Nervous Tissue

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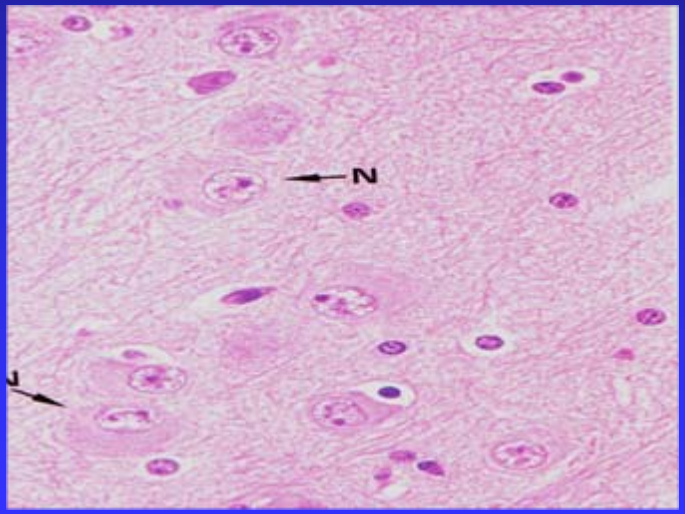
Organization:

neurons (nerve cells)
neuroglial cells

Function:



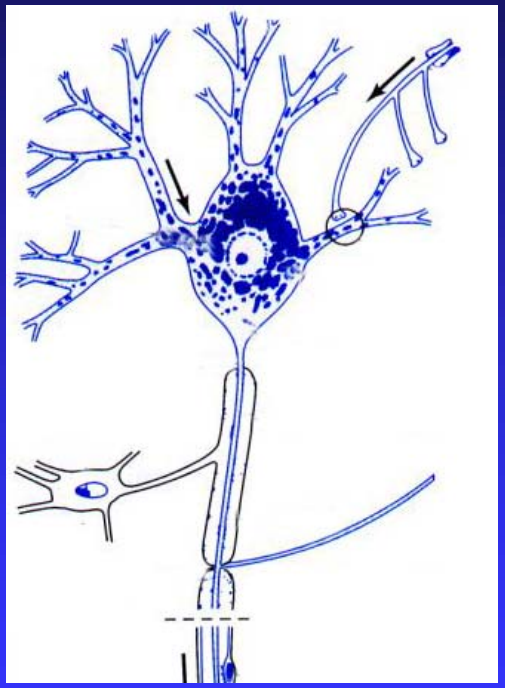
Ⅰ Neurons

1. structure of neuron

soma

neurite a. dendrite

b. axon



1.1 soma

(1) nucleus

Located in the center of soma,

large and pale-staining nucleus

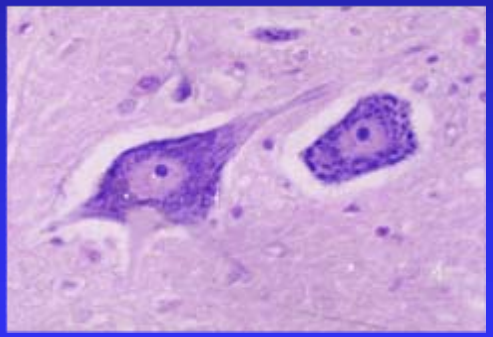
Prominent nucleolus

(2) cytoplasm (perikaryon)

a. Nissl body

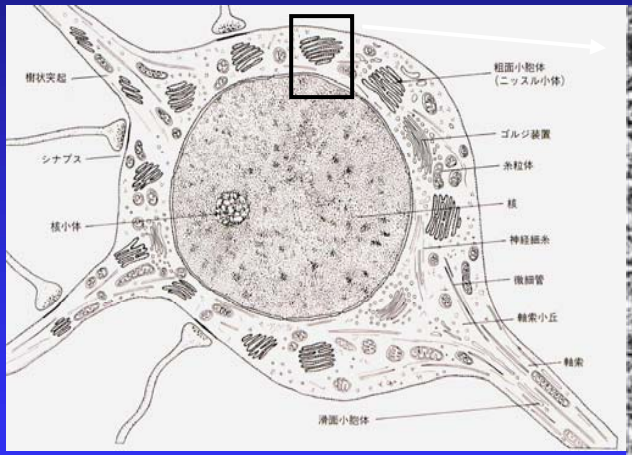
b. neurofibril

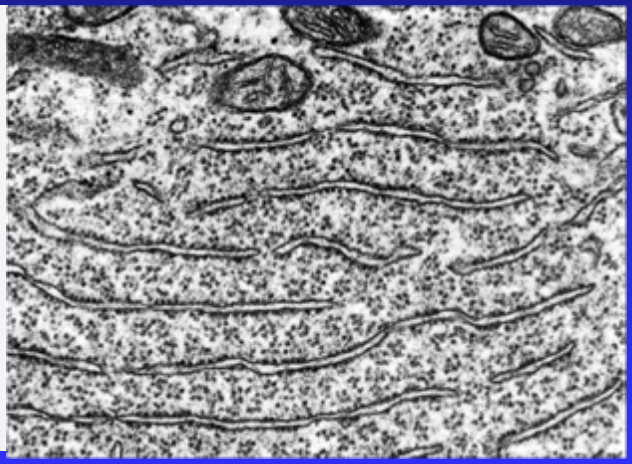
- **Nissl's bodies**



LM: basophilic mass or granules

Nissl’s Body (TEM)



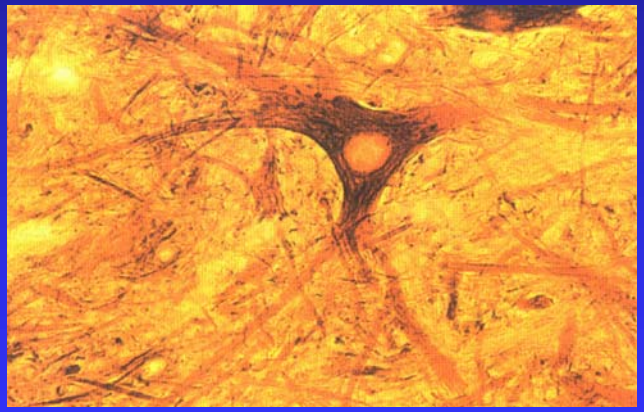


EM: RER, free Rb

Function: producing the protein of neuron structure and enzyme producing the neurotransmitter

Neurofibril

- **the structure**
  - **LM:**
  - **EM: Neurofilament microtubule**



- **Function**

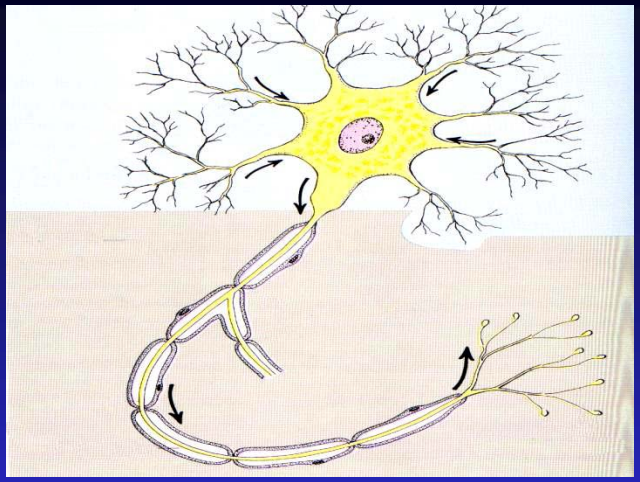
  cytoskeleton, to participate in substance transport

  Lipofuscin

(3) Cell membrane

excitable membrane , receiving stimutation, froming and conducting nerve impules

neurite:



1.2 Dendrite

- dendritic spine
- spine apparatus
- Function:

1.3 Axon

- axon hillock, axon terminal, axolemma
- Axoplasm: microfilament, microtubules, neurofilament, mitochondria, SER and vesicles in it
- function: conducting impules and axonal transport

2. Classification of neuron:

2.1 Classification according to numbers of neurites

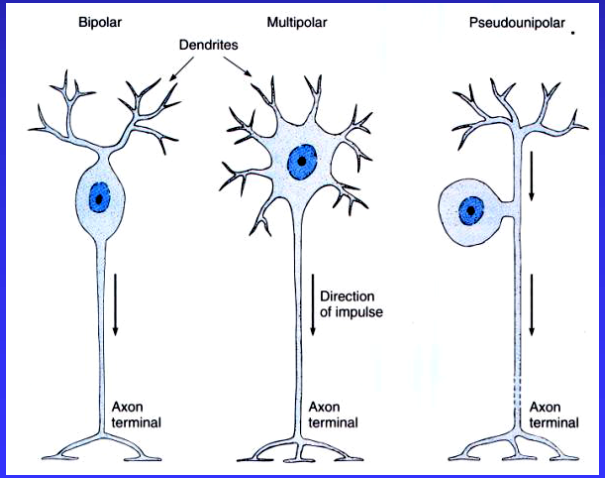
(1) multipolar neuron

(2) bipolar neuron

(3) Pseudounipolar neuron

peripheral process

central process



2.2 Classification according to their the functions

(1) sensory neuron :

(2) motor neuron:

(3) interneuron:

2.3 Classification according to the neurotransmitter and neuromodulator

(1) cholinergic neuron: acetylcholine (Ach),

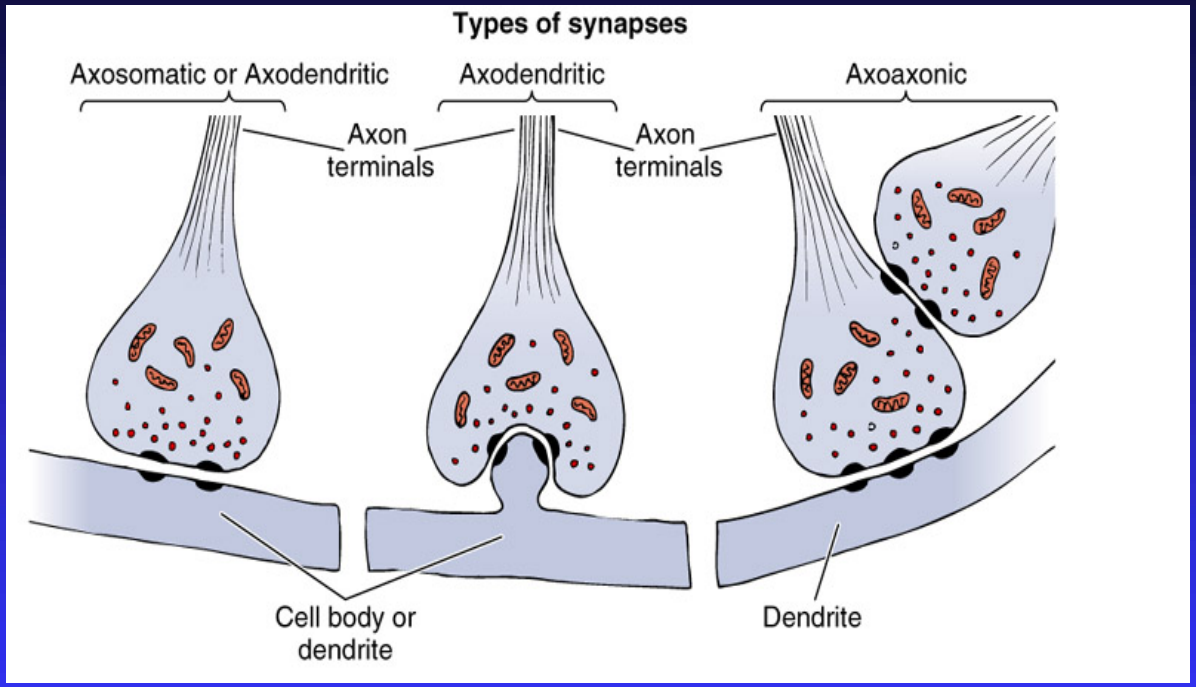
(2) aminergic neuron: norepinephrine (NA), dopamine (DA), 5-HT,

(3) peptidergic neuron: substance P, enkephaline

(4) aminoacidergic neuron: GABA, glutamic acid

Ⅱ Synapse

- One kind of specialized cell junction, or the contact of one neuron with another neuron or one neuron with a effector cells (gland or muscle cells)
- junction mode :
  - axo-dendritic synapse (most synapse)
  - axo-somatic synapse (most synapse)
- classification of synapse:
  - chemical synapse
  - electrical synapse (gap junction)



The type of synapse

Chemical Synapse

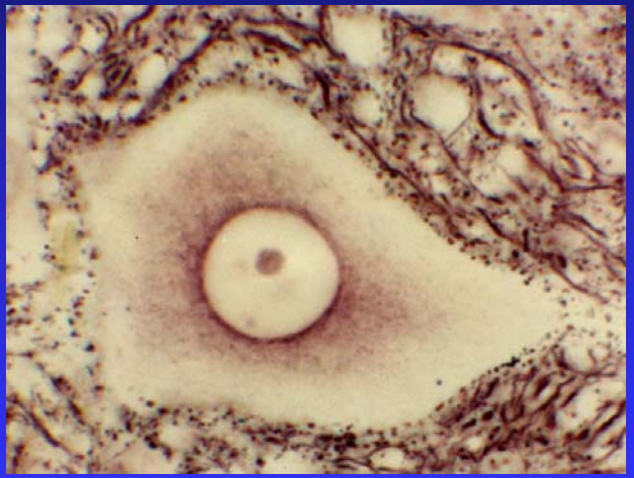
The stucture of synapse

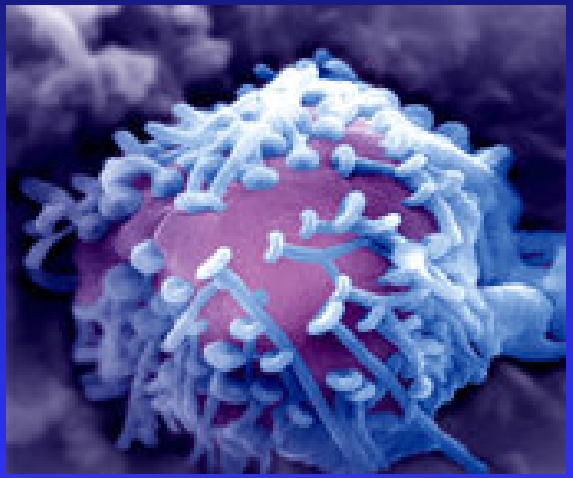
LM: synaptic knob

EM:

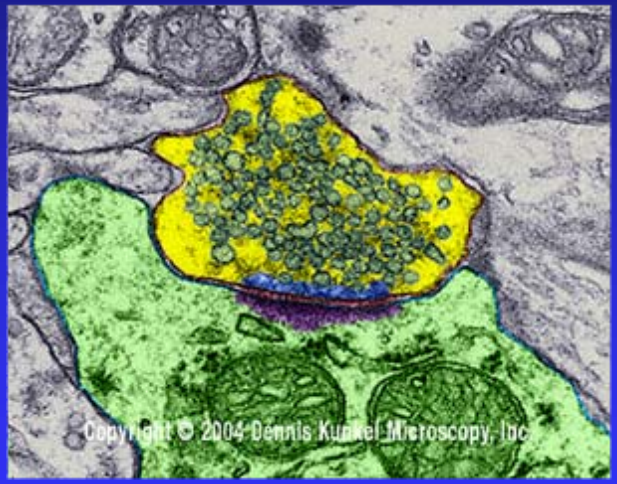
- **presynaptic element**
  - **presynaptic membrane**
  - **synaptic vesicles (*synapsin Ⅰ)**
  - **mitochondria , SER, microfilament and microtubule**
- **synaptic cleft**
- **postsynaptic element**
  - **postsynaptic membrane**
  - **Function: excitatory synapse, inhibitory synapse**

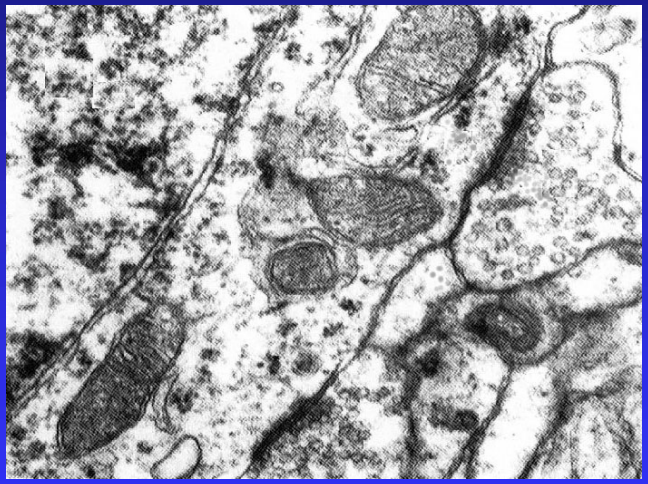
Synaptic knob





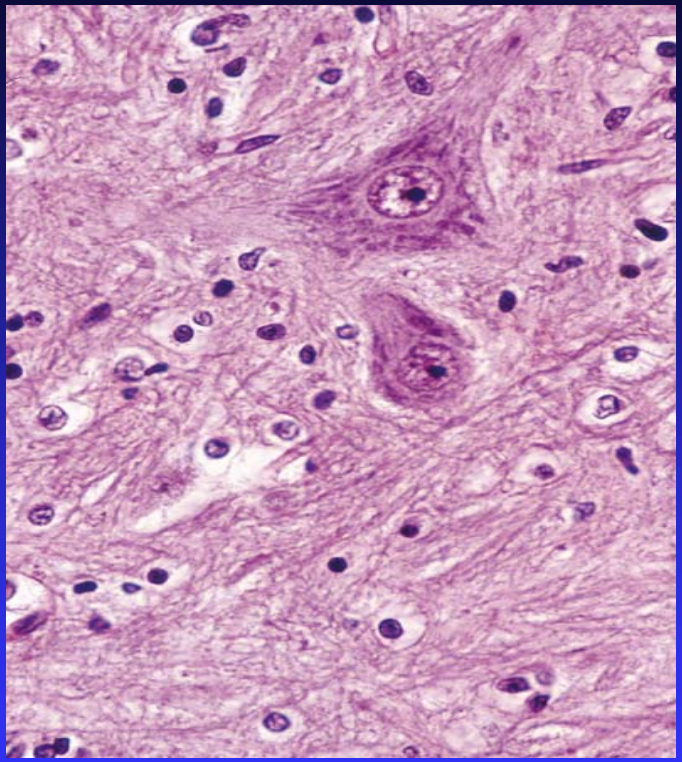
Synapse (TEM)





Ⅲ Neuroglial cells (glial cell)

1. glial cells of central nerve system
   - astrocyte:
   - oligodendrocyte
   - microglia
   - ependymal cell
2. glial cells of peripheral nerve system
   - schwann cell
   - satellite cell



Neuroglial cell

(1) Astrocytes

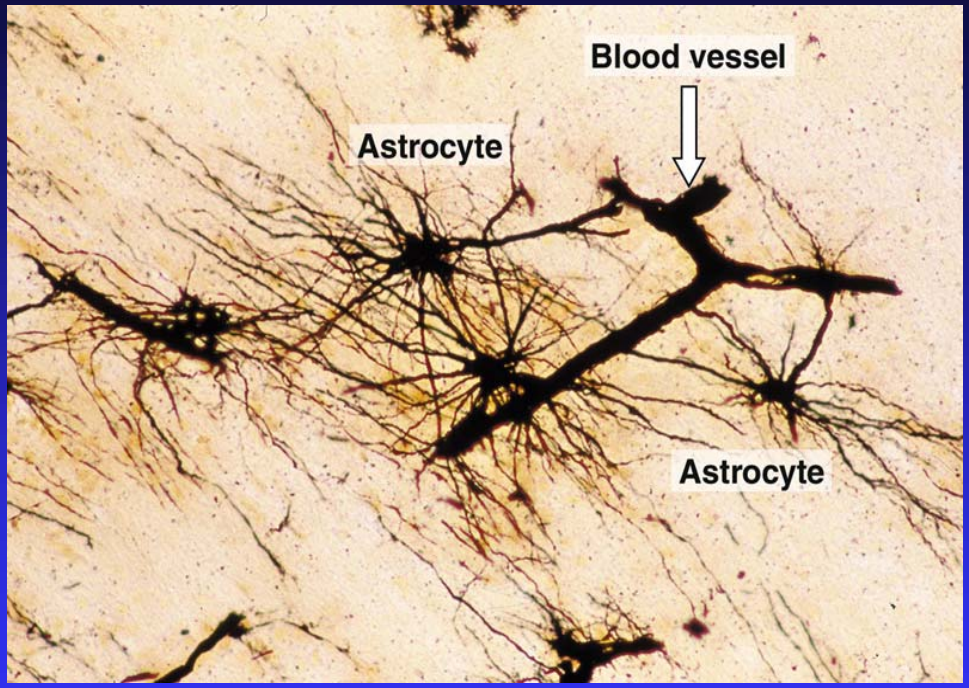
- **The morphologic structure:**

  fibrous astrocyte (the most in white matter),

  protoplasmic astrocyte (the most in gray matter),

  glial filament

  glial fibrillary acidic protein, GFAP



astrocyte (LM)

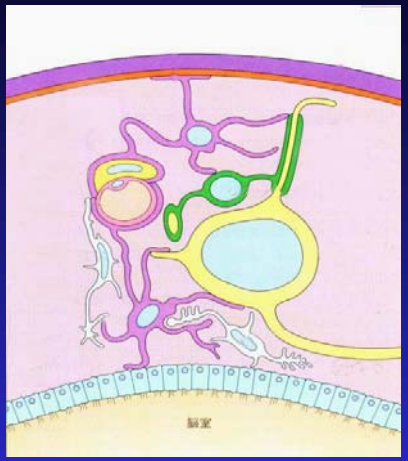
end feet, glia limitans

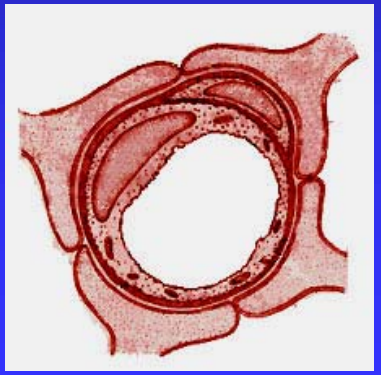
Function:

① to **form blood-brain barrier**

② to **produce the neurotrophic factors (NGF)**

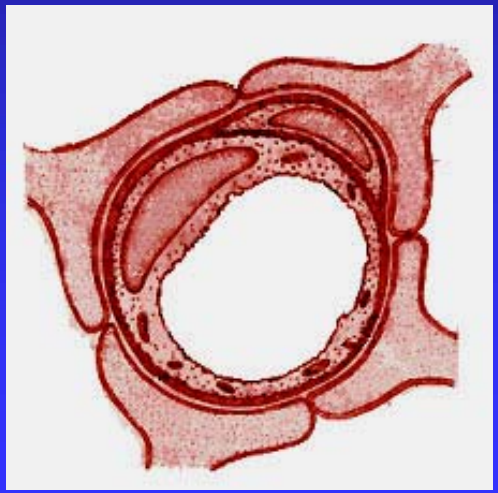
③to **repair never tissue after the damage**





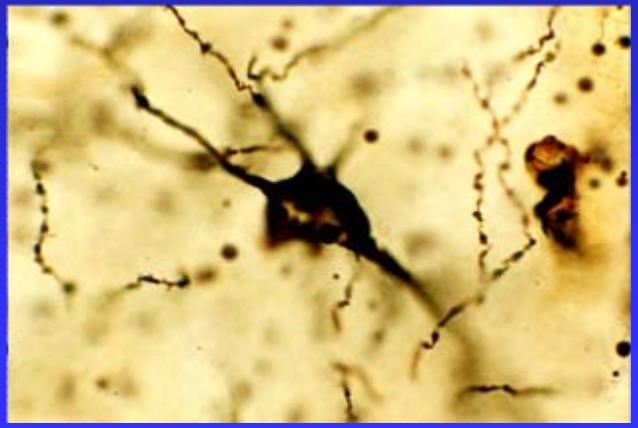
blood brain barrier(BBB):

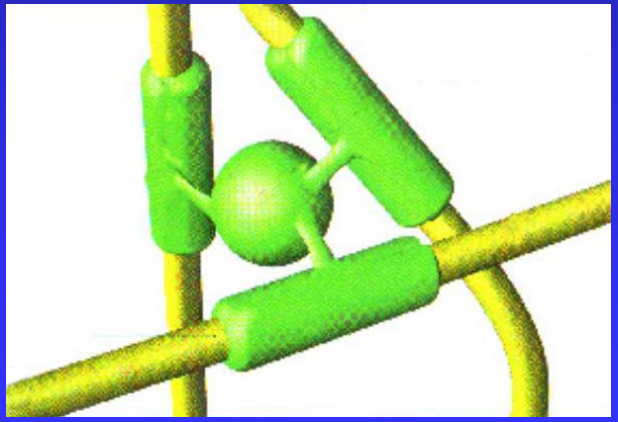
- *continuous capillary, tight junction
- *basement membrane
- *neuroglial membrane



(2) oligodendrocyte

- the morphologic structure:
- function: forming myelin sheath of CNS





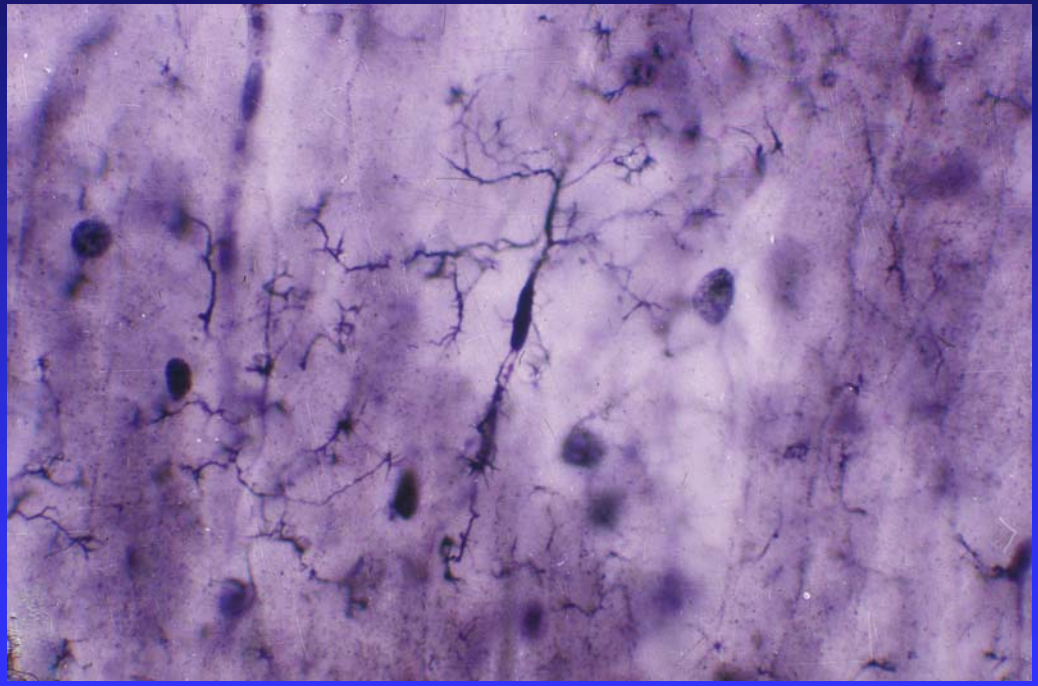
(3) microglia

- The morphologic structure:
- function: macrophagic activity, derived from monocyte of blood

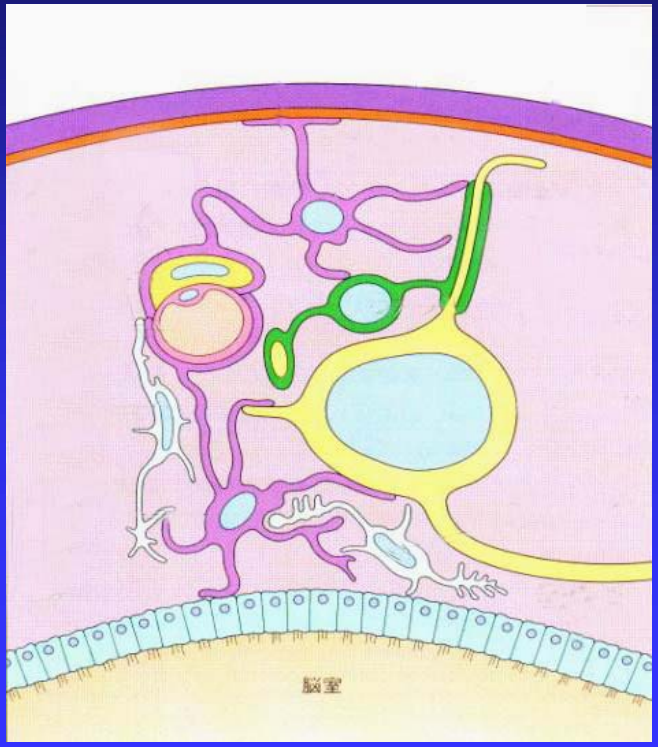
(4) ependymal cells

- the distribution: lining cavities of central nervous system
- the structure:
- function: transport

Microglial



Ependymal cells



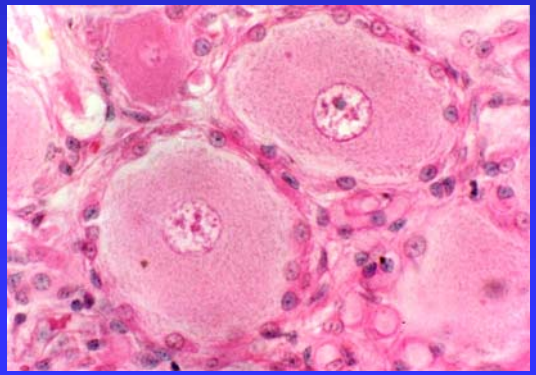
(2) glial cells of peripheral nerve system

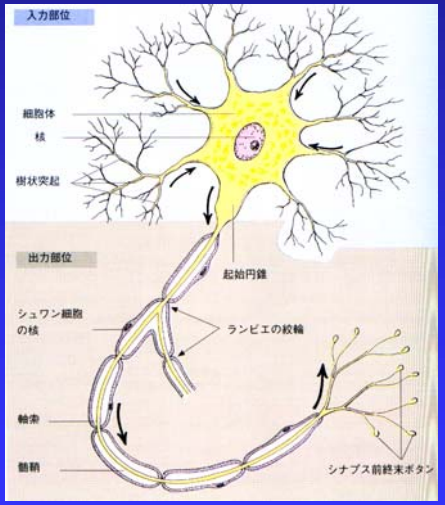
(1) schwann cell :

to repair never tissue after the damage

producing NGF

(2) satellite cell:





Ⅳ Nerve fiber and peripheral nerve

1. nerve fiber

being composed of long axon or dendrite of neuron enveloped by glial cells

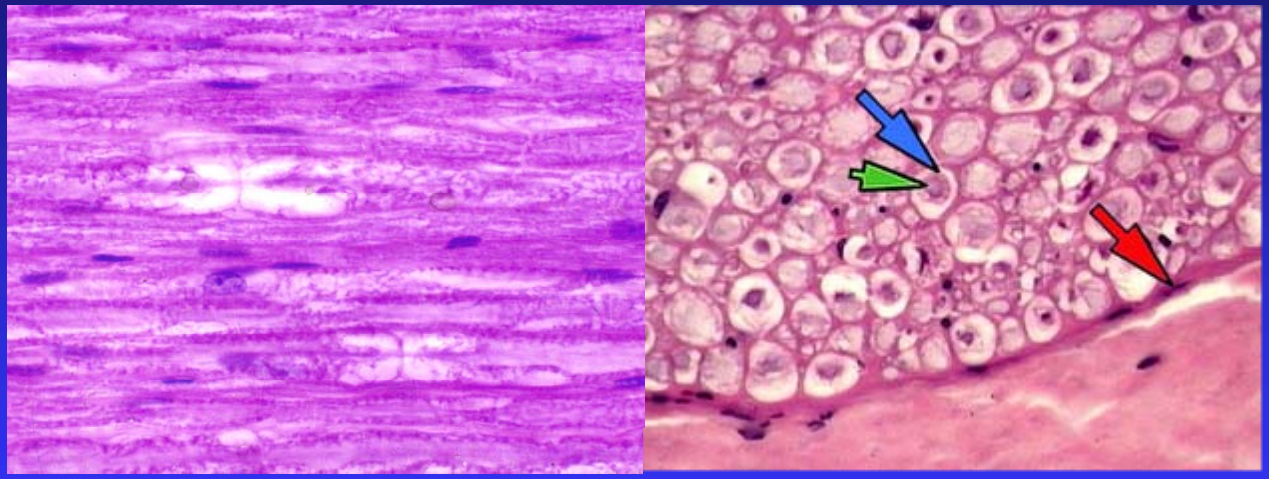
1.1 myelinated nerve fiber

(1) myelinated nerve fiber of PNS

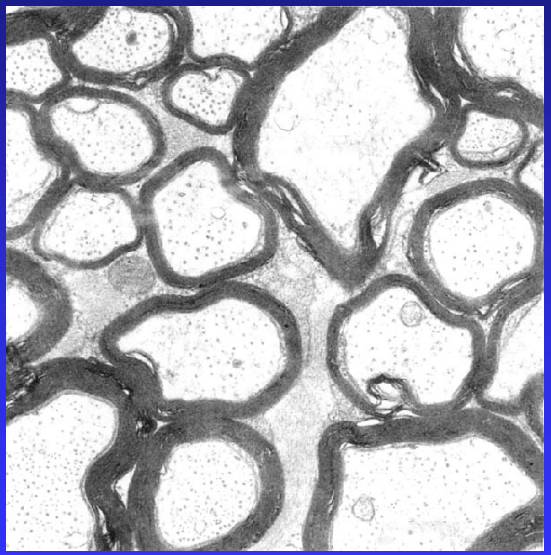
the structure:

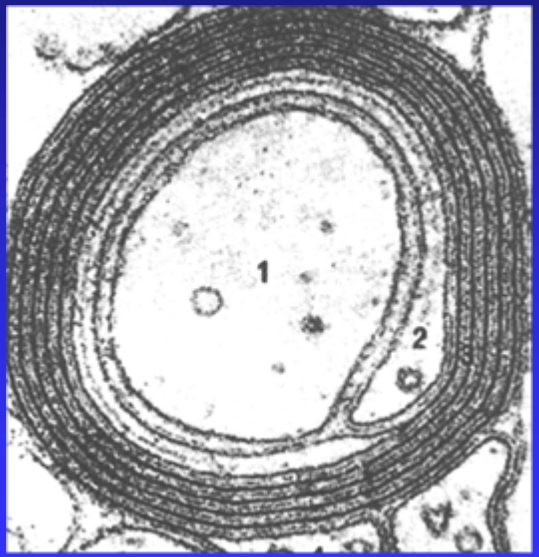
Ranvier node, internode,

Myelinated nerve fiber (LM)

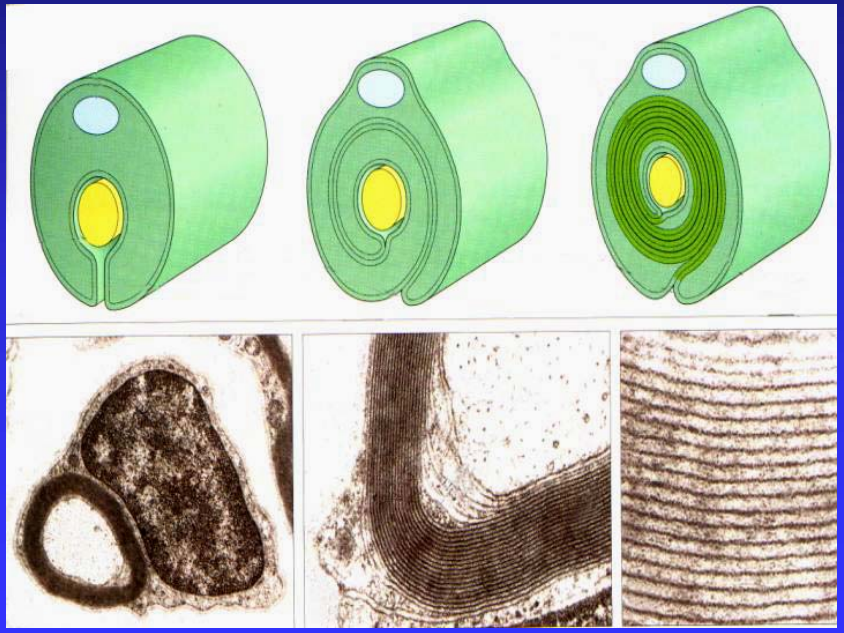


myelinated nerve fiber (TEM)

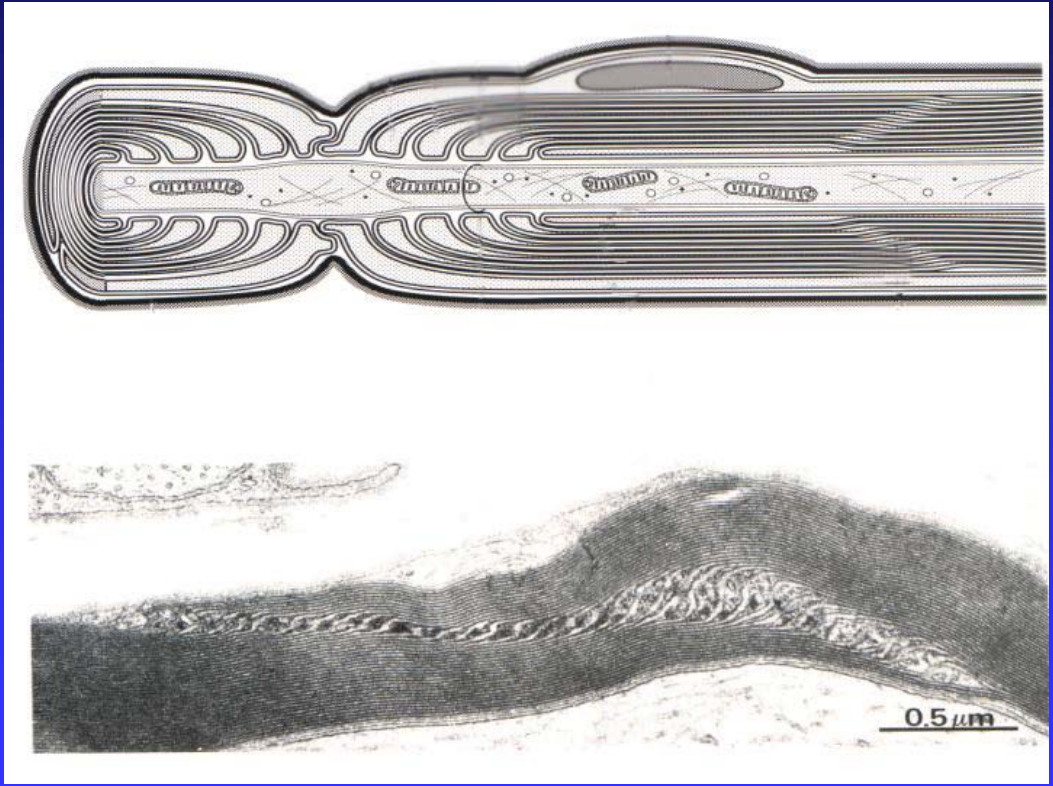




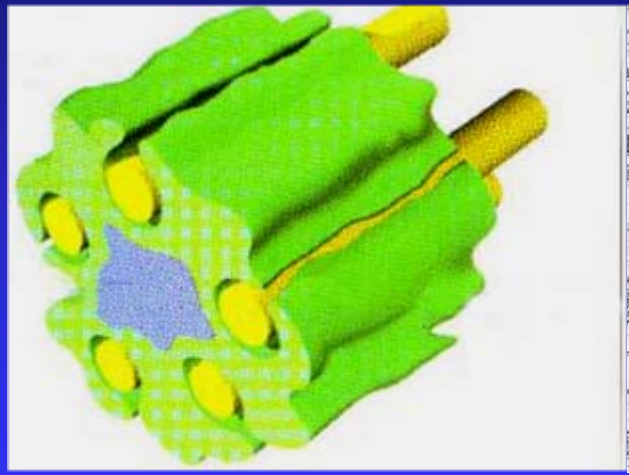
- **Formation of myelin sheath of PNS: incisure of myelin**

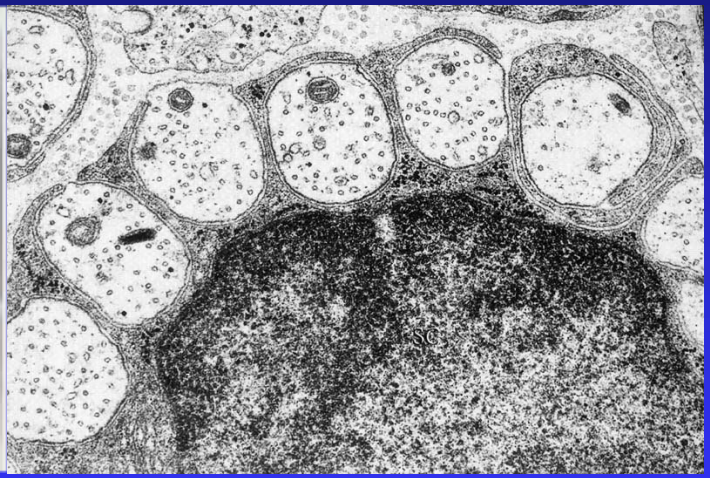


Incisure of myelin



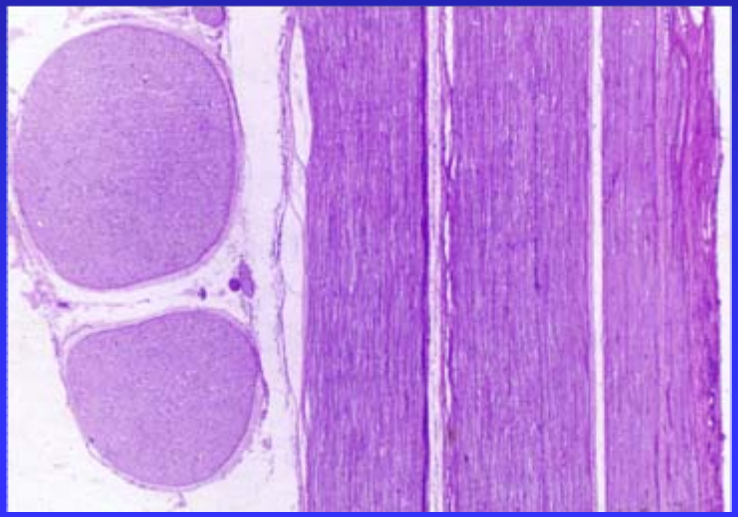
1.2 Unmyelinated nerve fiber





2. Peripheral Nerve

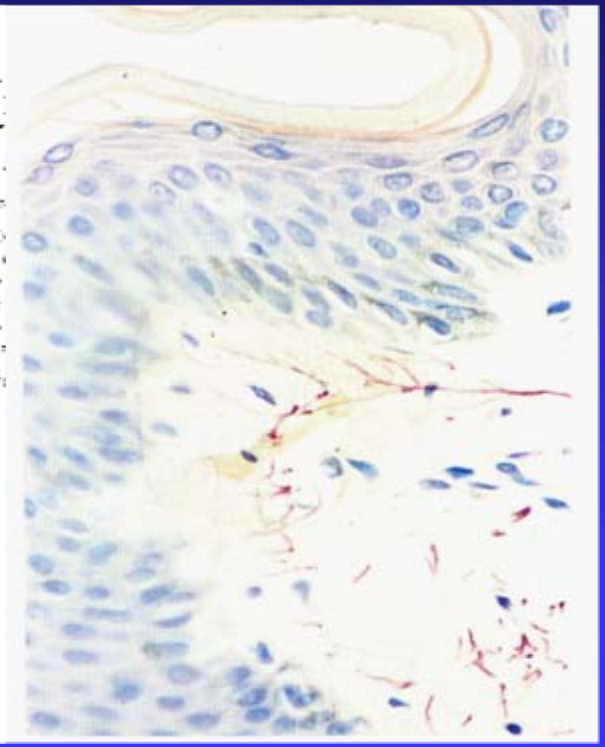
- Epineurium
- Perineurium
- Endoneurium



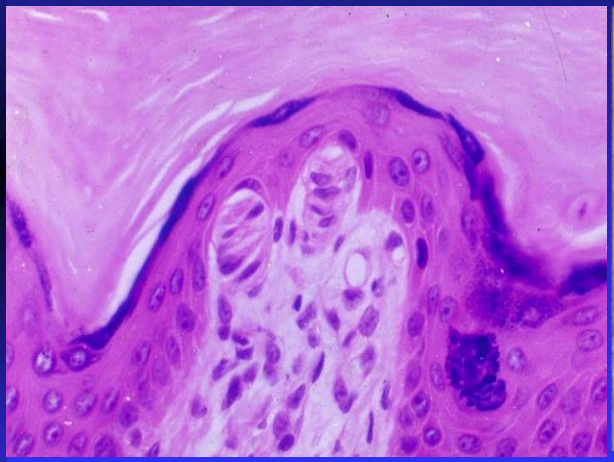
Ⅴ Nerve ending

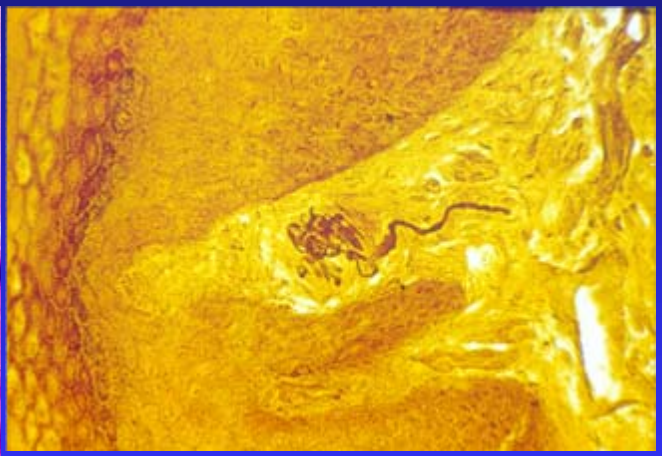
1. sensory nerve ending
   receptor
   (1) free nerve ending
   (2) encapsulated nerve ending
      tactile corpuscle
      lamellar corpuscle
      muscle spindle
2. motor nerve ending
   effector

Free nerve ending

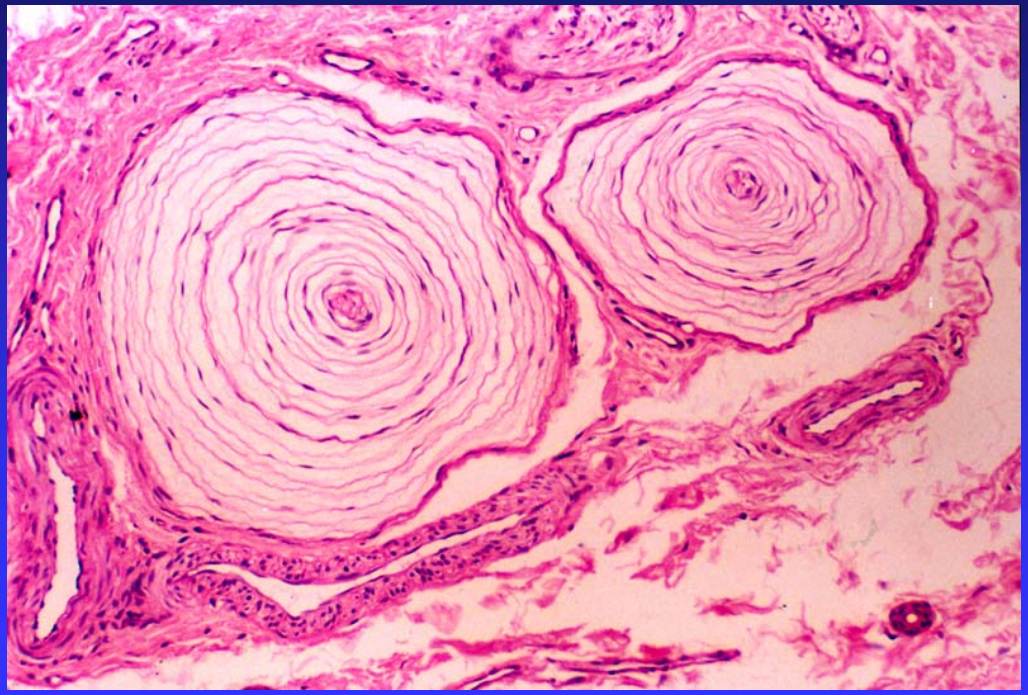


Tactile corpuscle





Lamellar corpuscle

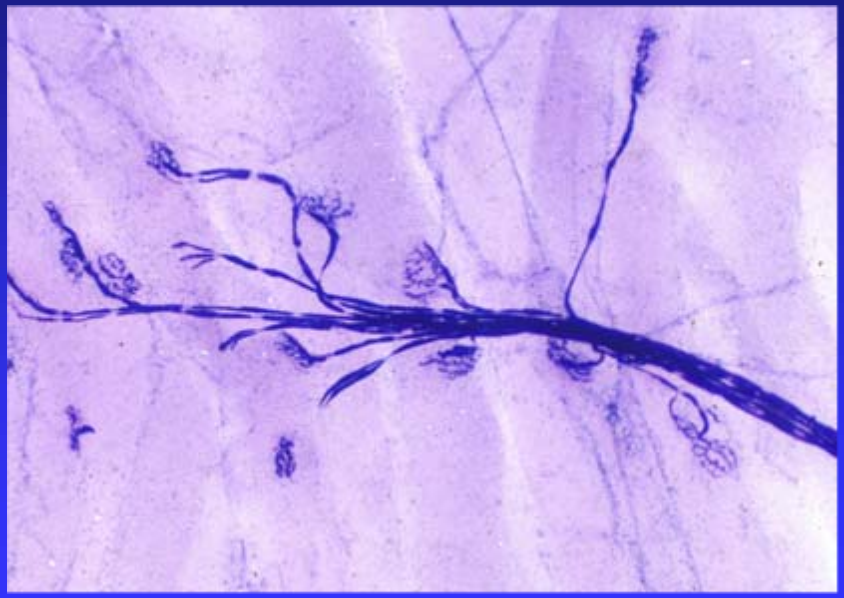


(1) somatic motor nerve ending

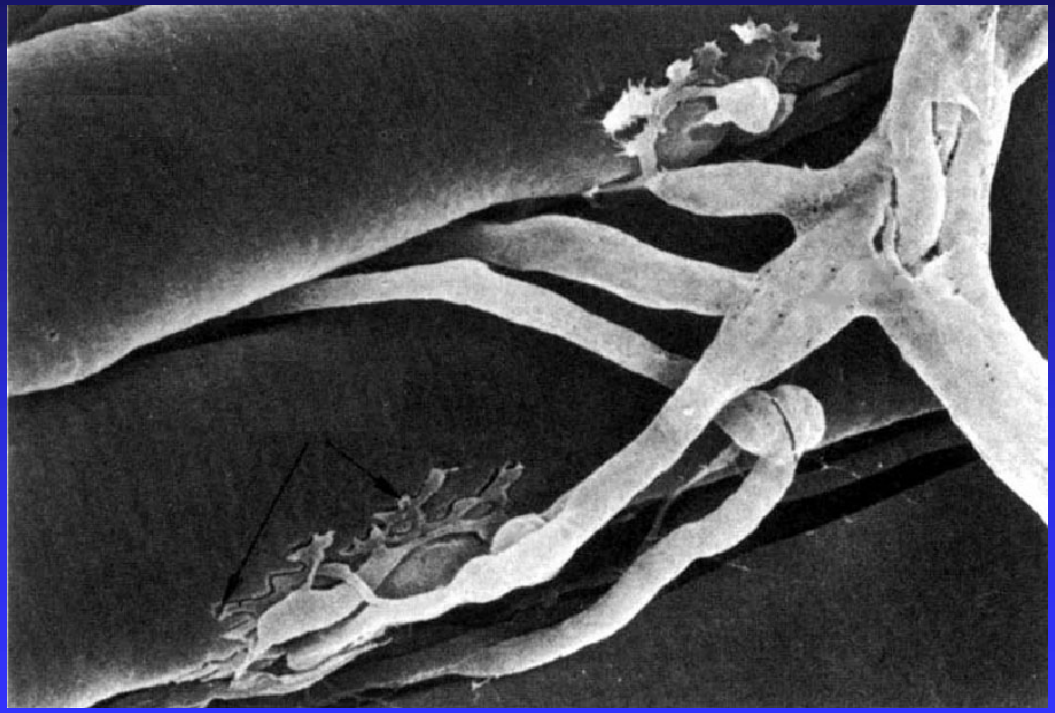
motor end plate

LM:

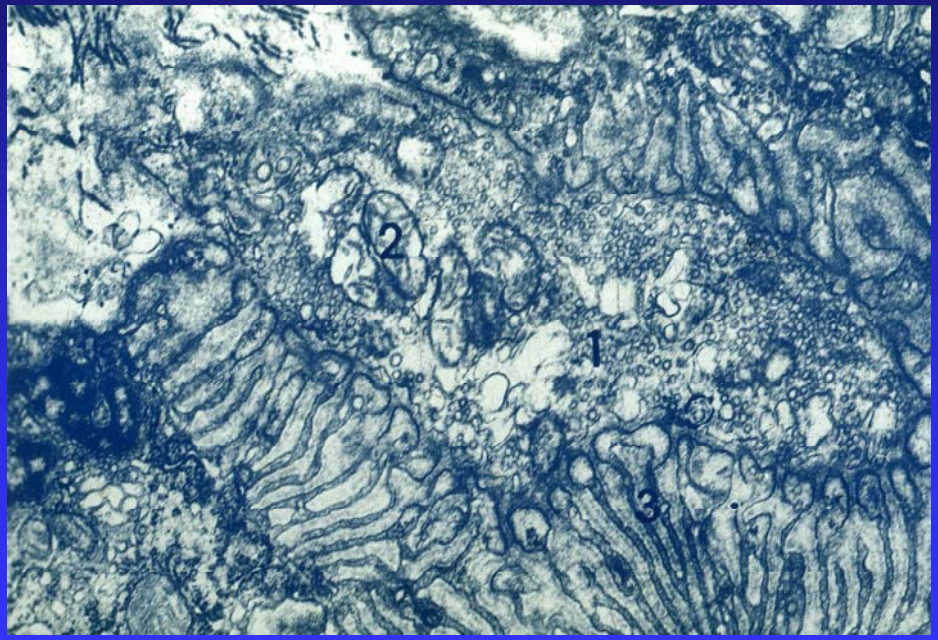
EM:



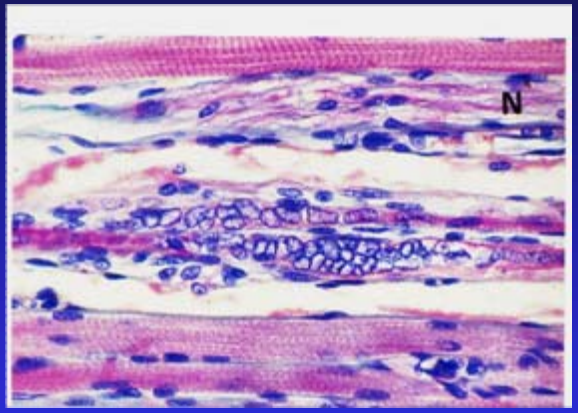
Motor end plate (SEM)

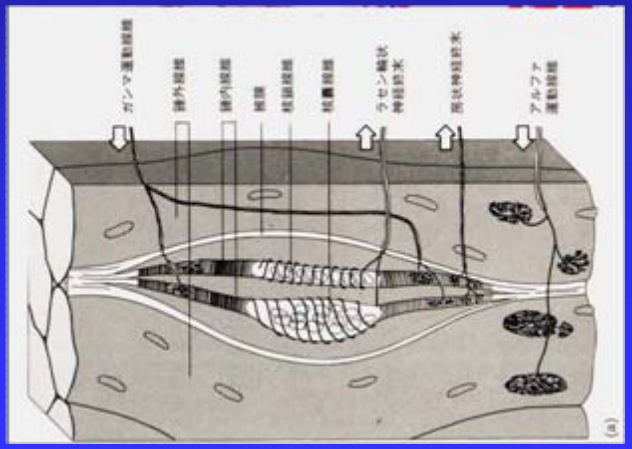


Motor end plate(TEM)

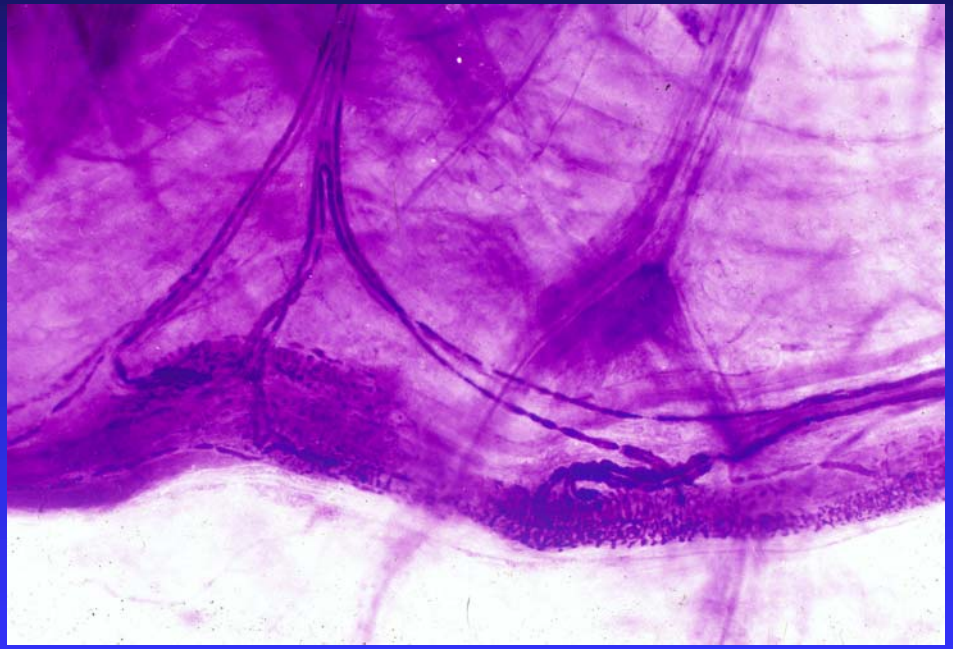


muscle spindle



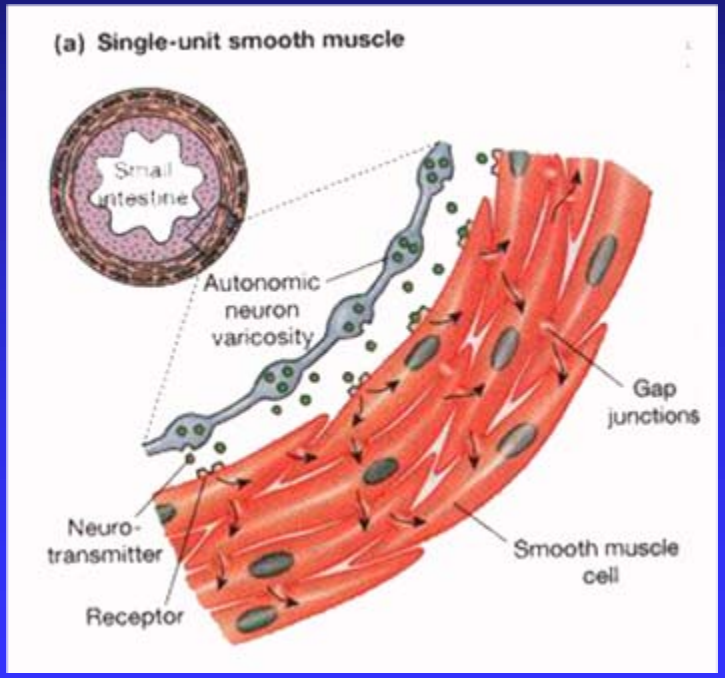


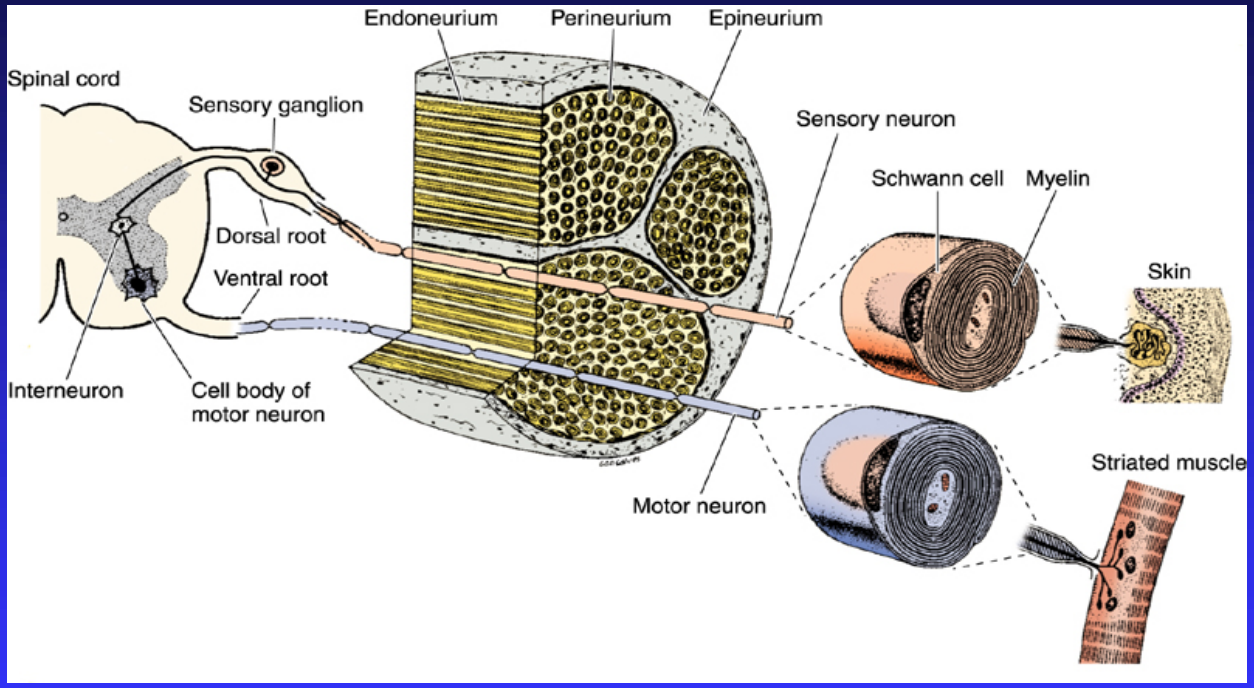
Muscle spindle



Visceral motor nerve ending

- varicosity




Endoneurium
Perineurium
Epineurium
Spinal cord
Sensory ganglion
Sensory neuron
Schwann cell
Myelin
Dorsal root
Ventral root
Skin
Interneuron
Cell body of
motor neuron
Striated muscle
Motor neuron