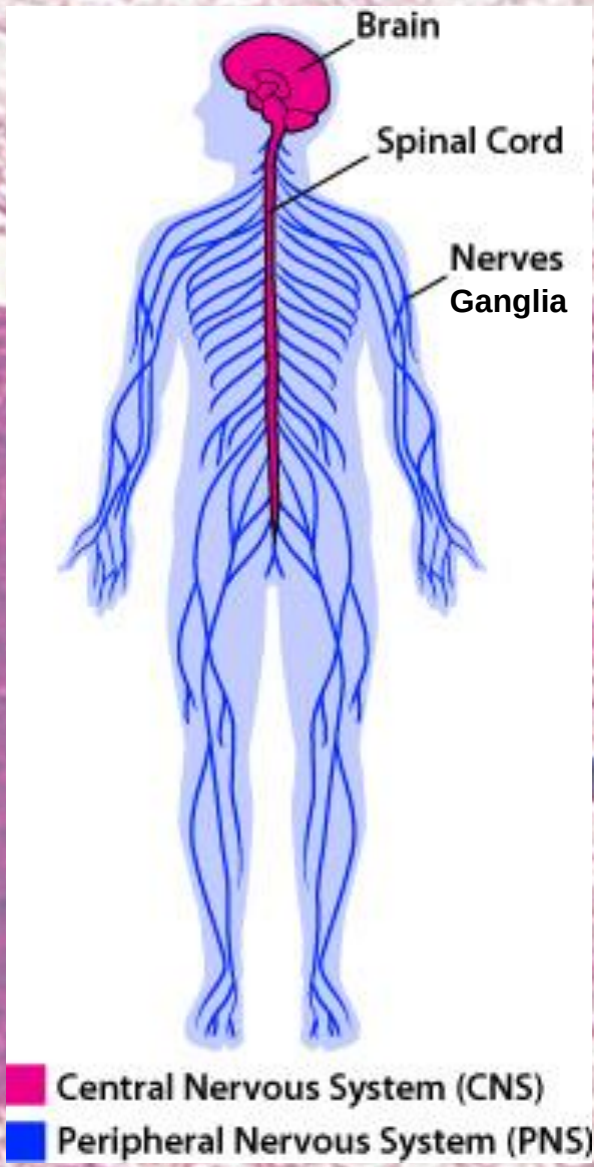
Tecido Nervoso

- **Objetivos da aula**: os estudantes deverão ser capazes de....
  - **relacionar** os constituintes do tecido nervoso (neurônios e células da glia)
  - **descrever** a estrutura e função do tecido nervoso e seus constituintes
  - **descrever** a organização de seus componentes do tecido no Sistema Nervoso Central (cérebro e medula) e Sistema Nervoso Periférico (gânglios e nervos)
  - **identificar** e **reconhecer** as diferentes estruturas do tecido nervoso

Tecido Nervoso

- O que o caracteriza?
- O que faz?
- Onde tem?
- De que é constituído?



https://www.youtube.com/watch?v=yy994HpFudc

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https://www.youtube.com/watch?v=Py9ob0lSovM

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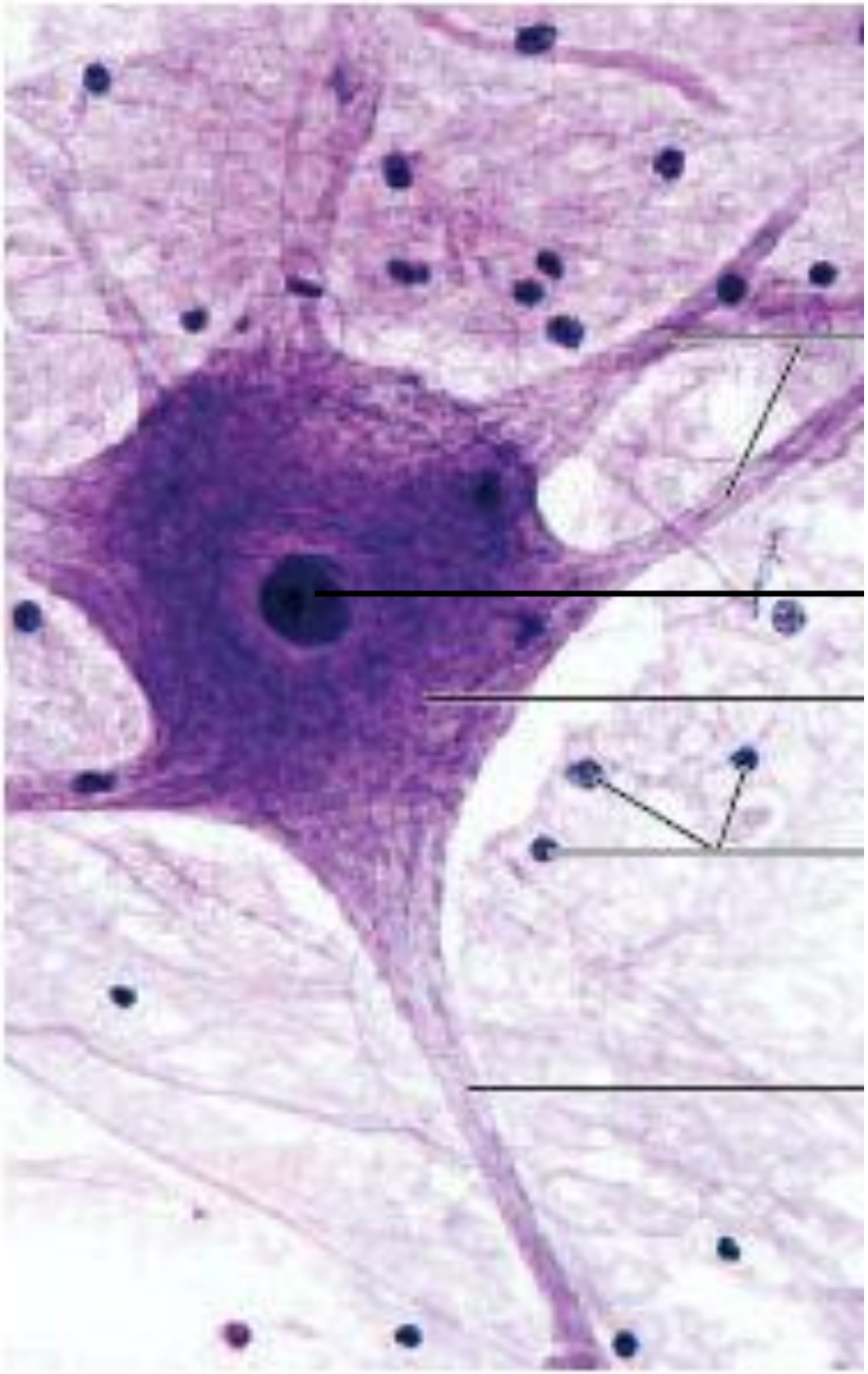
https://www.youtube.com/watch?v=8NA_o1jOjsQ



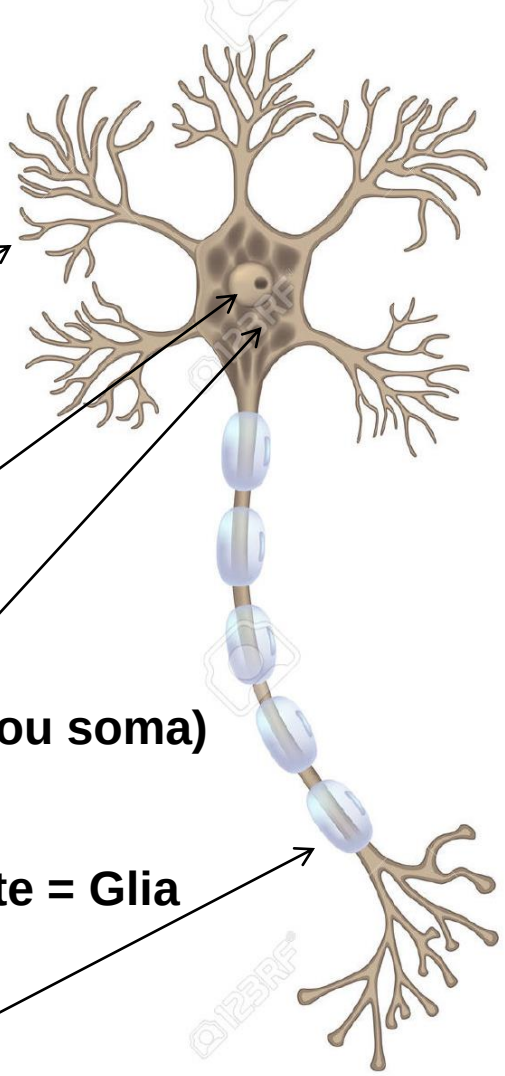
3. dendritos

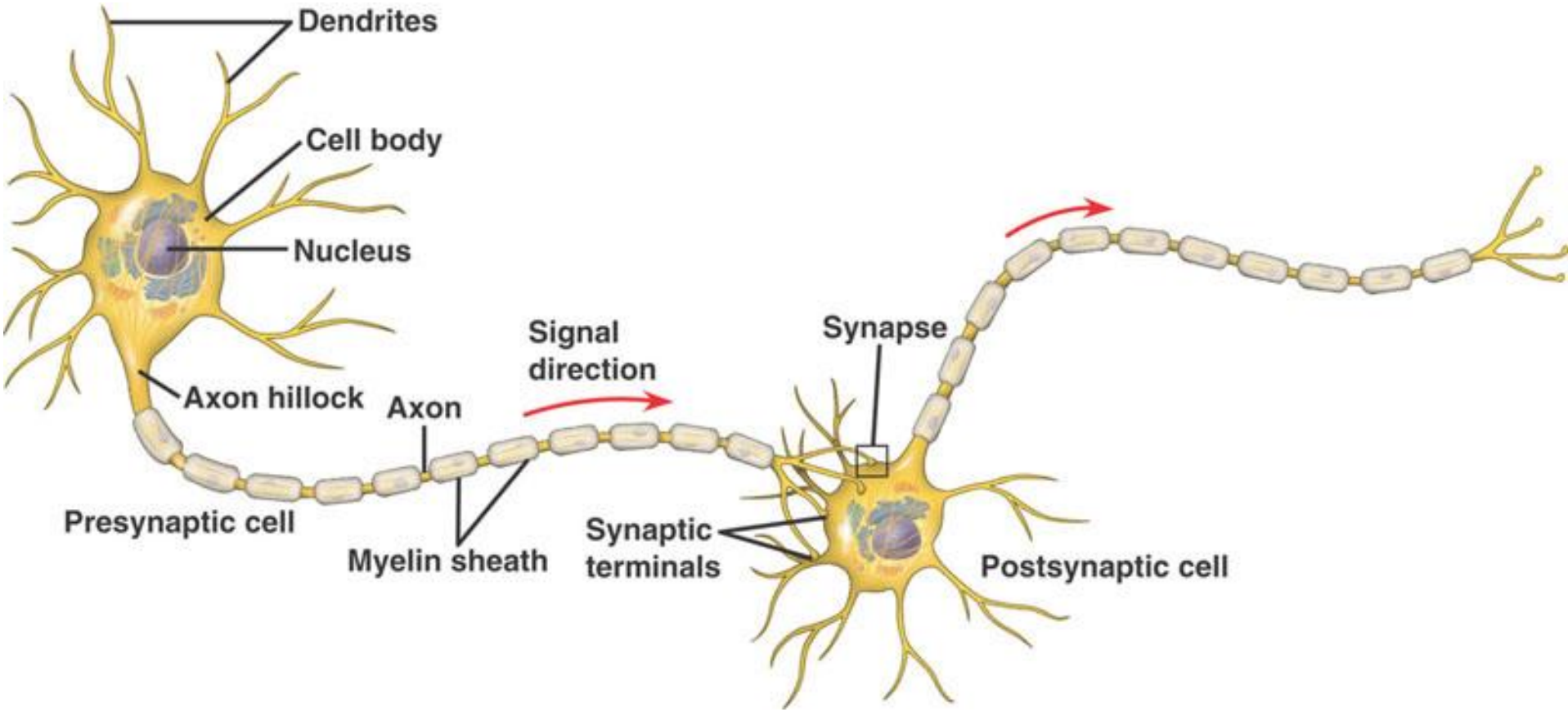
2. núcleo

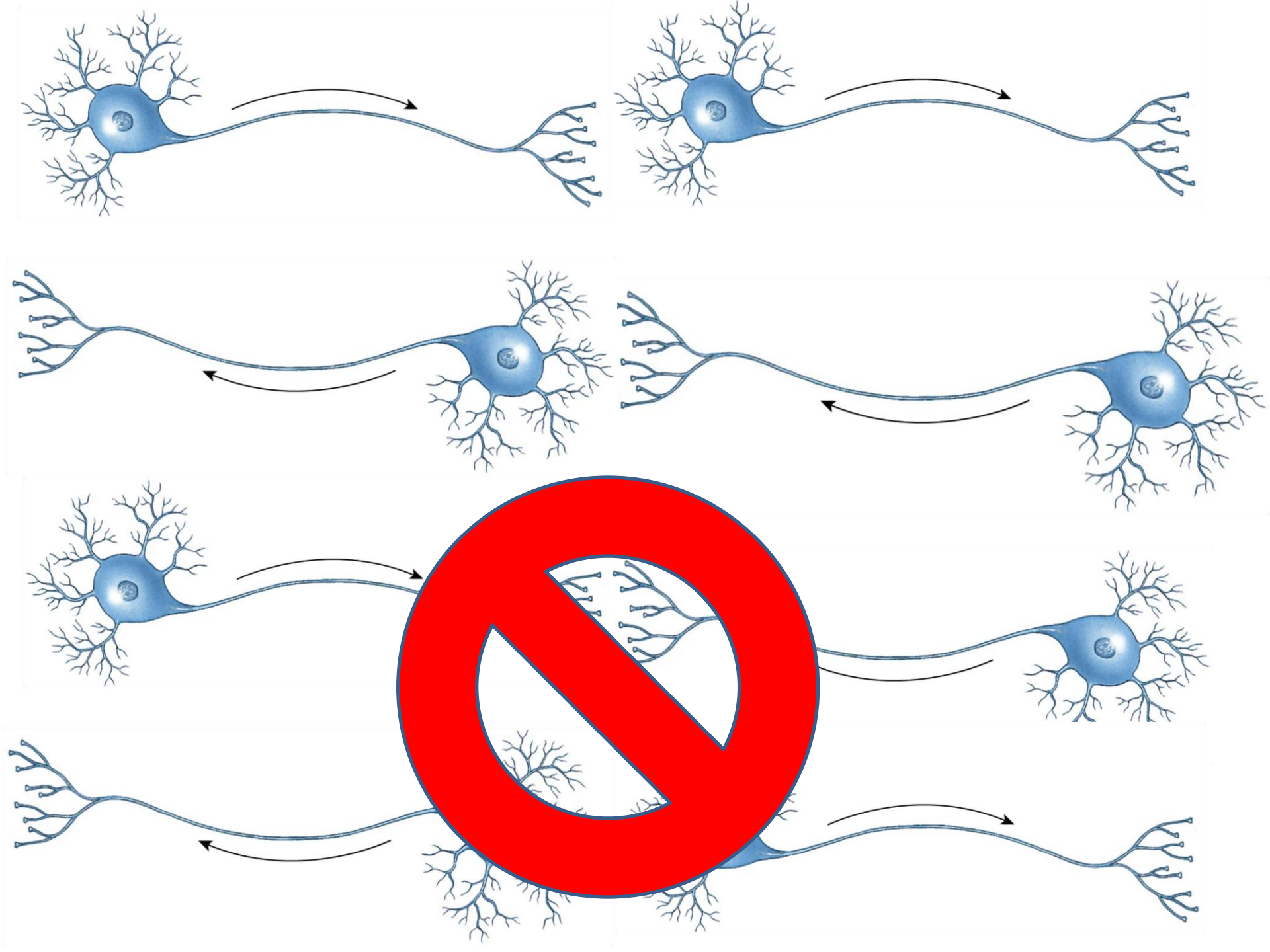
1. corpo (pericário ou soma)

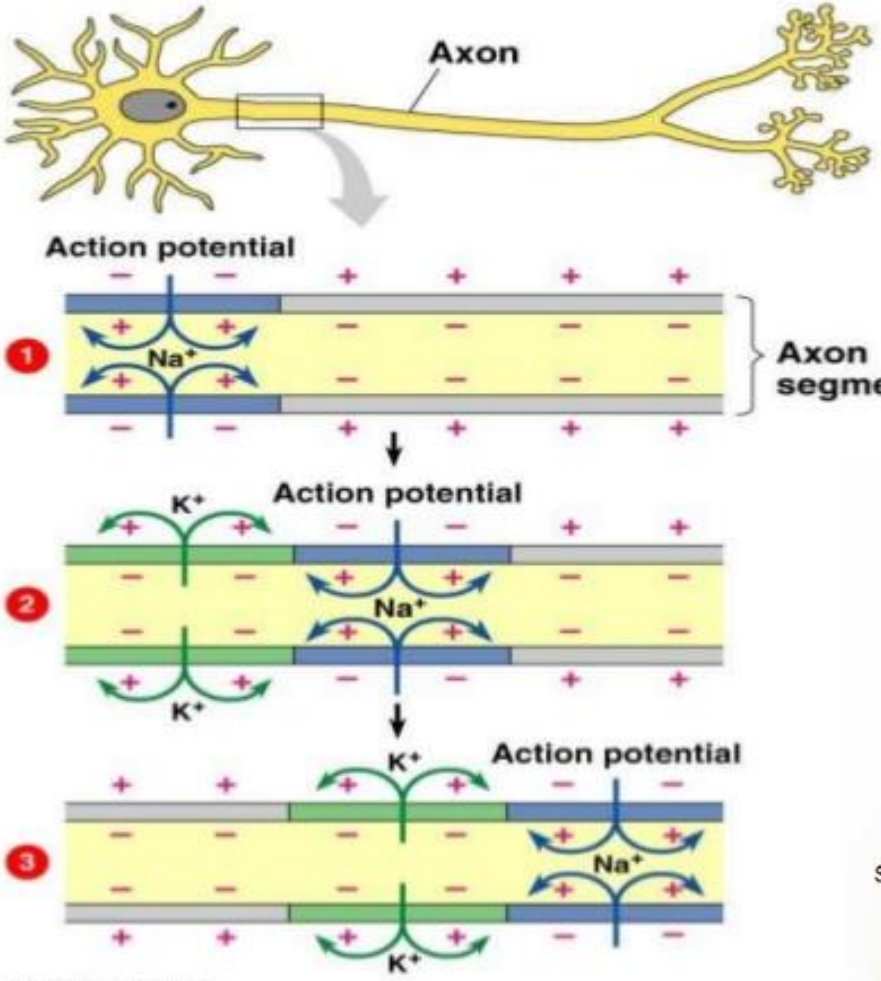
5. células de suporte = Glia

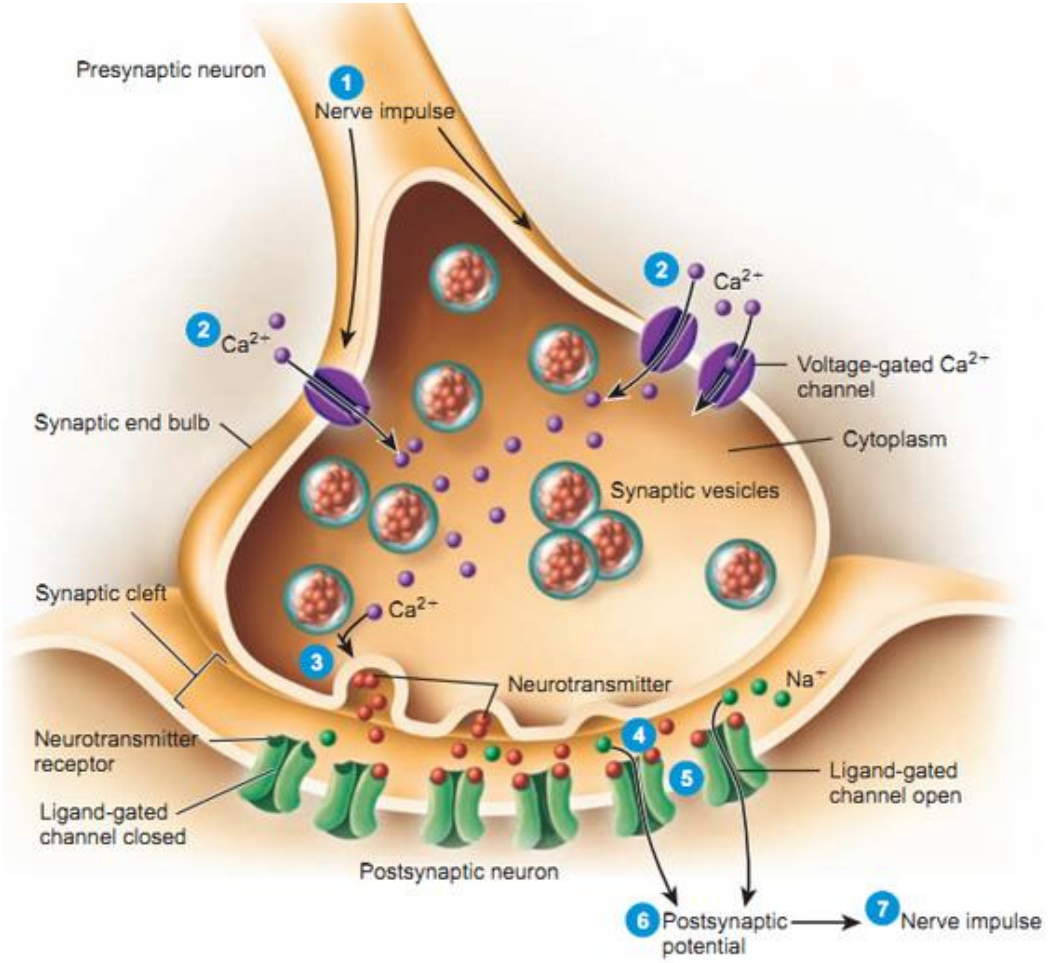
4. axônio



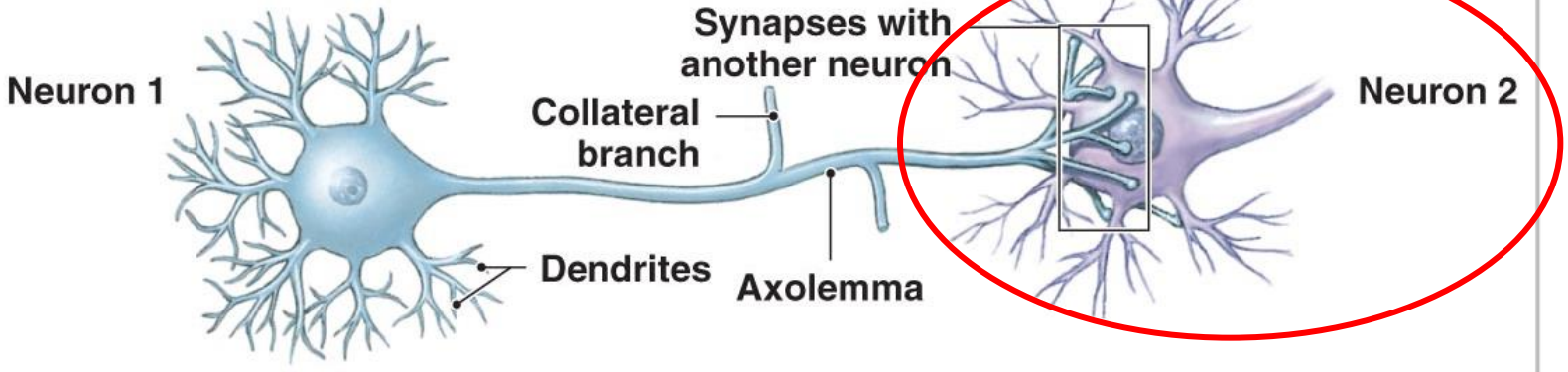

Dendrites
Cell body
Nucleus
Axon hillock
Axon
Signal direction
Synapse
Presynaptic cell
Myelin sheath
Synaptic terminals
Postsynaptic cell



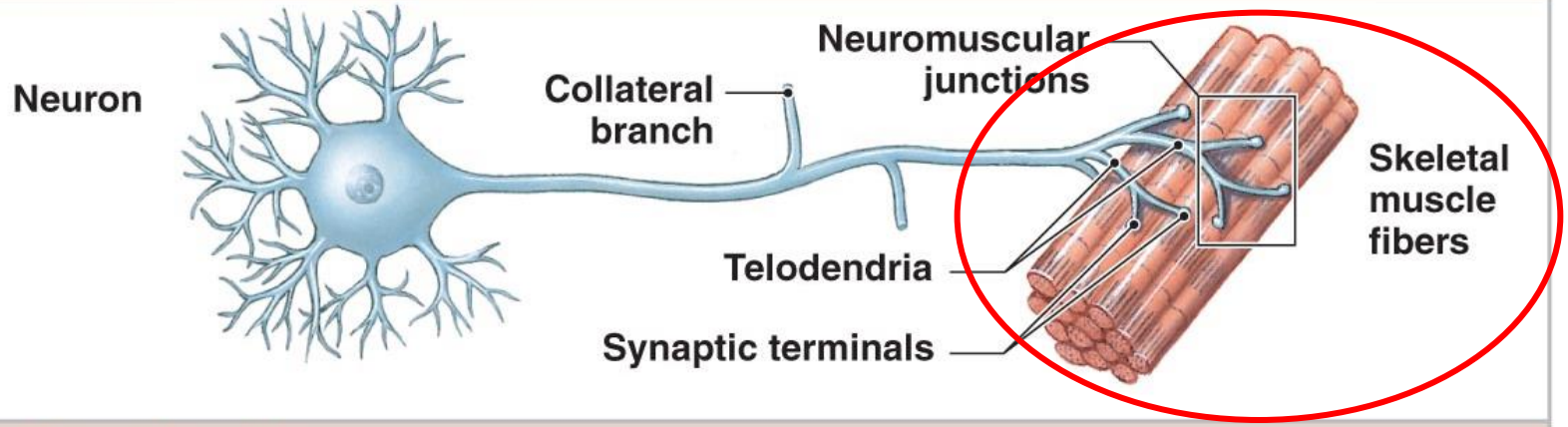

Axon
Action potential
Na+
Axon segment
K+
Action potential
Na+
K+
K+
Action potential
Na+
K+
©Addison Wesley Longman, Inc.


Presynaptic neuron
1
Nerve impulse
2
Ca2+
2
Ca2+
Voltage-gated Ca2+ channel
Synaptic end bulb
Cytoplasm
Synaptic vesicles
Synaptic cleft
Ca2+
3
Neurotransmitter
Na+
Neurotransmitter receptor
4
5
Ligand-gated channel open
Ligand-gated channel closed
Postsynaptic neuron
6
Postsynaptic potential
7
Nerve impulse

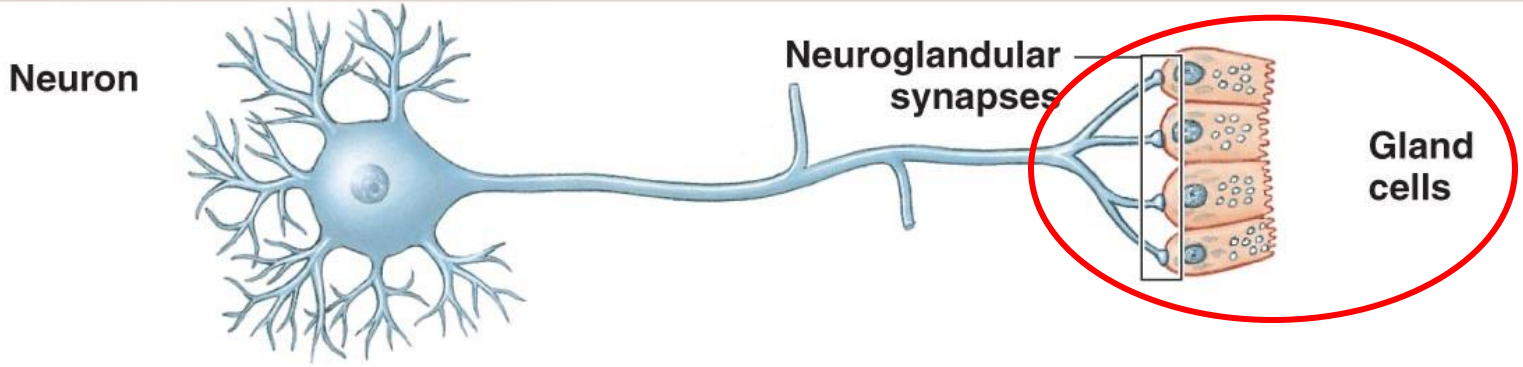
Synapses with another neuron

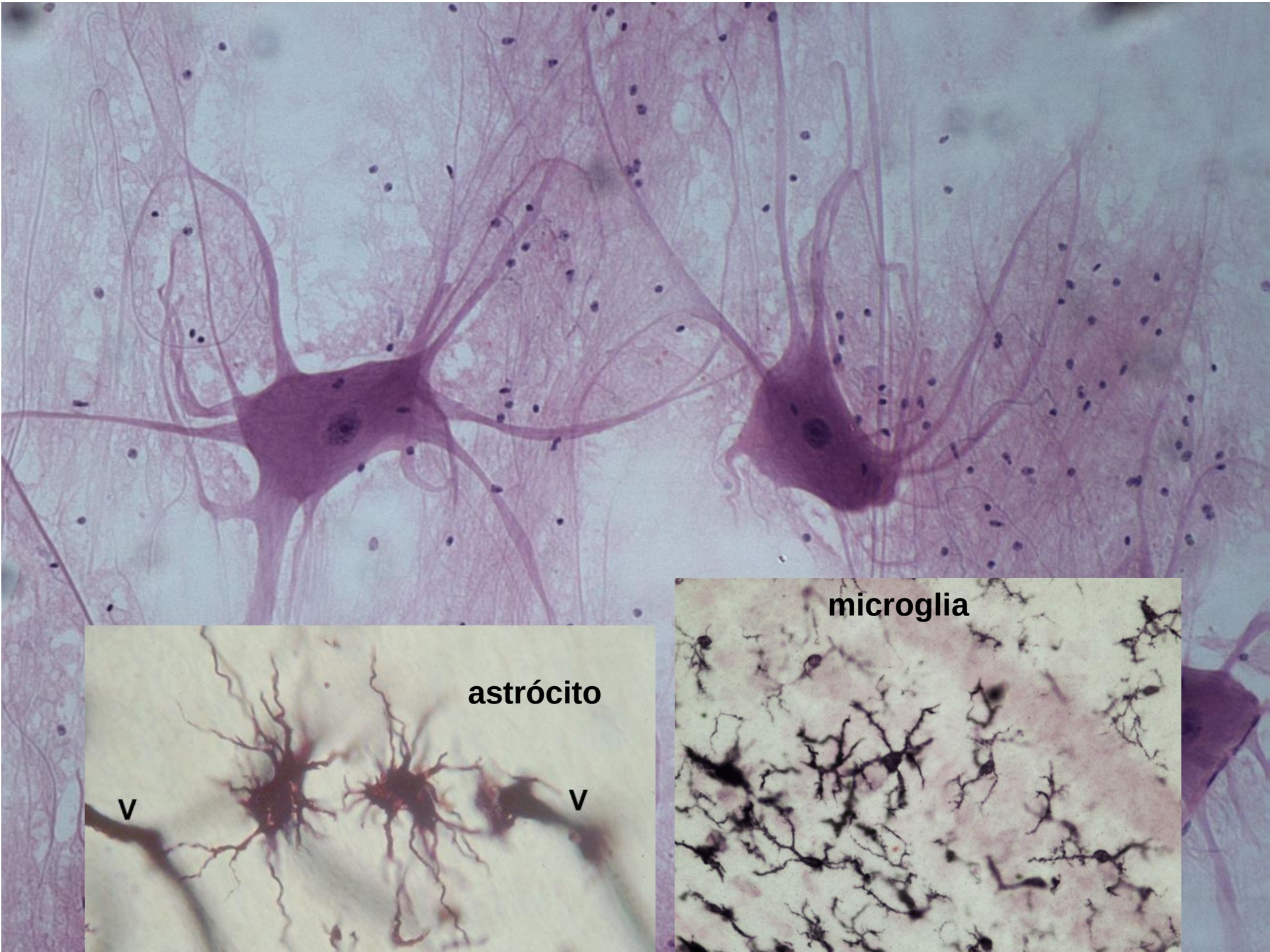


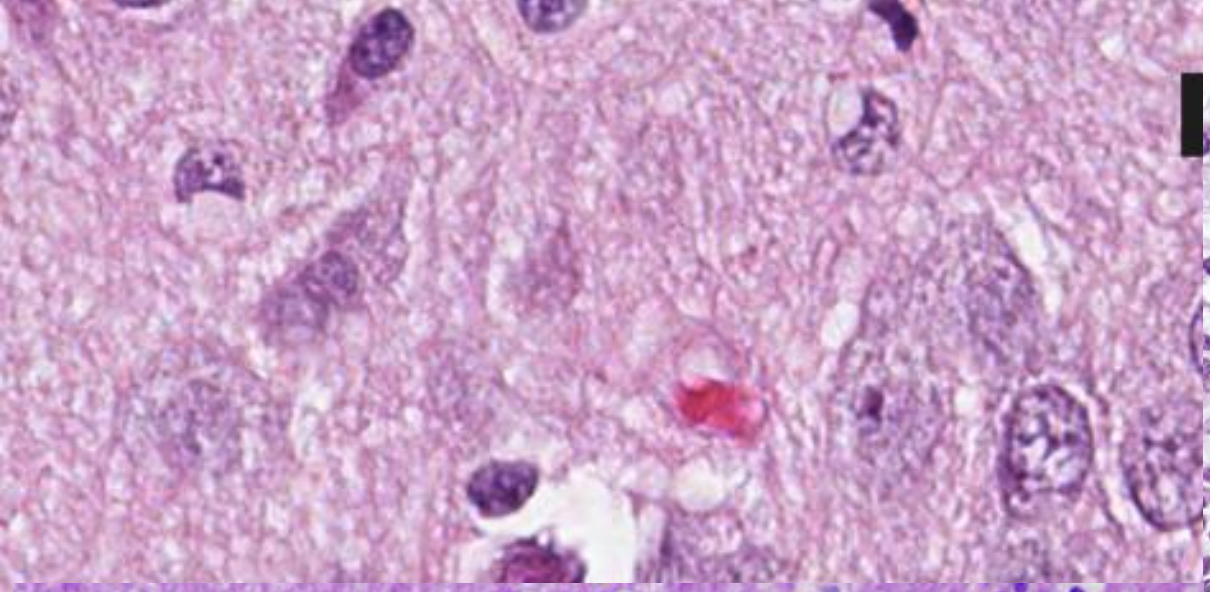
Neuromuscular junctions

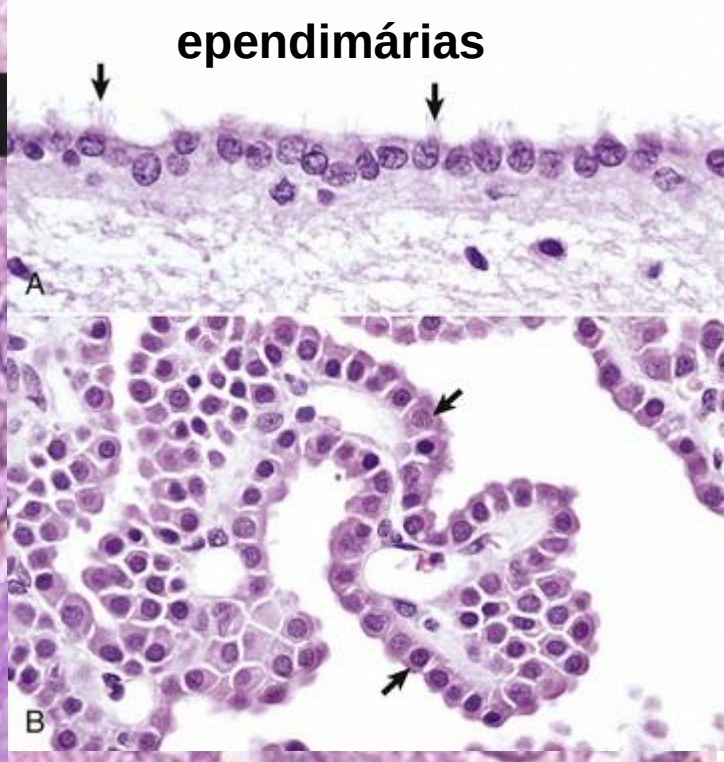


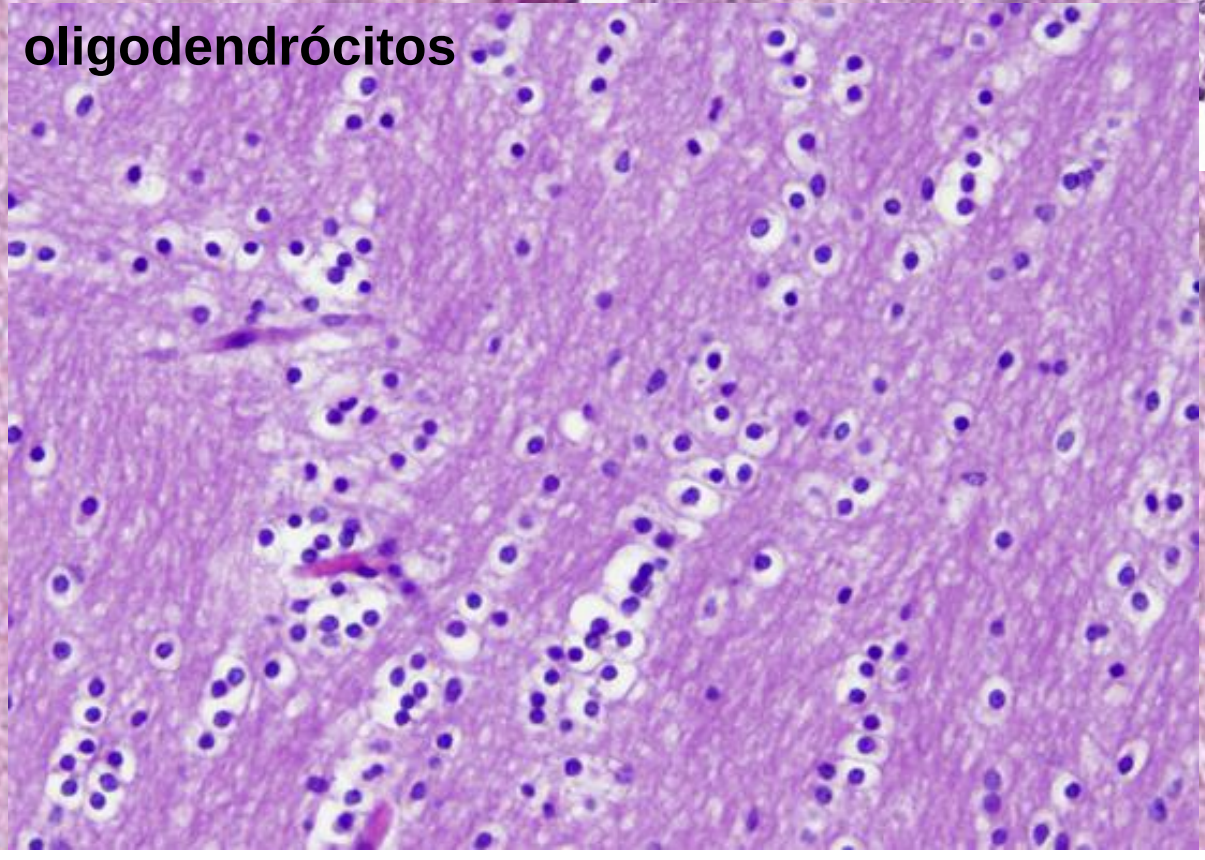
Neuroglandular synapses

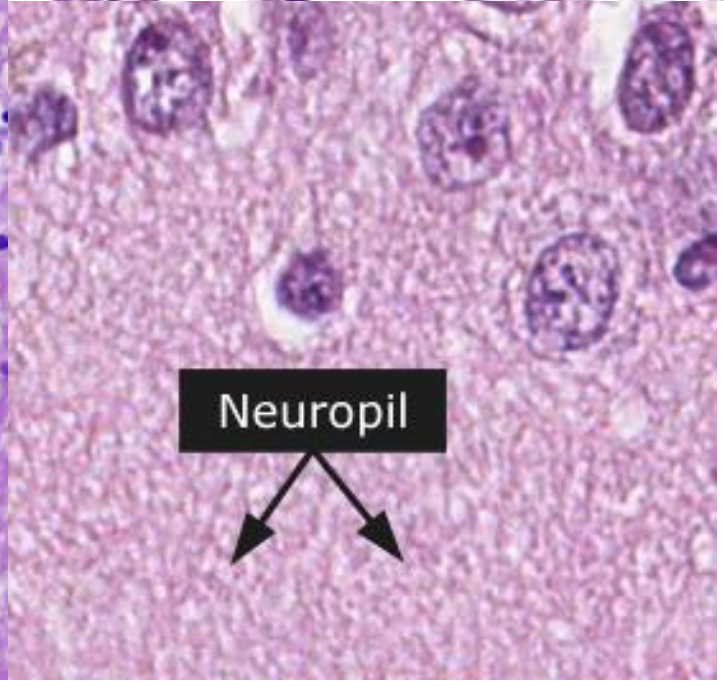


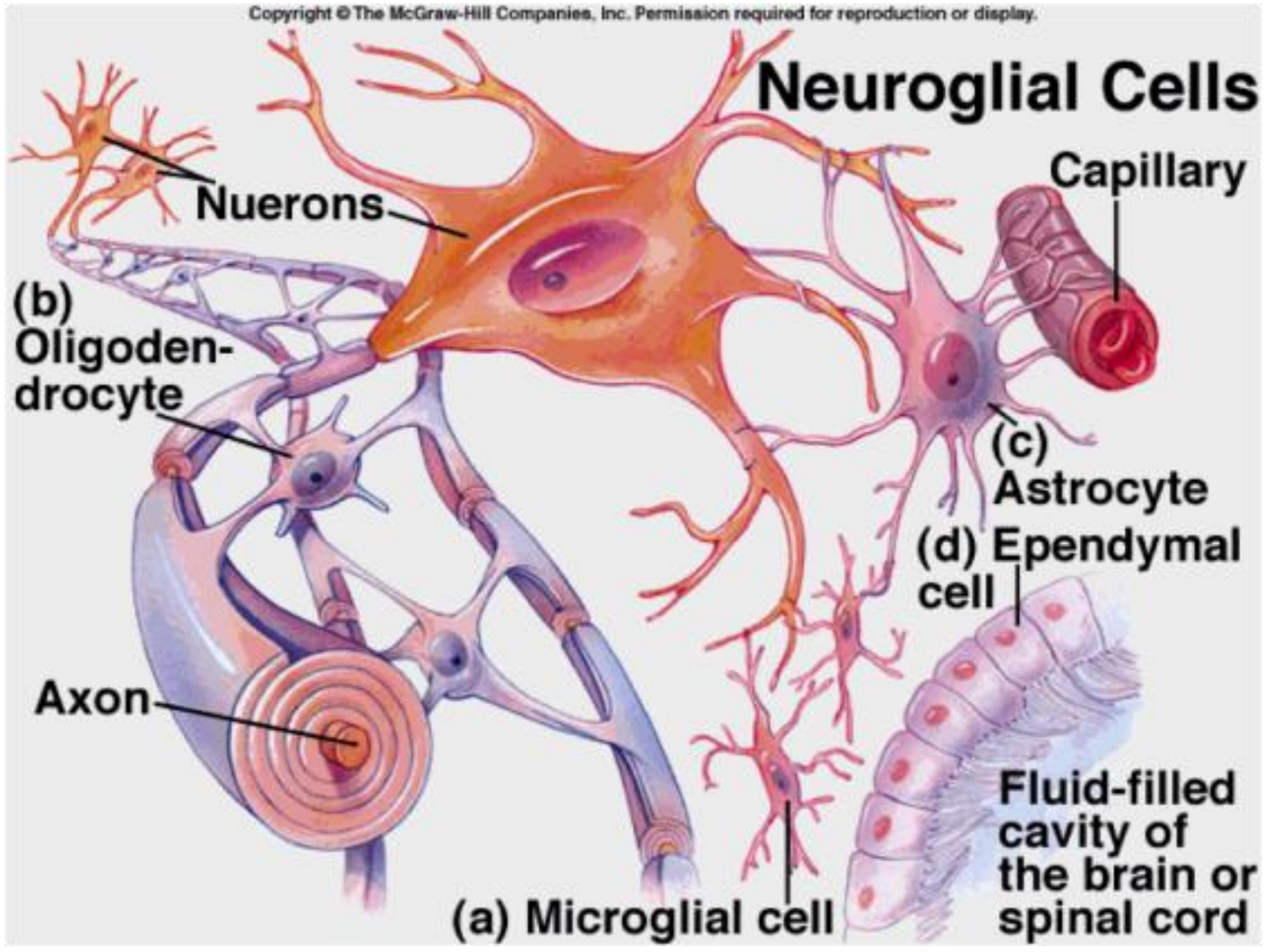

astrócito
v
v
microglia

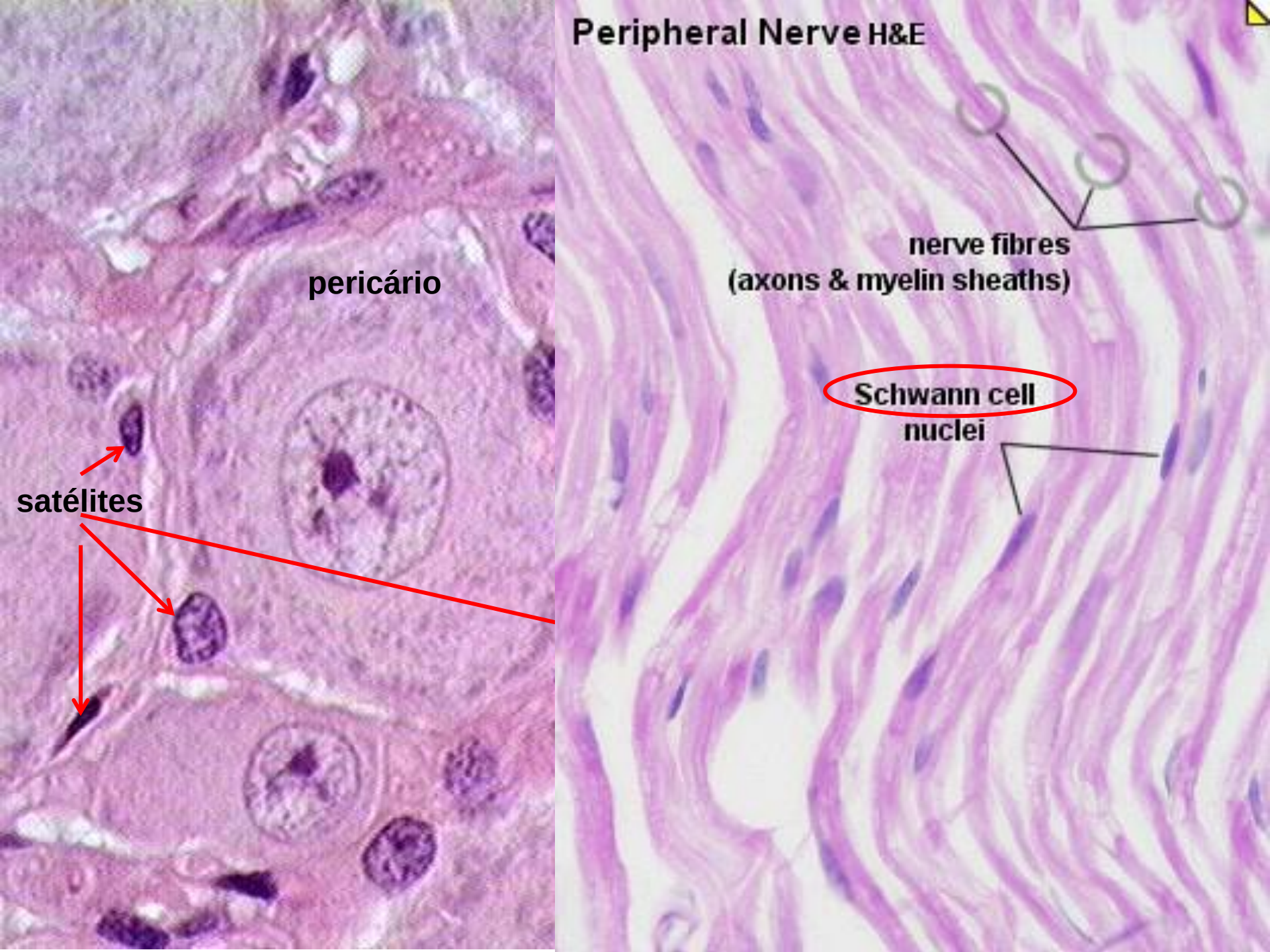


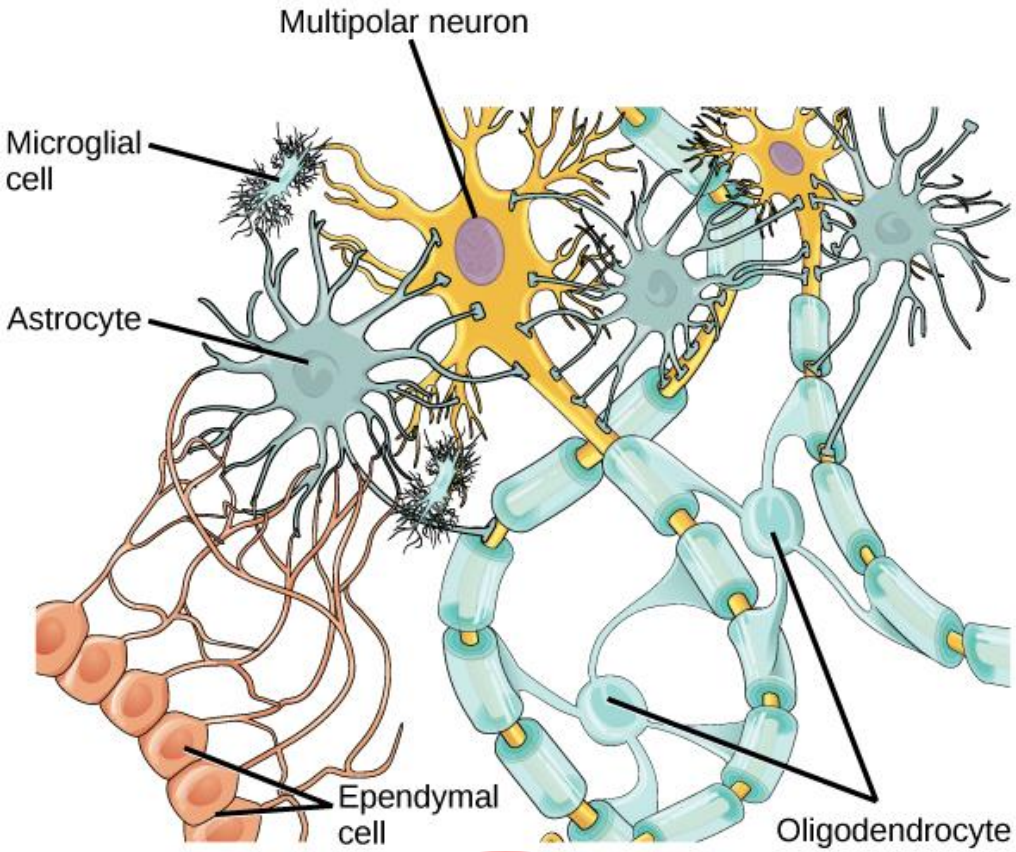

ependimárias
A
B


oligodendrócitos

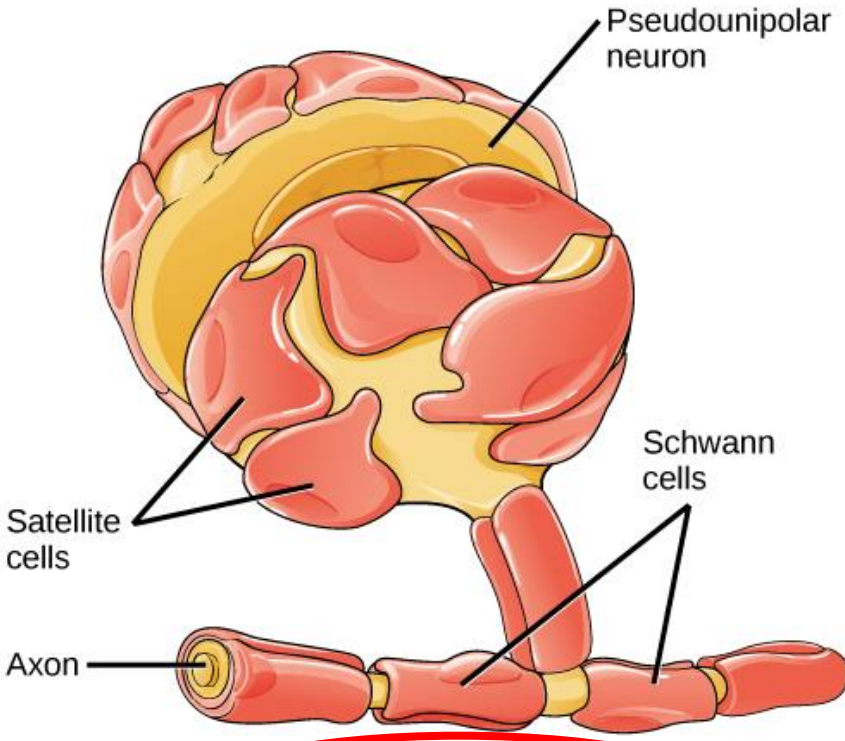

Neuropil




pericário
satélites
Peripheral Nerve H&E
nerve fibres
(axons & myelin sheaths)
Schwann cell
nuclei

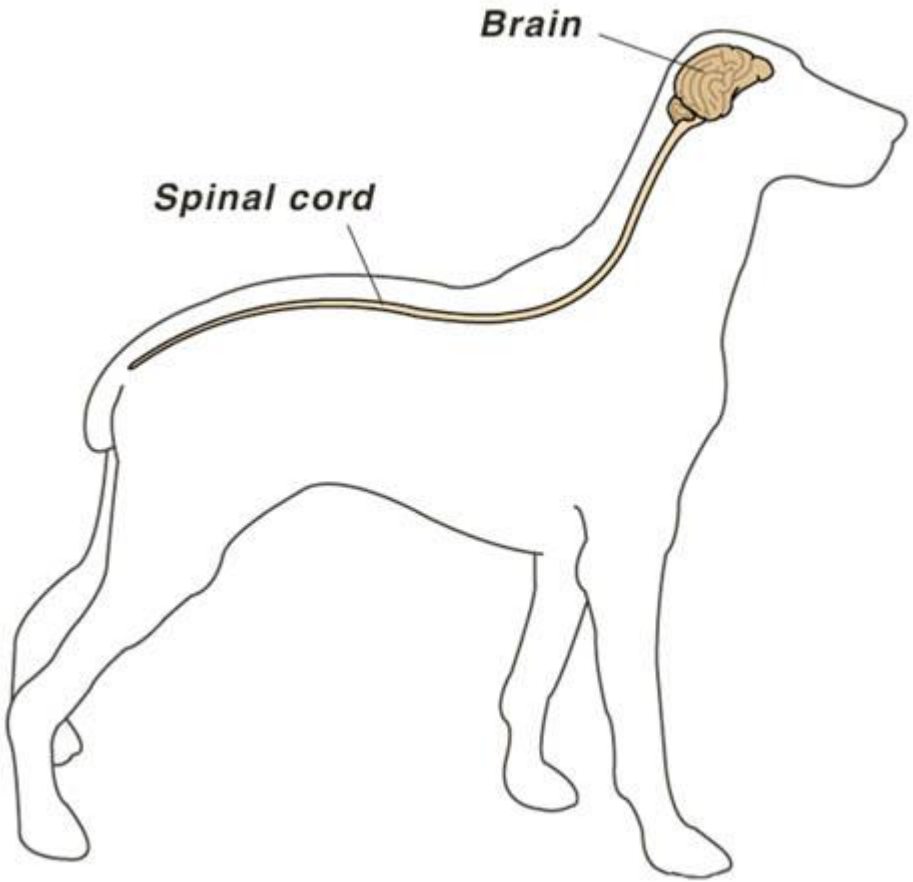


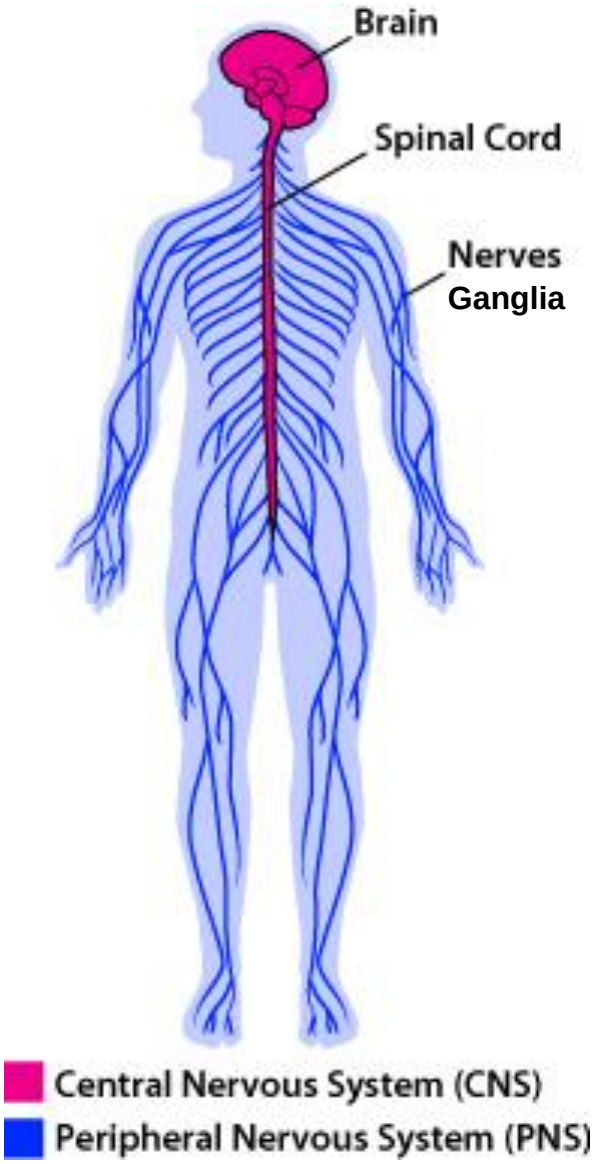
(a) Central nervous system

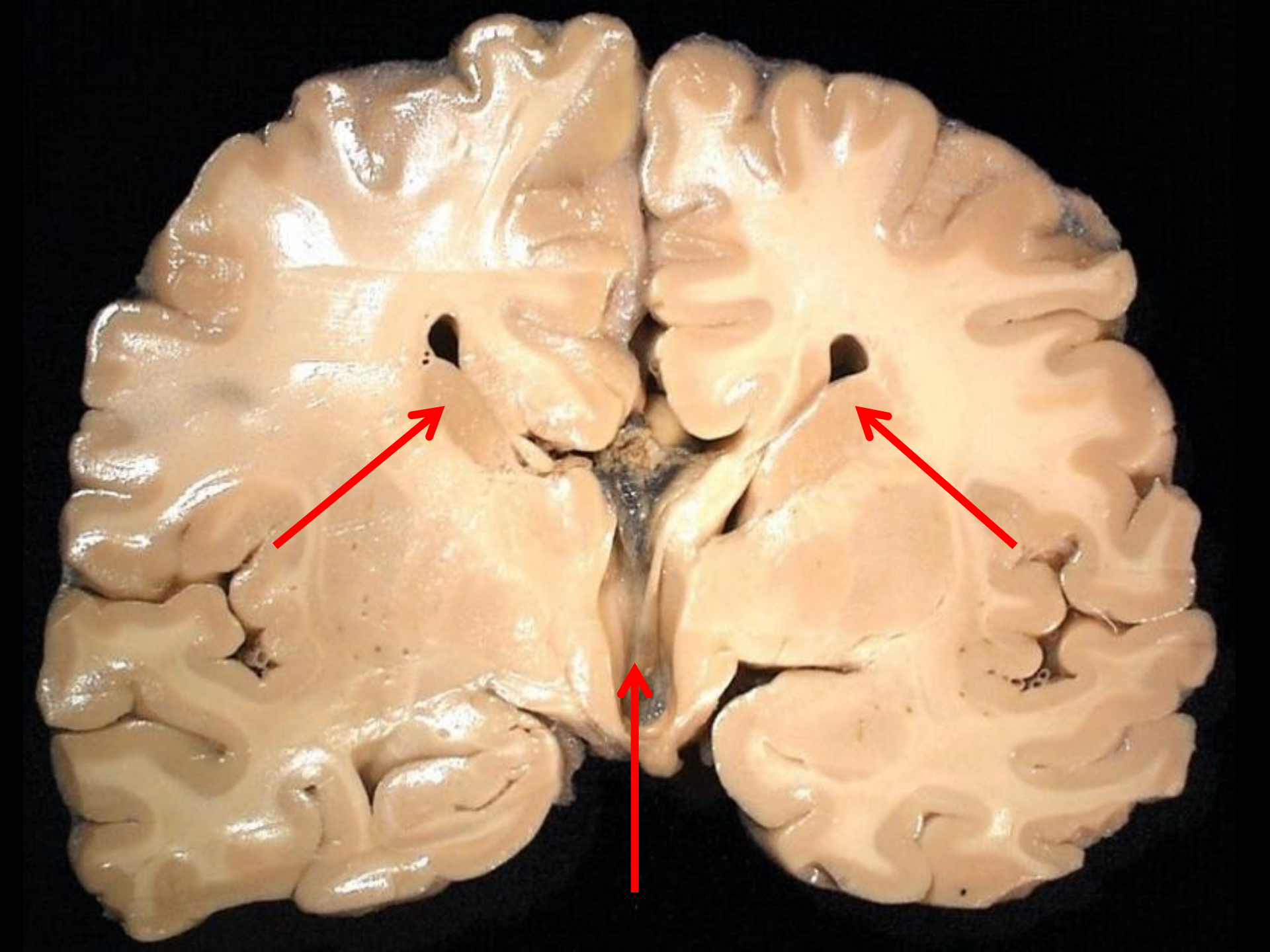


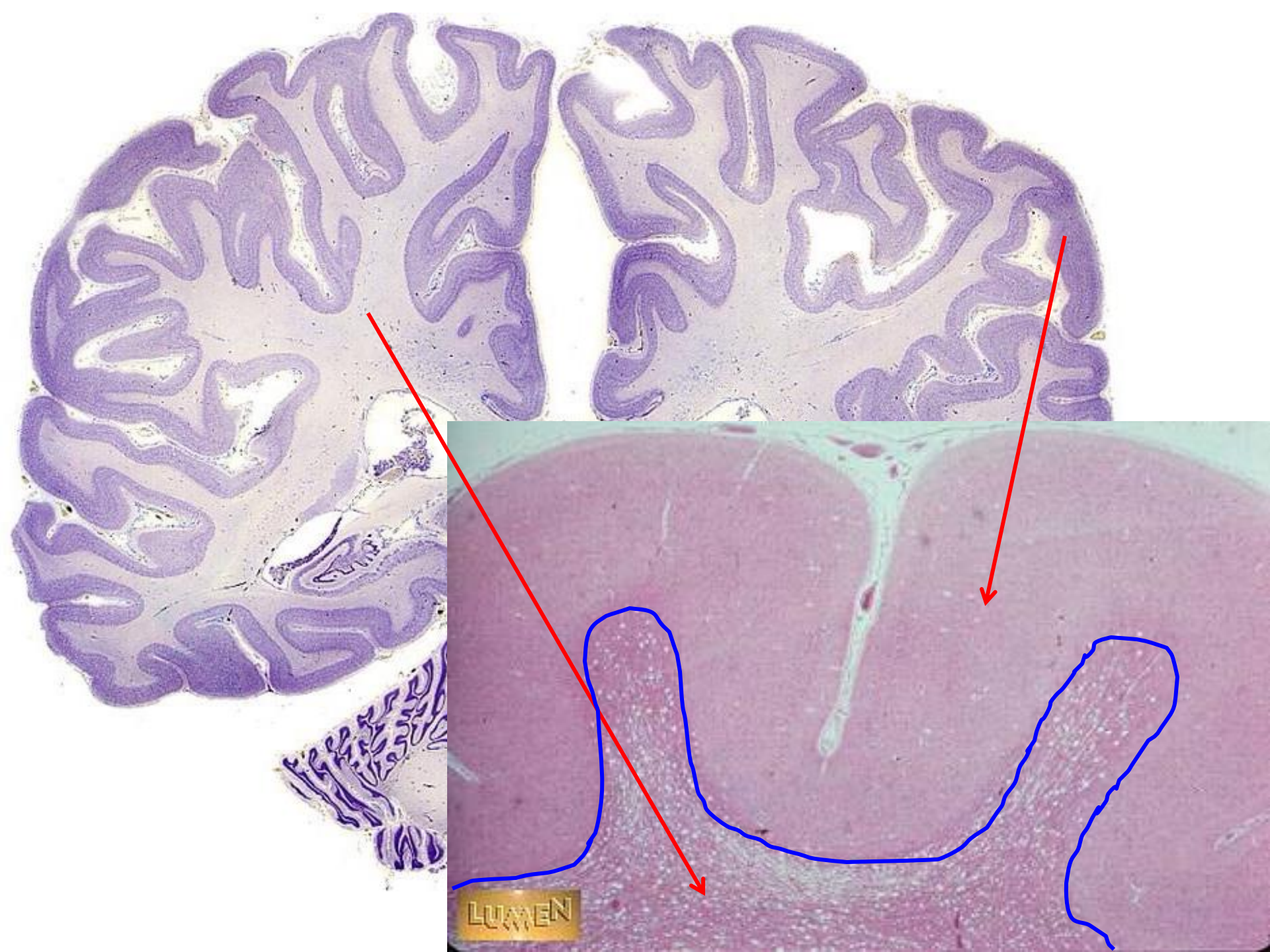
(b) Peripheral nervous system

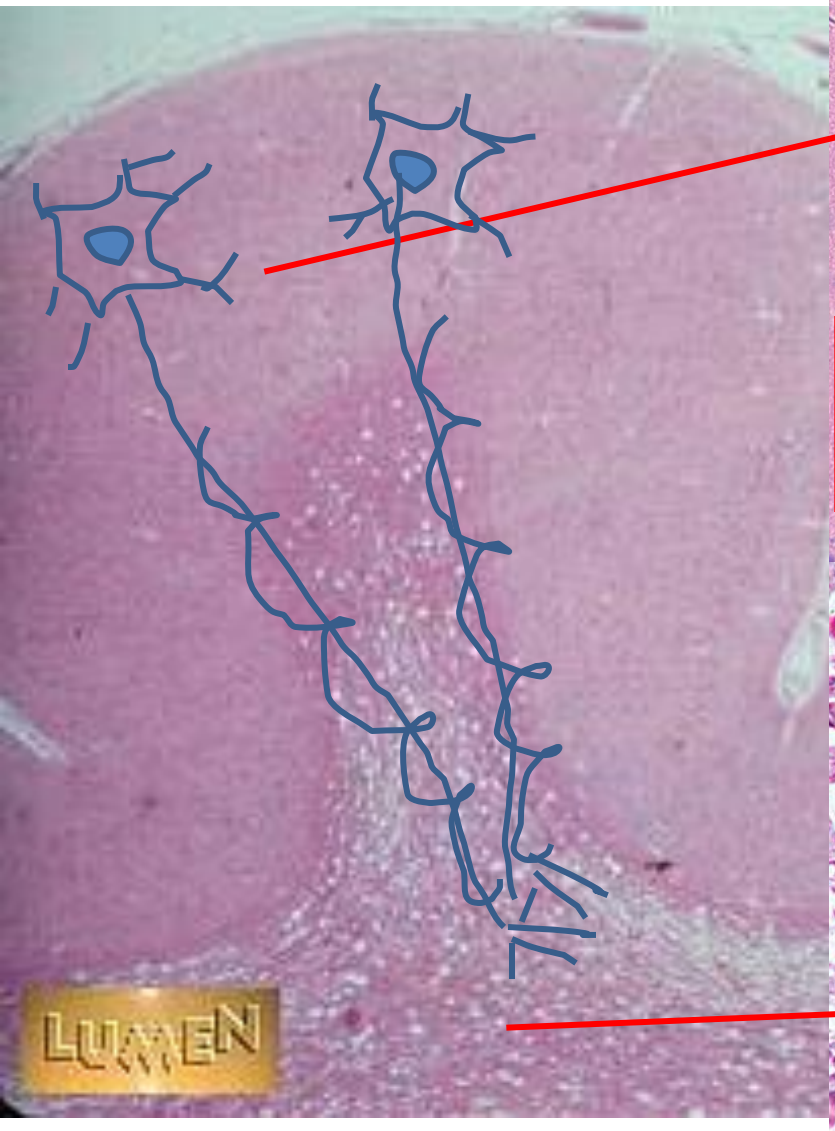
SNC

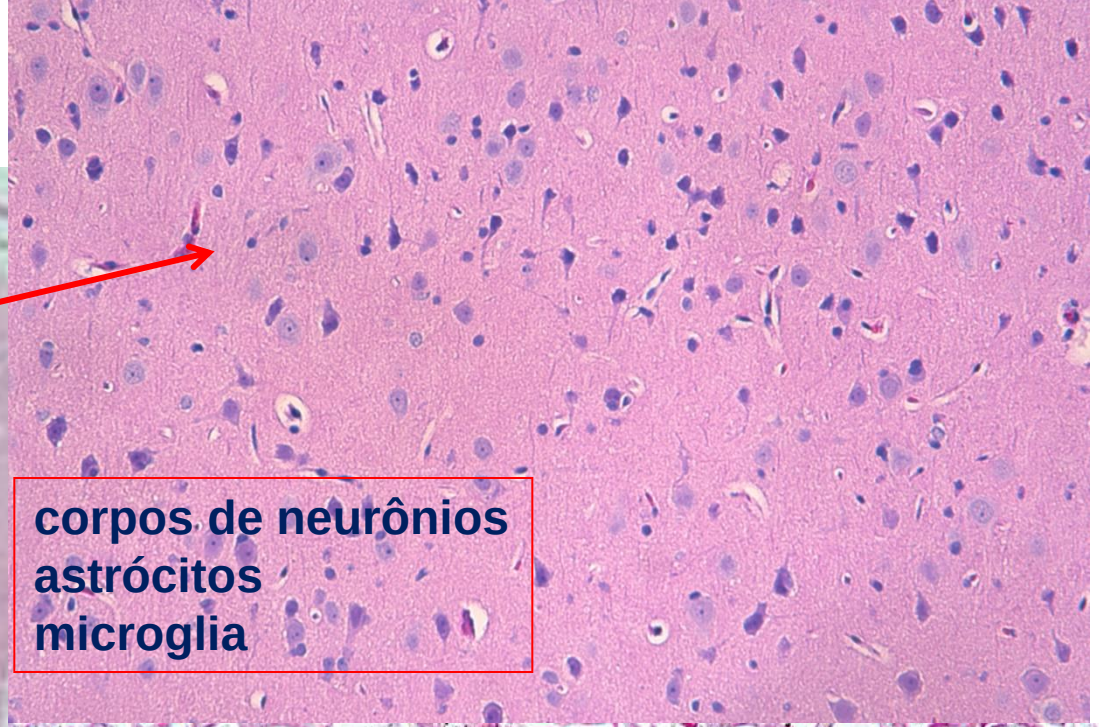

Brain
Spinal cord

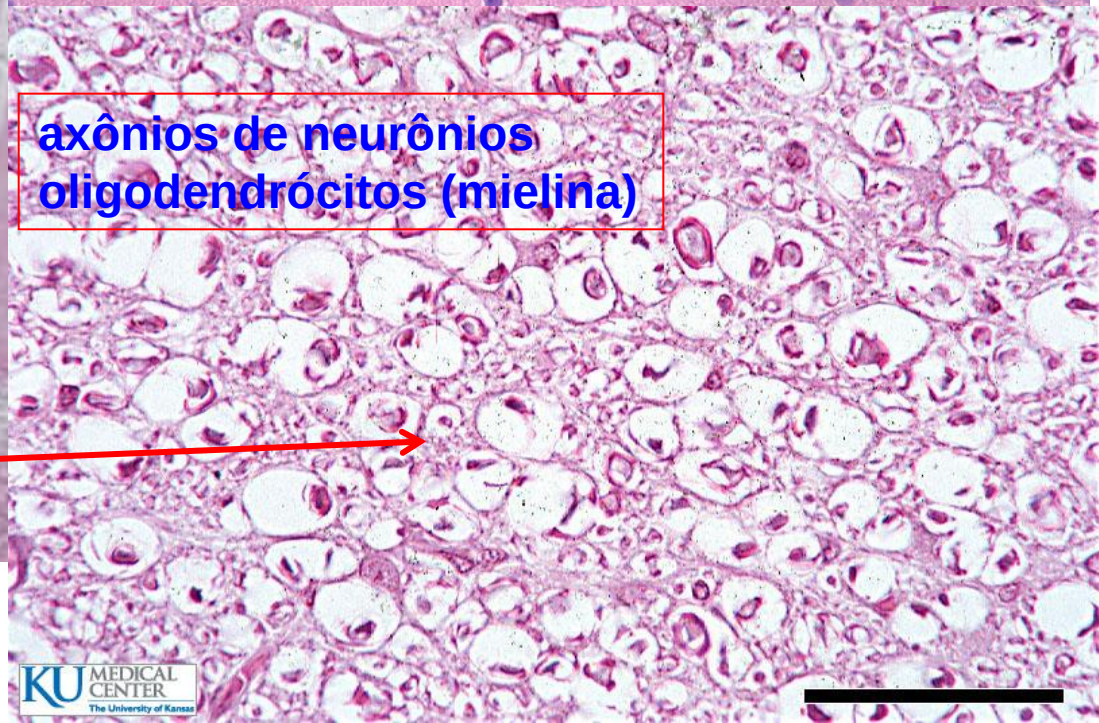

Brain
Spinal Cord
Nerves
Ganglia
Central Nervous System (CNS)
Peripheral Nervous System (PNS)

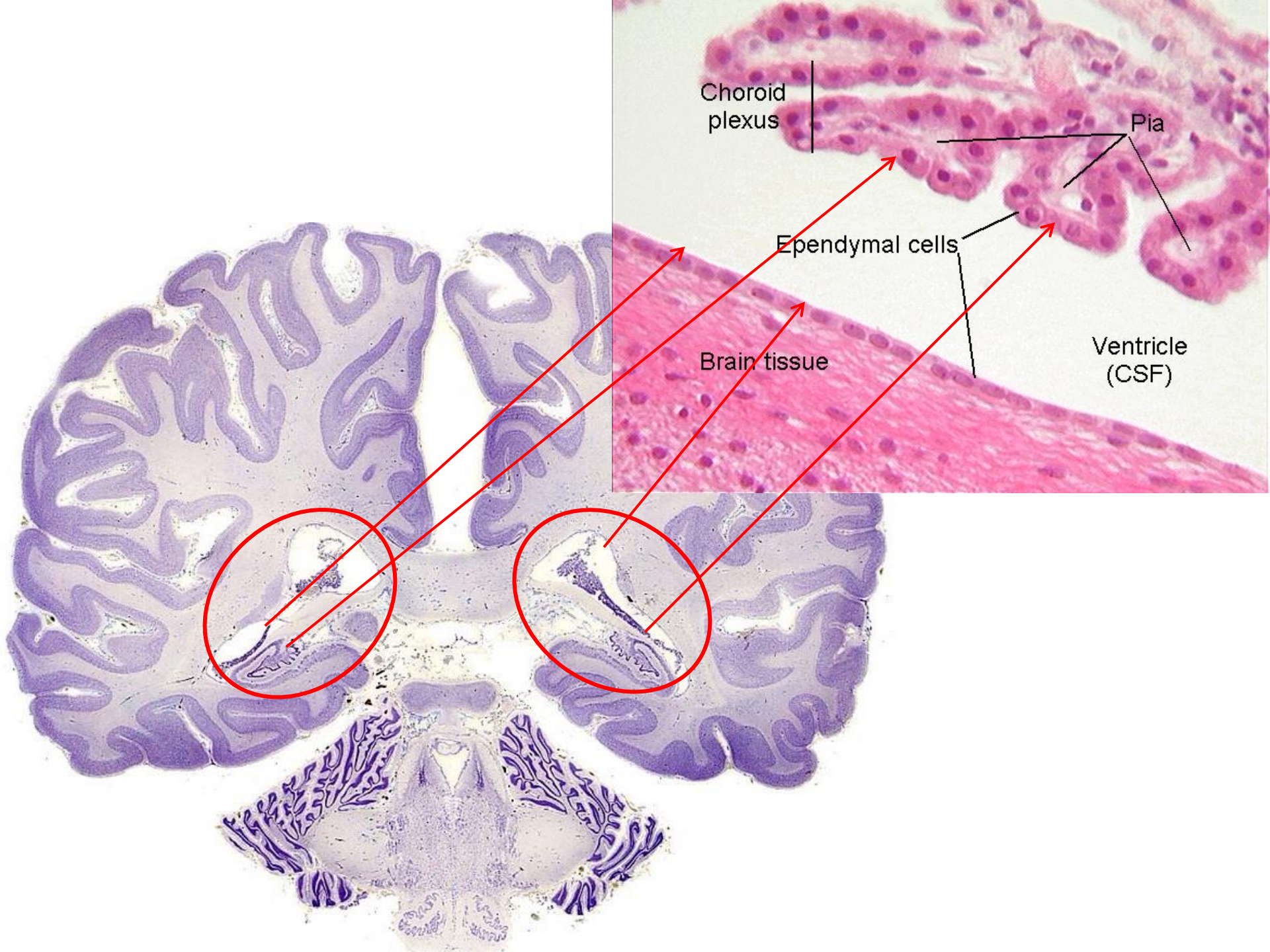


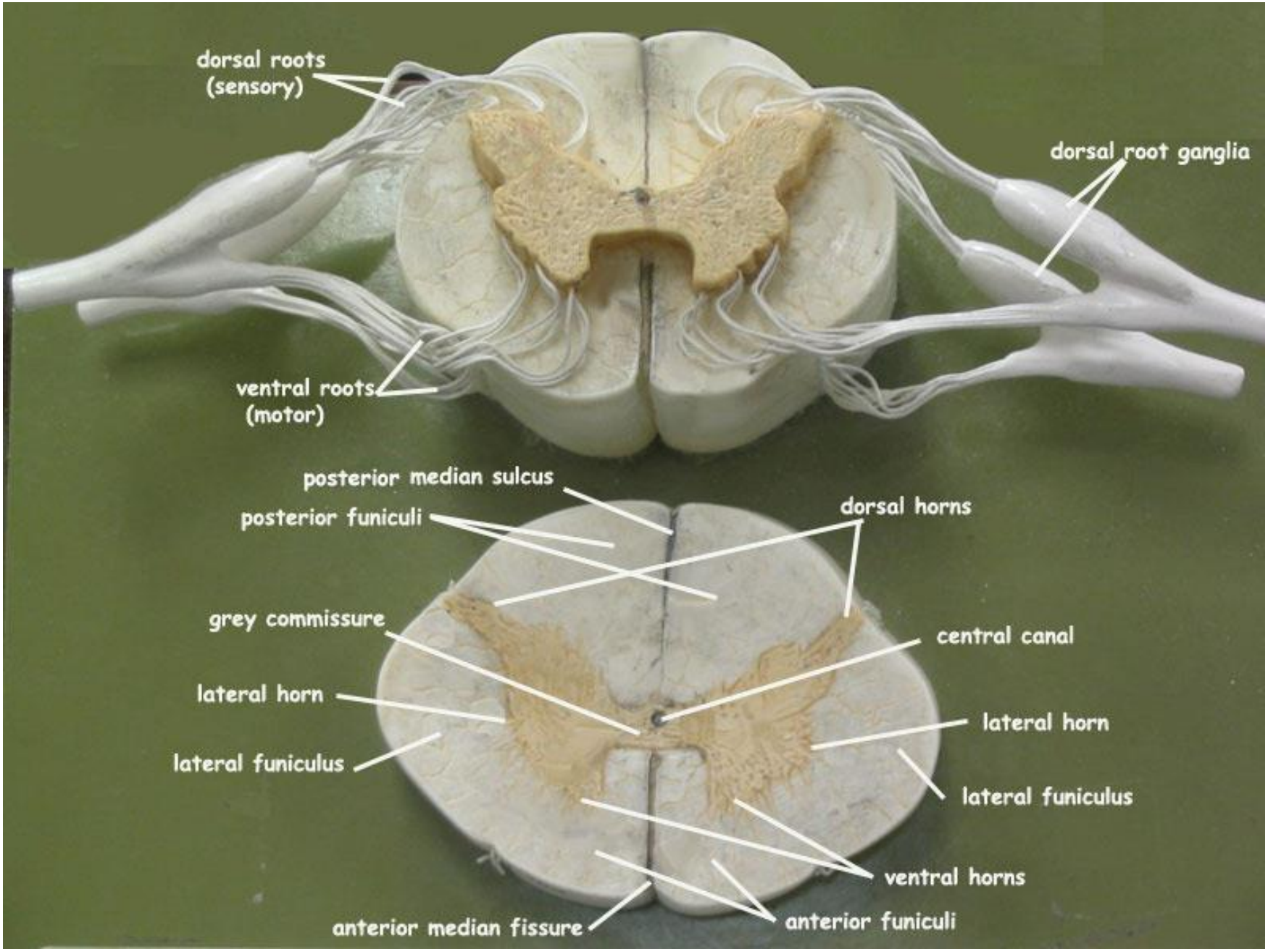

LUMEN

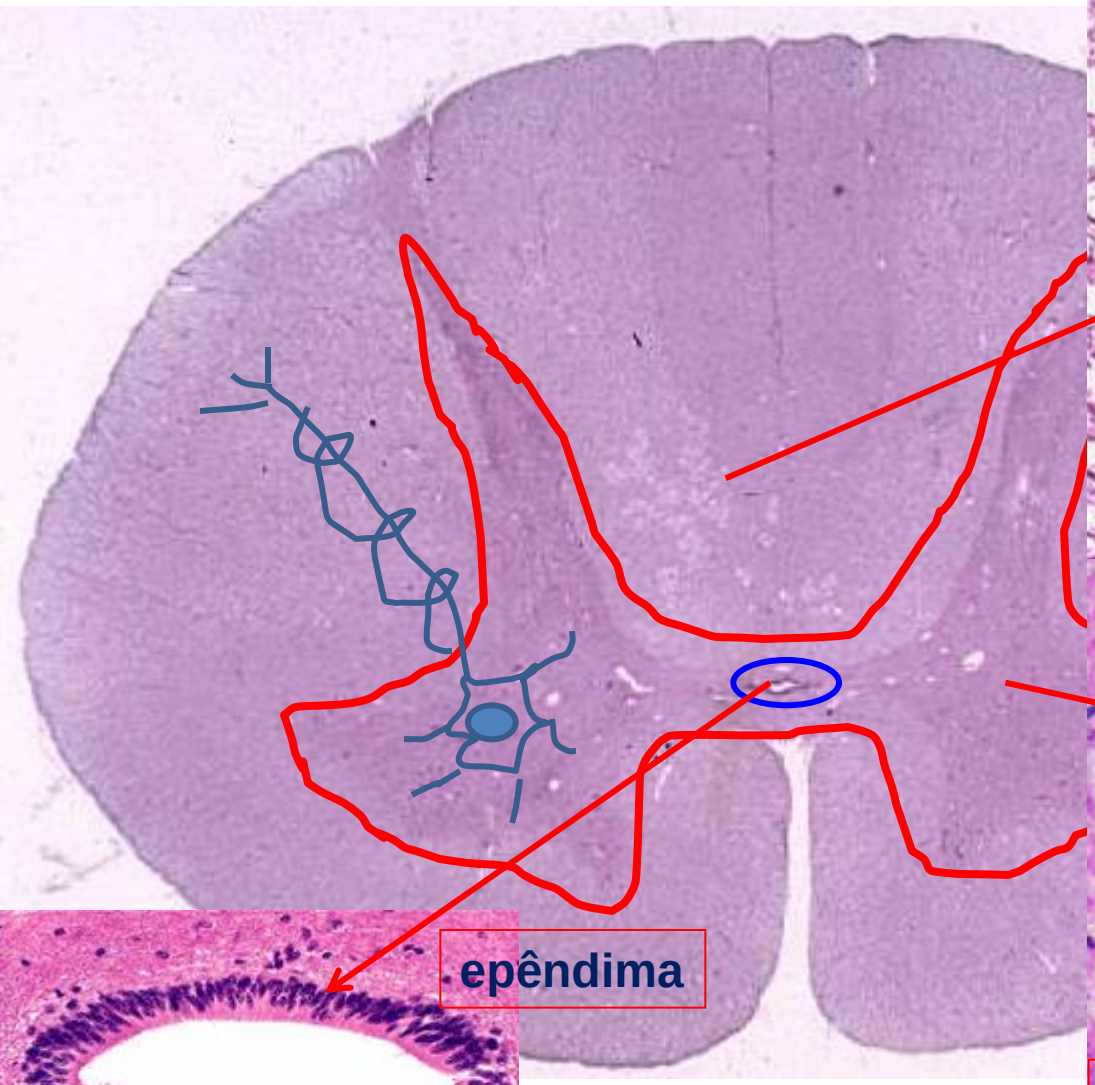

LUMEN

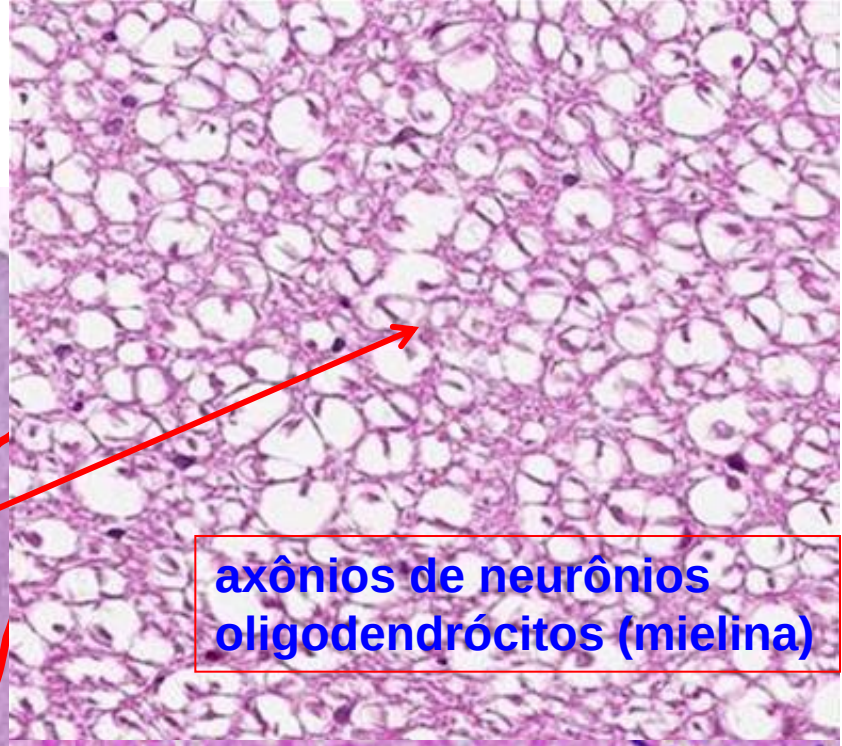

corpos de neurônios
astrócitos
microglia


axônios de neurônios
oligodendrócitos (mielina)
KU MEDICAL CENTER
The University of Kansas

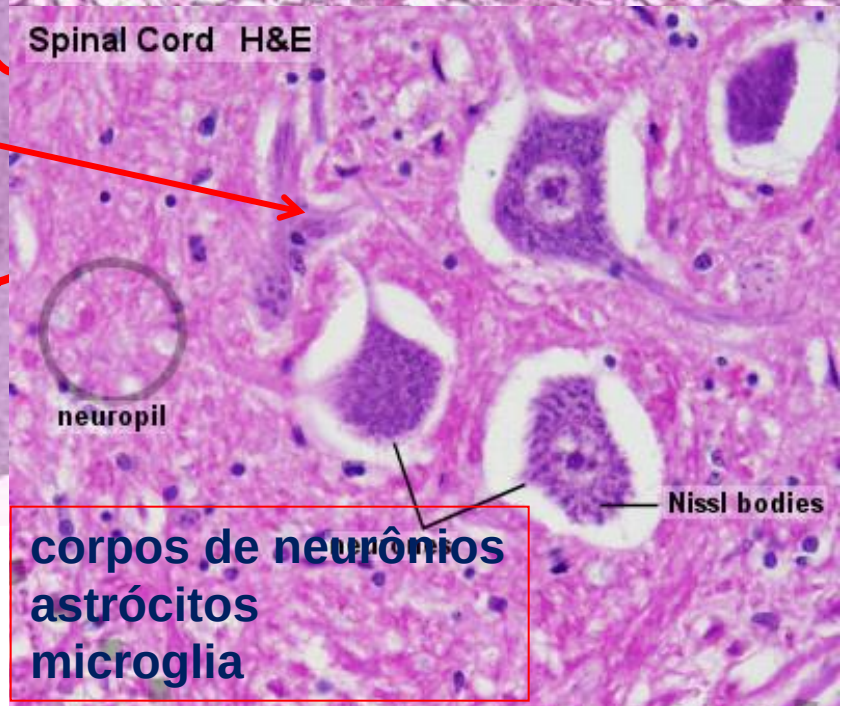

Choroid plexus
Pia
Ependymal cells
Brain tissue
Ventricle (CSF)


dorsal roots
(sensory)
dorsal root ganglia
ventral roots
(motor)
posterior median sulcus
posterior funiculi
dorsal horns
grey commissure
central canal
lateral horn
lateral horn
lateral funiculus
lateral funiculus
ventral horns
anterior median fissure
anterior funiculi

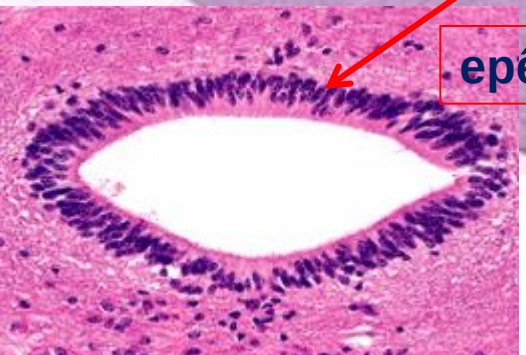




axônios de neurônios
oligodendrócitos (mielina)

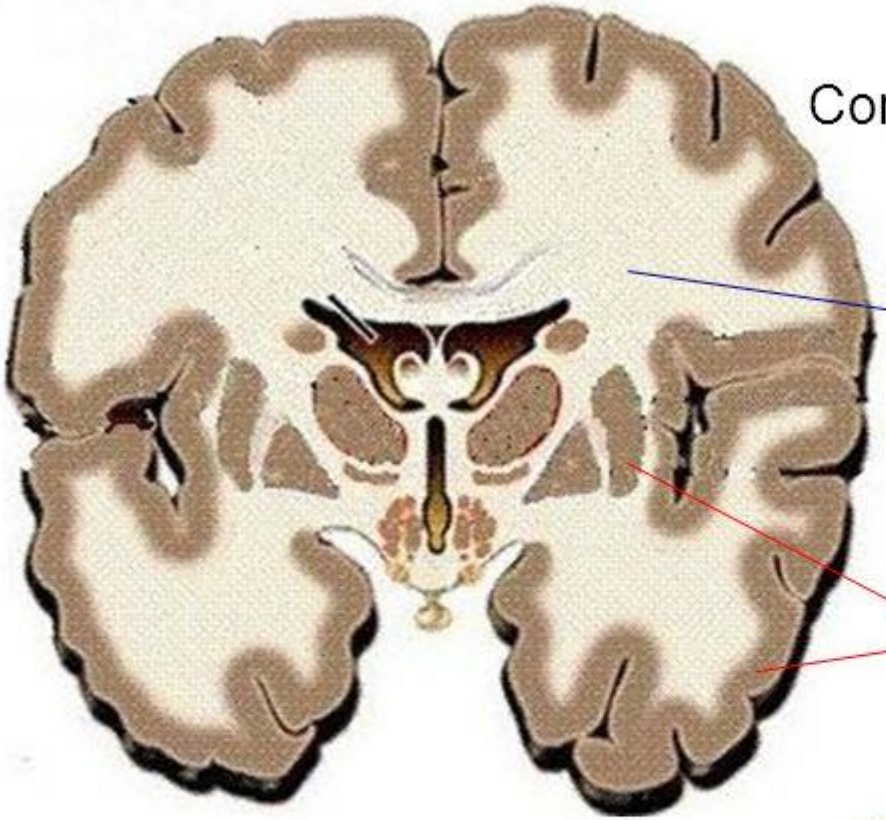


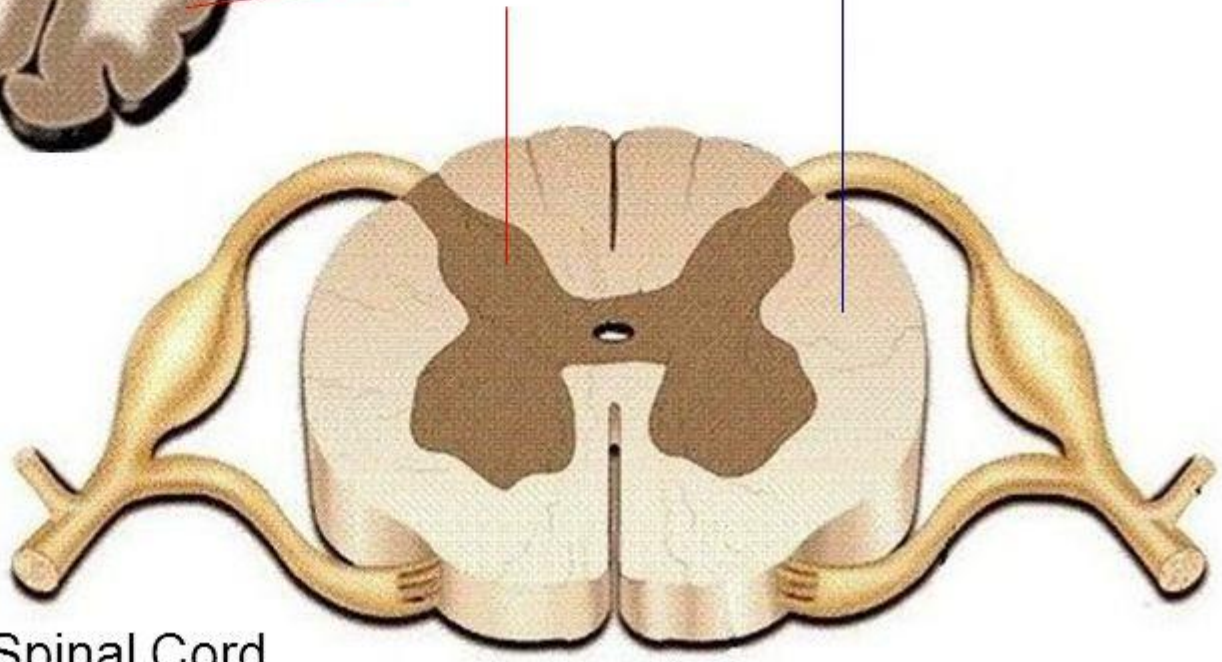
corpos de neurônios
astrócitos
microglia



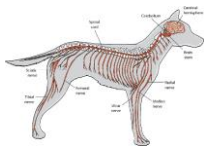
epêndima

Coronal Section of Brain

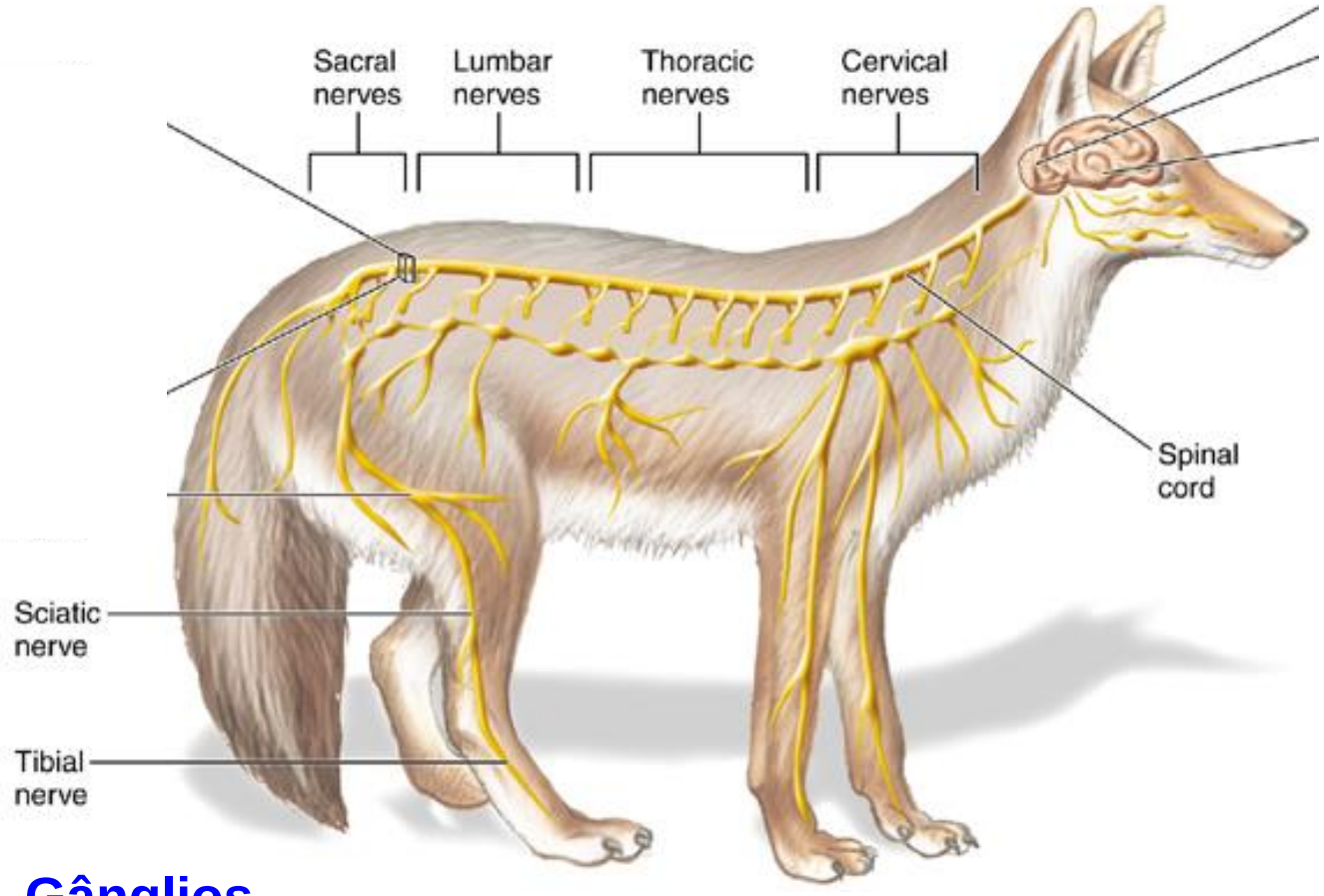


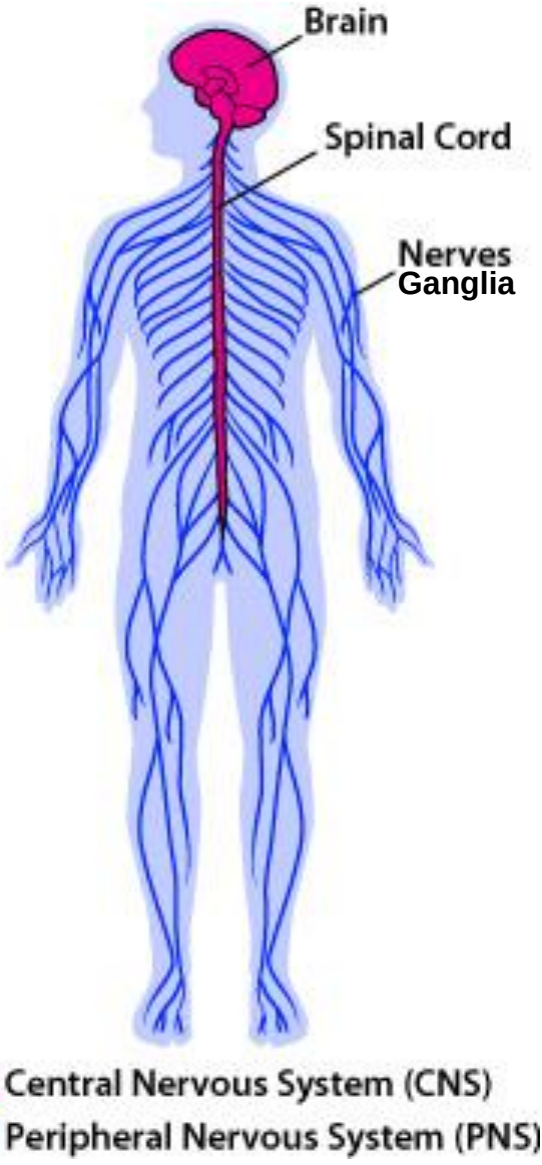


Cross Section of Spinal Cord



SNP

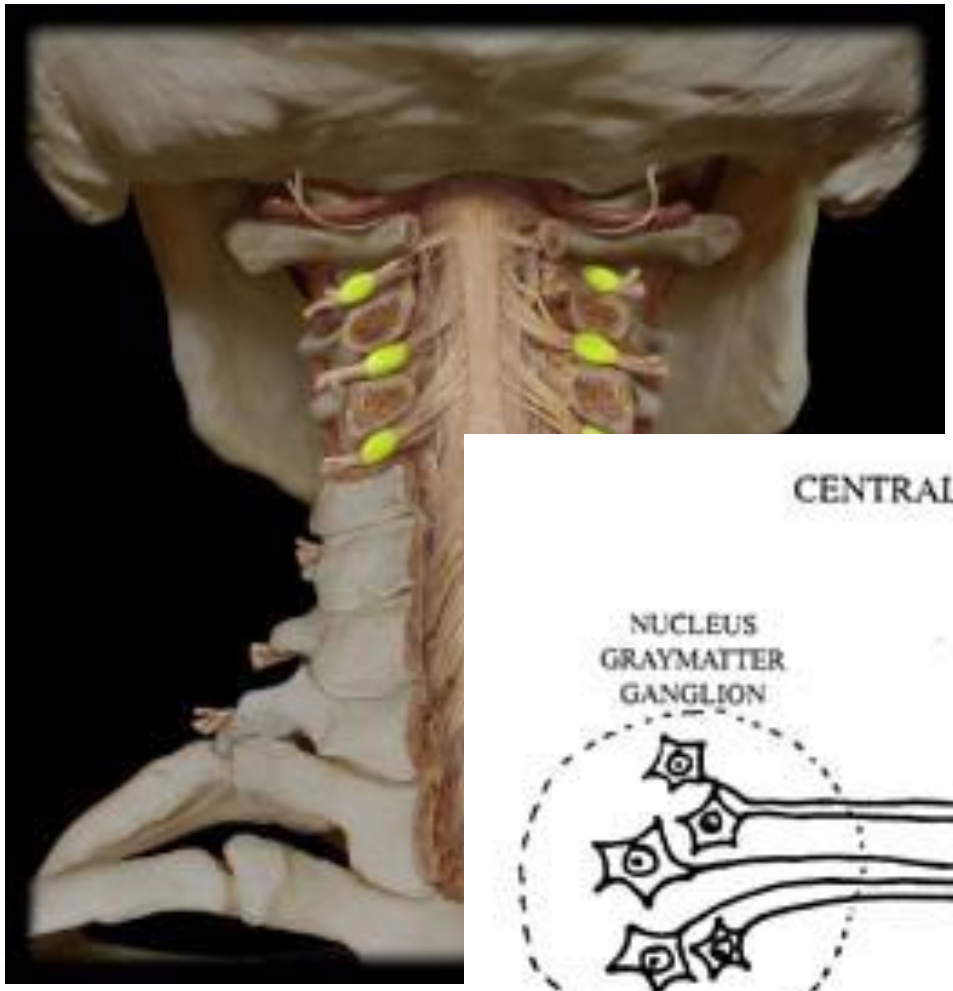


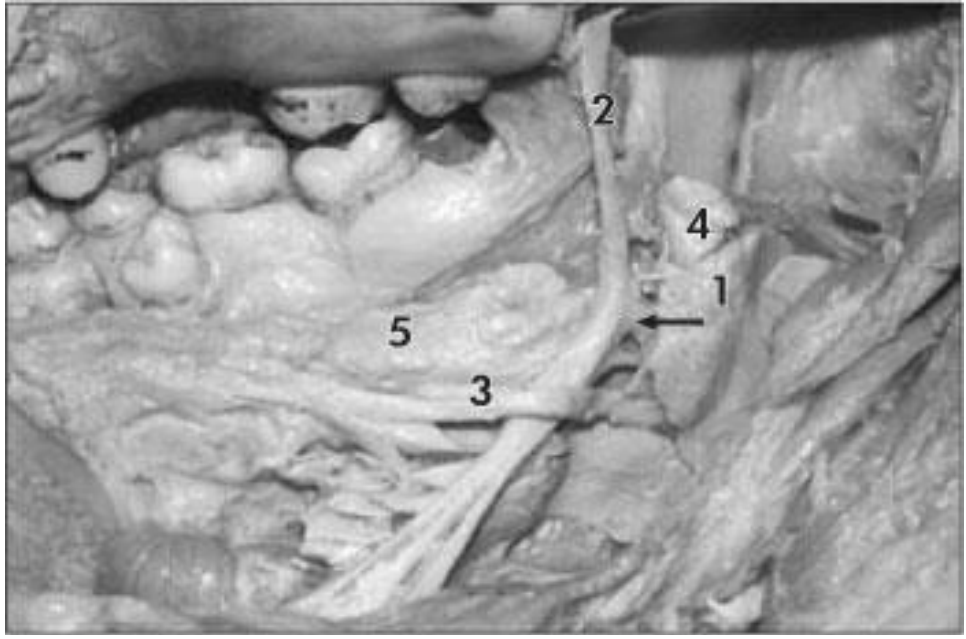


Gânglios

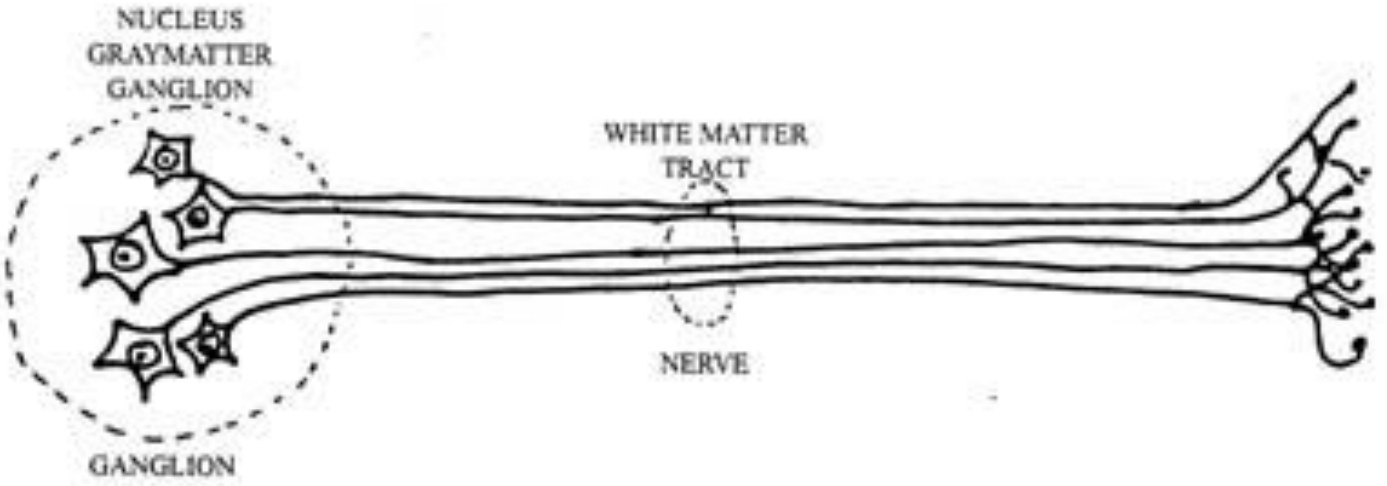
Nervos **tipo de informação - sentido da transmissão**

- sensoriais **info do ambiente (interno ou externo) ao SNC (aferente)**
- motores **ordem motora do SNC ao órgão efetor (eferente)**
- mistos **fibras dos 2 tipos; info nos 2 sentidos (aferente + eferente)**

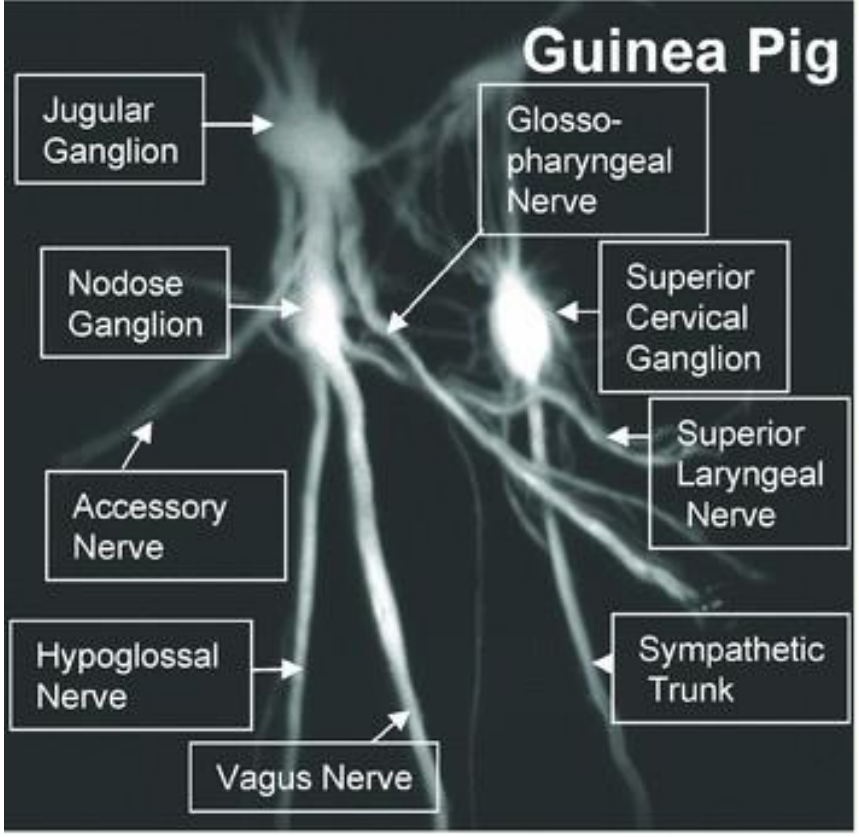


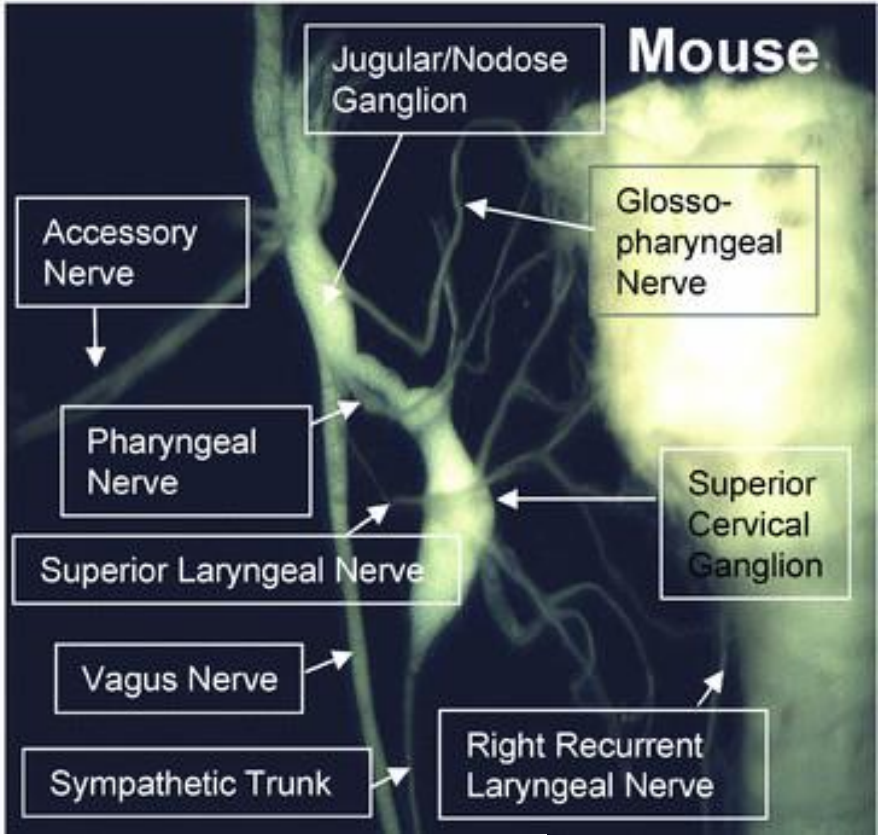


CENTRAL NERVOUS SYSTEM

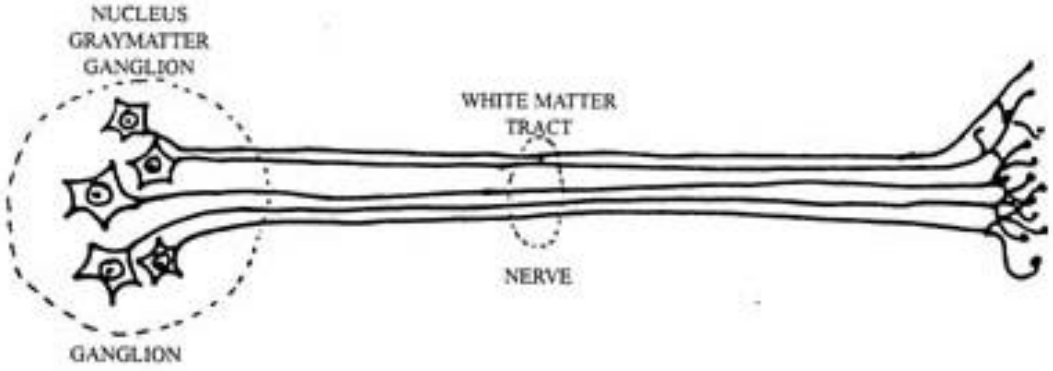


PERIPHERAL NERVOUS SYSTEM

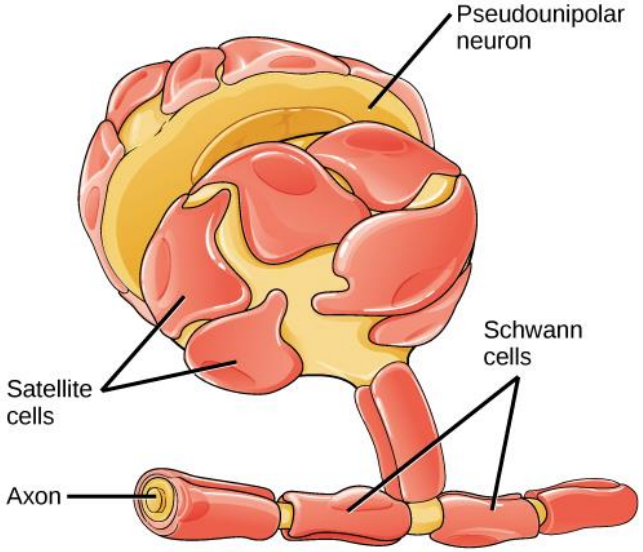




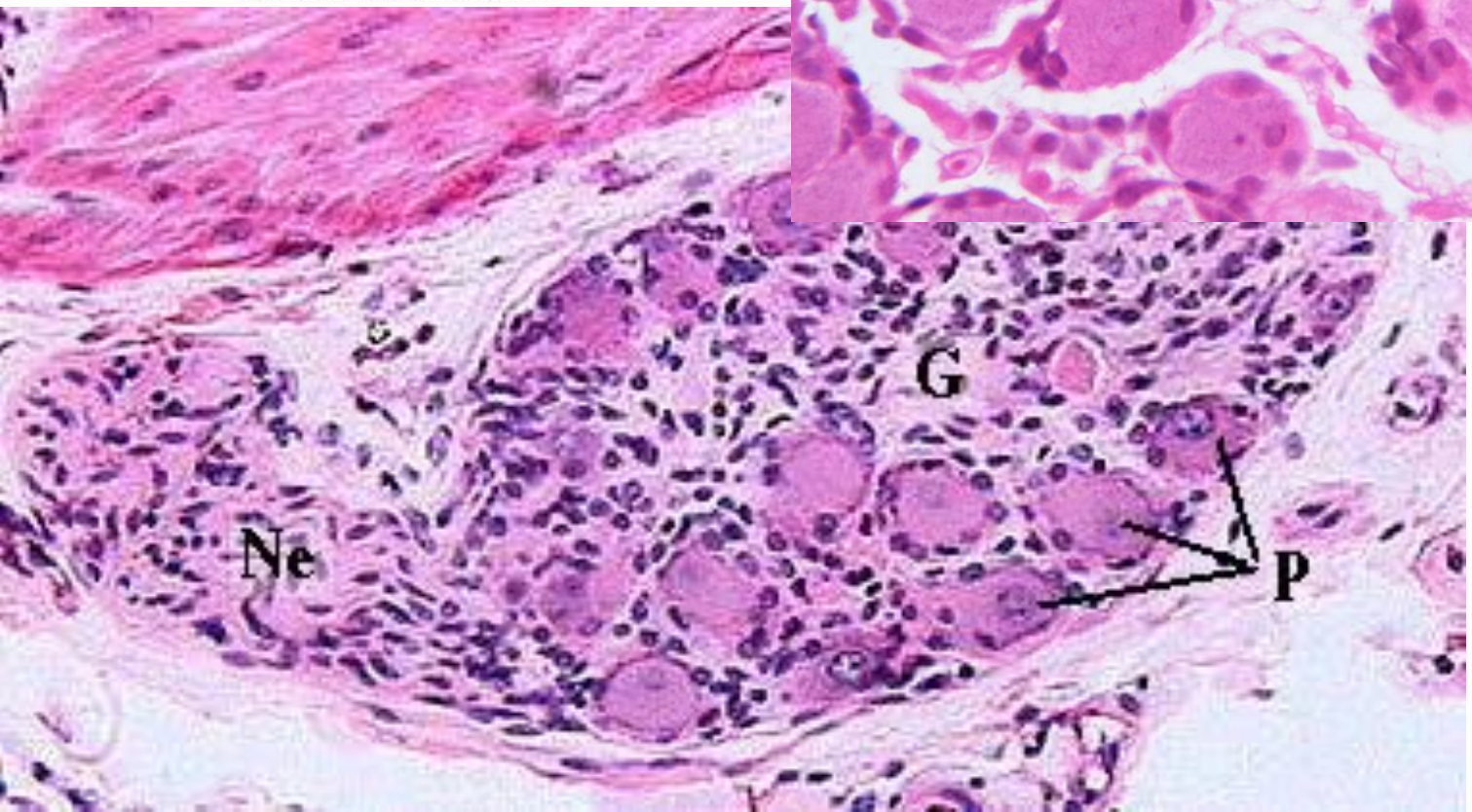
CENTRAL NERVOUS SYSTEM

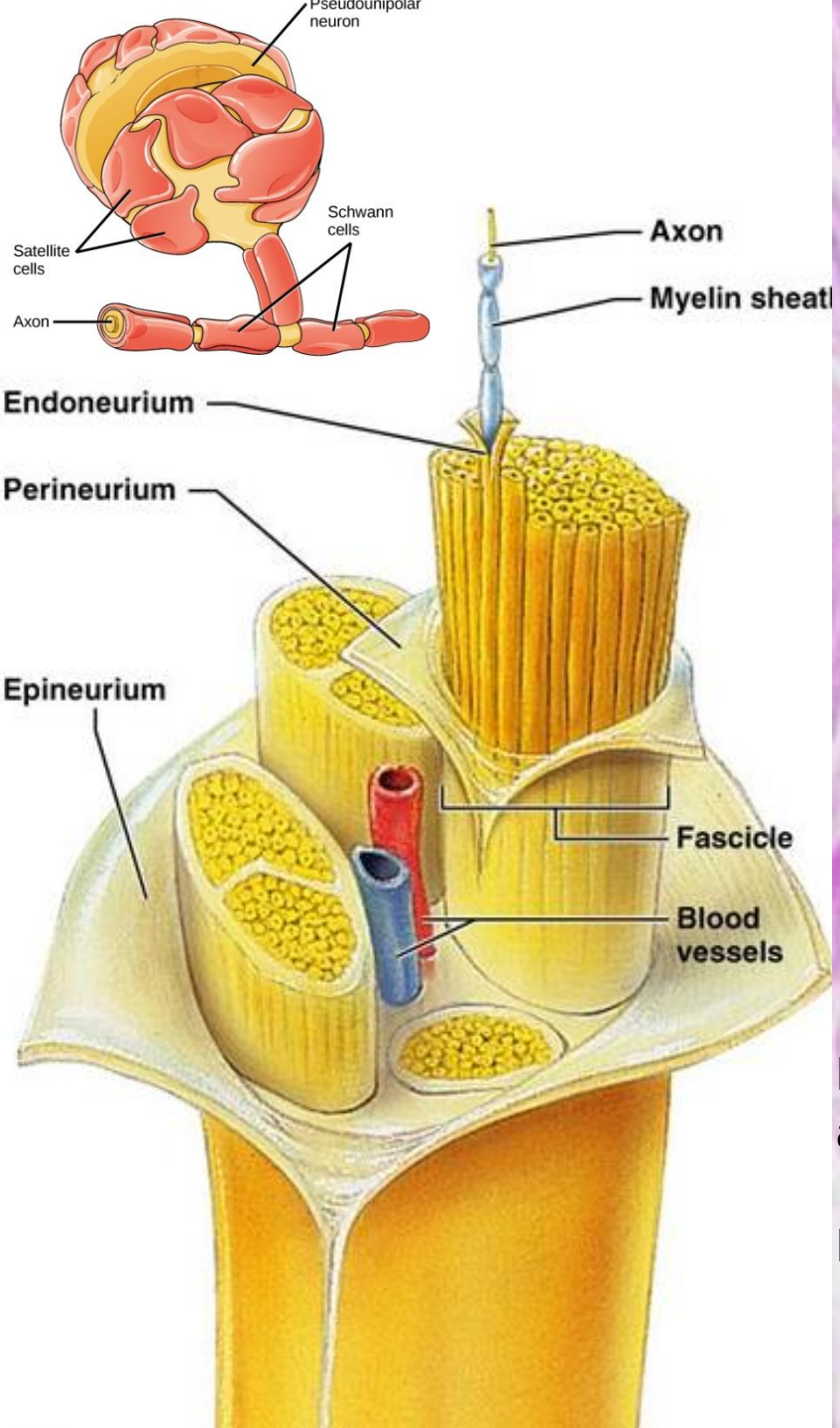


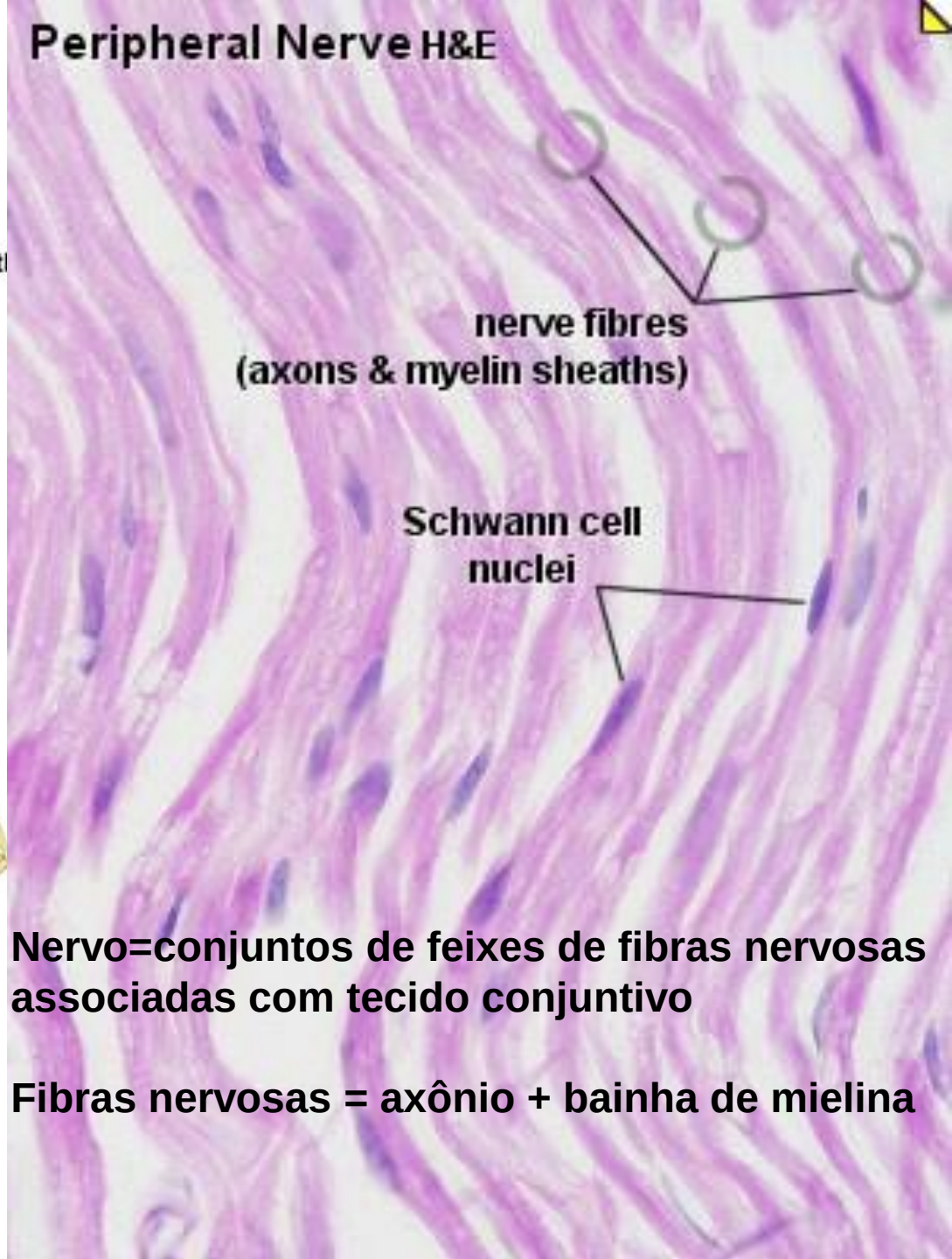
PERIPHERAL NERVOUS SYSTEM



(b) Peripheral nervous system

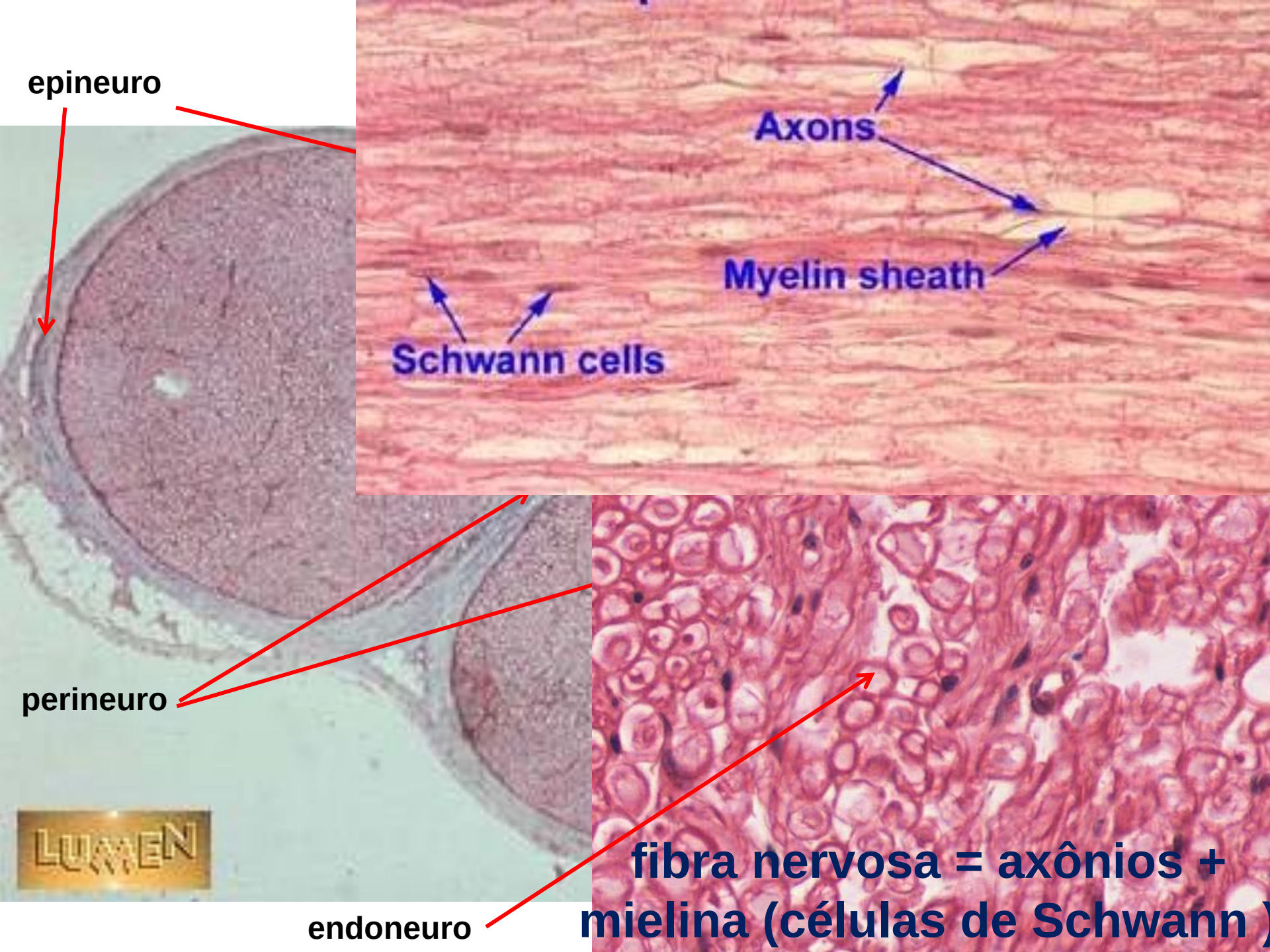






Nervo=conjuntos de feixes de fibras nervosas associadas com tecido conjuntivo

Fibras nervosas = axônio + bainha de mielina


epineuro
Axons
Myelin sheath
Schwann cells
perineuro
LUMEN
endoneuro
fibra nervosa = axônios +
mielina (células de Schwann)

Sistema Nervoso Periférico - SNP

Sistema Nervoso Central – SNC

Sistema Nervoso

Periférico
(gênglios+nervos)

Central
(cérebro+medula)

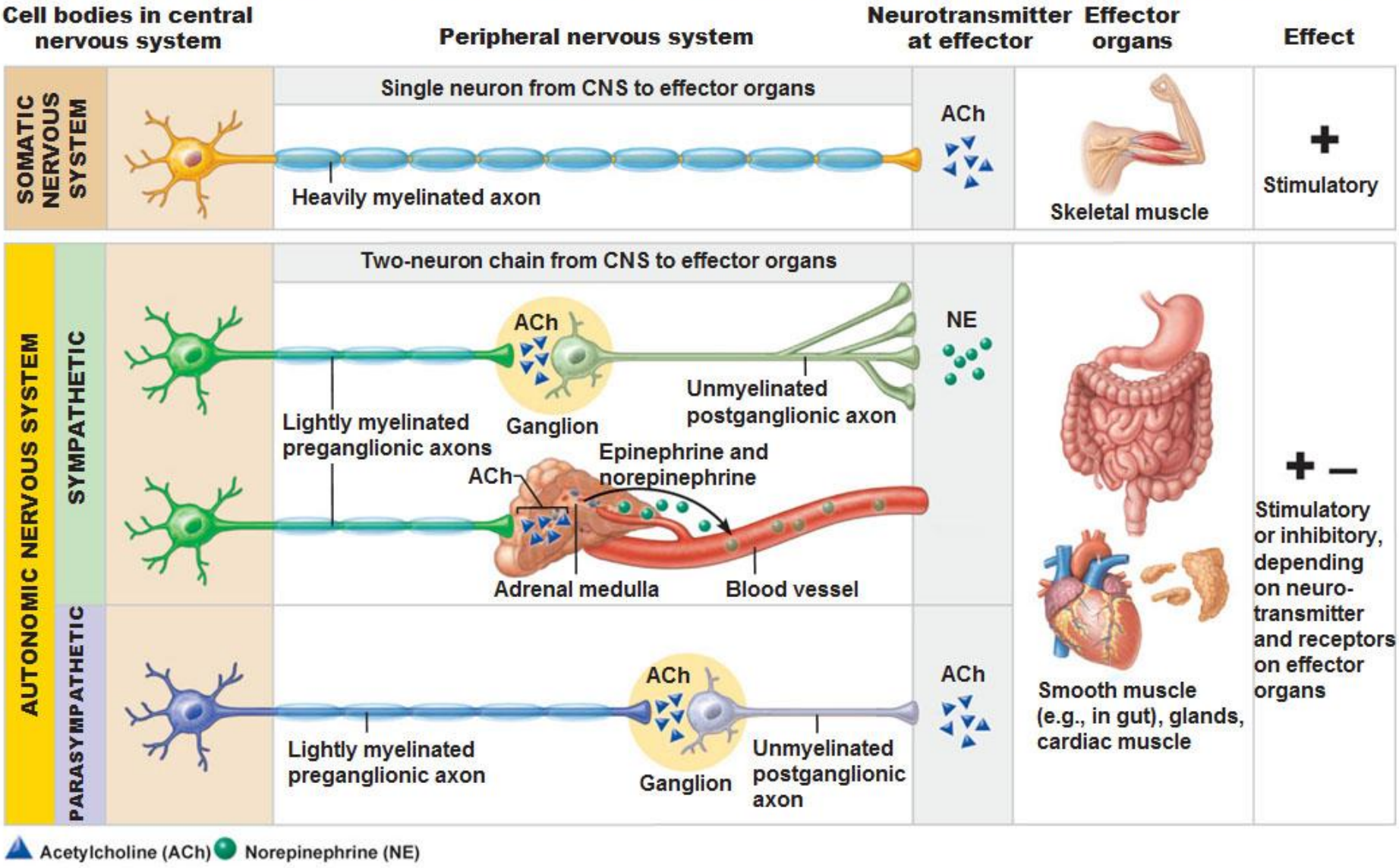
Autonômico
(involuntário)

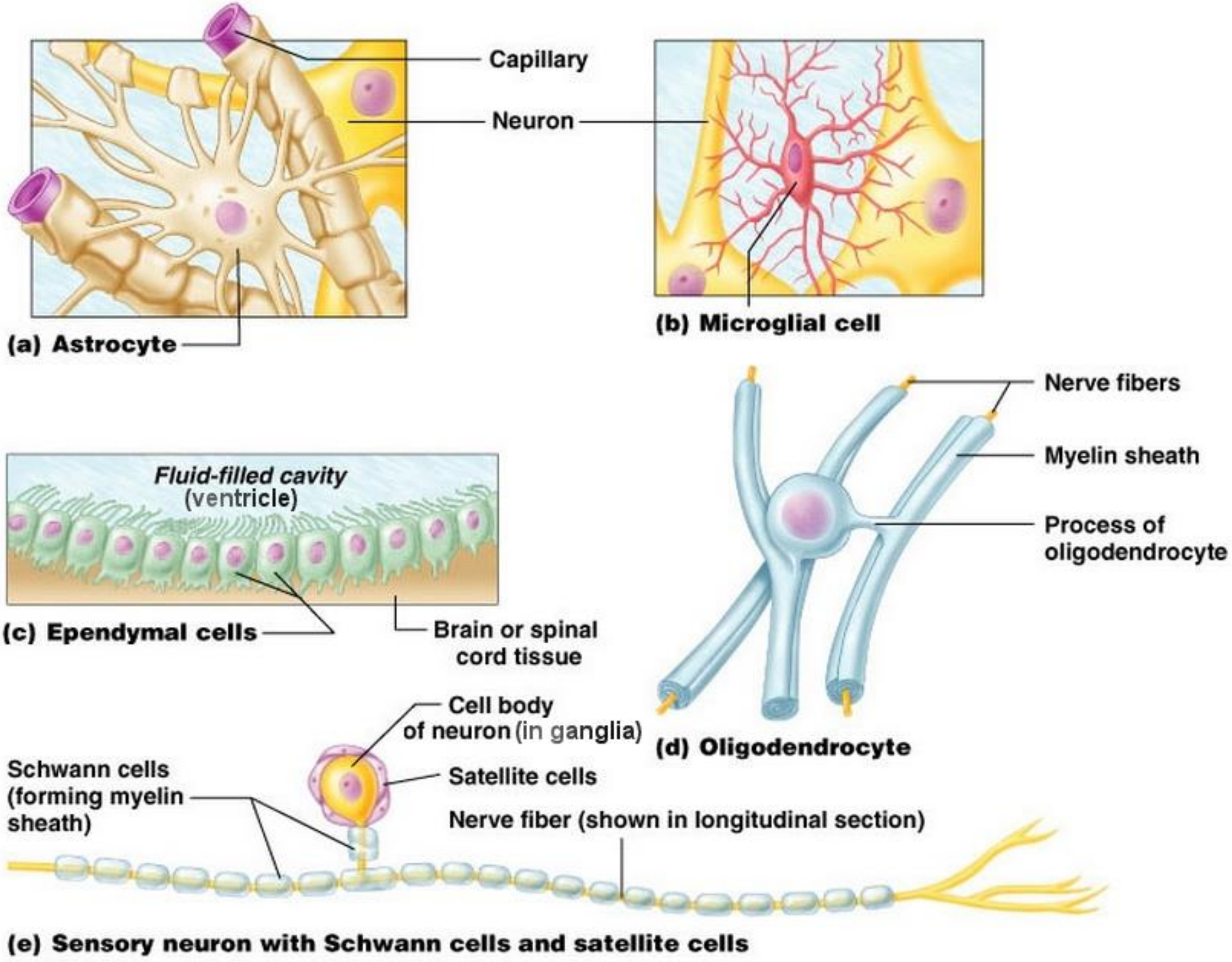
Somático
(voluntário)

Simpático

Parassimpático

Comparison of Autonomic and Somatic Motor Systems

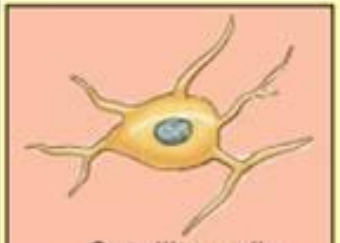



Capillary
Neuron
(a) Astrocyte
(b) Microglial cell
Nerve fibers
Myelin sheath
Process of oligodendrocyte
Fluid-filled cavity (ventricle)
(c) Ependymal cells
Brain or spinal cord tissue
(d) Oligodendrocyte
Cell body of neuron (in ganglia)
Satellite cells
Schwann cells (forming myelin sheath)
Nerve fiber (shown in longitudinal section)
(e) Sensory neuron with Schwann cells and satellite cells

NEUROGLIA

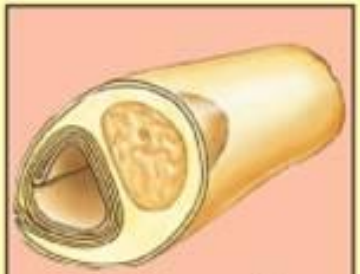
are found in

Peripheral Nervous System



Satellite cells

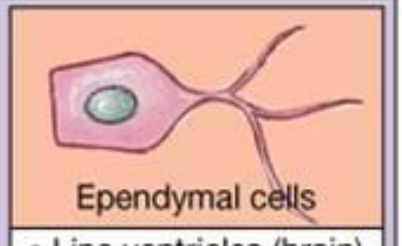
- Surround neuron cell bodies in ganglia
- Regulate O_2, CO_2, nutrient, and neurotransmitter levels around neurons in ganglia



Schwann cells

- Surround axons in PNS
- Are responsible for myelination of peripheral axons
- Participate in repair process after injury

Central Nervous System



Ependymal cells

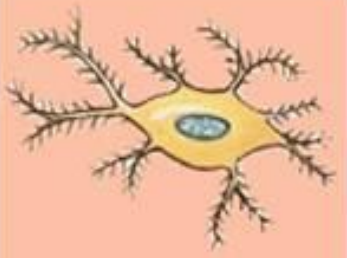
- Line ventricles (brain) and central canal (spinal cord)
- Assist in producing, circulating, and monitoring of cerebrospinal fluid

Oligodendrocytes

- Myelinate CNS axons
- Provide structural framework

Astrocytes

- Maintain blood-brain barrier
- Provide structural support
- Regulate ion, nutrient, and dissolved gas concentrations
- Absorb and recycle neurotransmitters
- Form scar tissue after injury



Microglia

- Remove cell debris, wastes, and pathogens by phagocytosis

1. Que características deve ter um tecido para ser classificado de nervoso?
2. Quais as funções gerais do tecido nervoso?
3. Quais as células do tecido nervoso?
4. Como é a morfologia das diferentes células e suas respectivas funções?
5. Qual o sentido da transmissão do impulso nervoso (elétrico) entre dois neurônios?
6. Onde se dá a parte elétrica da transmissão do impulso nervoso?
7. E a parte química dessa transmissão?
8. De que é constituída a bainha de mielina e onde é encontrada?
9. Para que serve a bainha de mielina e quais células a formam?
10. Considerando a divisão do sistema nervoso em central (SNC) e periférico (SNP), qual a localização das diferentes células no SNC e no SNP?

11. Quais os órgãos que compõem o sistema nervoso central?

12. O que constitui a substância cinzenta?

13. E a branca?

14. Como estão organizadas essas substâncias nos órgãos do SNC?

15. Quais as estruturas que compõem o SNP?

16. Como estão organizadas as células nessas estruturas?

17. O tecido nervoso tem conjuntivo associado?

18. Como esse tecido conjuntivo organiza a estrutura de um nervo?

19. Quais os tipos de nervos em relação ao tipo de informação que transmitem e qual o sentido da transmissão da informação em cada um (SNC ao SNP ou SNP ao SNC)?

20. O que existe entre as células nervosas do sistema nervoso central?

Tecido Nervoso

- **Funções**

- controle das funções do organismo

processamento
integração / interpretação

transmissão
info sensorial

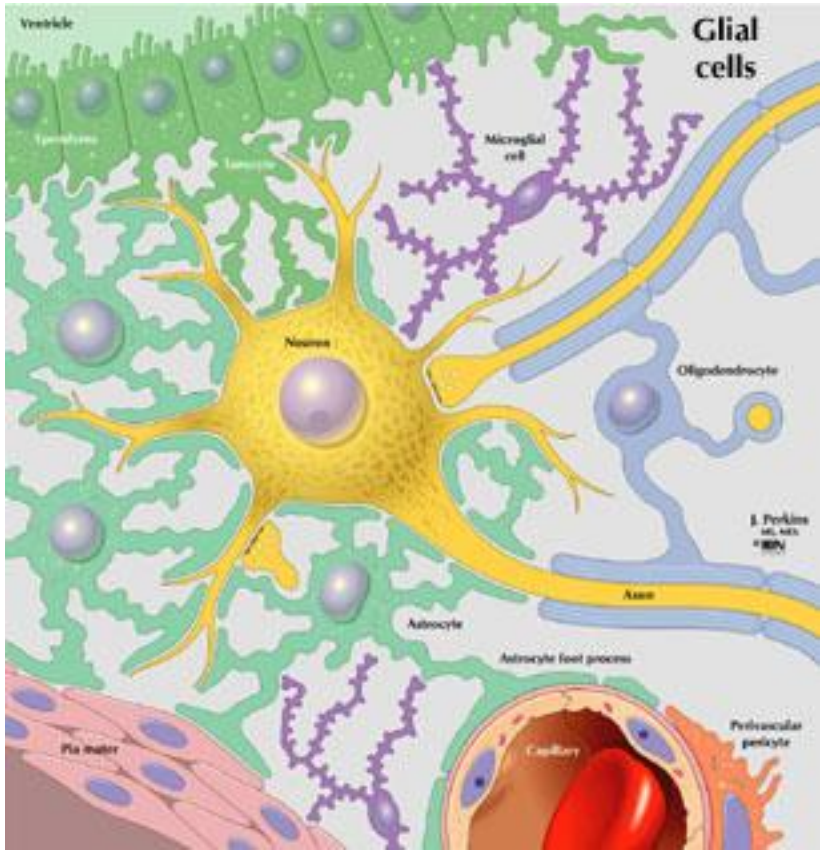
transmissão da
ordem motora

execução da
ordem motora

captação informação sensorial → interna ou externa

Tecido Nervoso

- **Constituintes**

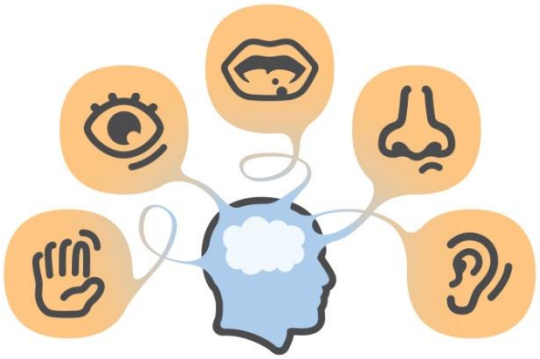


Células

- Neurônios

- Neuroglia

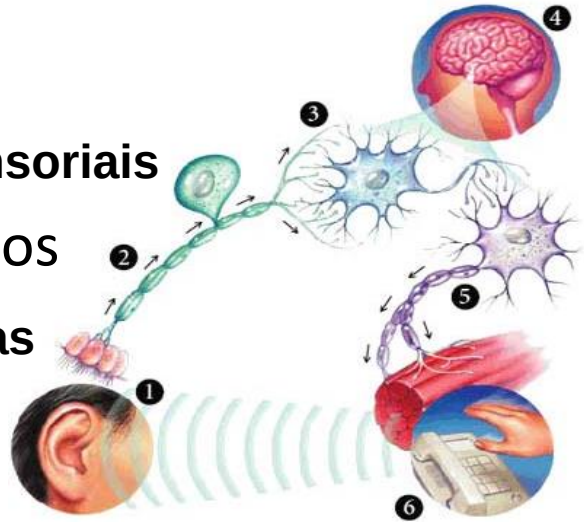
Neurônio

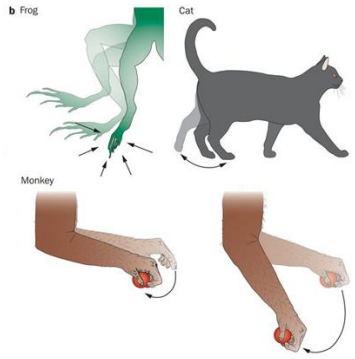


ambiente { externo / interno

– Funções

- **detectar** e **transmitir estímulos** ⇒ **sensoriais**
- **integrar** e **processar** os estímulos recebidos
- **transmitir** e **enviar respostas** ⇒ **motoras**



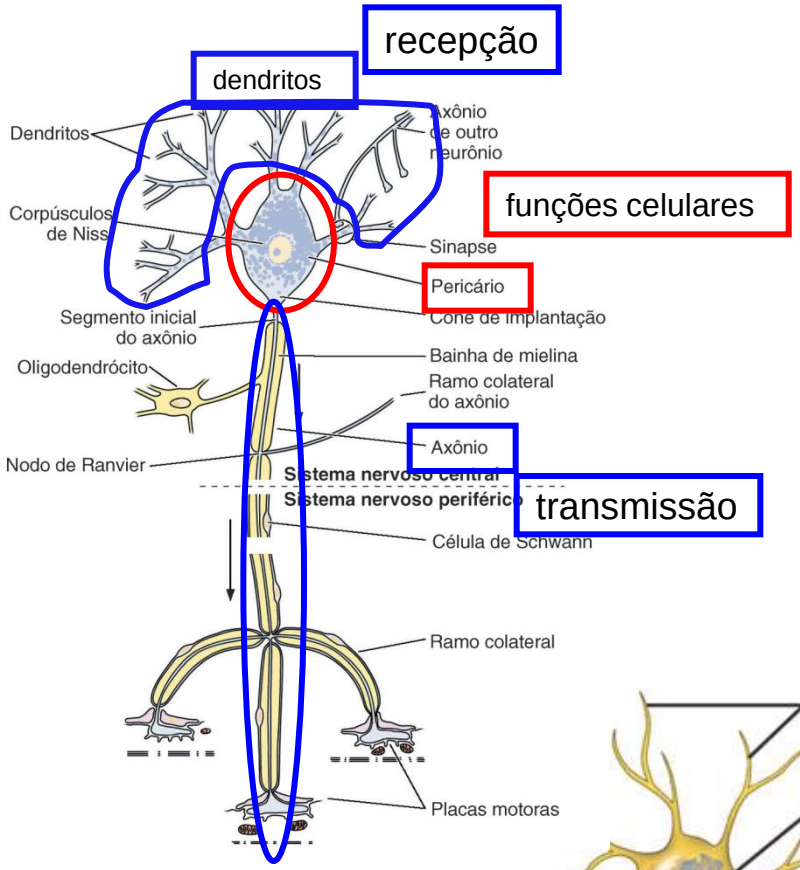


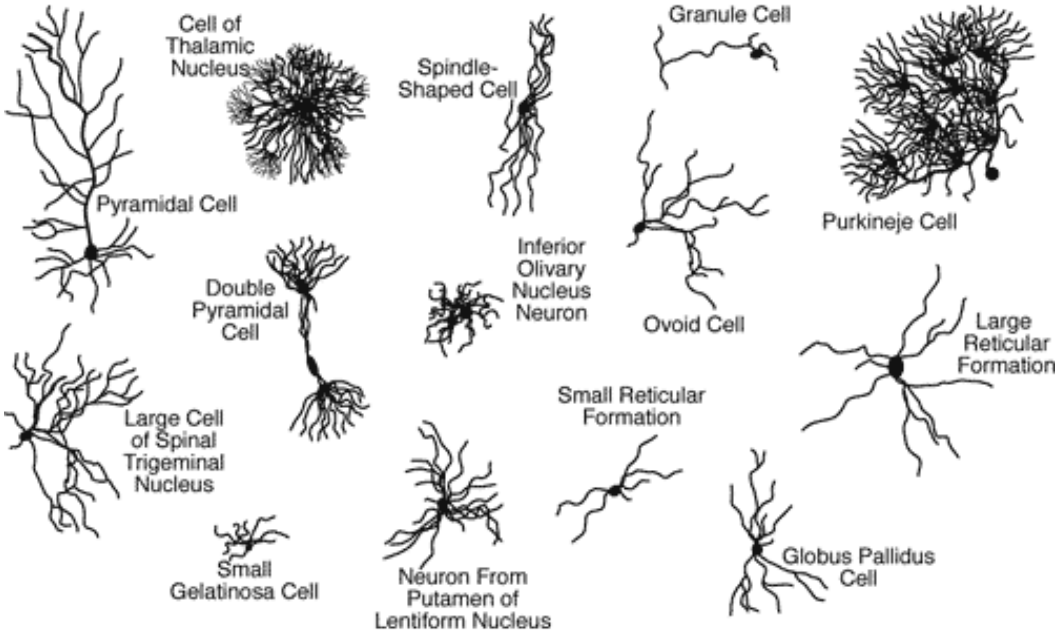
efetores
- **órgãos**
- **glândulas**
- **músculos**

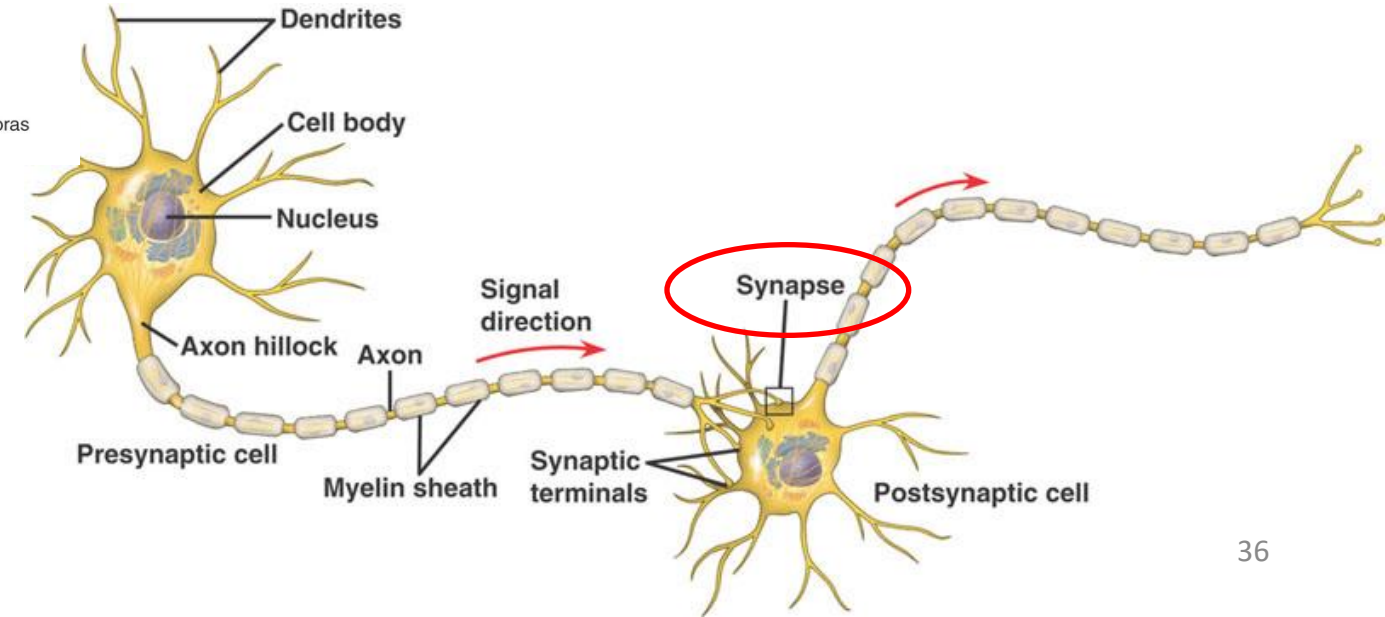
adaptação às variações do meio!!!!! (interno e externo)

– Morfologia

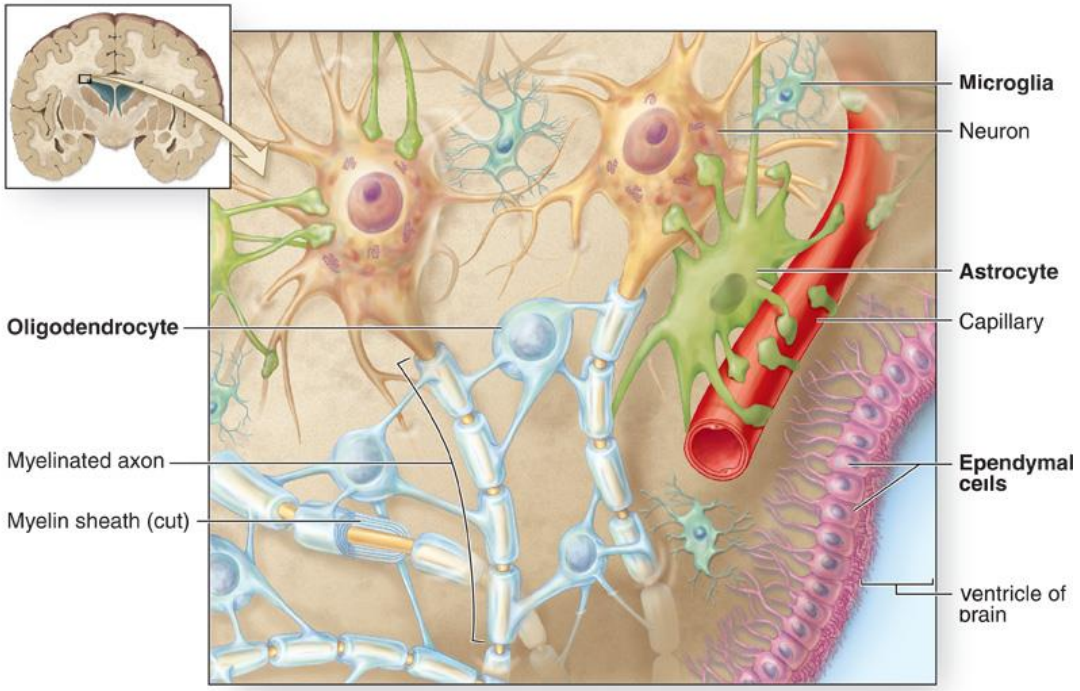
Neurônio

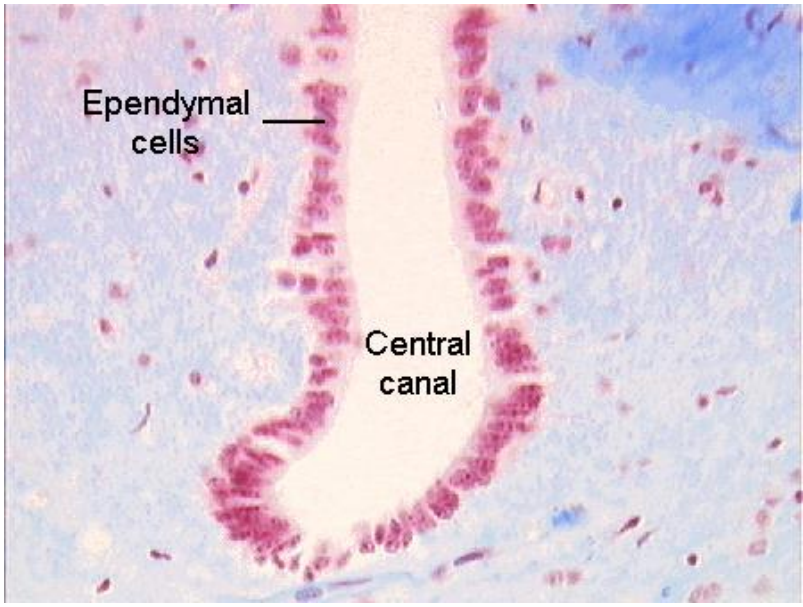


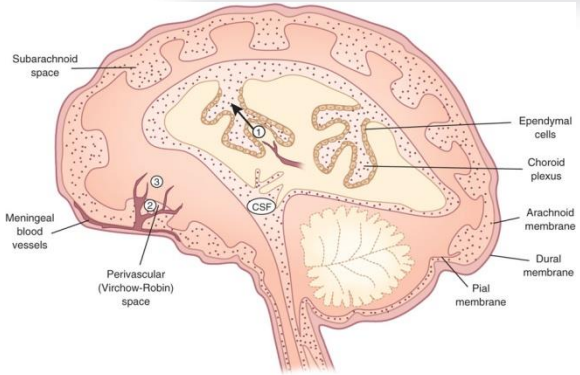


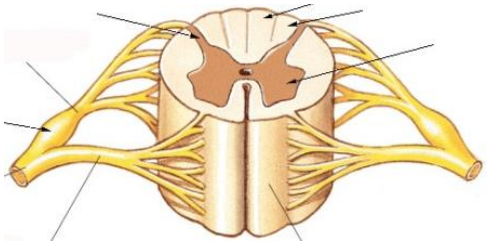


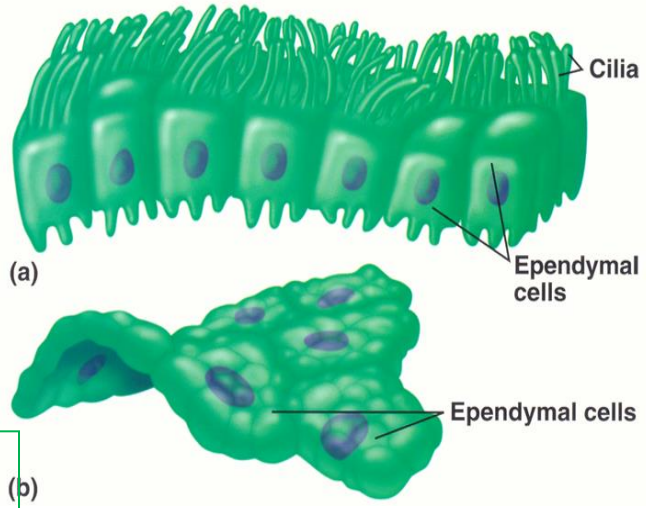
Células da Glia (neuroglia) - SNC







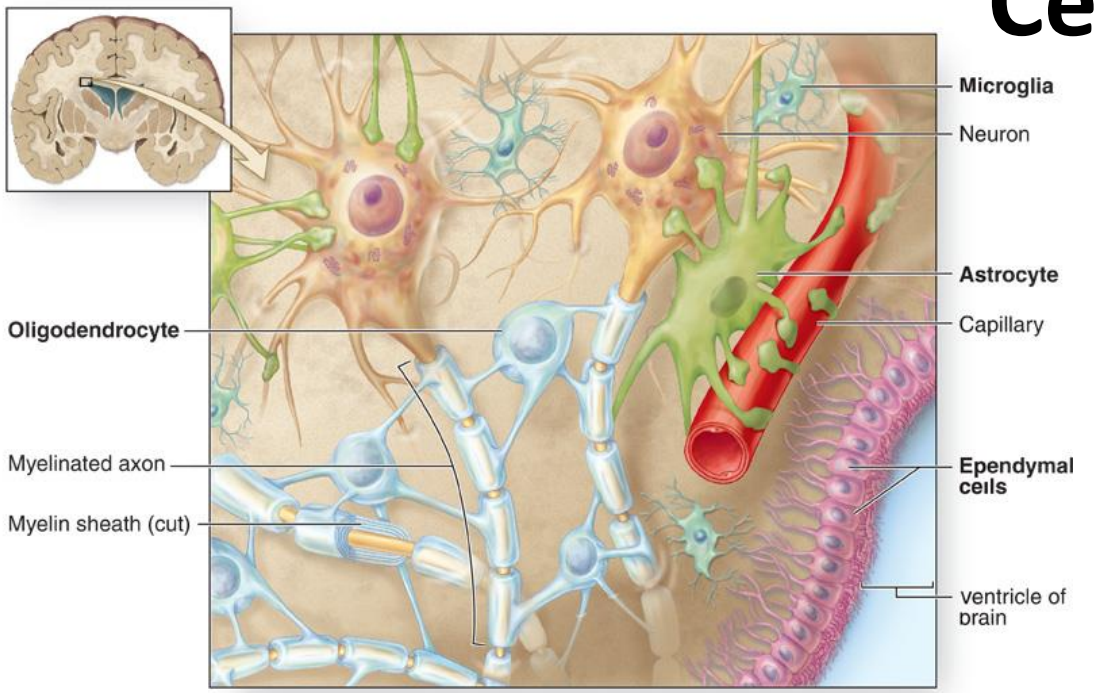


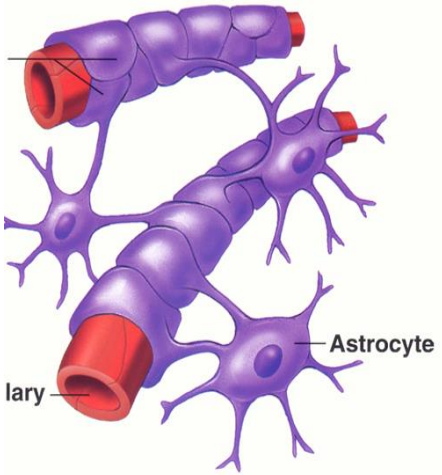


Células do epêndima ou ependimárias

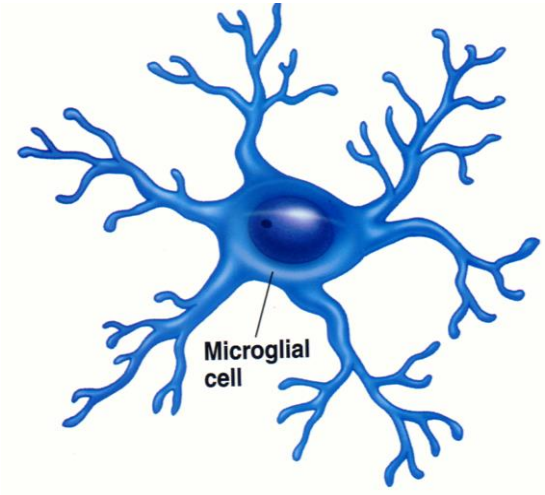
produzem líquido cefalorraquidiano nos ventrículos cerebrais e canal medular

Células da Glia - SNC

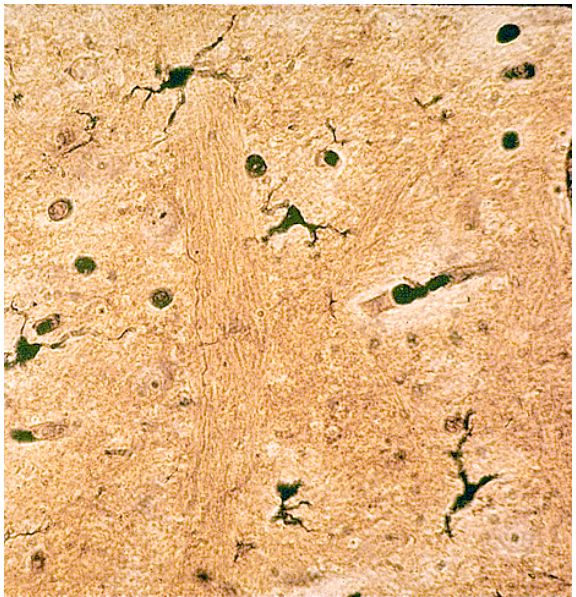




Microglia



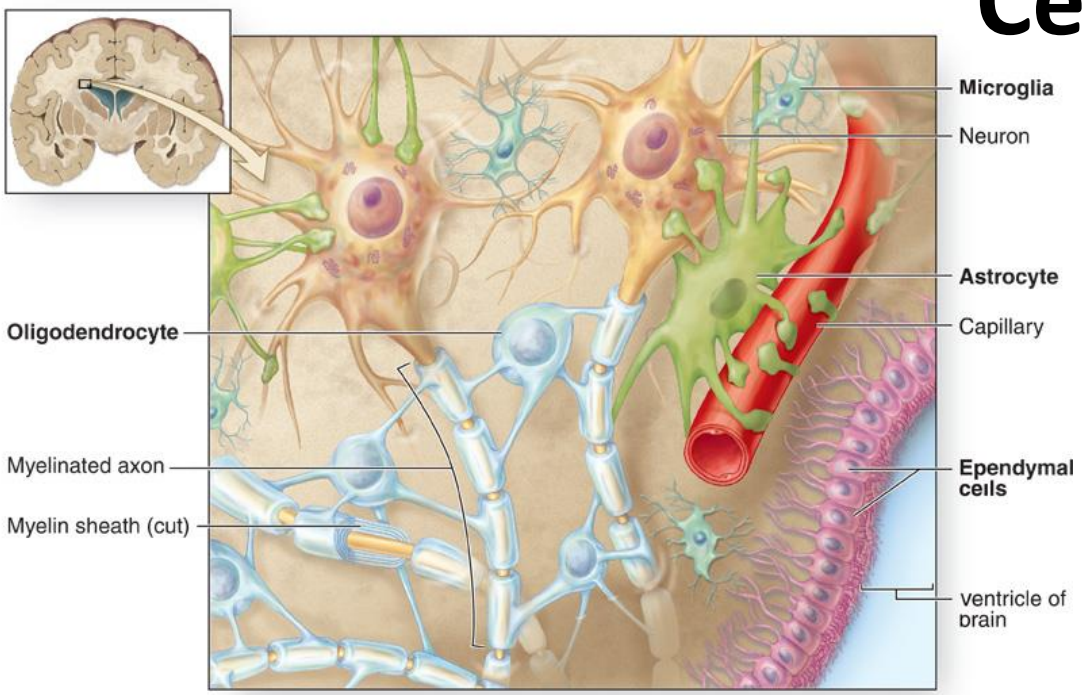
proteção (fagocitose)



Astrócitos

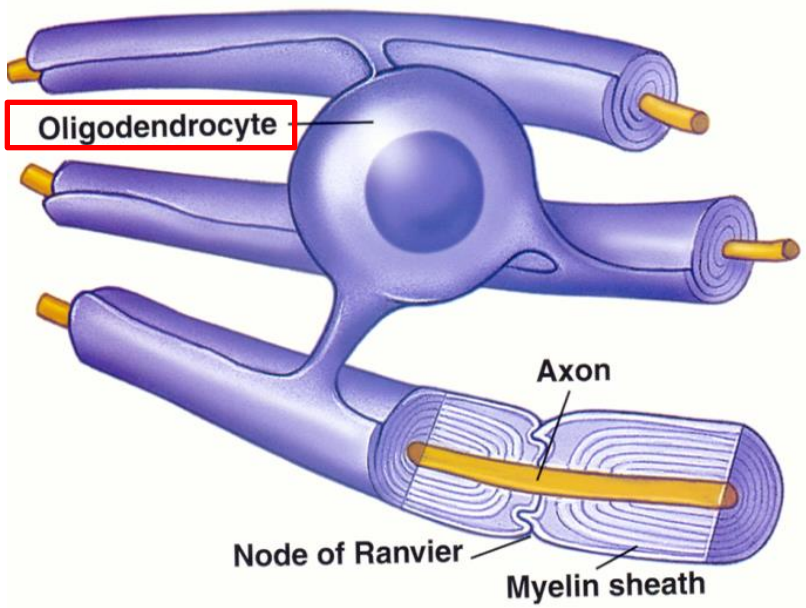
controla o ambiente dos neurônios (nutrição, proteção, suporte)

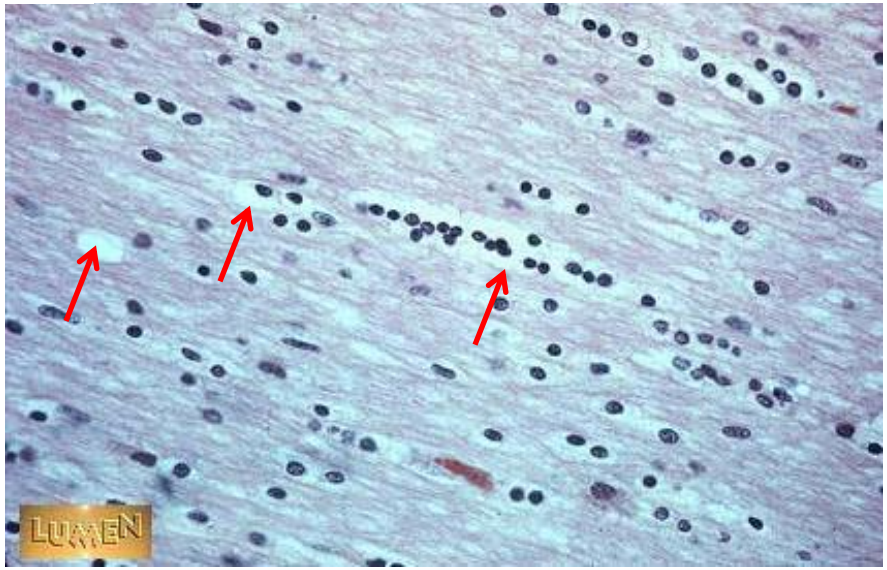
Células da Glia - SNC



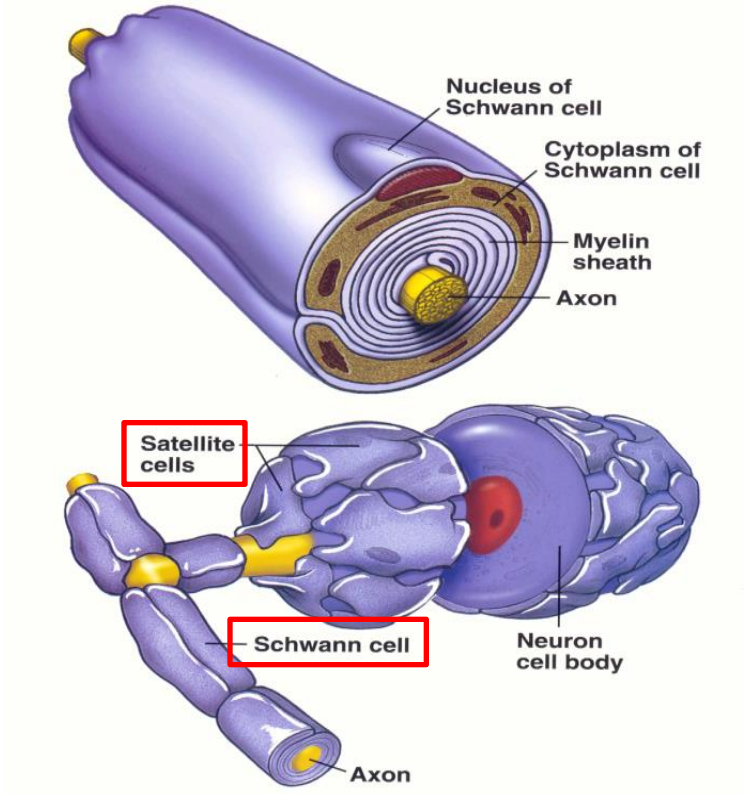
forma a **bainha de mielina** em volta dos **axônios**

isolante elétrico
acelera transmissão do impulso nervoso

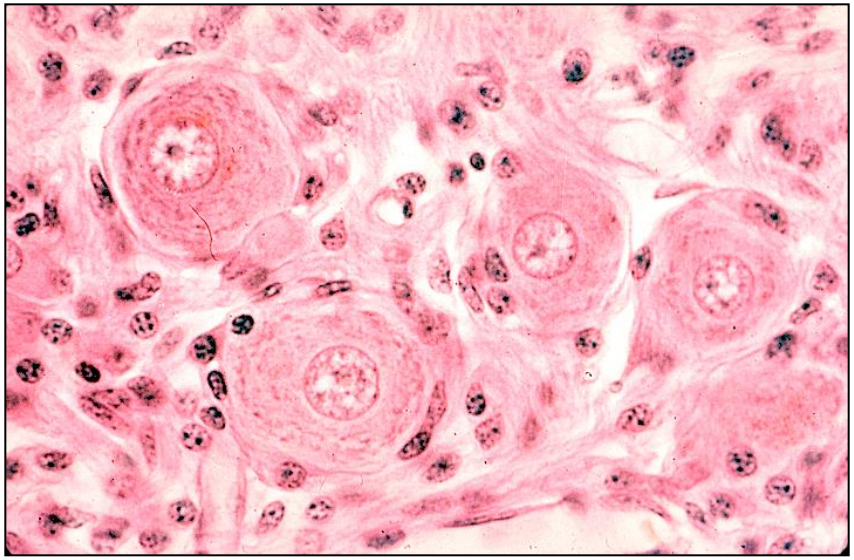




Células da Glia - SNP



células de Schwann - formam a **bainha de mielina** em volta dos **axônios**, apenas no SNP (nervos)



células satélites – proteção e suporte dos neurônios, apenas no SNP (gânglios)

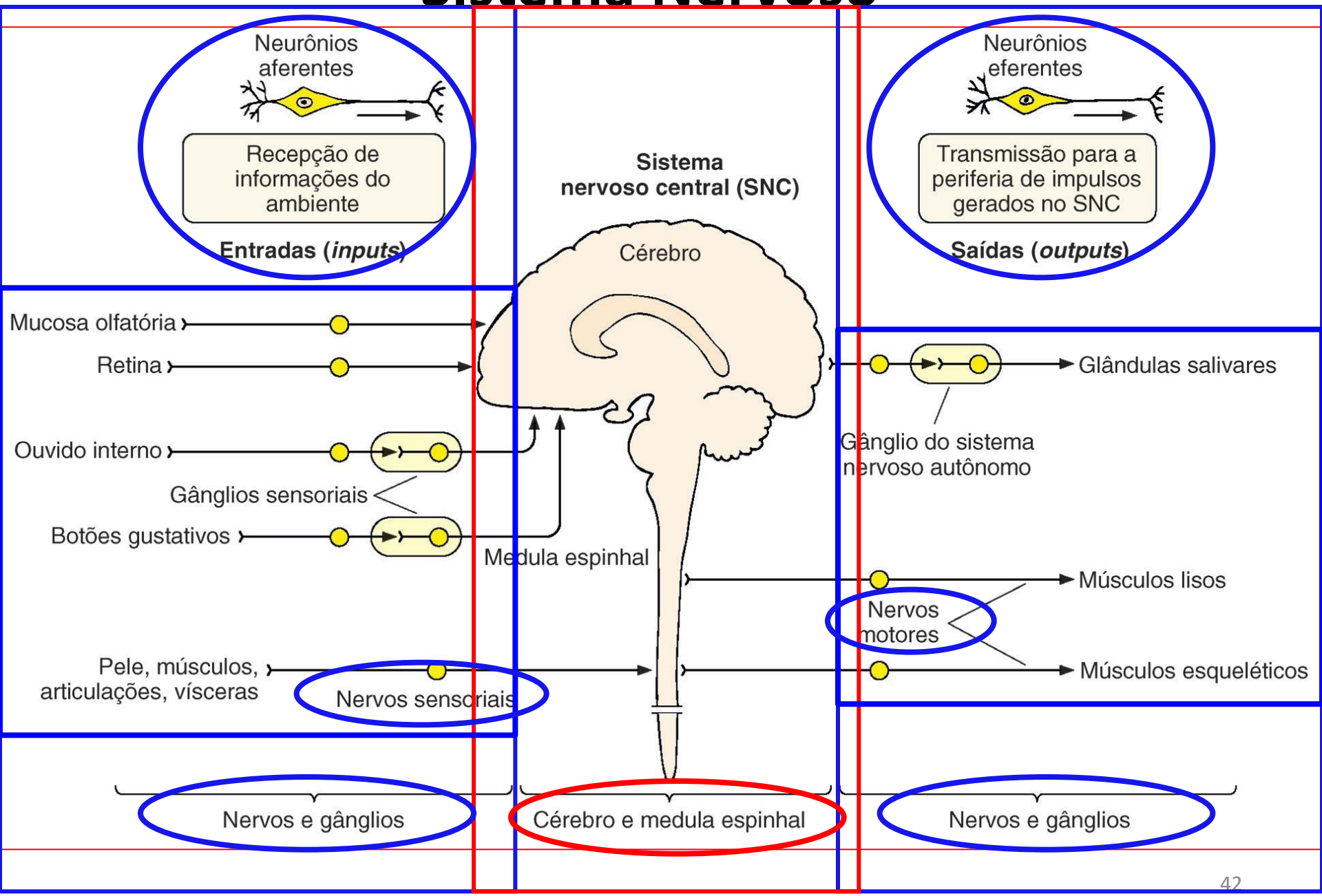
Distribuição das células do tecido nervoso

Célula	SNC	SNP
Neurônio	√	√
Glia		
- astrócito	√	
- microglia	√	
- epêndima	√	
- oligodendrócito	√	
- satélite		√
- Schwann		√

Bainha de mielina no axônio do neurônio

Associado ao corpo (pericário) do neurônio

Sistema Nervoso



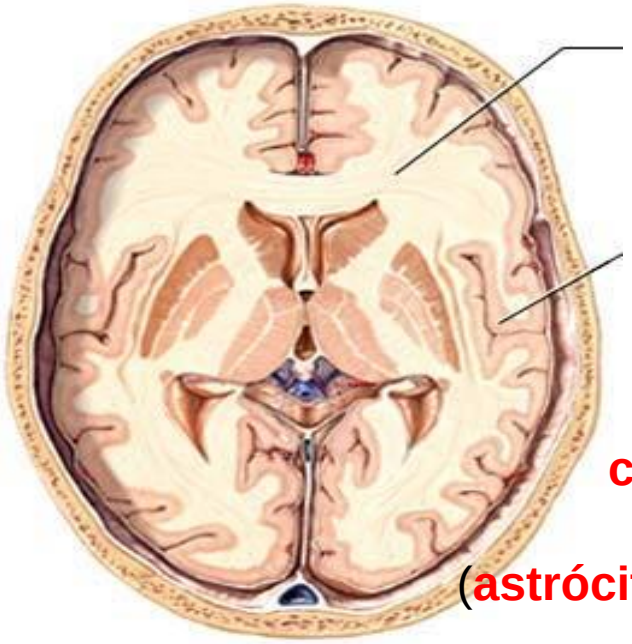
SNC

- **Constituintes**
- **Organização**

Neurônios
Glia

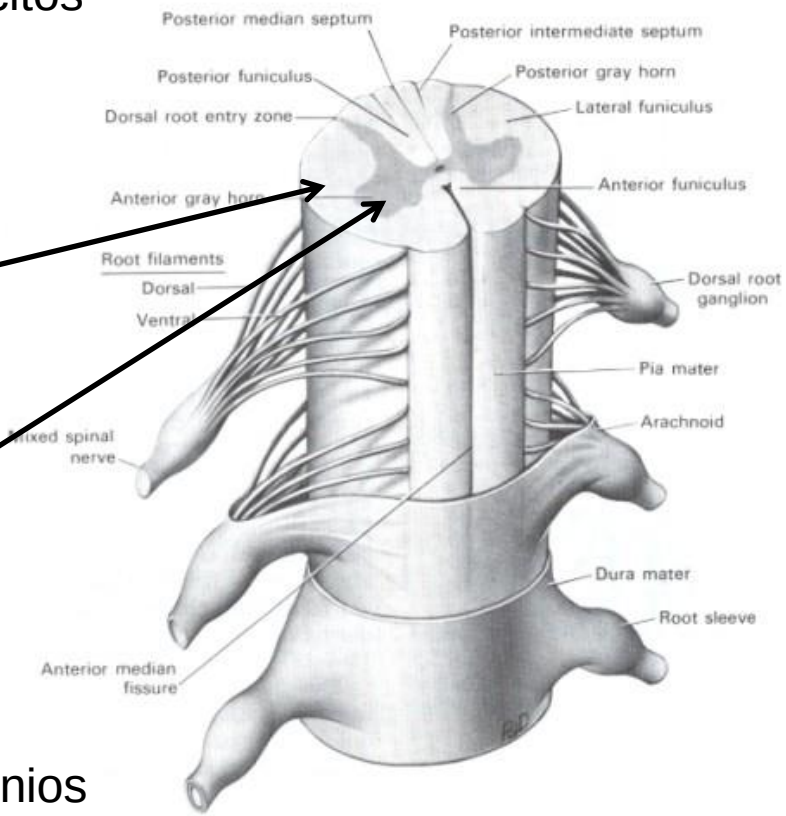
oligodendrócitos
astrócitos
microglia
epêndima

axônios de neurônios
oligodendrócitos (mielina)



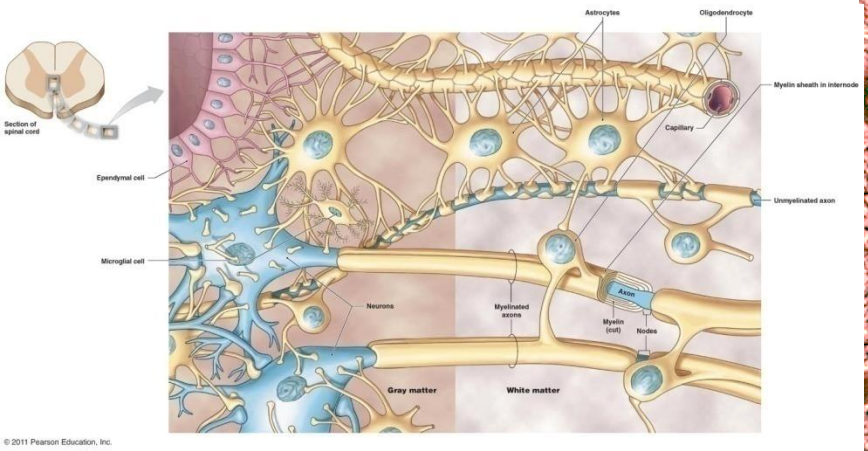
substância branca

substância cinzenta



corpos de neurônios
neuroglia
(**astrócitos, microglia, epêndima**)

Substância branca

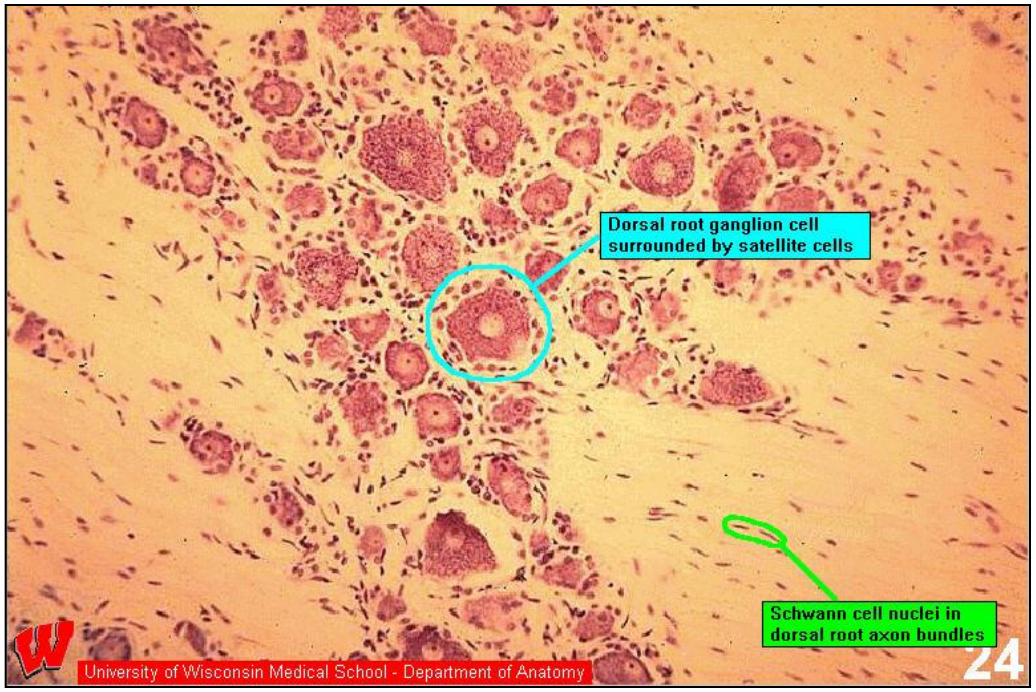


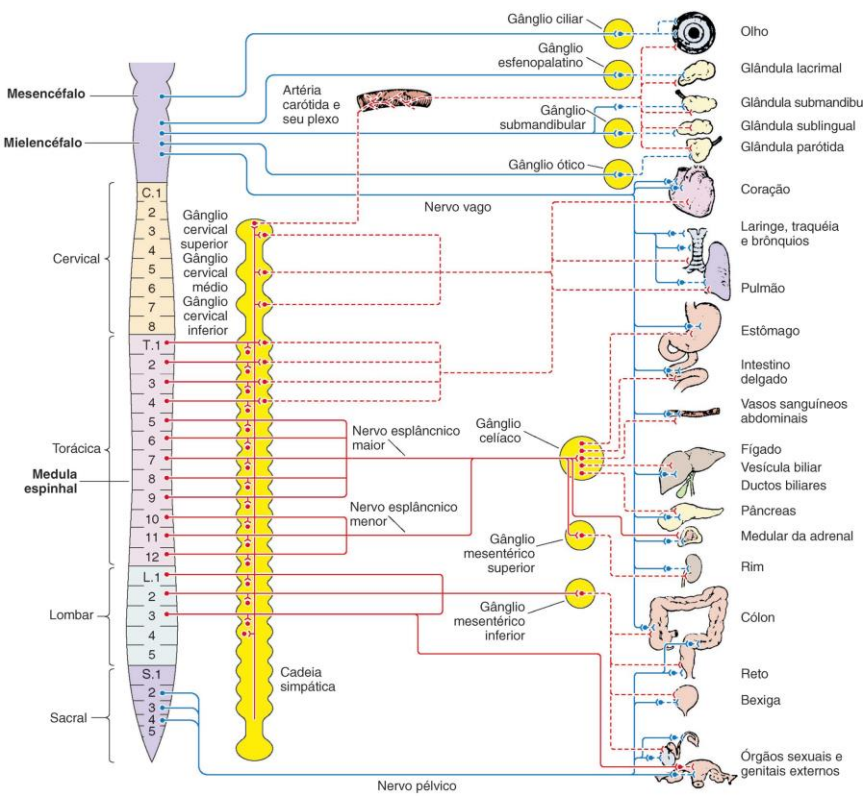
SNP

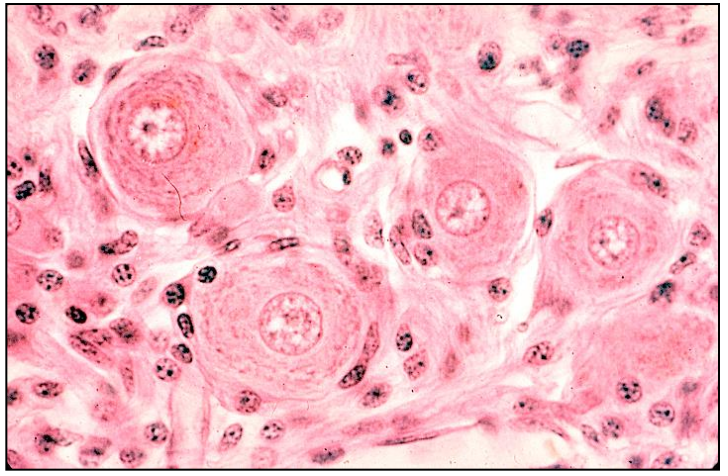
- **Constituintes** — **Neurônios**, **Glia** (Schwann, satélite)
- **Organização**

– gânglios nervosos

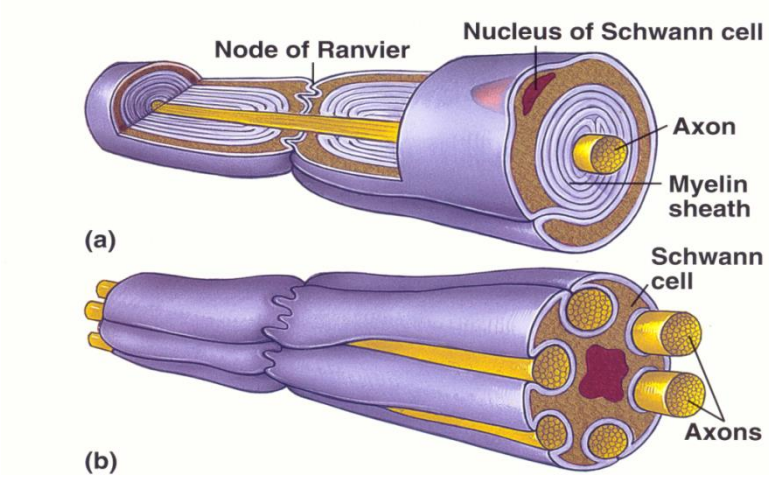
- **pericários**, satélites e Schwann

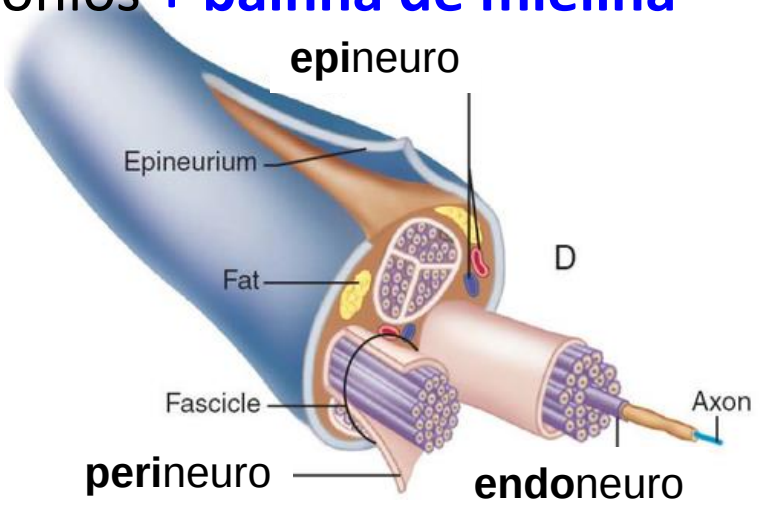


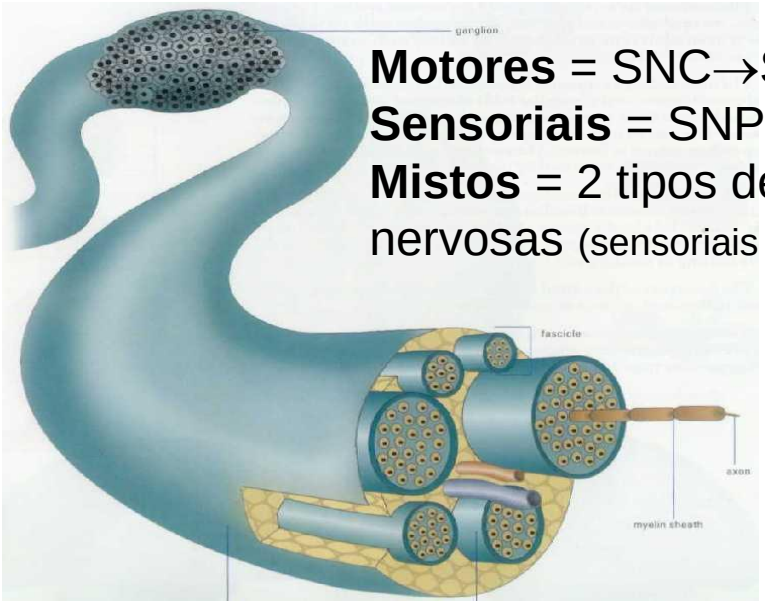




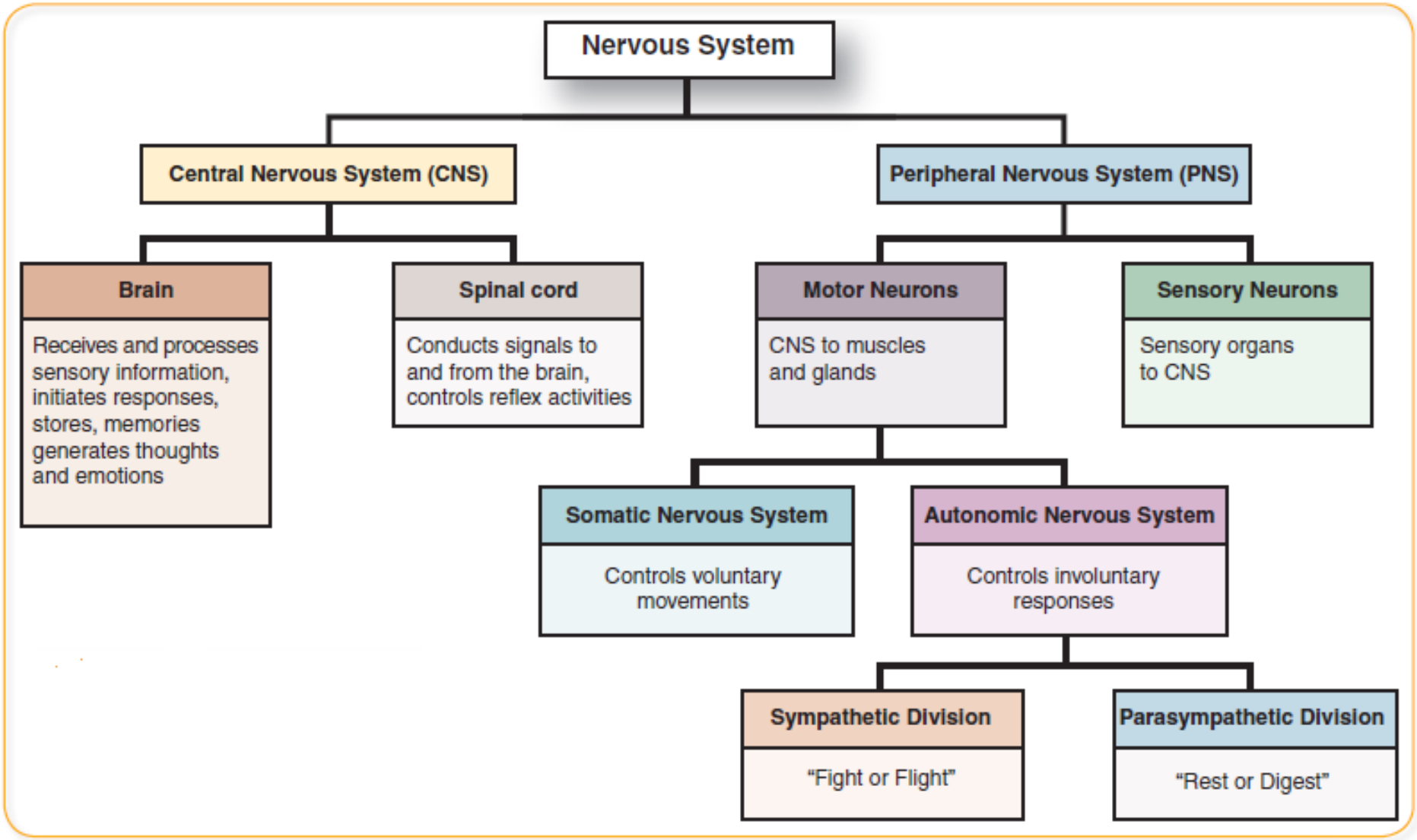
- **Nervos**
  - feixes de **fibras nervosas** + **conjuntivo**
    - fibras nervosas **=** **axônios** de neurônios **+ bainha de mielina**







Motores = SNC→SNP
Sensoriais = SNP→SNC
Mistos = 2 tipos de fibras nervosas (sensoriais e motores)


Nervous System
Central Nervous System (CNS)
Peripheral Nervous System (PNS)
Brain
Receives and processes sensory information, initiates responses, stores, memories generates thoughts and emotions
Spinal cord
Conducts signals to and from the brain, controls reflex activities
Motor Neurons
CNS to muscles and glands
Sensory Neurons
Sensory organs to CNS
Somatic Nervous System
Controls voluntary movements
Autonomic Nervous System
Controls involuntary responses
Sympathetic Division
"Fight or Flight"
Parasympathetic Division
"Rest or Digest"

Tarefas para 19/09

- Ler o capítulo referente ao Sistema Endócrino com base nos objetivos de aula no Moolde

- Realizar o teste online antes da aula (e depois tb!)

- Trazer livro, computador...