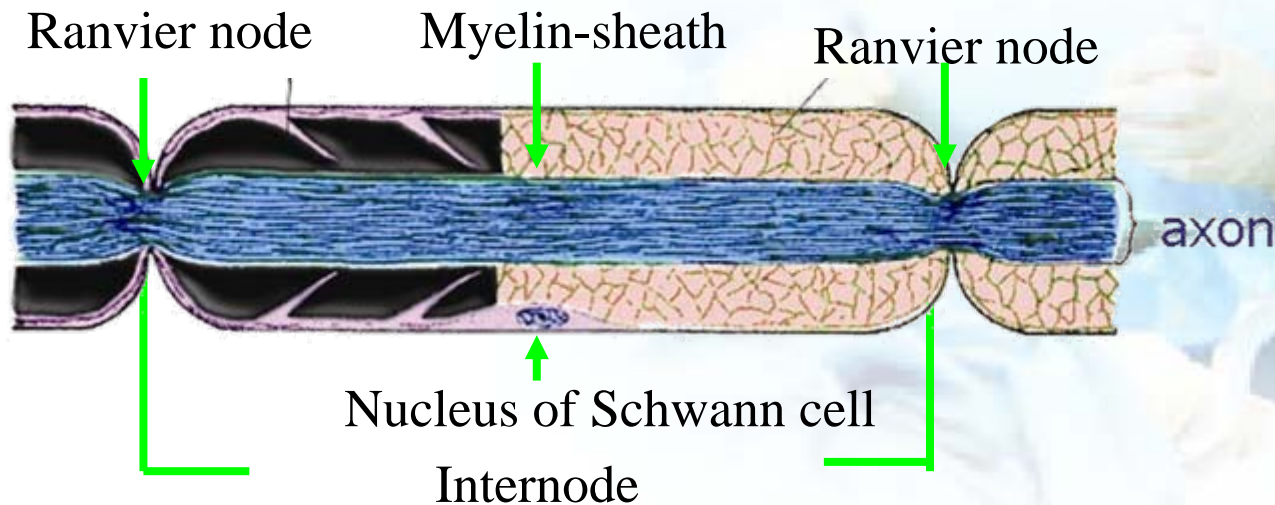
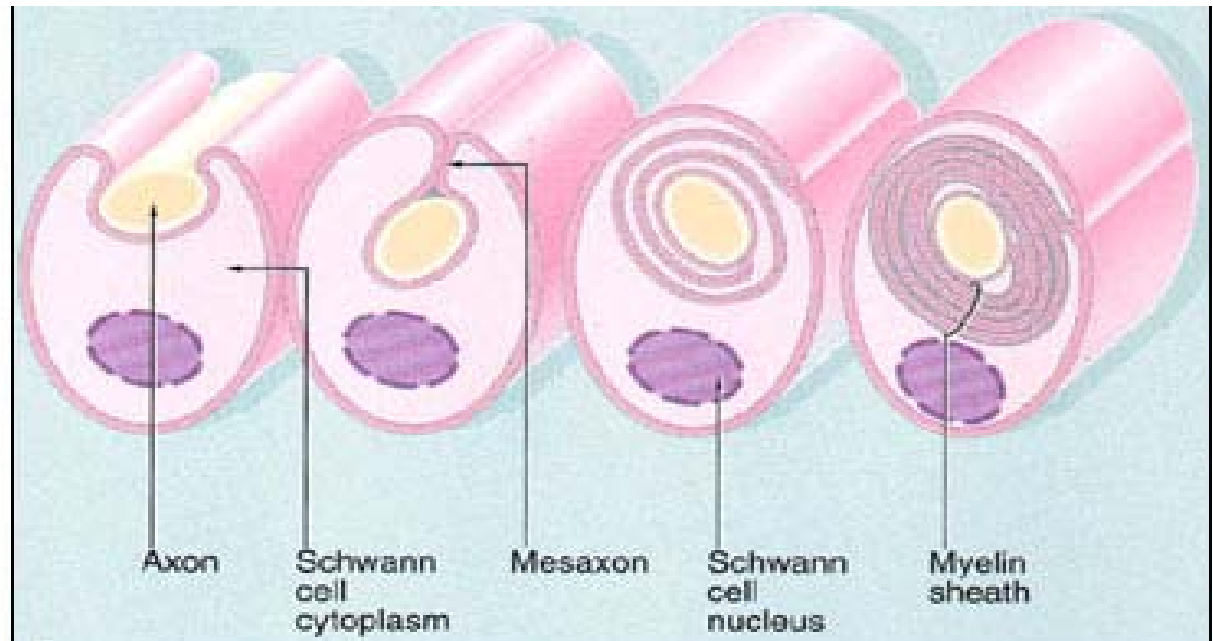
❖ Classification:

- Myelinated nerve fiber
 - Peripheral nervous system
 - Central nervous system
- Unmyelinated nerve fiber



Myelinated nerve fibers of PNS

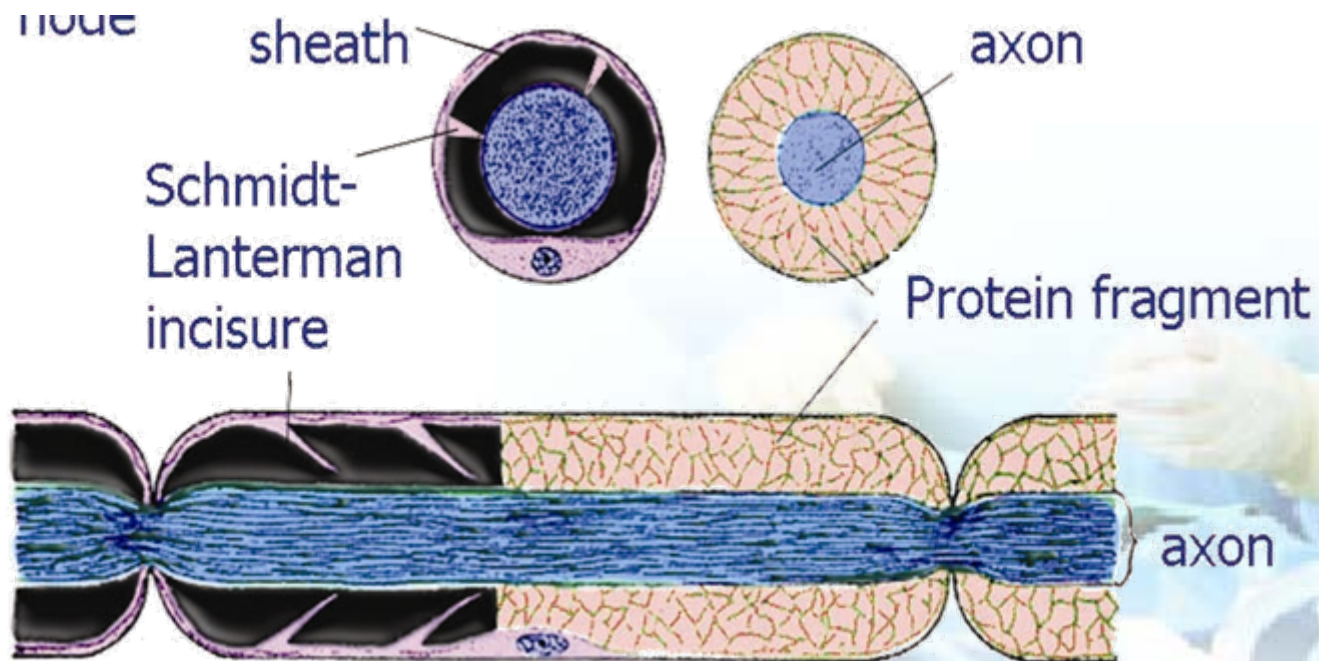
- ❖ Myelin-sheath
- ❖ Ranvier nodes
- ❖ Internode



Myelinated nerve fibers of PNS

Nerve tissue

- ❖ Schmidt-Lantermann incisure
- ❖ Neurokeratin network
- ❖ Neurilemma

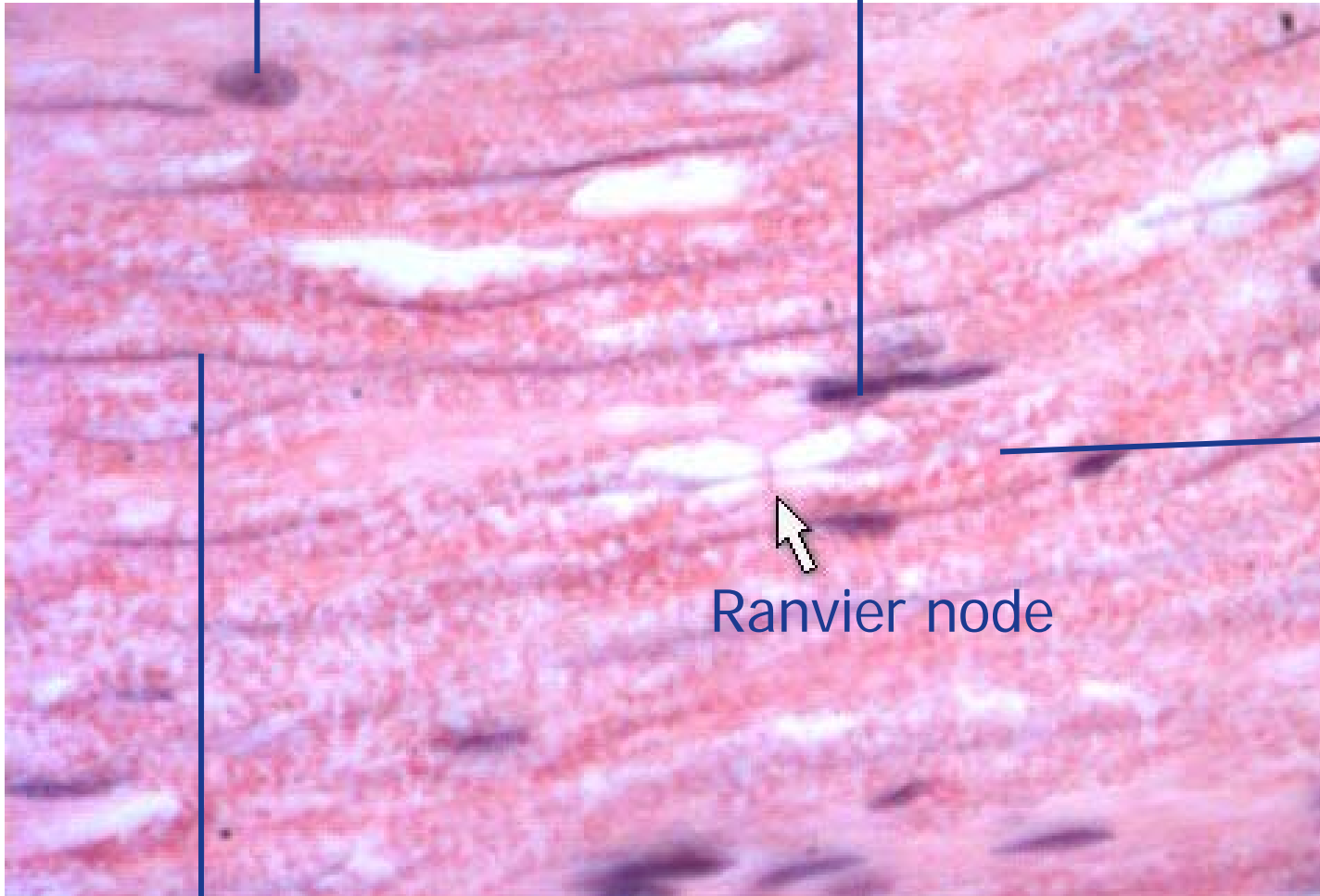


Myelinated nerve fibers of PNS

Nerve tissue

Nucleus of Schwann cell

Nucleus of fibroblast



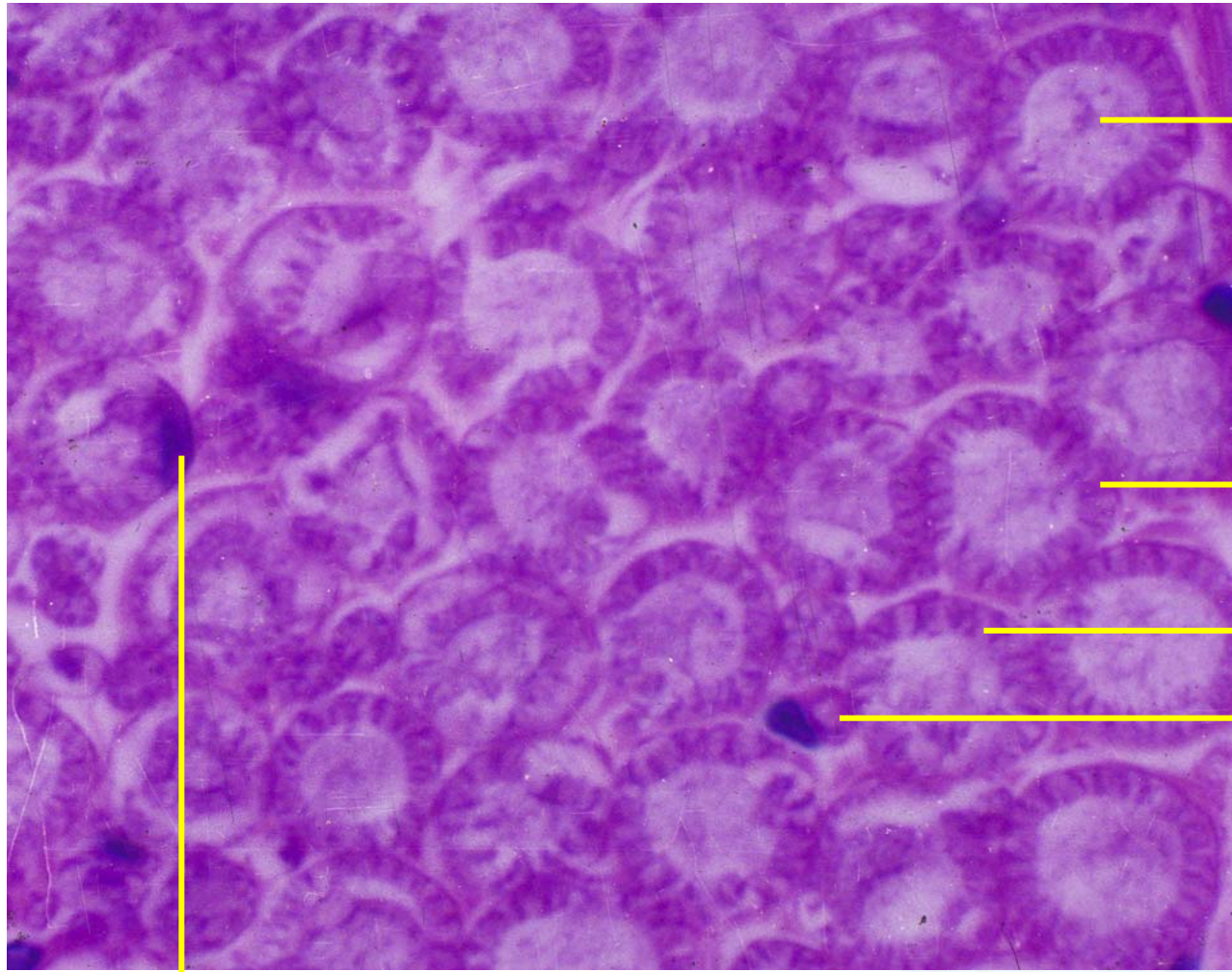
Myeline sheath

Ranvier node

axon

Myelinated nerve fibers of PNS

Nerve tissue



axon

cytoplasm
of Schwann cell

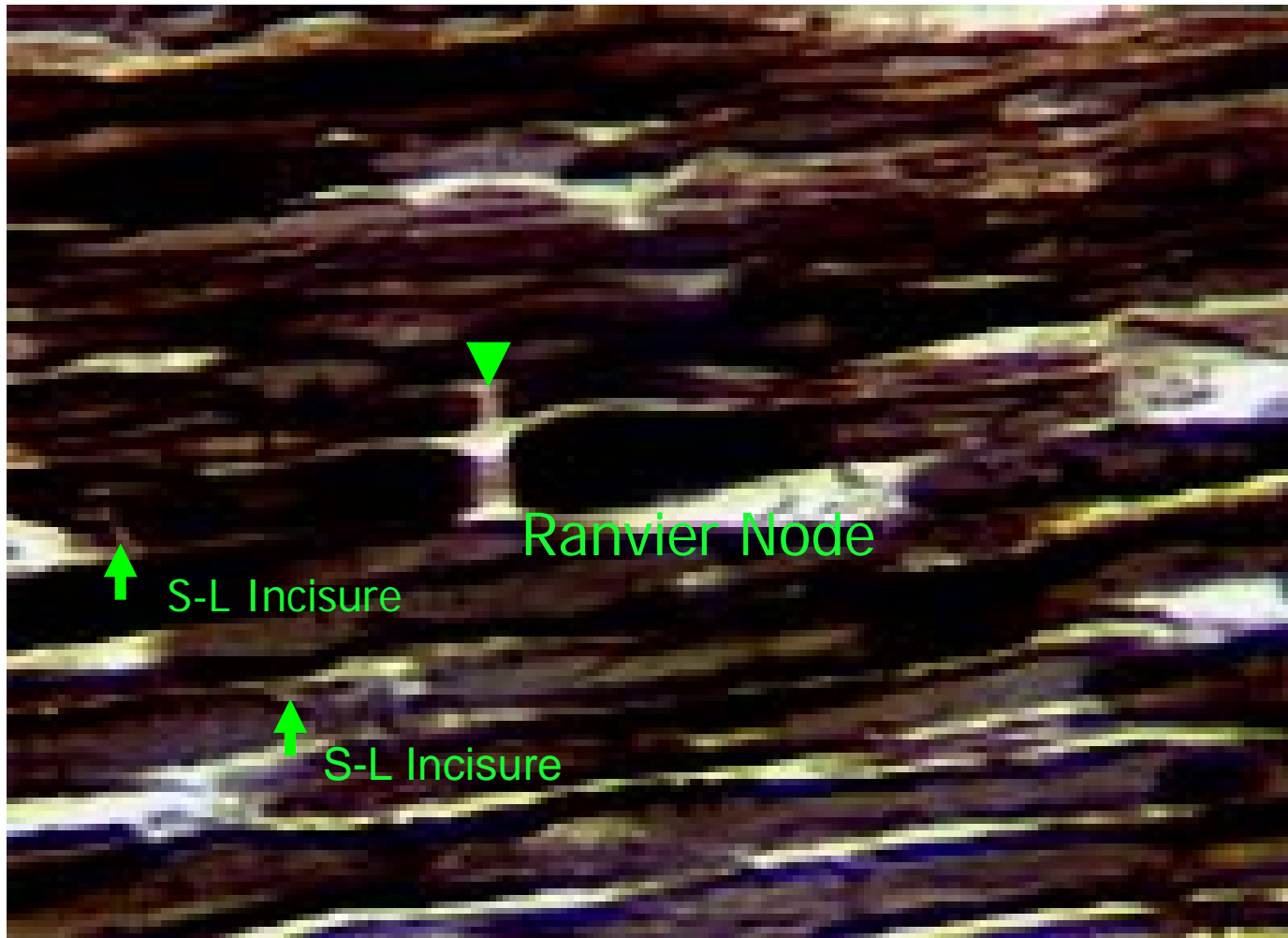
Myeline sheath

unmyelinated fiber

Nucleus of Schwann cell

Myelinated nerve fibers of PNS

Nerve tissue



Myelinated nerve fibers of PNS

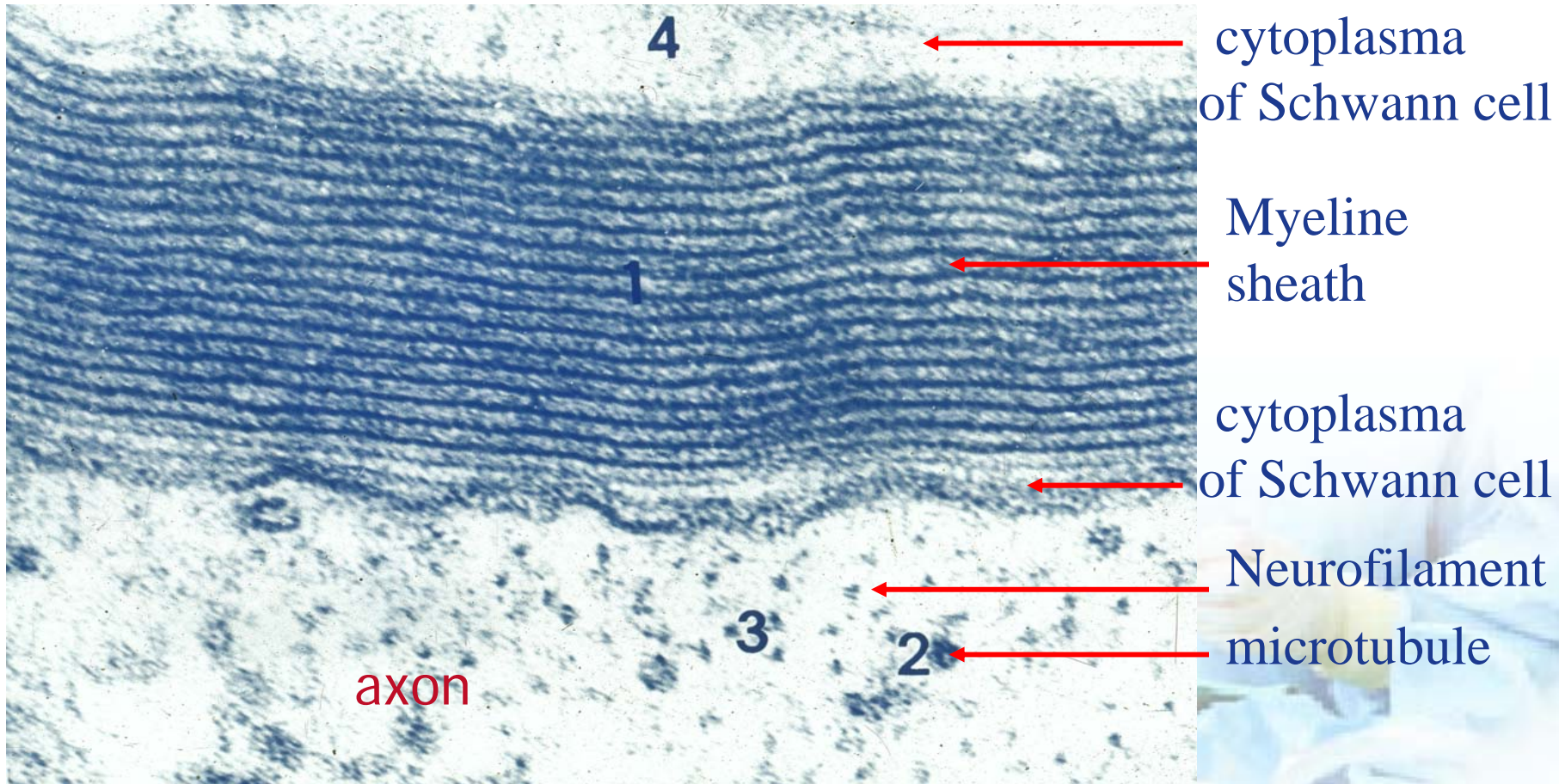
Nerve tissue



axion

Myelinated nerve fibers of PNS

Nerve tissue



❖ Definition:

- Nerve fiber: axon enveloped by neuroglial cells

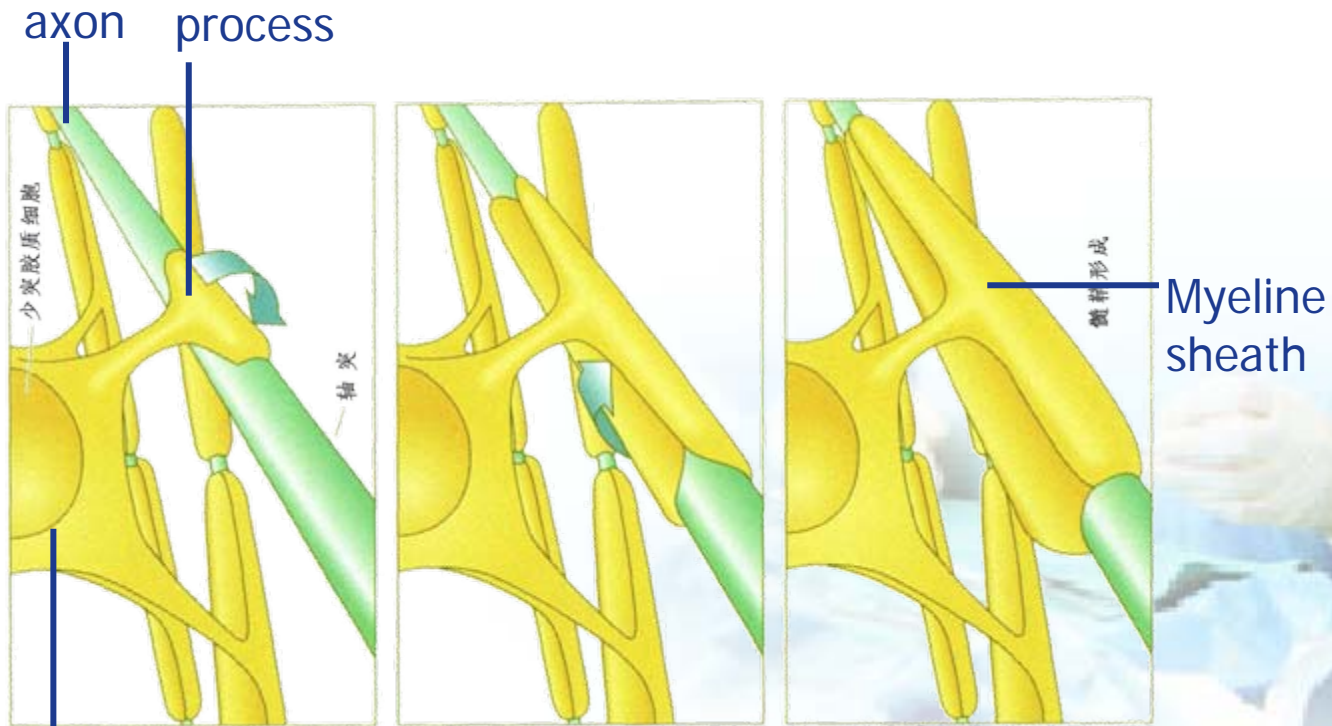
❖ Classification:

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 - Peripheral nervous system
 - Central nervous system
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Myelinated nerve fibers of CNS

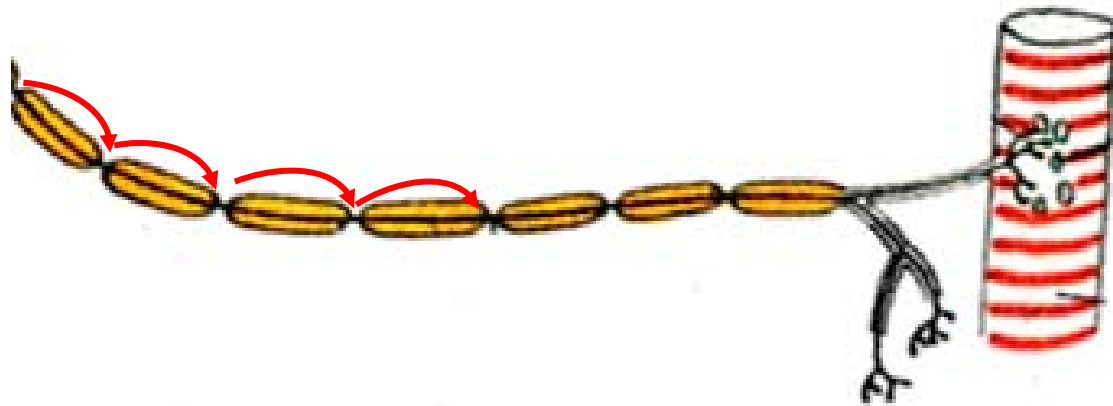
- ❖ Myelin sheaths
- ❖ Processes of oligodendrocytes
- ❖ Ranvier node are broad
- ❖ S-L incisure are absent.



oligodendrocyte

❖ Functions of myelin sheath

- Provide an insulation layer around the axon and to speed up impulse conduction
- Nerve impulses jump from node to node across internodes of myelin sheath.



❖ Definition:

- Nerve fiber: axon enveloped by neuroglial cells

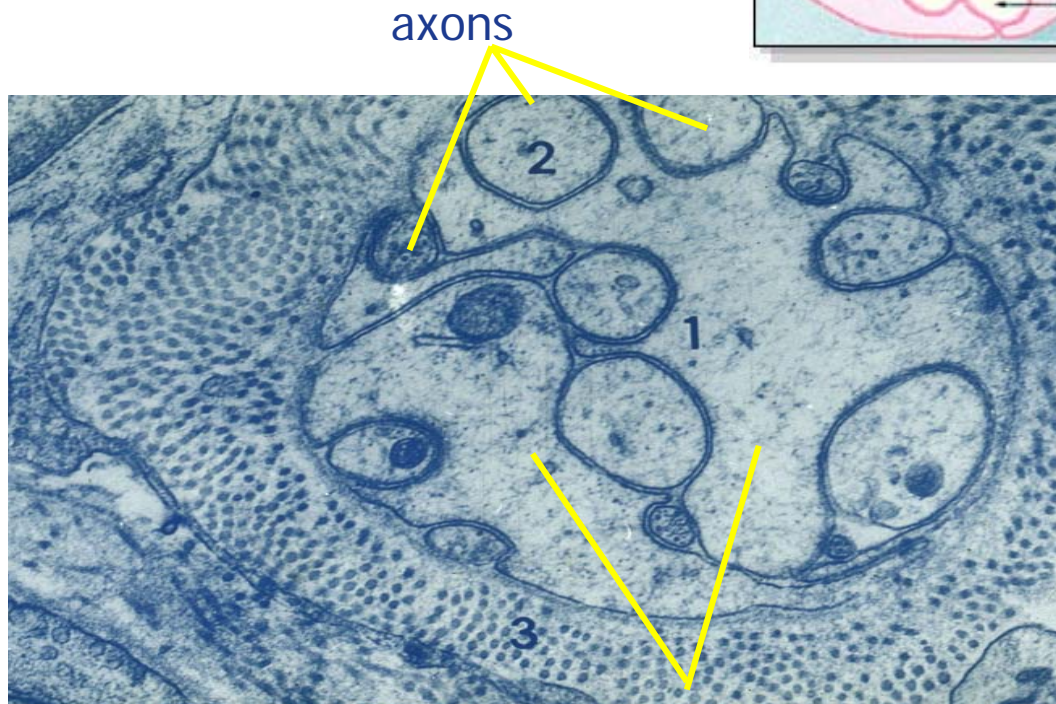
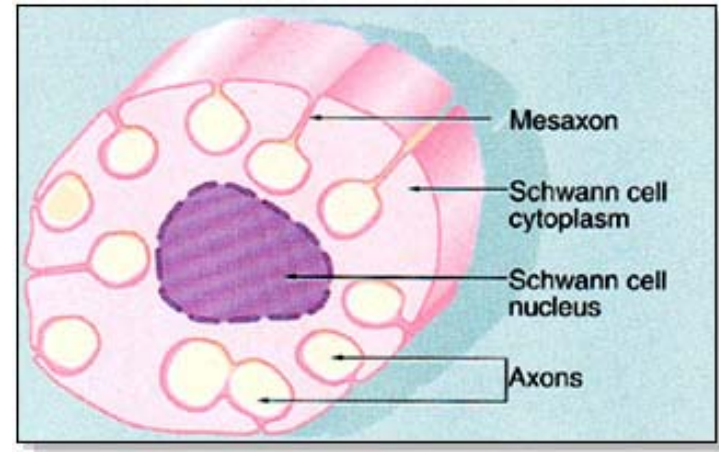
❖ Classification:

- Myelinated nerve fiber
 - Peripheral nervous system
 - Central nervous system
- Unmyelinated nerve fiber



Unmyelinated nerve fiber

- ❖ Schwann cells
- ❖ No Ranvier node
- ❖ No myelin sheath

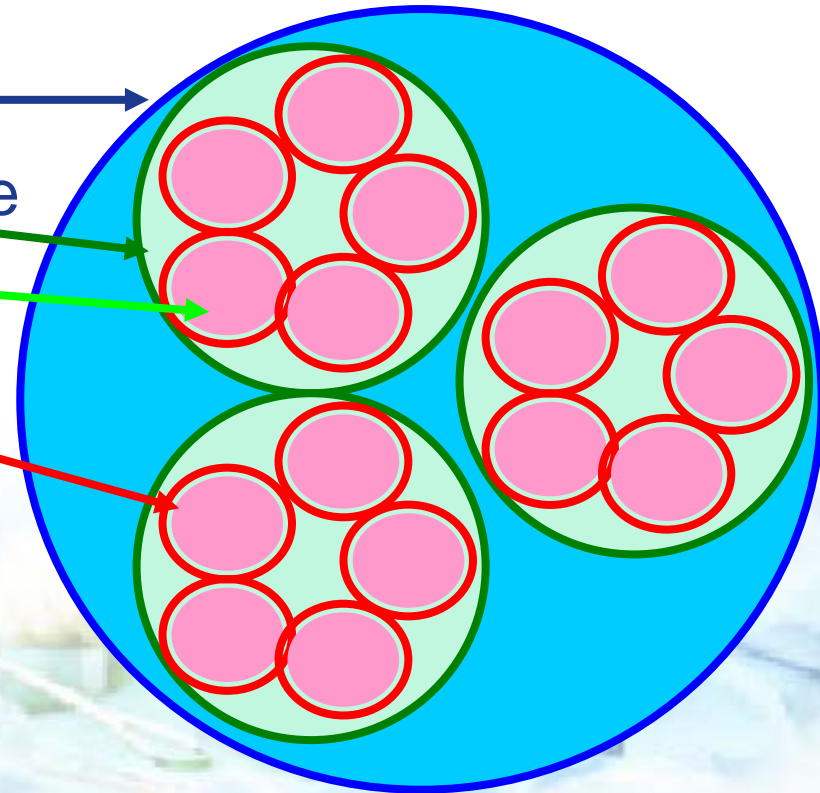
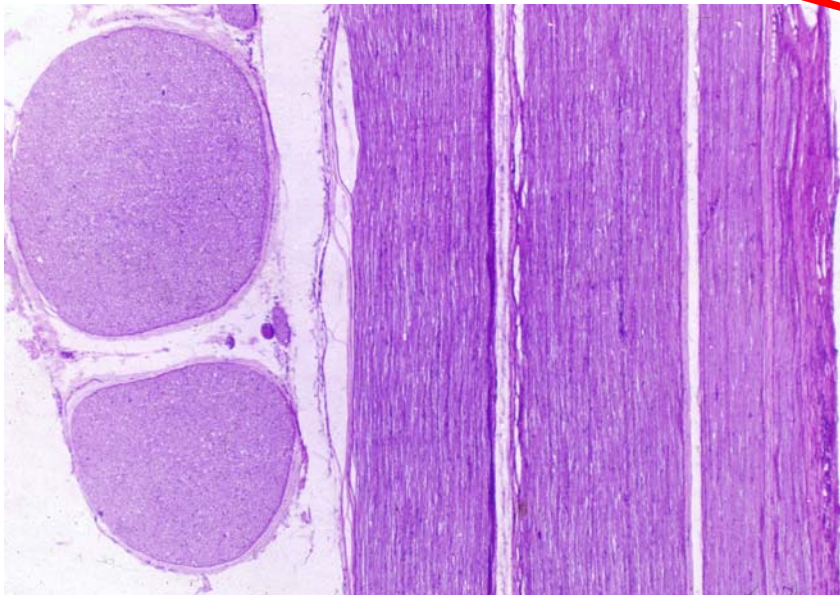


Schwann cell



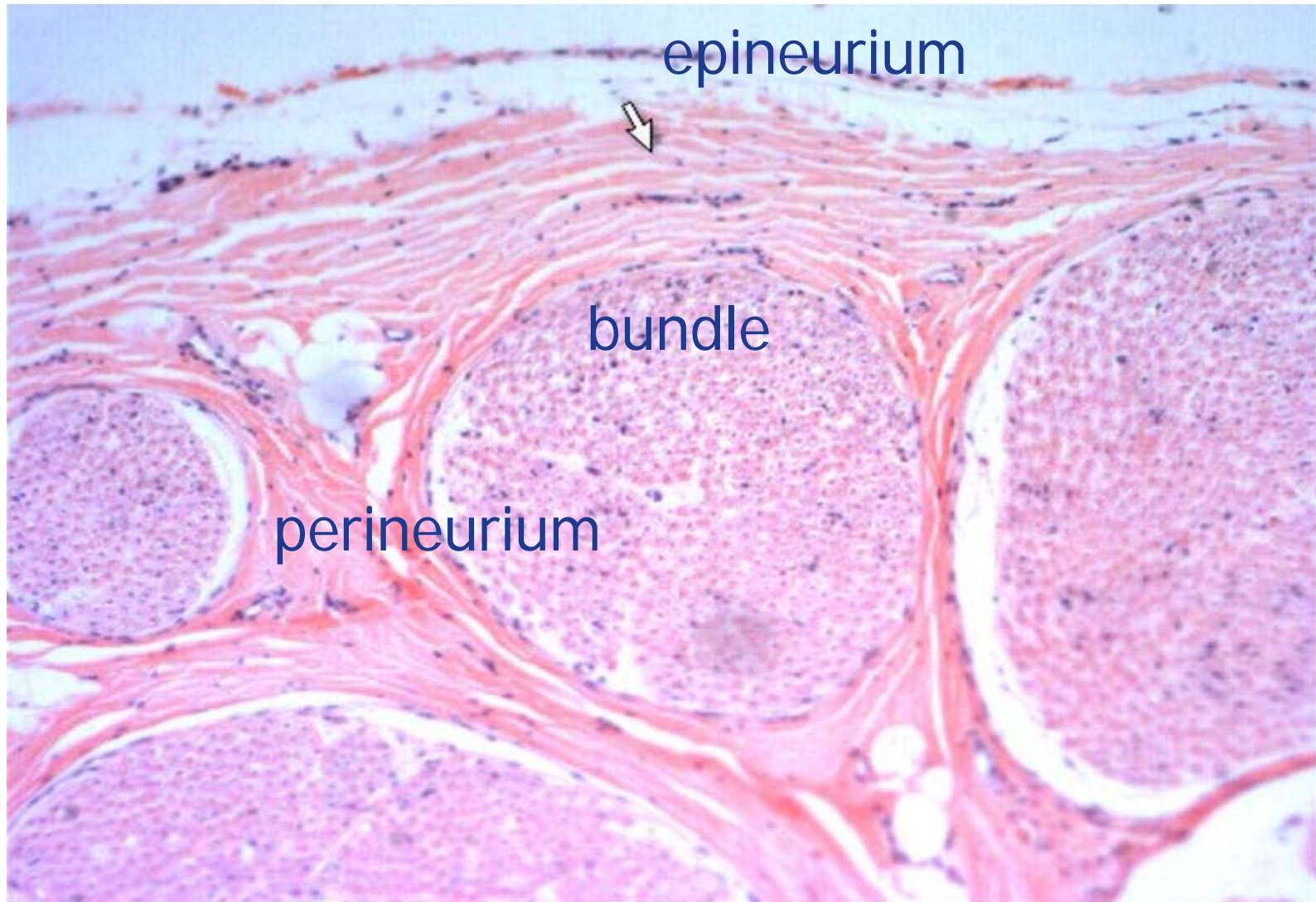
❖ structure:

- epineurium: nerve
- perineurium: nerve fibers bundle
- endoneurium: nerve fiber



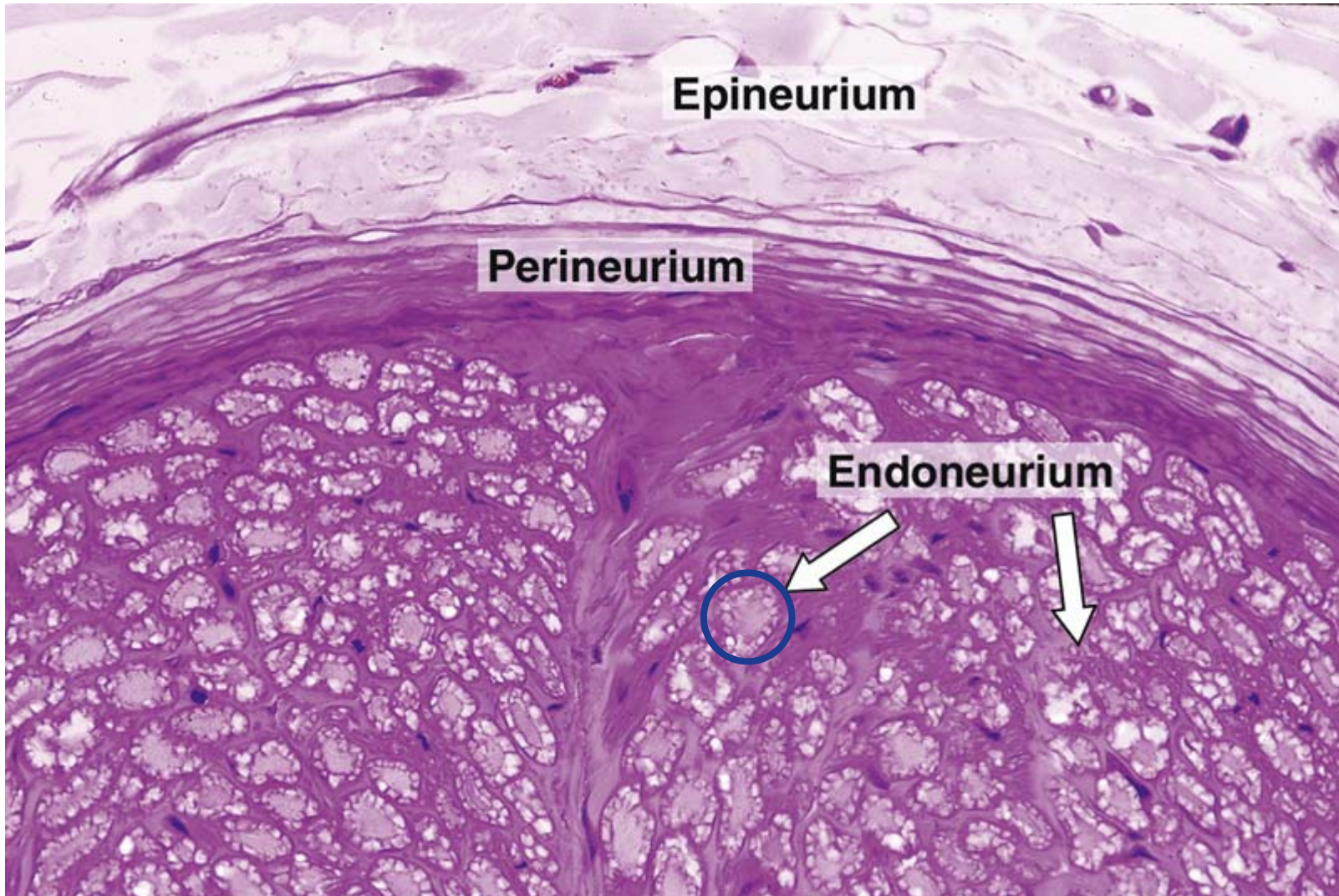
Nerves

Nerve tissue



Nerves

Nerve tissue



Contents

Nerve tissue



Neuron



Synapse



Neuroglia



Nerve Fiber and Nerve



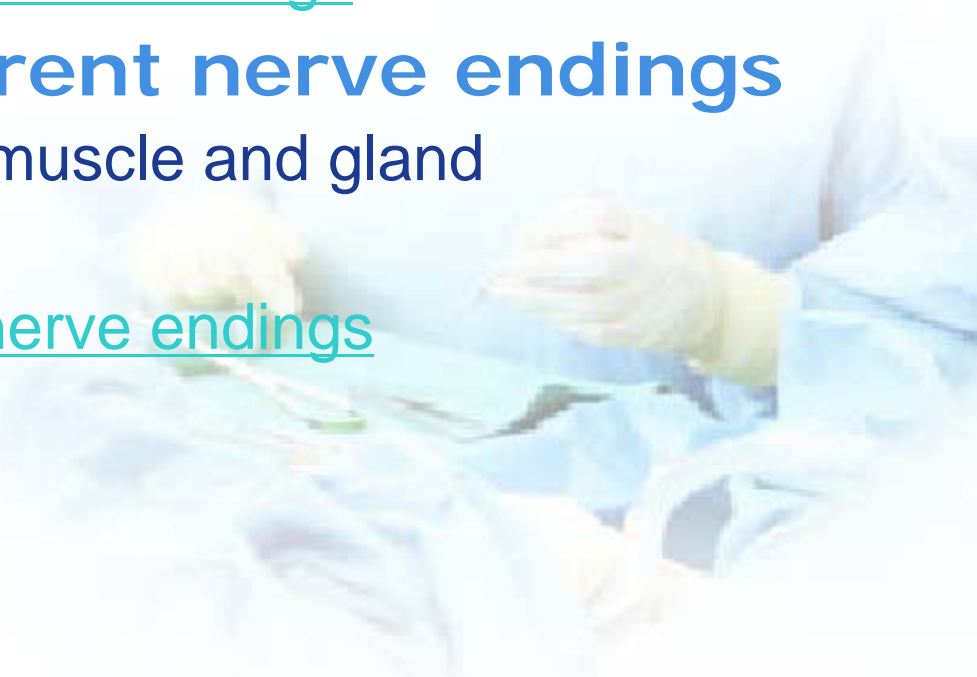
Nerve Ending

❖ 5.1 Sensory or Afferent nerve endings

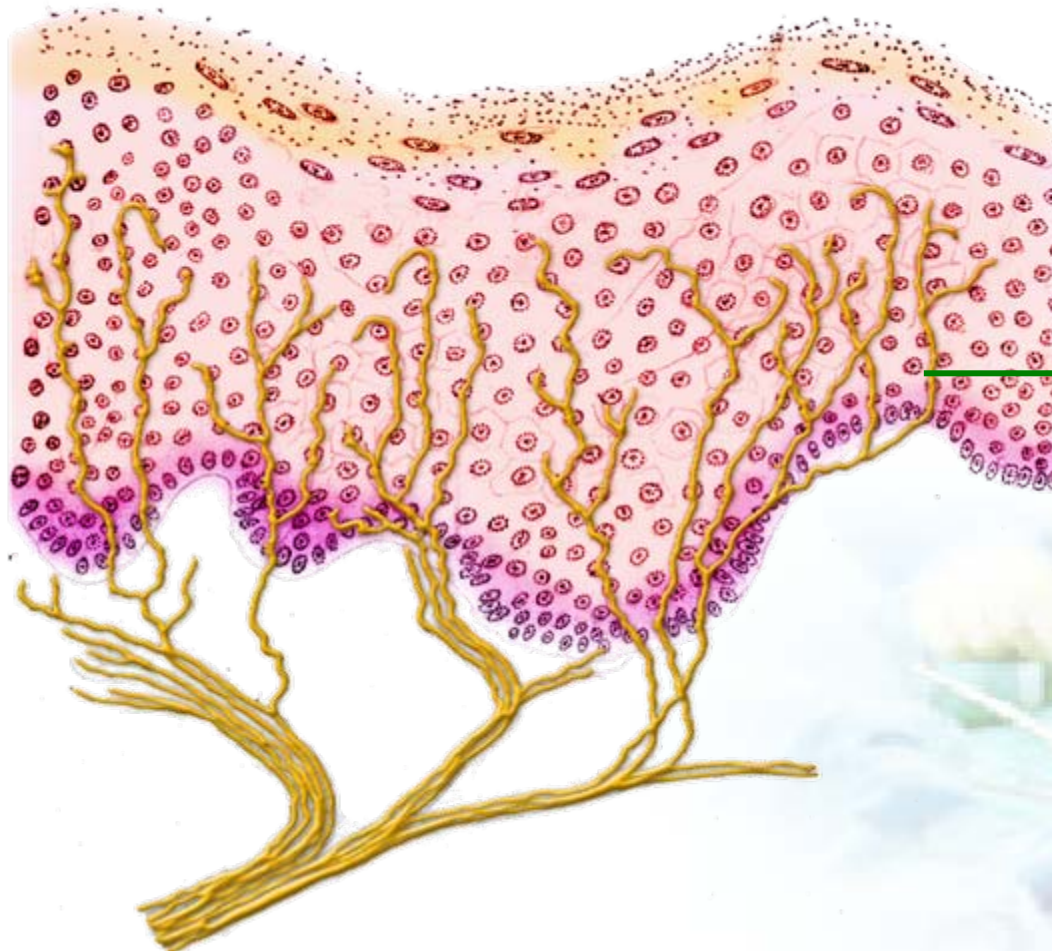
- Receive physical and chemical stimuli
- Generate nerve impulses responding to stimuli
- 5.1.1 [Free nerve ending](#)
- 5.1.2 [Encapsulated nerve endings](#)

❖ 5.2 Motor or Efferent nerve endings

- Control the activity of muscle and gland
- 5.2.1 [Motor end plate](#)
- 5.2.2 [Visceral motor nerve endings](#)



5.1.1 Free nerve ending



epithelium

free nerve endings



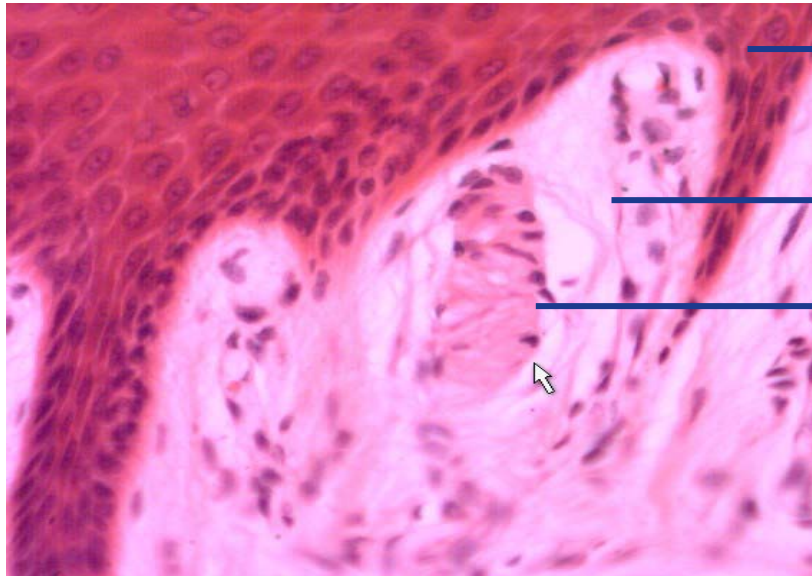
❖ Connective capsule surround unmyelinated sensory nerve endings

- Tactile corpuscle
- Lamellar corpuscle
- Muscle spindle



Tactile corpuscle (Meissner corpuscle)

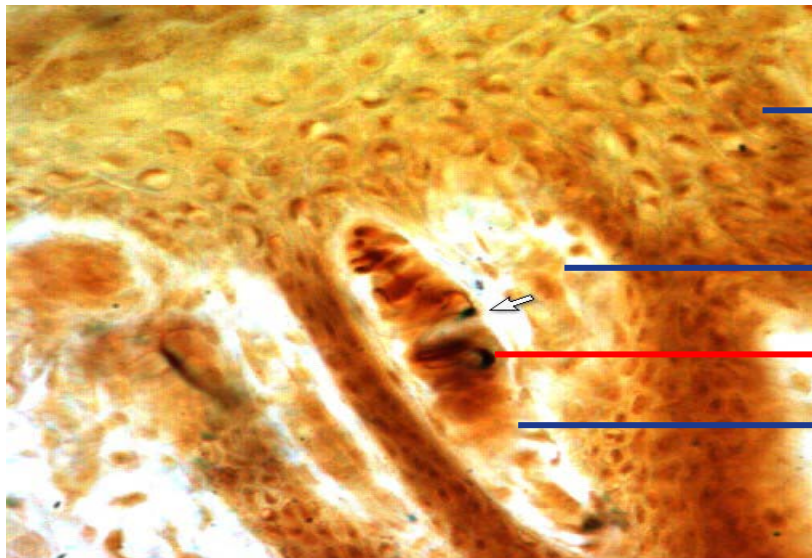
Nerve tissue



Epidermis

Dermal papillae

Tactile corpuscles



Epidermis

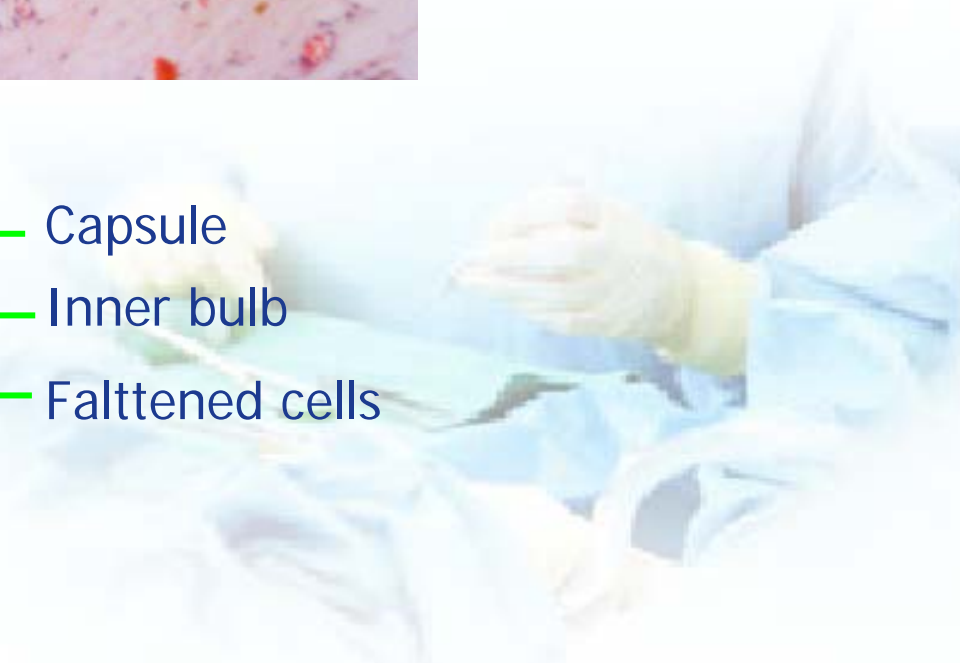
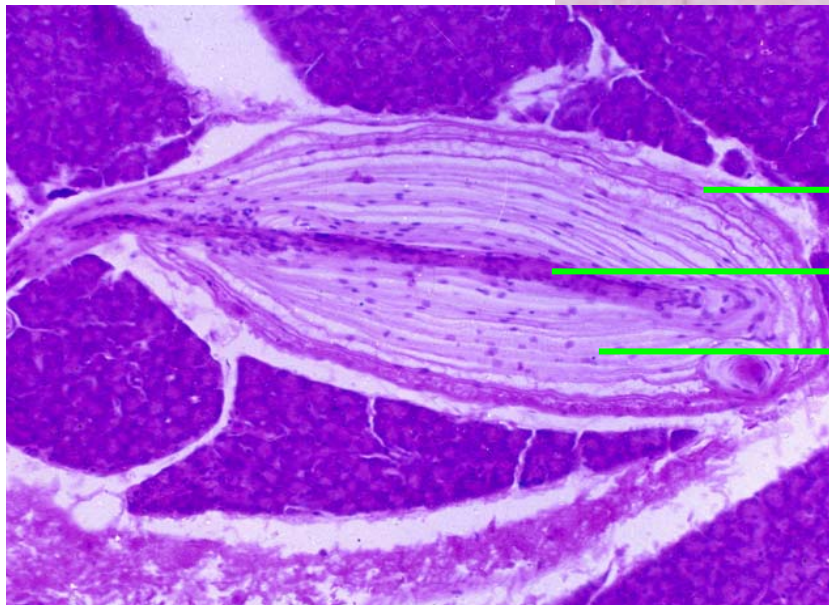
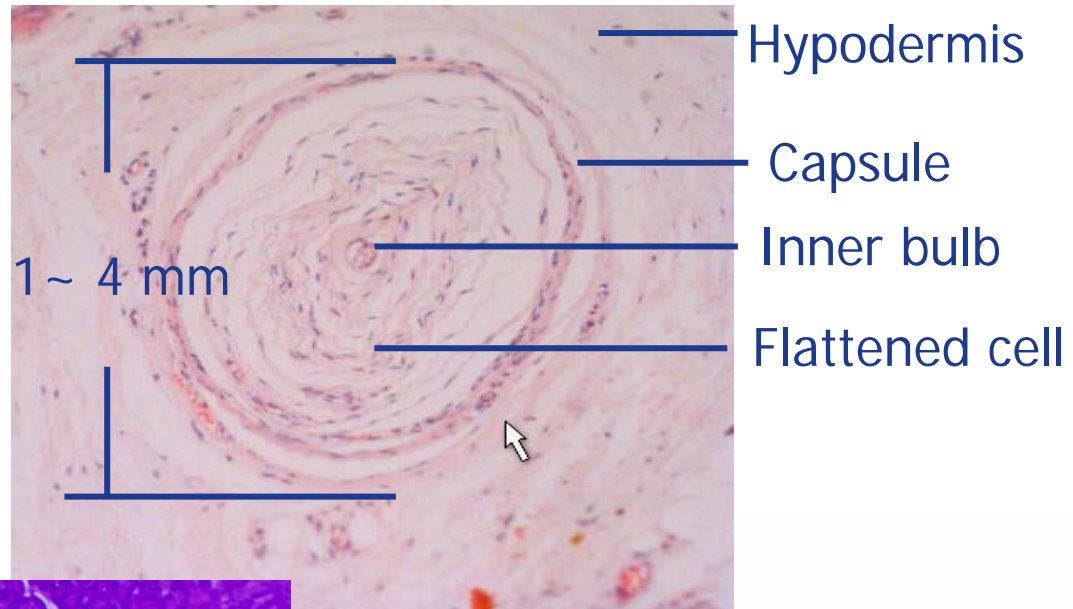
Dermal papillae

Nerve endings

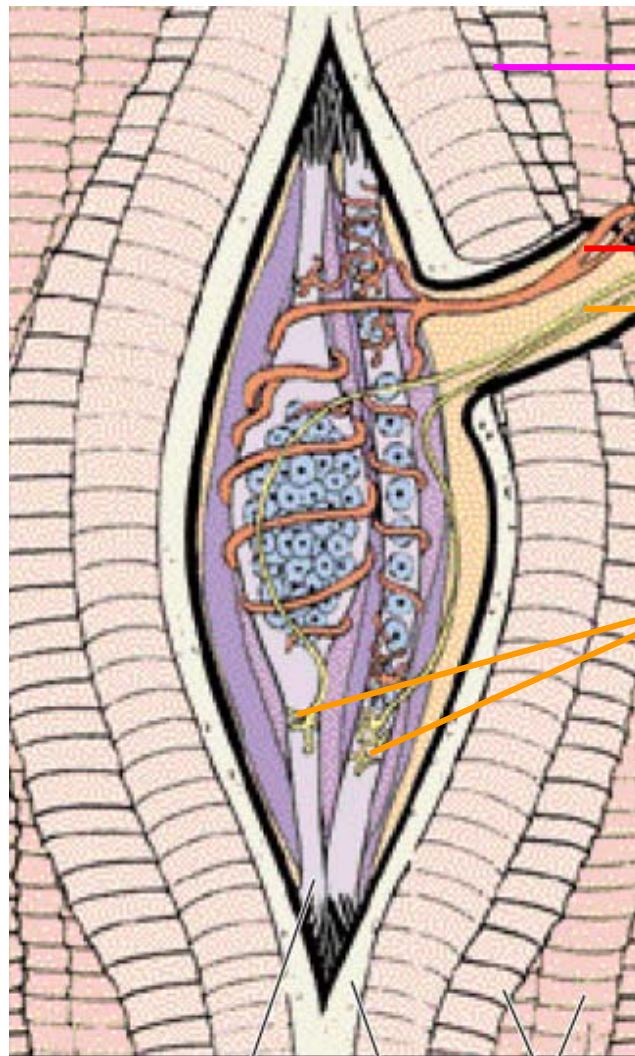
Tactile corpuscles

Lamellar corpuscle (Pacinian corpuscle)

Nerve tissue



Muscle spindle



Extradefusal muscle fibers

Sensory nerve fiber ending

Motor nerve fiber ending

Motor end plate

Intrafusal fibers

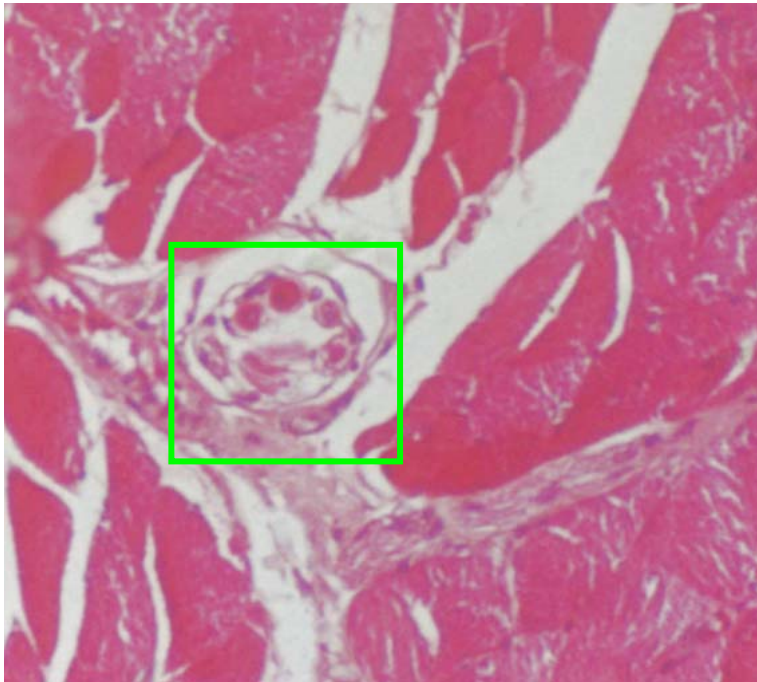
External capsule

Striated muscle

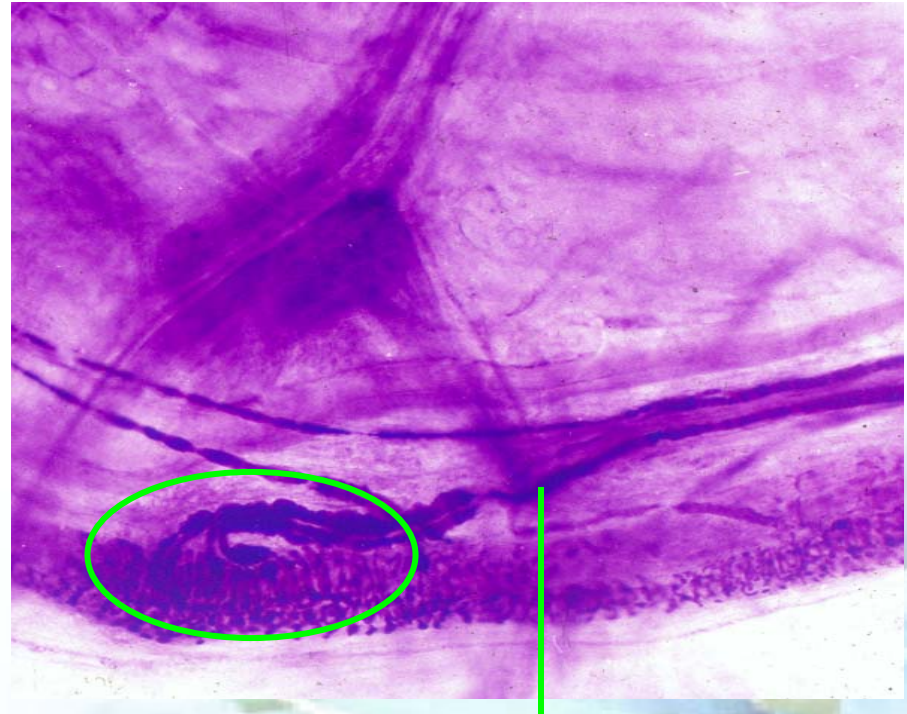


Muscle spindle

Nerve tissue



Muscle spindle, cross section



Sensory nerve fiber ending

Muscle spindle, longitudinal section

❖ 5.1 Sensory or Afferent nerve endings

- Receive physical and chemical stimuli,
- Generate nerve impulses responding to stimuli
- 5.1.1 [Free nerve ending](#)
- 5.1.2 [Encapsulated nerve endings](#)

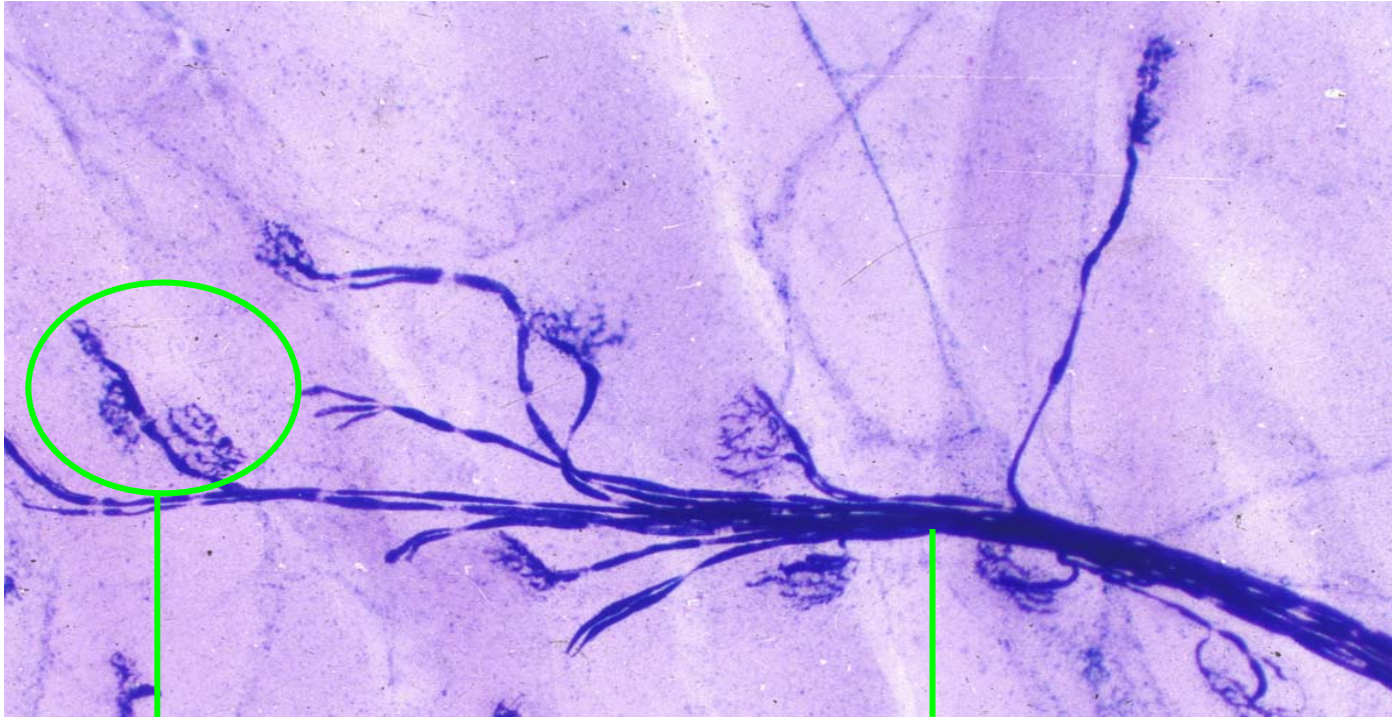
❖ 5.2 Motor or Efferent nerve endings

- Control the activity of muscle and gland
- 5.2.1 [Motor end plate](#)
- 5.2.2 [Visceral motor nerve endings](#)



Motor end plate

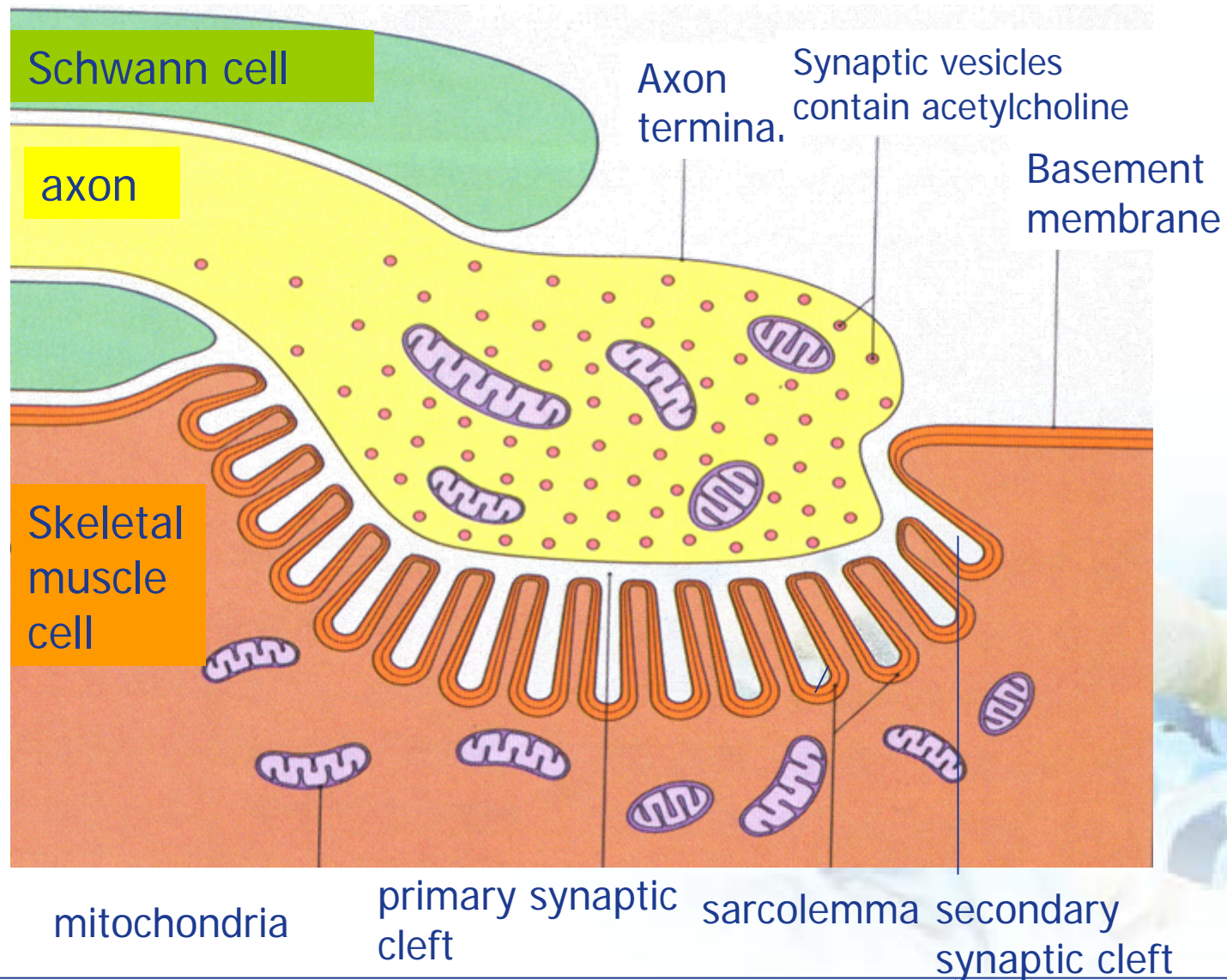
Nerve tissue



motor end plate

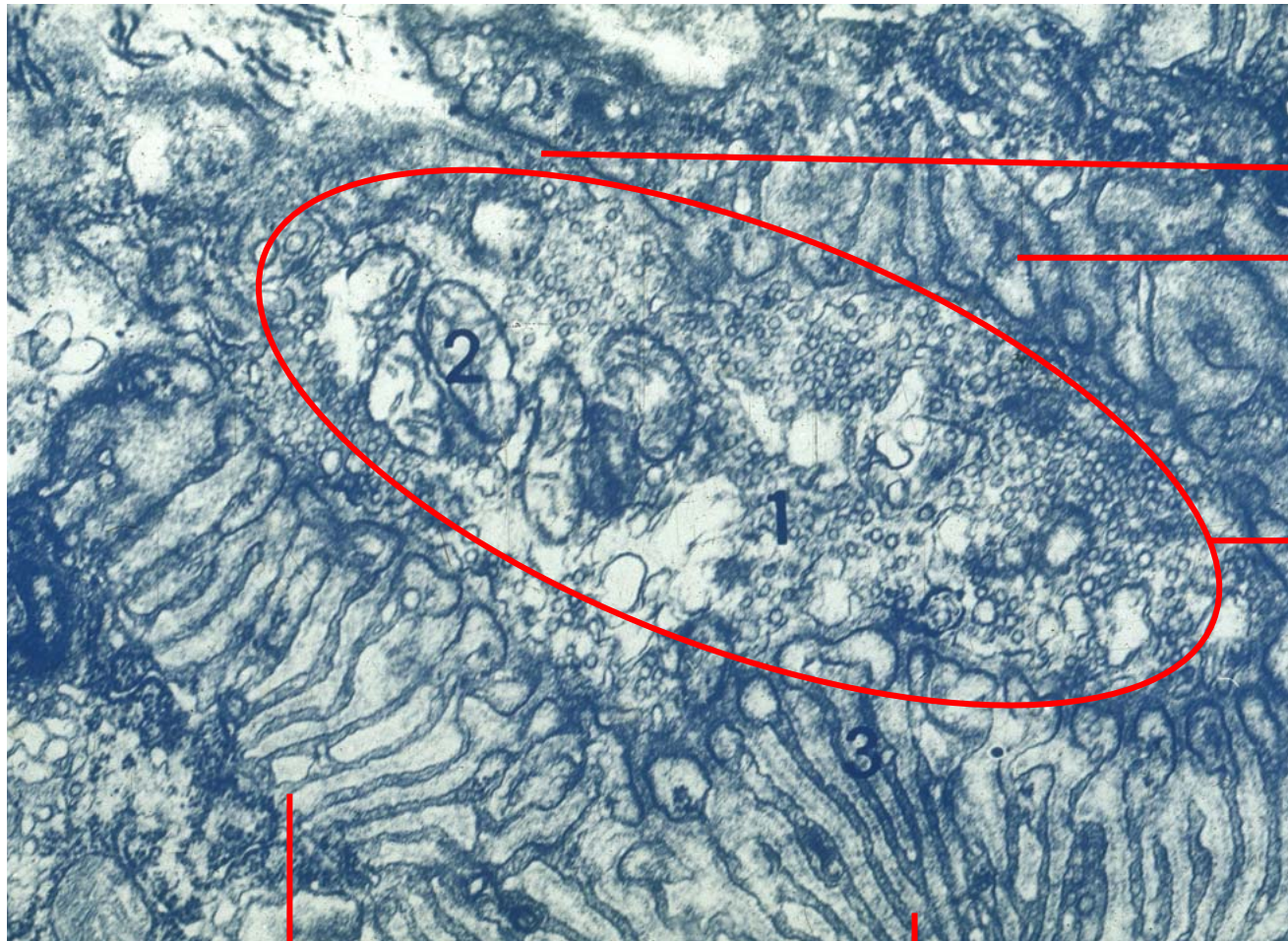
motor nerve fiber ending

Motor end plate



Motor end plate

Nerve tissue



primary synaptic cleft

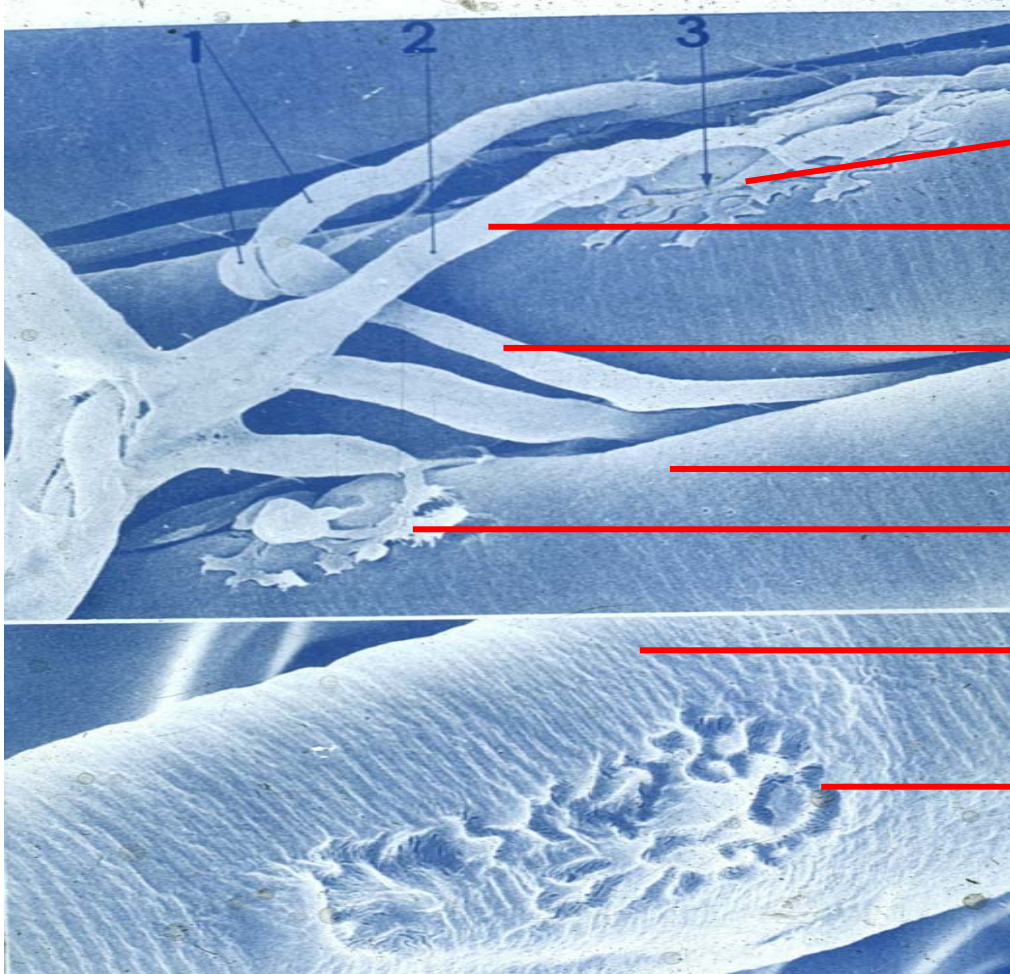
sarcolemma

Axon terminal with synaptic vesicles

sarcolemma

Secondary synaptic cleft

Motor end plate



Motor end plate

Motor nerve ending

Capillary

Skeletal muscle

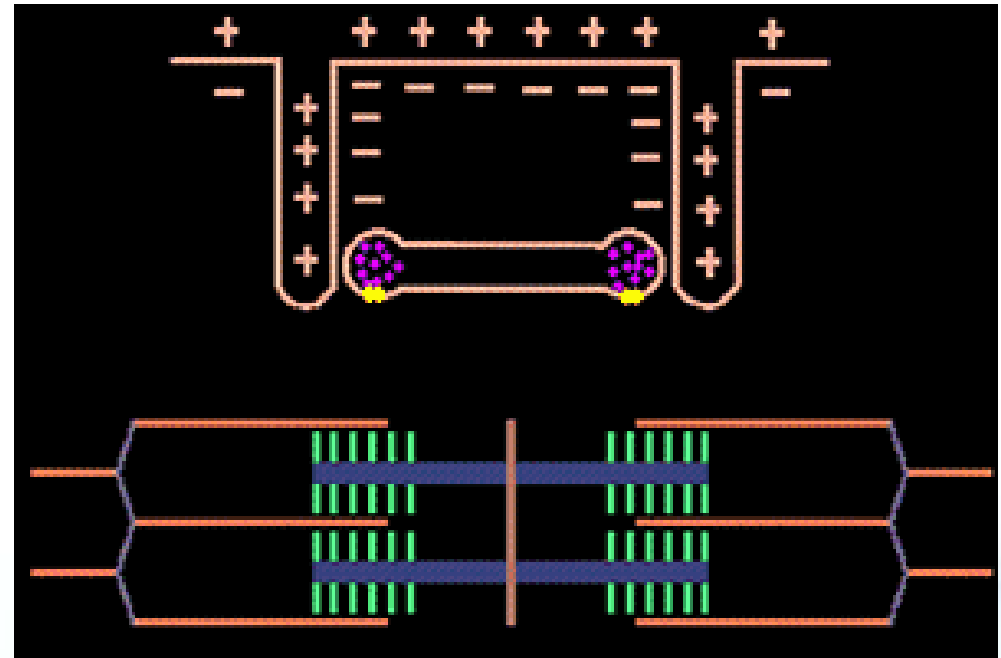
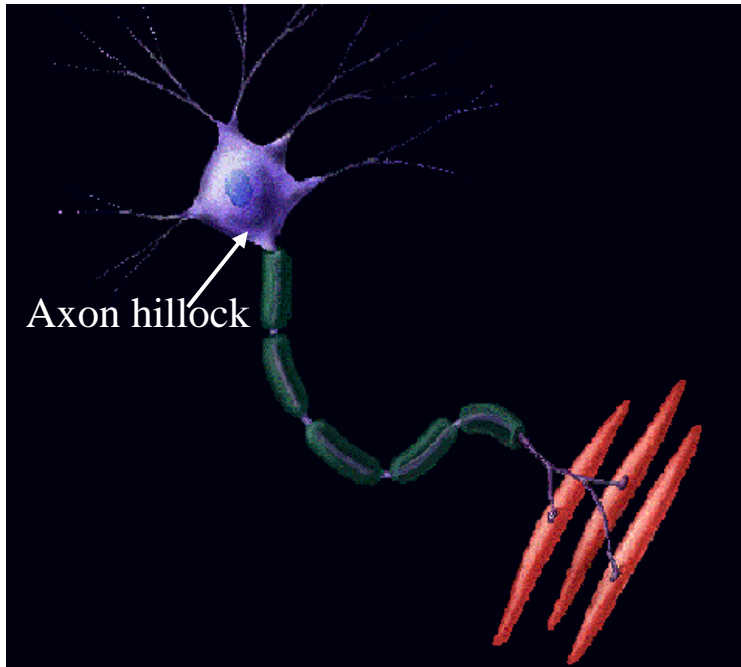
Motor end plate

Skeletal muscle

Primary synaptic cleft

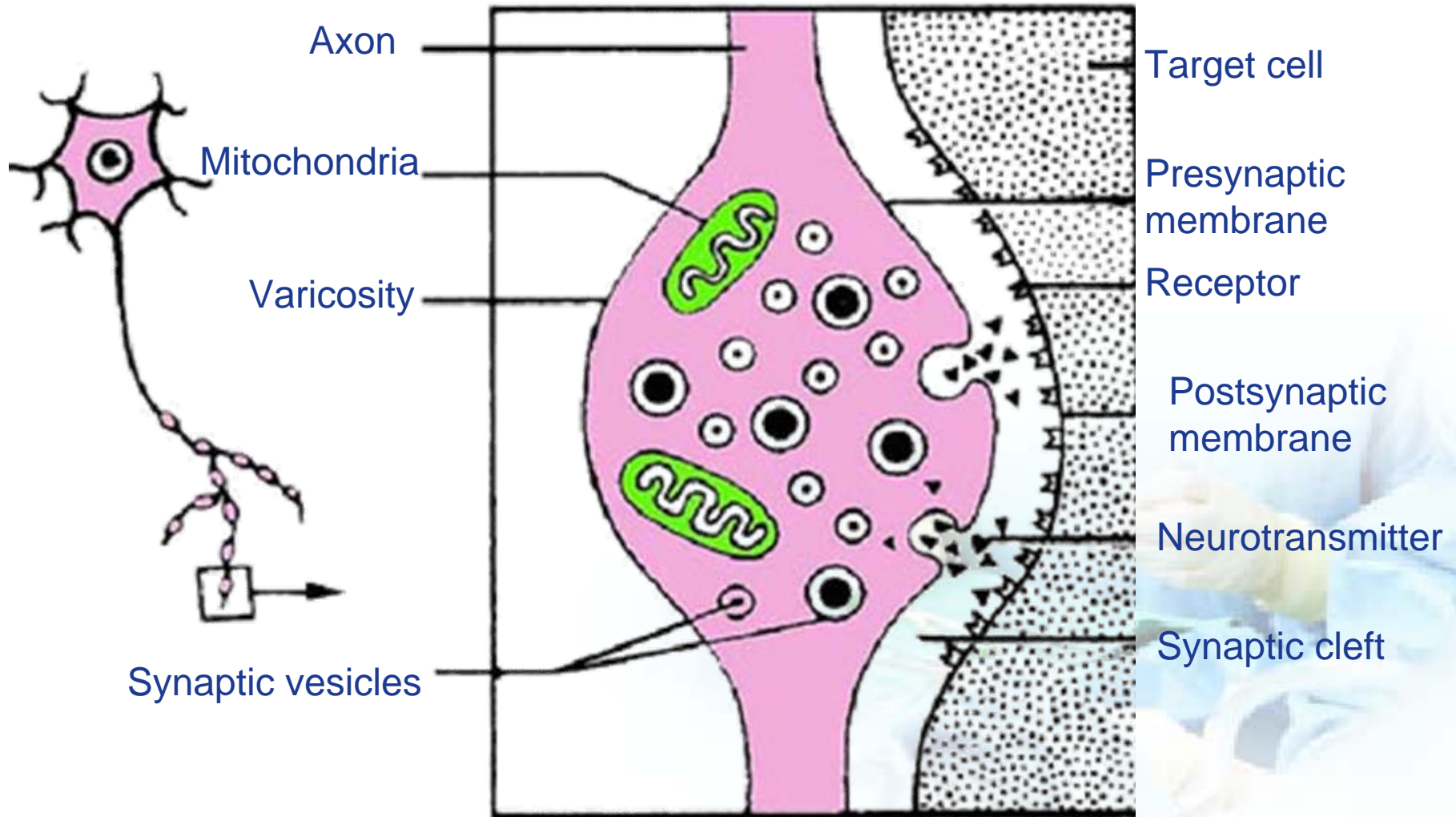
Motor end plate

Nerve tissue

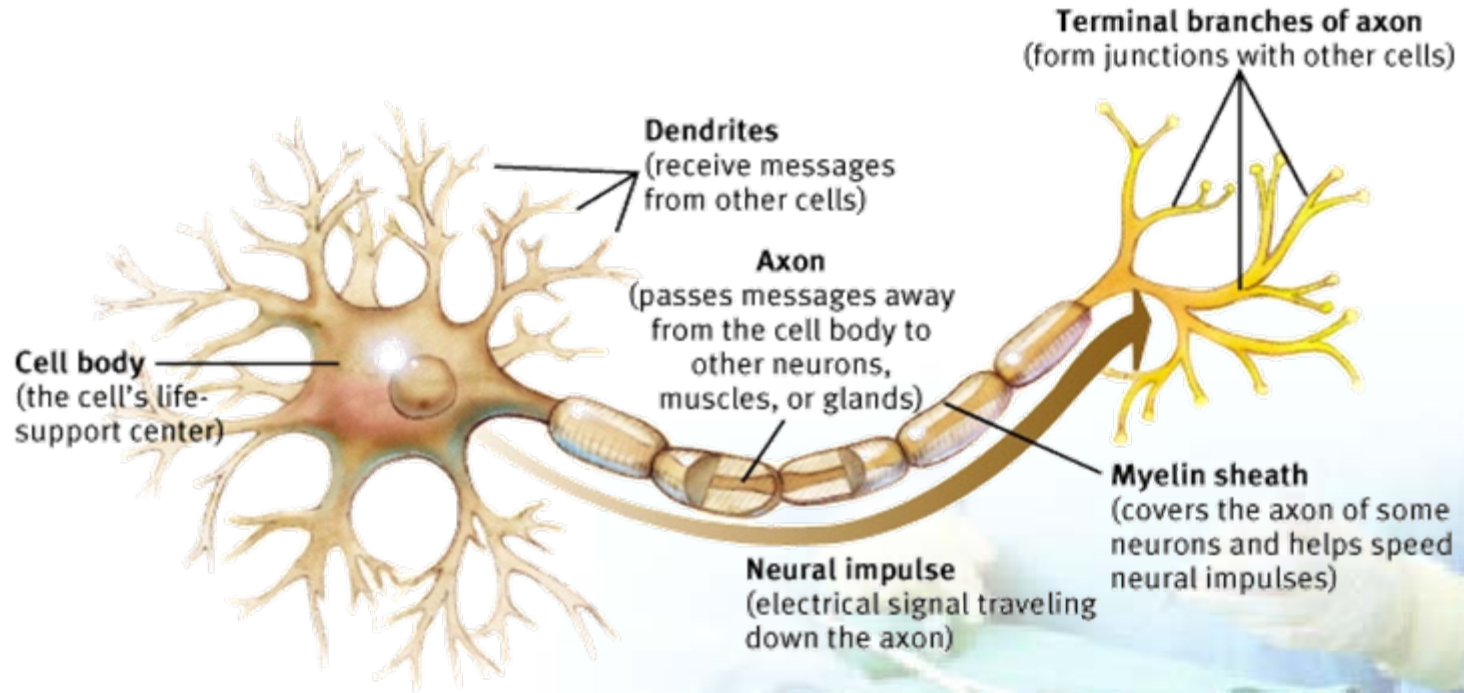


Visceral motor nerve ending

Nerve tissue



Summary



- ❖ **Group1:** 神经干细胞
- ❖ **Group2:** 造血干细胞
- ❖ **Group3:** 胚胎干细胞
- ❖ **Group4:** 肿瘤干细胞



A pair of glasses and a pen are visible in the lower-left corner of the image. The glasses have a dark frame and clear lenses. The pen is silver and has a white eraser. The background is a solid blue color with a subtle gradient.

Thank You !