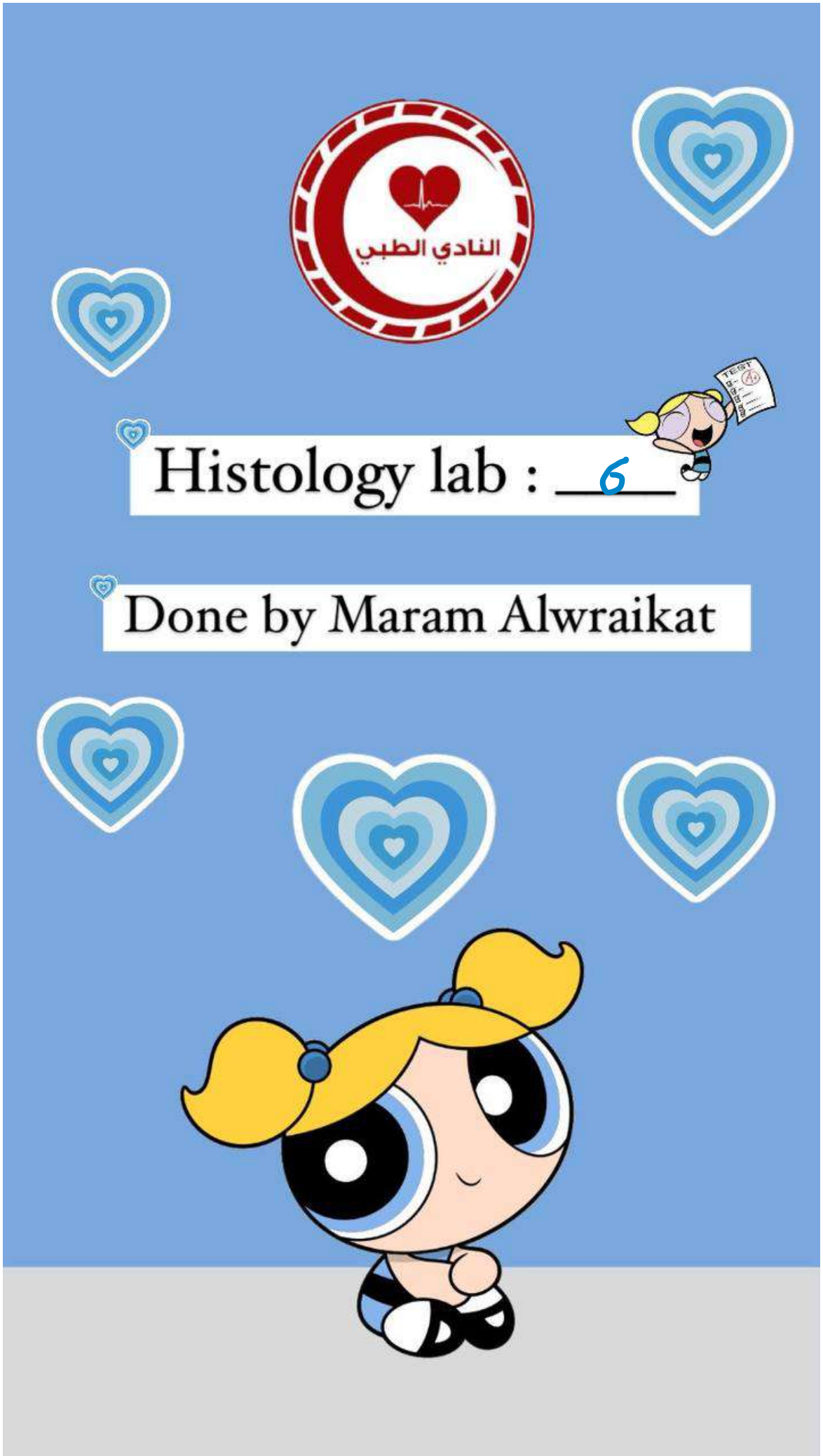

النادي الطبي
Histology lab : 6
Done by Maram Alwraikat

Nervous Tissue

* In nervous tissues we have several types of cells classified into 2 Groups : (Neurons, Glial cells)
* The histology of the varries organs in the nervous tissue differs But they Are all made of Neurons And Glial cells.

① Neurons :

(في جسمي أنواع كثيرة في Nervous system) لكن اي رح نشوف بالمحبّر

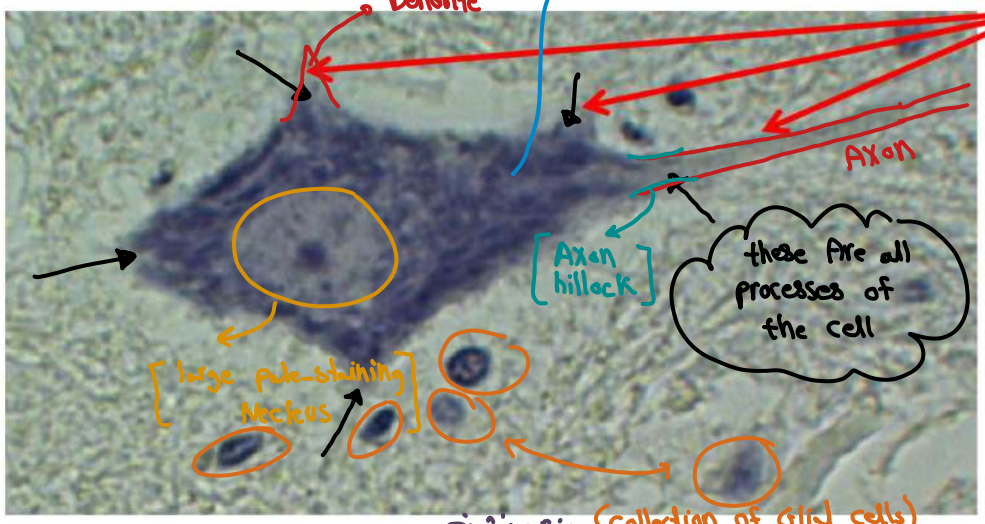
Neurons الكبيرة

كتير بدل نشوفها تحت المجهر

وبلش نتعرف عليها بسهولة

Part 3: Nervous Tissue

(1) Neurons



typical features

This is Anterior horn cells of the spinal cord

And they Are multipolar Neurons with typical features

Anterior horn cell of the spinal cord. Note the typical features of neurons: basophilic cytoplasm, large spherical pale-staining nucleus with prominent nucleolus and cell processes.

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(Blue in color)

*ممكن هيم الفرق بين (Axon و Dendrites)

But

Axon	Dendrite
1- Diameter (Thick + ما بتغير) في بيقى ناعم	كل ما يبعد عن الخلية يصغر
2- Axon اي يبدأ فيا المنطقة. (It is cone in shape)	

(تكون مرتفعة الخلل / مثلثة) + لونها بيكون فاتح

→ It is (Axon Hillock)

كانت ماوية Nissl Bodies ← ؟؟ why

what Are the nissl Bodies of the Neurons?

* Nissl Bodies :

Are Aggregation of RER And Ribosomes

↓

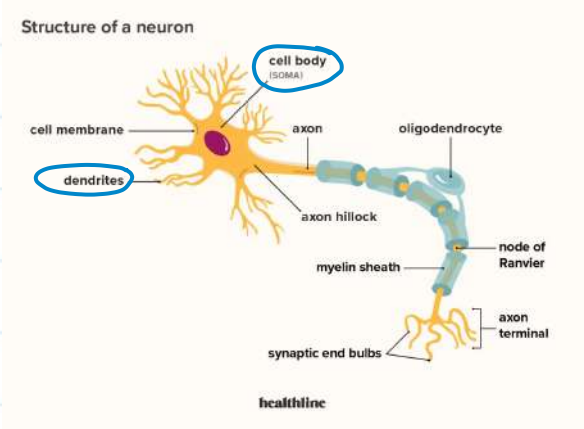
Rough Endoplasmic Reticulum

(Nissl Bodies) تتجمع على شكل كتل اسمها Neurons في

↓

موجودة في

Soma of the Neuron + Dendrites



عادة هيك

Soma of Neuron

بيكون لونه أزرق (Basophilic)

Dendrites + بيكون لونها أزرق

بس Axon مافيه Nissl Bodies

↓

بيكون لونه أفتح

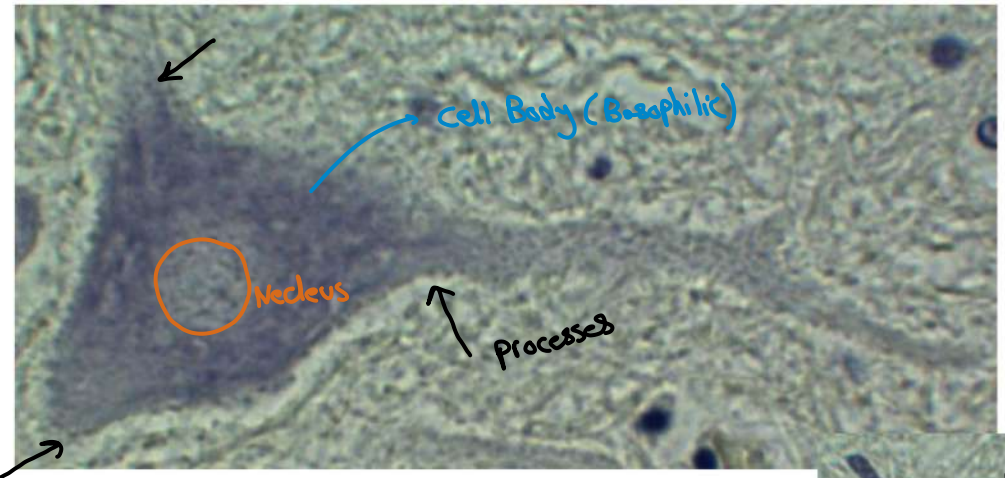
↓

بس هنا معك بالـ slide (بس في بعض الأحيان ممكن تظهر عنا)

(Glial cells) ← صح ← (Nuclei) الموجودين على جنب هم

↓

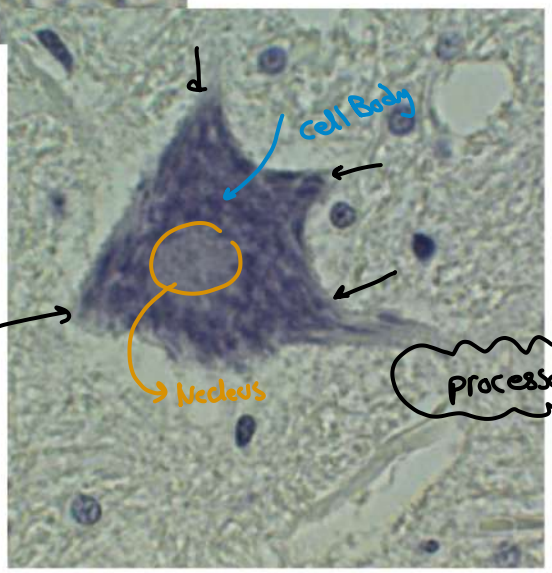
بس ما منقدر نفرق نوعهم بالضبط



some other views of Anterior horn cells of the spinal cord

(Are multipolar Neurons)

Anterior horn cells of the spinal cord. Because these cells have at least three processes, they're multipolar neurons.



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* Another type of Neurone

one of the largest neurones in the nervous system Are (purkinje cells)

[which is found in the cerebellar cortex]

[منقدر نشوف purkinje Neurons ببساطة جدًا]

* لذلك منقدر نشوف cerebellar cortex كمان ببساطة أيضًا

Cerebellar cortex

يتكون من عدة طبقات (≈ 6 layer) ← لكن من الصعب التفريق بين هذه الطبقات

في أنواع كثيرة من (Neurons)

لكن cerebellar cortex في المخيخ بس عندي (3 layers) من الكلايا

ولكن أقدر أتعرف عليها ببساطة تحت المجهر

First ن

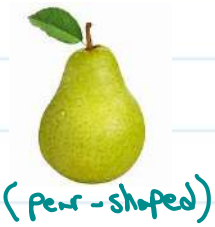
we have to recognize the (purkinje cells)

[في أضخم أنواع Neurons الموجودة بالجسم]

cell body عندن شكل

شكله: (pear-shaped)

(لونها بني فاتح جدًا)



(pear-shaped)

Purkinji cell Bodies الموجود في (cerebellar) cortex * جزء

اسمه: (purkinje cell layer)

(cell bodies of purkinje cells) هي الطبقة اللي فيها

Superficial to it is layer of Neurons called (the molecular layer)

تمتاز بوجود عدد قليل من Neurons وتكون متباعدة

They Are far away from each other: معناها بالعربي

Neurons ← جزء يكون لا Nuclei

Glial cells ← وجزء لا ← لكن صعب التعرف عليها

* Deep to purkinje cell layer

we have a (granular layer)

why ?

(Granular layer) اسمها

كانت الخلايا فيها بتكون كبيرة جدًا

(like: Granules of sand)

Neurons تمتاز بوجود نوع من

(Granular Neurons) اسمها

تمتاز بصغر حجمها وكثرة عددها

* They Are small Round Neurons

And they Are usually found

in large numbers

في ← Nuclei الموجودة (عددها كبير جدًا + متقاربين من بعض)

They look like (Granules of sand)

حبيبات الرمل

Cerebellar Cortex

Summary

يتكون من ← (3layers of Neurons) ← Purkinje cell layer : طبقة بالوسط

تحتوي على (purkinje cell Bodies)

more superficial to ← the purkinje cell Bodies

(I have of scattered neurons)

متناثرة

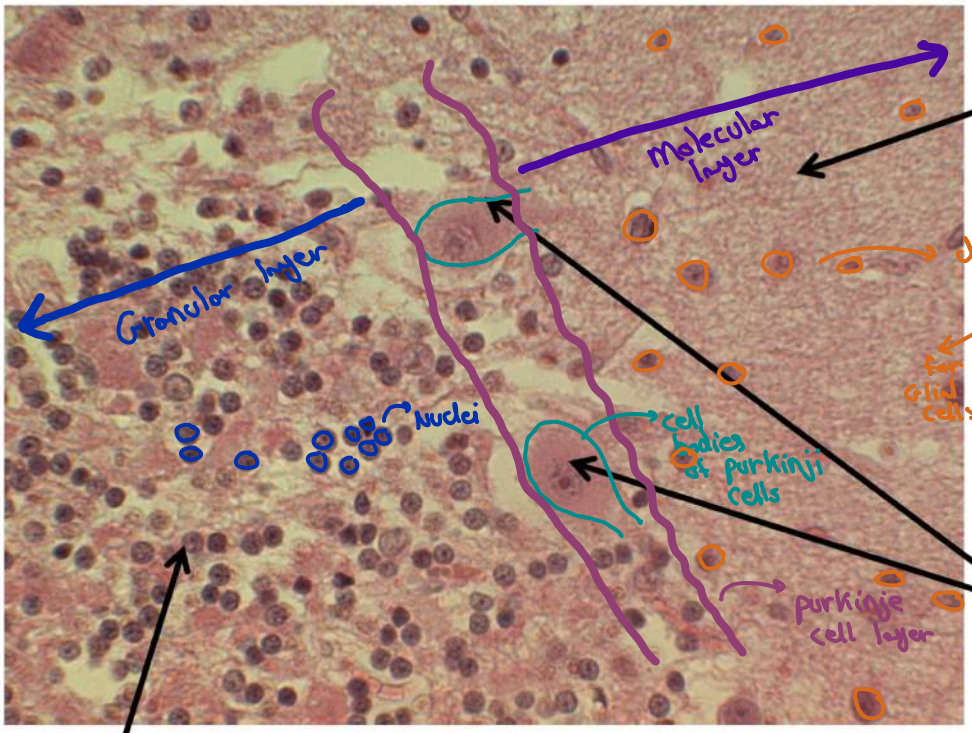
called: (Molecular layer)

Deep to the purkinje cell layer ←

I have the (Granular layer)

which contains numerous Granular cells

(2) Cerebellar Cortex



Molecular Layer

منشوف عدد قليل من Nuclei

for Glial cells or for Neurons

Cell bodies of Purkinje Cells

Granular Layer

Cerebellar Cortex

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الصبغة المستخدمة في هذا slide: في الصبغة الاعتيادية

[Hematoxylin Eosin]

بيصبغ structures الاعتيادية

cell bodies — Nuclei

But in Nervous system يفضل نستخدم (Silver staining)

why?

لأن (Silver) بيتفاعل مع (Neurofilaments) الموجودة في Neuron

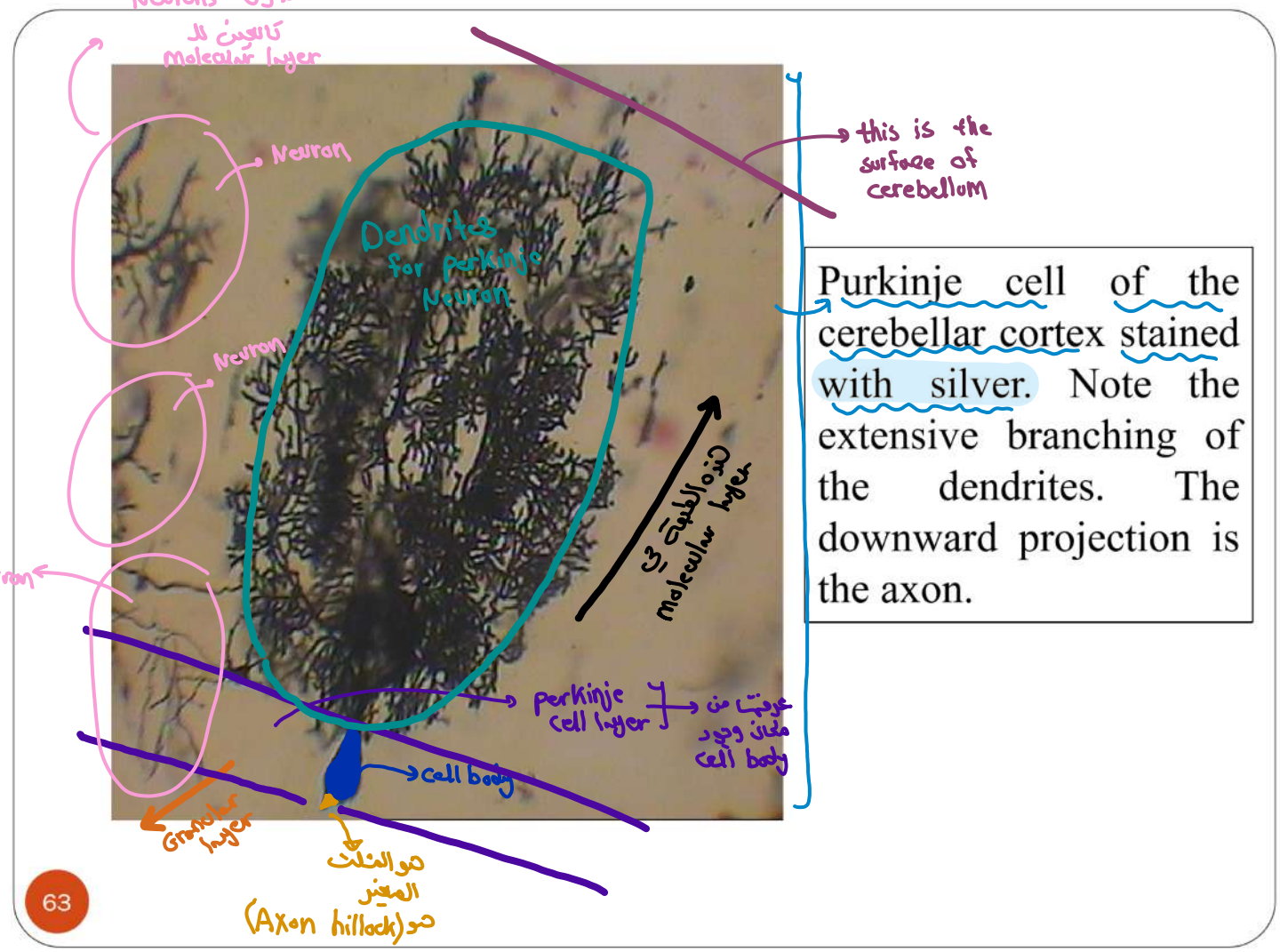
cell body — Dendrites — Axon

وبيصبغ باللون الأسود

Silver staining ← so

مش بيصبغ Neuron بشكل كامل

Example



perkinje cell layer (هيك)

why? ليه Dendrites هيك اسمه ؟
(لأنه يتفرع مثل أغصان الشجر) ← (Purkinje cells): تأكيد لهذا ذلك.
حتى اسمه: The Dendritic tree of the Neuron

why? اسم Axon هيك ؟
لأنه عمودي مثل المحور (Axis)

→ cell bodies of purkinje cells Are found in the purkinje cell layer of (cerebellar cortex)

→ Axon pass Deep (so it is in Granular layer)

→ Dendrites (they will pass more superficially) so in molecular layer → Dendrites تعريب ولمات إي (surface of cerebellum)

معلومة إضافية : ← Purkinje Neuron

(في المخ Neuron يتم دراستها ورسمها)

العالم (Purkinje) درس (cerebellum) ودرس (cerebellar cortex)

ومتى Purkinje cells ورسمها

لماذا أخذنا Neurons ←

And Example of Neurons ←

in CNS : (cerebellar cortex)

PNS ← we have

Spinal Ganglia

Peripheral Nerves

→ Spinal Ganglia or Dorsal Root Ganglia :

موجودة في ← Dorsal Root of the spinal Nerve

داخل ← Dorsal Root Ganglia

في : (Pseudounipolar Neuron)

The cell bodies of these Neurons
Are surrounded by A Group of
Glial cells called → Satellite cells

→ Peripheral Nerve

* عبارة عن مجموعة من (Neurons) تغطي (Axons)

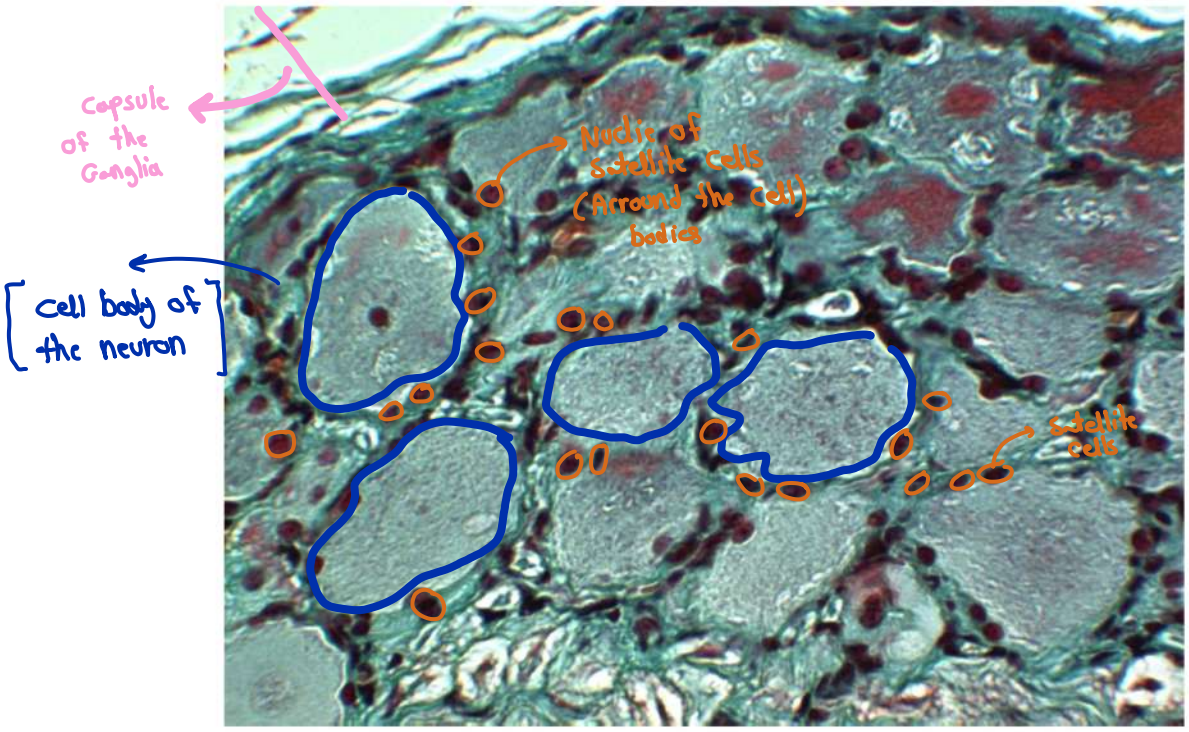
Nerve fiber تطلق عليها
why ?
(لأنه Axon بتكون طويلة)

مجموعة من Axon في ترتيب ← (Group together) مع

To form A bundle of nerve fibers

Then A Group of
bundles of Nerve fibers
come together
to form A peripheral Nerve

(3) Spinal Ganglia or Dorsal Root Ganglia



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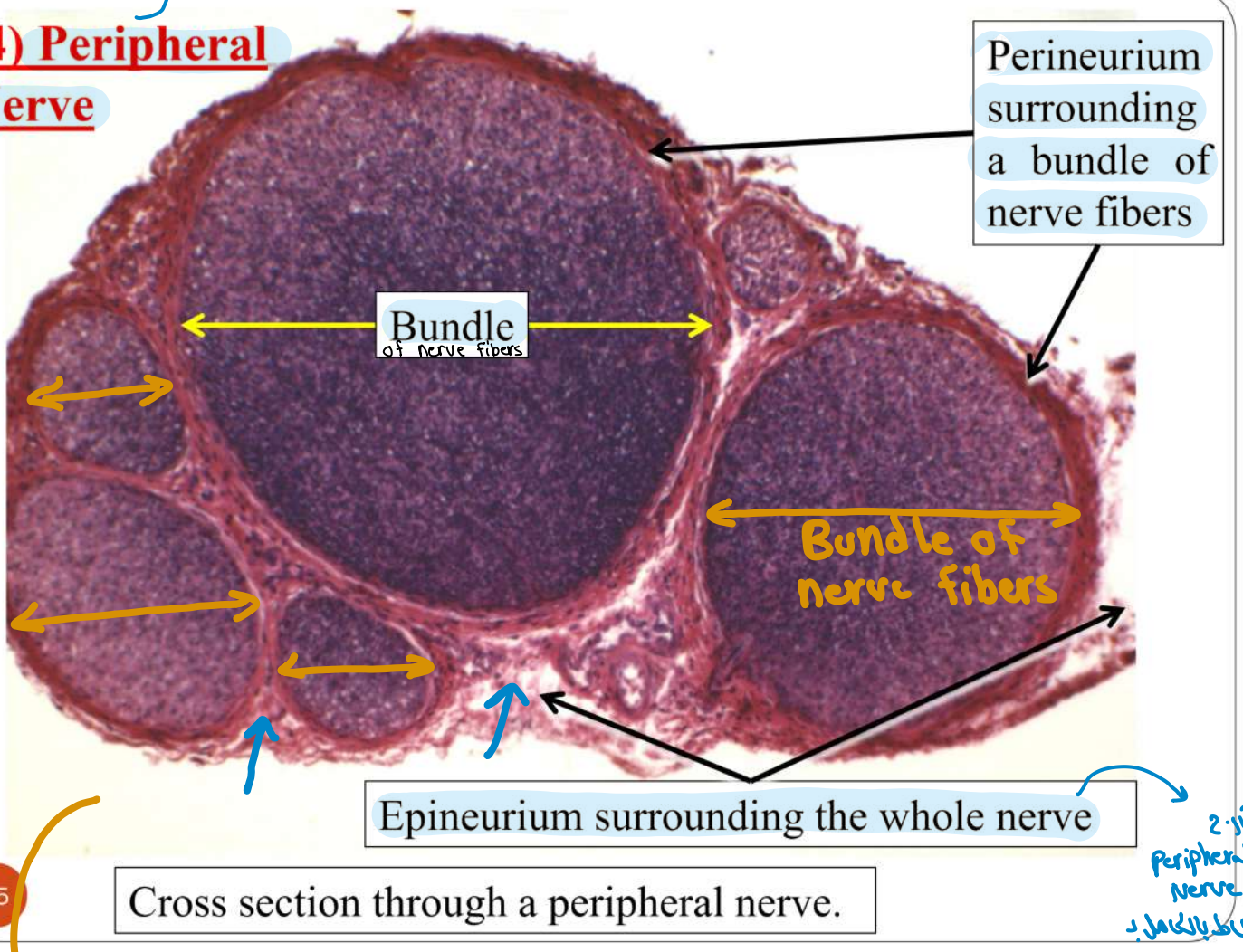
The larger structures are the cell bodies of the pseudounipolar neurons. The smaller dark circles around the neurons are the nuclei of the Satellite glia cells.

في الأعصاب اي بتمشي في جسم الإنسان → It is group of bundles of nerve fibers

(4) Peripheral Nerve



65

Cross section through a peripheral nerve.

من اكثر ٢ Peripheral Nerve بتكون مغطية بالكامل بـ (Epineurium)

Here we have (6 Bundles) of nerve fibers

(Nerve fiber / Axon) كل نقطة غمقة داخل ← عبارة عن Bundle في

(Nerve fibers) كل ← حتى نحمي (لكي تحميها) بطبقات تغطيها

(connective tissue layers)

Axon يحيط

(Endoneurium) : اسمها (connective tissue) من بطبقة يحاط الواحد Nerve fiber *

: يتكون من

(Areolar connective tissue)

It is found between nerve And muscle fibers

هذا ما منشوفه بمحولة فتح microscope

Called : perineurium ← (protective layer) الواحدة Bundle * احيطت بطبقة

Dense collagenous connective tissue ← connective tissue layer ← بالكامل nerve ←

Epineurium ← اسم الطبقة

Endoneurium ← Nerve fiber / Axon

Perineurium ← Bundle

Epineurium ← Nerve بالكامل

components تحتوي على مجموعة من

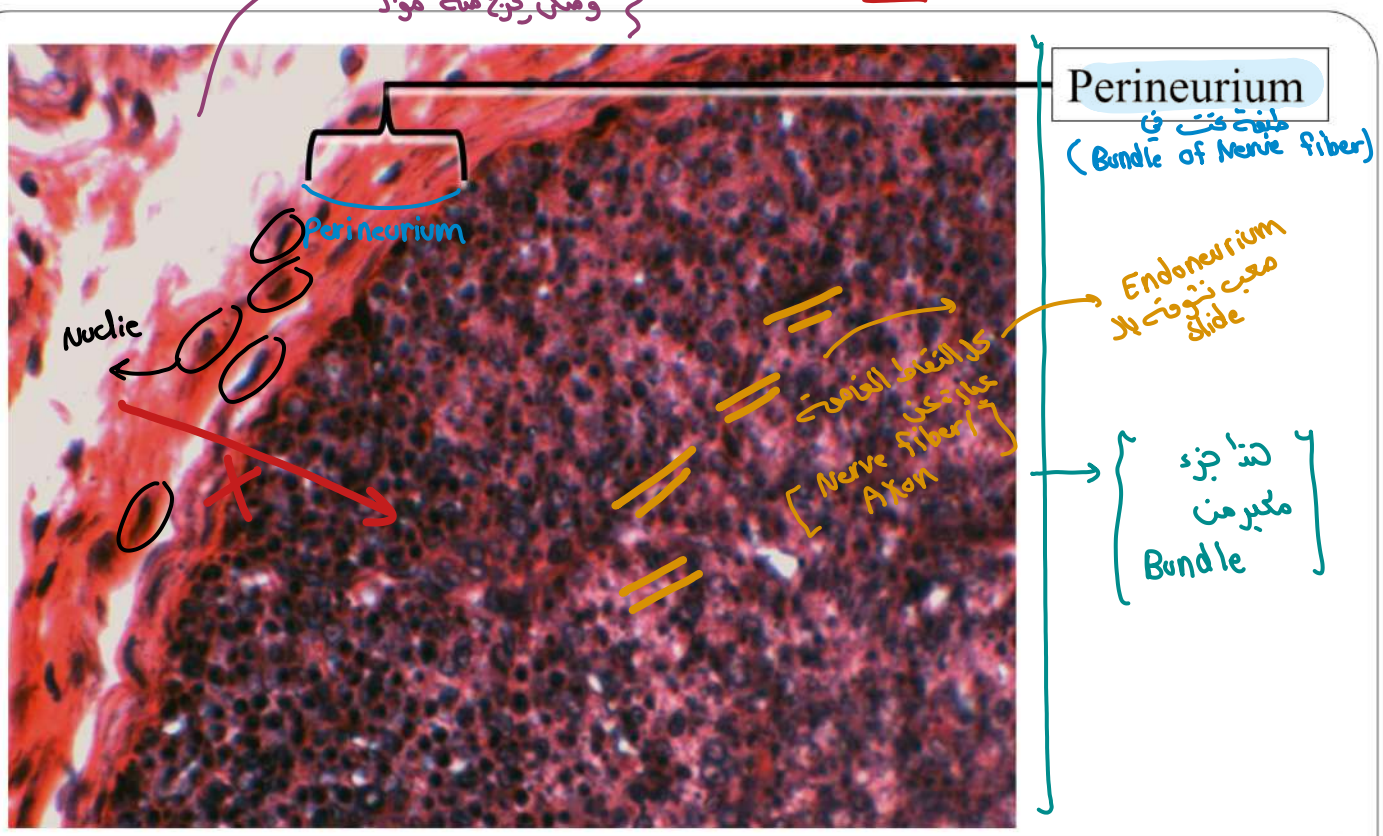
Nuclie

بالدور مهم تتبنا

Nuclie of cells that form (Blood Nerve Barrier)

nerve fibers + فاصل بين مكونات الدم

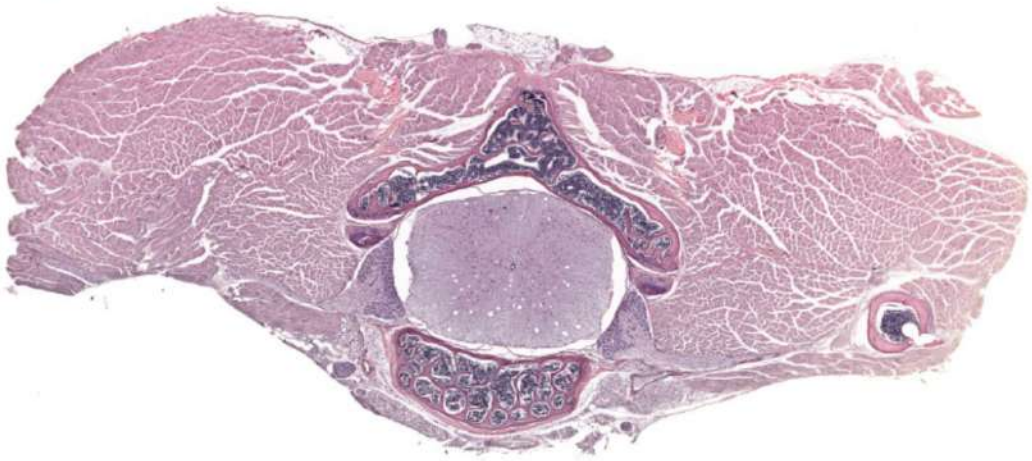
(Bundle) الموجودة داخل



It controls what substances can pass And " " can not pass into the bundle of Nerve fibers ← (perineurium) ← So الخلايا الموجودة في

خلصنا ن
الله يوفقكم
كتشونا من صالح دعائكم

Whole Slide



2000 µm

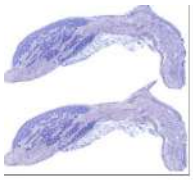
MH 047 Spinal Cord

Dorsal Root Ganglion

Emitting from the spinal cord are dorsal and ventral roots. The dorsal roots contain sensory nerve fibers and the ventral roots contain motor nerve fibers.

Unlike motor neurons, which have cell bodies in the ventral horn of the spinal cord, sensory neurons have their cell bodies massed together in ganglia located outside of the spinal cord.

- Dorsal Root Ganglion (left, right) - aggregation of sensory neurons (pseudounipolar) located on each dorsal root.
  - Ganglion Cells - large, nerve cell bodies with centrally located nuclei and prominent nucleoli. The cytoplasm contains abundant Nissl substance.
  - Satellite Cells (or capsule cells) - glial cells at the periphery of nerve cell bodies.
- Spinal Nerves (left, right) - nerve fibers exiting each dorsal root ganglion.



Whole Slide

1000 µm

MHS 285-286 Spinal Ganglion

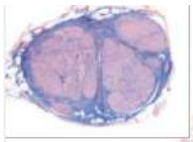
Dorsal Root Ganglion (Toluidine)

Toluidine blue is a basic dye that binds nucleic acids, but preferentially stains RNA.

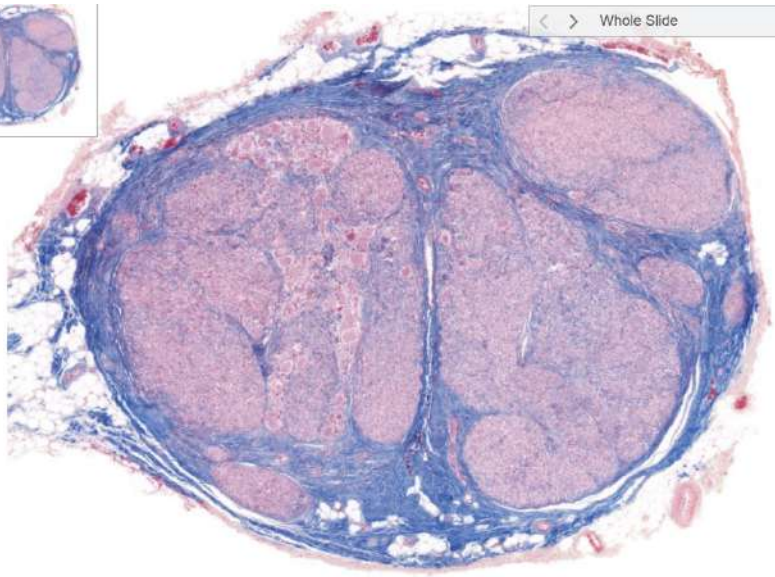
Dorsal root ganglion is an aggregation of sensory neurons (pseudo-unipolar) located on each dorsal spinal root.

- Ganglion cells - large, nerve cell bodies with centrally located nuclei
  - Nucleolus - intensely stained because it contains negatively charged RNA involved in ribosome assembly
  - **Nissl (chromophil) Substance** - contains negatively charged RNA found in free ribosomes and ribosomes bound to endoplasmic reticulum (*i.e.*, RER)
    - Only found in cell body and dendrites
    - Abundant chromophil substance suggests these

prev 1 2 next

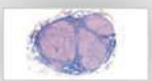


Whole Slide



1000 µm

MH 051 Dorsal Root Ganglion

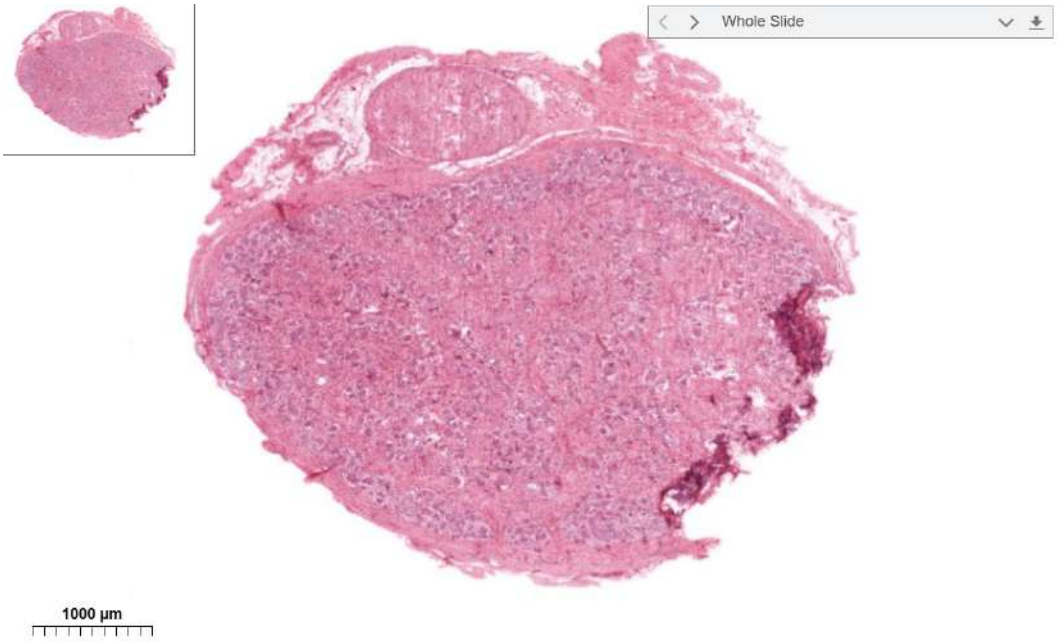


Dorsal Root Ganglion (Azan)

A cross-section of a dorsal root ganglion stained with azan to make it easier to see nerve fibers and connective tissue.

Compare this slide with MH 050 Dorsal Root Ganglion (H&E).

- Ganglion Cells - large, nerve cell bodies with large nuclei and prominent, red nucleoli. Their cytoplasm contains abundant Nissl substance.
- Satellite (or Capsule) Cells - glial cells at the periphery of nerve cell bodies.
- Nerve Fibers - non-myelinated and myelinated axons of different diameters seen in cross-section.
  - Axon - light blue material at the center of each nerve fiber.
  - Schwann Cells - glial cells that wrap axons in the peripheral nervous system. Their large, round nuclei are adjacent to some axons



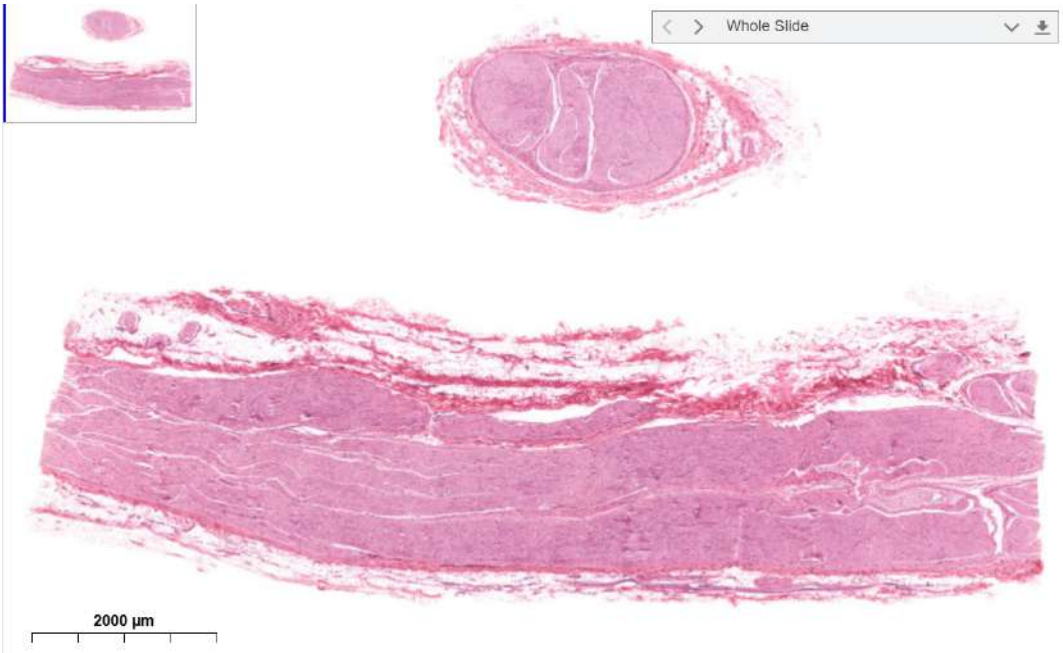
MH 050 Dorsal Root Ganglion

Dorsal Root Ganglion

It is difficult to identify nerve fibers and connective tissue in this cross section of a dorsal root ganglion because both stain pink/red.

Compare this slide with MH 051 Dorsal Root Ganglion (Azan).

- Ganglion Cells - large, nerve cell bodies with large nuclei and prominent nucleoli. Their cytoplasm contains abundant Nissl substance.
  - Lipofuscin - yellow-brown pigment granules in some nerve cell bodies.
- Satellite (or Capsule) Cells - glial cells at the periphery of nerve cell bodies.
- Nerve Fibers - non-myelinated and myelinated axons of different diameters seen in cross-section.
  - Axon - pink material at the center of each nerve fiber.
  - Schwann Cells - glial cells that wrap axons in the



MH 052 Peripheral Nerve

Peripheral Nerve

Cross-section of a peripheral nerve.

- Connective tissue
  - Epineurium - dense irregular connective tissue surrounding the entire nerve.
  - Perineurium - connective tissue surrounding a bundle of nerve fibers (fascicle) within nerves.
  - Endoneurium - connective tissue surrounding individual nerve fibers within nerves.
- Nerve fibers - non-myelinated and myelinated axons of different diameters seen in cross-section.
  - Axons - light blue material at the center of each nerve fiber.
  - Schwann Cells - their large, round nuclei are adjacent to some axons. Myelin sheaths appear as pink/red

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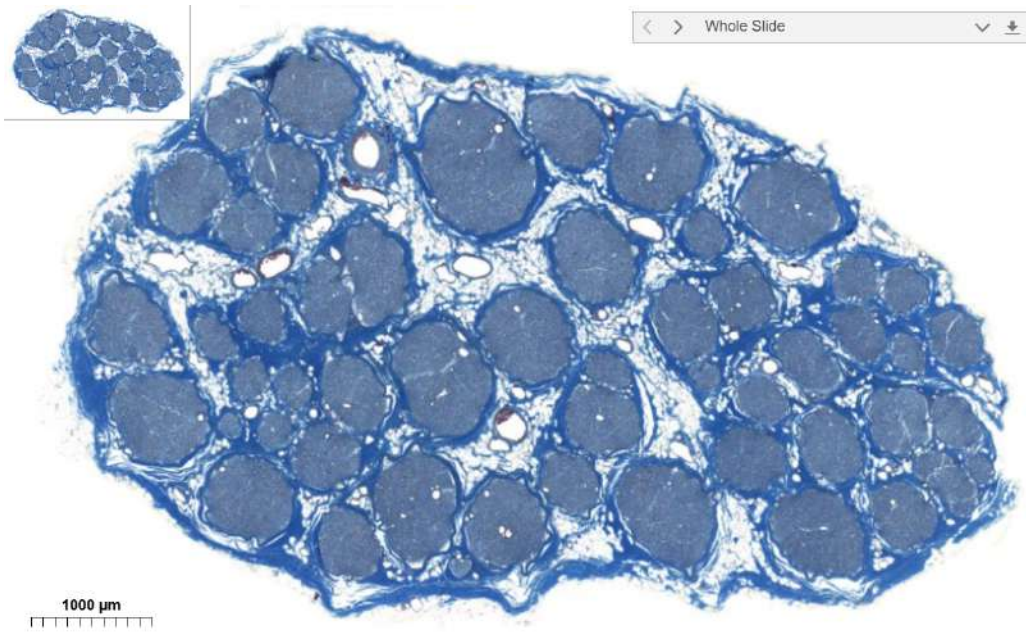
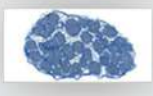


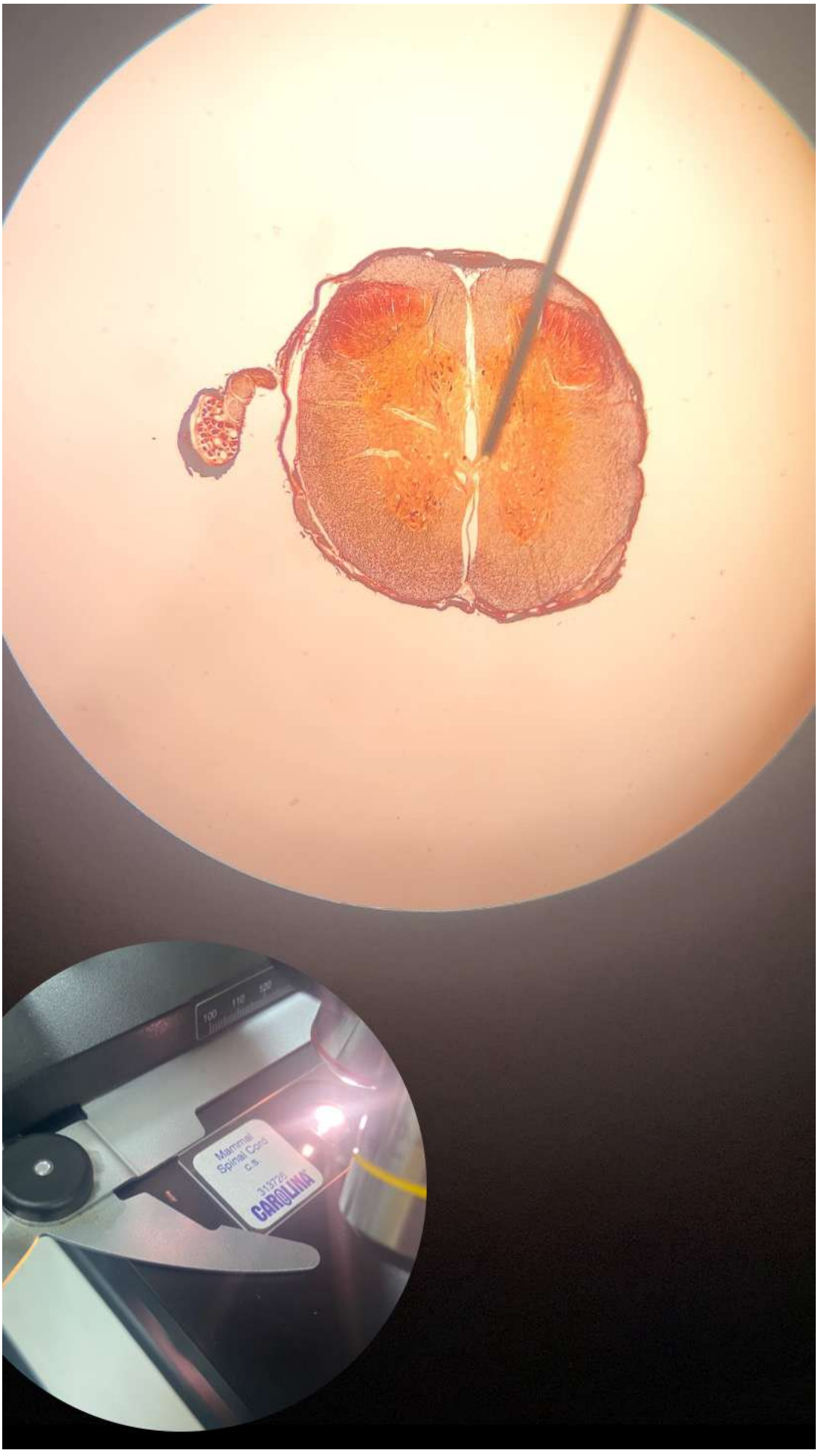
MHS 239 Peripheral Nerve

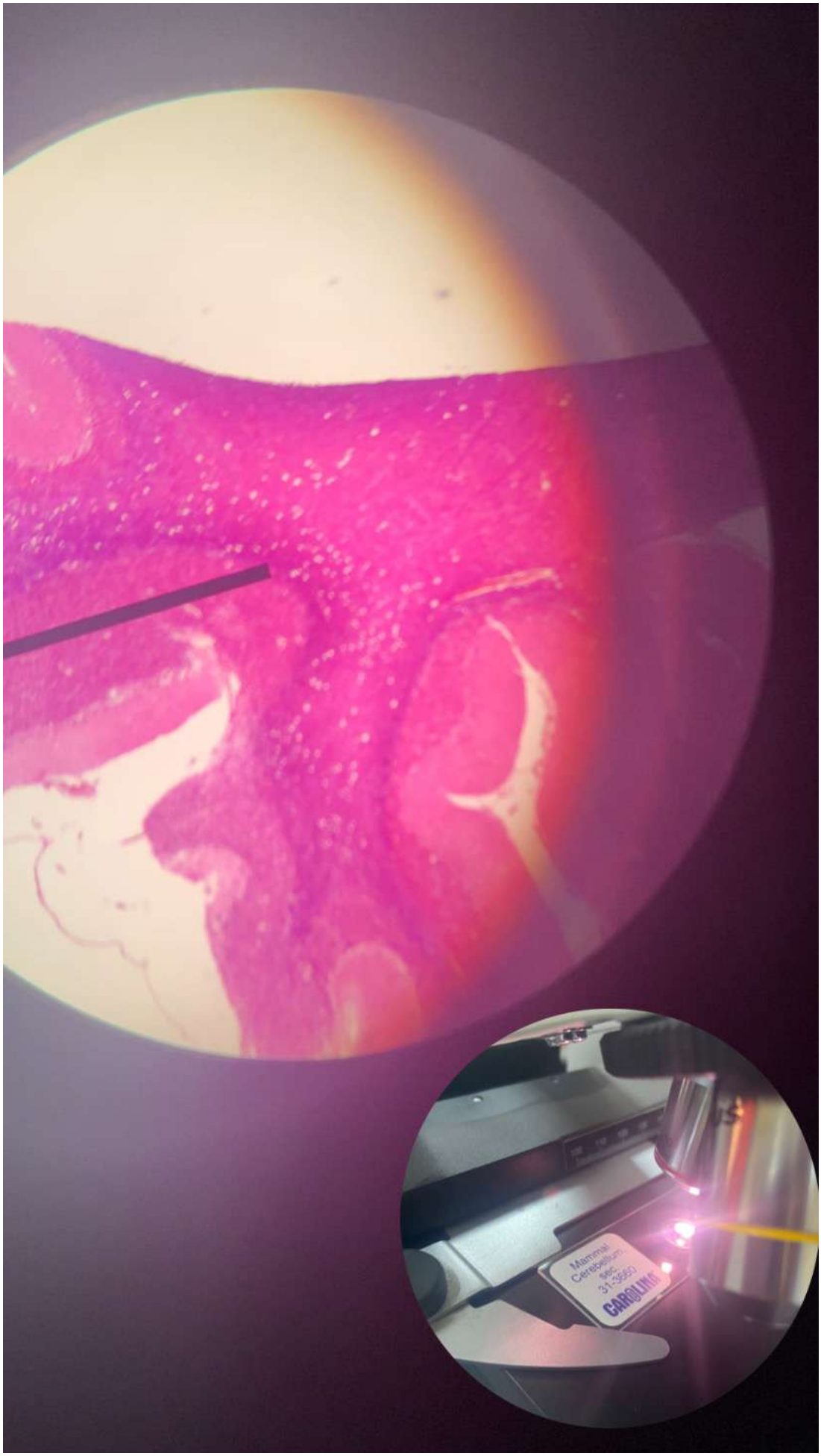


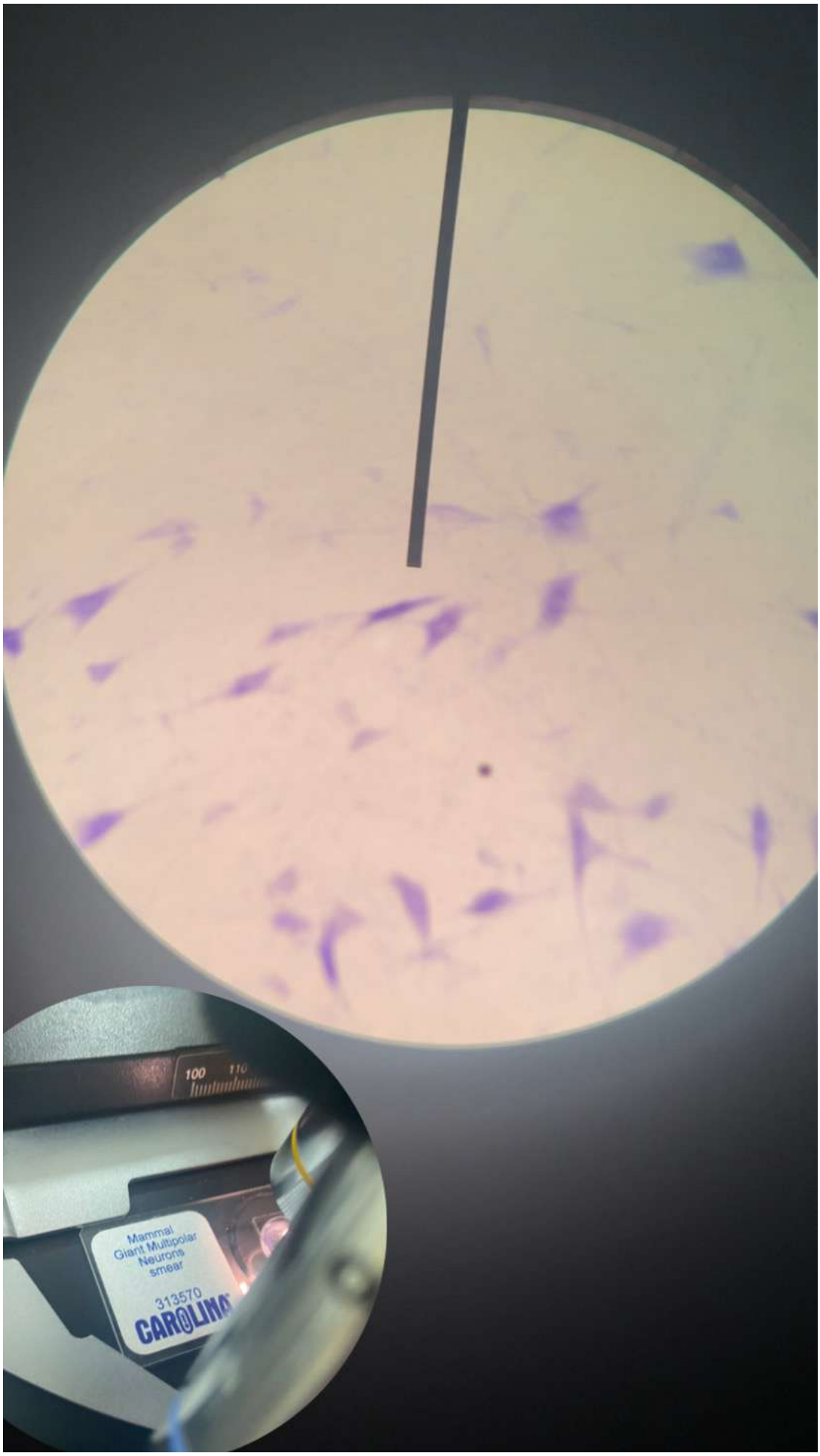
Peripheral Nerve (Masson's Trichrome)

A nerve is a bundle of nerve fascicles surrounded by a connective tissue sheath (epineurium). This is easily seen in this specimen stained with Masson's trichrome.

- Connective tissue - collagen fibers stain blue.
  - Epineurium - dense irregular connective tissue surrounding the entire nerve.
  - Perineurium - connective tissue surrounding a bundle of nerve fibers (fascicle). It consists of two parts:
    - Fibrous Layer - an outer layer of connective tissue (blue) that is similar to the endoneurium.
    - Cellular Layer - inner cellular layer (3 to 8 cells thick) of flattened fibroblasts (blue/gray cells).
  - Endoneurium - connective tissue surrounding individual nerve fibers.
- Nerve Fascicle - bundle of nerve fibers surrounded by a


Mammal
Spinal Cord
C.S.
CAROLINA


Mammal
Cerebellum
CAROLINA


Mammal
Giant Multipolar
Neurons
smear
313570
CAROLINA

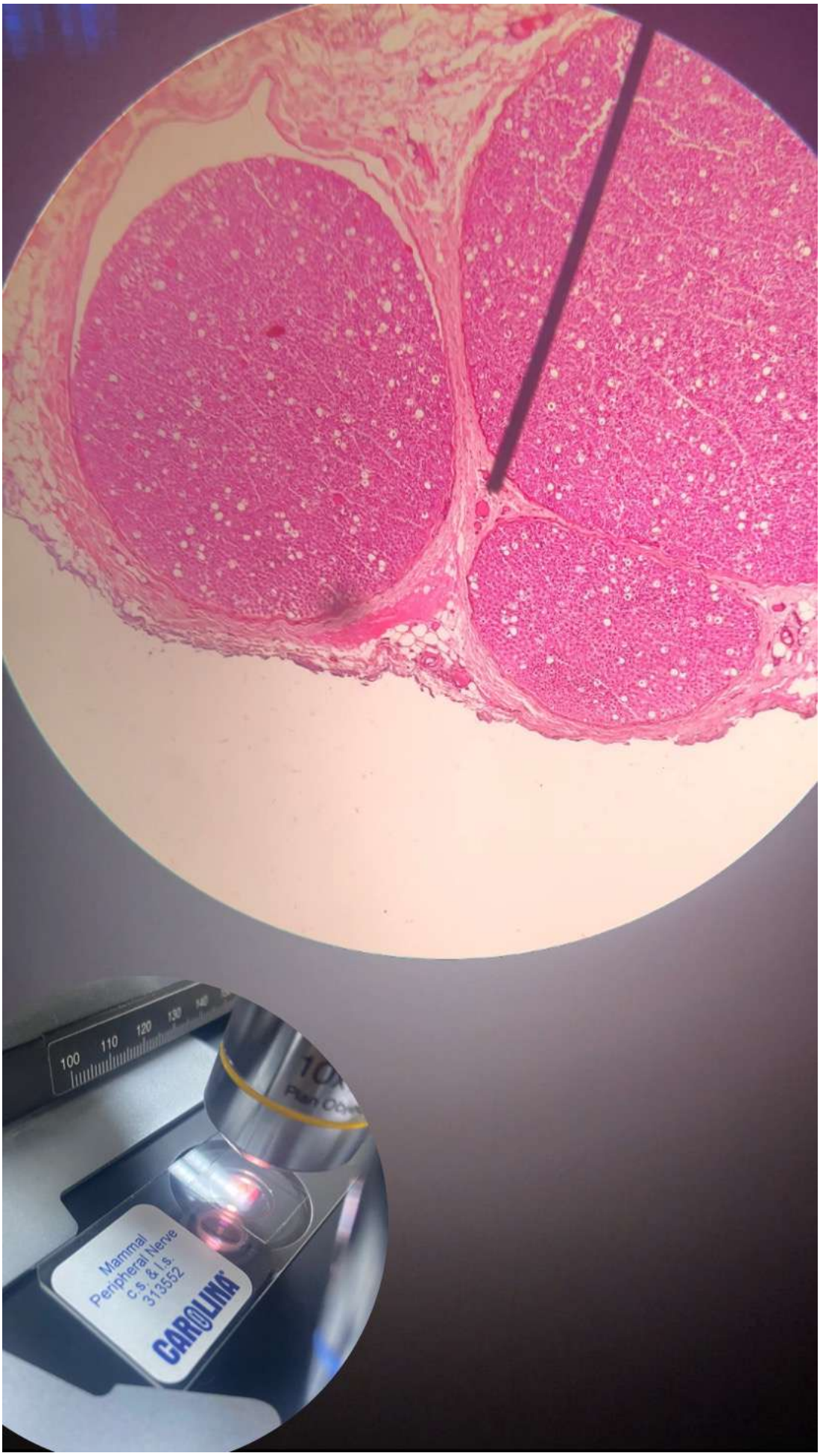
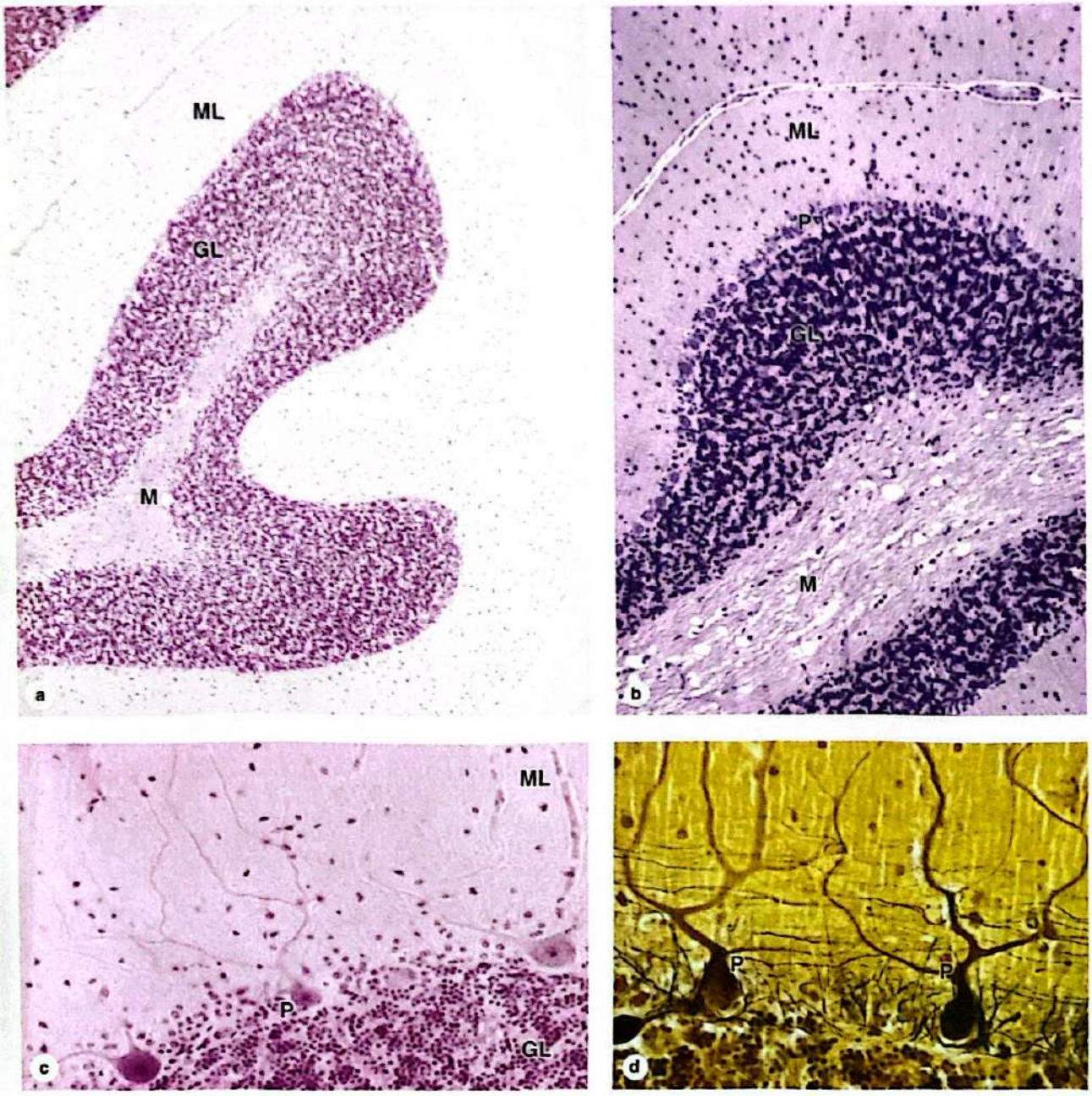

100
110
120
130
140
Mammal
Peripheral Nerve
C.S. & L.S.
313552
CAROLINA

FIGURE 9–16 Cerebellum.



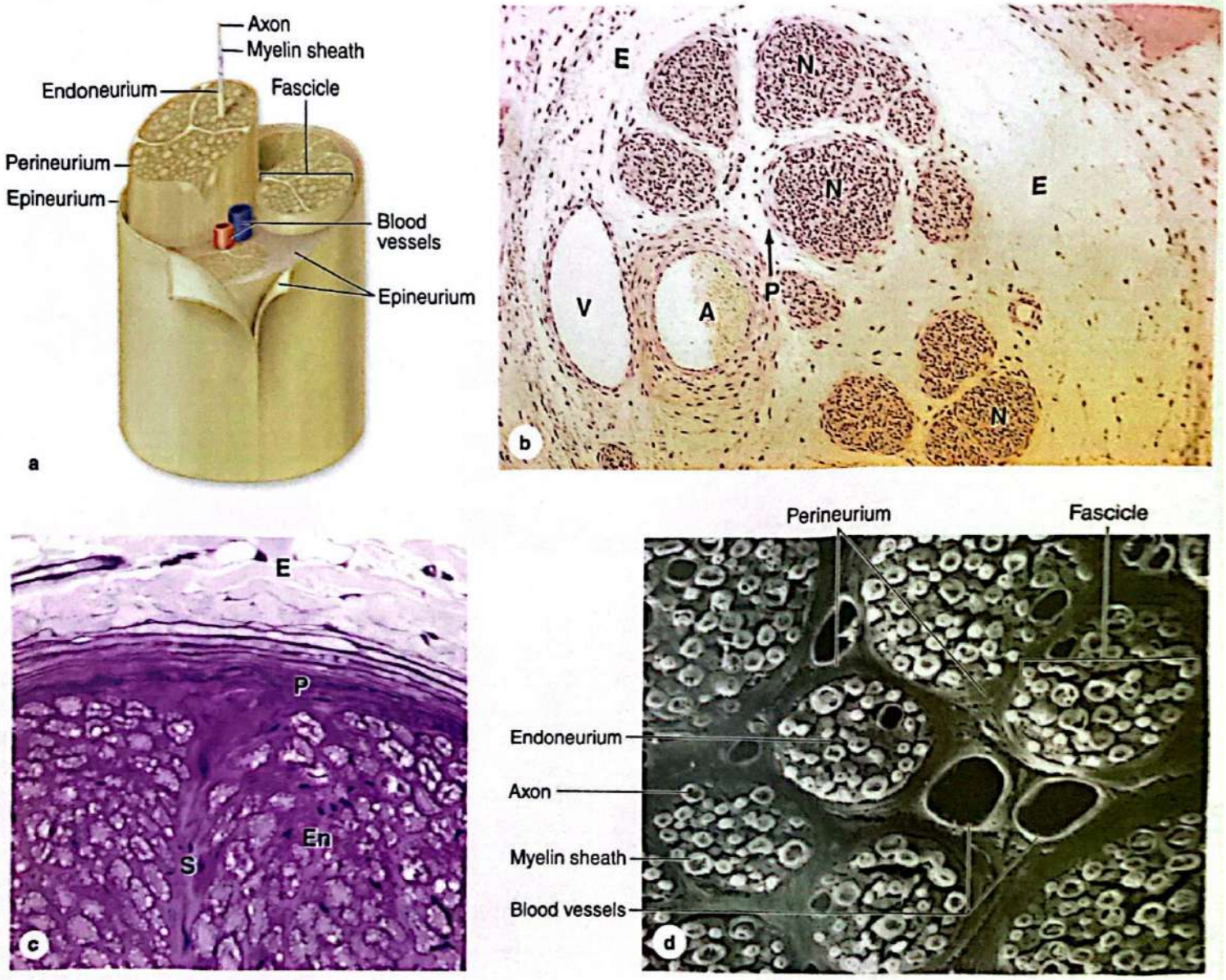
(a) The cerebellar cortex is convoluted with many distinctive small folds, each supported at its center by tracts of white matter in the cerebellar medulla **(M)**. Each fold has distinct molecular layers **(ML)** and granular layers **(GL)**. (X6; Cresyl violet)

(b) Higher magnification shows that the granular layer **(GL)** immediately surrounding the medulla **(M)** is densely packed with several different types of very small rounded neuronal cell bodies. The outer molecular layer **(ML)** consists of neuropil with fewer, much more scattered small neurons. At the interface of these two regions a layer of large Purkinje neuron **(P)** perikarya can be seen. (X20; H&E)

(c) A single intervening layer contains the very large cell bodies of unique Purkinje neurons **(P)**, whose axons pass through the granular layer **(GL)** to join tracts in the medulla and whose multiple branching dendrites ramify throughout the molecular layer **(ML)**. Dendrites are not seen well with H&E staining. (X40; H&E)

(d) With appropriate silver staining dendrites from each large Purkinje cell **(P)** are shown to have hundreds of small branches, each covered with hundreds of dendritic spines. Axons from the small neurons of the granular layer are unmyelinated and run together into the molecular layer where they form synapses with the dendritic spines of Purkinje cells. (X40; Silver)

FIGURE 9–26 Peripheral nerve connective tissue: Epi-, peri-, and endoneurium.



(a) The diagram shows the relationship among these three connective tissue layers in large peripheral nerves. The epineurium **(E)** consists of a dense superficial region and a looser deep region that contains the larger blood vessels.

(b) The micrograph shows a small vein **(V)** and artery **(A)** in the deep epineurium **(E)**. Nerve fibers **(N)** are bundled in fascicles. Each fascicle is surrounded by the perineurium **(P)**, consisting of a few layers of unusual squamous fibroblastic cells that are all joined at the peripheries by tight junctions. The resulting blood-nerve barrier helps regulate the microenvironment inside the fascicle. Axons and Schwann cells are in turn surrounded by a thin layer of endoneurium. (X140; H&E)

(c) As shown here and in the diagram, septa **(S)** of connective tissue often extend from the perineurium into larger fascicles. The endoneurium **(En)** and lamellar nature of the perineurium **(P)** are also shown at this magnification, along with some adjacent epineurium **(E)**. (X200; PT)

(d) SEM of transverse sections of a large peripheral nerve showing several fascicles, each surrounded by perineurium and packed with endoneurium around the individual myelin sheaths. Each fascicle contains at least one capillary. Endothelial cells of these capillaries are tightly joined as part of the blood-nerve barrier and regulate the kinds of plasma substances released to the endoneurium. Larger blood vessels course through the deep epineurium that fills the space around the perineurium and fascicles. (X450)