SHOWING UP DAILY

What we think it means:

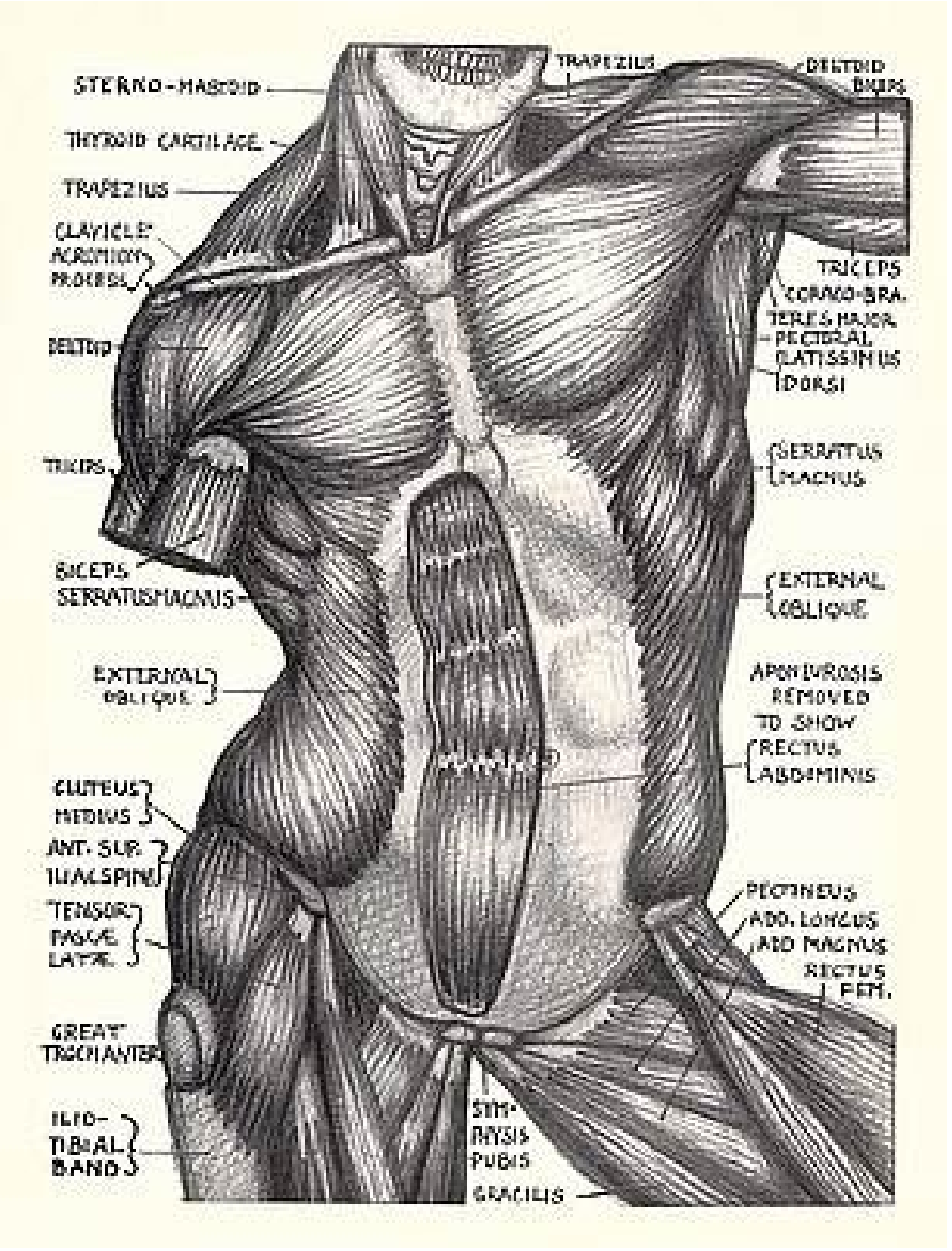
What it actually means:

Contractile Cells

&

Nervous Tissue

Contractile Cells



Contractile cells

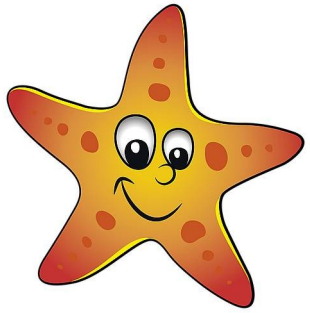
6 Types contractile cells

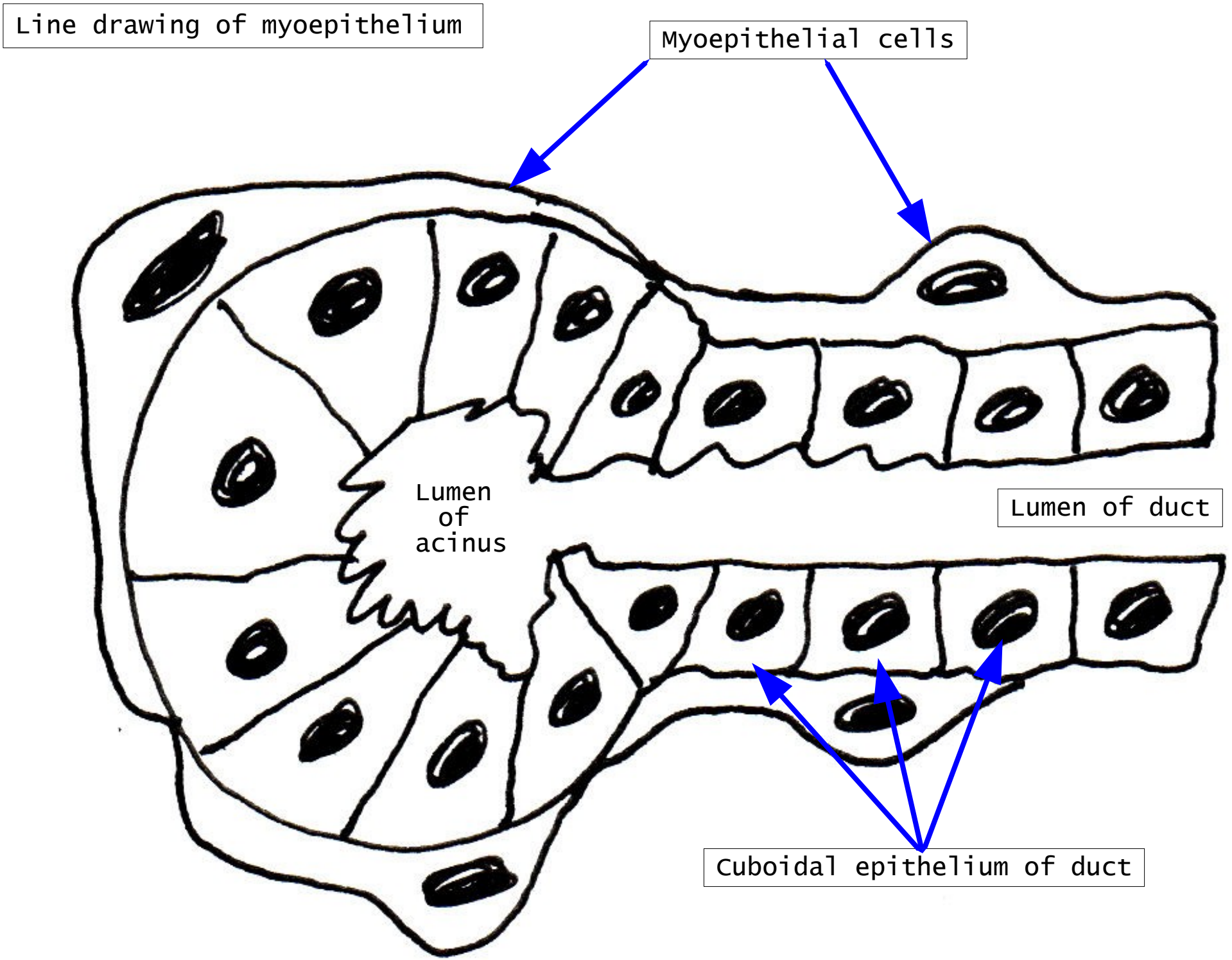
1. Pericytes
2. Myofibroblasts
3. Myoepithelium
4. Smooth muscle
5. Cardiac muscle
6. Skeletal muscle

Myoepithelial cells

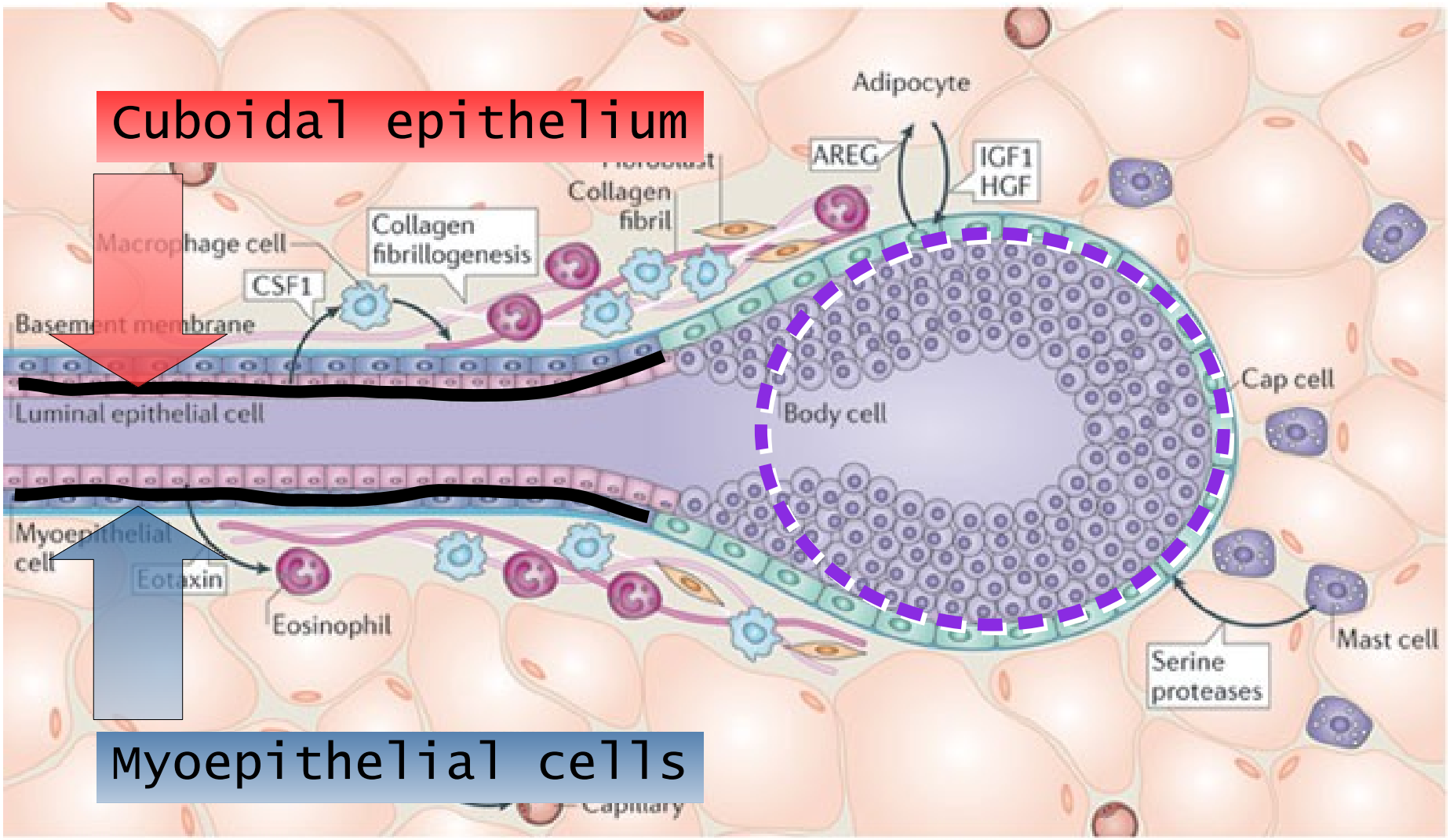
- Stellate shape with radiating processes
- Cytoplasma difficult to see with LM
- Resemble smooth muscle in function
- Located between epithelium & basal lamina
- In glands and ducts
- Hemidesmosomes attaches to basal lamina
- Contains actin, myosin & intermediate filaments
- Contraction forces secretory material
  - from glandular epithelium
  - into duct
  - out of gland

Stellate shaped with radiating processes.



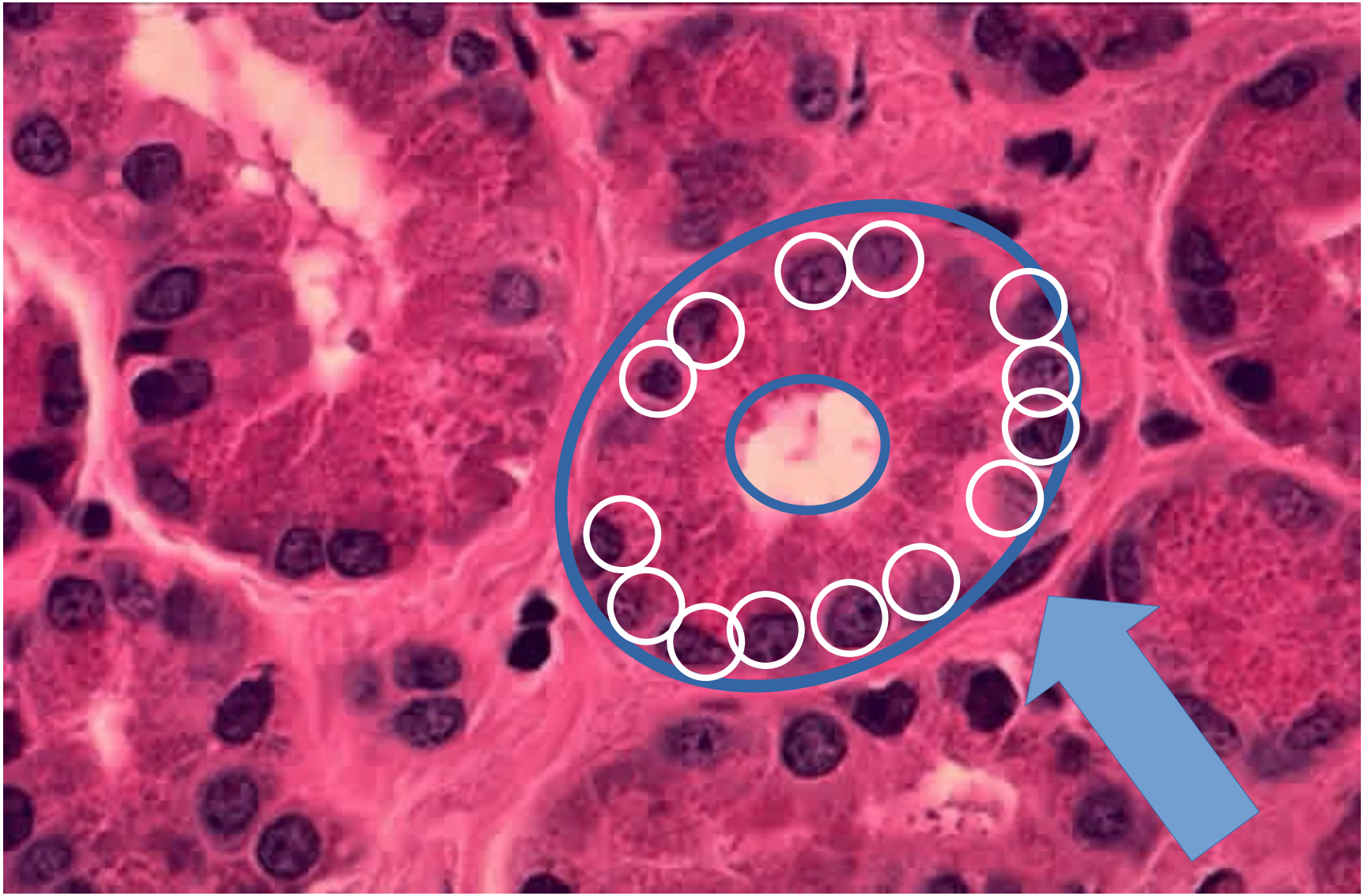

Line drawing of myoepithelium
Myoepithelial cells
Lumen of acinus
Lumen of duct
Cuboidal epithelium of duct

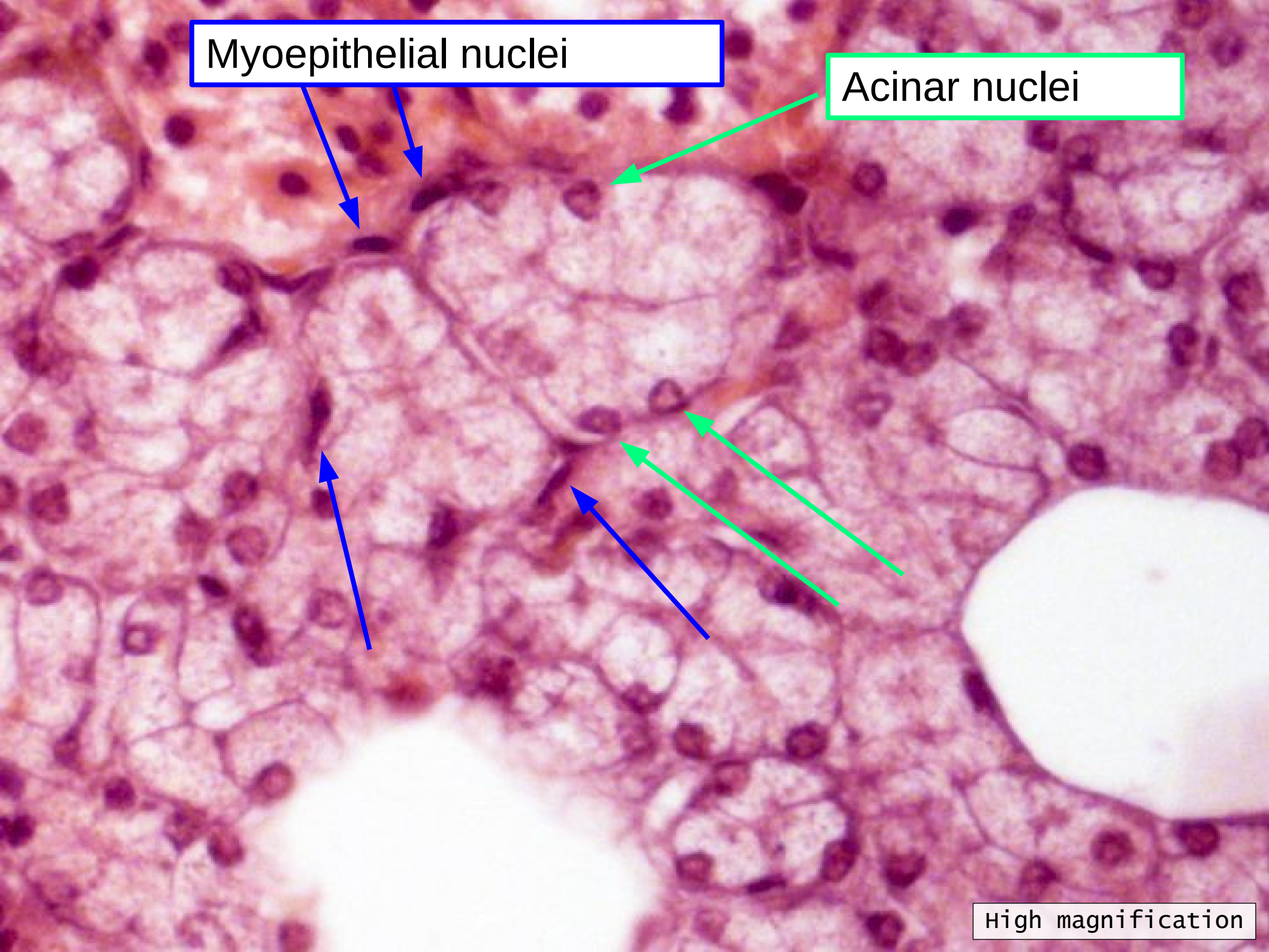
Myoepithelial cell

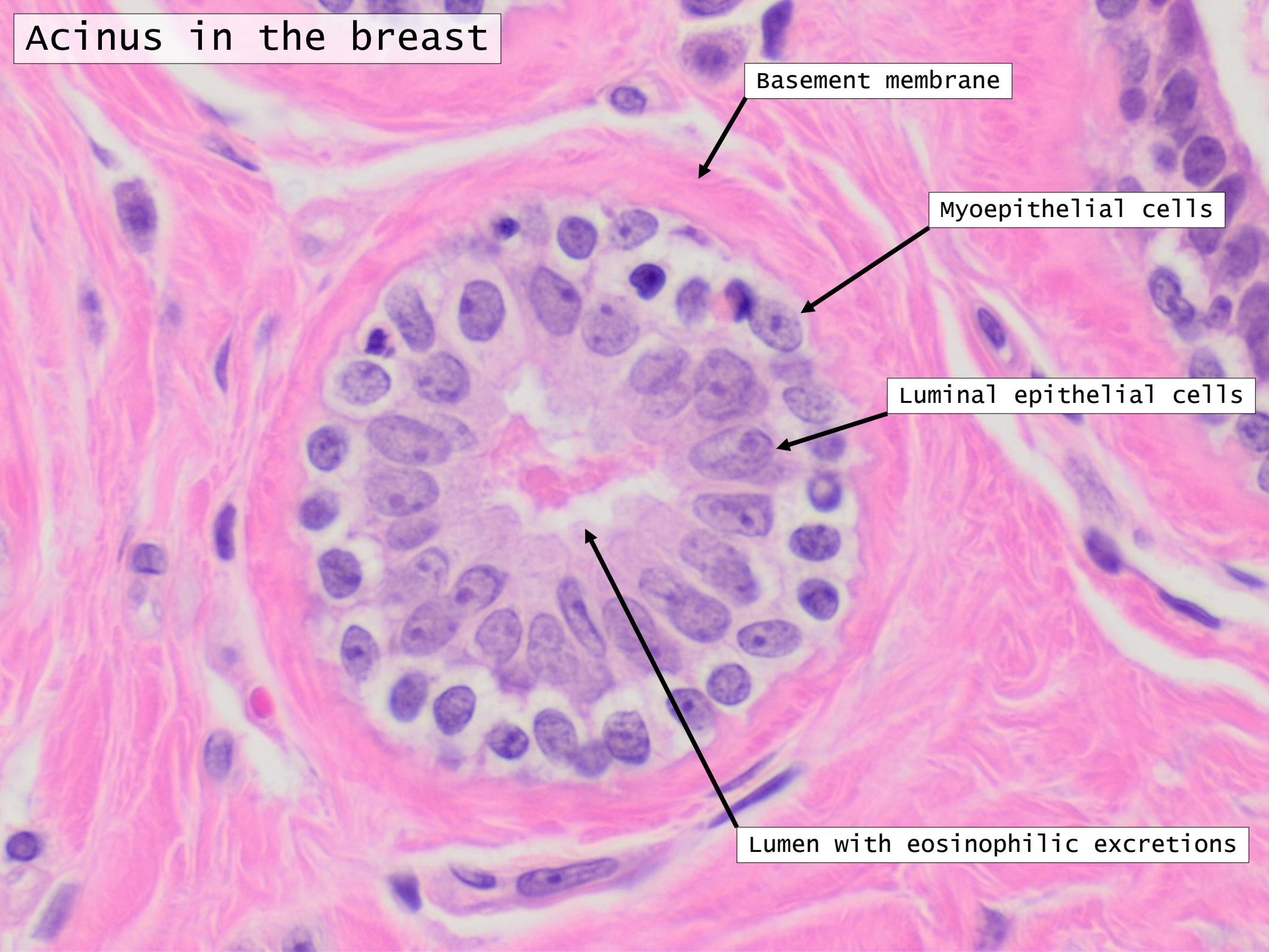


Nature Reviews | Molecular Cell Biology

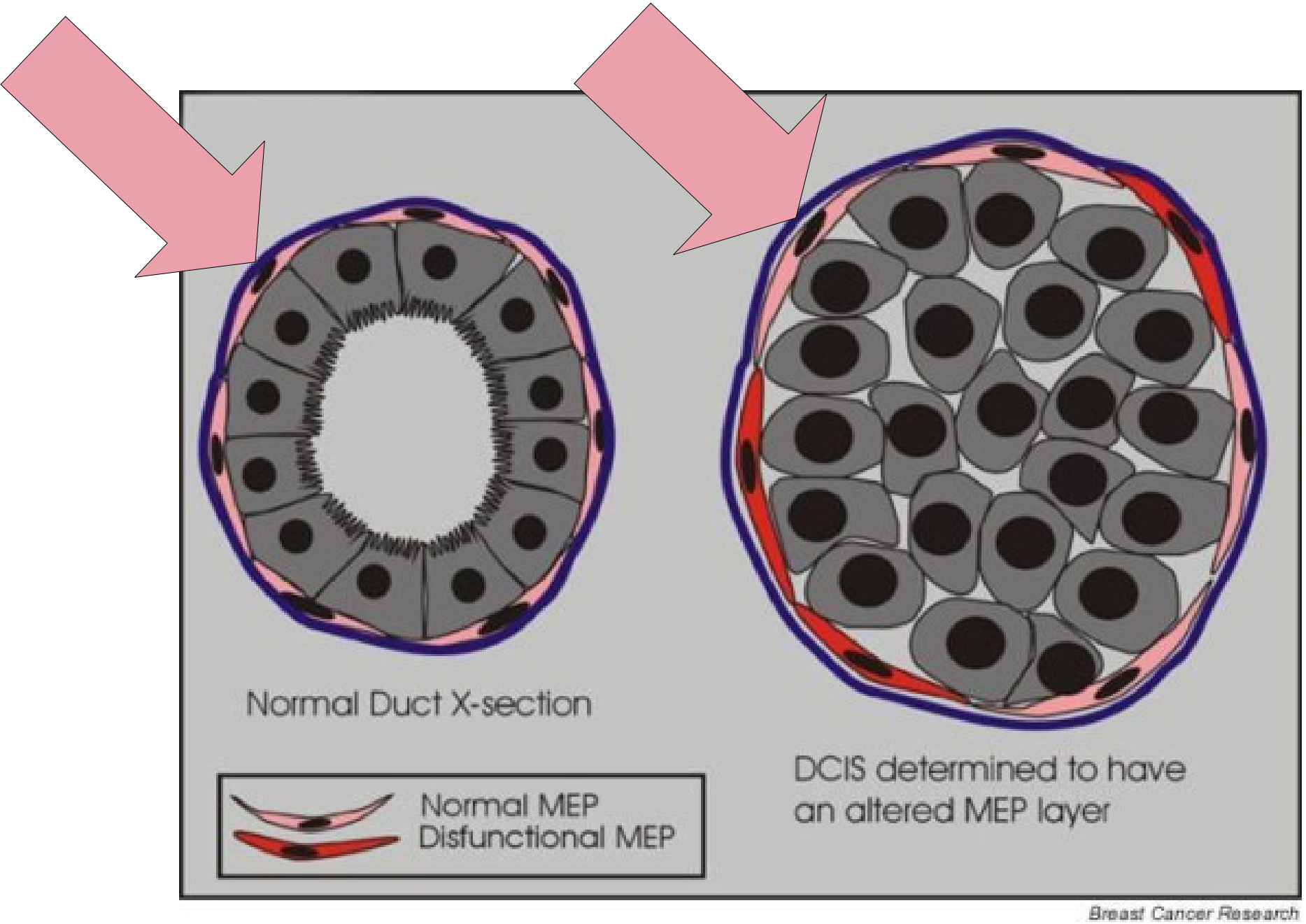
Myoepithelial cell




Myoepithelial nuclei
Acinar nuclei
High magnification


Acinus in the breast
Basement membrane
Myoepithelial cells
Luminal epithelial cells
Lumen with eosinophilic excretions

Myoepithelial cell

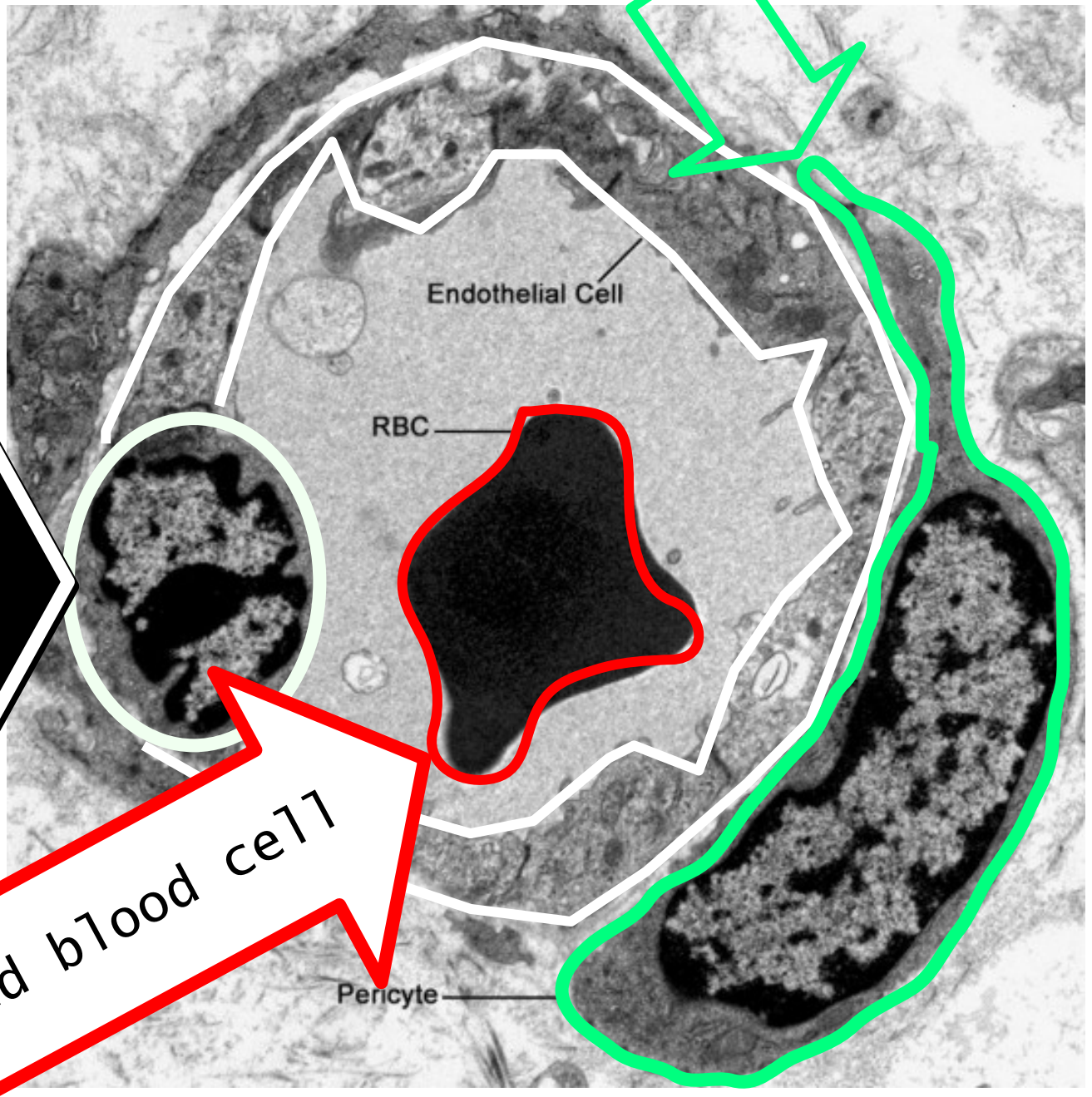


Pericytes

- Looks similar to fibroblasts
- Located along capillaries

Pericyte

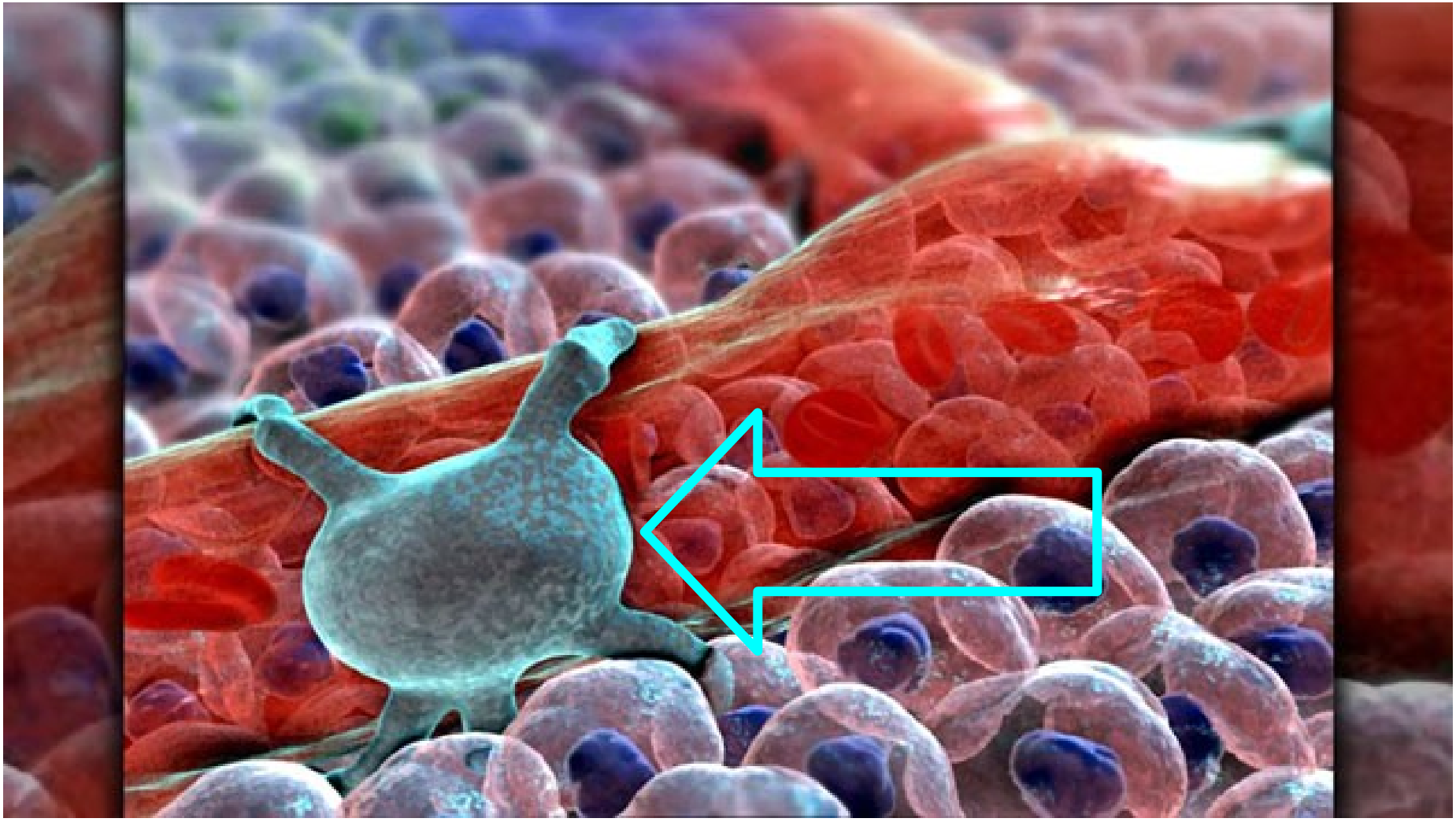
TEM



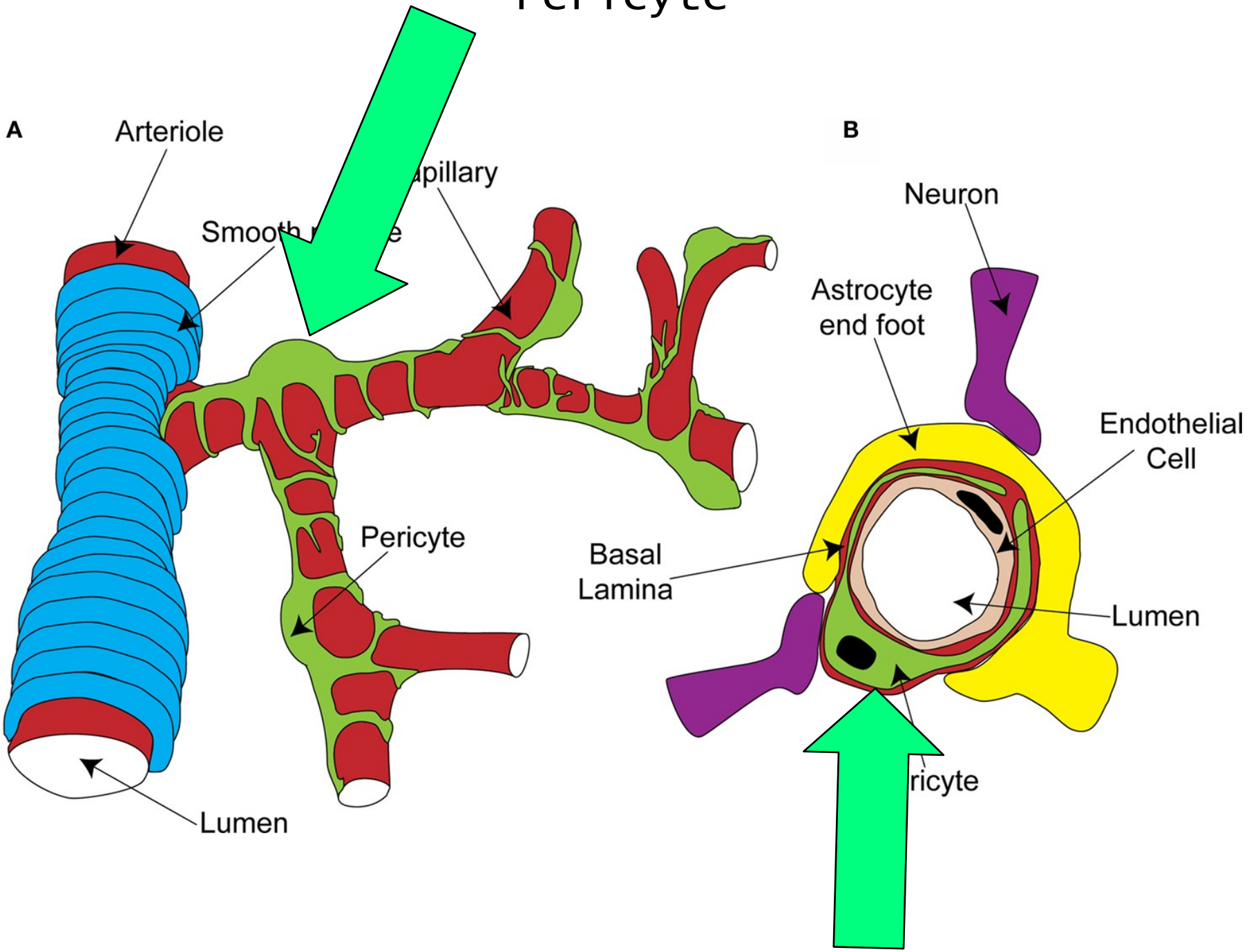
Endothelium

Red blood cell

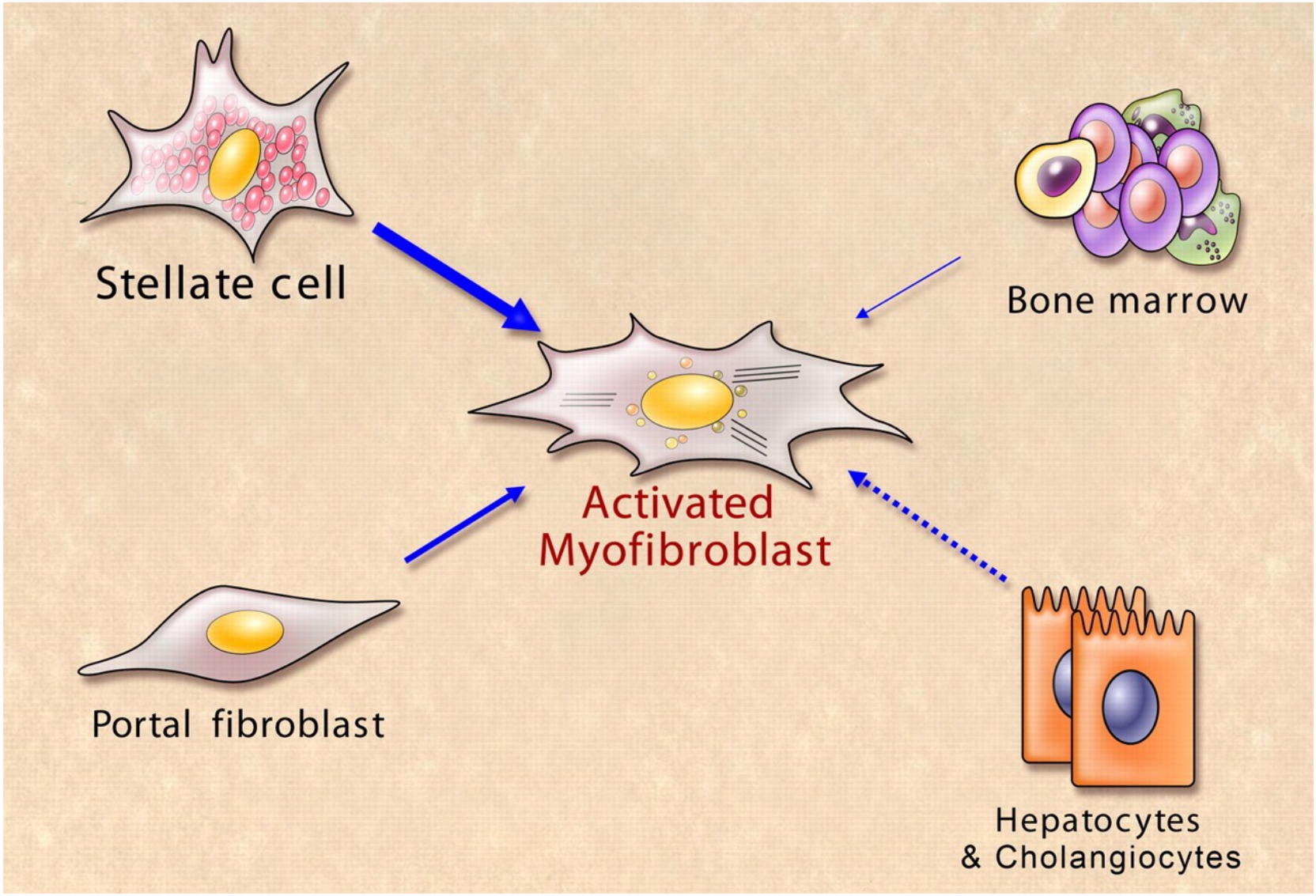
Pericyte

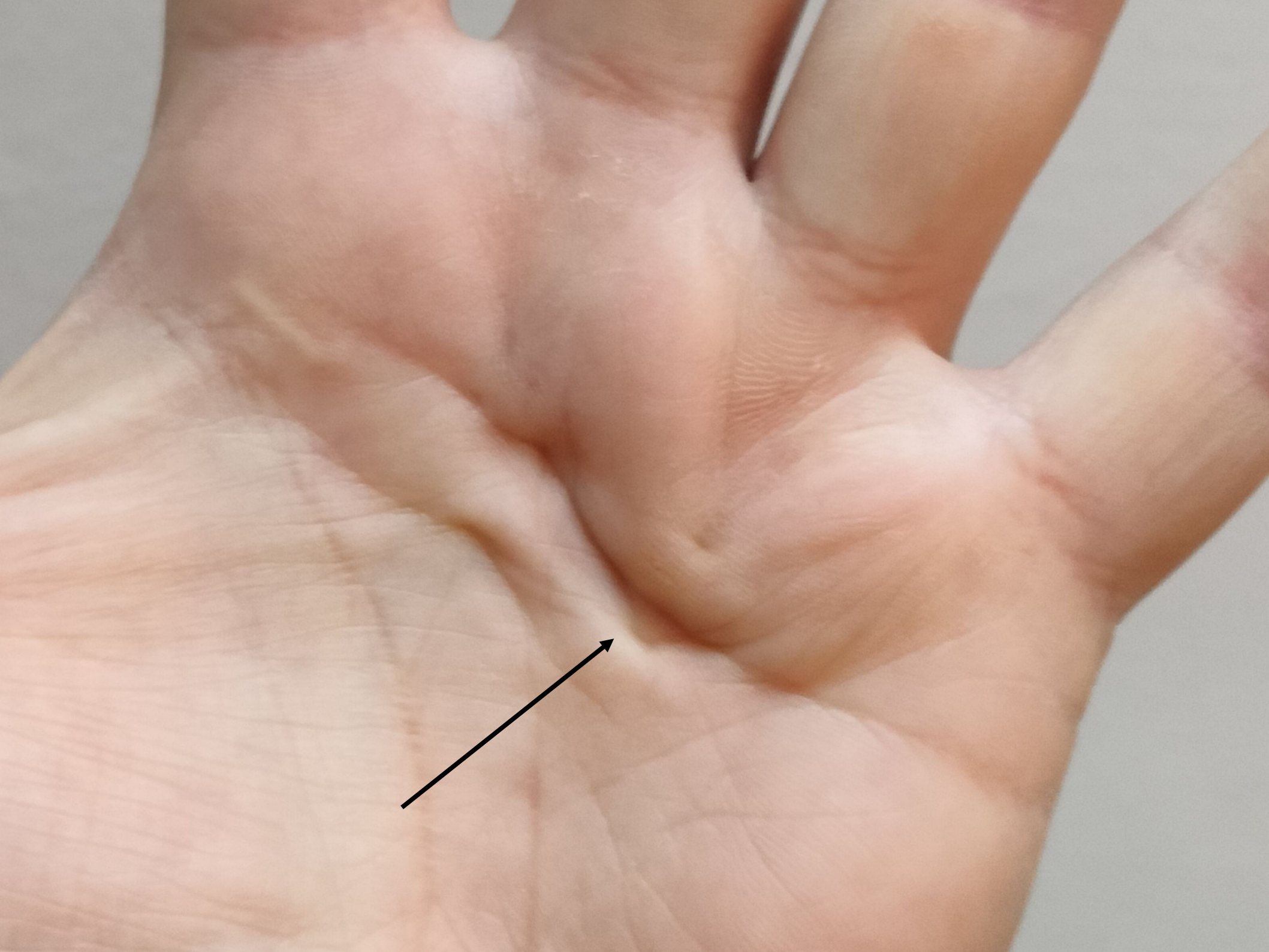


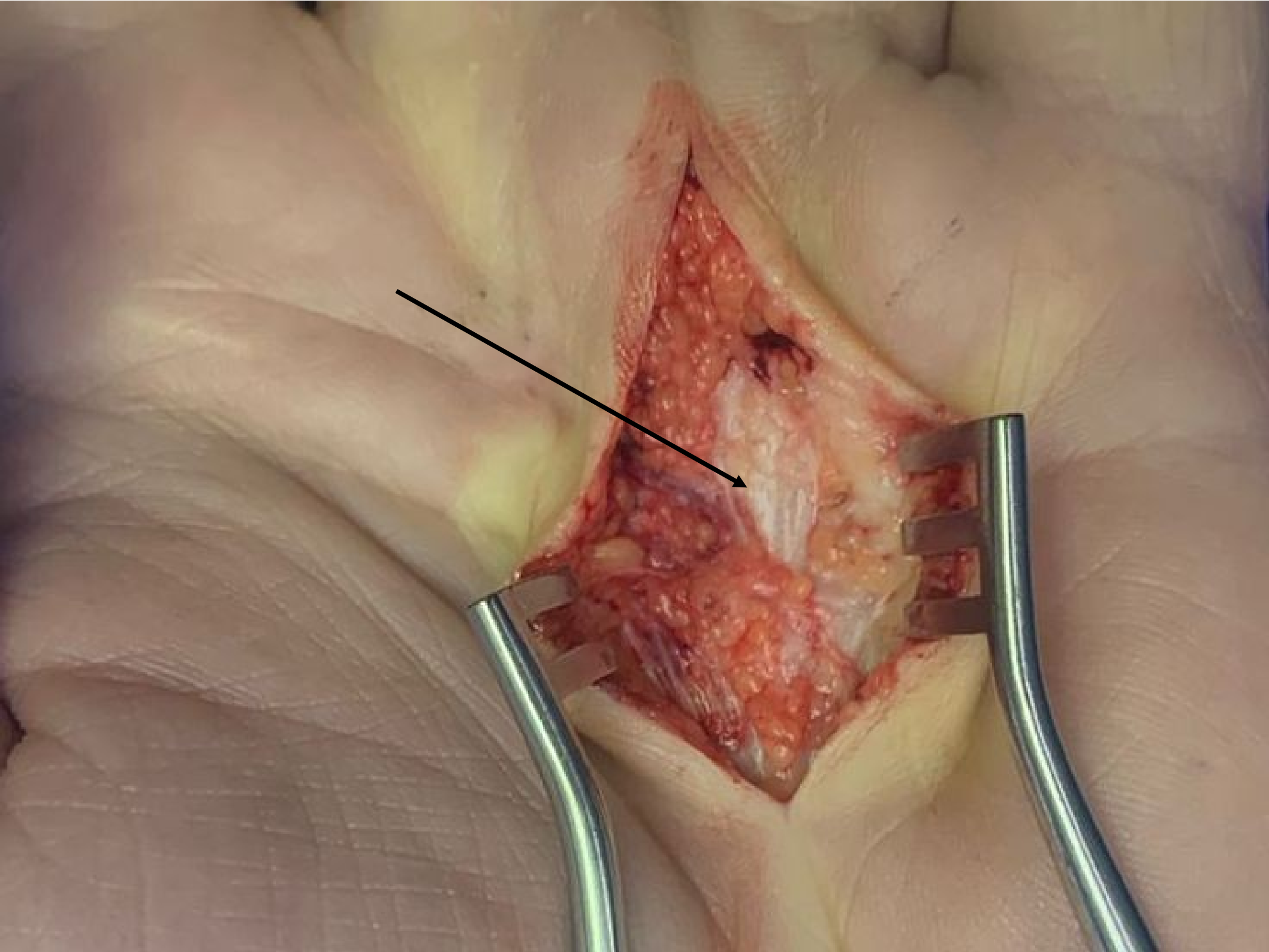
Pericyte

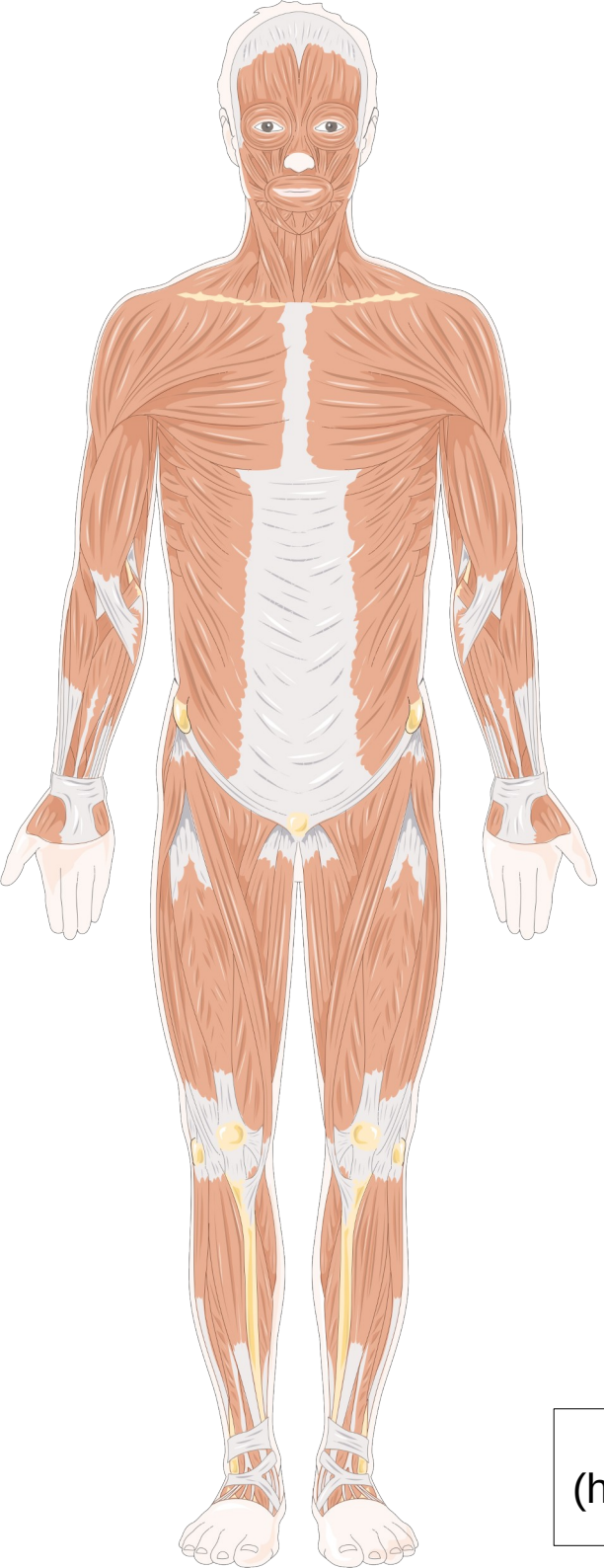

A
Arteriole
Smooth
apillary
Pericyte
Lumen
B
Neuron
Astrocyte
end foot
Endothelial
Cell
Basal
Lamina
Lumen
ricyte

Myofibroblast

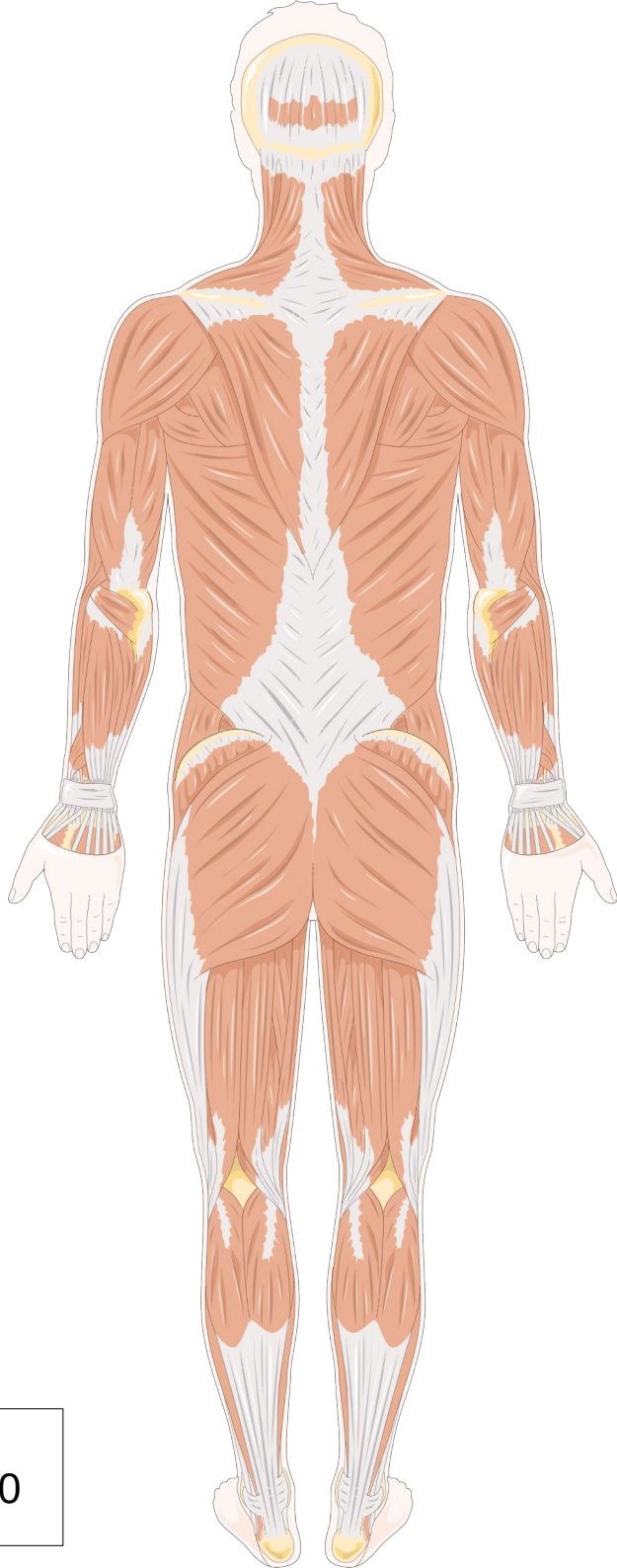








Skeletal muscle



Connective tissue

- At 3 major levels of organisation
- Surrounds entire muscle
  - Epimysium
- Surrounds muscle fasciculus
  - Perimysium
- Surrounds each fibre (muscle cell)
  - Endomysium

Skeletal muscle fibres (cells)

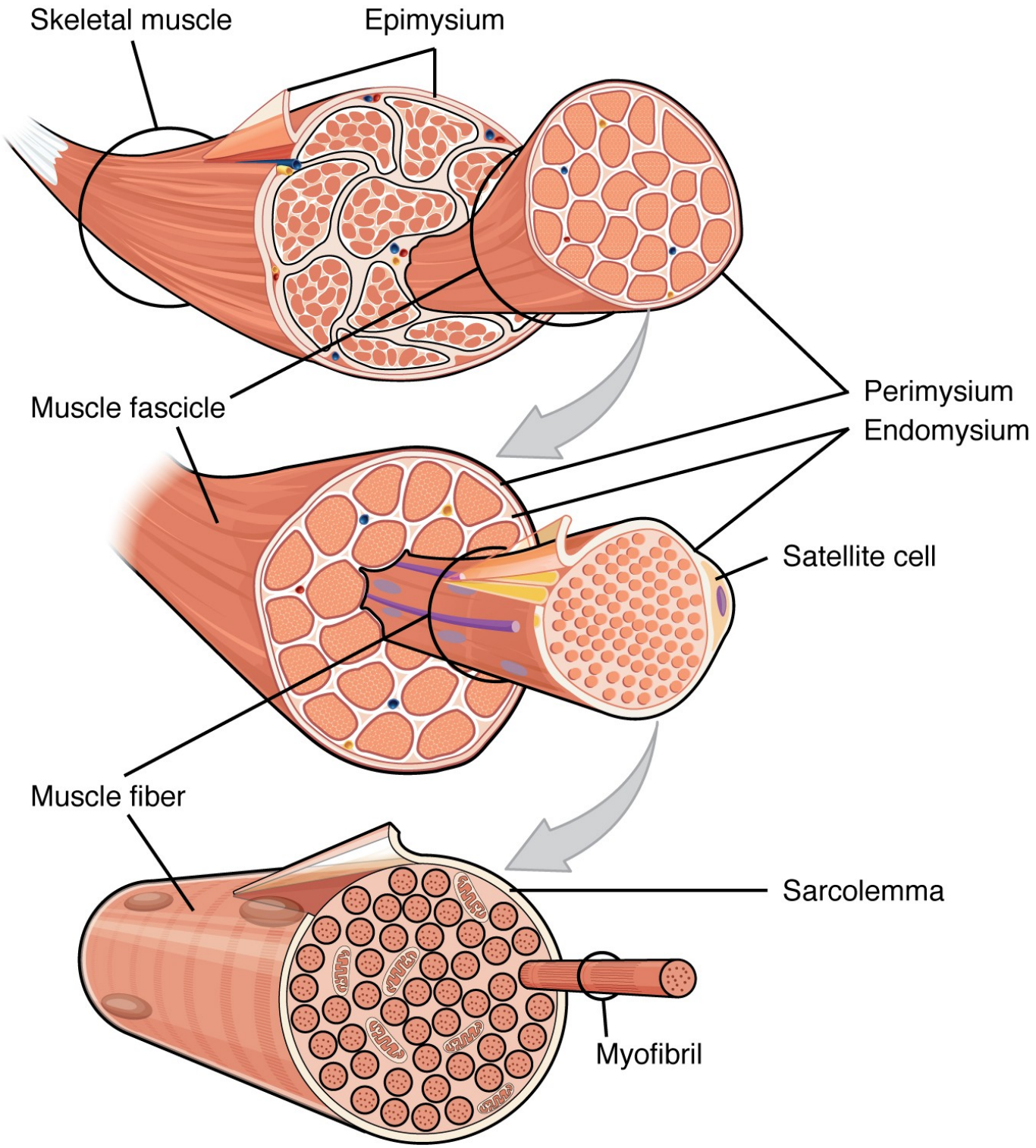
- Long multinucleated cells
- Cross-striations repeat to form a banding pattern
- A band
  - Anisotropic
  - Stains dark
- I band
  - Isotropic
  - Stains light
- Z line
  - Dense area bisects I band
- H band
  - Transects A band with dark M line in center
- Z line to Z line = sarcomere

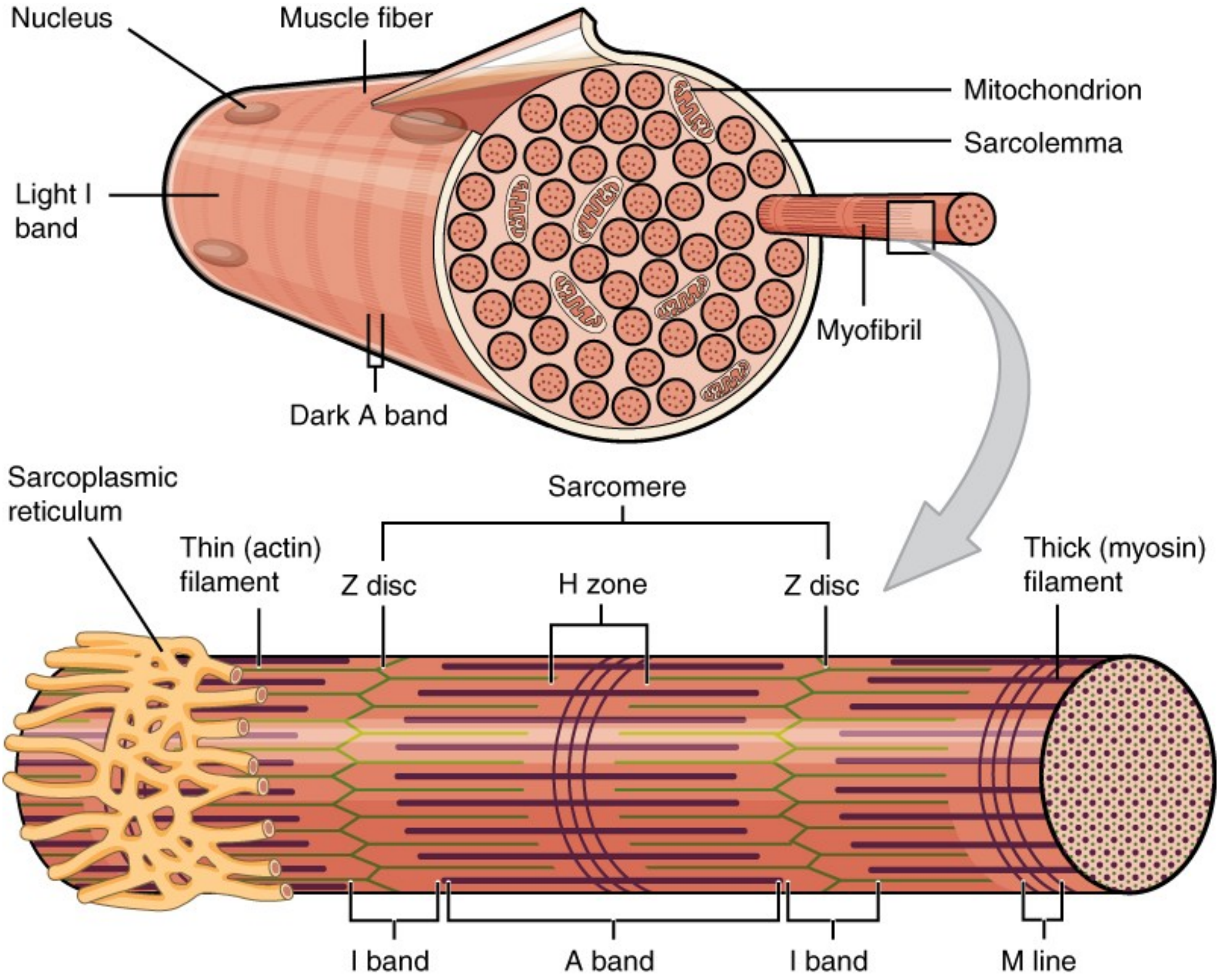
Sarcomere

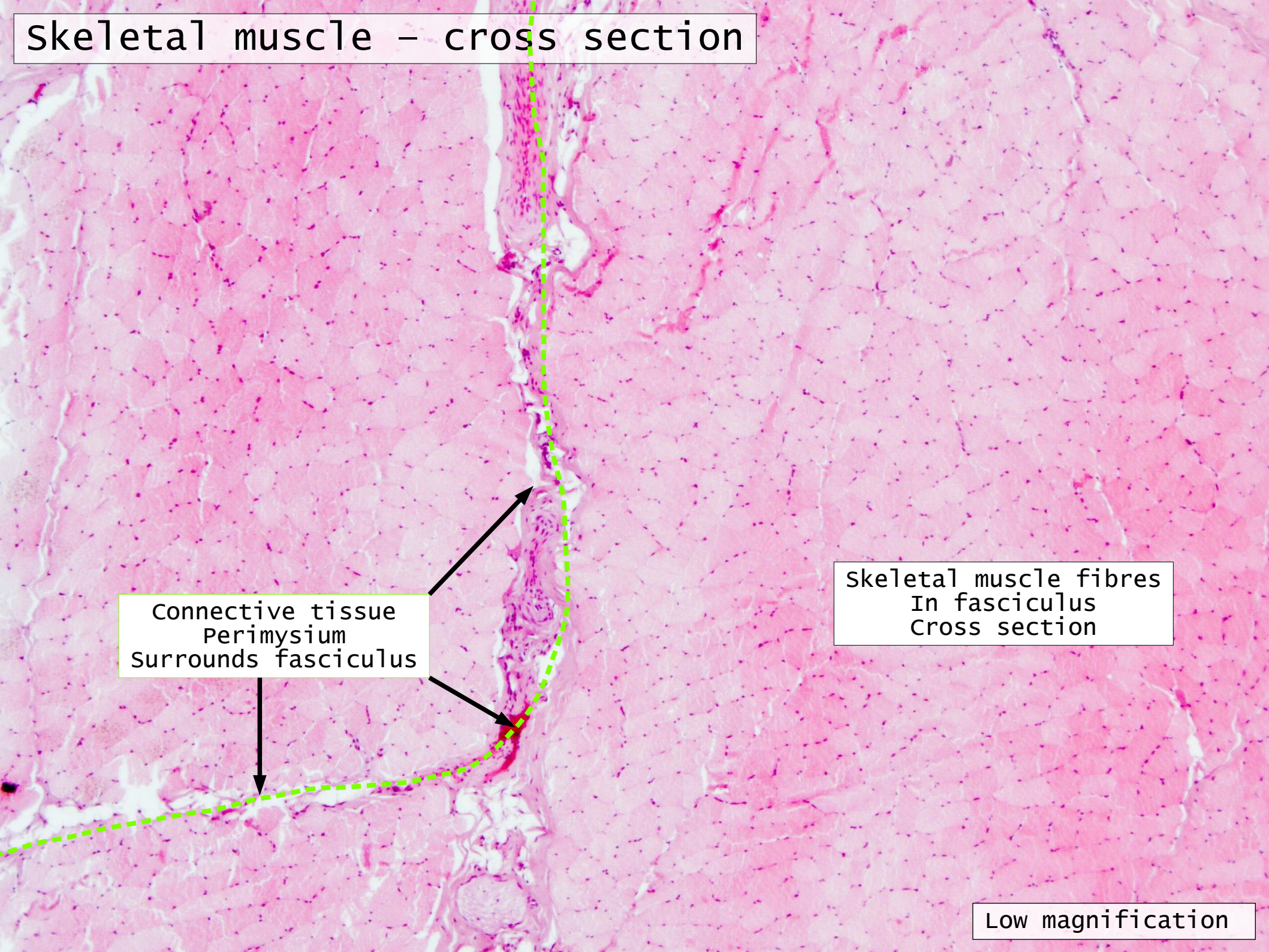
- Functional unit of contraction in striated muscle
- Is the distance between two successive Z lines

Skeletal muscle

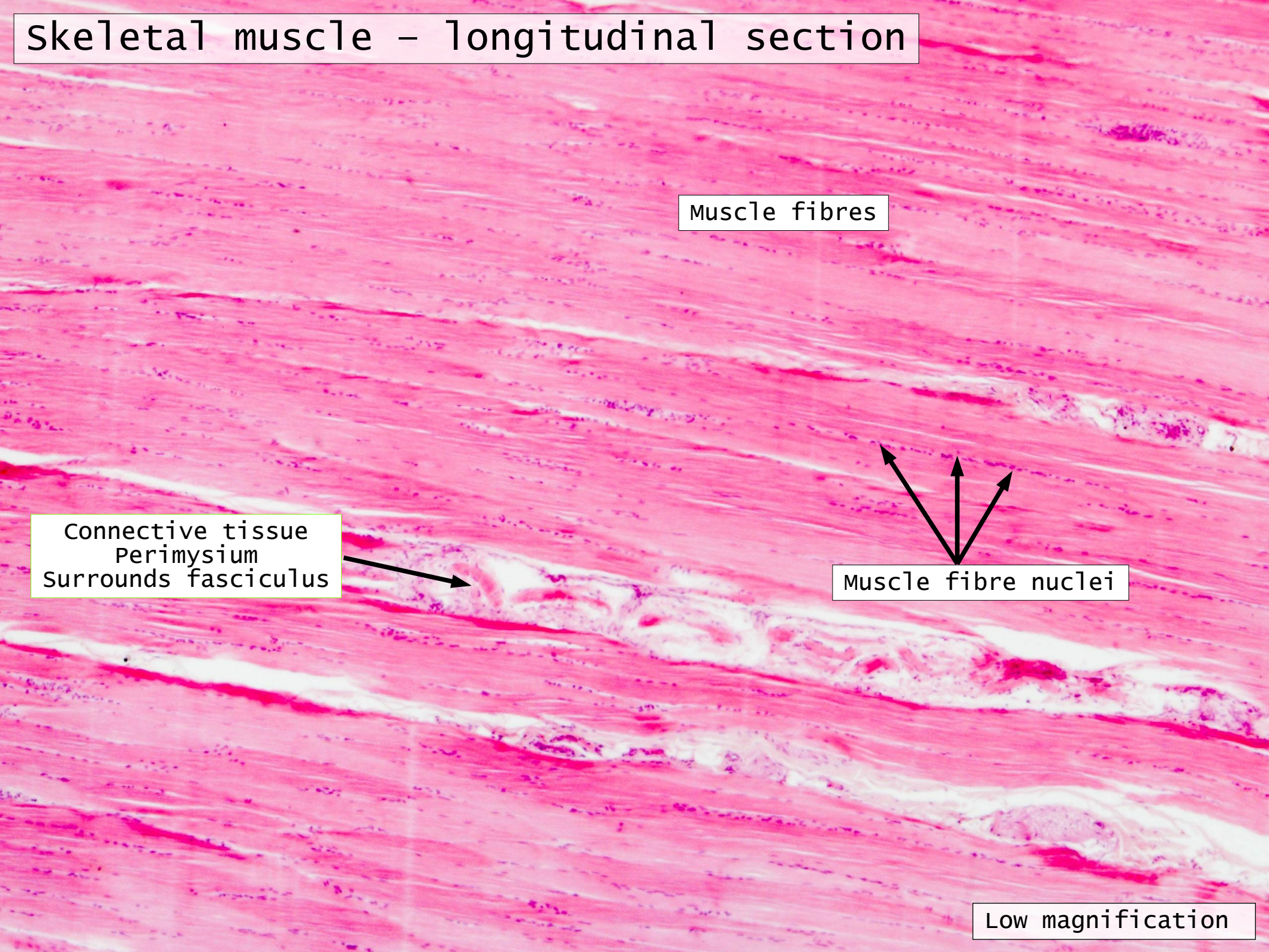
Slide 18 & 19

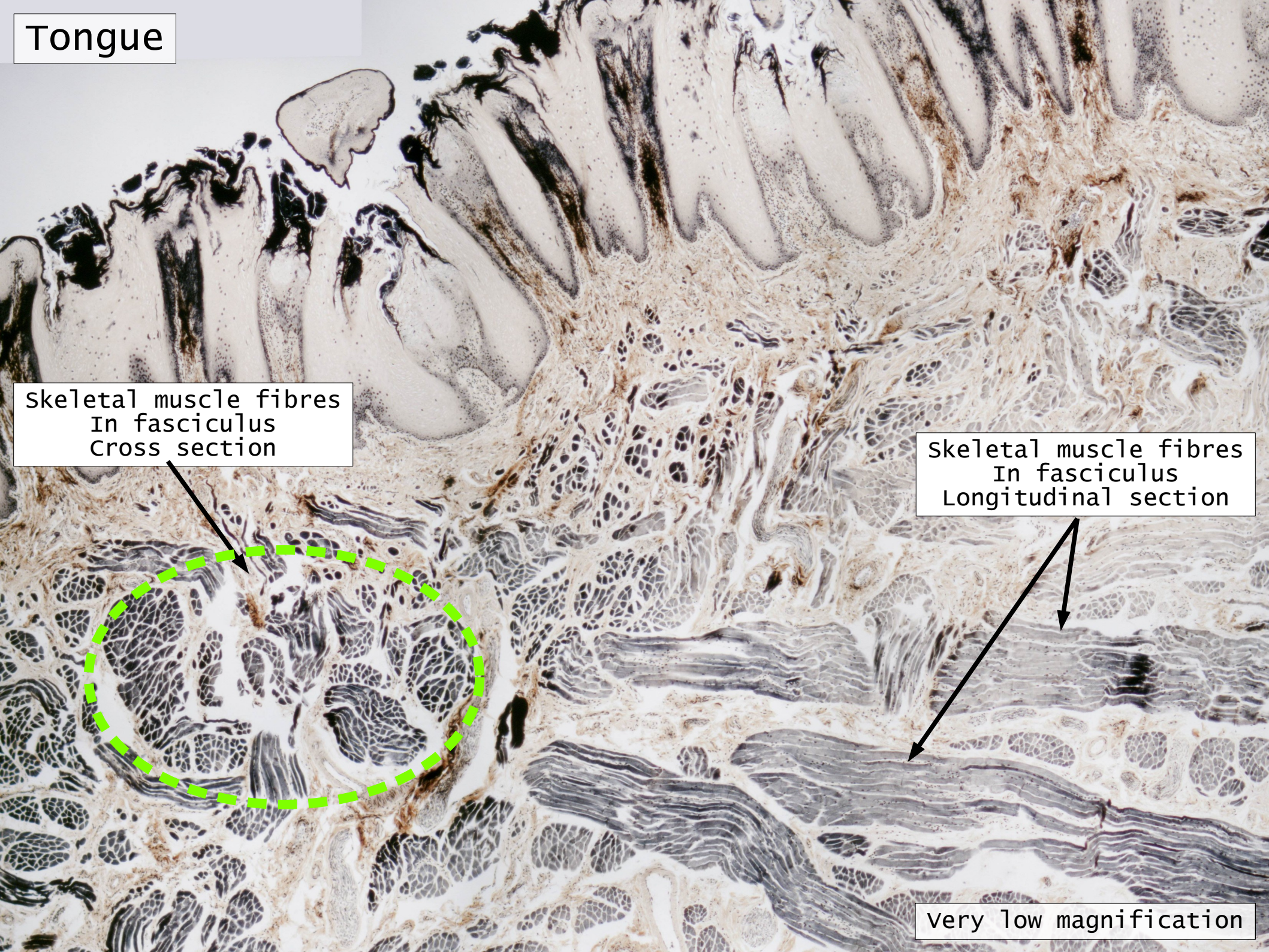

Skeletal muscle
Epimysium
Muscle fascicle
Perimysium
Endomysium
Satellite cell
Muscle fiber
Sarcolemma
Myofibril

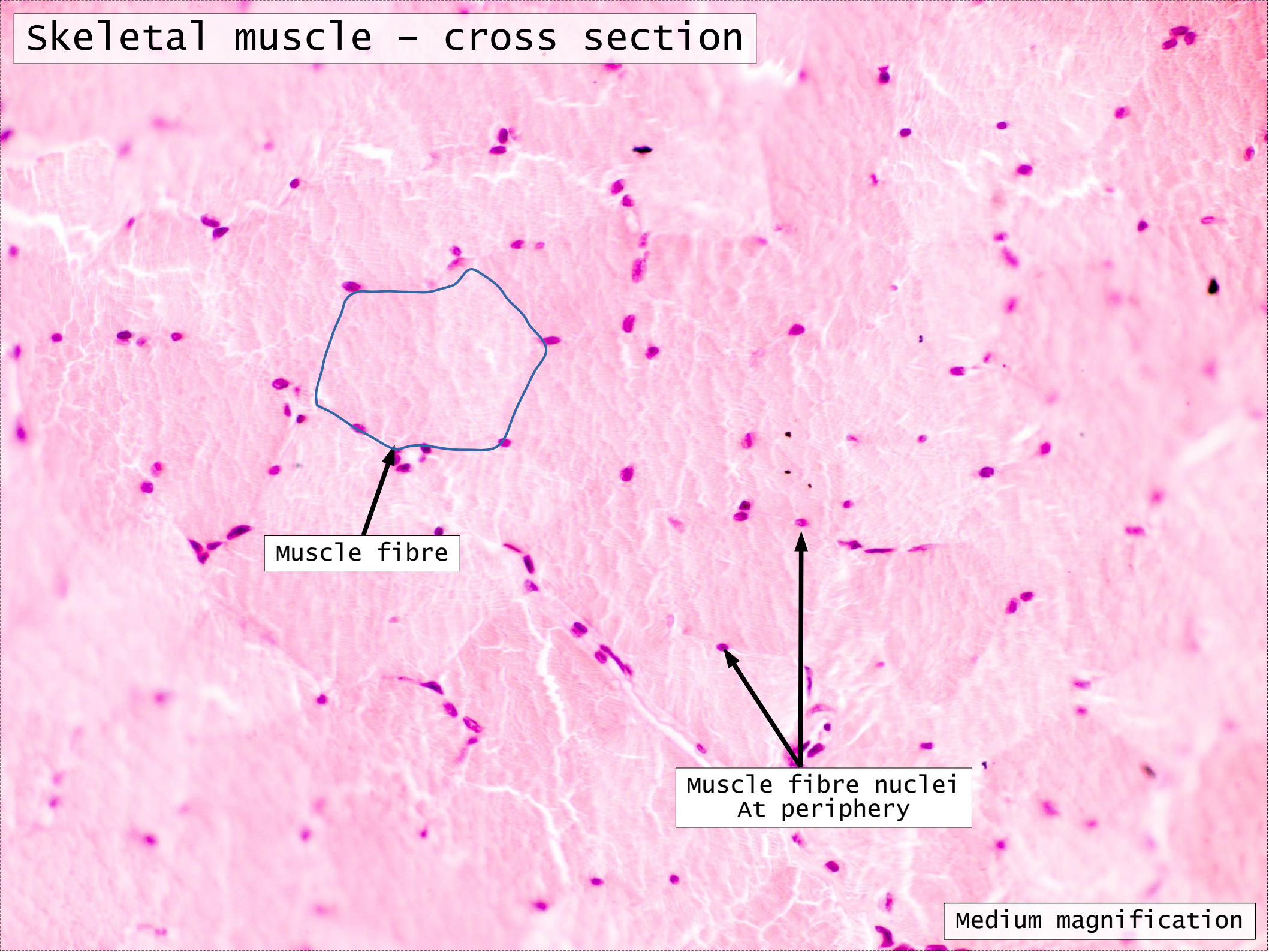

Nucleus
Muscle fiber
Mitochondrion
Sarcolemma
Light I band
Myofibril
Dark A band
Sarcoplasmic reticulum
Sarcomere
Thin (actin) filament
Z disc
H zone
Z disc
Thick (myosin) filament
I band
A band
I band
M line

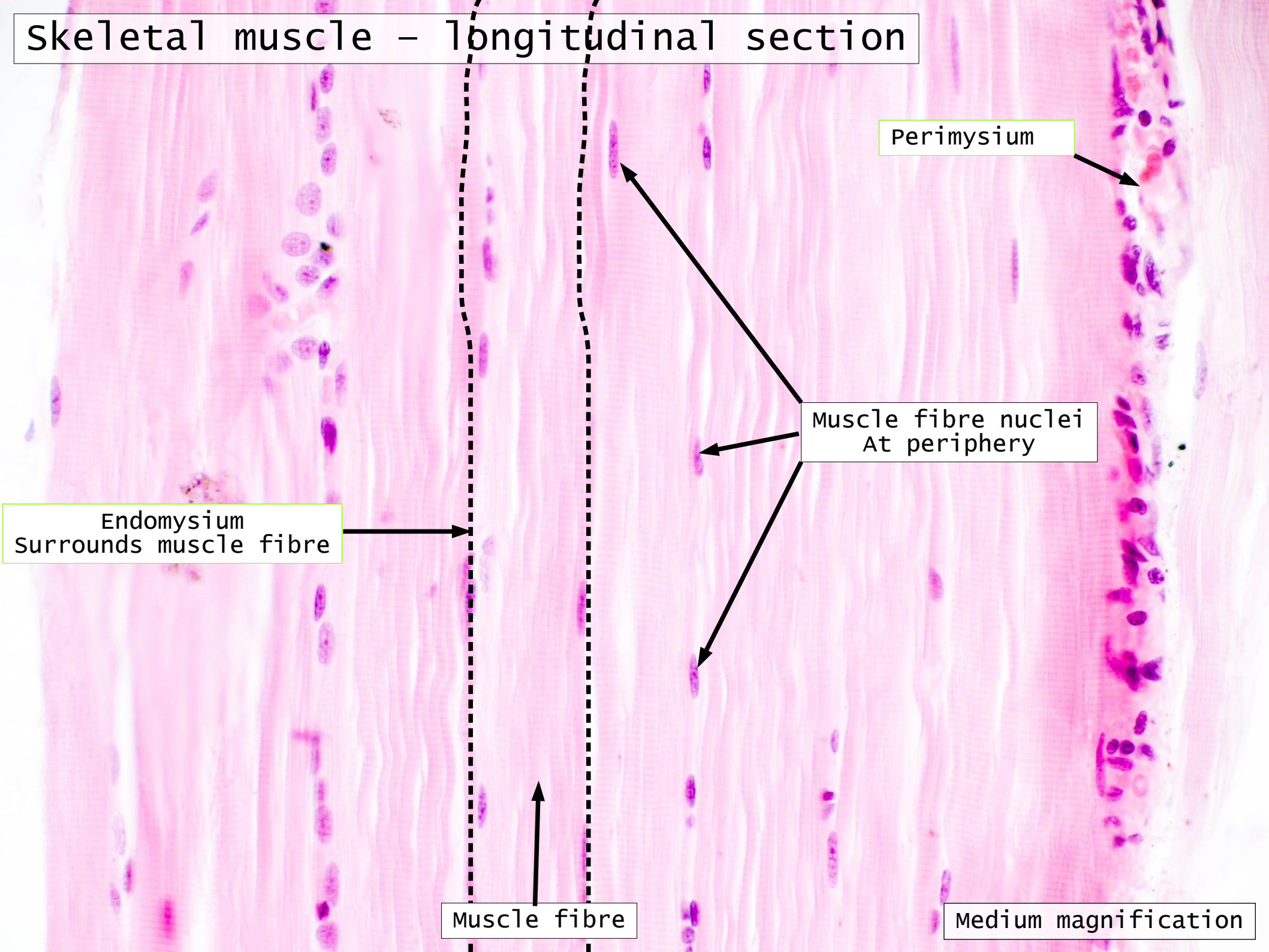

Skeletal muscle – cross section
Connective tissue
Perimysium
Surrounds fasciculus
Skeletal muscle fibres
In fasciculus
Cross section
Low magnification

Skeletal muscle – longitudinal section

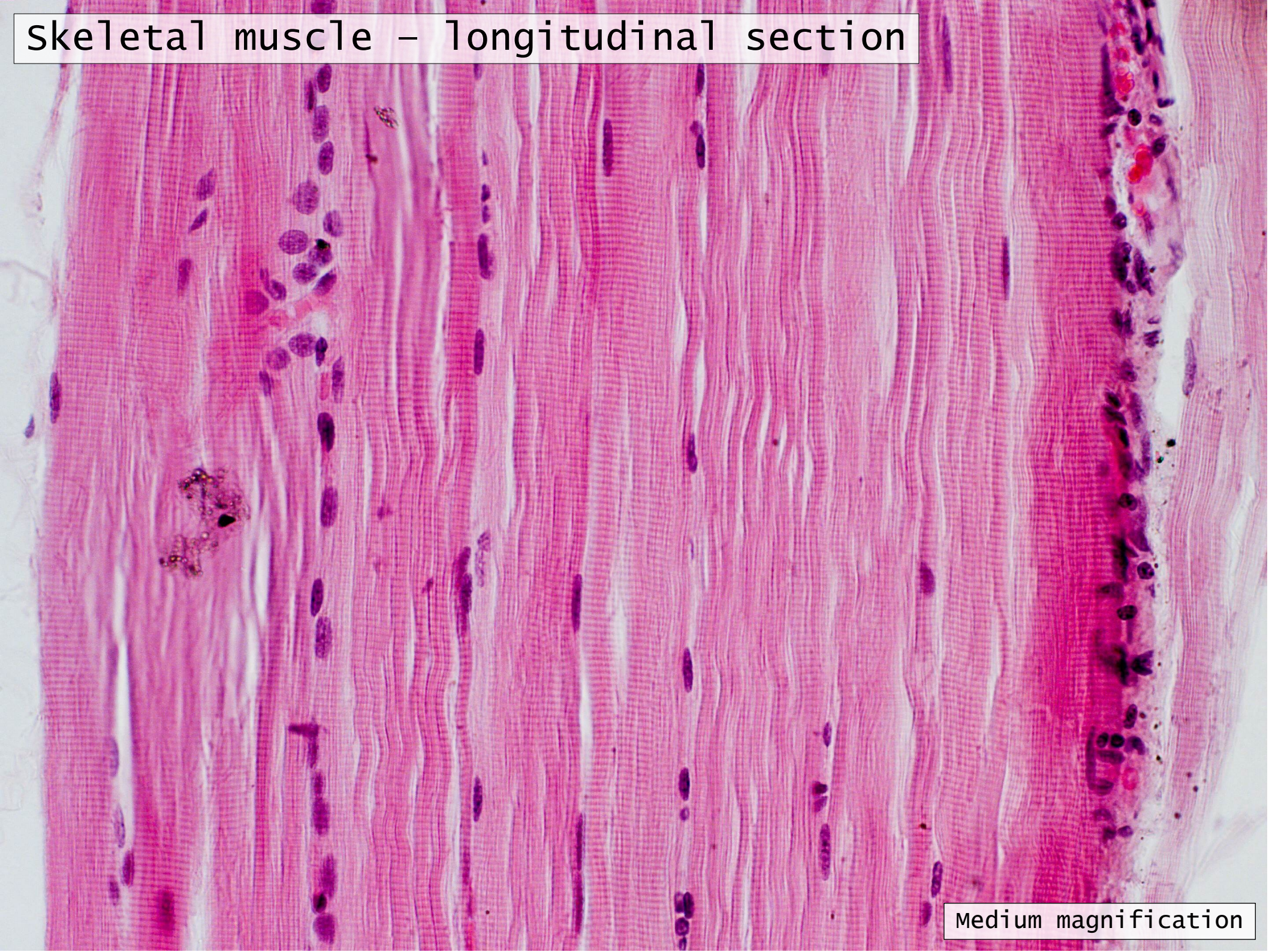



Tongue
Skeletal muscle fibres
In fasciculus
Cross section
Skeletal muscle fibres
In fasciculus
Longitudinal section
Very low magnification


Skeletal muscle – cross section
Muscle fibre
Muscle fibre nuclei
At periphery
Medium magnification

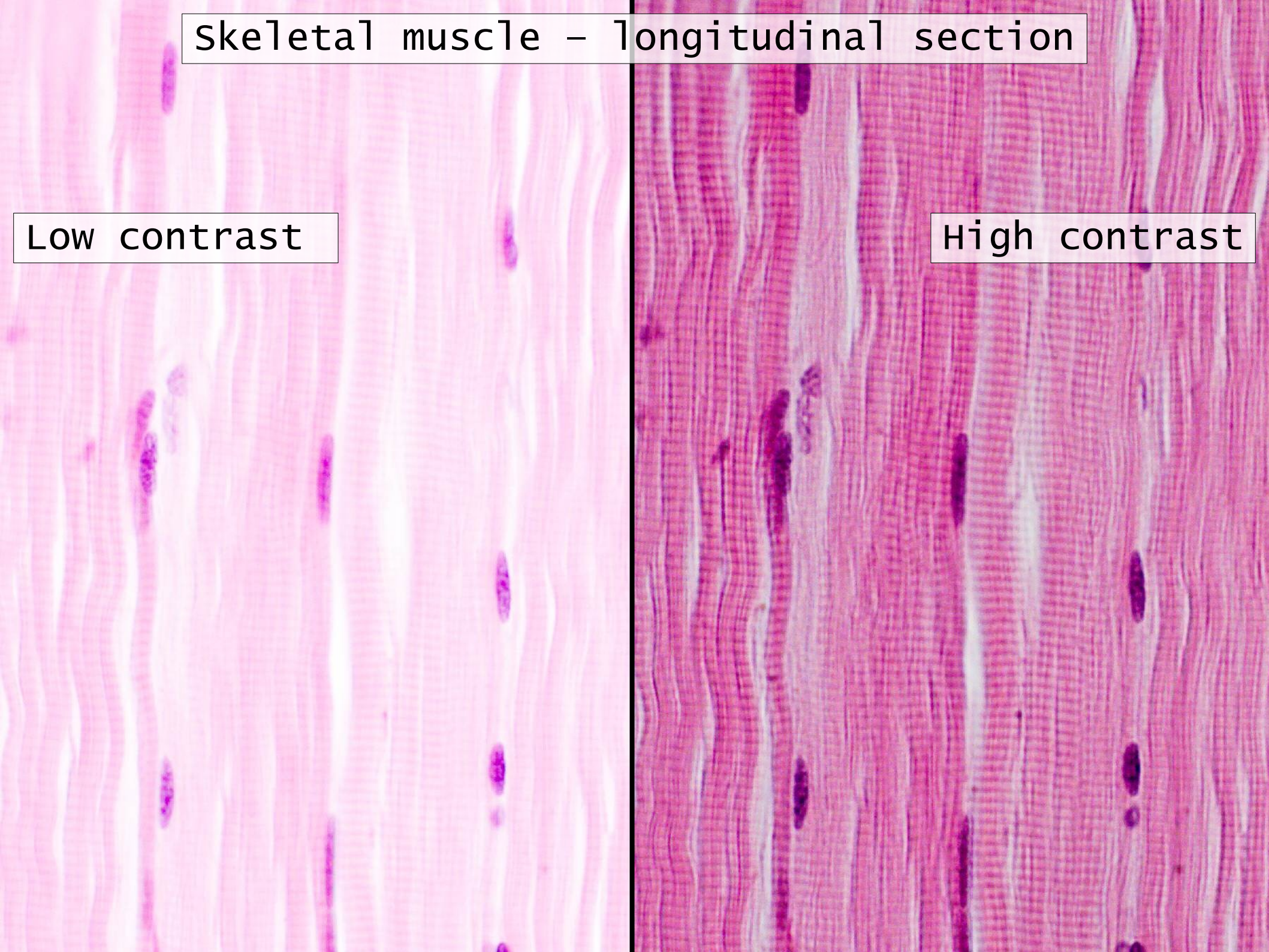

Skeletal muscle – longitudinal section
Perimysium
Muscle fibre nuclei
At periphery
Endomysium
Surrounds muscle fibre
Muscle fibre
Medium magnification

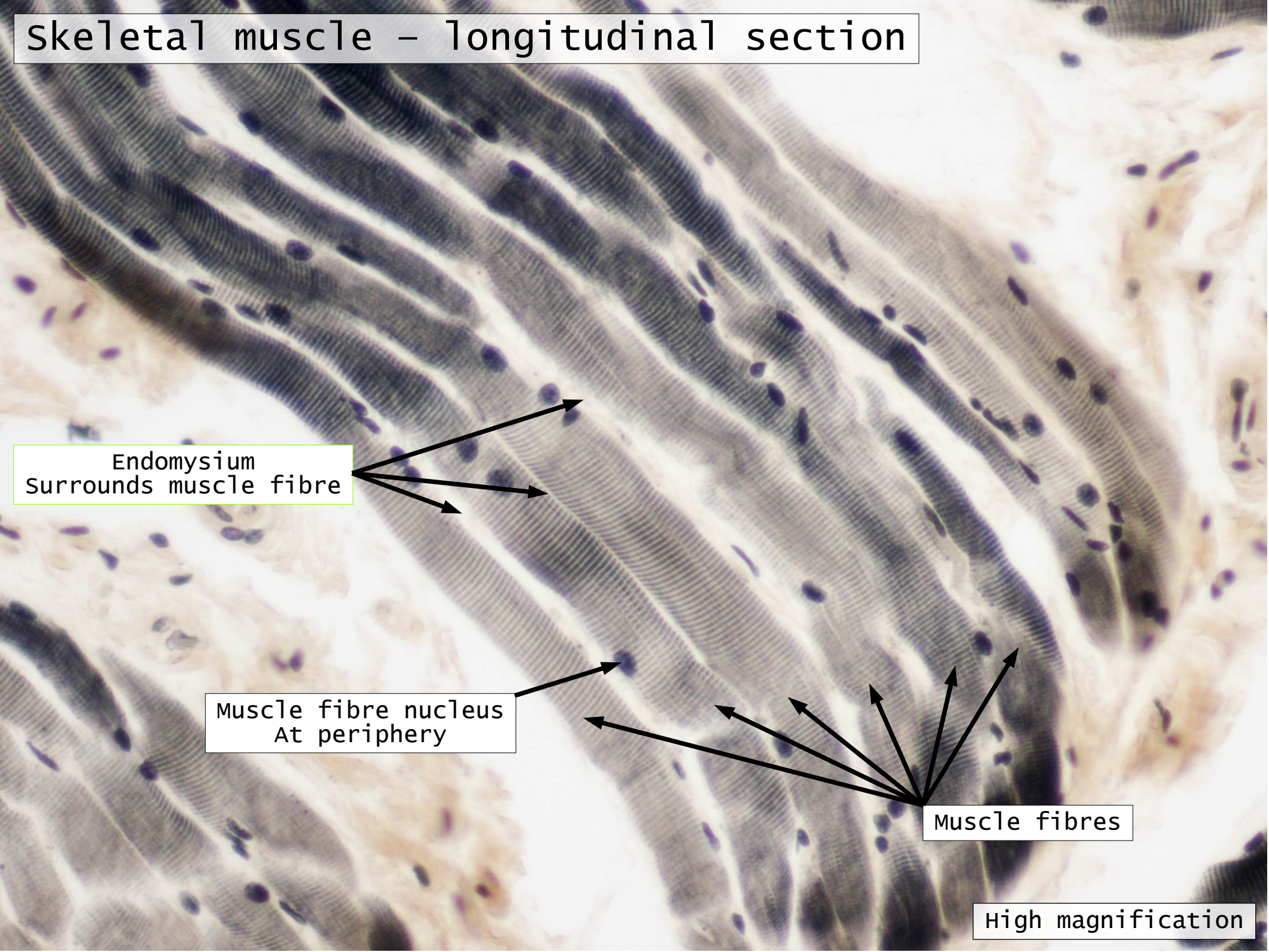
Skeletal muscle – longitudinal section

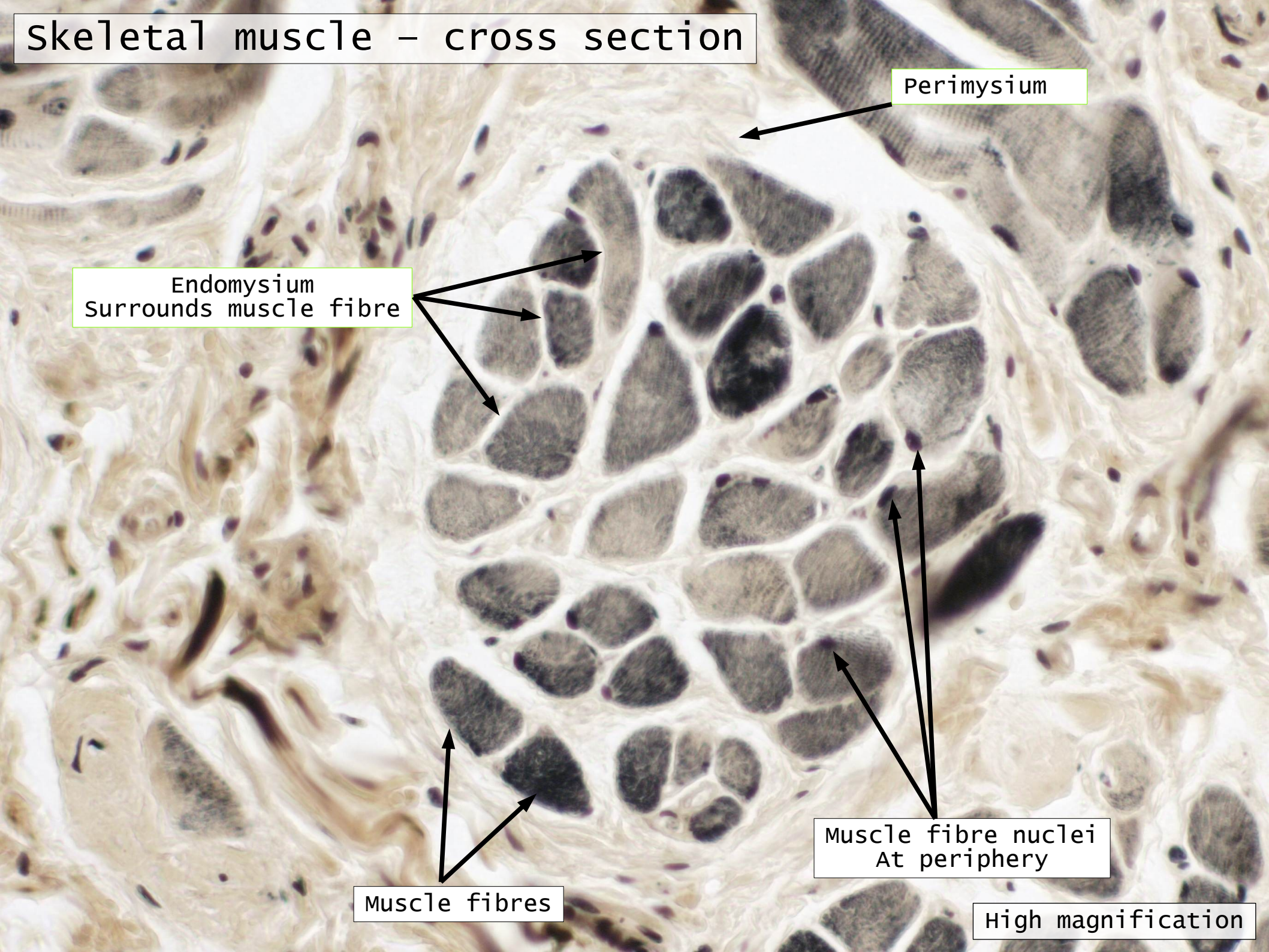


Medium magnification

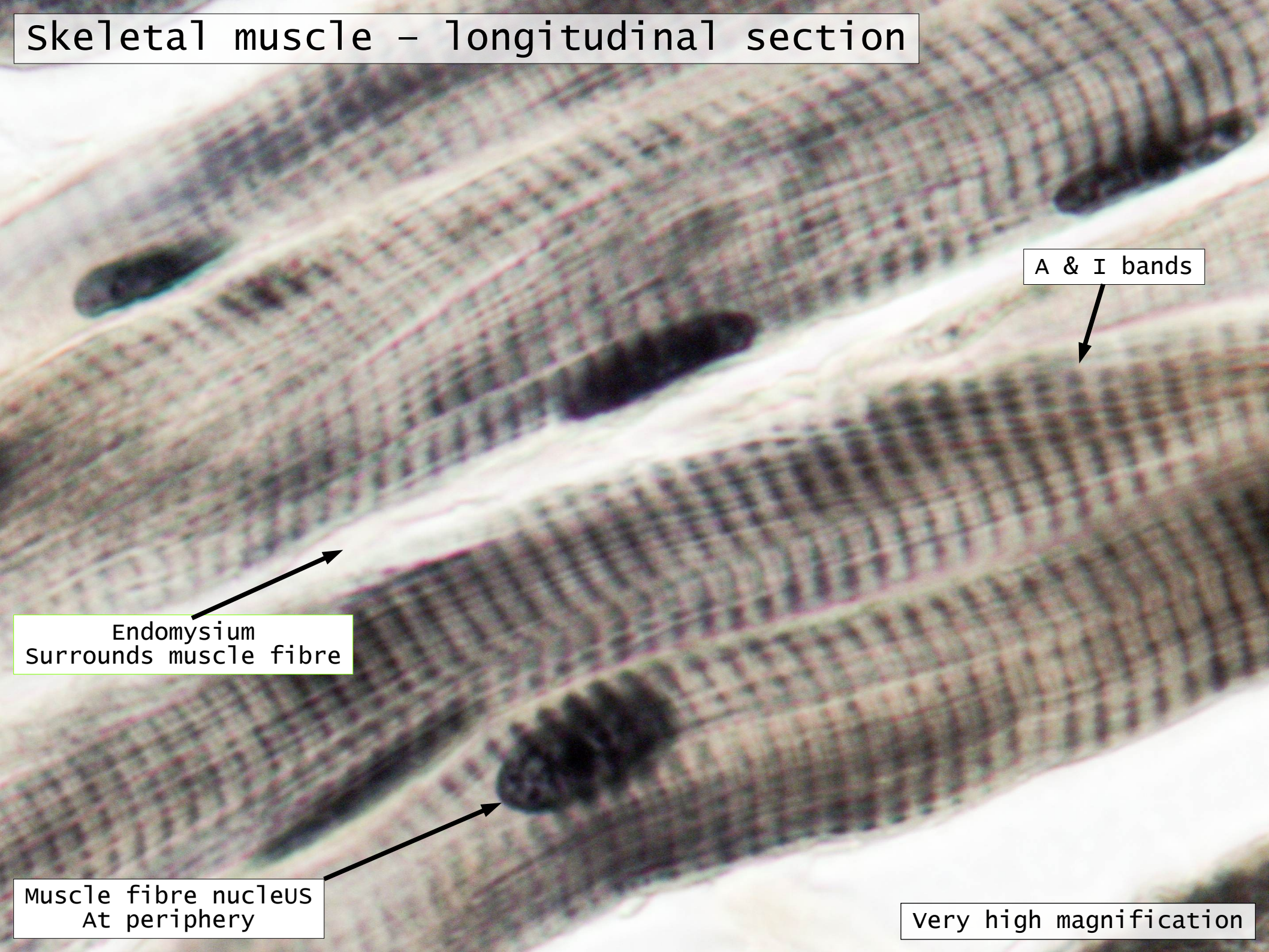
Skeletal muscle – longitudinal section

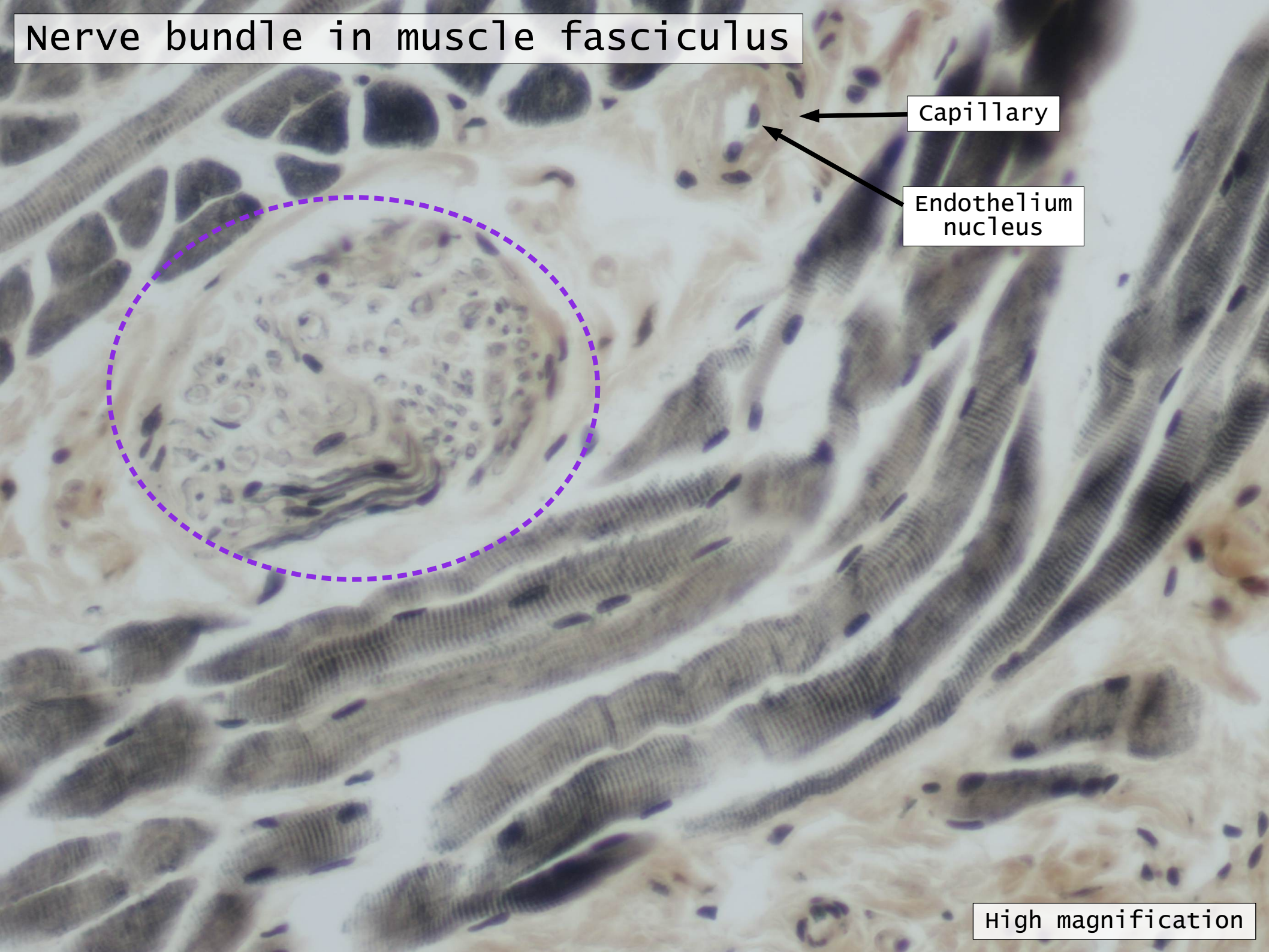



Skeletal muscle – longitudinal section
Endomysium
Surrounds muscle fibre
Muscle fibre nucleus
At periphery
Muscle fibres
High magnification

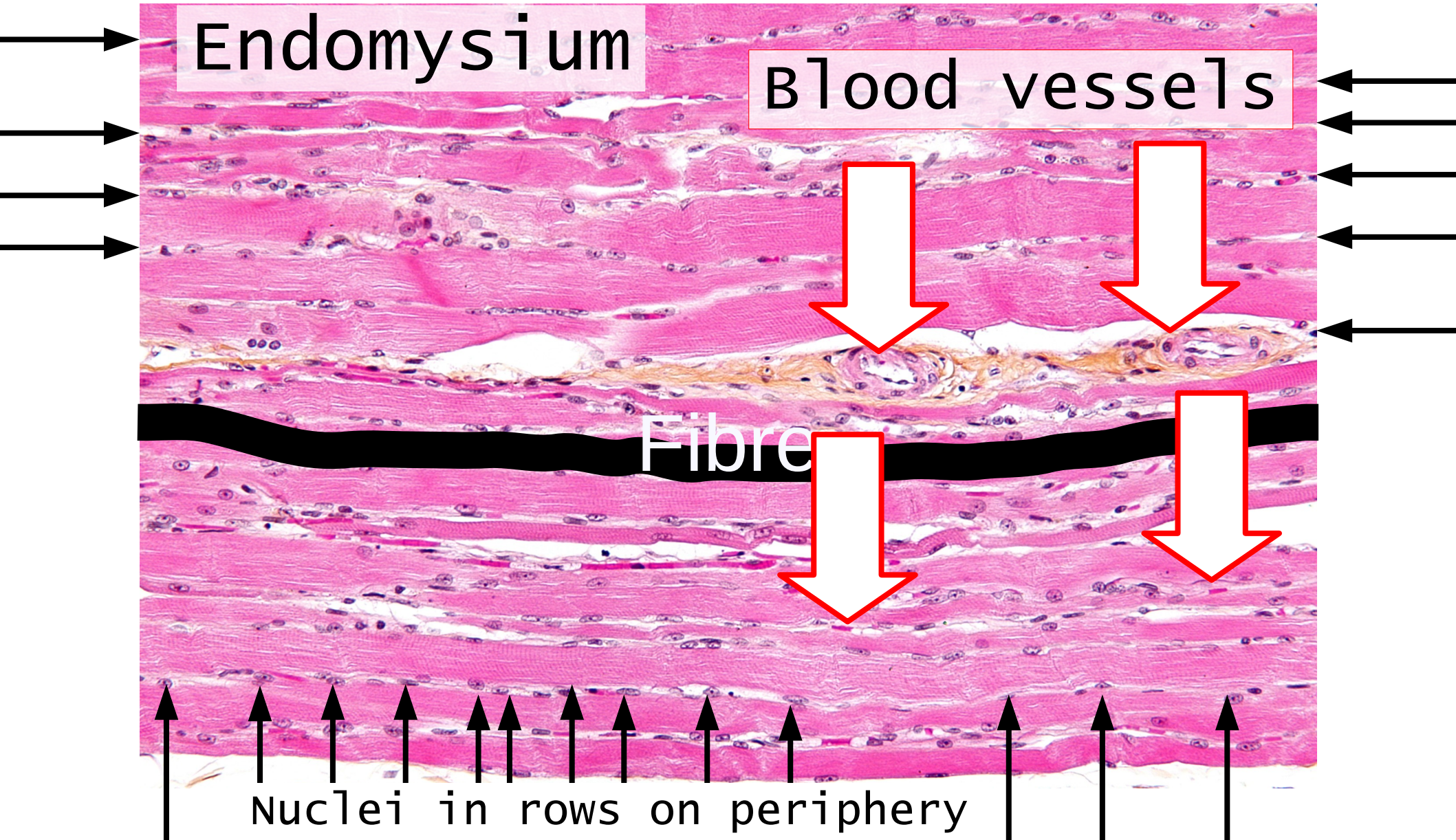

Skeletal muscle – cross section
Perimysium
Endomysium
Surrounds muscle fibre
Muscle fibre nuclei
At periphery
Muscle fibres
High magnification

Skeletal muscle – longitudinal section



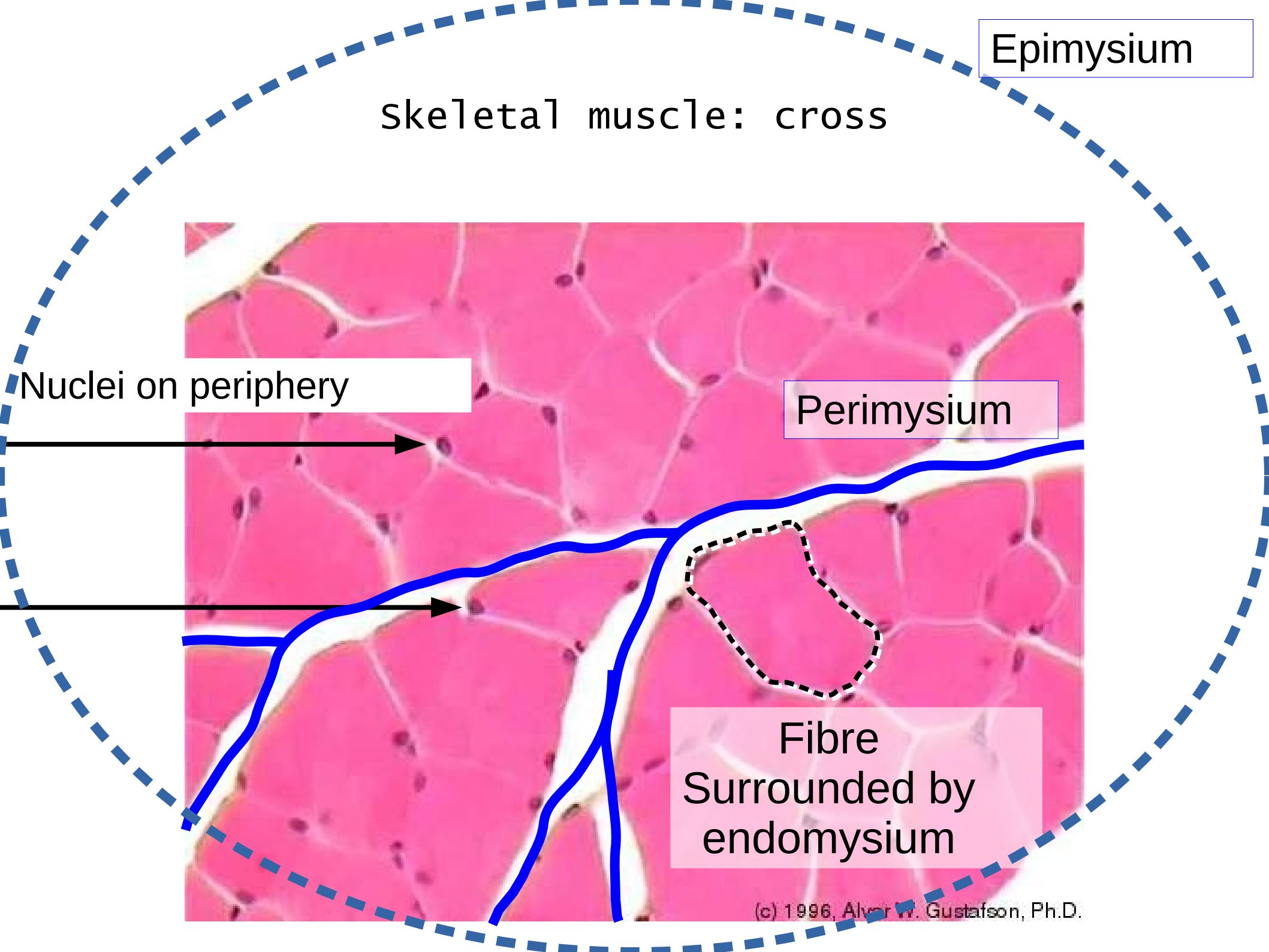

Nerve bundle in muscle fasciculus
Capillary
Endothelium nucleus
High magnification

Skeletal muscle: longitudinal



Epimysium

Skeletal muscle: cross



Connective tissue of muscle

(Sarcolemma <-> Microfibril)

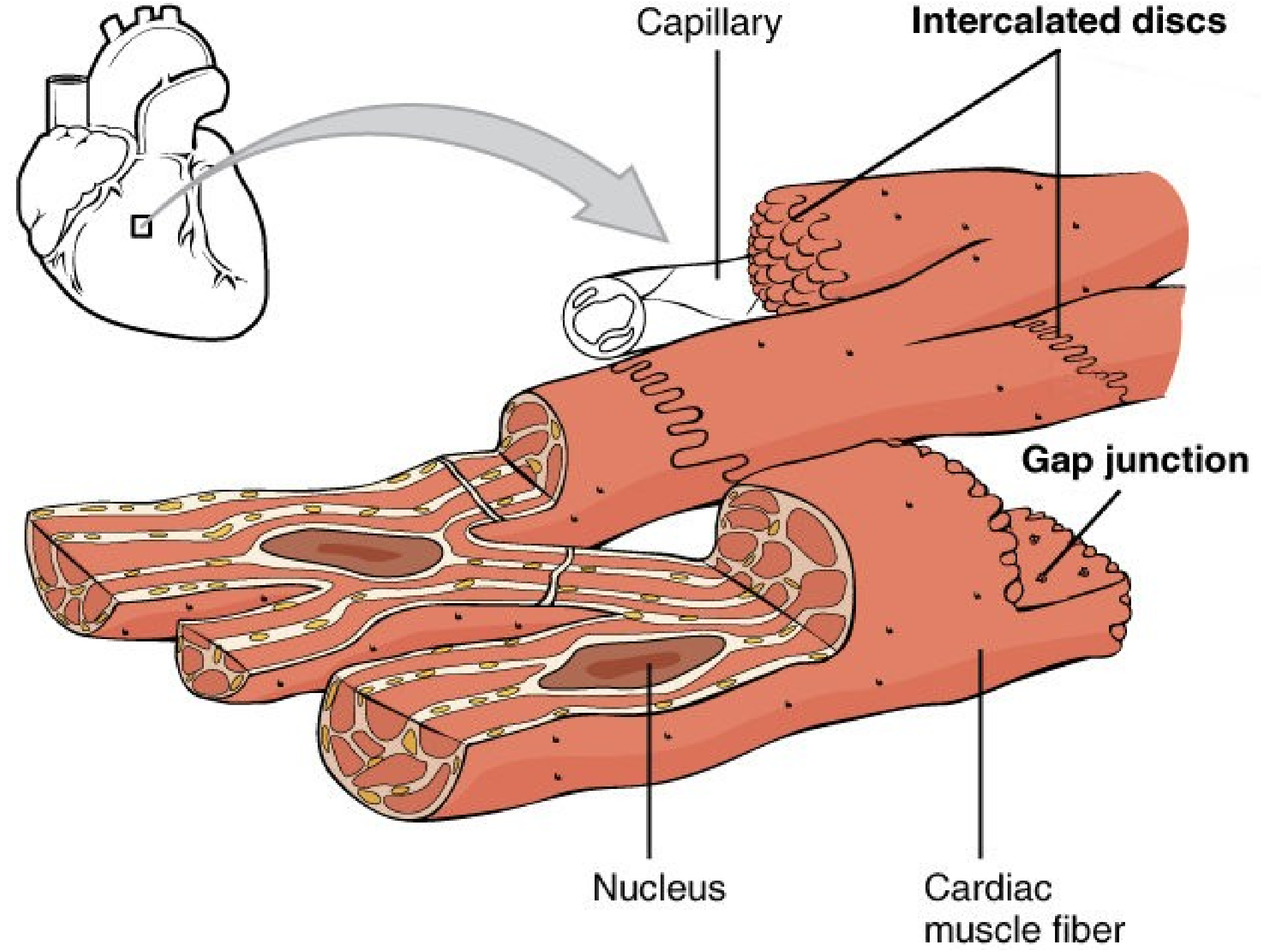
Endomysium <-> Fibre

Perimysium <-> Fascicle

Epimysium <-> Muscle

Cardiac muscle

slides 20 & 77 & 86


Capillary
Intercalated discs
Gap junction
Nucleus
Cardiac muscle fiber

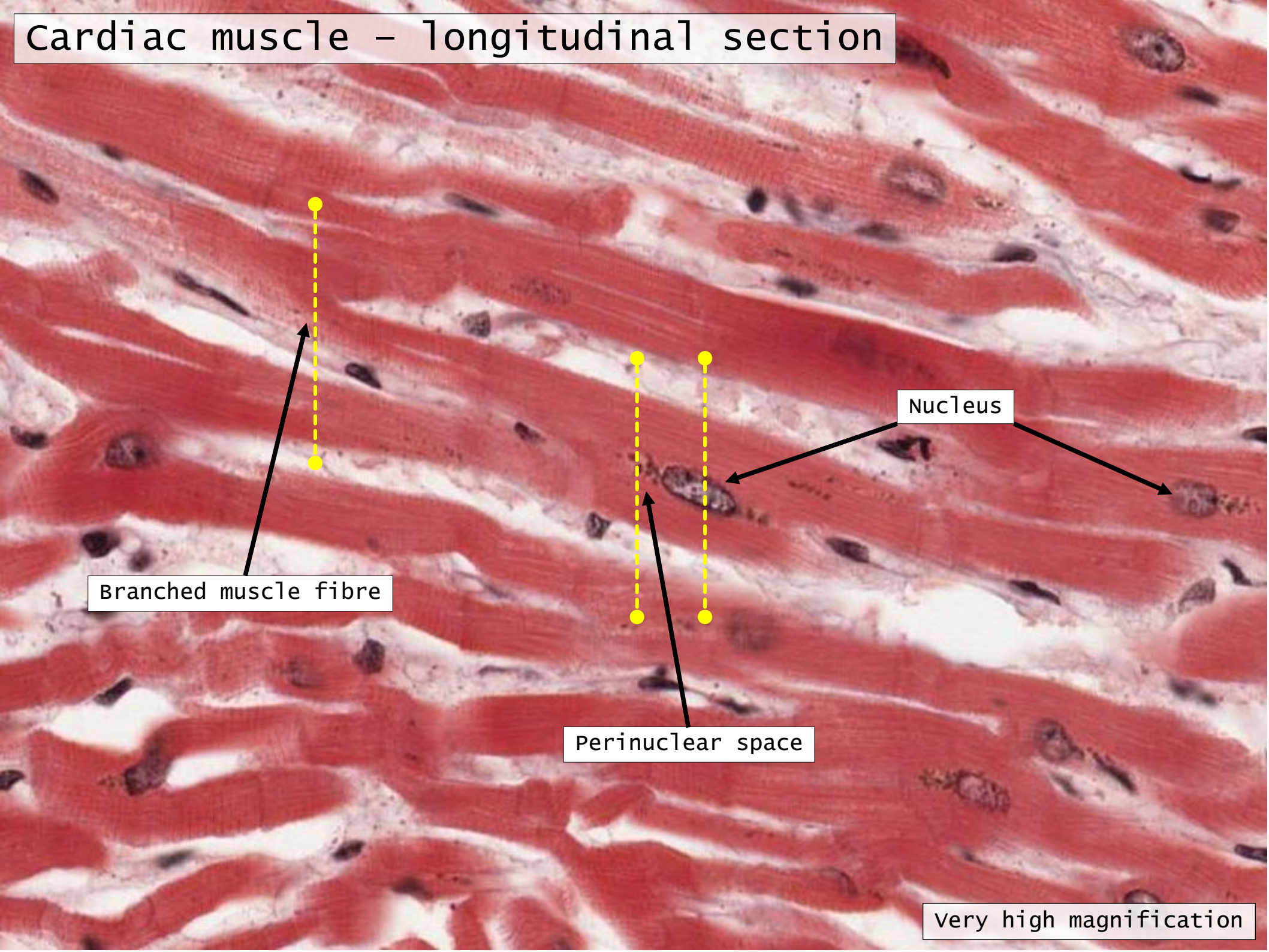
Cardiac muscle

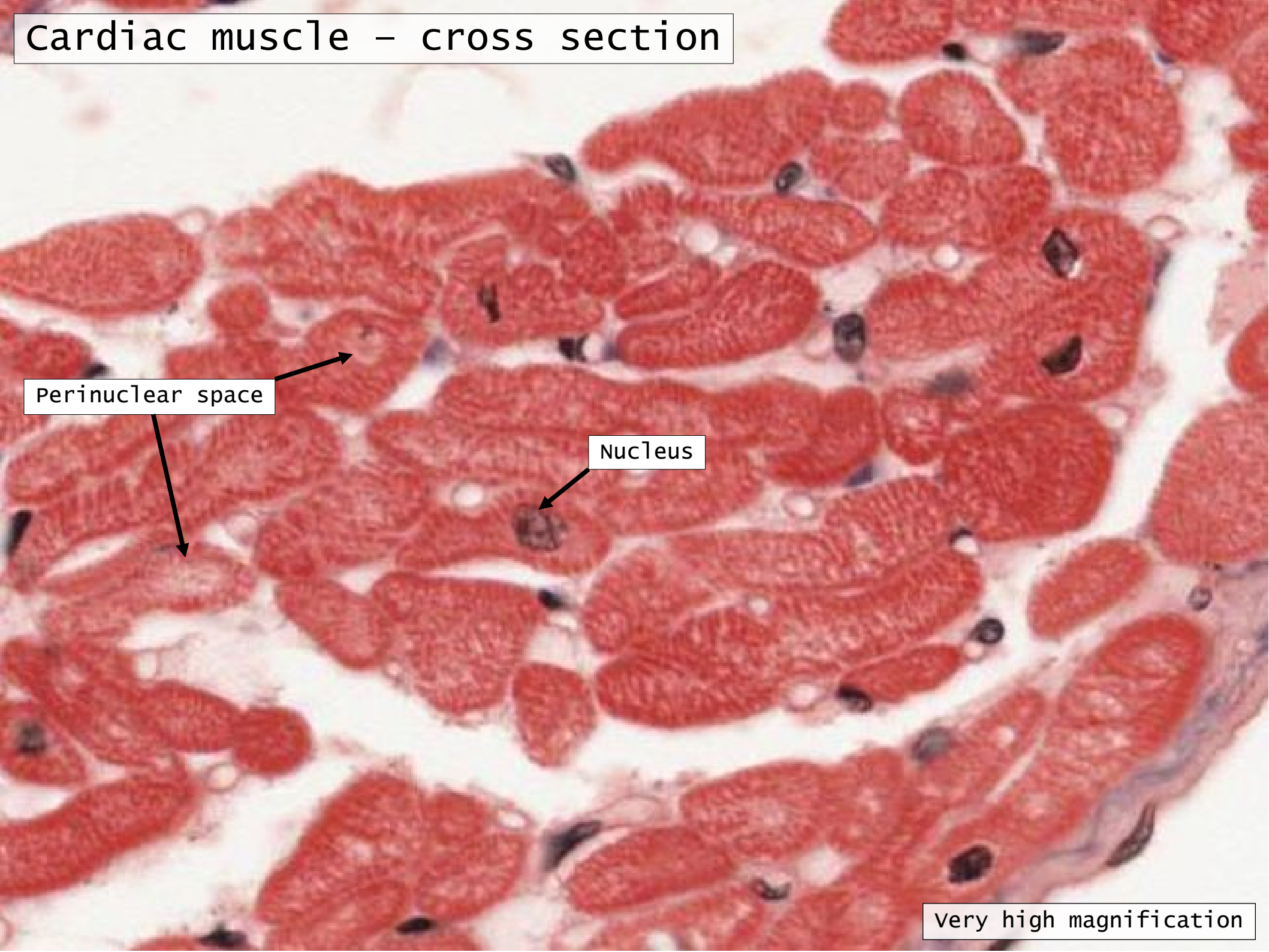
- Striated muscle fibres
- Contract spontaneously with rythmic beat
- Attached end-to-end by intercalated disks
- May branch to form connections with adjacent fibres
- One, sometimes two centrally located nuclei
- Thick and thin poorly defined myofibrils
- Crossbanding (AIHZM) same as skeletal muscle

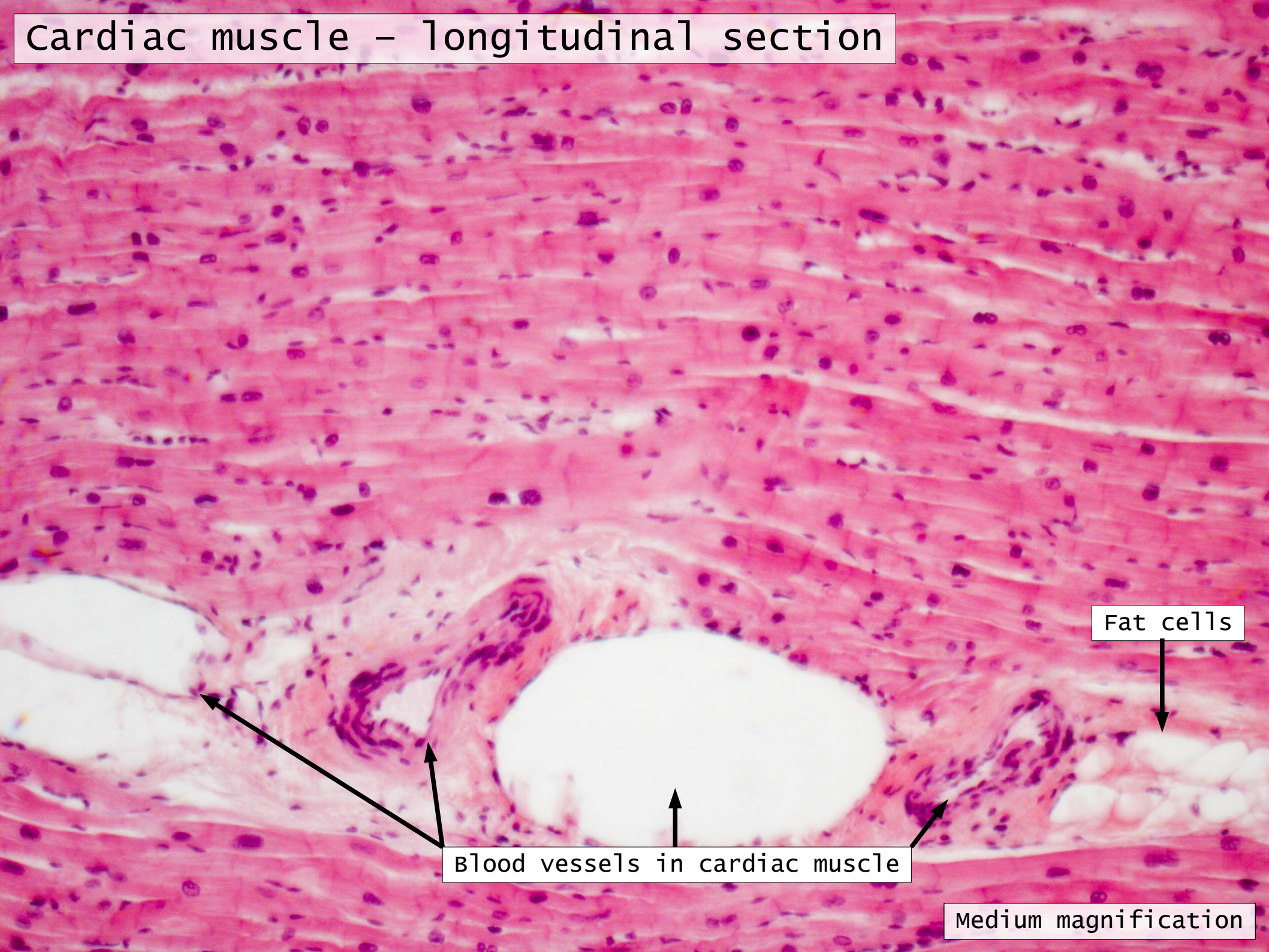
Intercalated disks

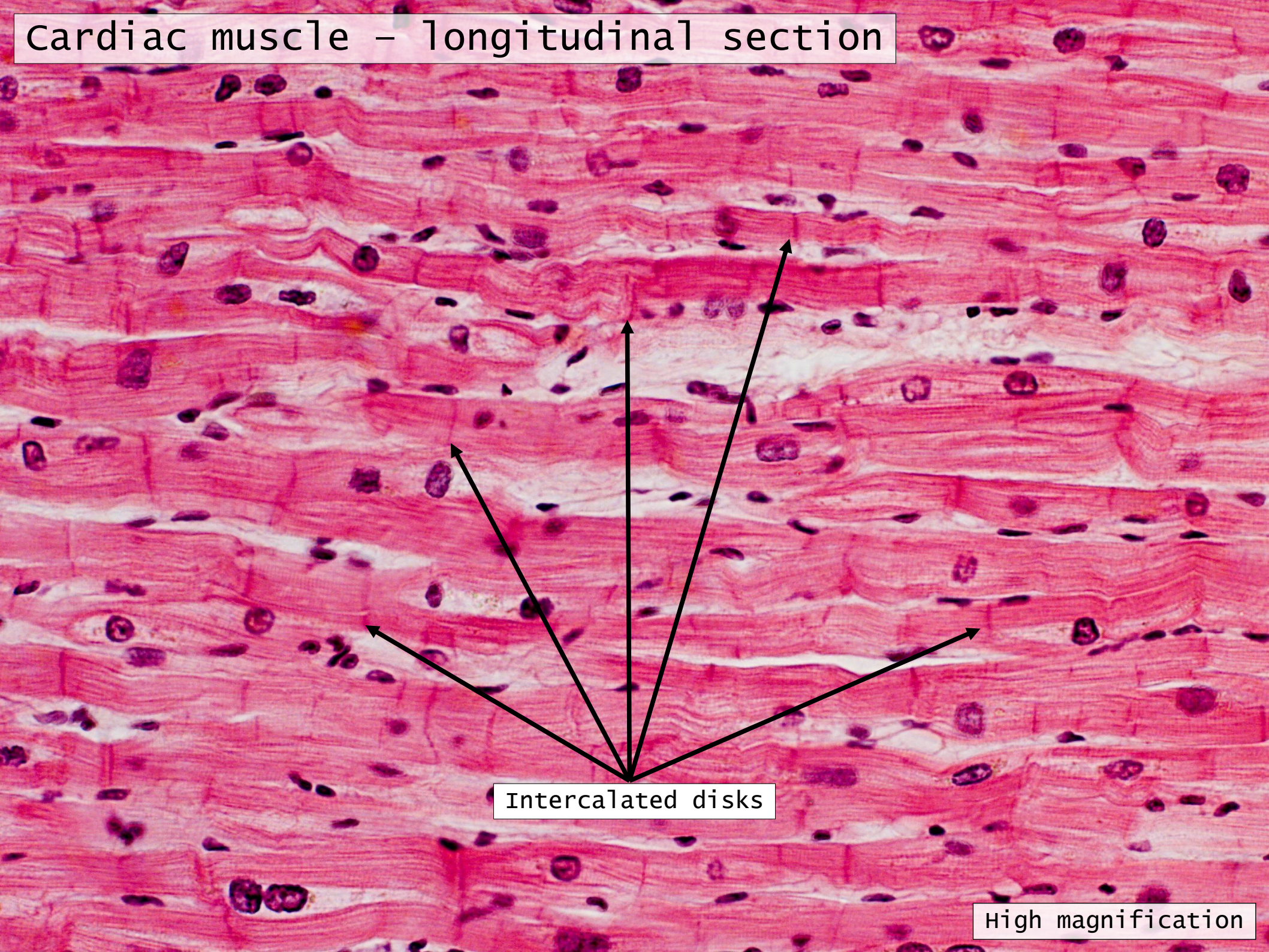
- Elaborate stepwise junctions
- Forms end-to-end attachments adjacent muscle fibres
- Transvers portion
  - Fascia adherens
  - Desmosomes
  - Gap junctions
- Longitudinal portion
  - Gap junctions
  - Desmosomes

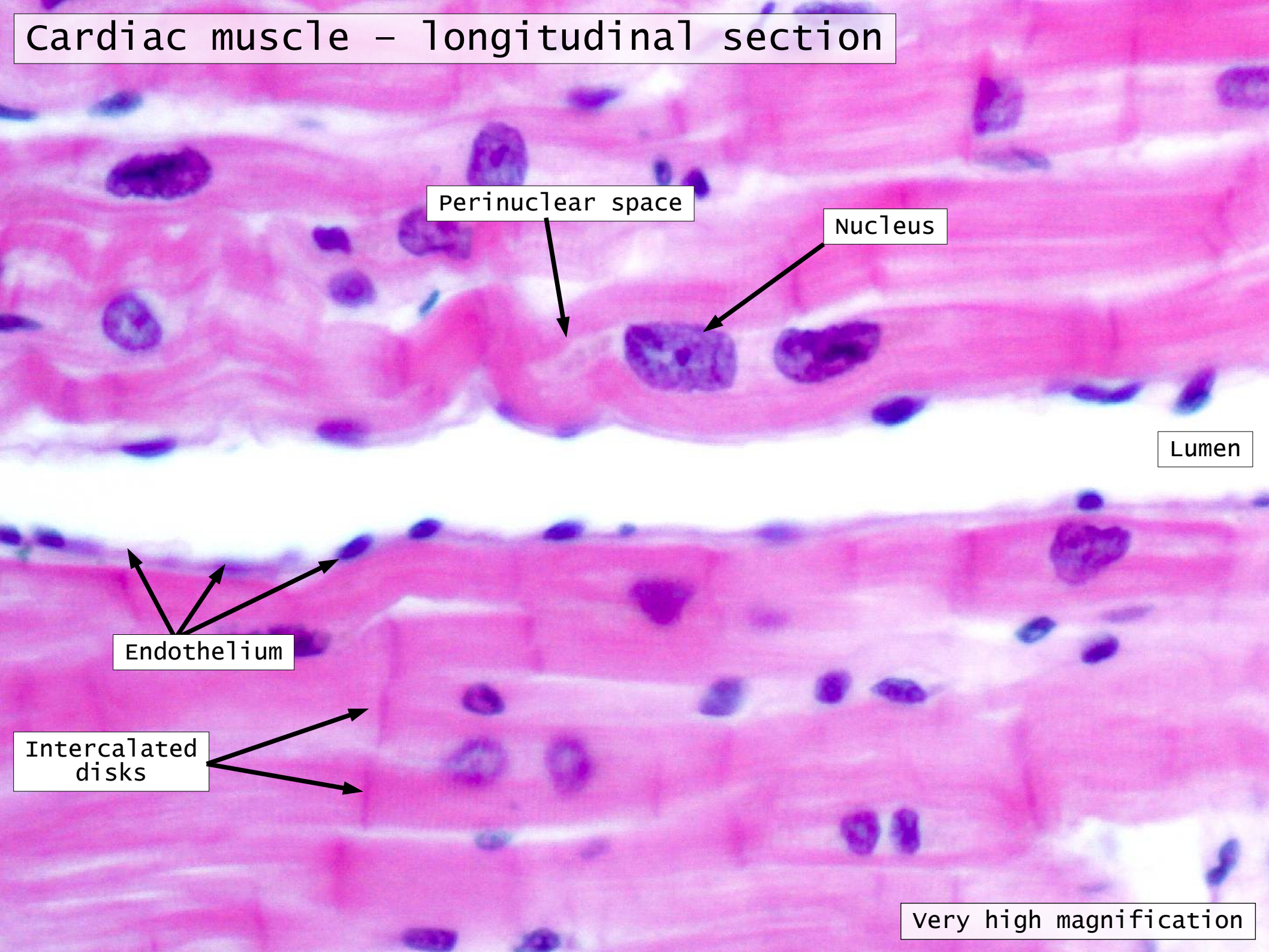
Cardiac muscle – longitudinal section




Cardiac muscle – cross section
Perinuclear space
Nucleus
Very high magnification

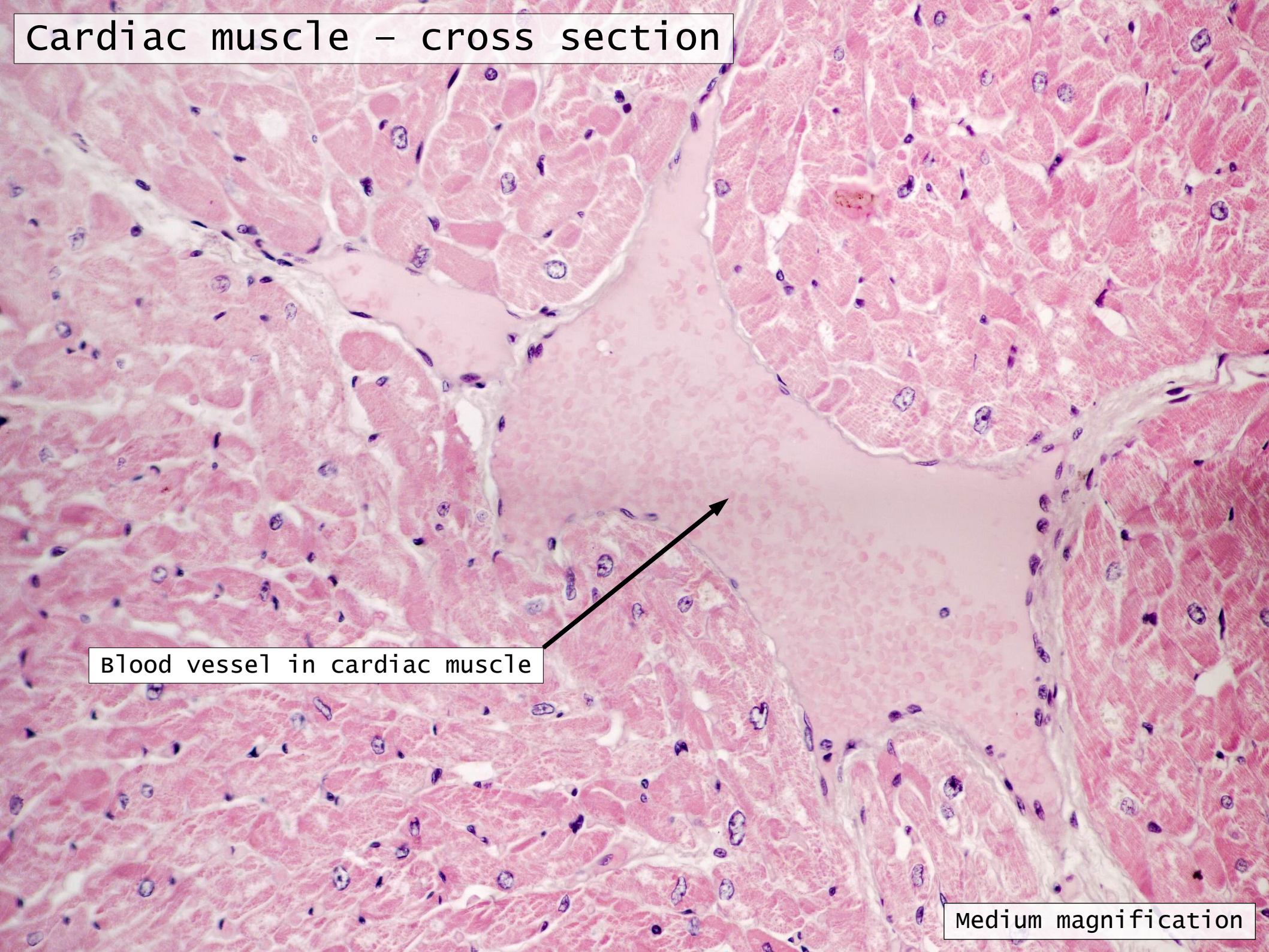

Cardiac muscle – longitudinal section
Fat cells
Blood vessels in cardiac muscle
Medium magnification


Cardiac muscle – longitudinal section
Intercalated disks
High magnification

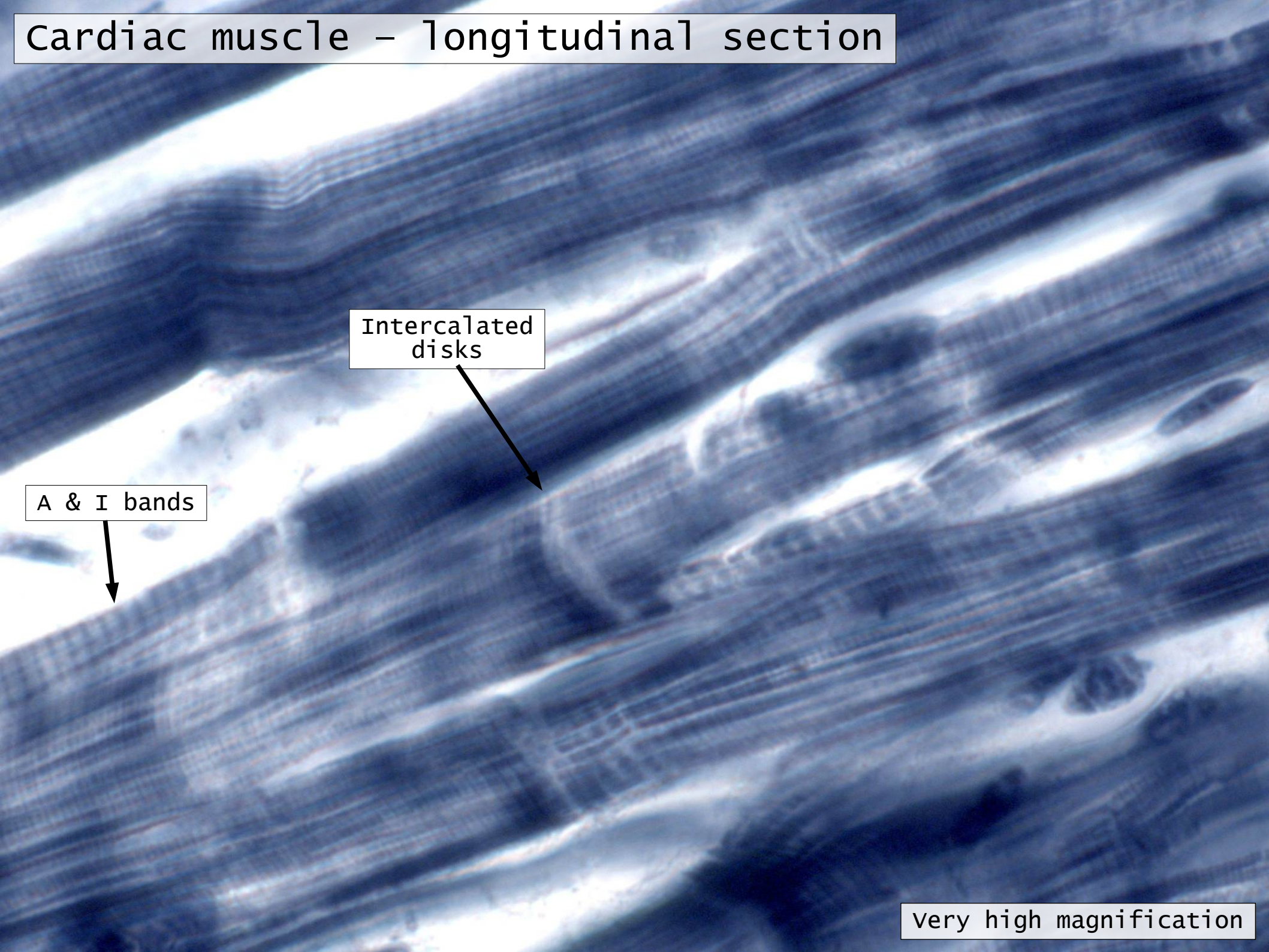

Cardiac muscle – longitudinal section
Perinuclear space
Nucleus
Lumen
Endothelium
Intercalated disks
Very high magnification

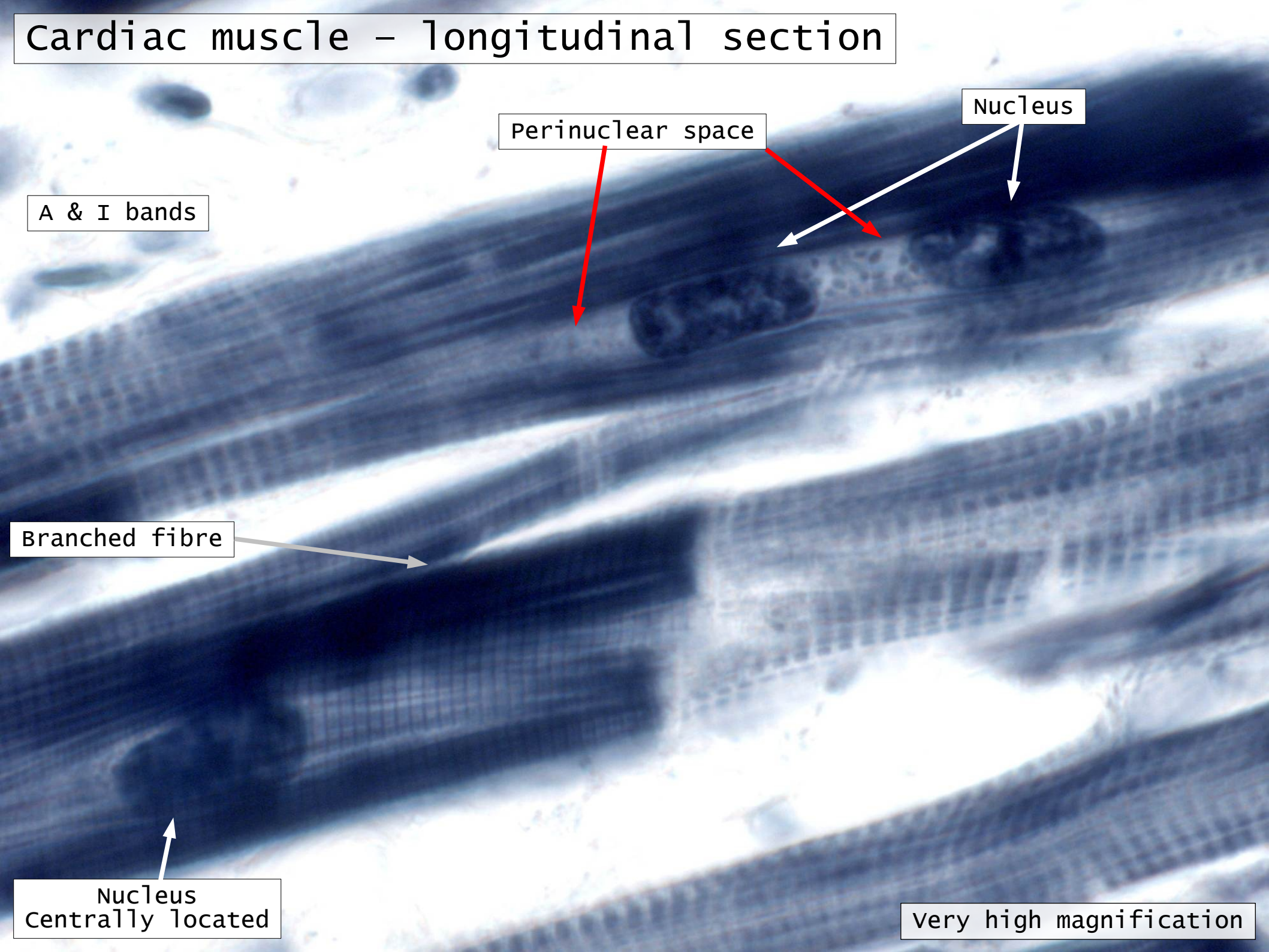

Cardiac muscle – cross section
Perinuclear space
Nucleus
Endothelium
Blood vessel with RBC
High magnification

Cardiac muscle – cross section

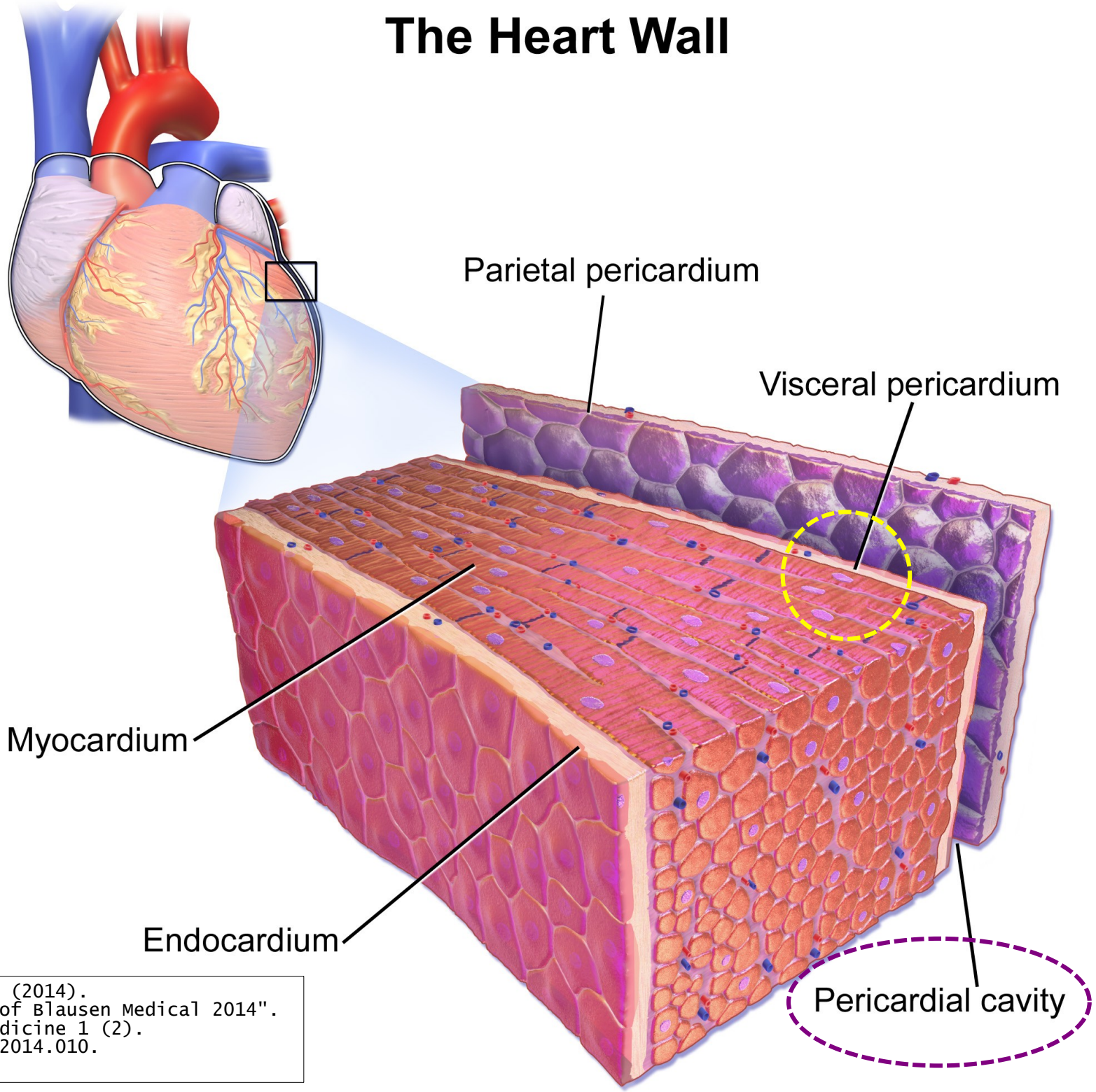


Cardiac muscle – longitudinal section

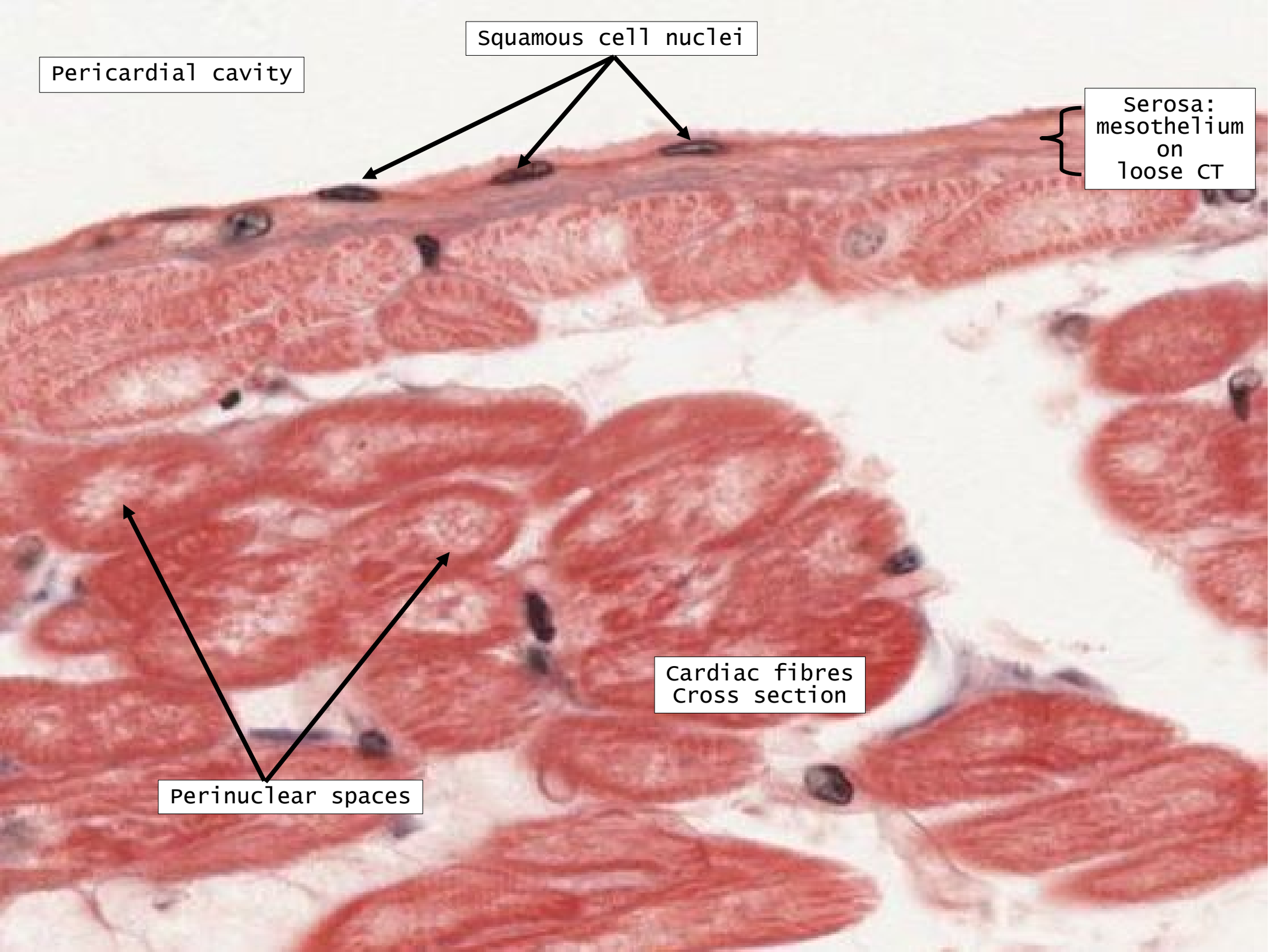


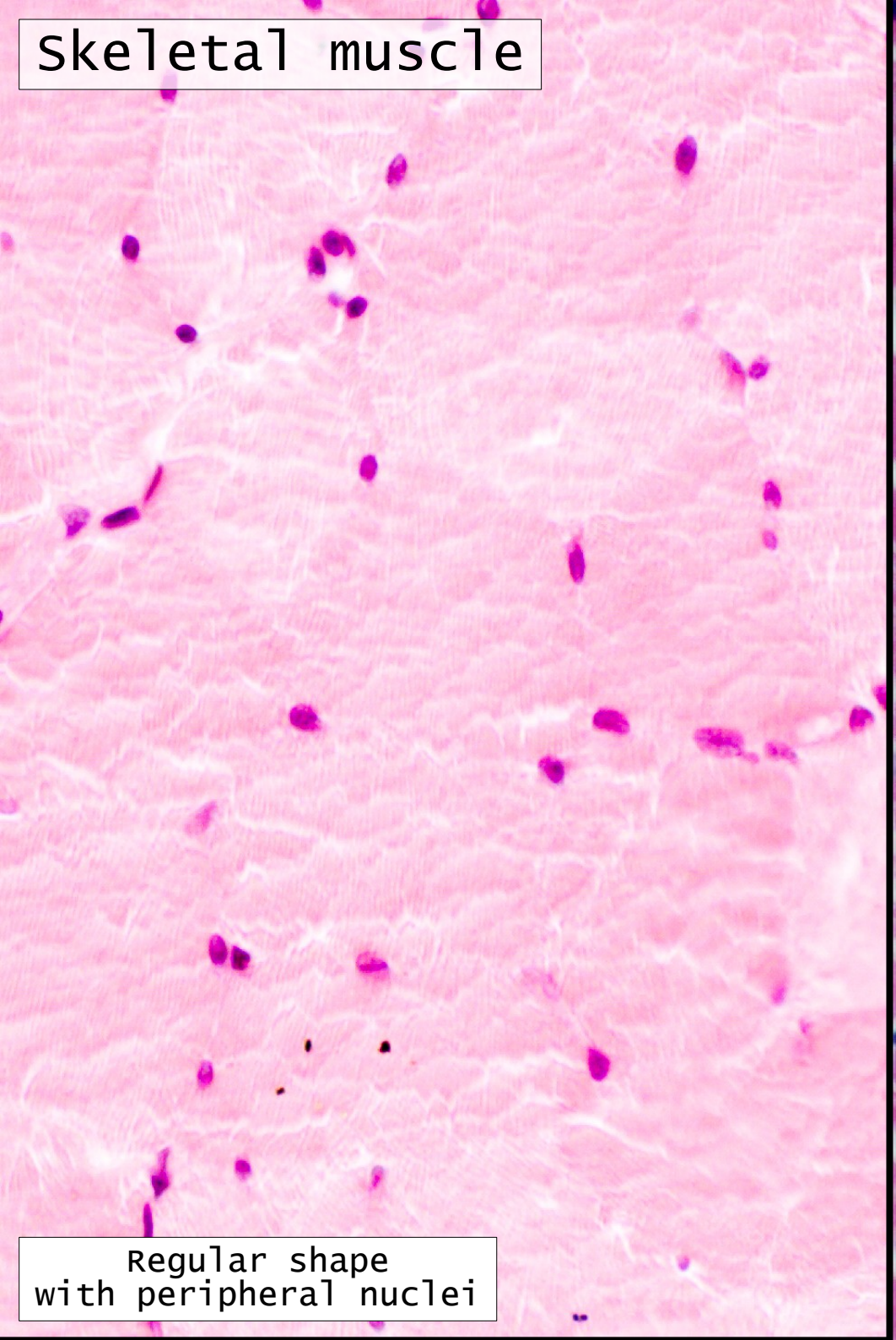

Cardiac muscle – longitudinal section
Nucleus
Perinuclear space
A & I bands
Branched fibre
Nucleus
Centrally located
Very high magnification

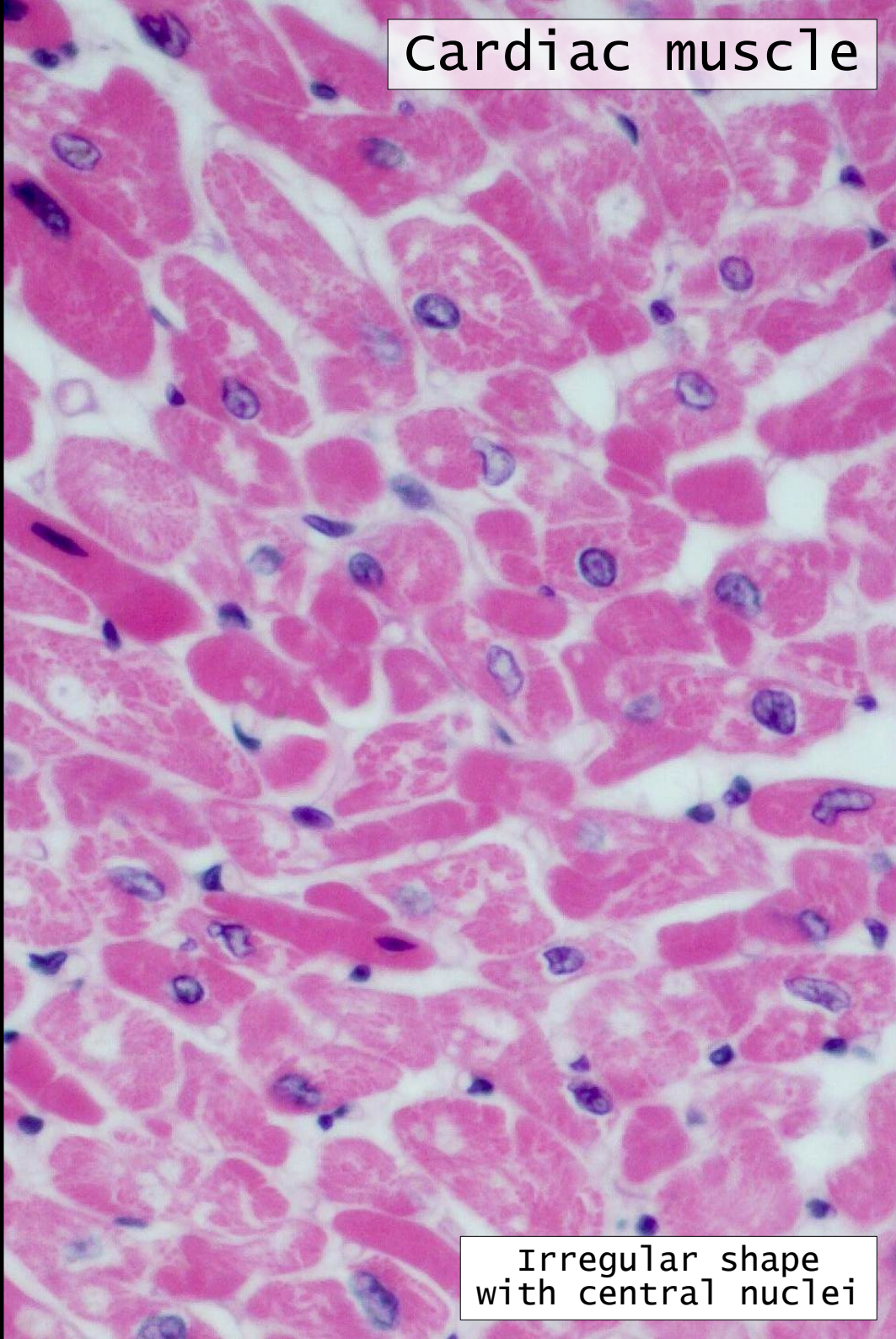
The Heart Wall

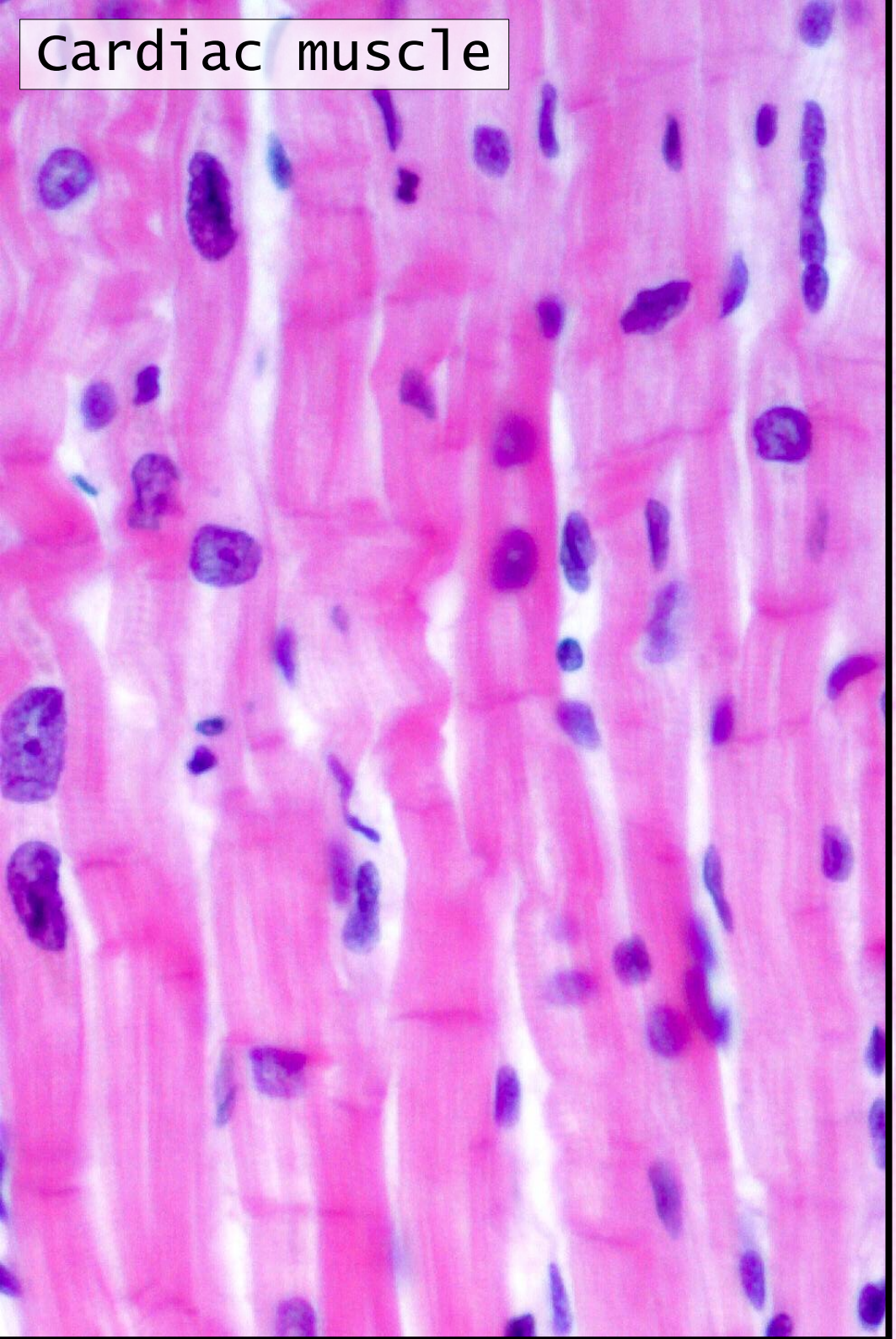


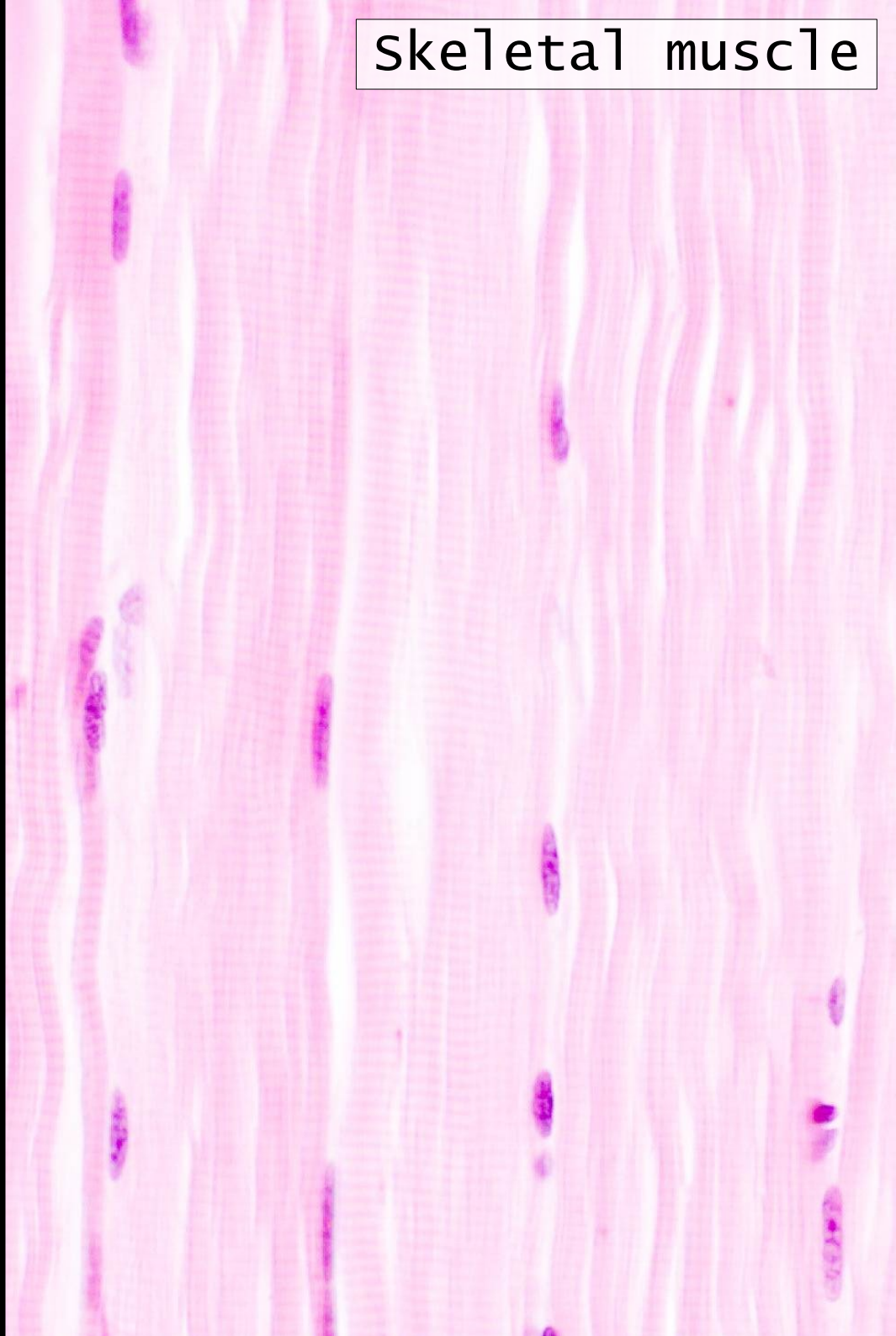
Blausen.com staff (2014).
"Medical gallery of Blausen Medical 2014".
WikiJournal of Medicine 1 (2).
DOI:10.15347/wjm/2014.010.
ISSN 2002-4436


Squamous cell nuclei
Pericardial cavity
Serosa: mesothelium on loose CT
Cardiac fibres Cross section
Perinuclear spaces


Skeletal muscle
Regular shape
with peripheral nuclei


Cardiac muscle
Irregular shape
with central nuclei


Cardiac muscle


Skeletal muscle

Umbilical cord

Slide 100

For
gelatinous CT
smooth muscle

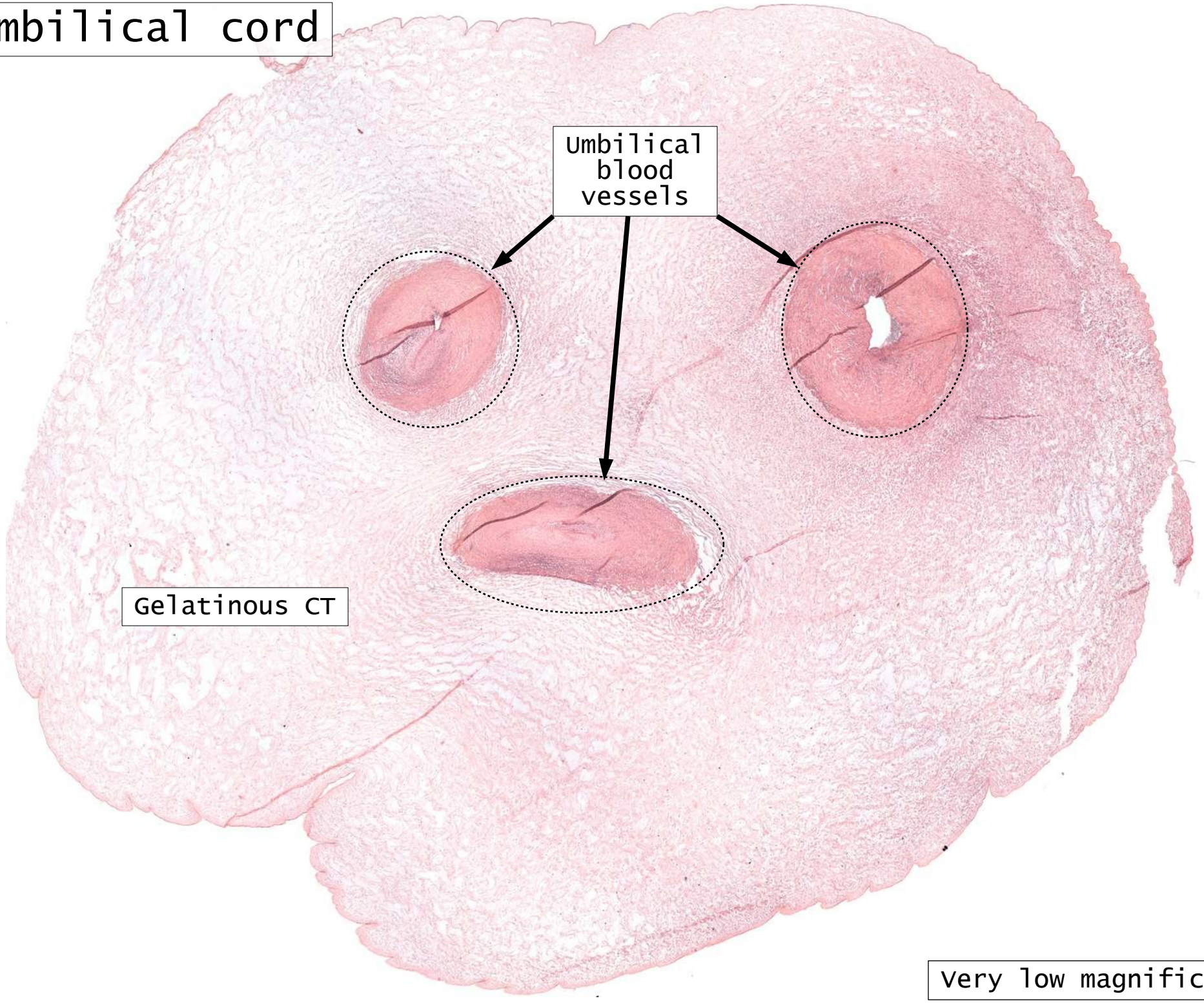
Smooth muscle fibres

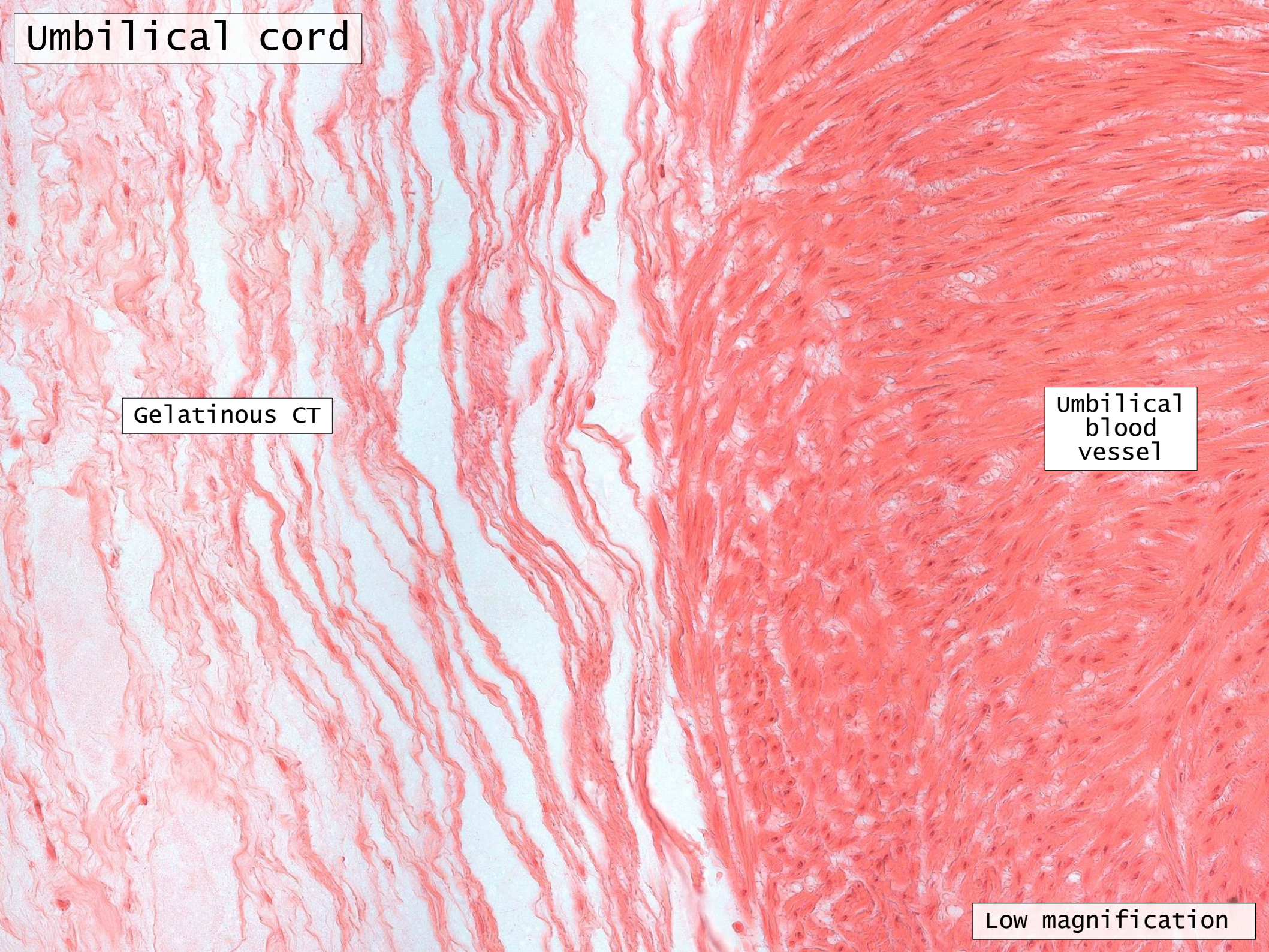
- Fusiform shape
- Arranged
  - Layers
  - Small bundles
  - Helical patterns
- Surrounded by reticular fibre network
- Nuclei
  - Centrally located
  - Cross-section not always visible
  - Longitudinal section in contracted state
    - Accordion pleated and deeply indented
- Contains actin, miosin, intermediate filaments
- Gap junctions facilitates spread of excitation

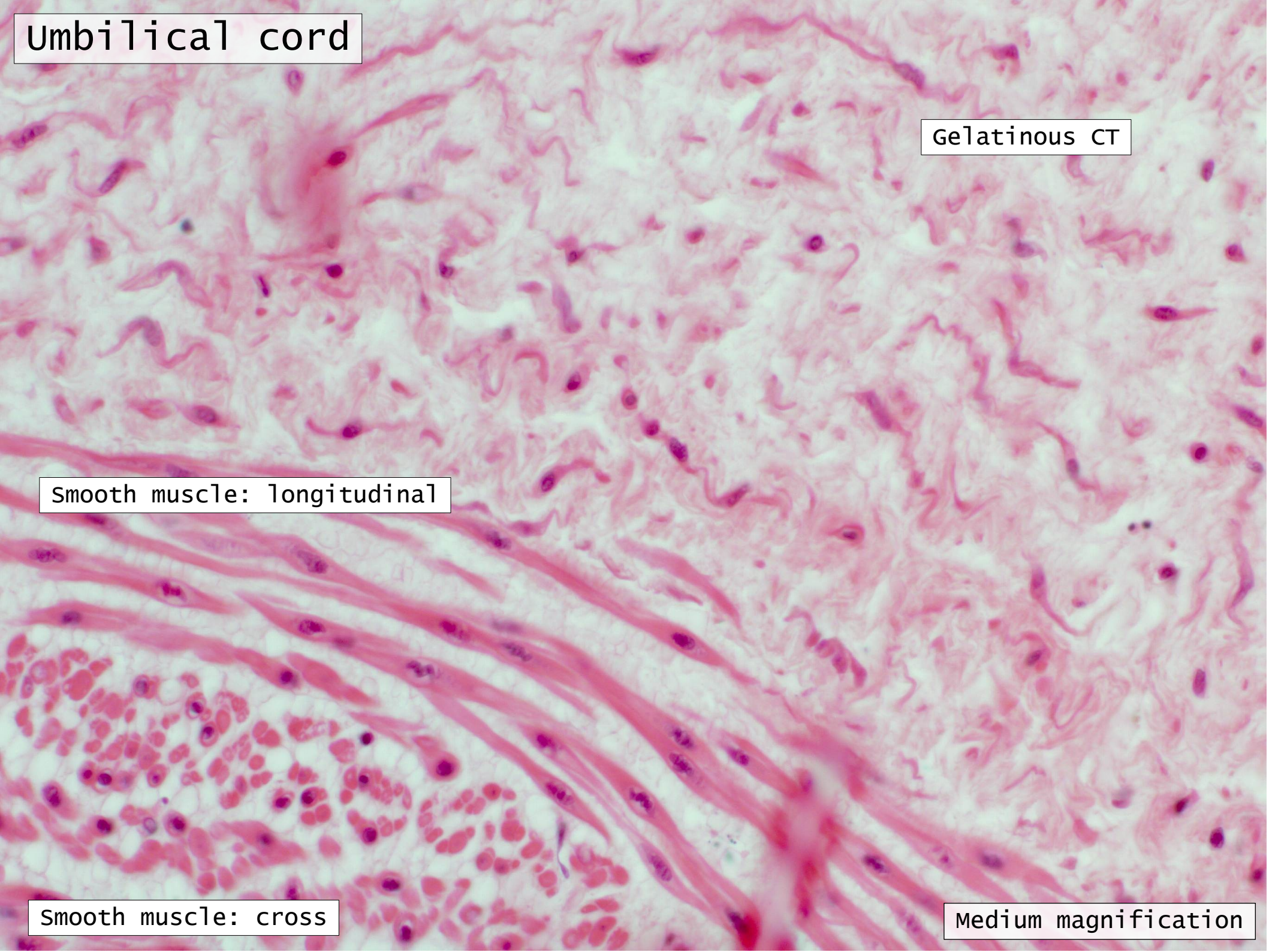
Umbilical cord

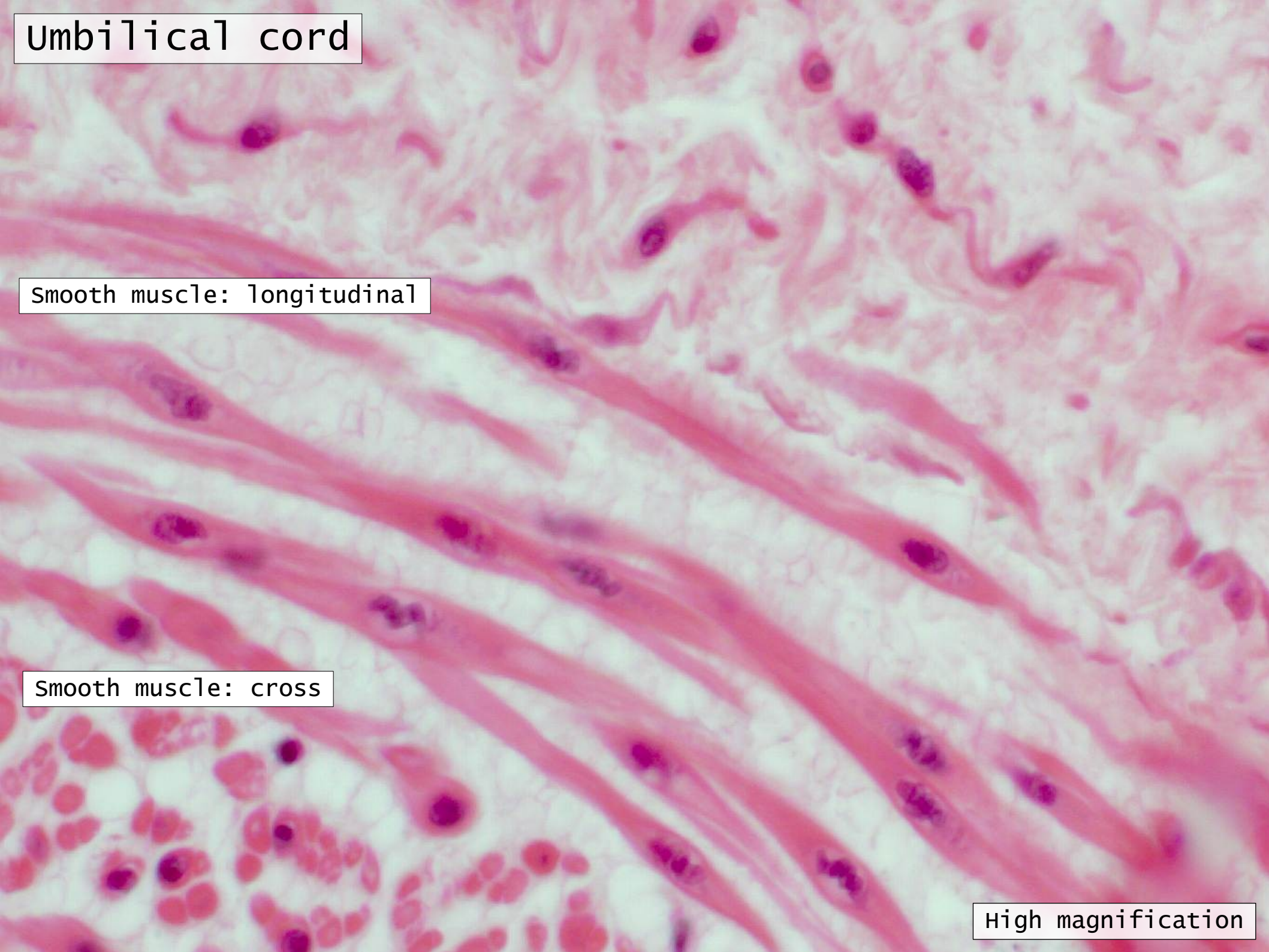
Very low magnification

Umbilical cord

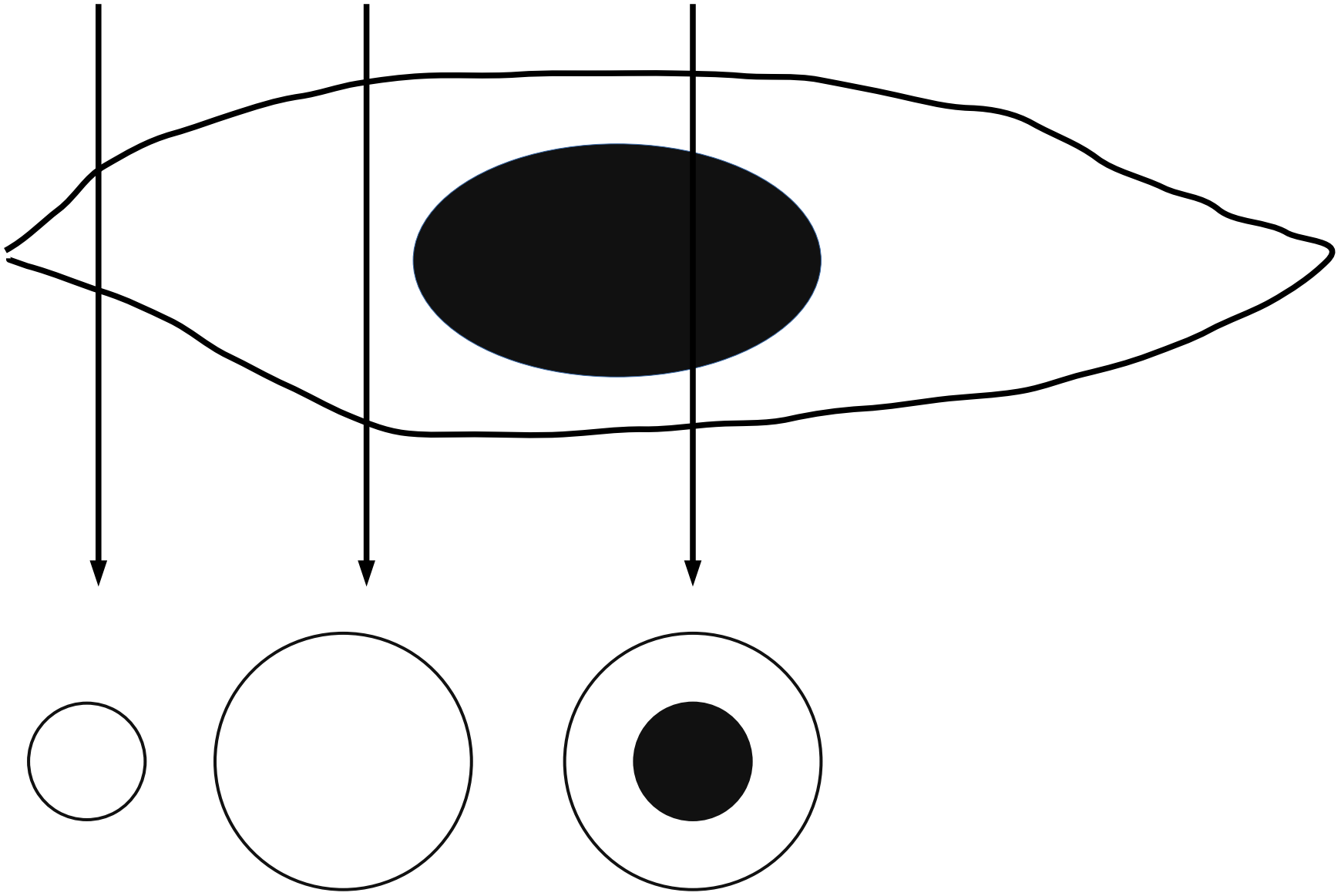



Umbilical cord
Gelatinous CT
Umbilical blood vessel
Low magnification

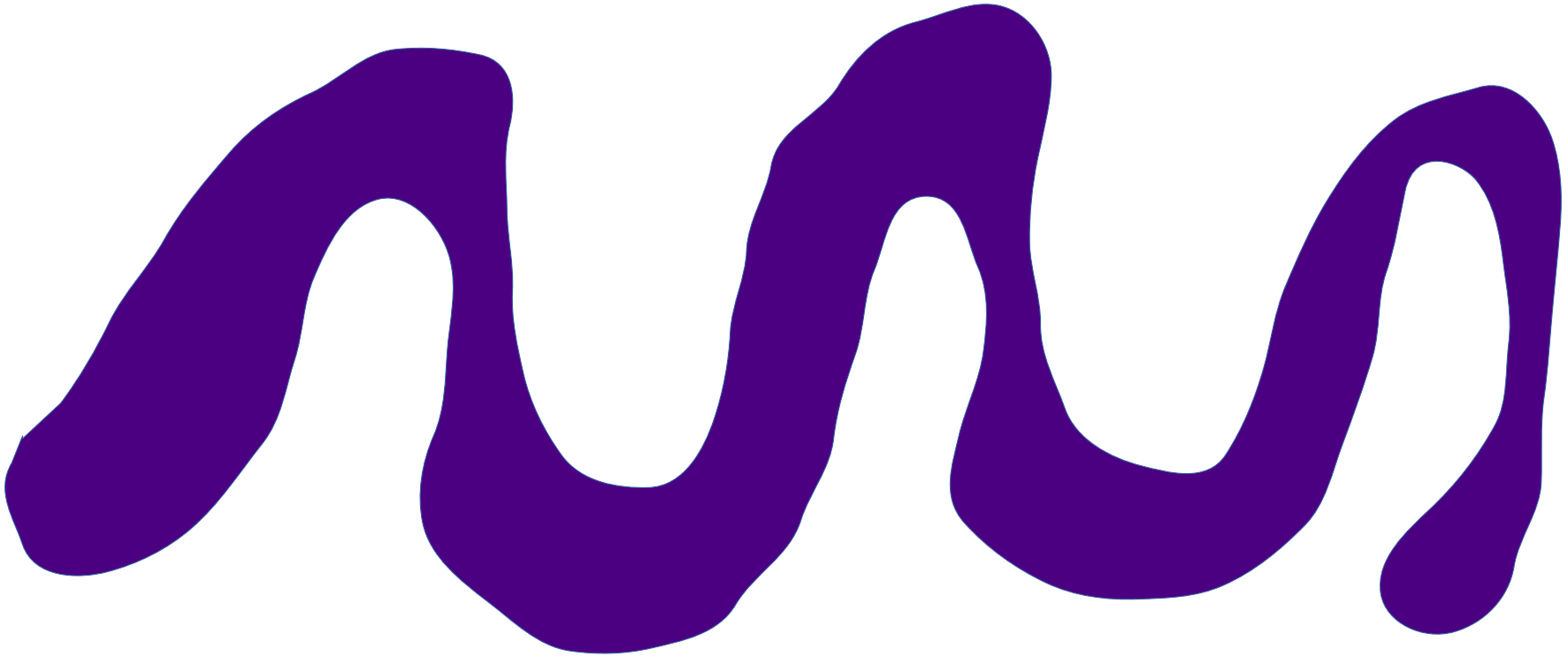

Umbilical cord
Gelatinous CT
Smooth muscle: longitudinal
Smooth muscle: cross
Medium magnification

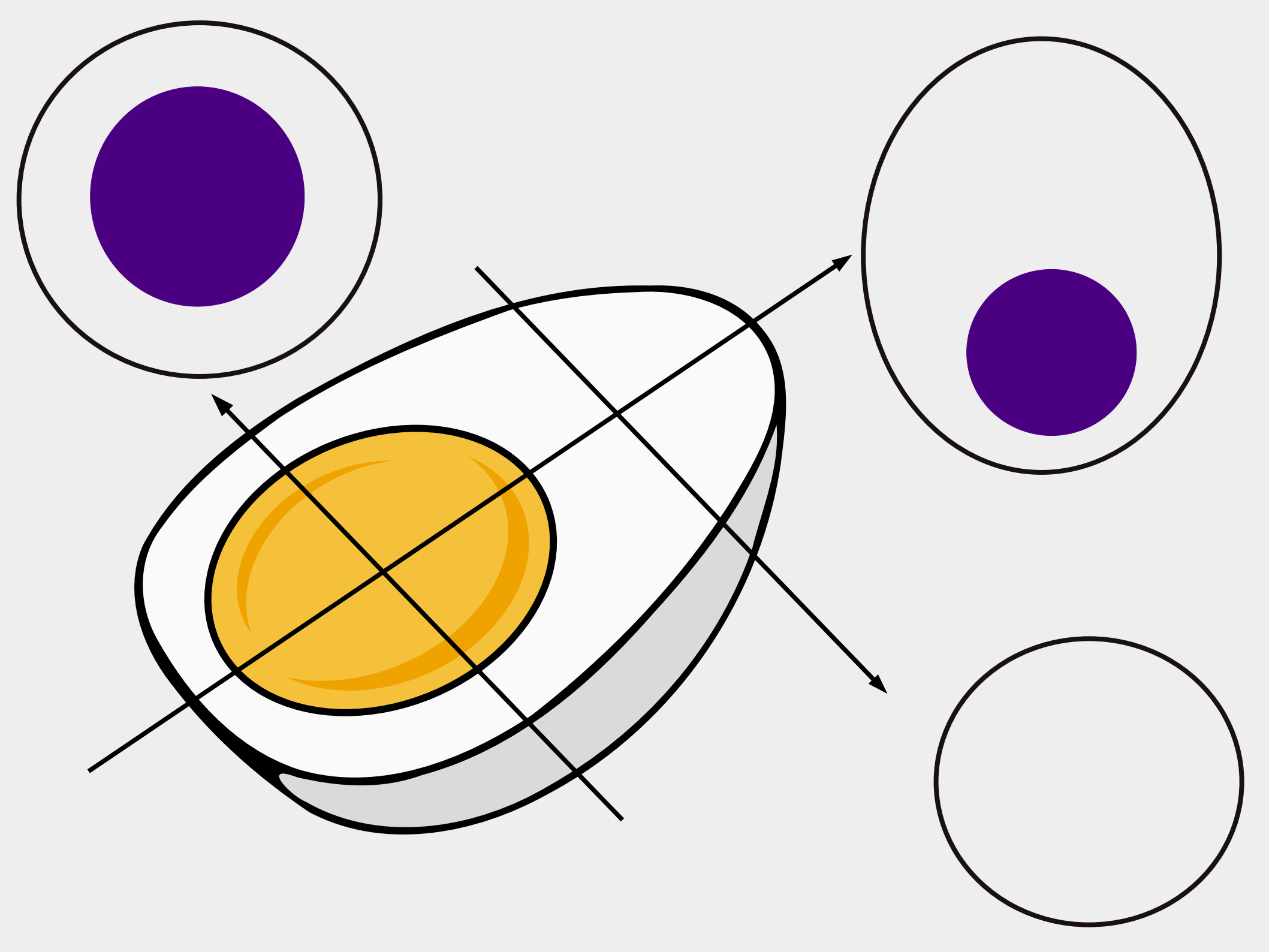

Umbilical cord
Smooth muscle: longitudinal
Smooth muscle: cross
High magnification

Nucleus on cross-section

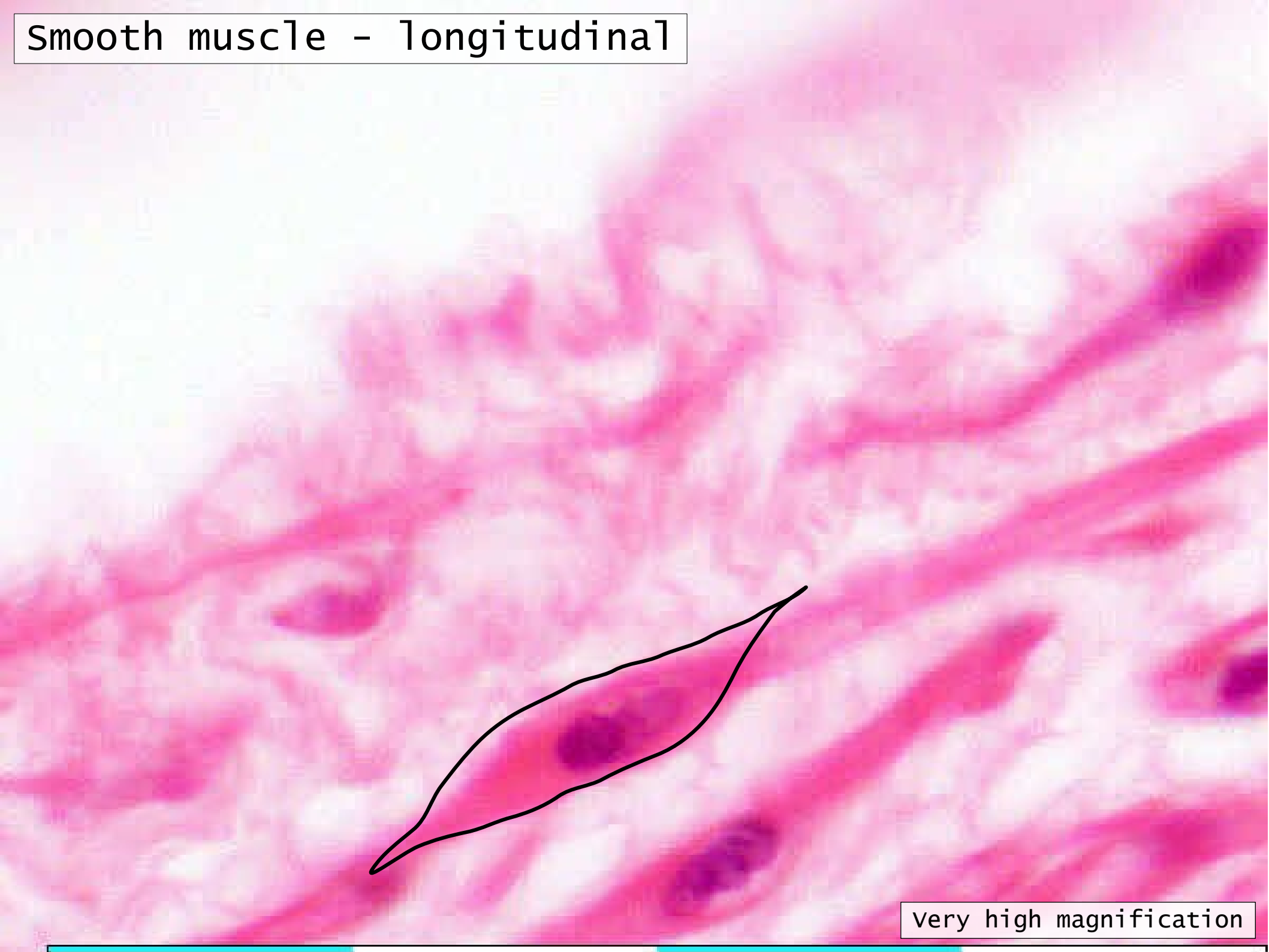


Longitudinal section in contracted state: Nucleus is accordion pleated and deeply indented.



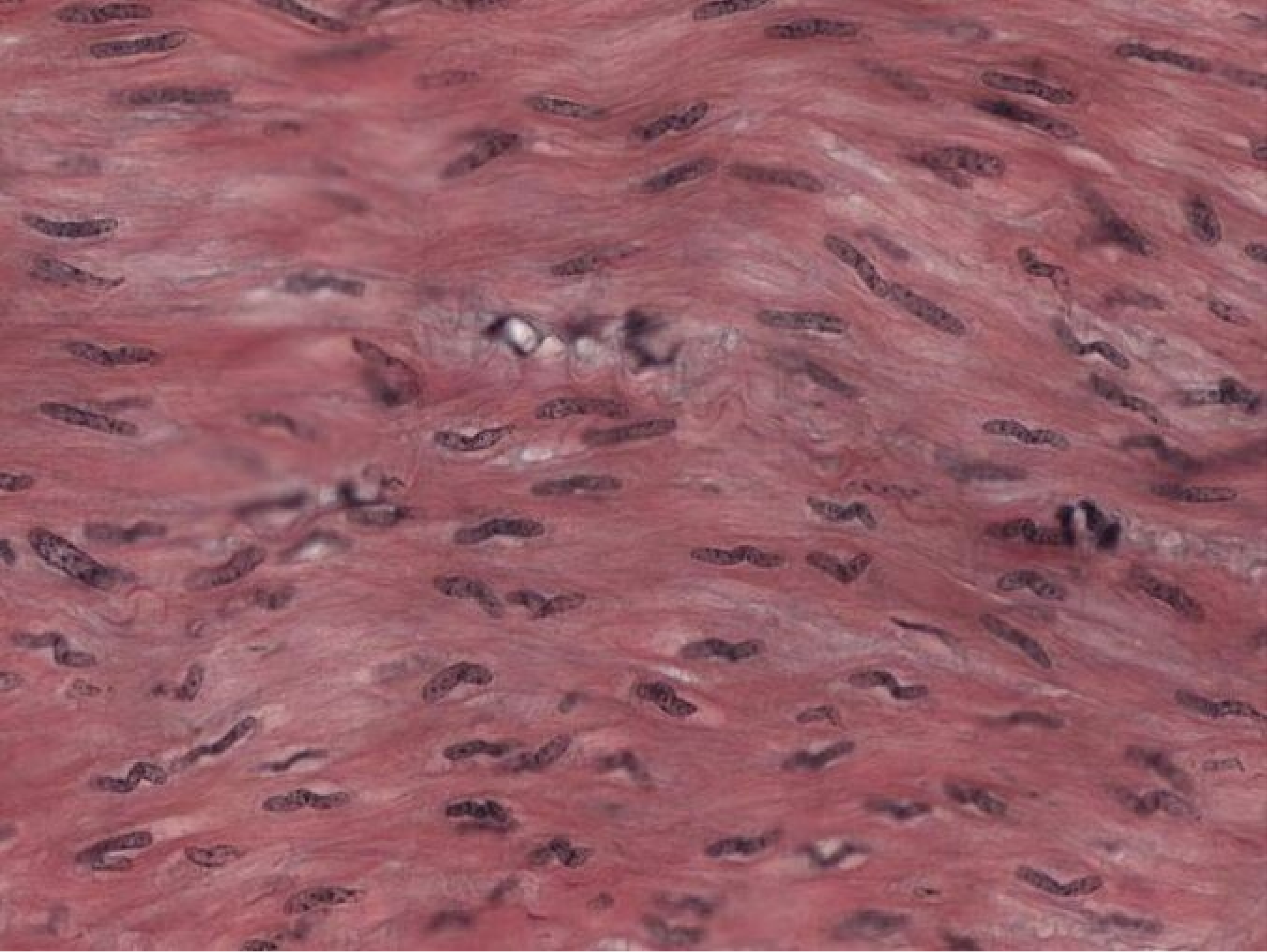


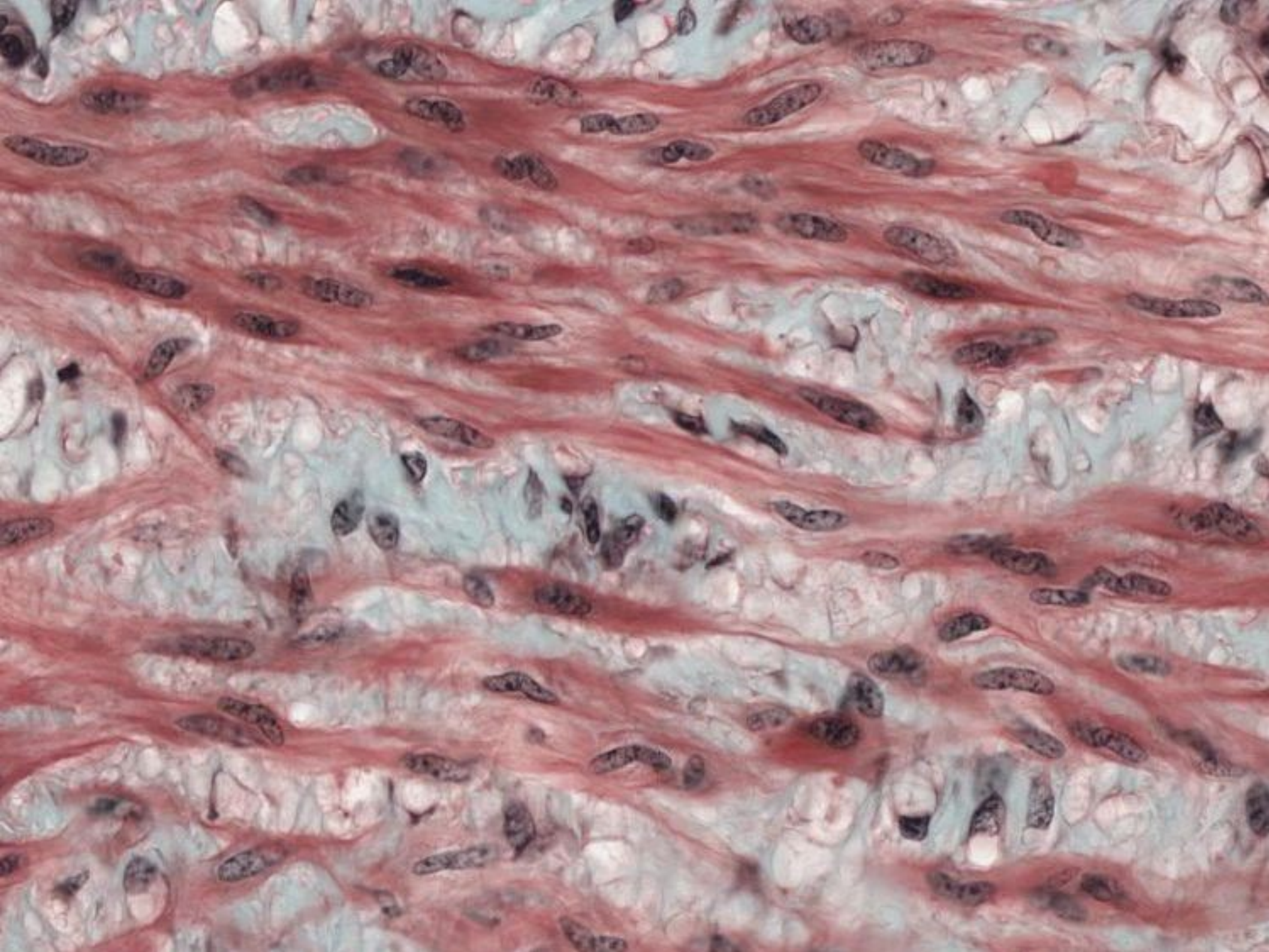
Smooth muscle - longitudinal

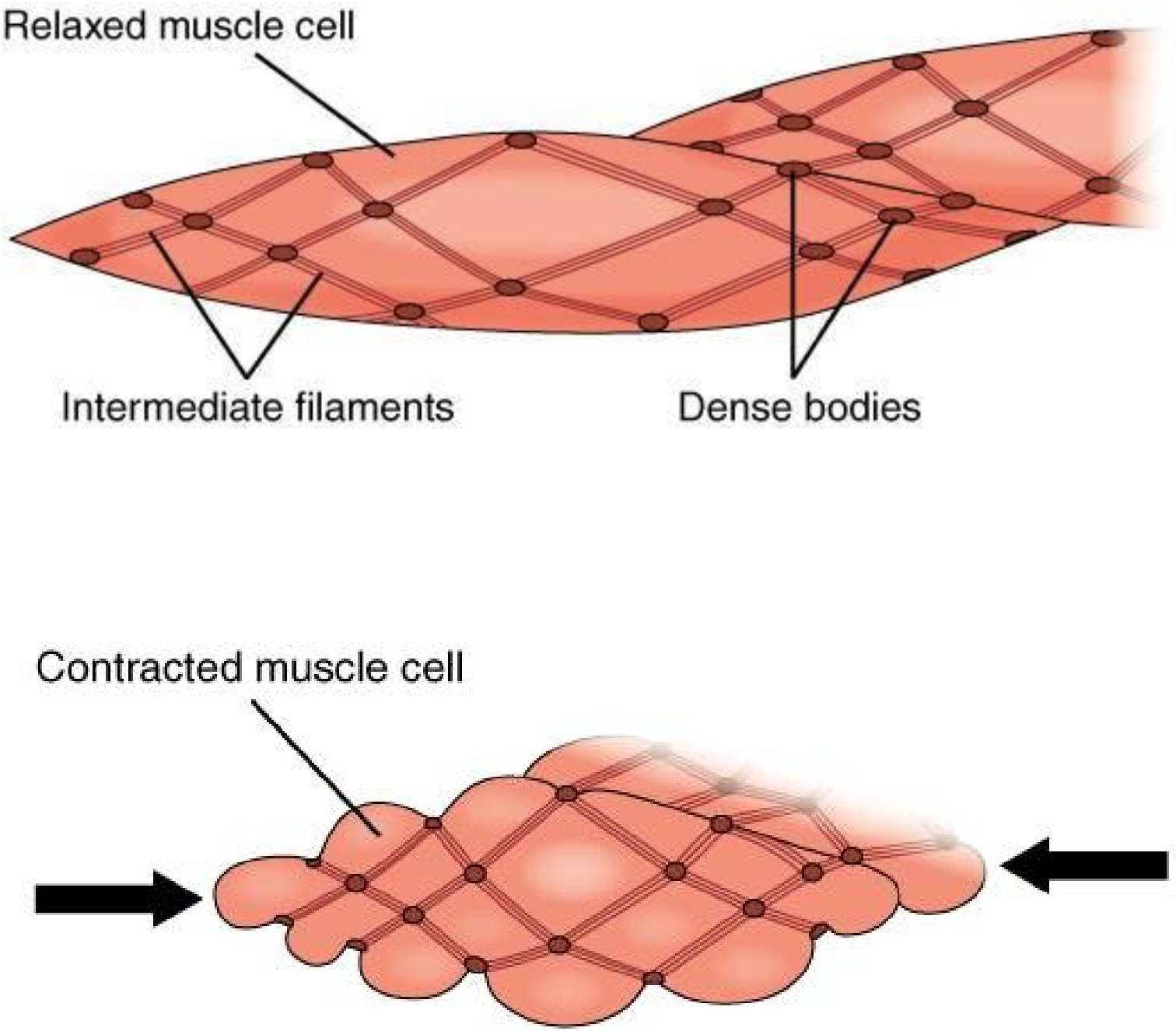


Very high magnification


Smooth muscle - cross
Very high magnification

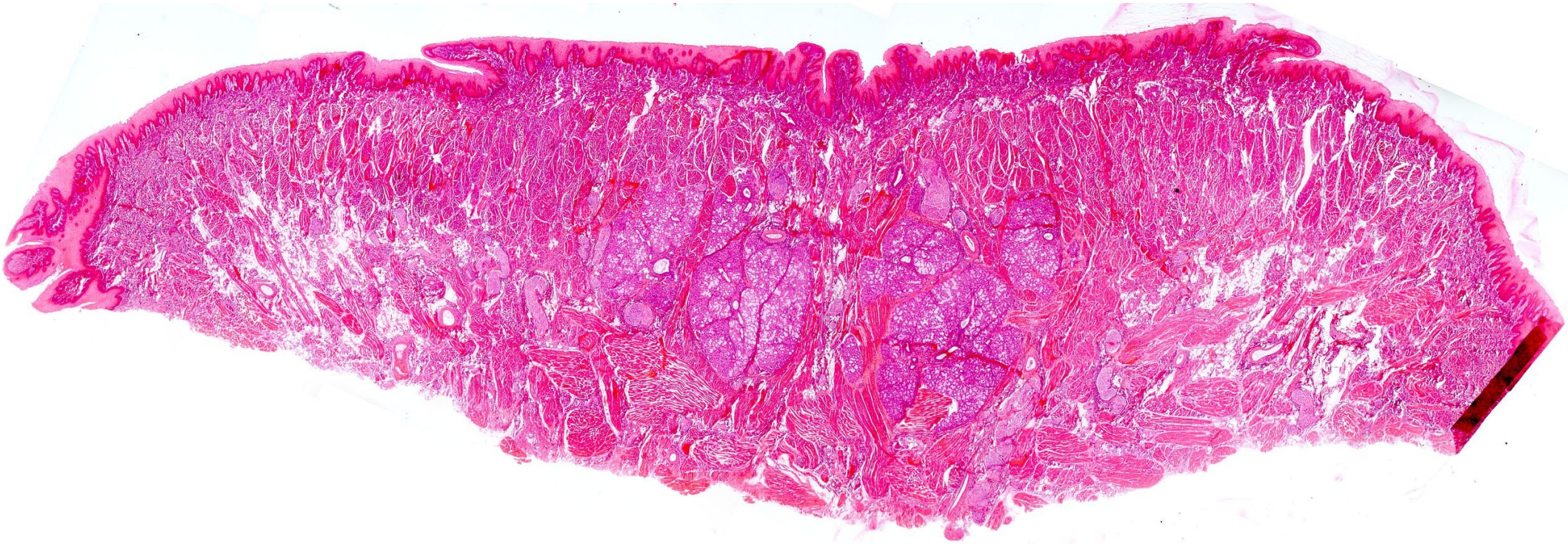





Relaxed muscle cell
Intermediate filaments
Dense bodies
Contracted muscle cell

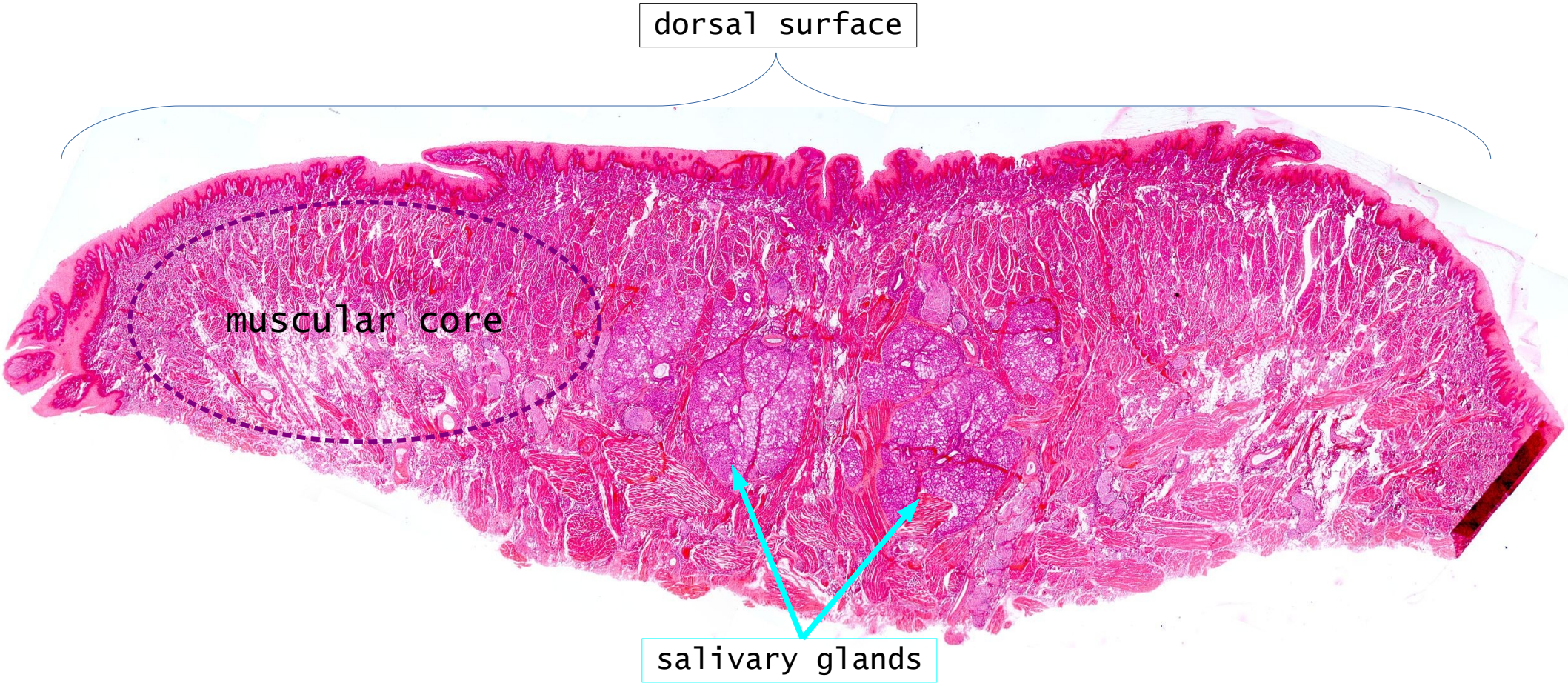
Tongue

Slides 7, 33 & 53



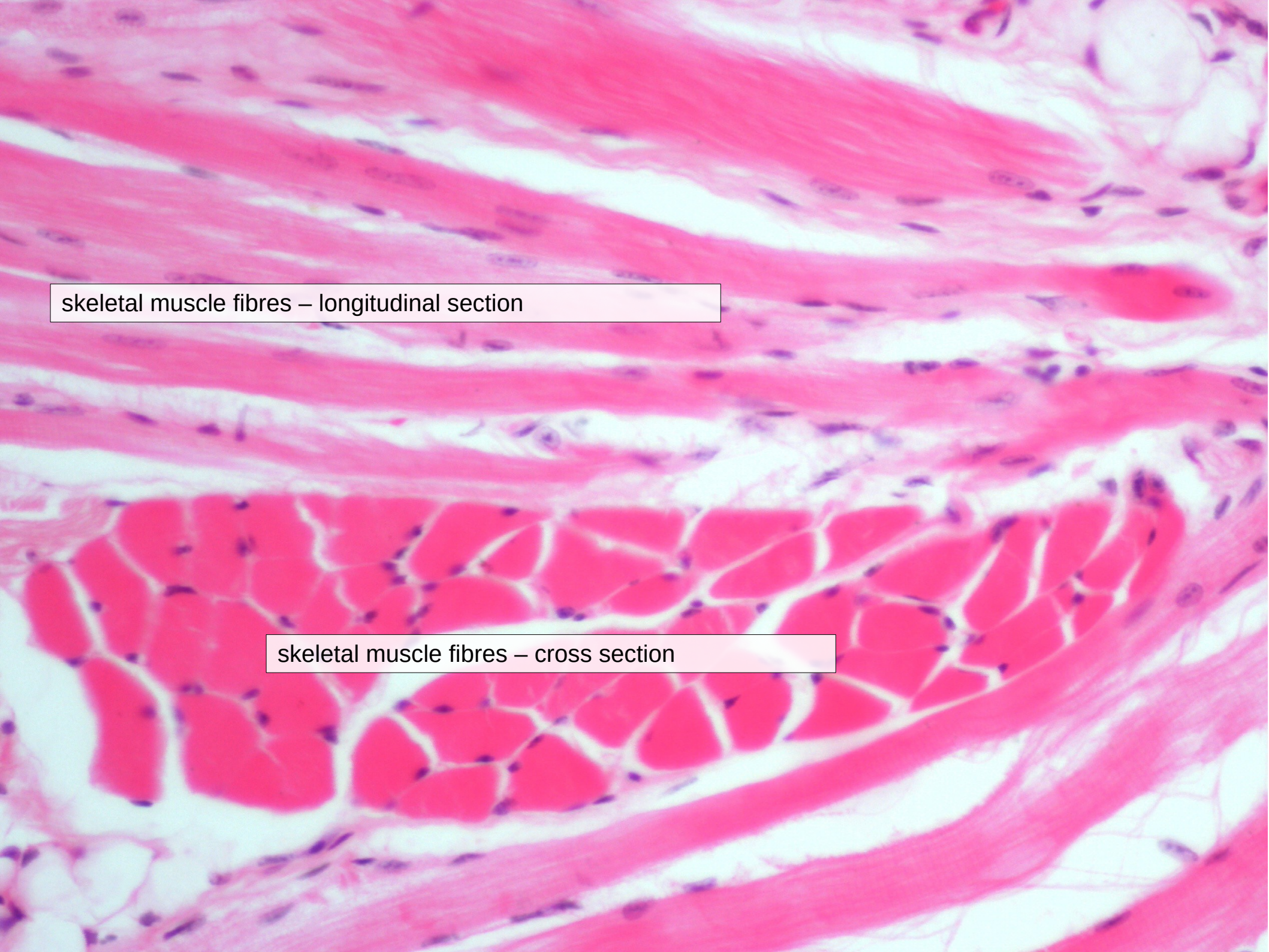
Tongue

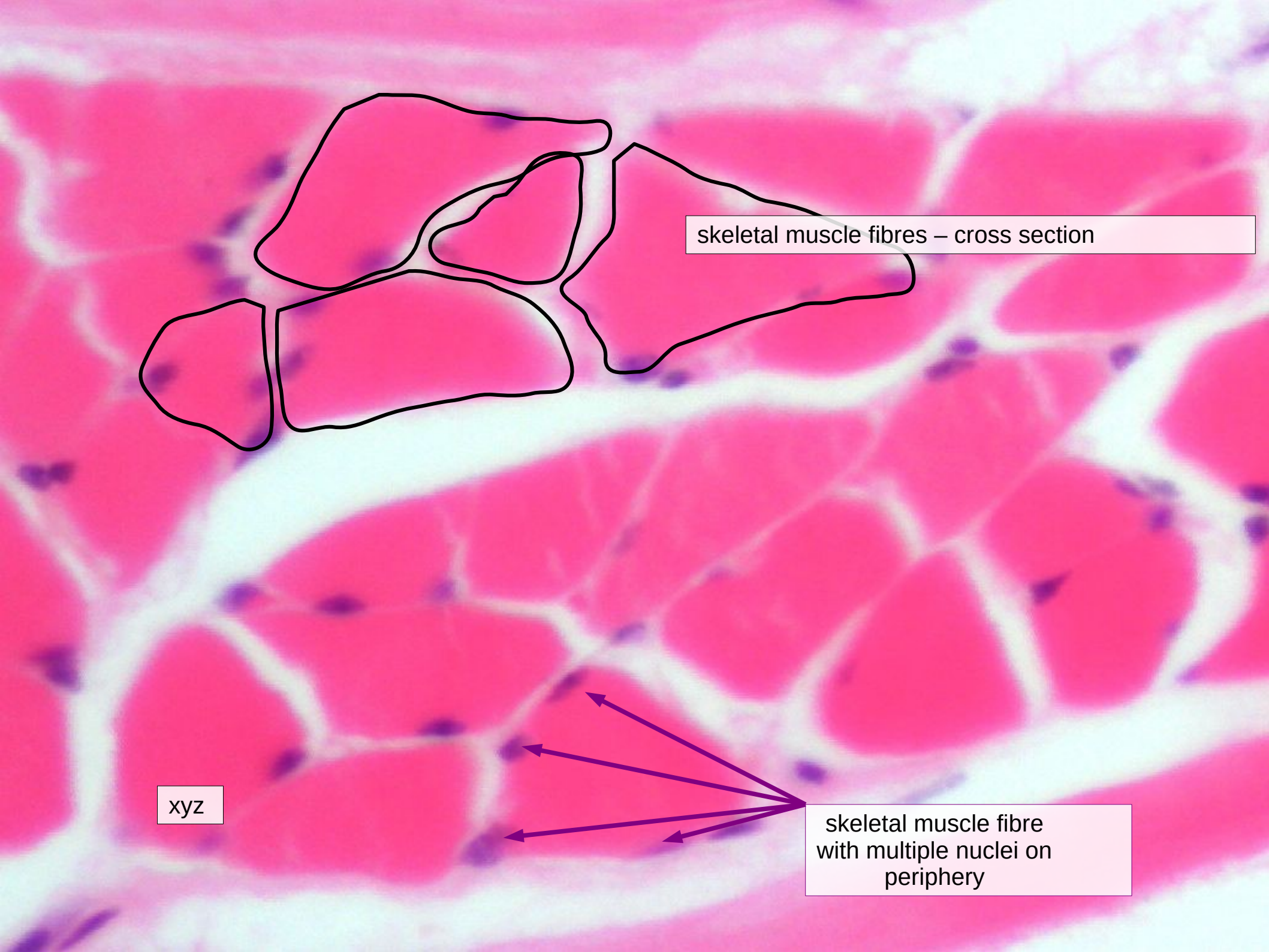
- Dorsal surface
  - With papillae
  - And taste buds
- Muscular core
- Minor salivary glands
- Ventral surface
- Posterior third


dorsal surface
muscular core
salivary glands

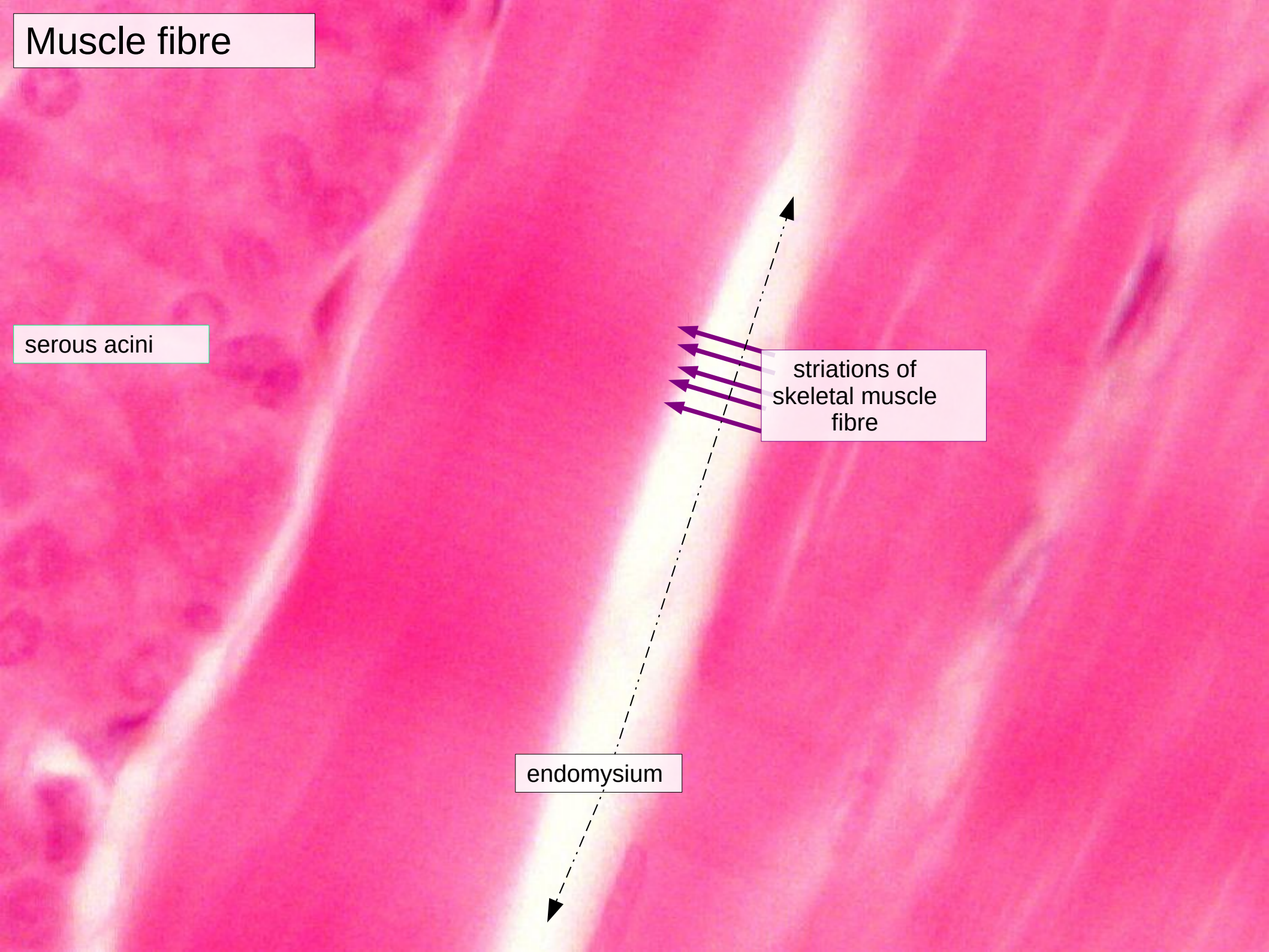
Muscular core

- Bulk of tongue
- Bundles skeletal muscle fibres
- All planes
- Interlaced with CT elements

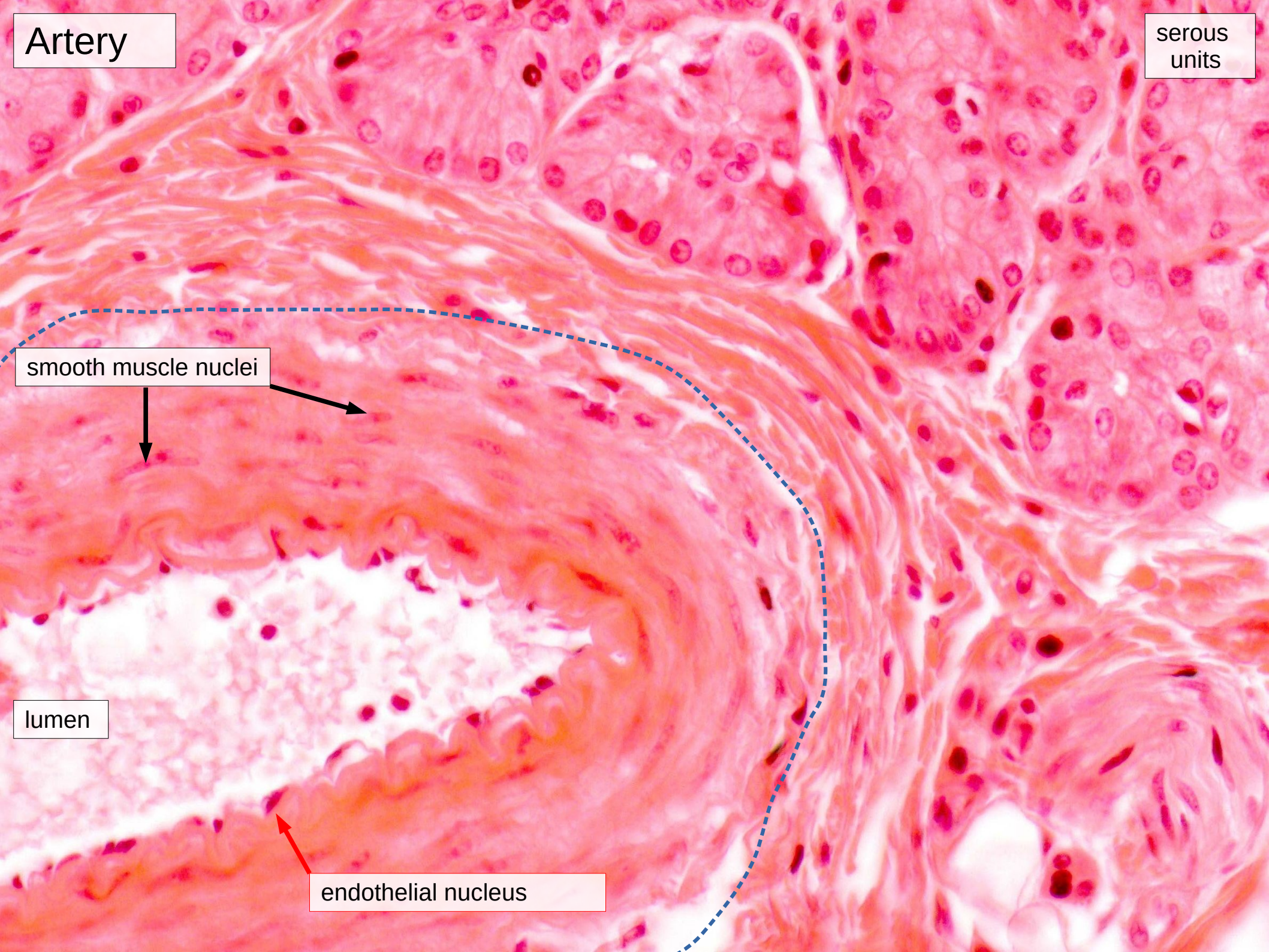

skeletal muscle fibres – longitudinal section
skeletal muscle fibres – cross section


skeletal muscle fibres – cross section
xyz
skeletal muscle fibre with multiple nuclei on periphery

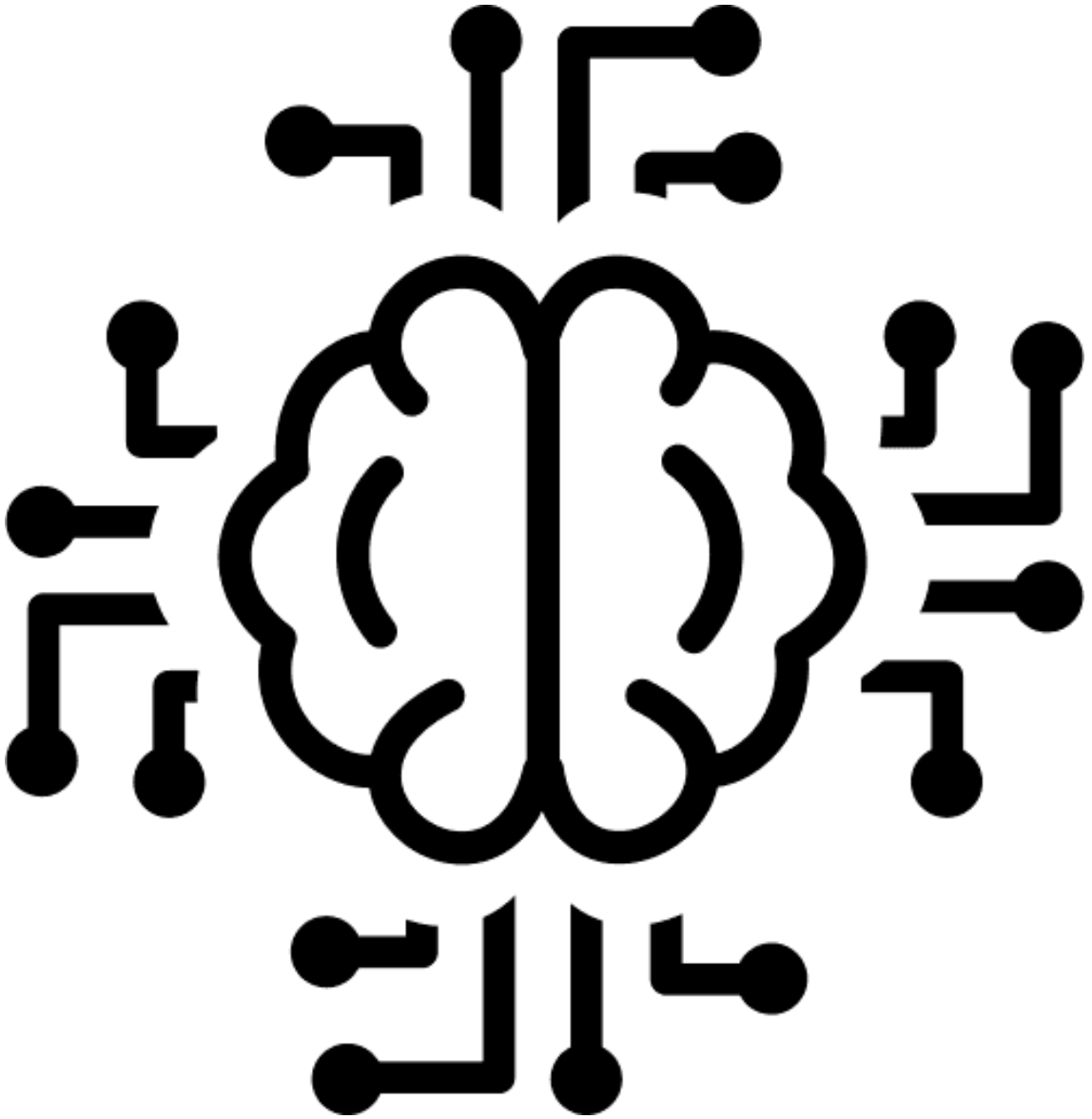

skeletal muscle fibre with multiple nuclei on periphery


Muscle fibre
serous acini
striations of skeletal muscle fibre
endomysium


Artery
muscle fibre
muscle fibre
endothelial nucleus
serous acini


Artery
serous units
smooth muscle nuclei
lumen
endothelial nucleus

Nervous Tissue



Muscle & Nerve Integration

Revision Task

Make an annotated line diagram of the pathway:

From – a sensory receptor
To – an effector

Nerve-muscle circuit

Sensory receptor
=
Wagner-Meissner body
Pacinian Corpuscle
Naked nerve ending

Nerve-muscle circuit

Effector

=

skeletal muscle

smooth muscle

Nerve-muscle circuit

Annotated diagram

Cells and structures in longitudinal section

Include:
Support cells
Connective tissue elements
Functions of everything

Nerve-muscle circuit

- From sensor: Meissner / Pacini / Naked
- To effector: skeletal muscle
- Longitudinal / Cross section
- Support cells & Connective Tissue & Functions
- Word bank: epidermis, dermis, hypodermis, motor neuron, motor endplate, Schwann cell, oligodendrocyte, endo-, epi-, peri-neurium/mysium, bipolar neuron, unipolar neuron, multipolar neuron, synaps, axon, dendrite, fibres, fascicles, interneuron, Ranvier

What is Nervous Tissue

Nervous tissue is excitable and capable of sending and receiving signals in the form of nerve impulses that provide and communicate information between regions of the body.

Classification Nervous Tissue

- Two main classes of cells
- Neurons
  - Functional units
  - Propagate impulses
- Neuroglia
  - Support and nutrition

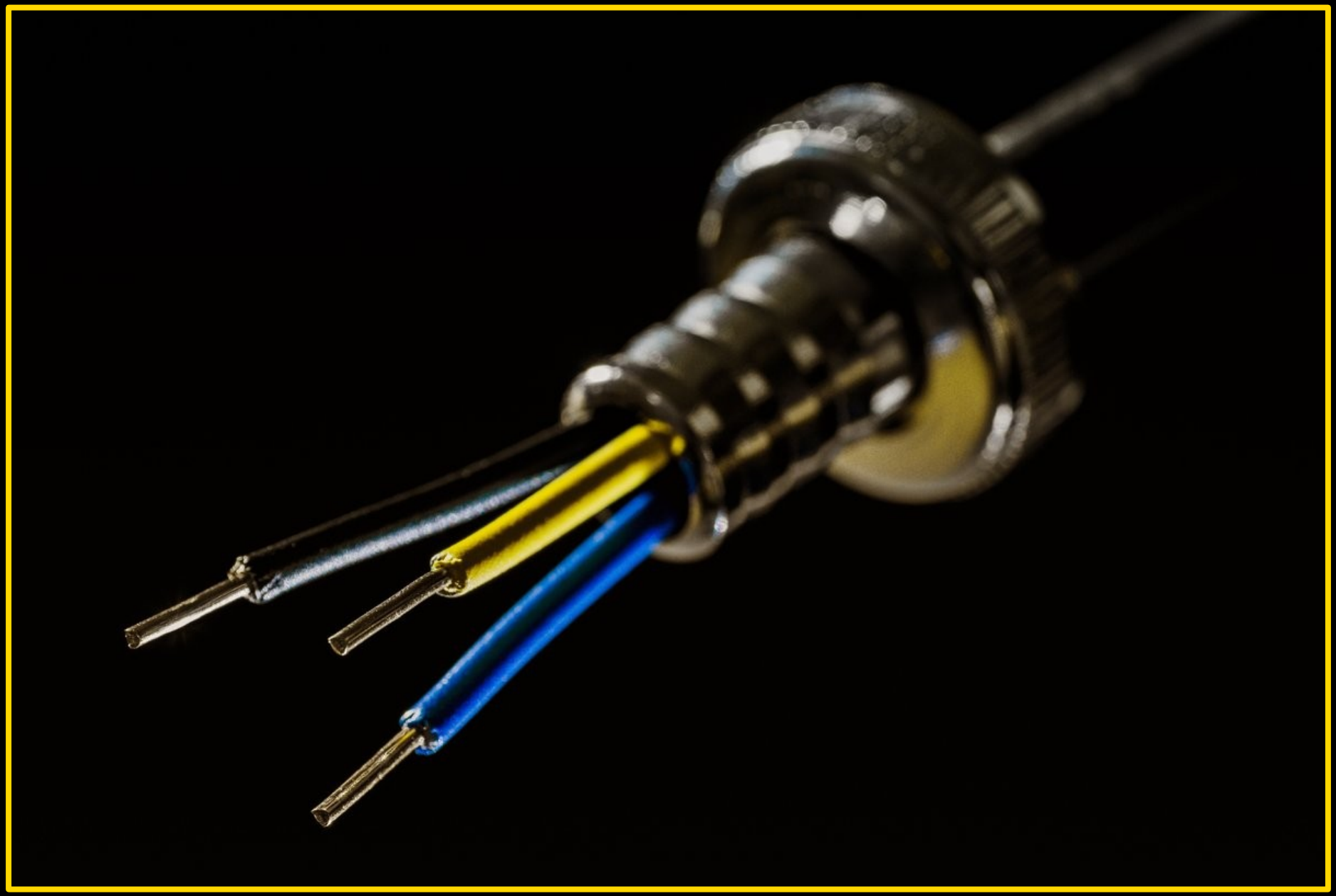
Neurons

- Specialised cells of the nervous system
- Conduct impulse to higher centra
- Conduct impulse to periphery
- Cell body
- Dendrite
- Axon

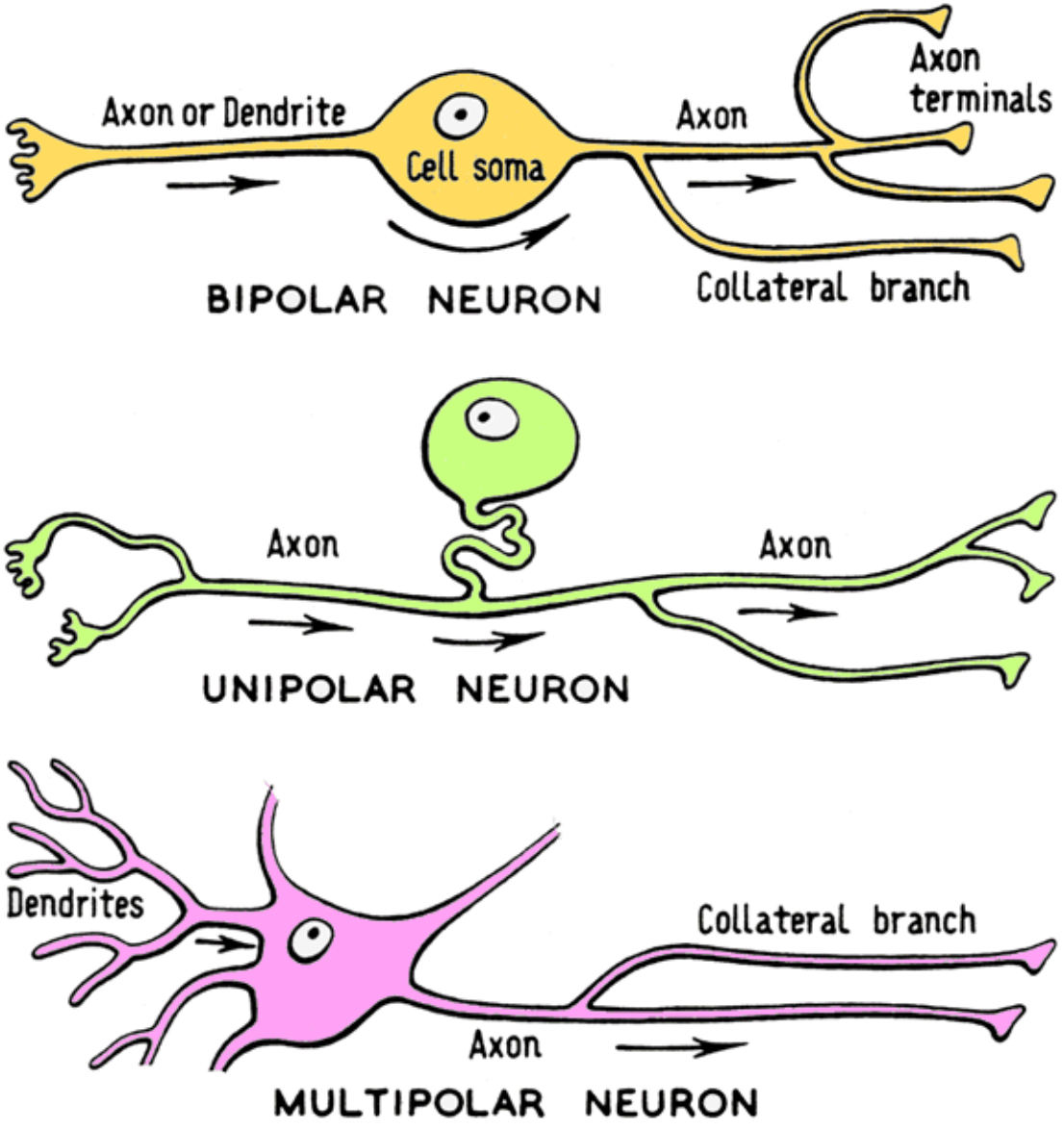
Neurons

- Unipolar
  - one process a single axon
  - Not in vertebrates
- Bipolar
  - one axon and one dendrite
- Multipolar
  - one axon and numerous dendrites
- Pseudo-unipolar
  - an axon and a dendrite is fused for a small distance before splitting

Neuron analogy



Three types of nerve cells



Neuron

- Cell body
  - Contains nucleus, organelles
  - Nucleus large round & large nucleolus
  - Nissl substance = Rough ER
    - Basophilic clumps except in axon
  - Neurofilaments profuse in cell
  - Neurofibrils visible with LM
    - Fixation artefacts
- Dendrite
  - Receive information = towards cell body
  - Arborized = multiple branches
- Axon
  - Vary in diameter & length (100 cm)
  - Originate at axon hillock
  - Devoid of Nissl substance (pale staining area)

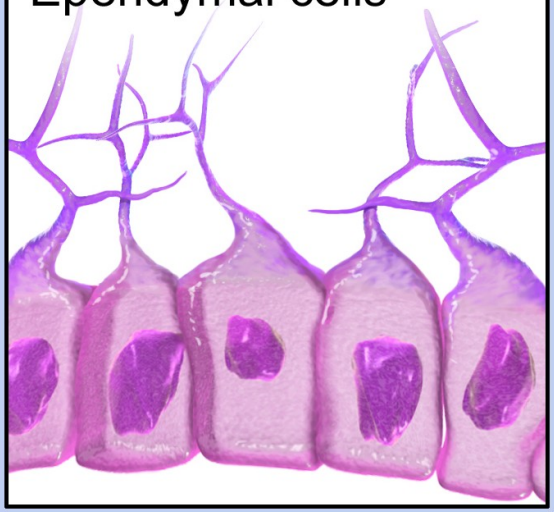
Glial cells

- Part of the nervous system
- Support
- Nurture
- Protect
- More numerous than neurons (10:1)

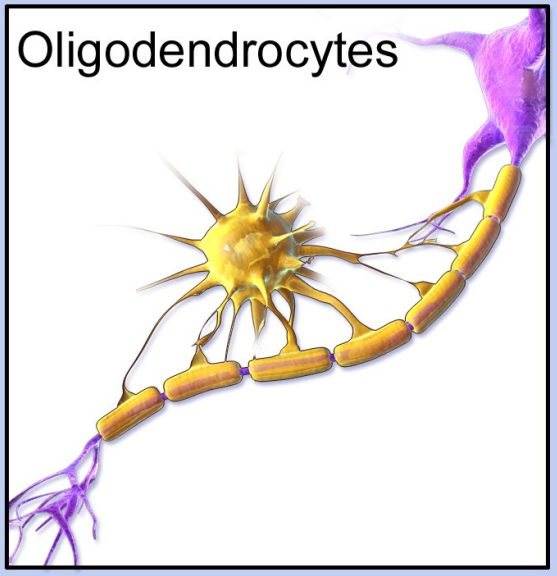
Types of Neuroglia

Central Nervous System

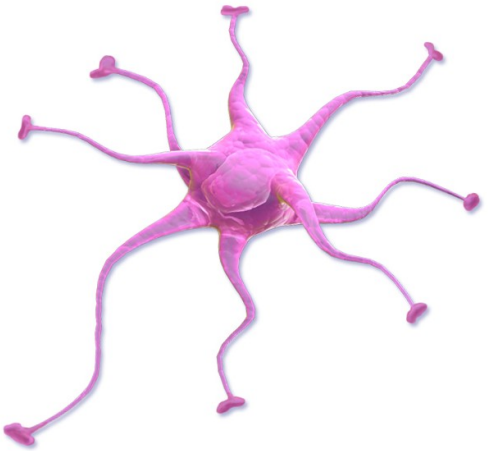
Ependymal cells



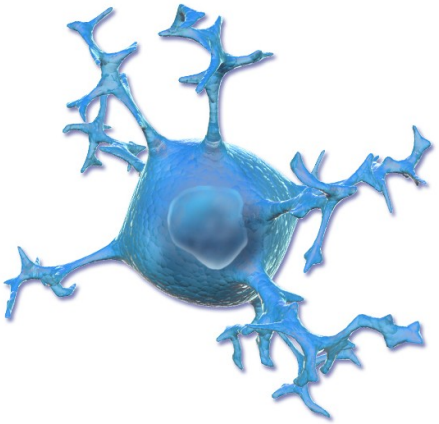
Oligodendrocytes



Astrocytes

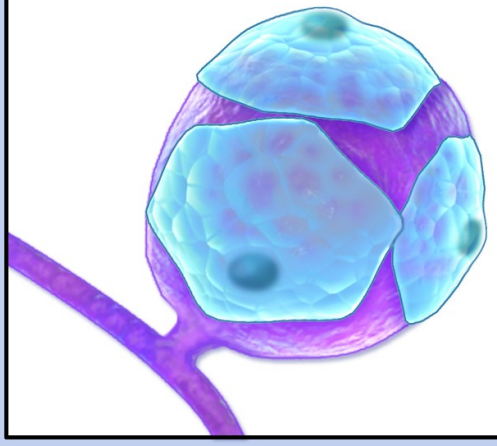


Microglia

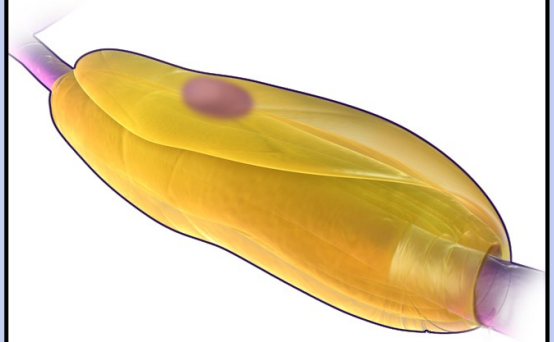


Peripheral Nervous System

Satellite cells



Schwann cells



Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014". WikiJournal of Medicine 1 (2). DOI:10.15347/wjm/2014.010. ISSN 2002-4436s

Neuroglia - CNS

- Astrocytes
  - Protoplasmic astrocytes
  - Fibrous astrocytes
- Oligodendroglia
- Microglia
- Ependyma

Neuroglia - PNS

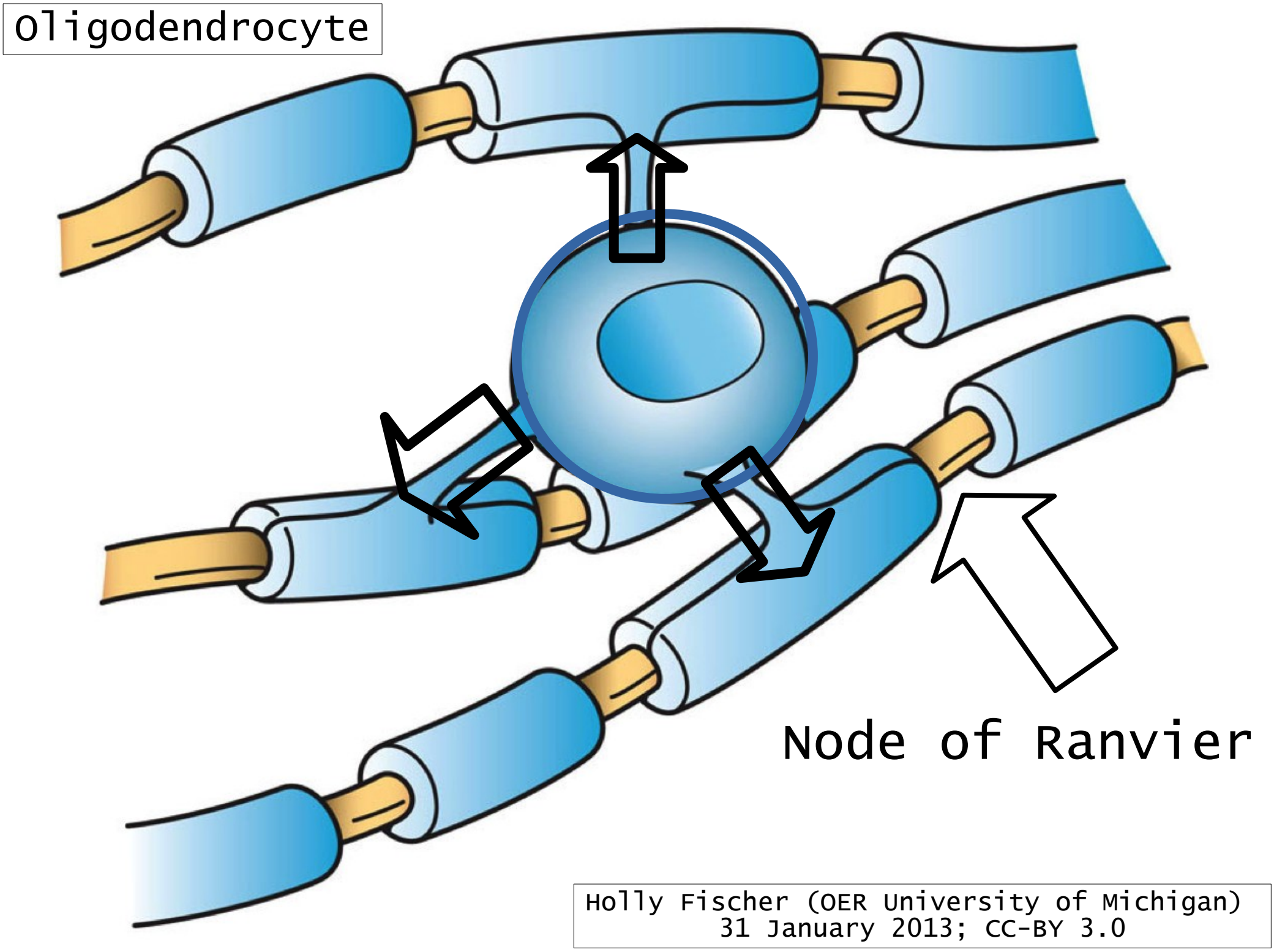
- Satellite cells
- Schwann cells

Astrocytes

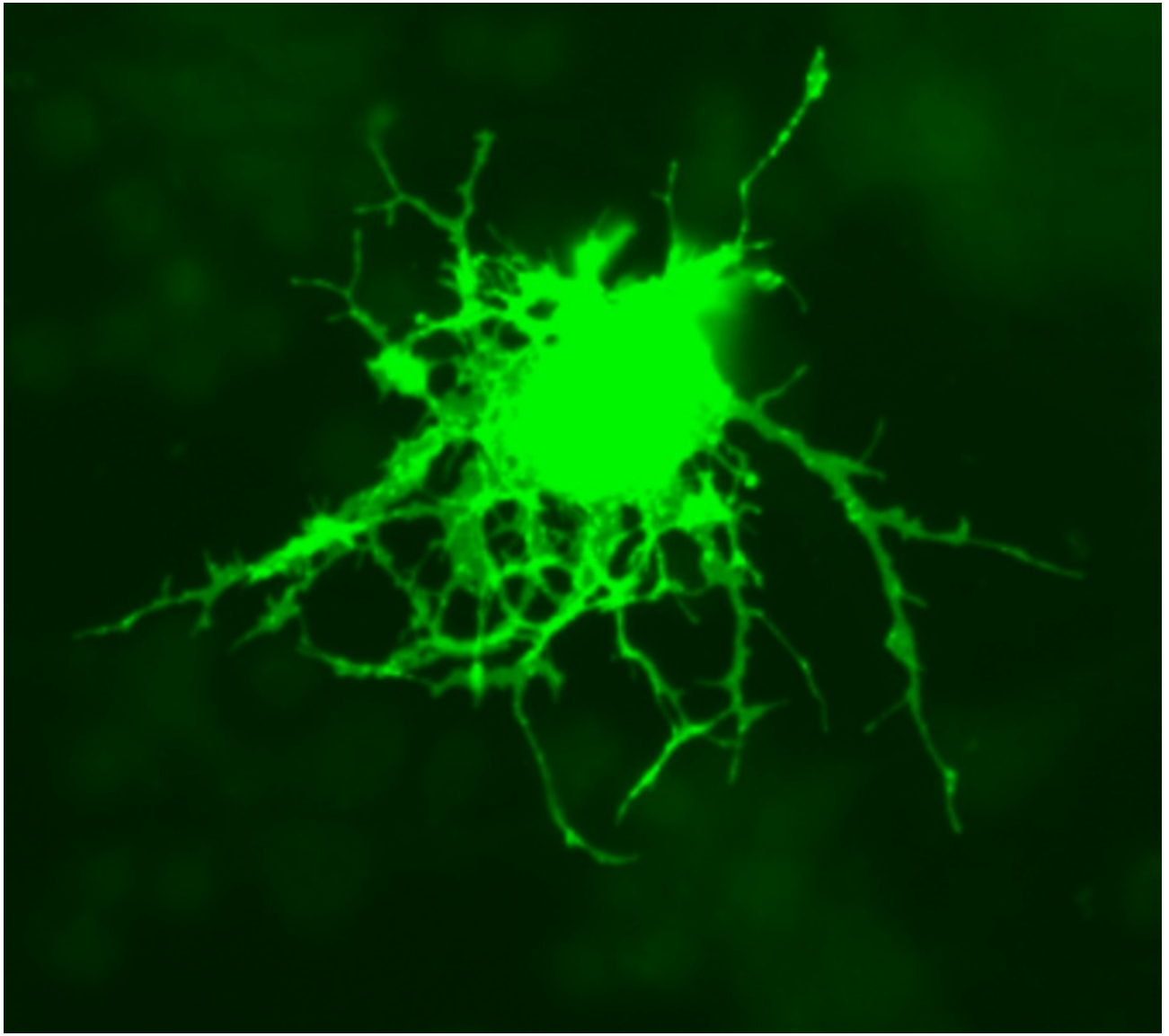
- Largest glial cells in CNS
- Star-shaped
  - Many processes
- Protoplasmic astrocytes
  - Gray matter of CNS
  - Many short processes
- Fibrous astrocytes
  - White matter of CNS
  - Few straight processes
- Role in blood-brain barrier

Oligodendrocytes

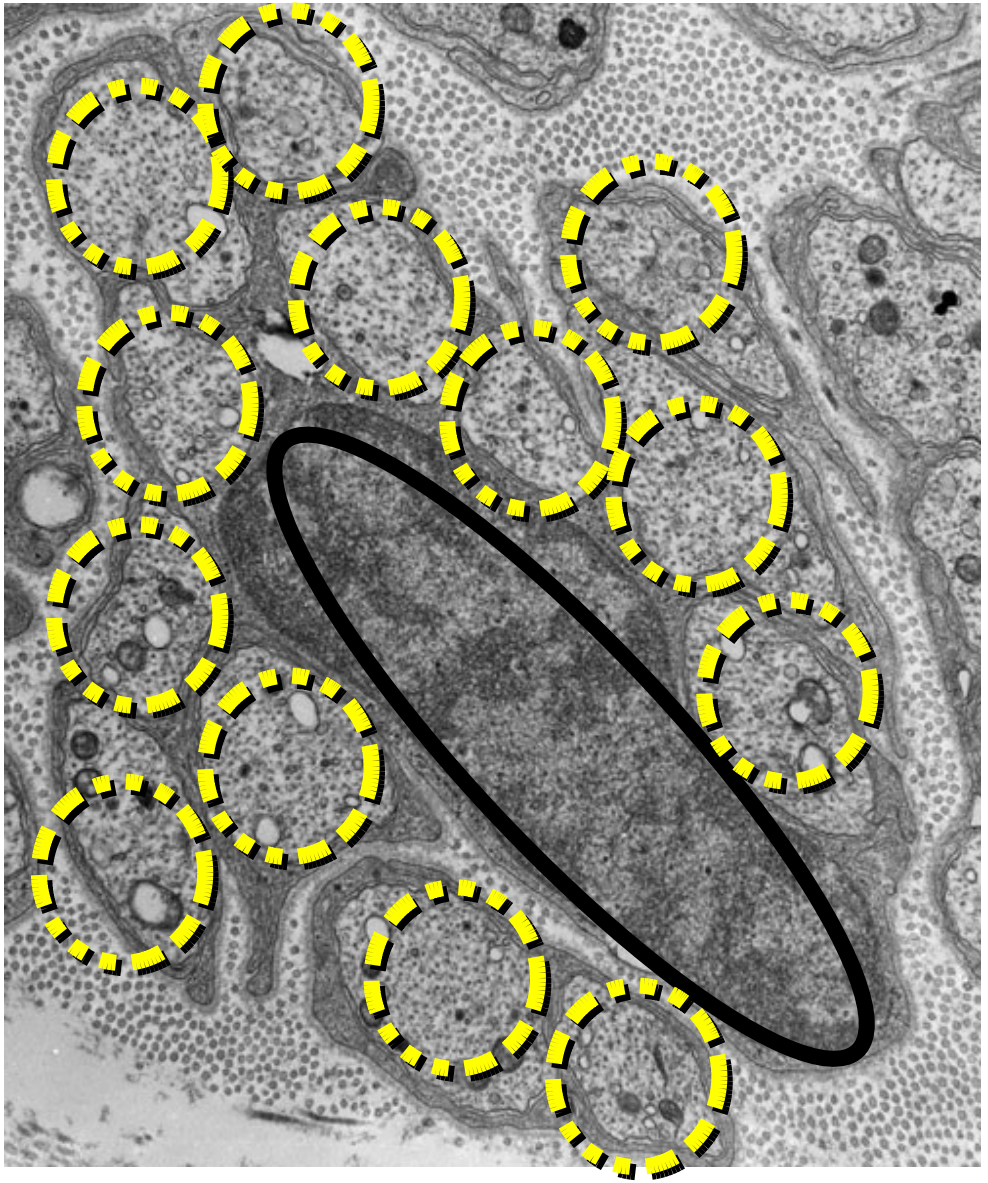
- Small glial cells in CNS
- Few short processes
  - Surrounds several axons in vicinity
- Small round condensed nucleus
- Produce myelin in CNS
  - Tight spiral around axon
- Myelinate several axons



Oligodendrocyte



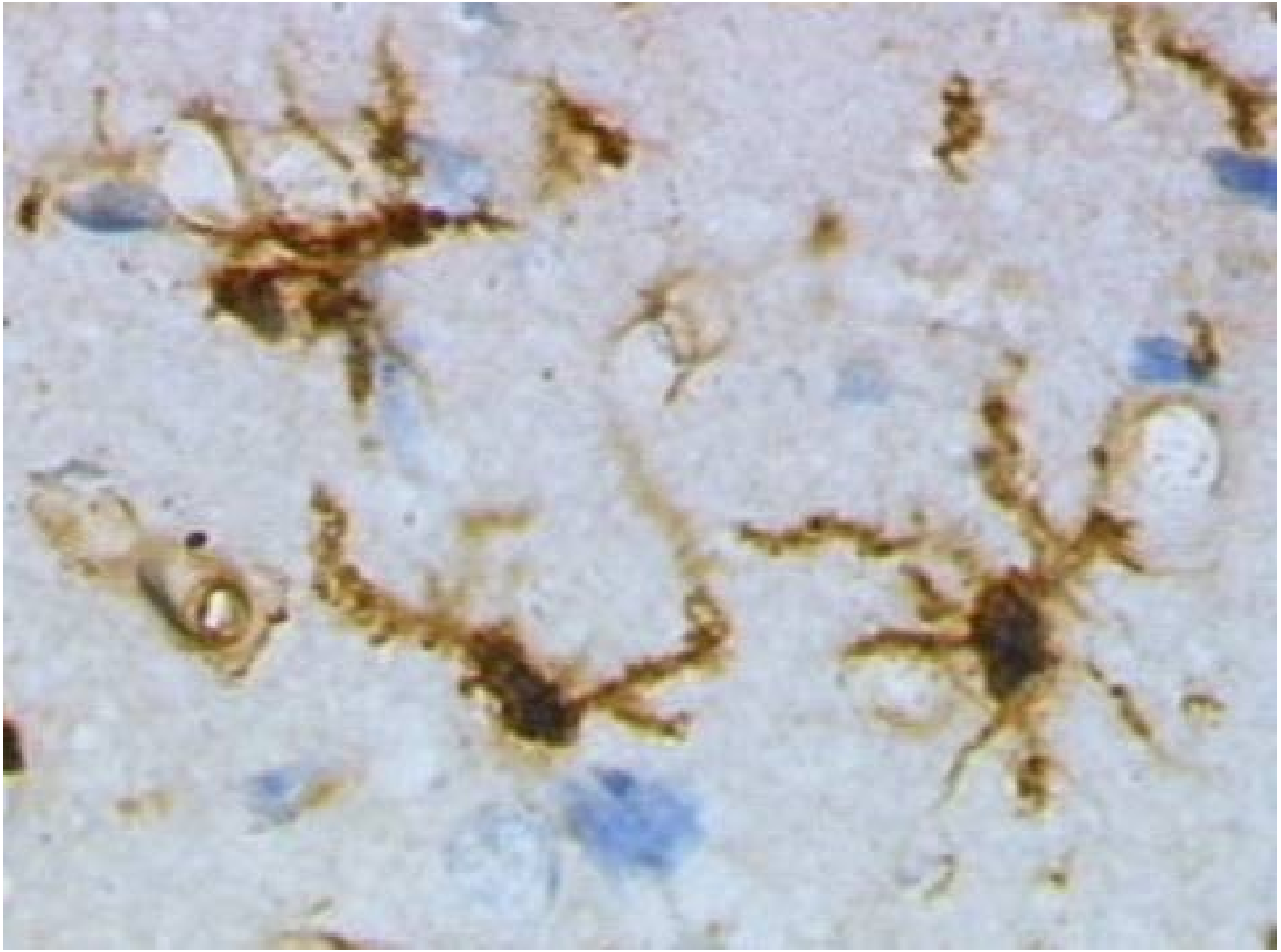
oligodendrocyte



Microglia

- Small cells in CNS
- Short processes
- Many small branches
- Condensed elongated nucleus
- From monocytes of bone marrow
- Phagocytic

Microglia



Satellite cells

- Surrounds cell bodies in ganglia

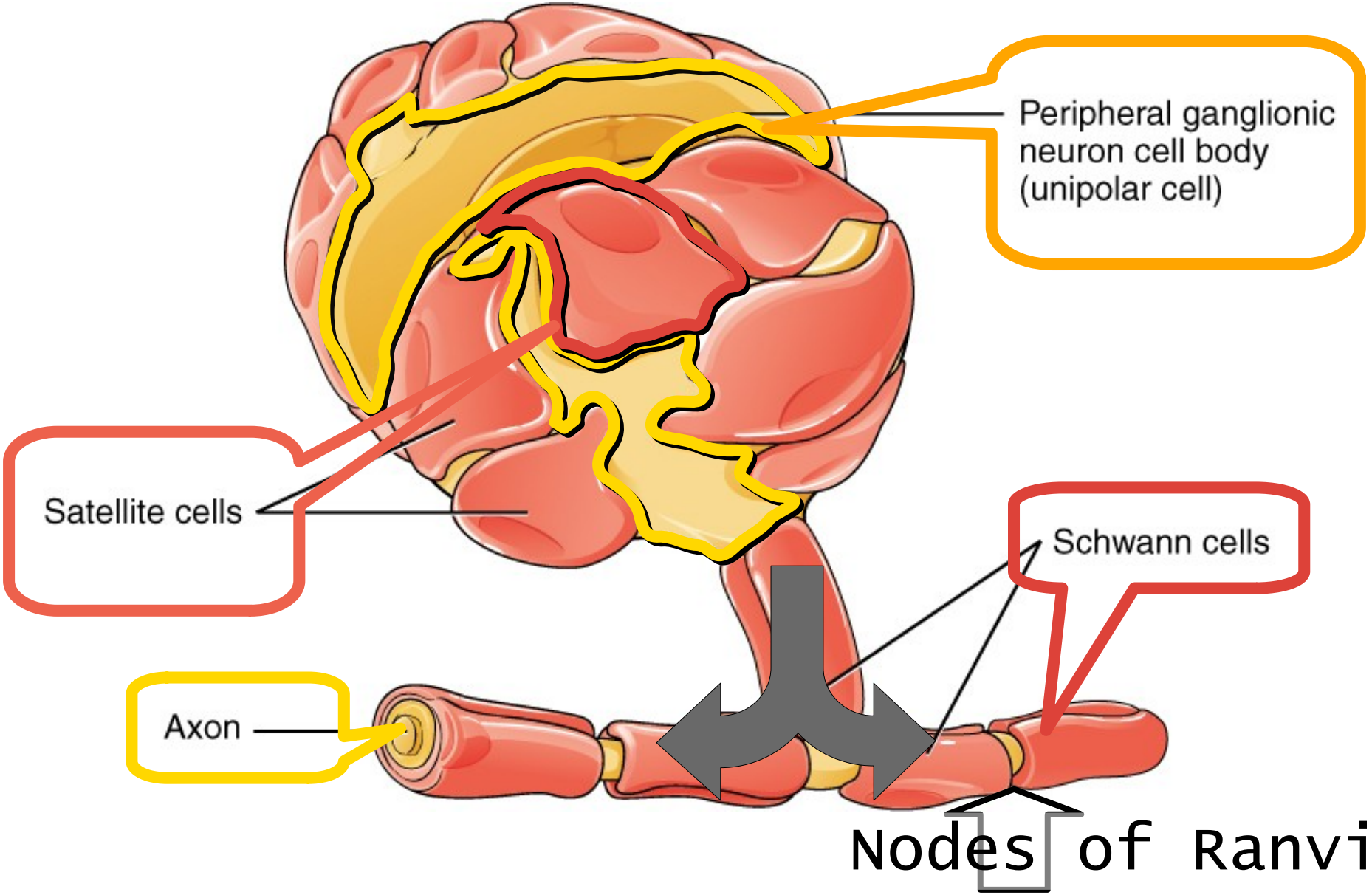
Satellite cell analogy

Schwann cells

- Nucleus surrounded by thin cytoplasm
- Layers of Schwann cell membrane surrounds axon
- One axon myelinate a segment of an axon
  - Saltatory conduction
  - Interrupted at node of Ranvier
  - Multiple Schwann cells per axon
- Unmyelinated axons
  - Supported in grooves of Schwann cell
  - No myelin
  - Impulse travel in continuous manner (slow)

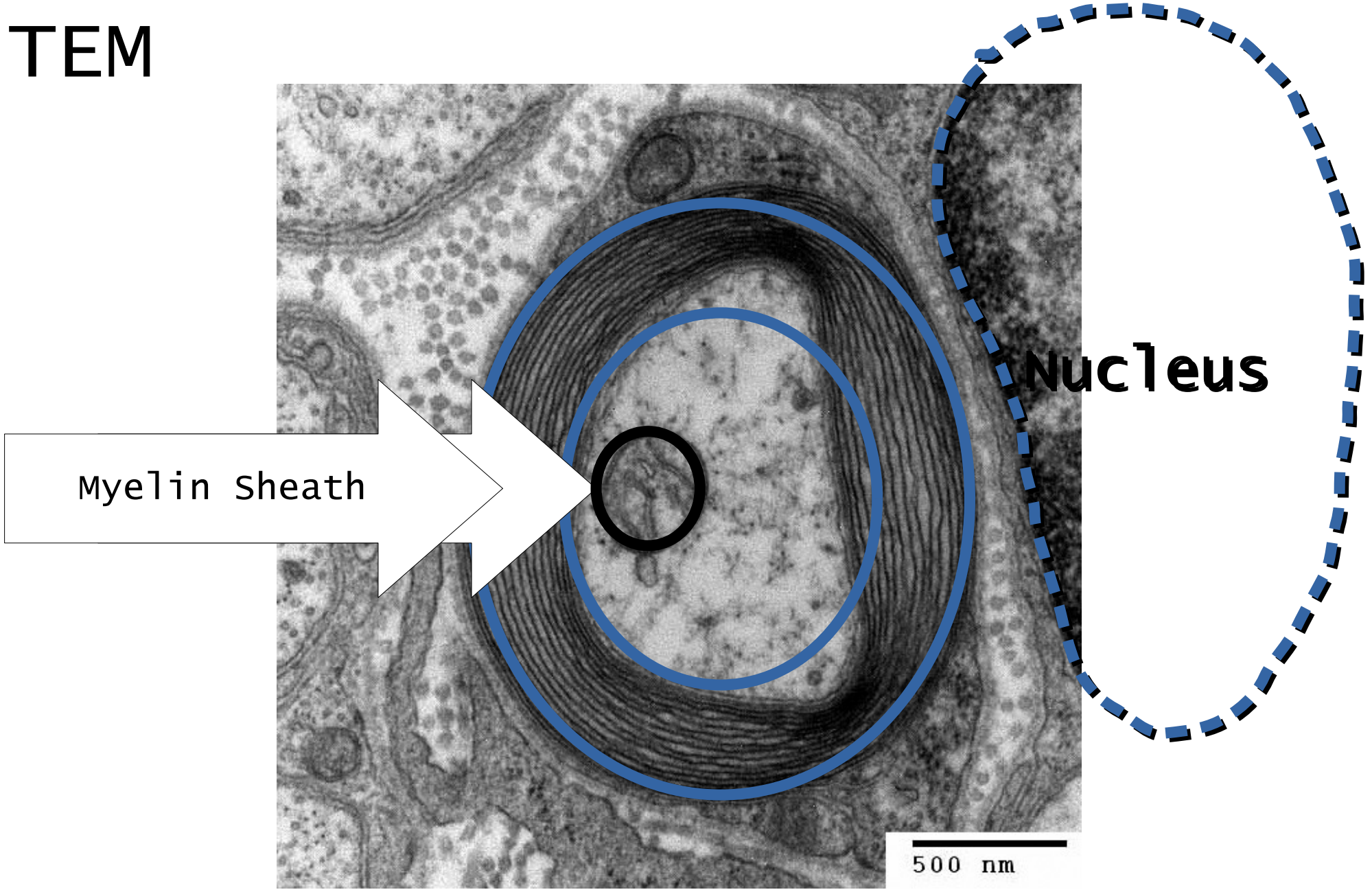
Schwann cell analogy

Satellite and Schwann cells



Schwann cell

TEM



CT of nerves

- Endoneurium
  - Thin layer CT of individual nerve fibres
- Perineurium
  - Around nerve fascicles
- Epineurium
  - Layer dense CT
  - Surrounds bundles of nerve fibres

Ganglia

- Relay stations in the PNS
- Three components
  - Neuron cell bodies
  - Support cells
    - Schwann cells
    - Satellite cells
  - Loose connective tissue

Nerve endings

- CNS
  - Synapse
- PNS
  - Motor endings
    - Motor end plate
  - Sensory endings
    - Pacini corpuscle
    - Meissner's corpuscle

Synapse

- Physiological connection
- Between neurons
- Where signal is transferred
- From neuron
- TO
- Other cell
- Axon – Dendrite
- Axon – Neuron cell body
- Axon – Axon
- Dendrite - Dendrite

Motor end plate

- Nerve ending on skeletal muscle fibre
- Motor nerve = motor end plate
- Axon looses myelin sheath
- Schwann cell still covers axon
- Branching end of axon
- Forms
- Indentation on skeletal muscle fibre

Pacini corpuscle

- Pressure receptor
- Deeper areas of dermis & hypodermis
- Large ellipsoid
- Encapsulated
- Resemble onion
- Multilayered capsule
- Fibroblasts, collagen, tissue fluid
- Core of unmyelinated nerve terminal

Meissner's corpuscle

- Fine touch receptor
- Located in papillary layer of skin
- Ellipsoid shape
- Encapsulated with CT
  - Around nerve terminal & Schwann cell

Slides Nervous tissue

- Multipolar neuron slide 26
- Multipolar neuron slide 82
- Pseudo-unipolar neuron slide 26
- Myelinated peripheral nerve slide 32
- Myelin sheath slide 59
- Synapse slide 82
- Motor end plate slide 44
- Pacinian corpuscle slide 93
- Meissner's corpuscle slide 24
- Astrocytes slide 61
- Ependyma slide 98

Spinal cord

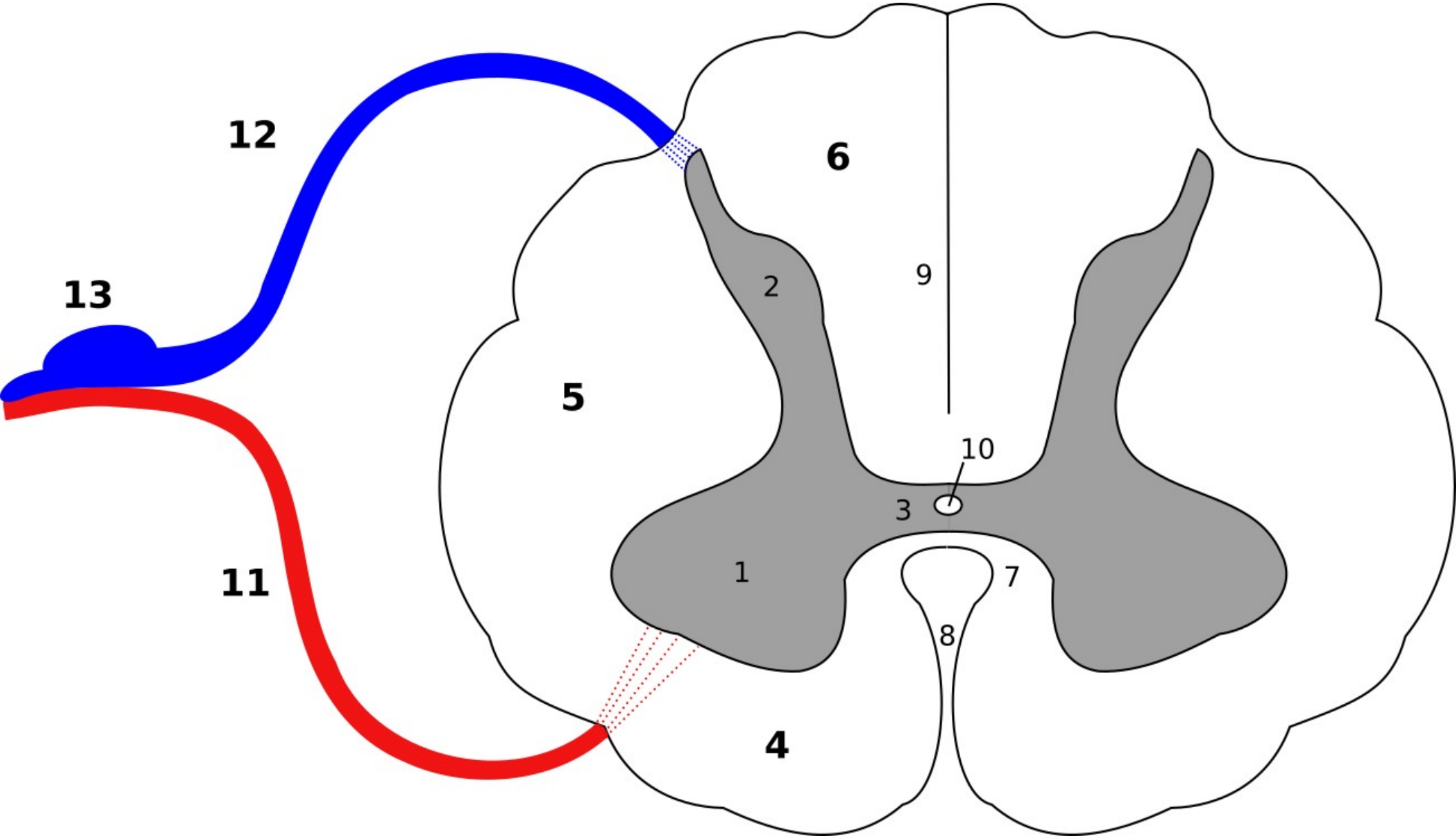
Slide 26 & 82

For
Multipolar neurons
Pseudo-unipolar neurons

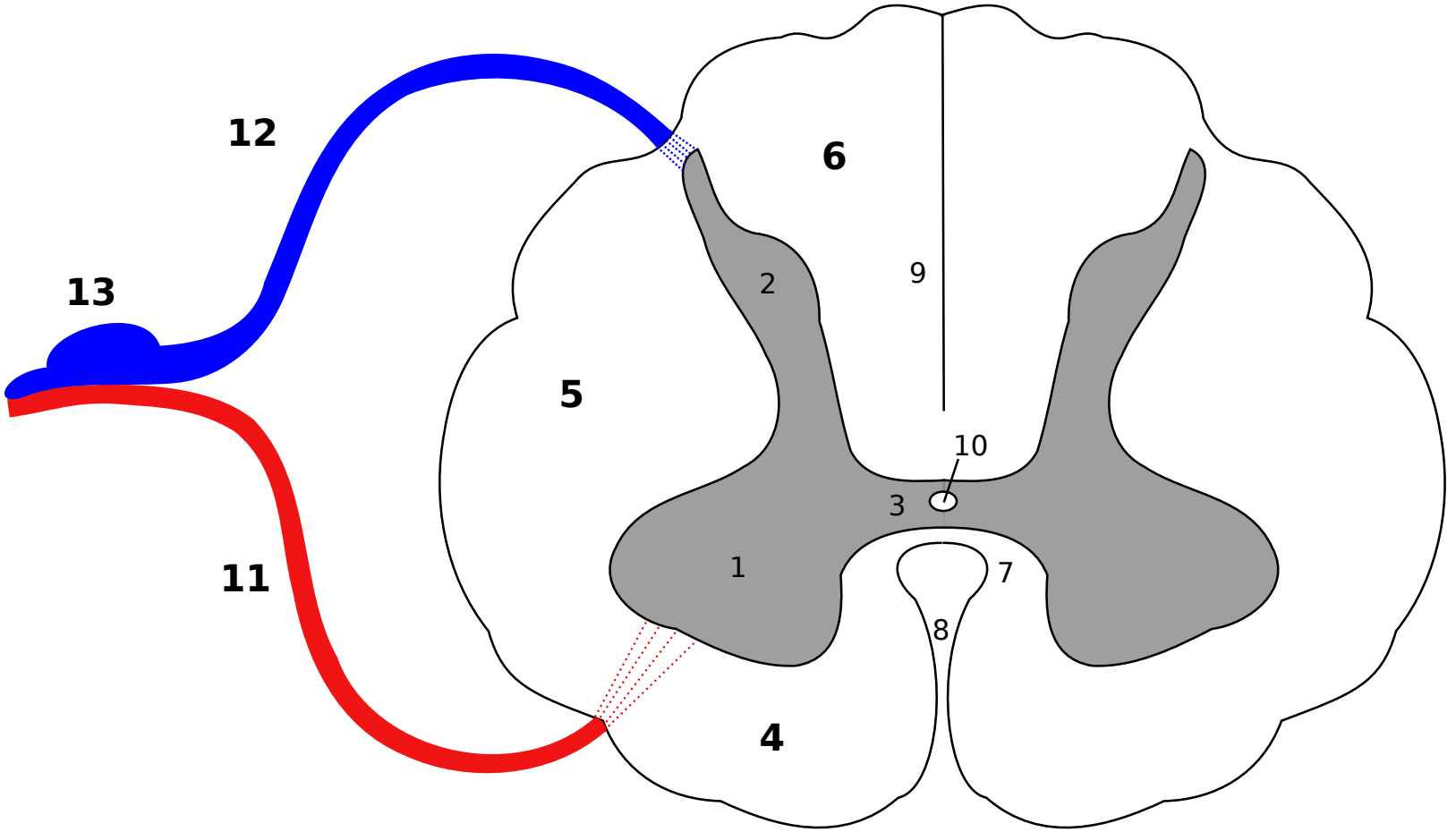
Spinal cord

slide 82

For
synapse


12
13
11
6
5
4
2
9
10
3
1
7
8

Section through the spinal cord; By Polarlys 3 June 2006;

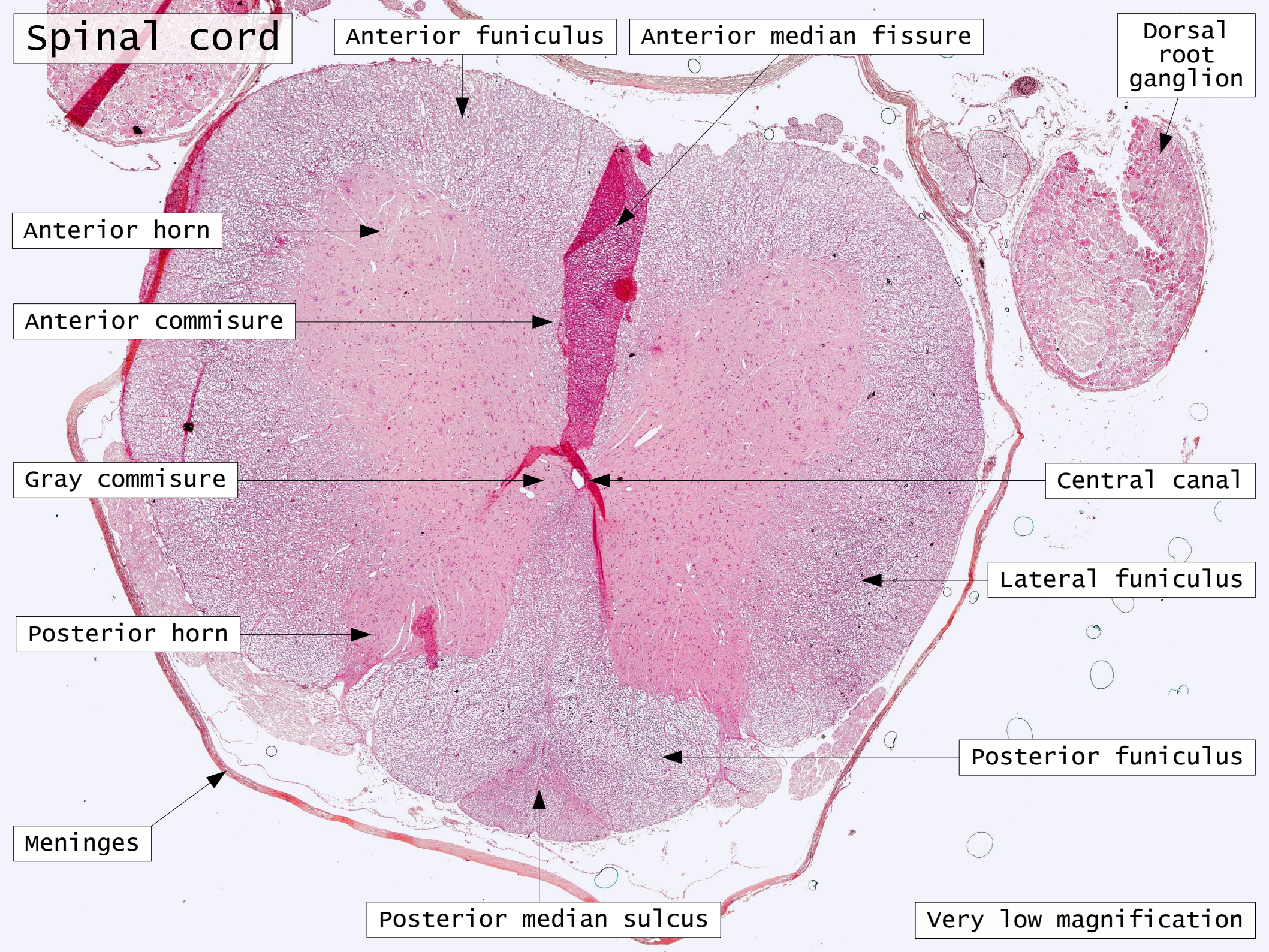


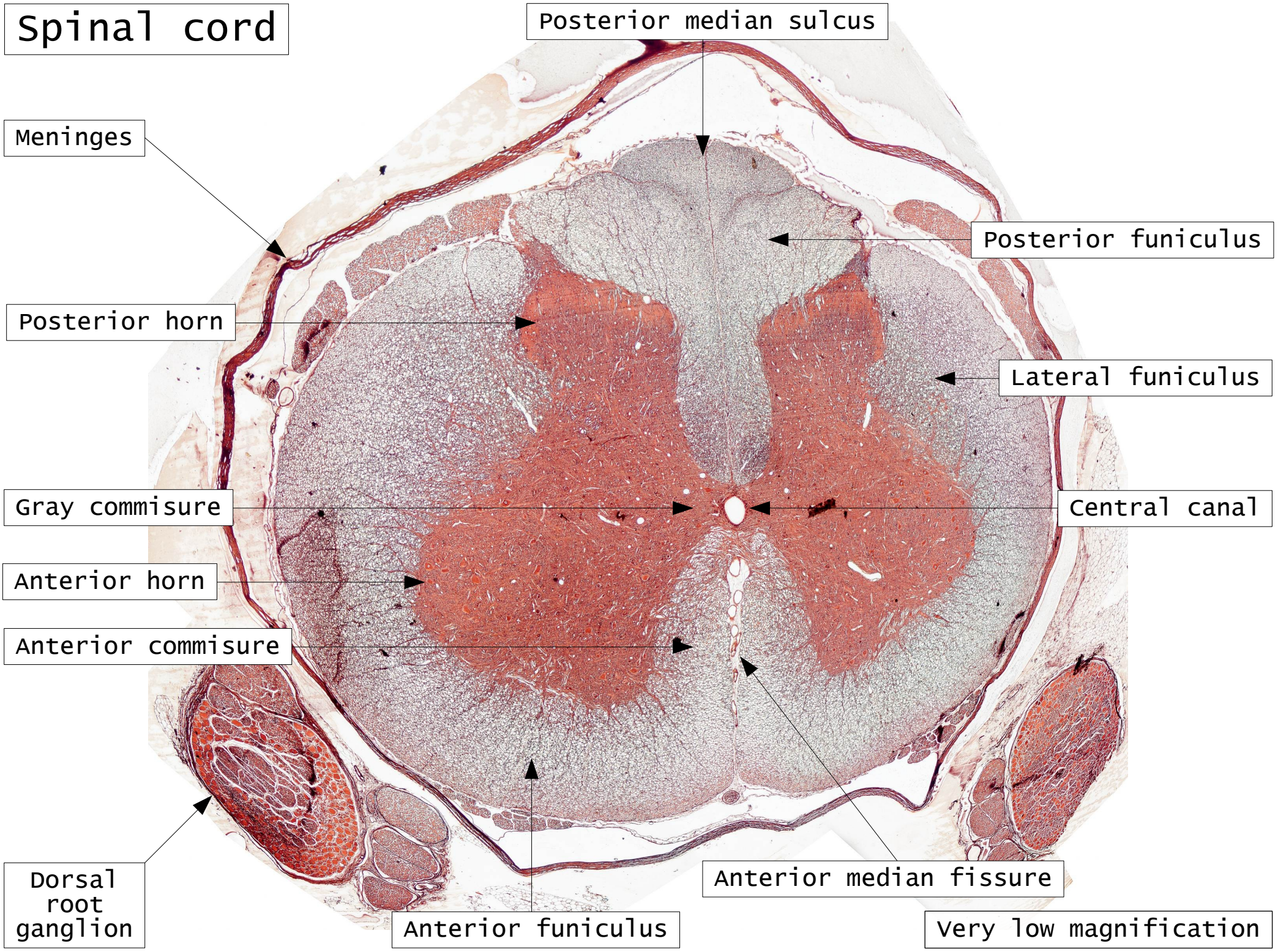
Gray matter

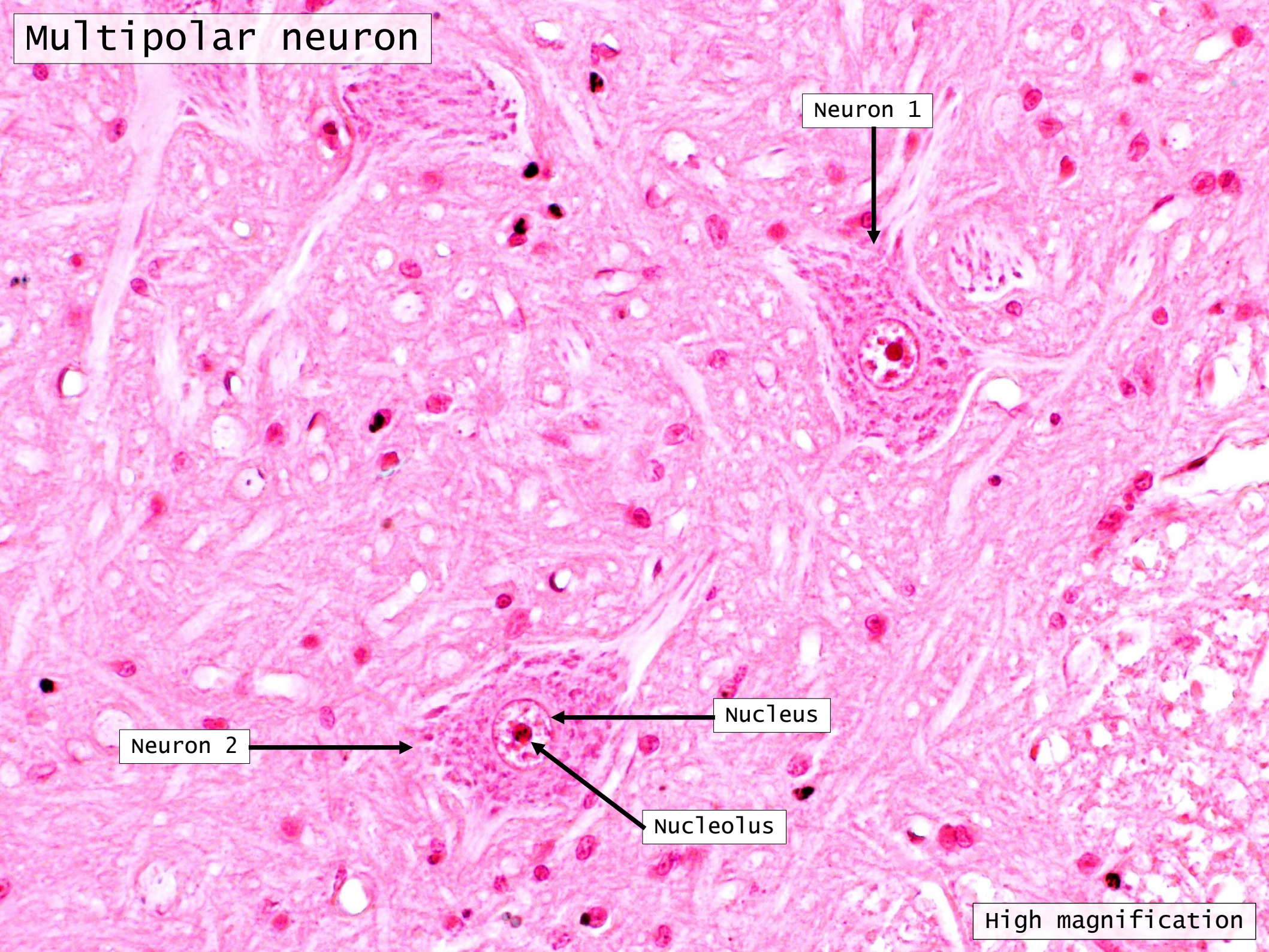
1. Anterior horn
2. Posterior horn
3. Gray commisure

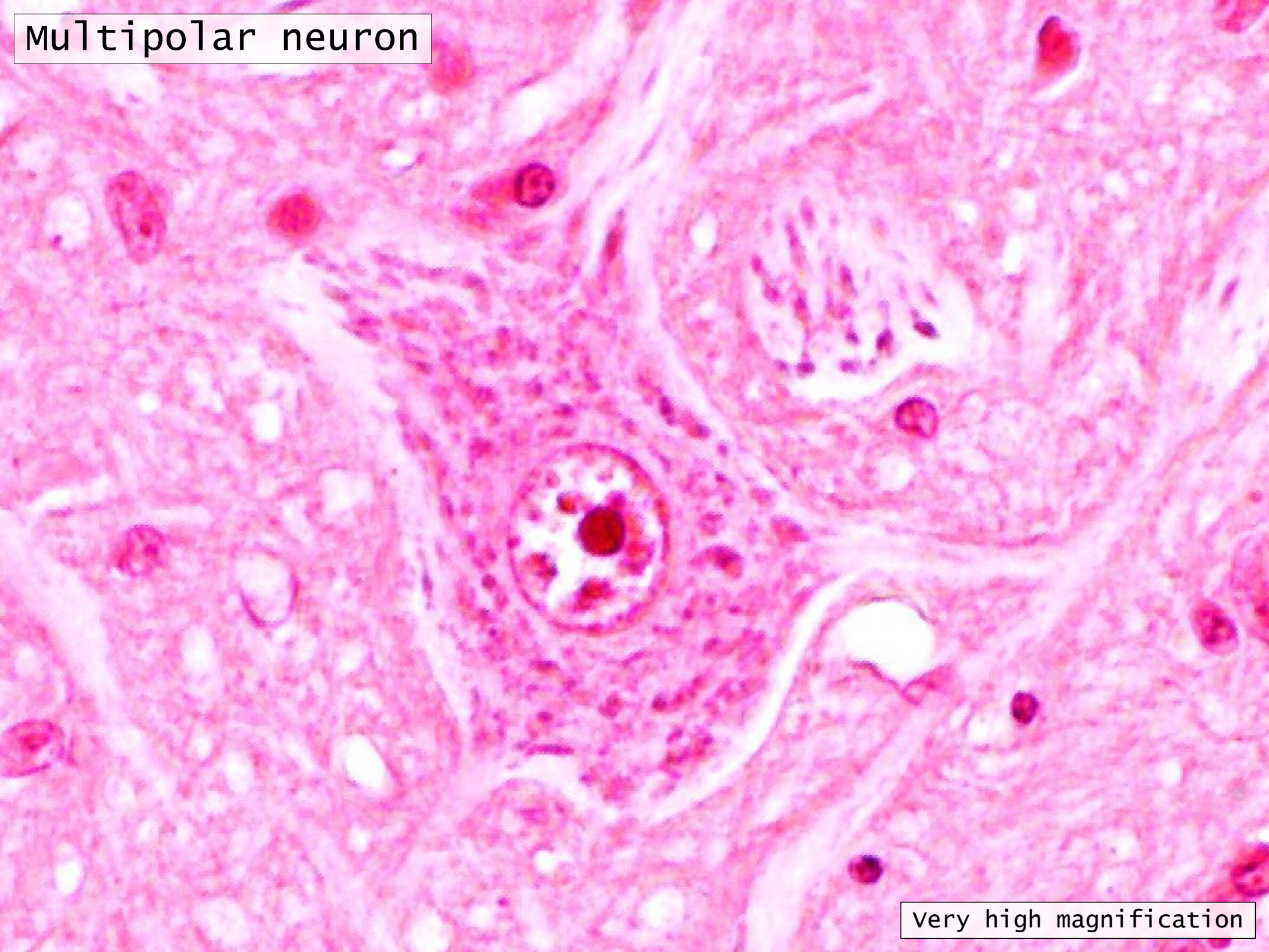
White matter

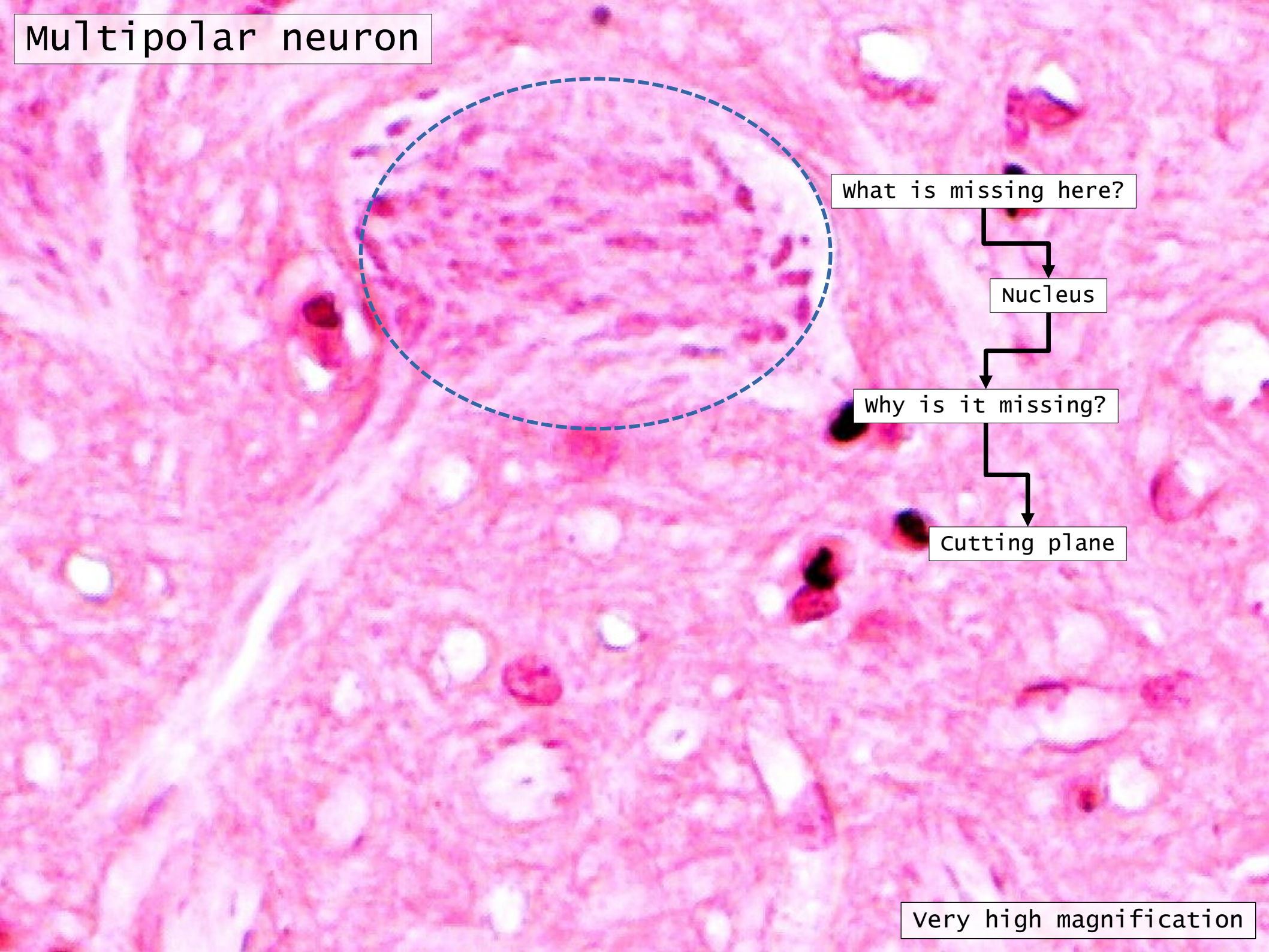
4. Anterior funiculus
5. Lateral funiculus
6. Posterior funiculus
7. Anterior commisure
8. Anterior median fissure
9. Posterior median sulcus
10. Central canal
11. Anterior root
12. Posterior root
13. Dorsal root ganglion

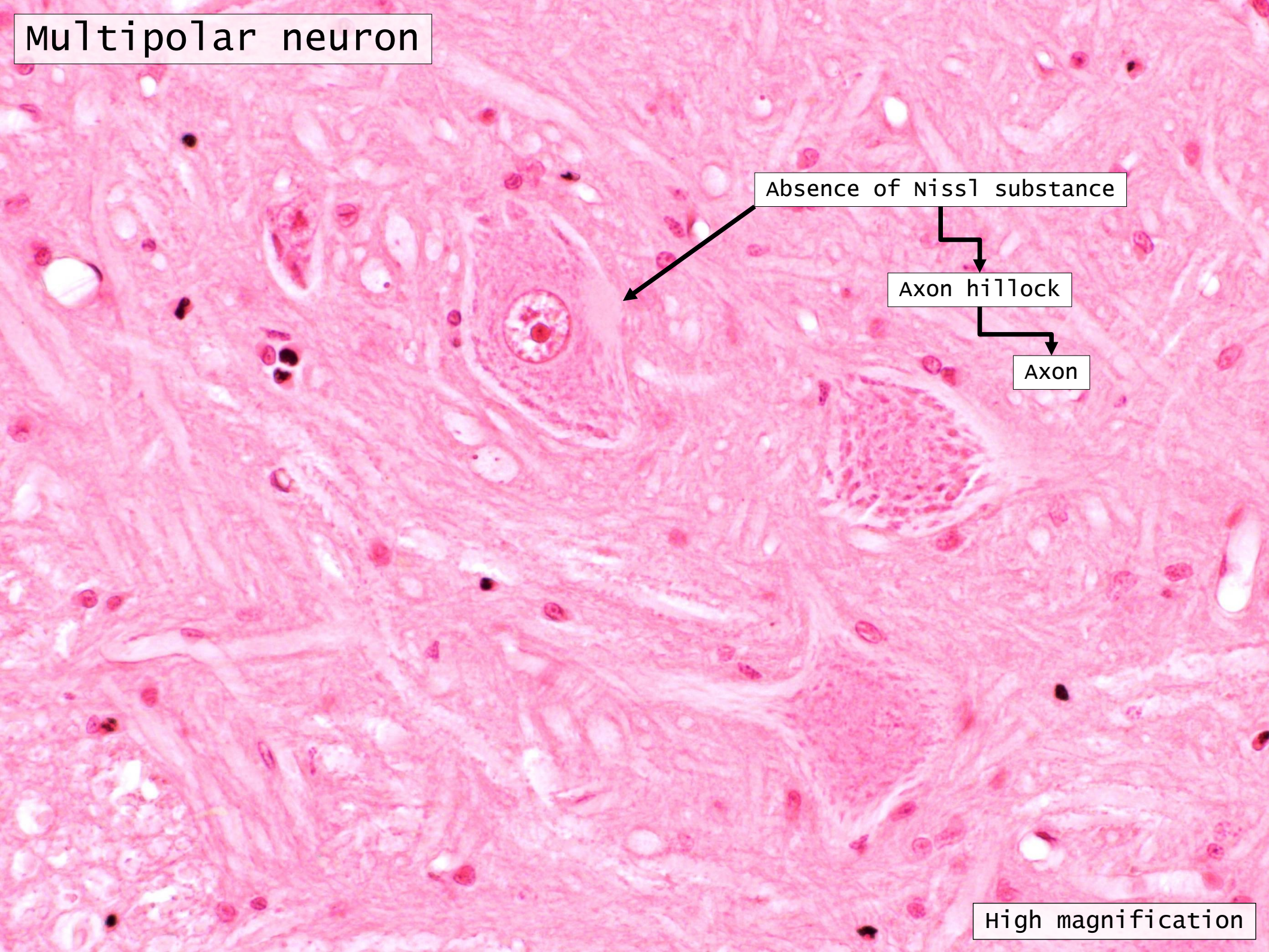

Spinal cord
Anterior funiculus
Anterior median fissure
Dorsal root ganglion
Anterior horn
Anterior commisure
Gray commisure
Central canal
Lateral funiculus
Posterior horn
Posterior funiculus
Meninges
Posterior median sulcus
Very low magnification

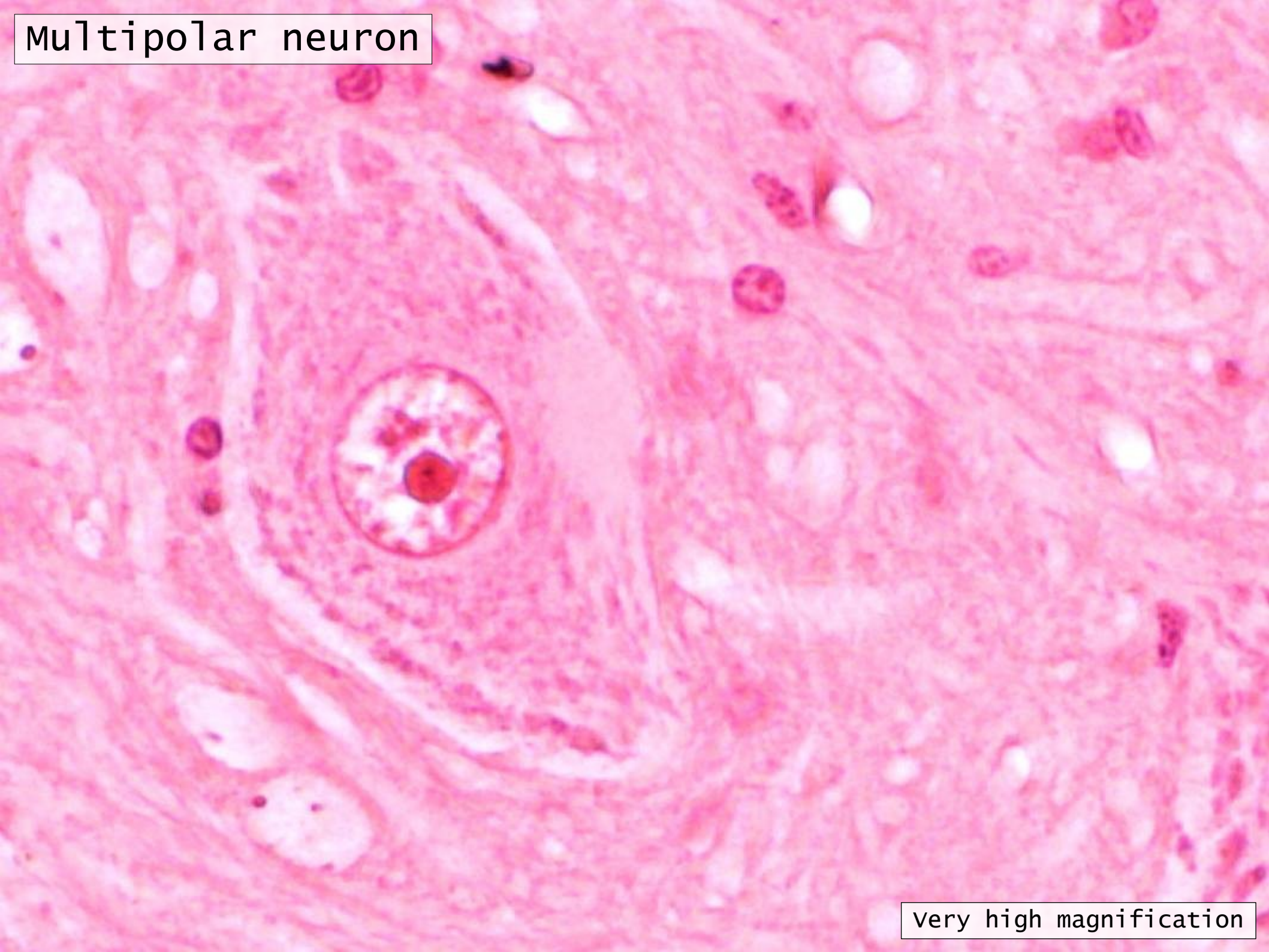

Spinal cord
Posterior median sulcus
Meninges
Posterior funiculus
Posterior horn
Lateral funiculus
Gray commisure
Central canal
Anterior horn
Anterior commisure
Dorsal root ganglion
Anterior funiculus
Anterior median fissure
Very low magnification


Multipolar neuron
Neuron 1
Nucleus
Neuron 2
Nucleolus
High magnification

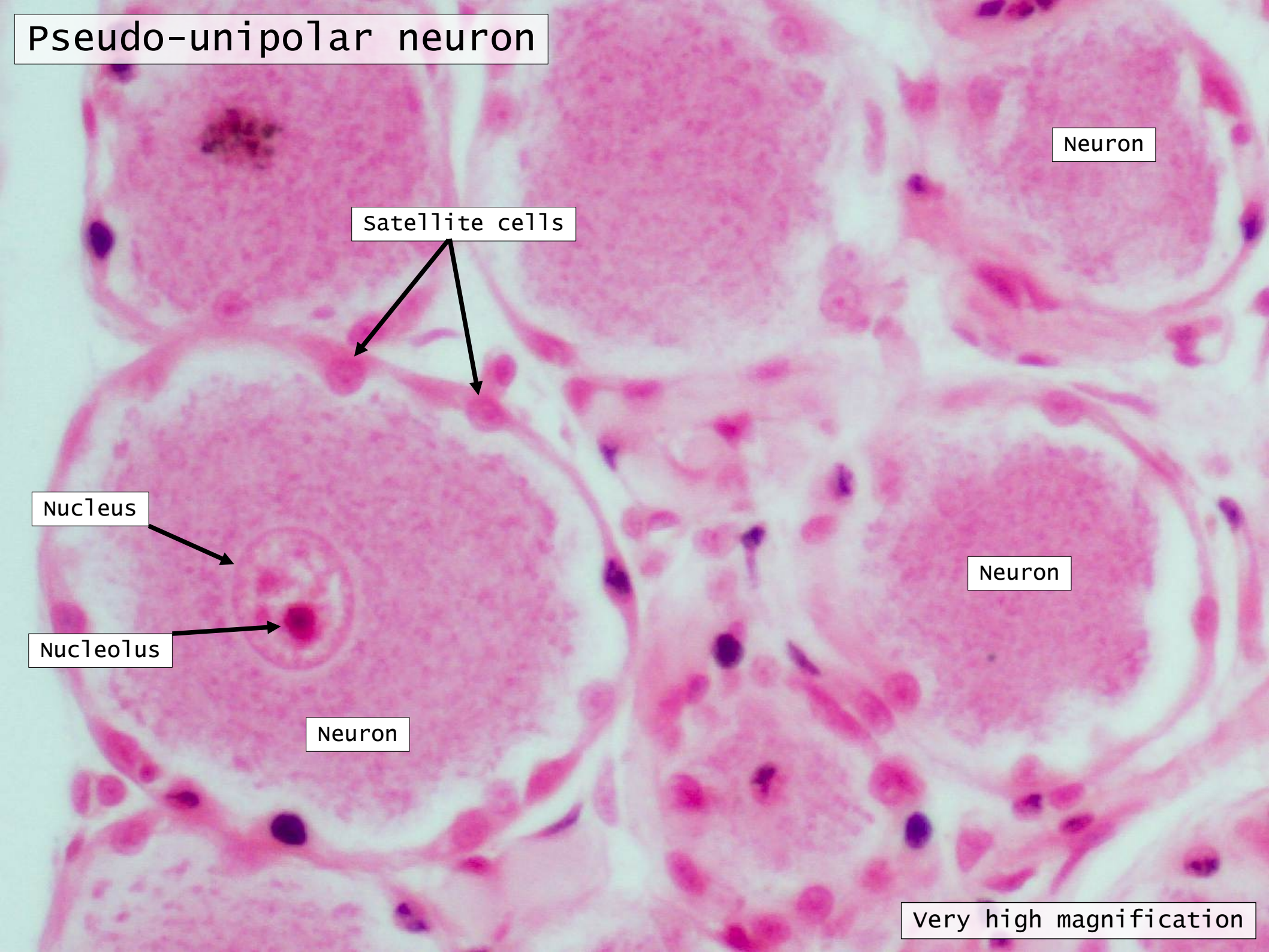

Multipolar neuron
Very high magnification

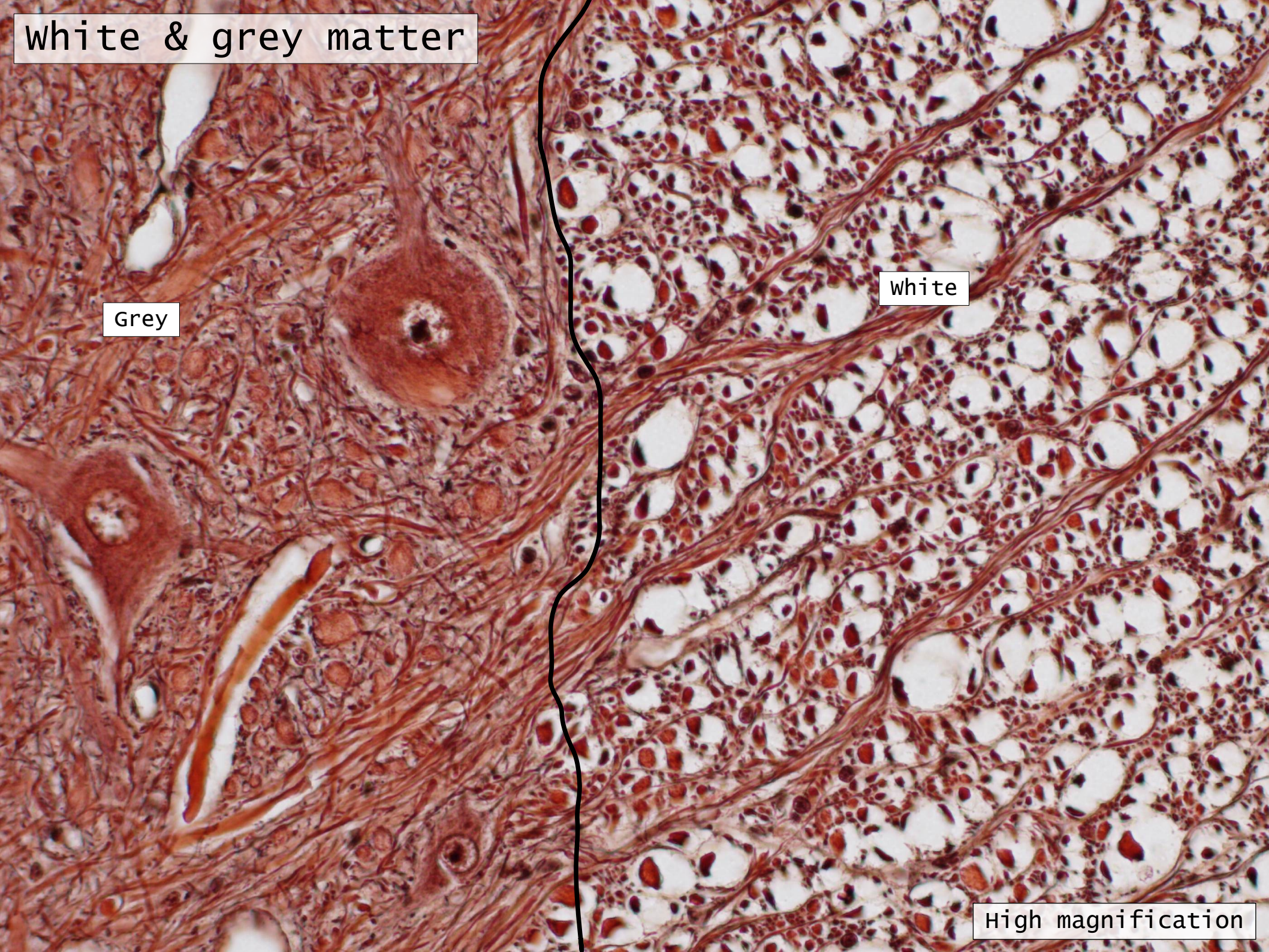

Multipolar neuron
What is missing here?
Nucleus
Why is it missing?
Cutting plane
Very high magnification

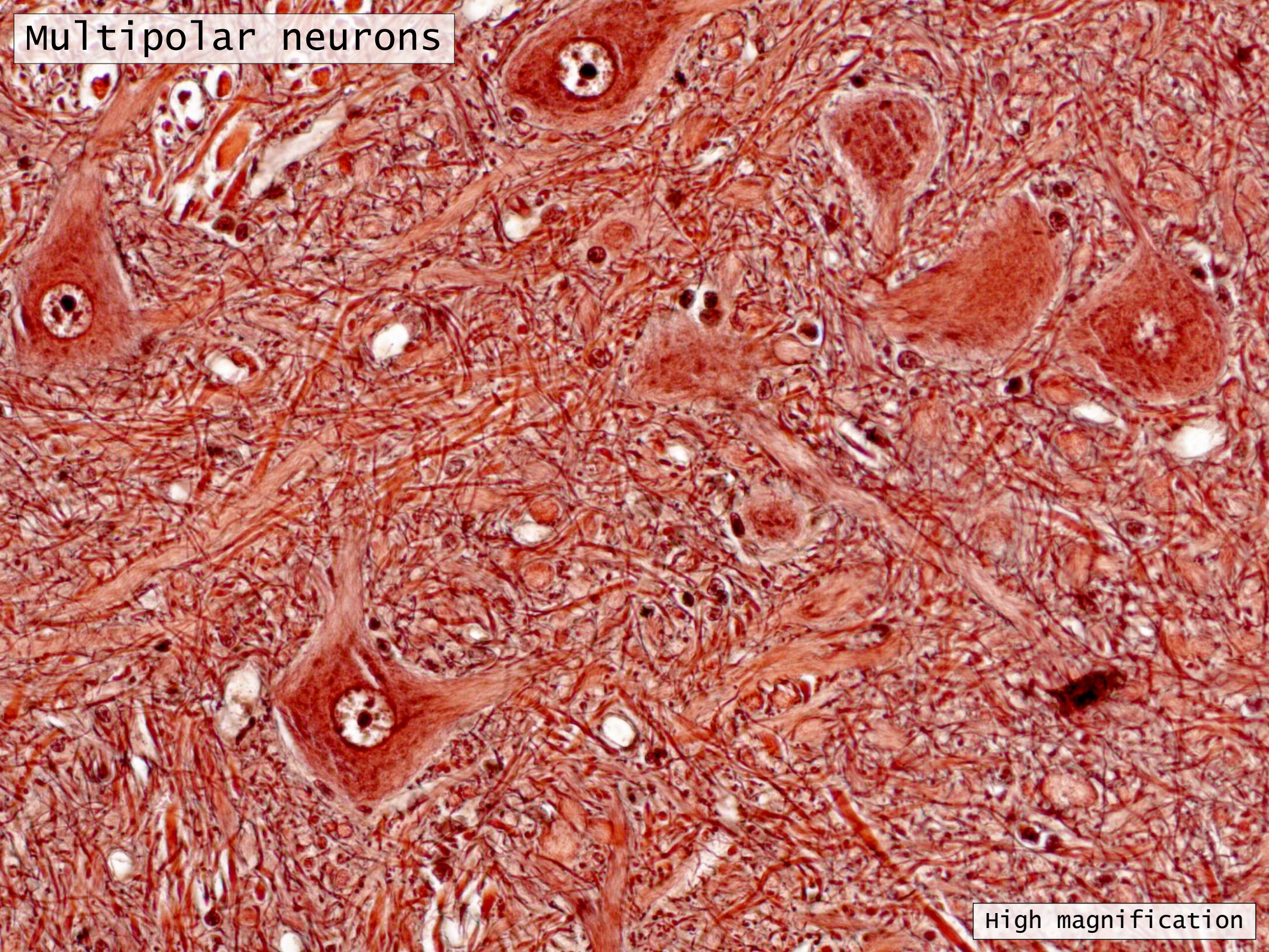

Multipolar neuron
Absence of Nissl substance
Axon hillock
Axon
High magnification


Multipolar neuron
Very high magnification


Pseudo-unipolar neuron
High magnification


Pseudo-unipolar neuron
Neuron
Satellite cells
Nucleus
Nucleolus
Neuron
Neuron
Very high magnification

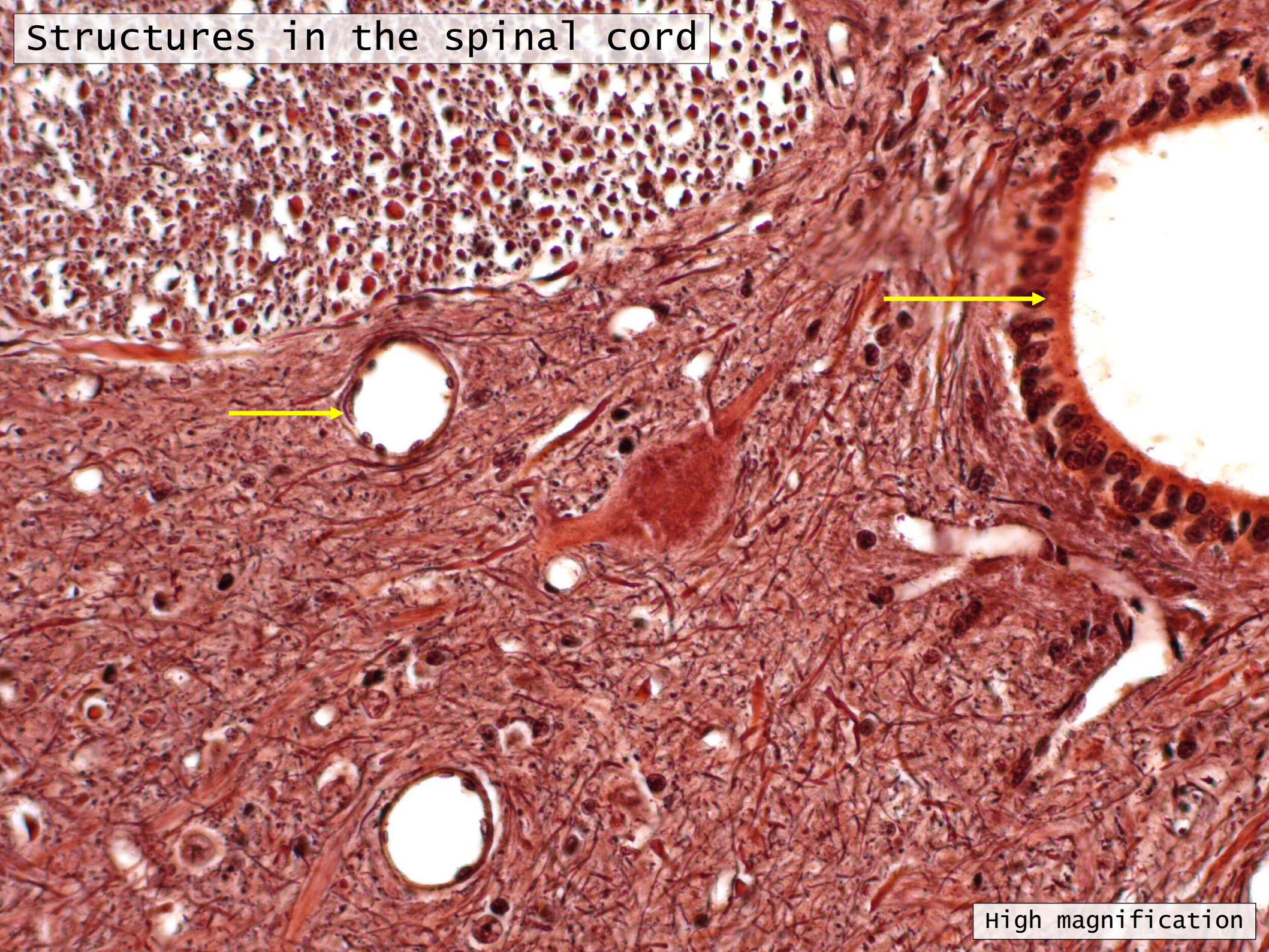

White & grey matter
Grey
White
High magnification

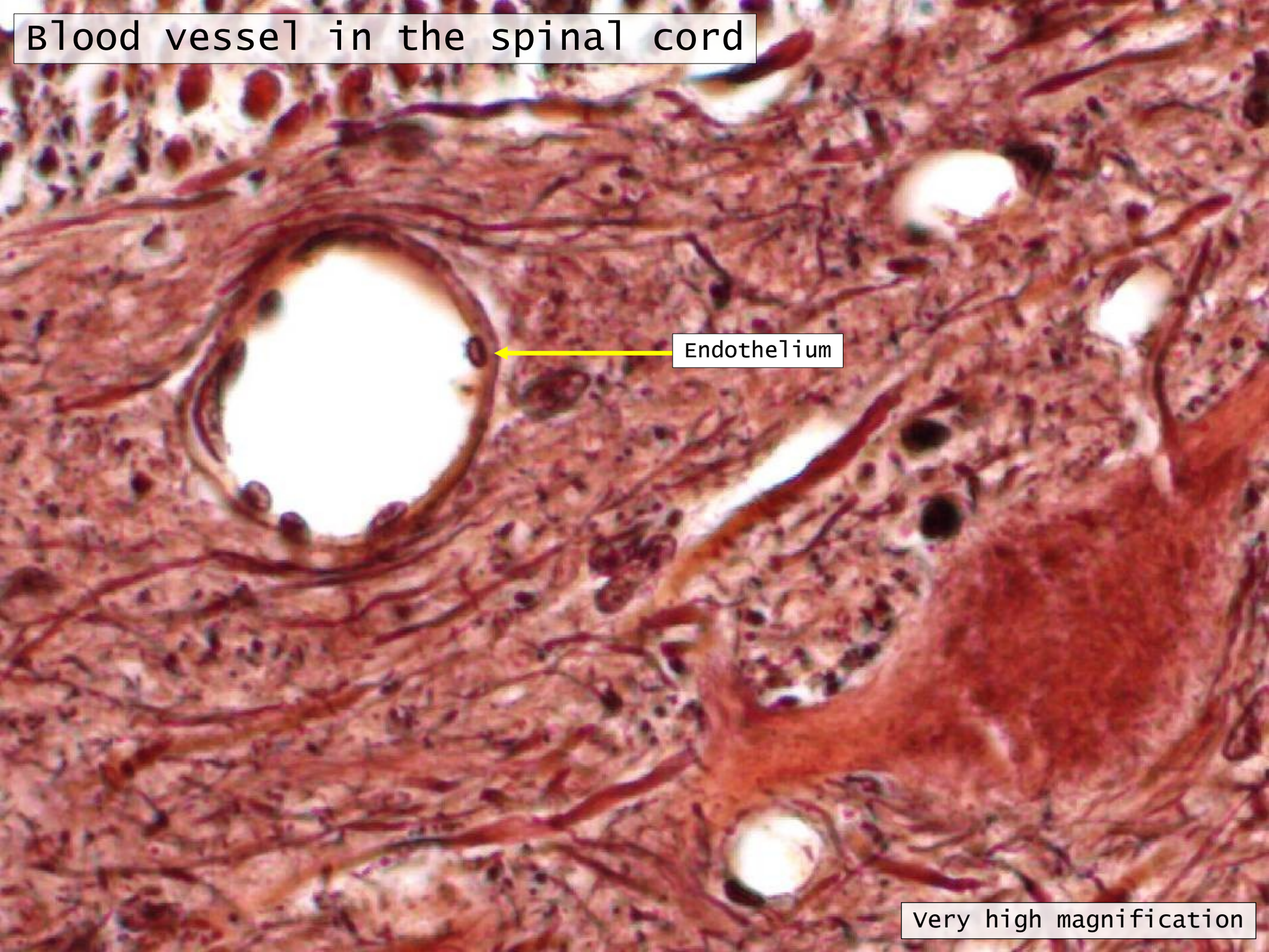

Multipolar neurons
High magnification

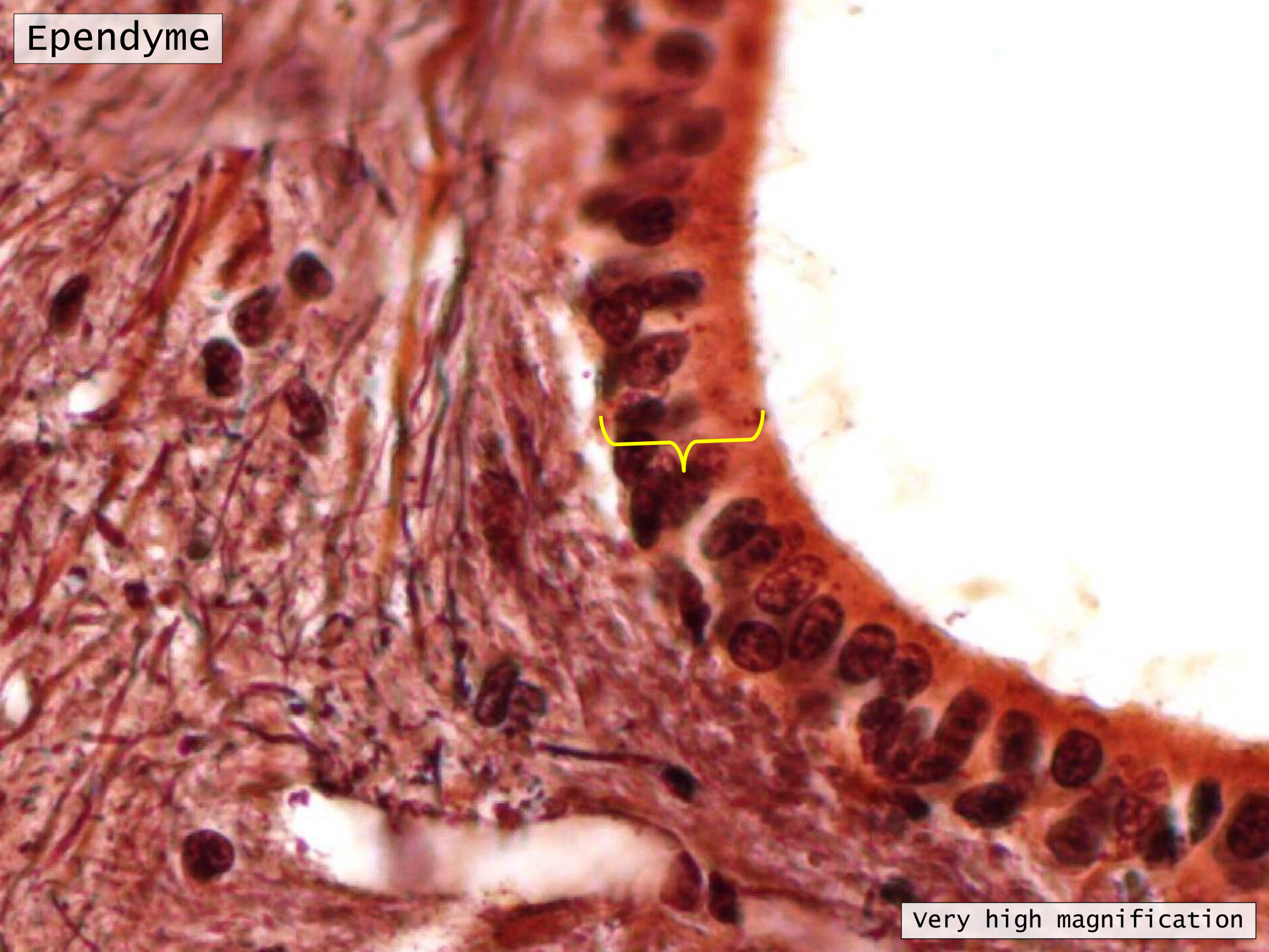

Multipolar neuron
Very high magnification


Pseudo-unipolar neuron
High magnification

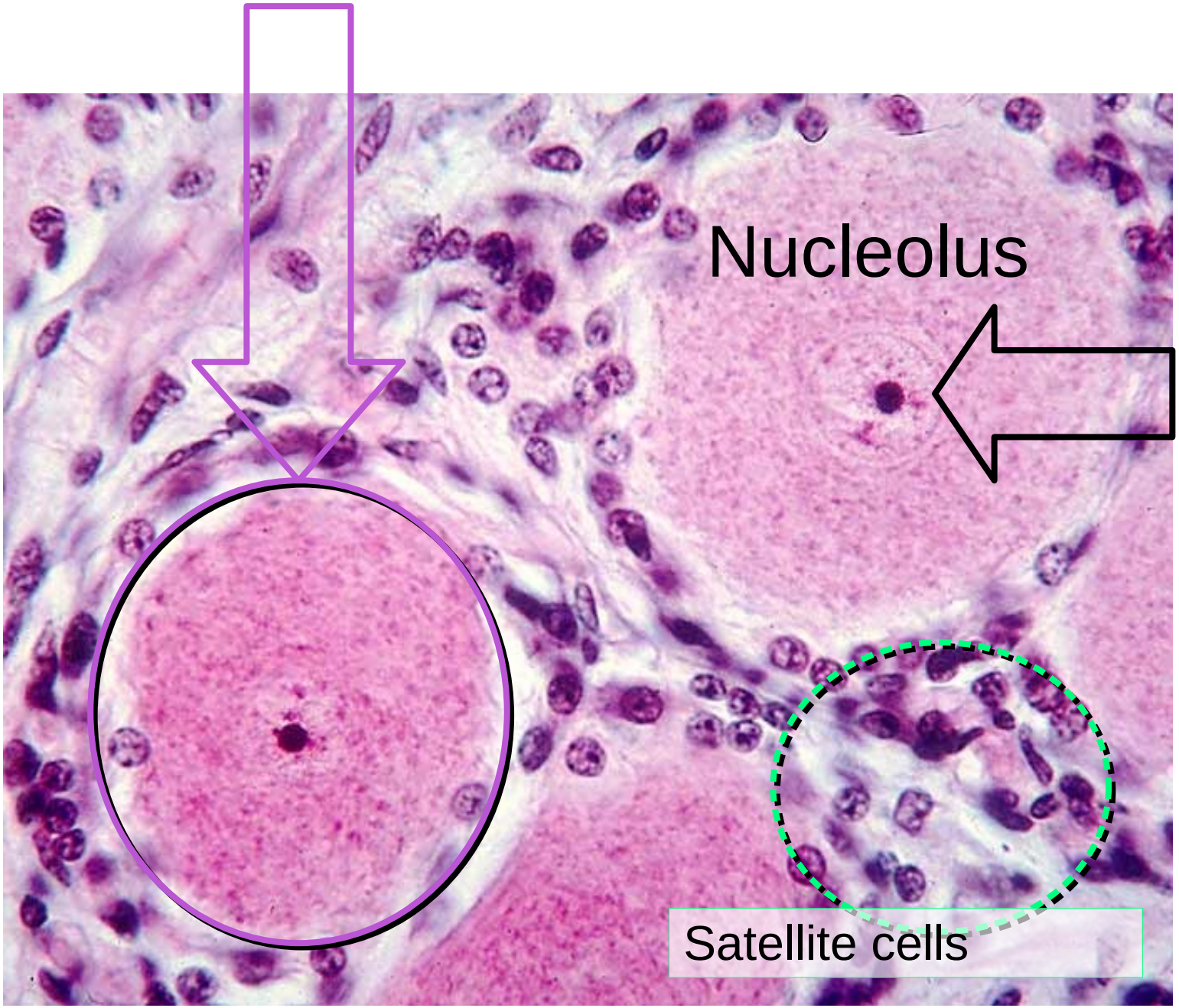
Structures in the spinal cord




Blood vessel in the spinal cord
Endothelium
Very high magnification


Ependyme
Very high magnification

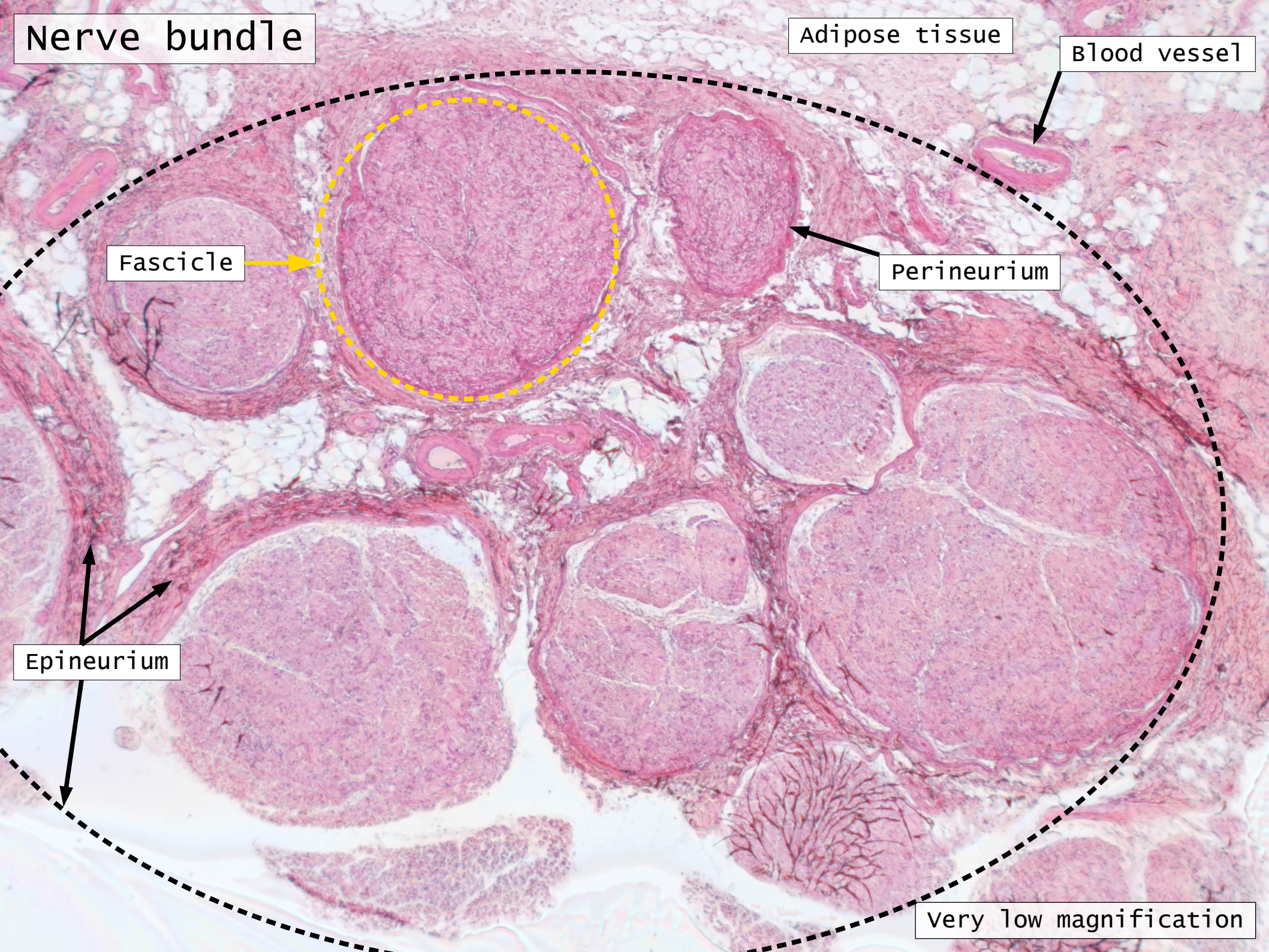
Pseudo-unipolar neuron

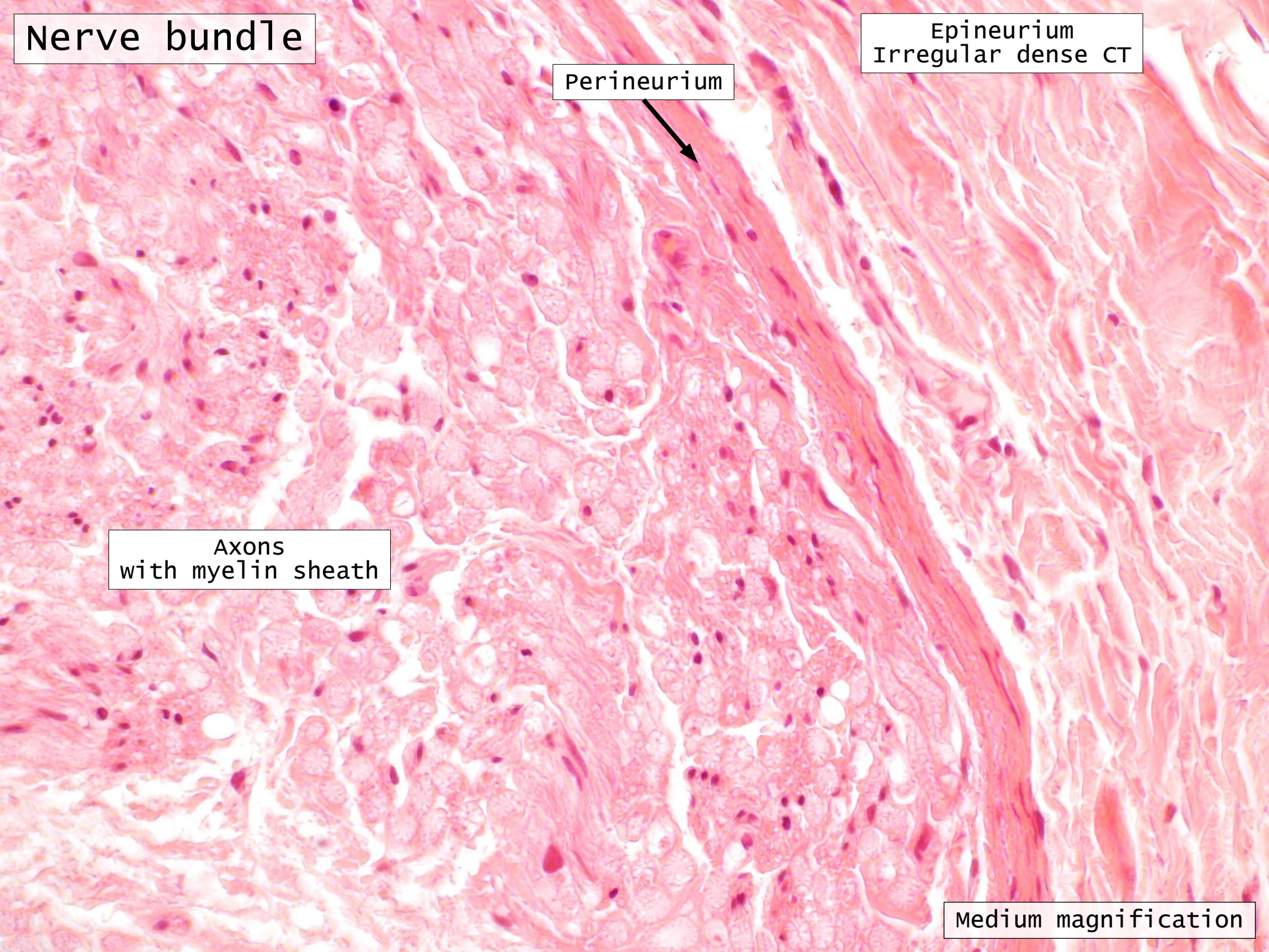


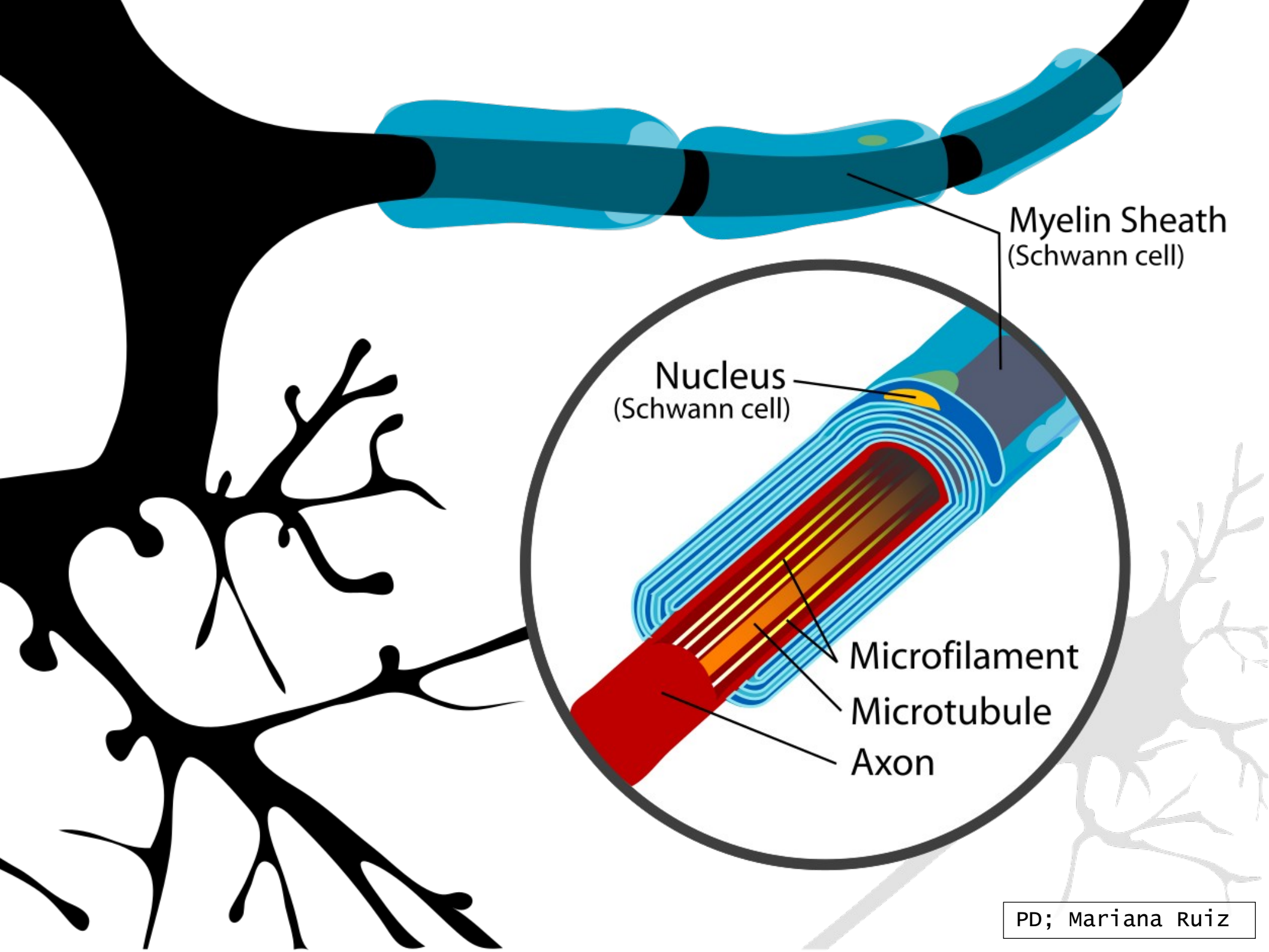
Peripheral nerve

Slide 32

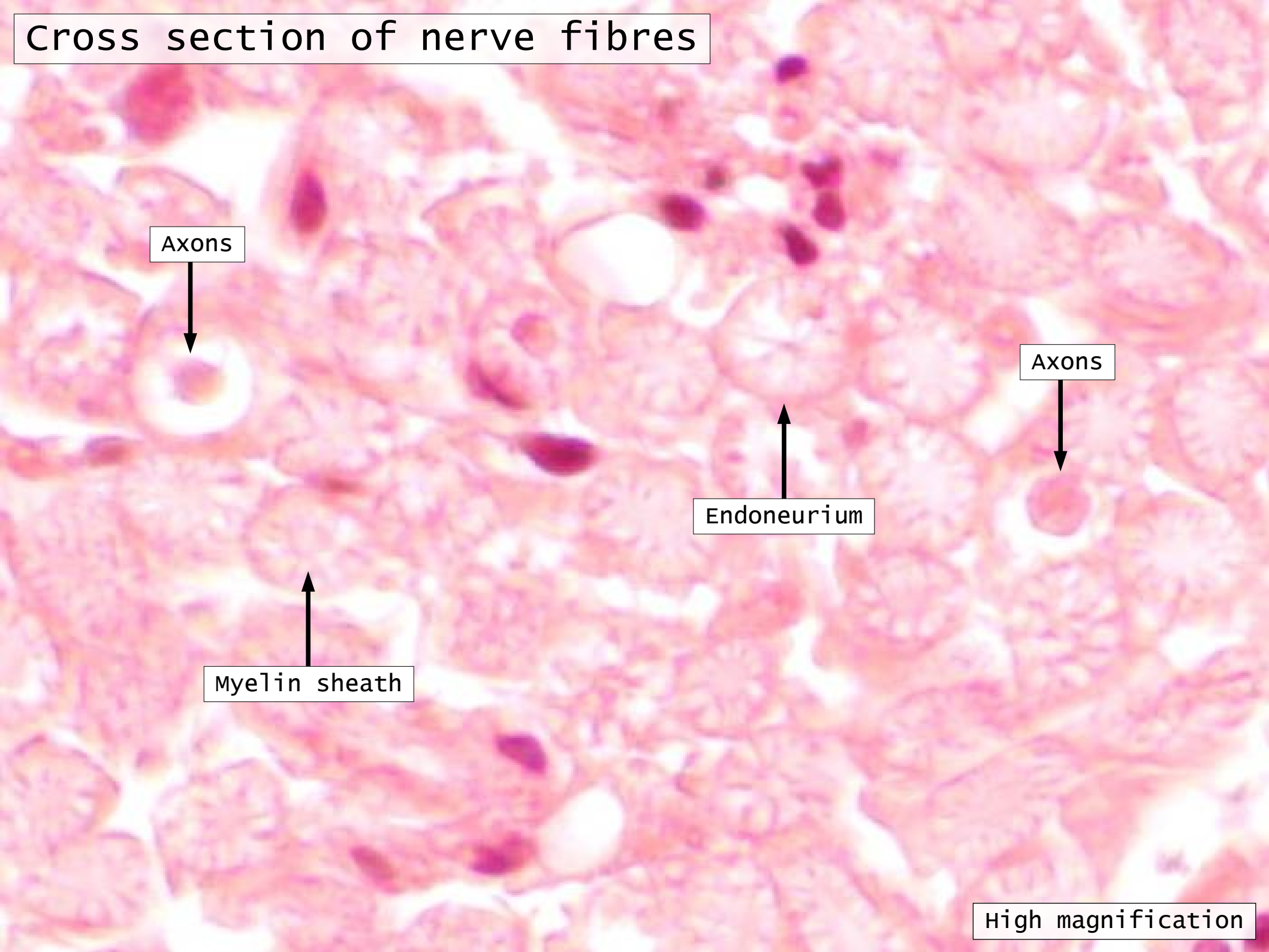
For myelinated fibres


Nerve bundle
Adipose tissue
Blood vessel
Fascicle
Perineurium
Epineurium
Very low magnification

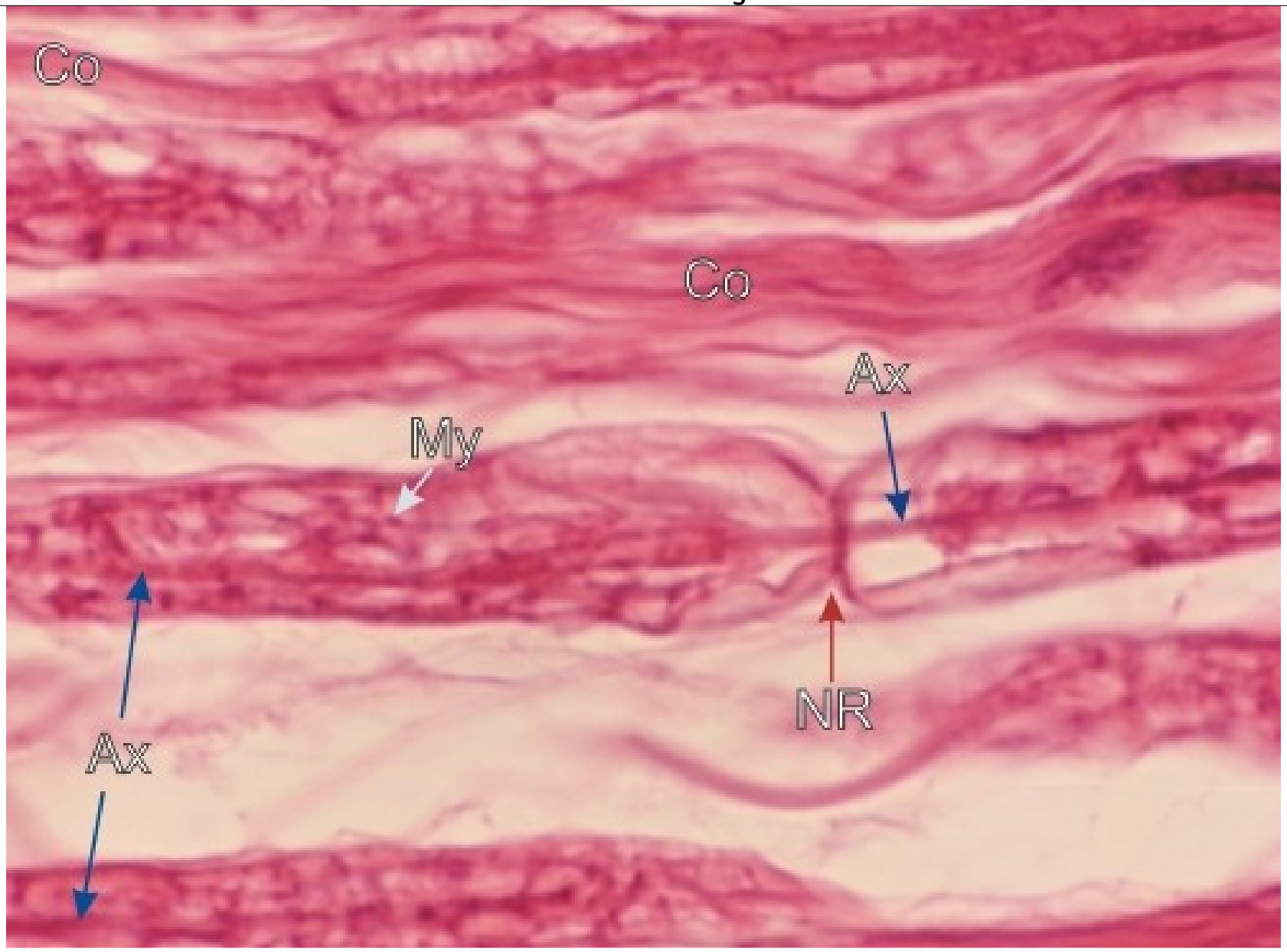

Nerve bundle
Perineurium
Epineurium
Irregular dense CT
Axons
with myelin sheath
Medium magnification



PD; Mariana Ruiz


Cross section of nerve fibres
Axons
Axons
Endoneurium
Myelin sheath
High magnification

Longitudinal section of a sciatic nerve. Separated by the connective tissue (Co) of the endoneurium, the nerve fibres show their characteristic acidophilic networks of myelin (My). The myelin sheath of one fibre is interrupted by a node of Ranvier (NR) traversed by an axon (Ax). Other axons, partly masked by myelin networks are seen in adjacent fibres.

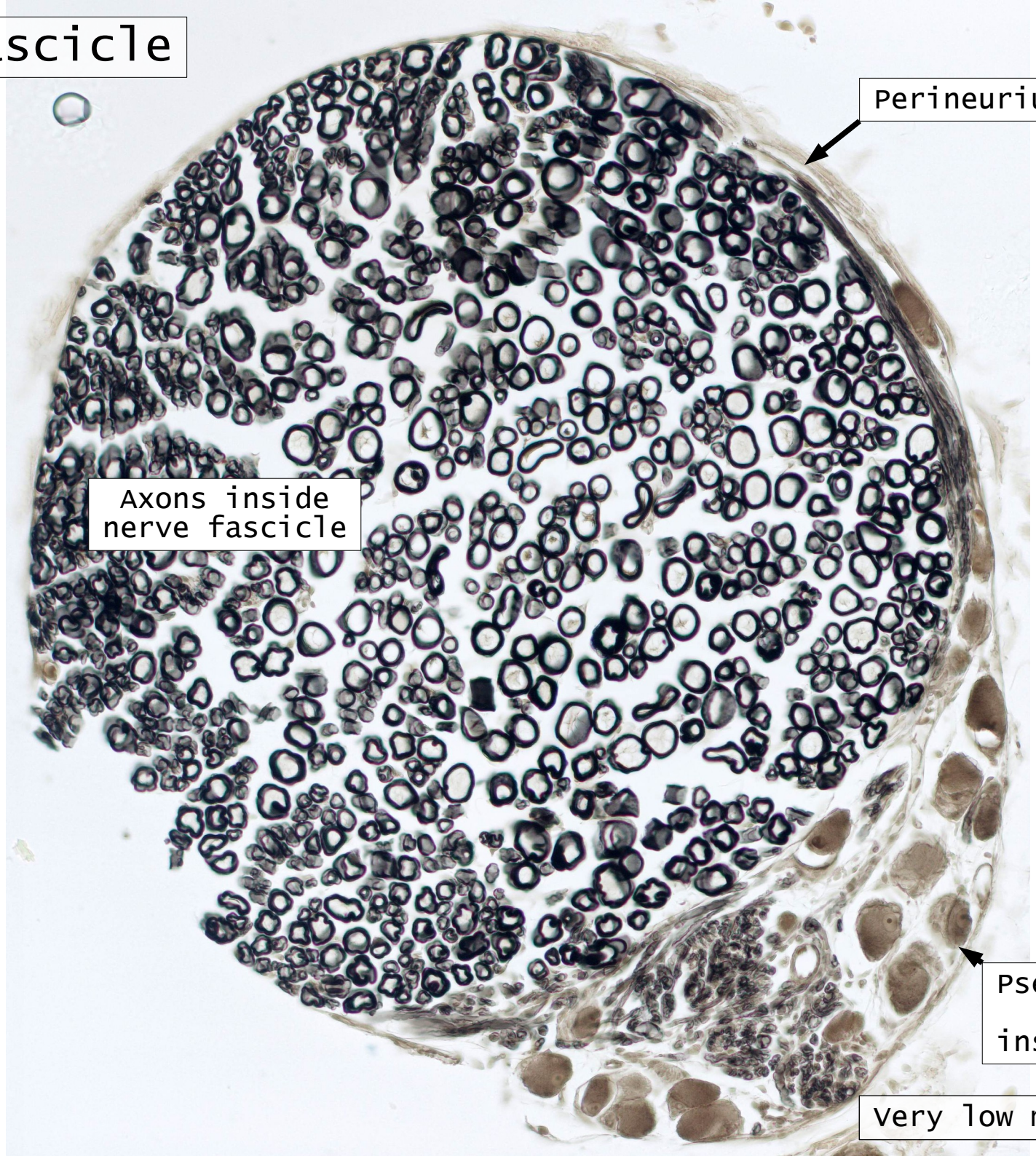


Peripheral nerve

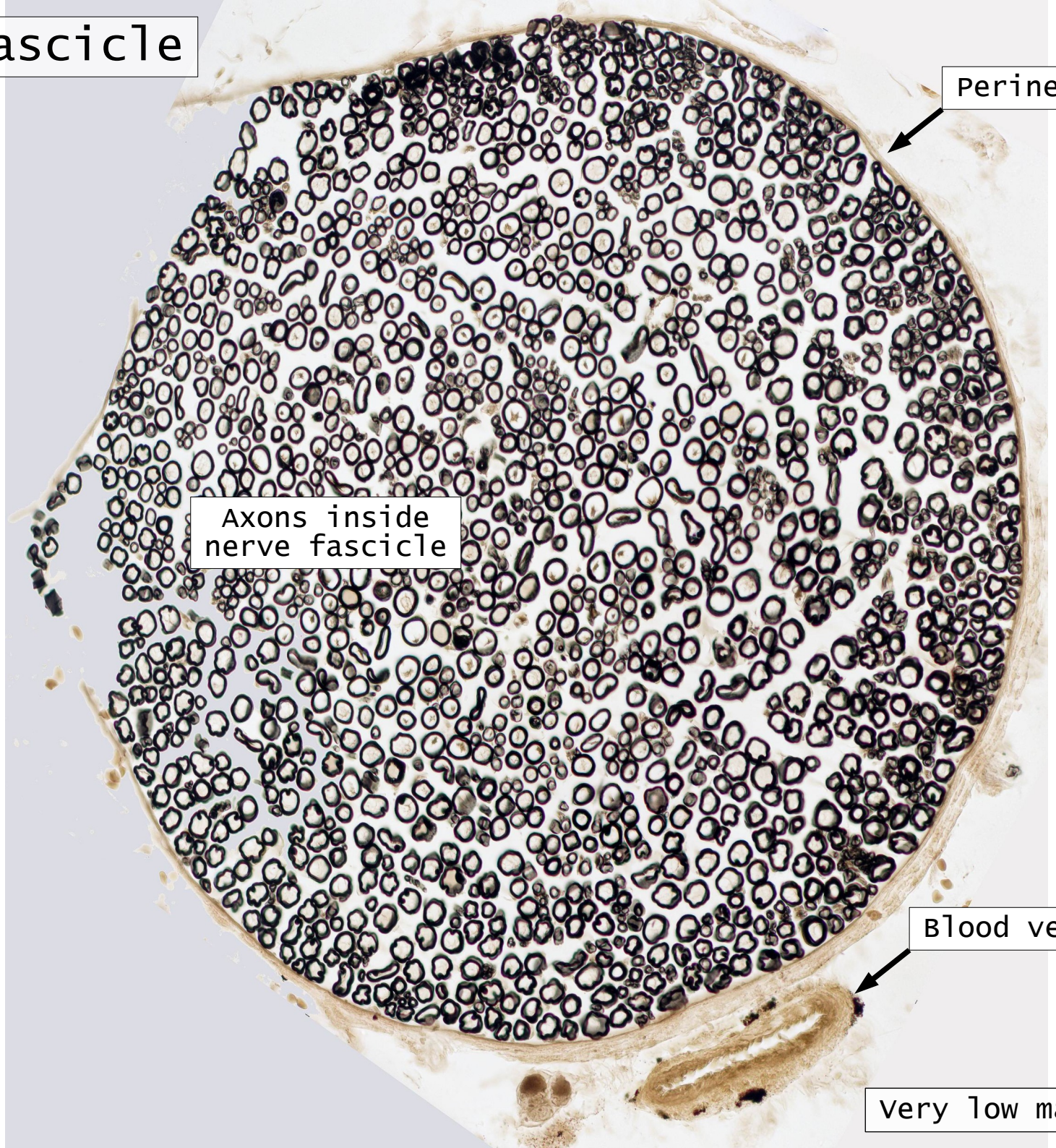
Slide 59

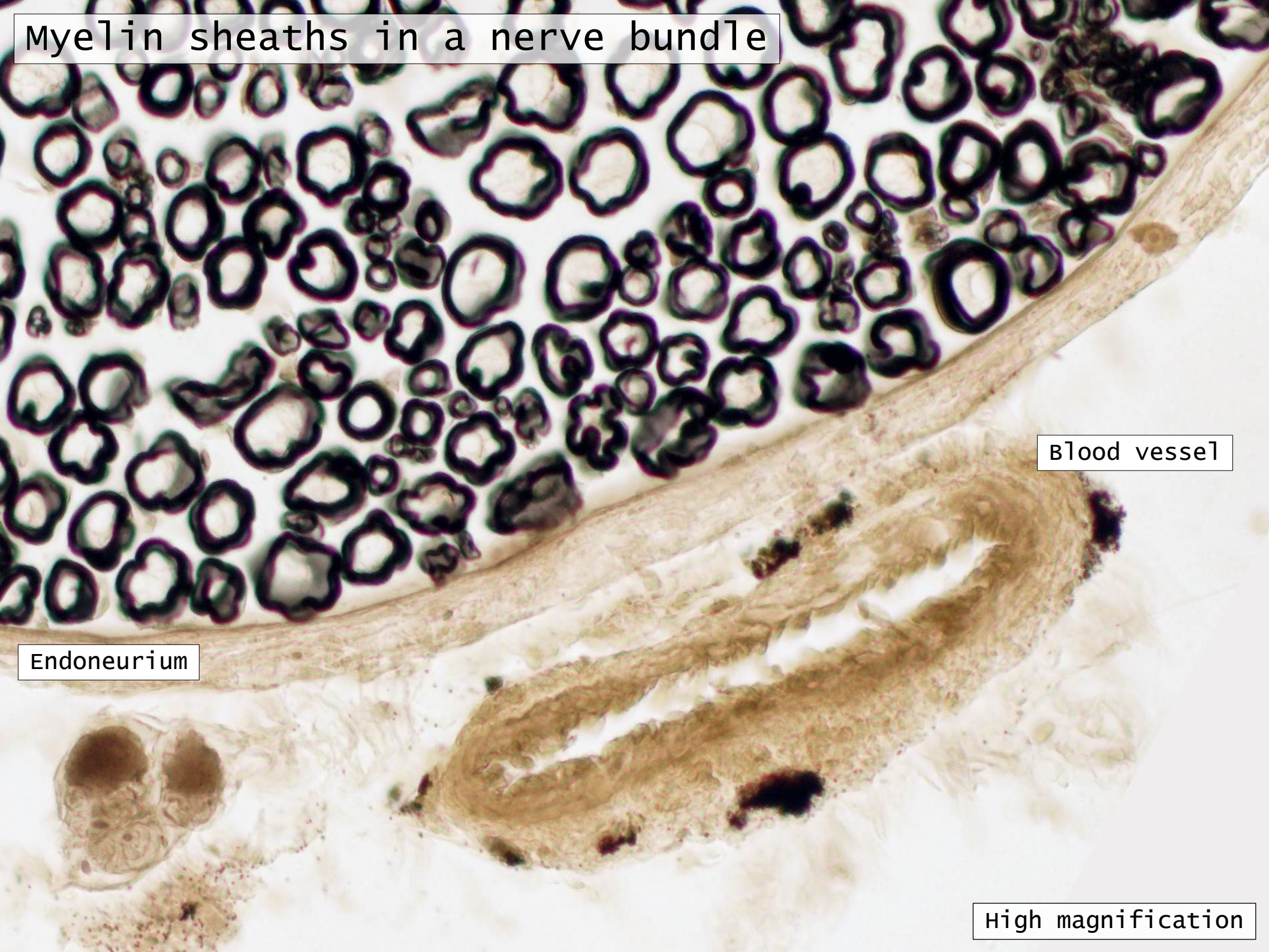
For
Myelin sheath

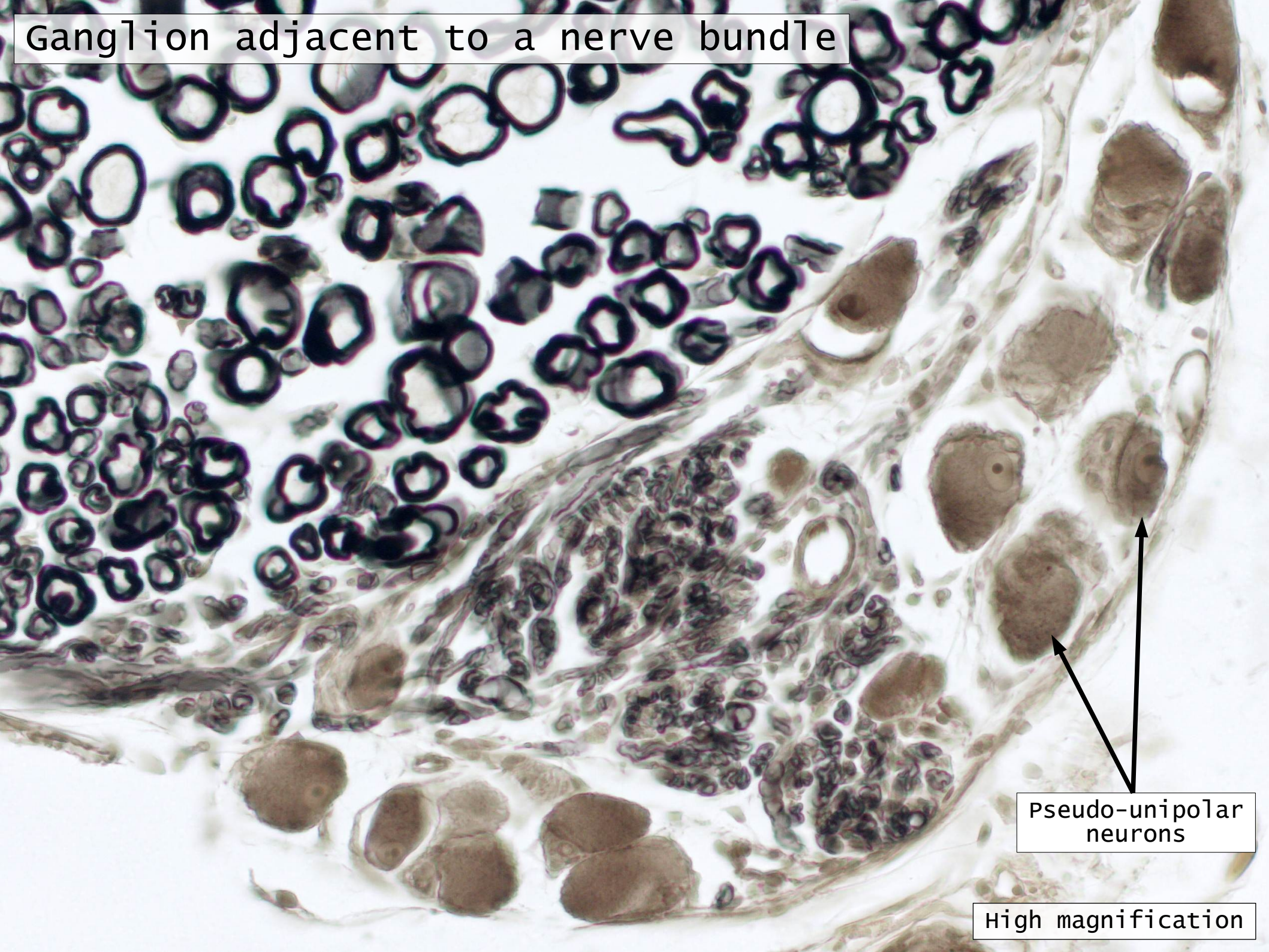
Nerve fascicle

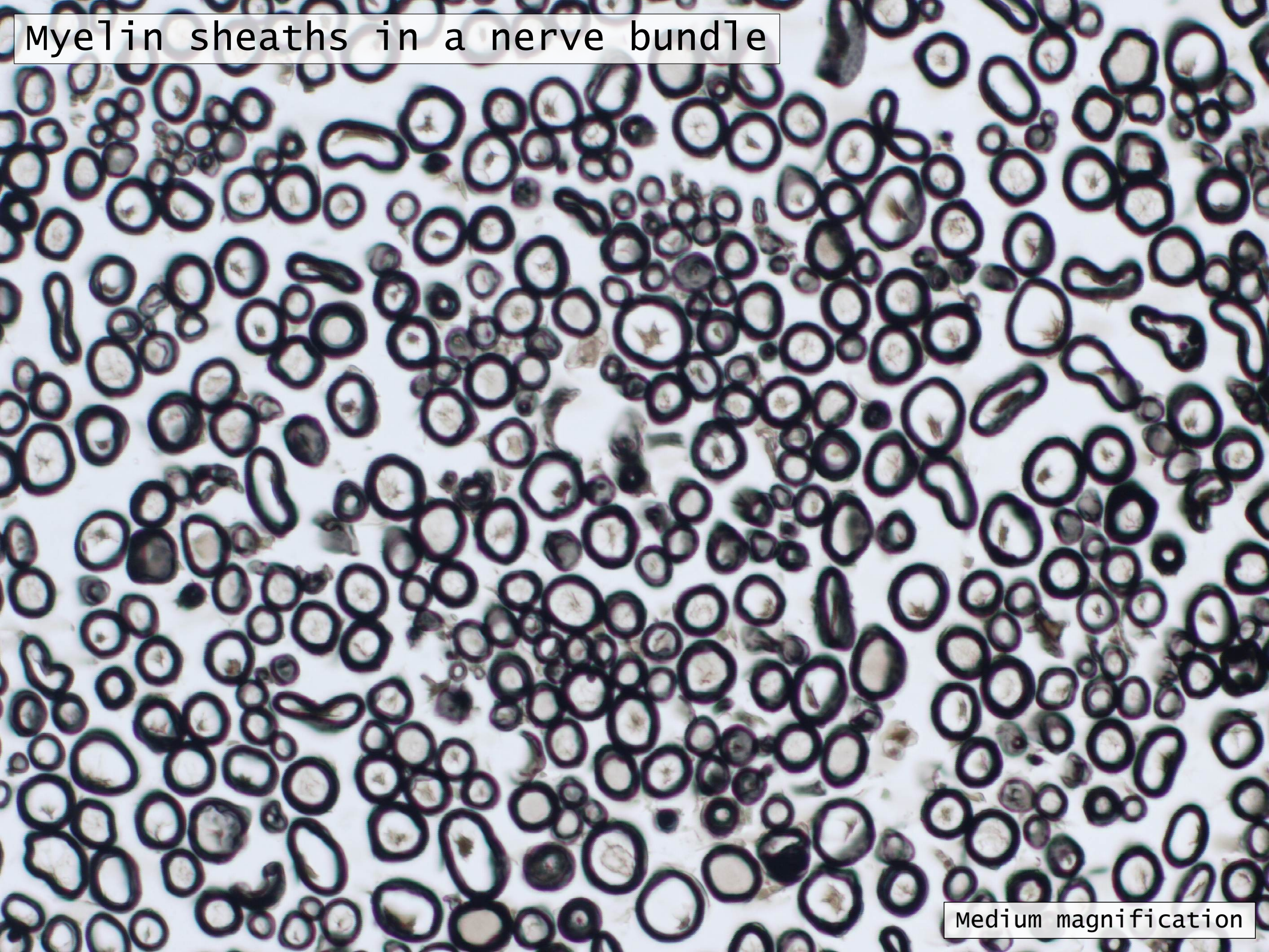


Nerve fascicle




Myelin sheaths in a nerve bundle
Blood vessel
Endoneurium
High magnification

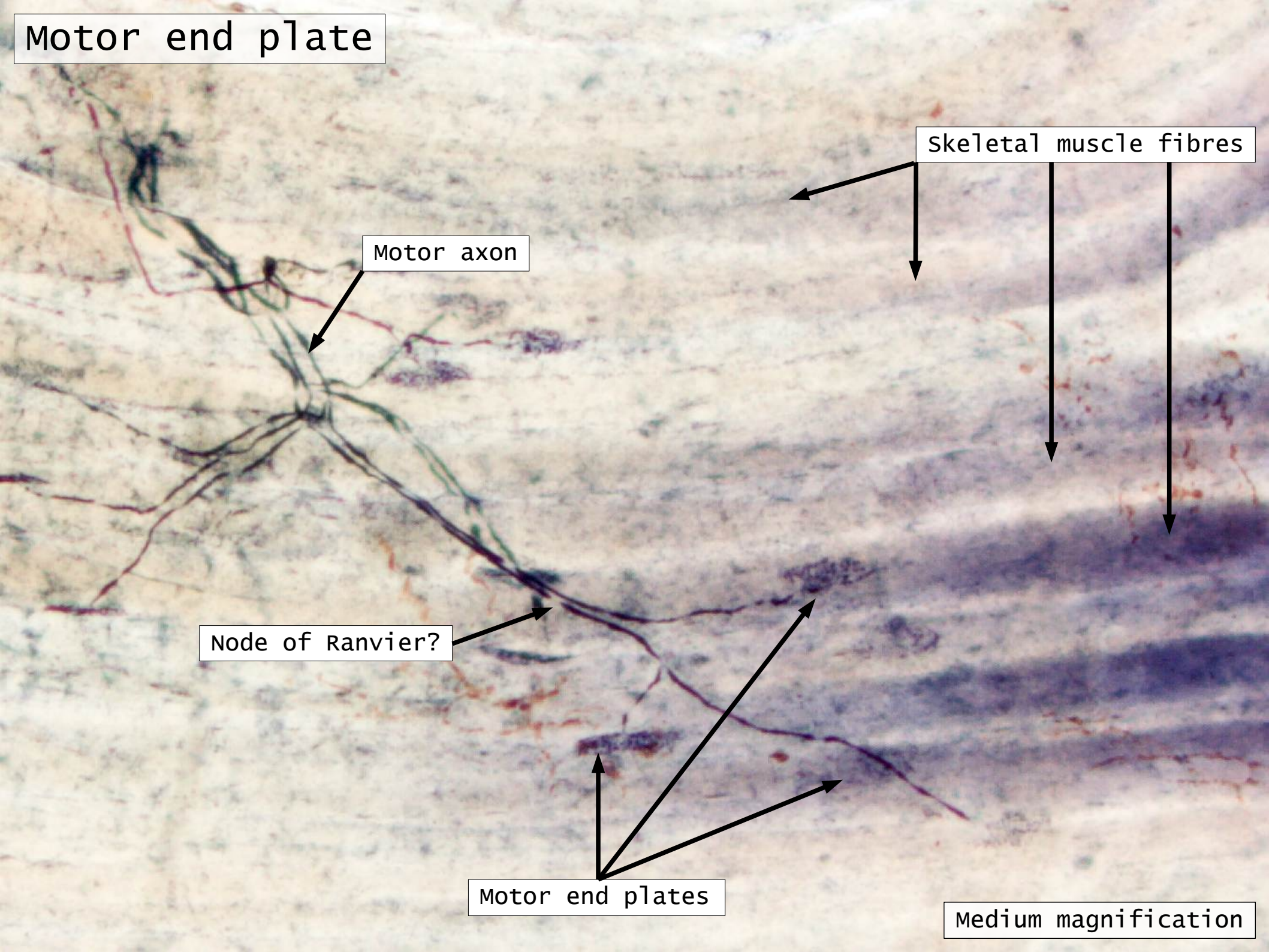

Ganglion adjacent to a nerve bundle
Pseudo-unipolar neurons
High magnification

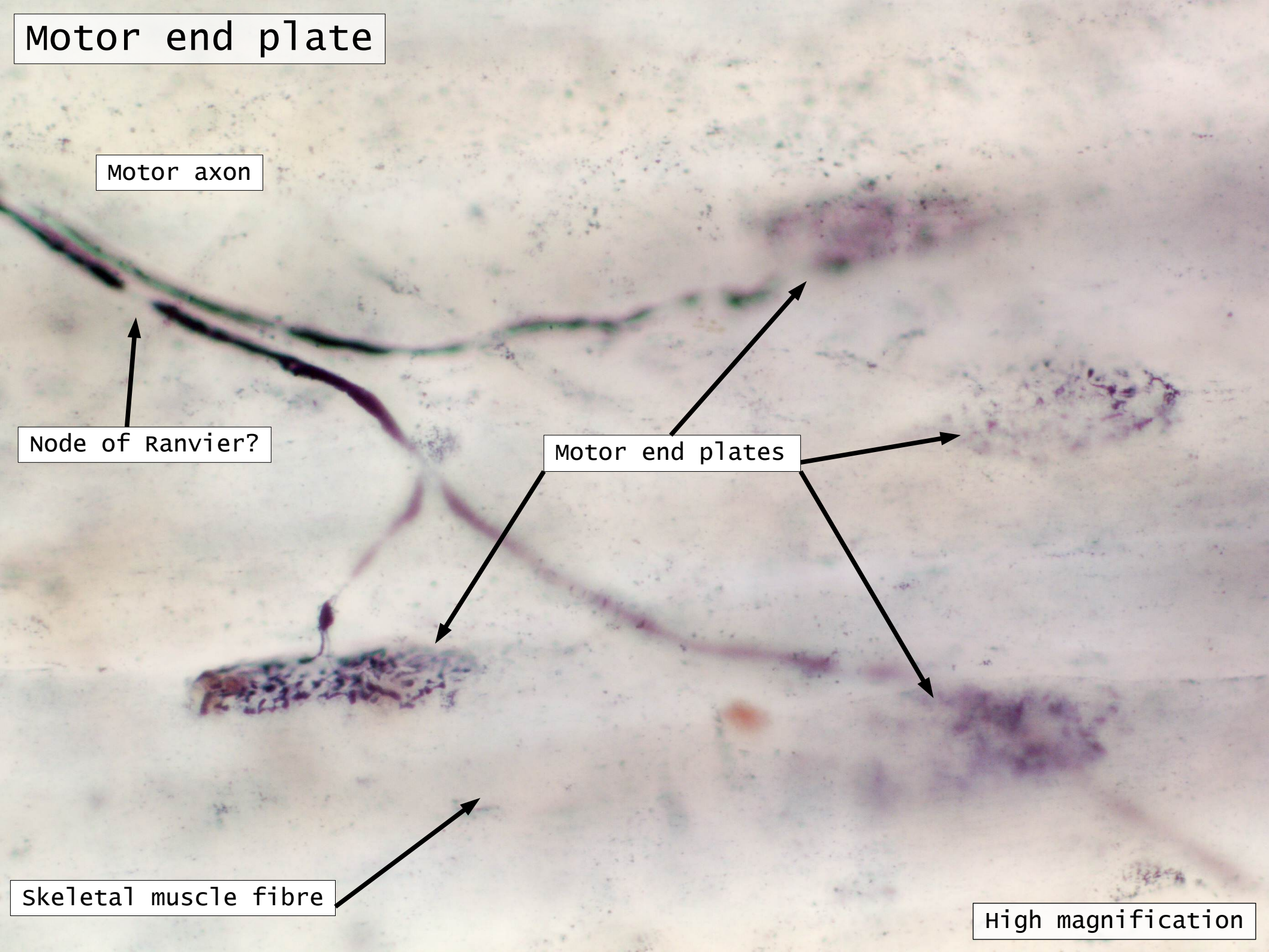

Myelin sheaths in a nerve bundle
Medium magnification


Myelin sheaths in a nerve bundle
Axon
Myelin sheath
Endoneurium
High magnification

Motor end plates

Slide 44


Motor end plate
Skeletal muscle fibres
Motor axon
Node of Ranvier?
Motor end plates
Medium magnification

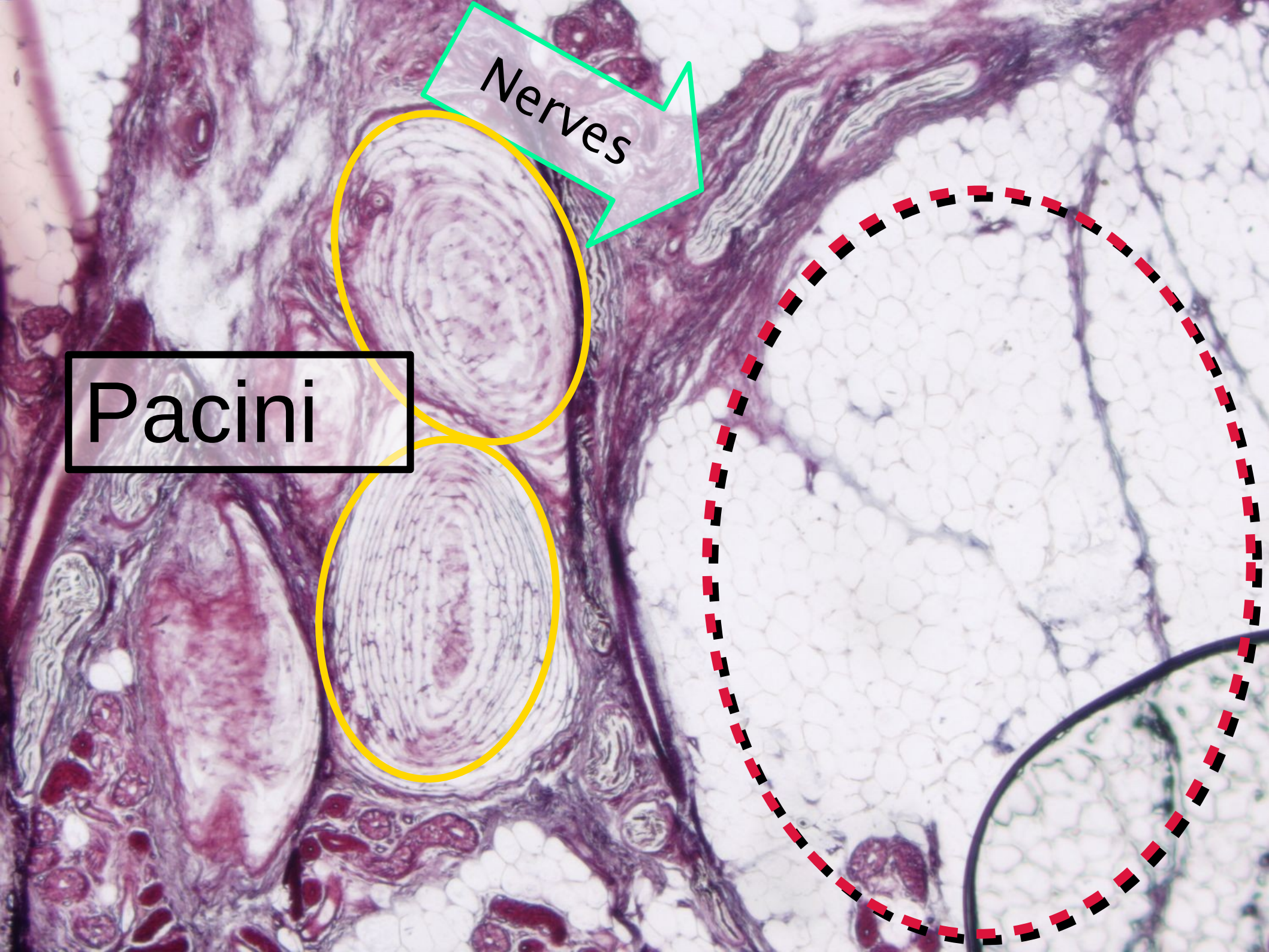

Motor end plate
Motor axon
Node of Ranvier?
Motor end plates
Skeletal muscle fibre
High magnification

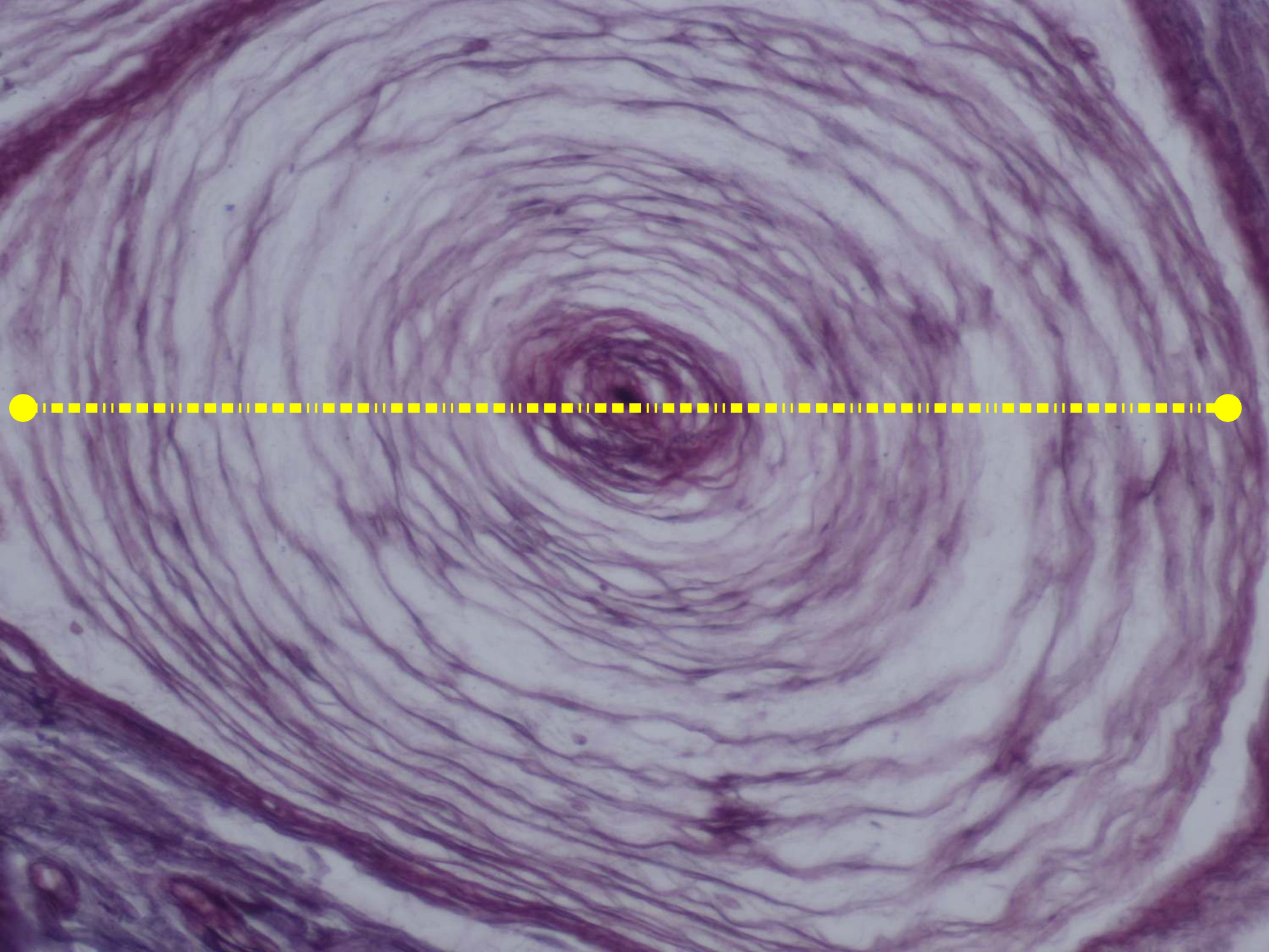

Skin

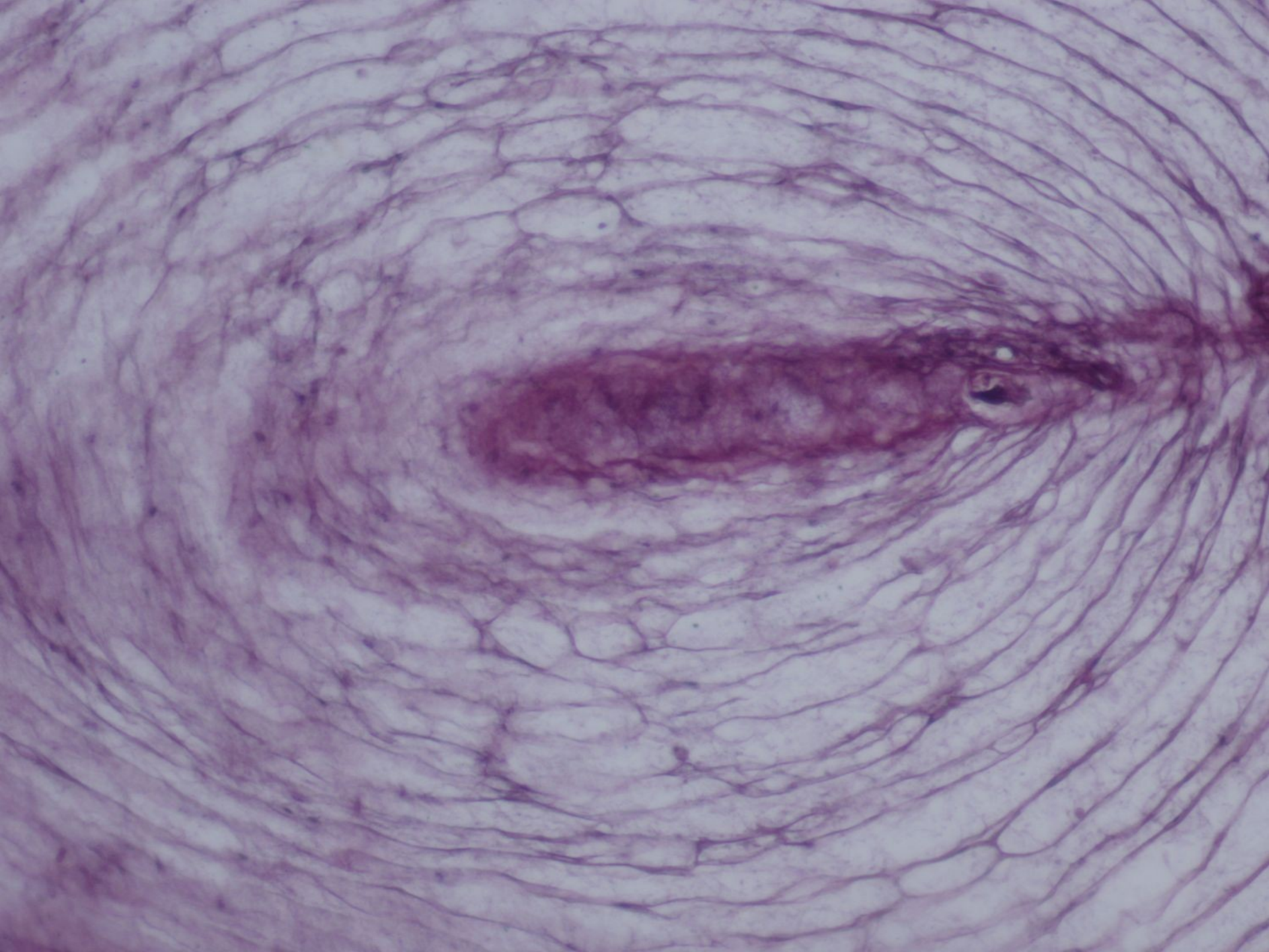
Palmar skin

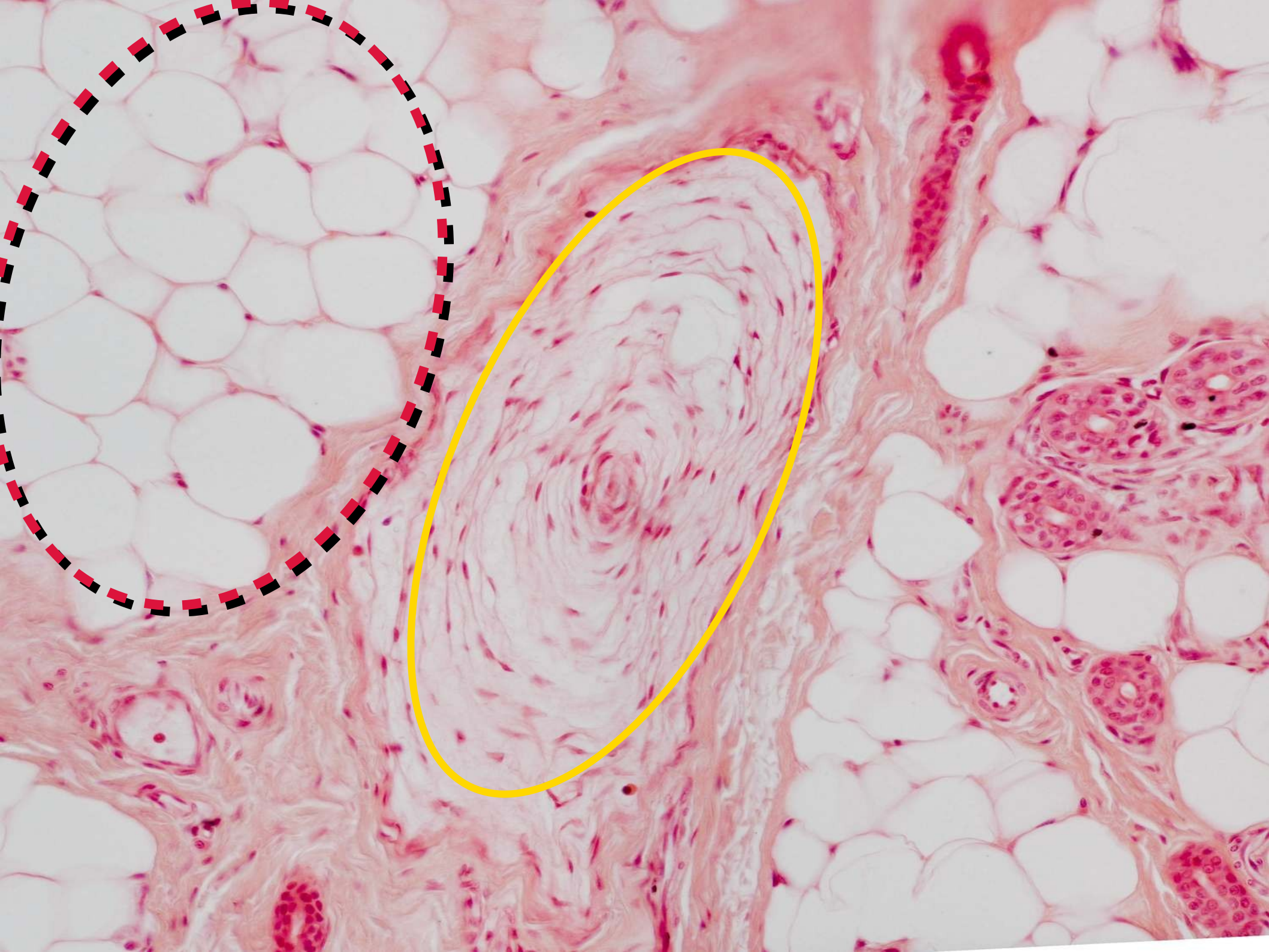
Slide 93

For
endothelium
stratified squamous keratinizing epithelium
adipose tissue
Nerve endings
loose connective tissue
dense irregular connective tissue


Nerves
Pacini



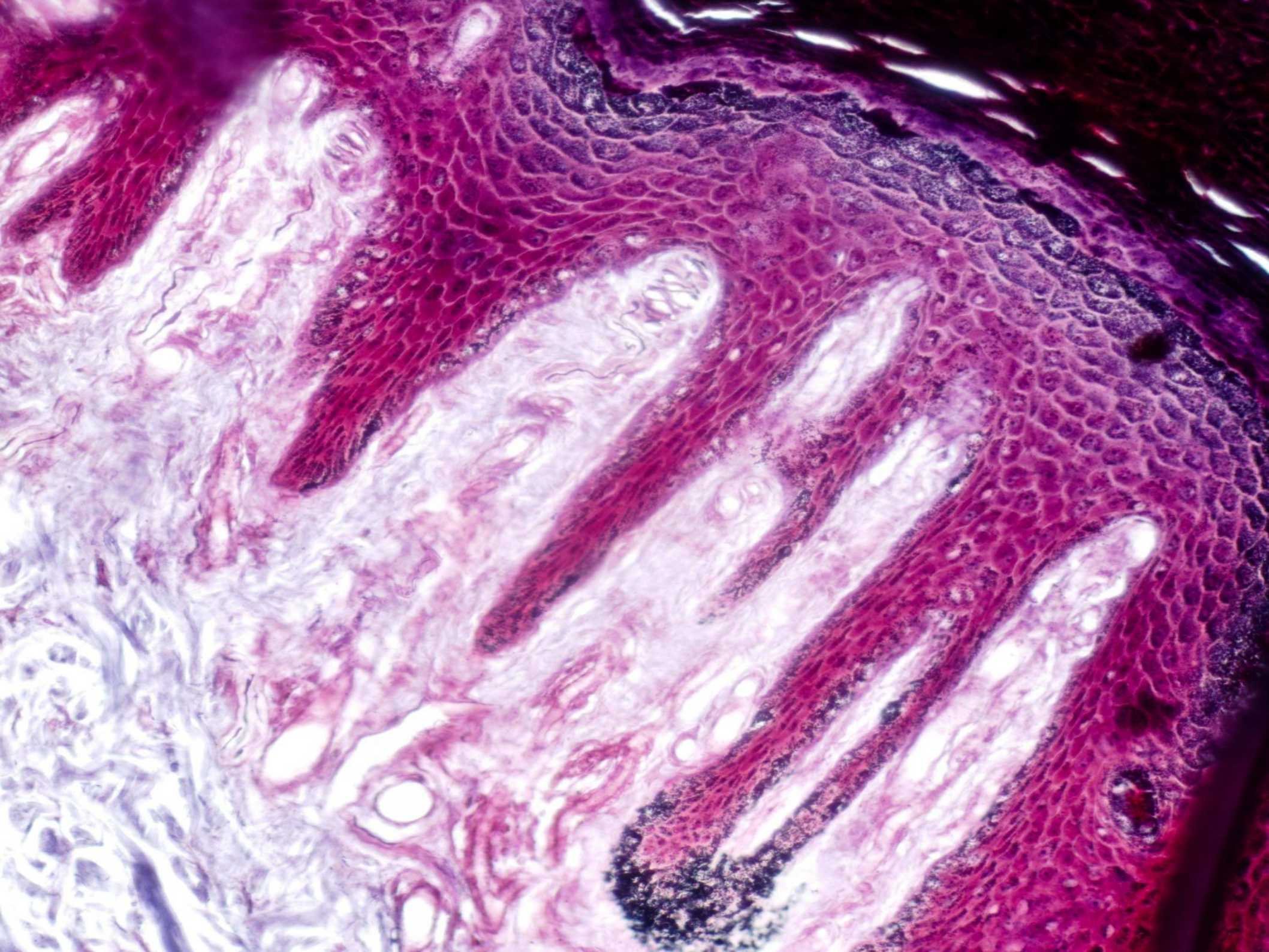


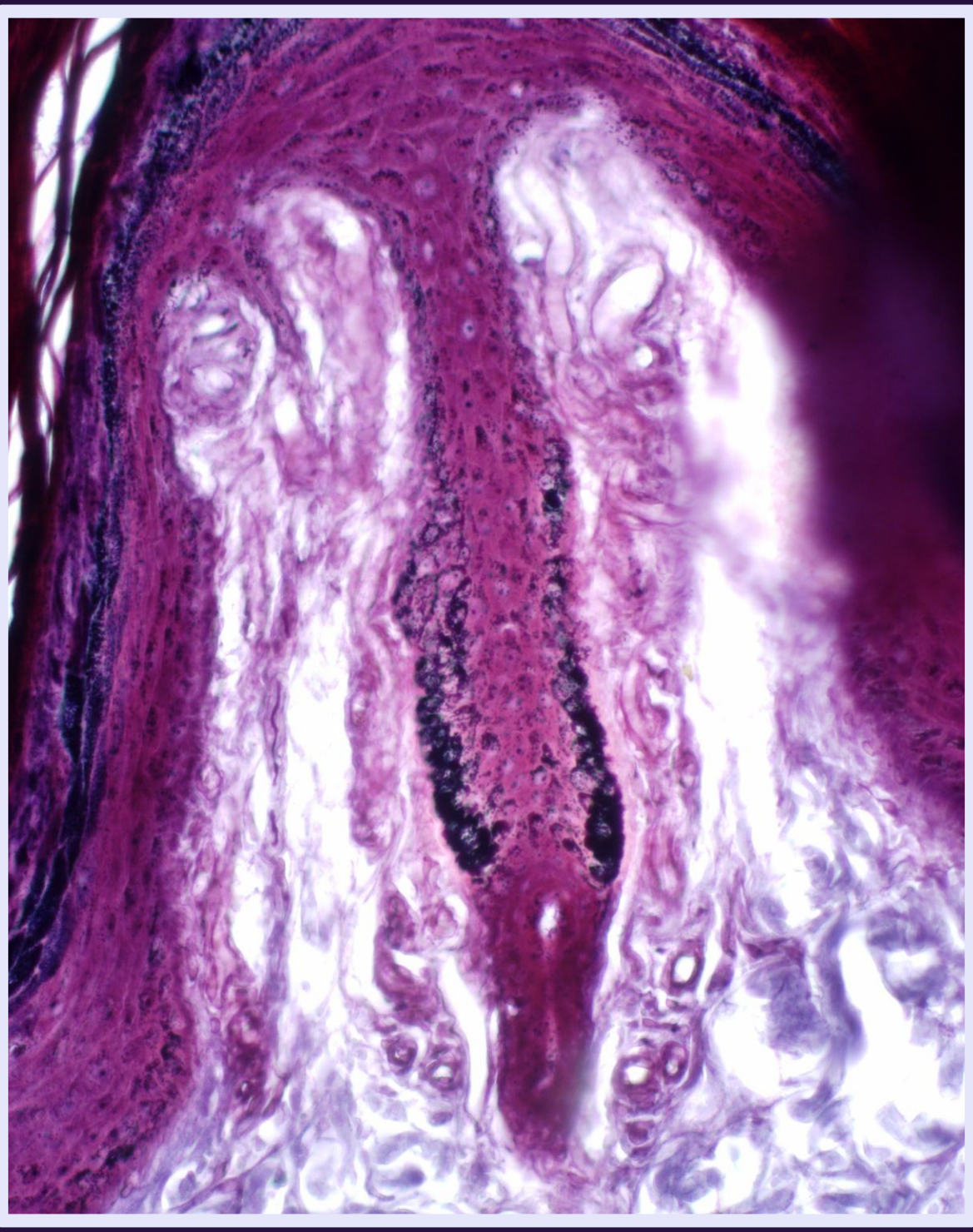


Meissner's corpuscle

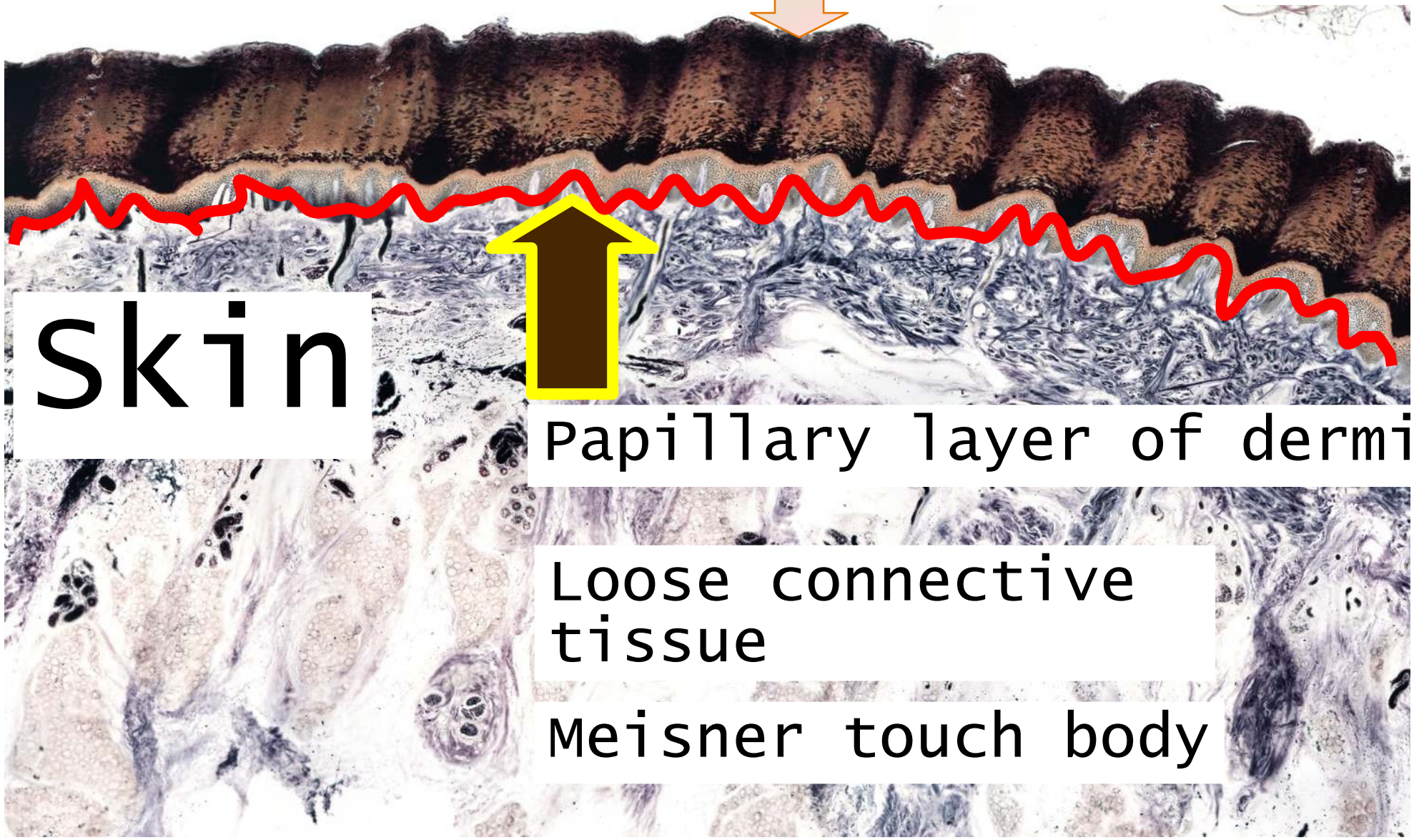
Slide 24

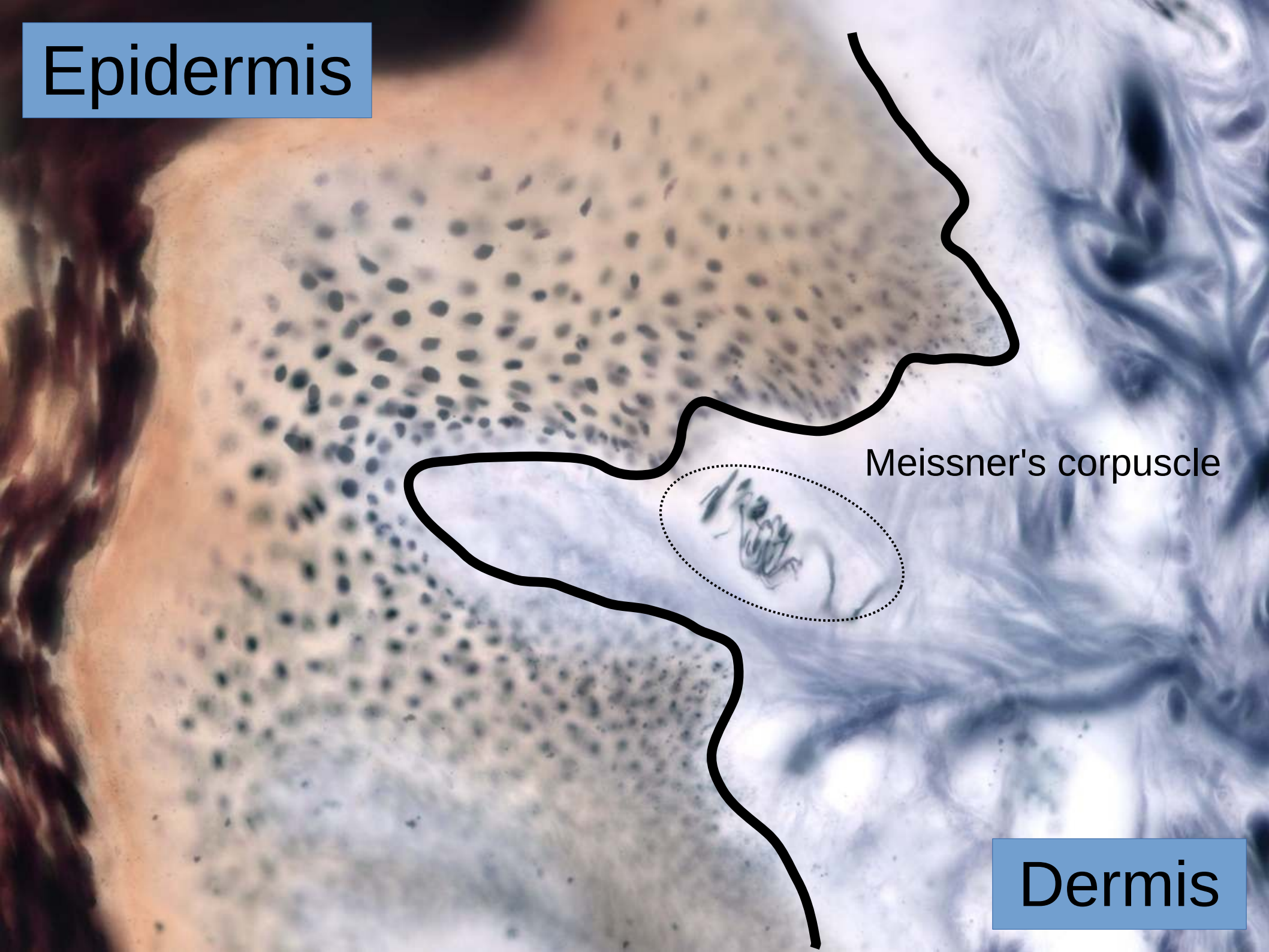
Skin





Stratified squamous keratinized epithelium



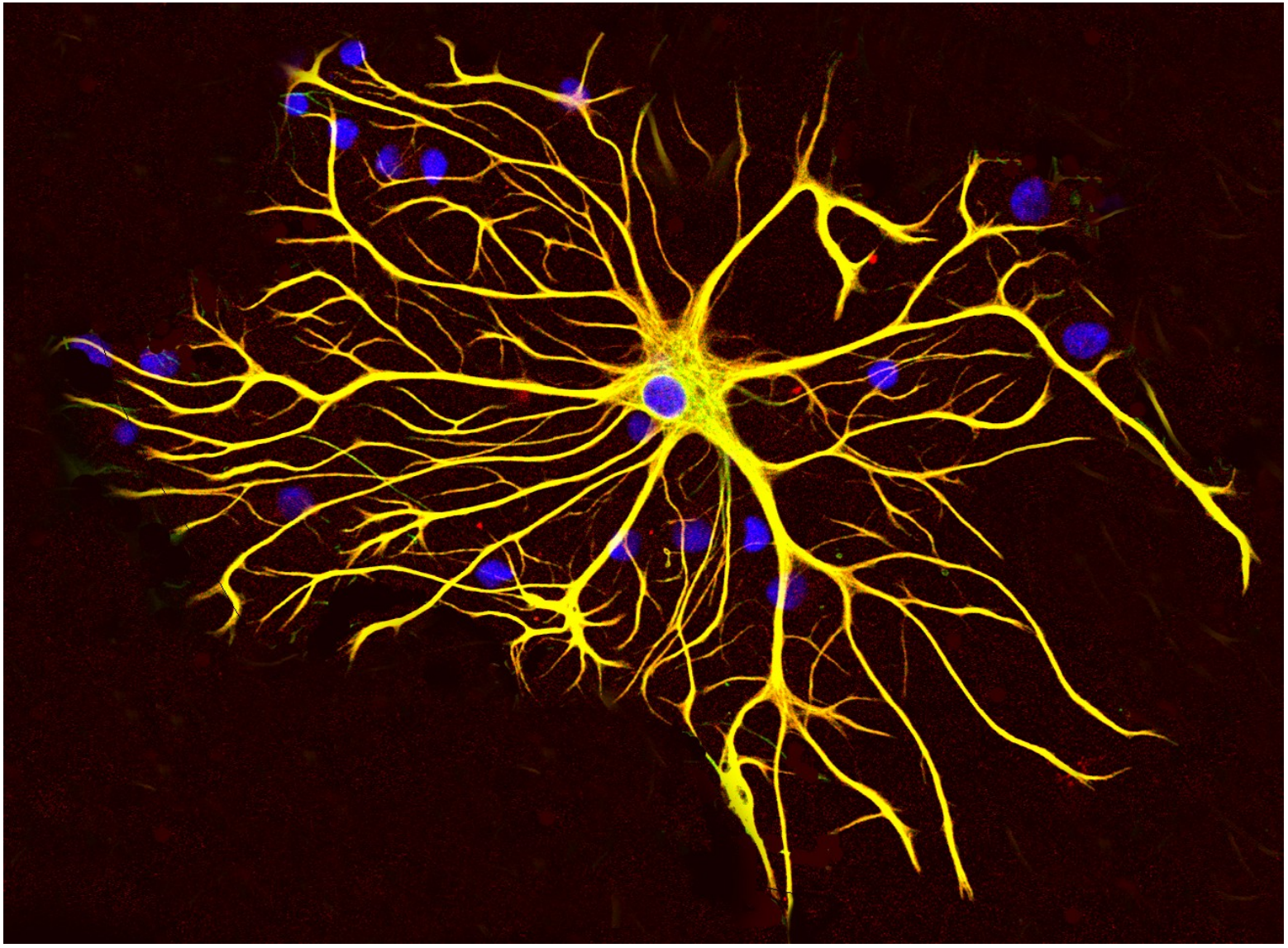

Epidermis
Meissner's corpuscle
Dermis

Cerebrum

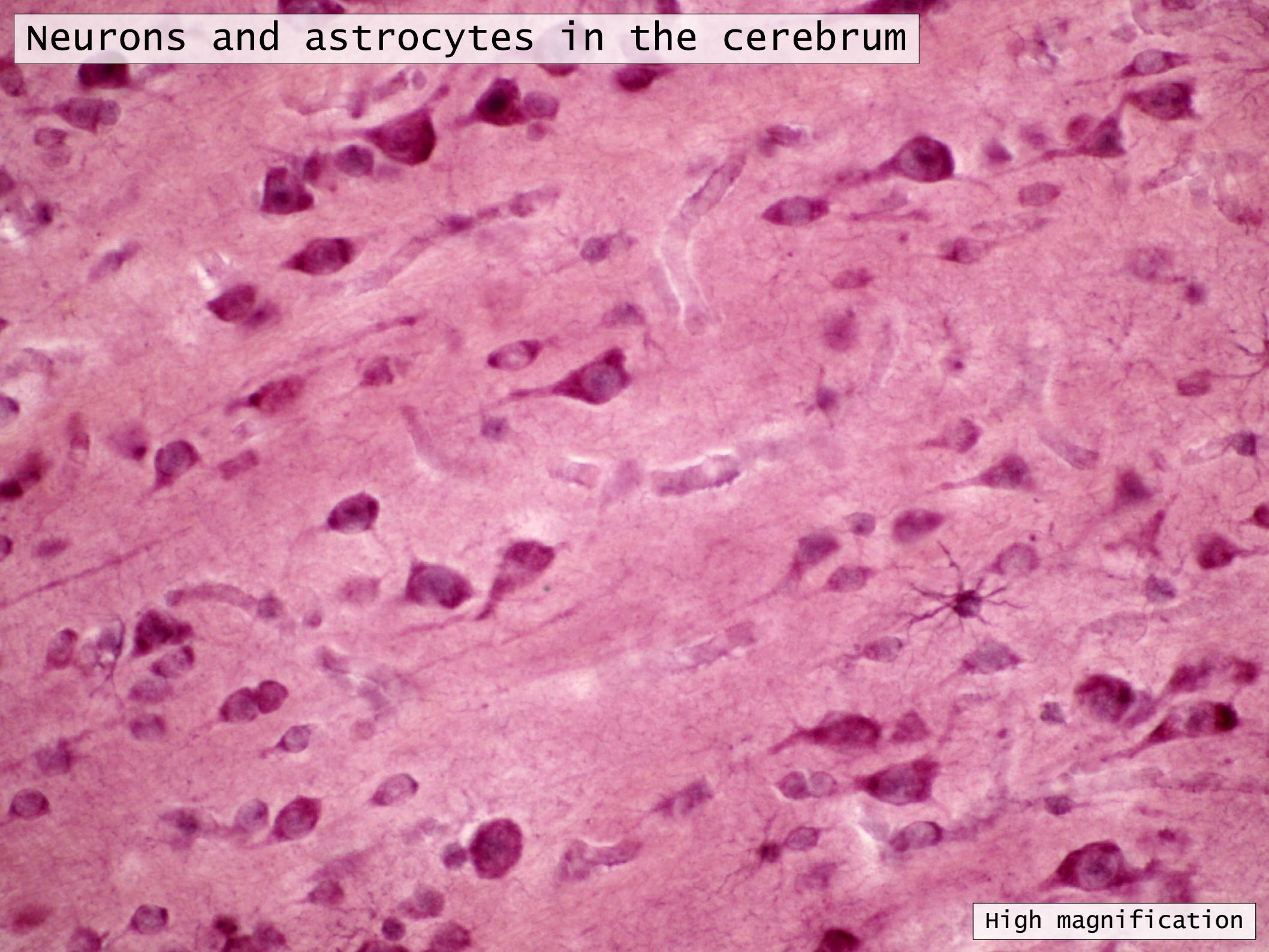
slide 61

For astrocytes

Astrocyte




Astrocytes in the cerebrum
High magnification


Neurons and astrocytes in the cerebrum
High magnification


Astrocyte
Very high magnification

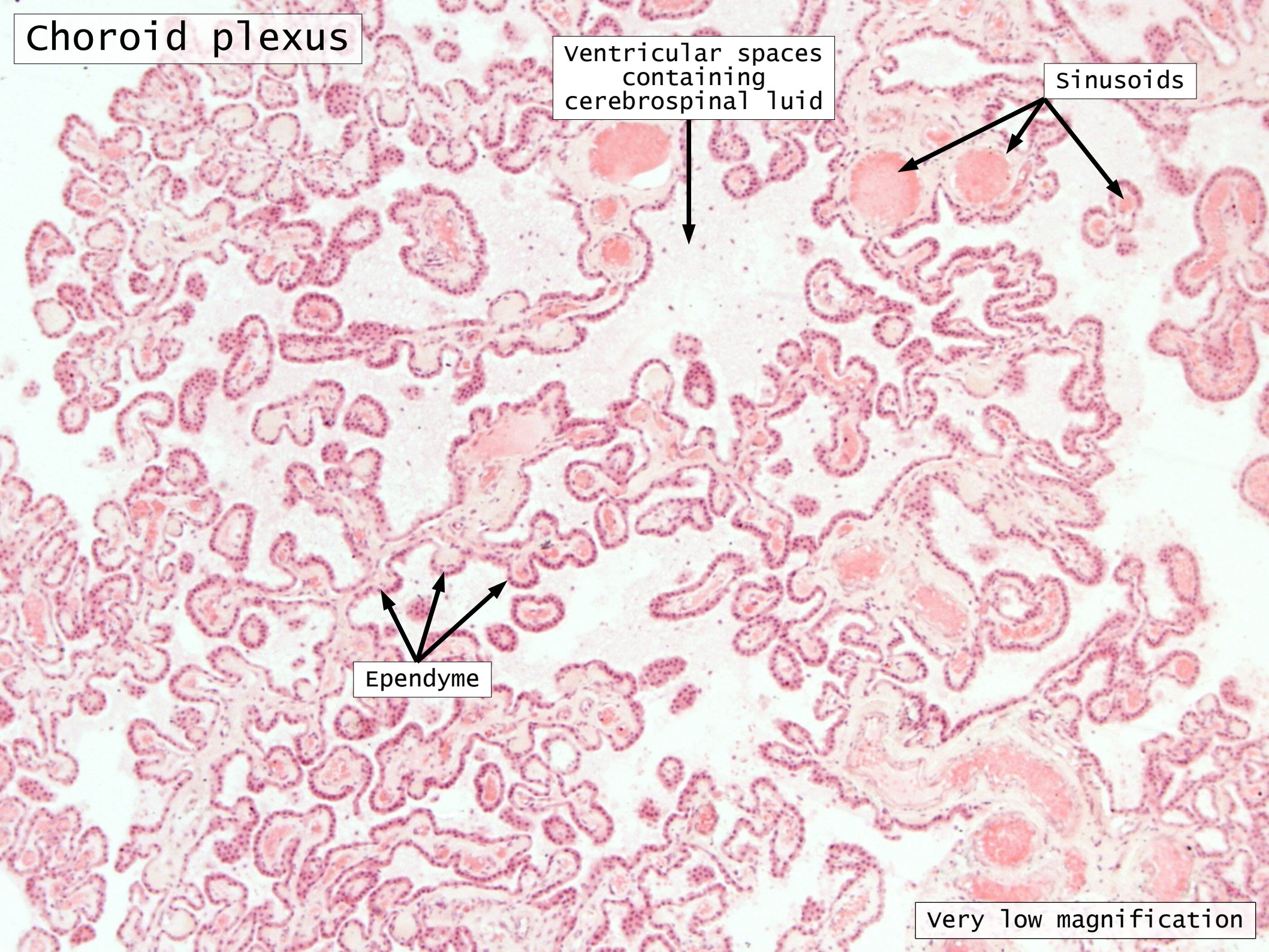
Ependyma

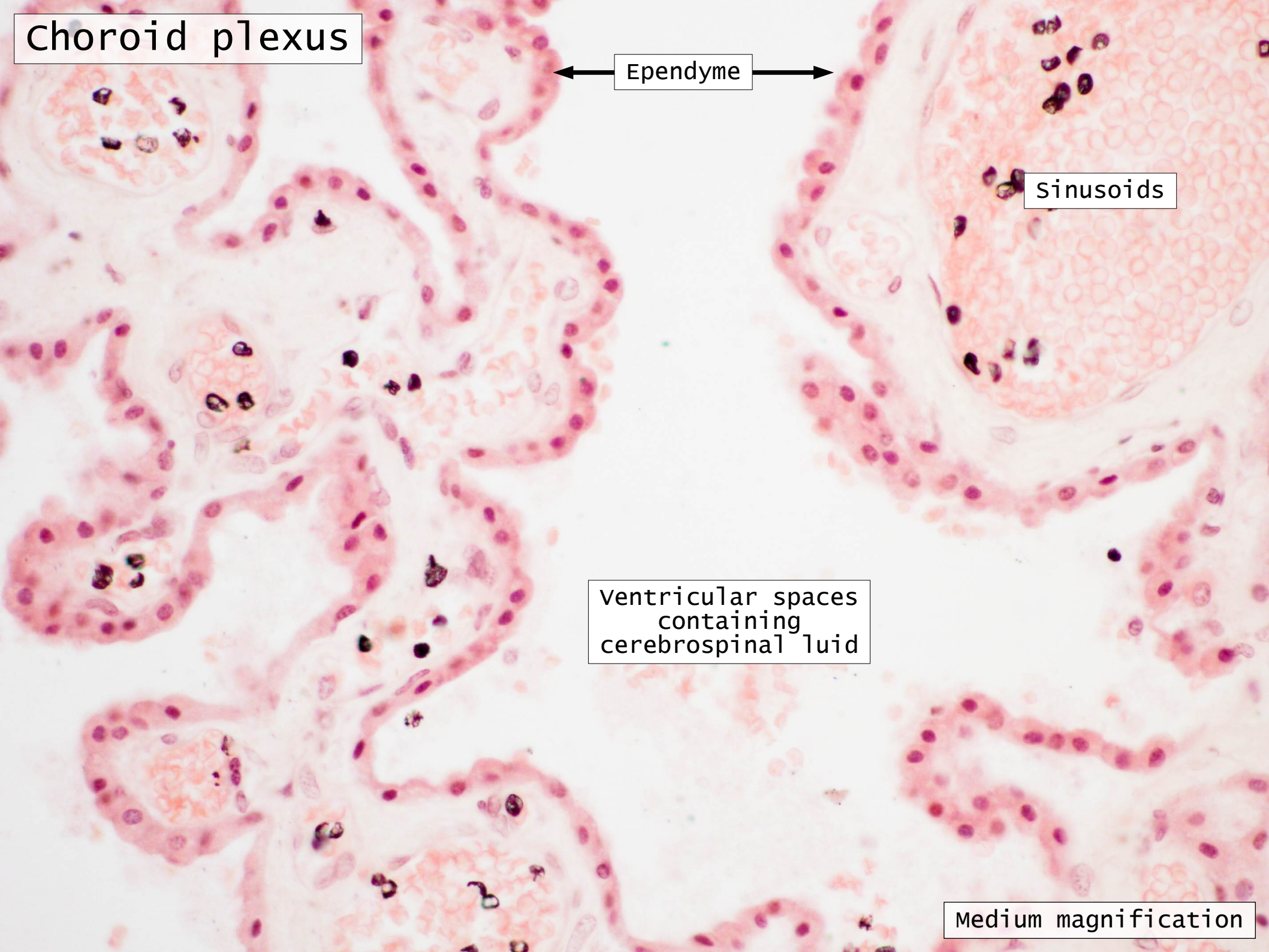
- Epithelium in brain
- Lines neural tube and ventricles
- Cuboidal to low columnar shape
- Cilia on free surface
- Produces cerebrospinal fluid (CSF)
- Cilia moves CSF

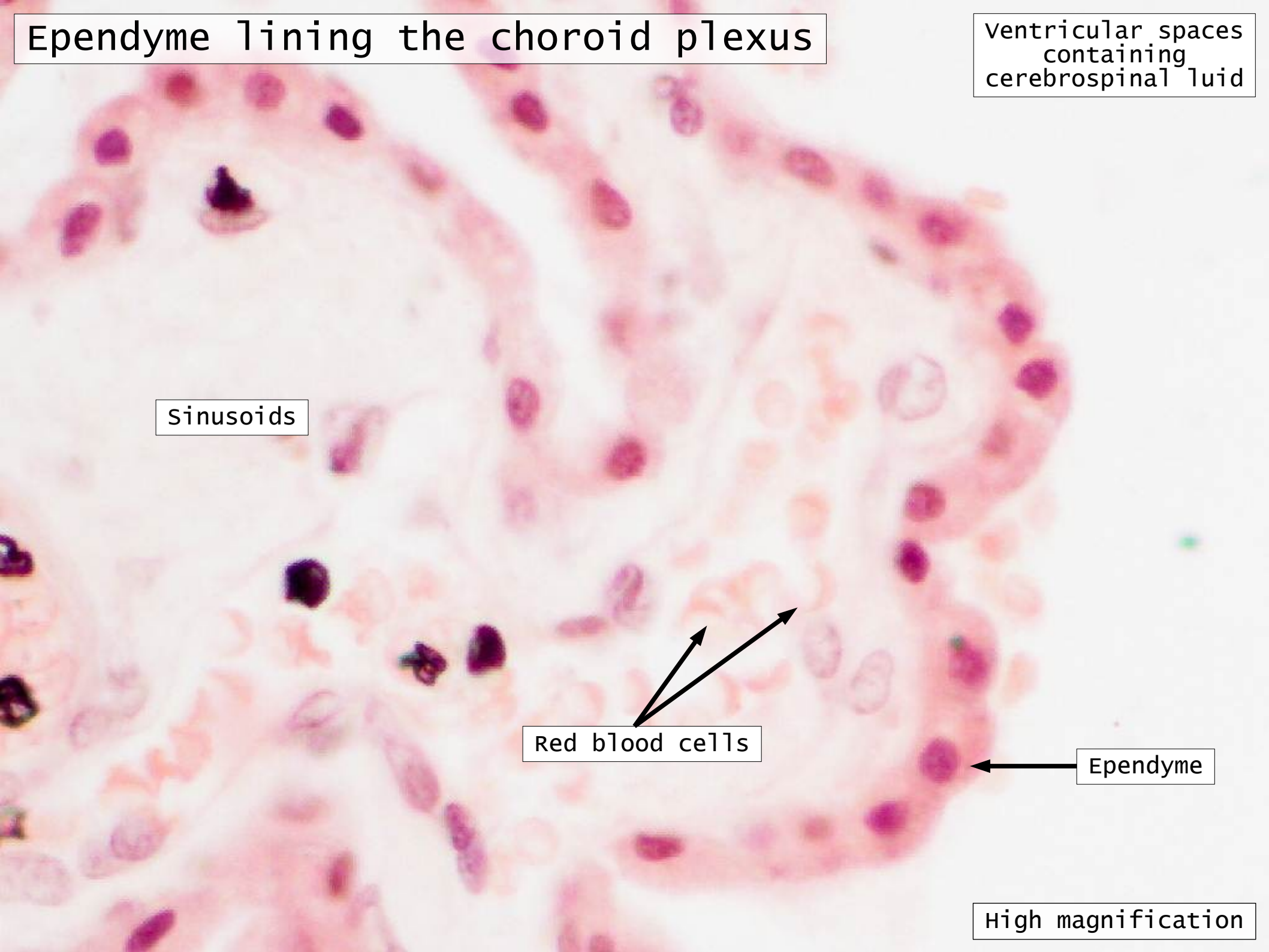
Choroid plexus

Slide 98

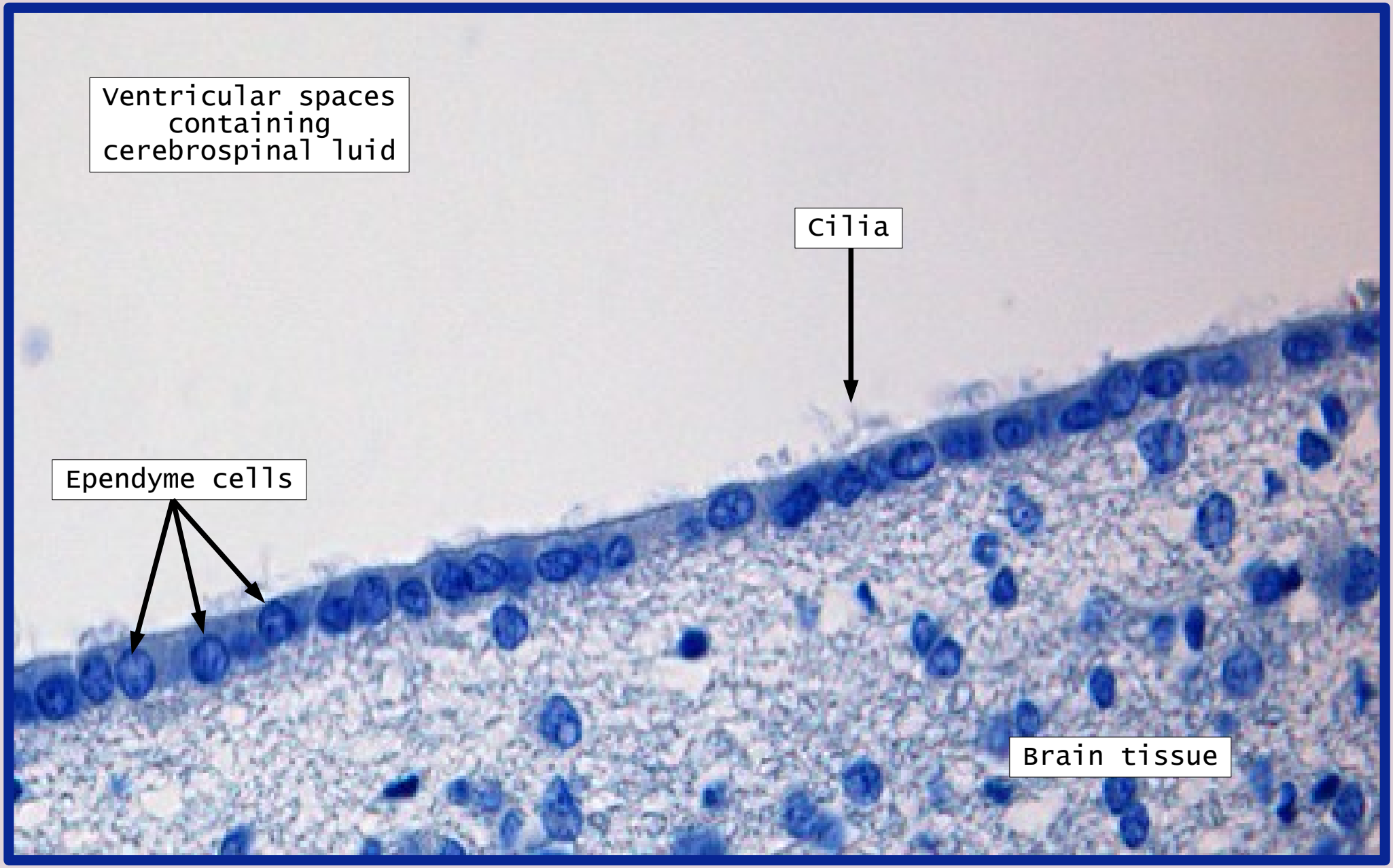
For ependyma


Choroid plexus
Ventricular spaces containing cerebrospinal luid
Sinusoids
Ependyme
Very low magnification


Choroid plexus
Ependyme
Sinusoids
Ventricular spaces containing cerebrospinal luid
Medium magnification


Ependyme lining the choroid plexus
Ventricular spaces containing cerebrospinal luid
Sinusoids
Red blood cells
Ependyme
High magnification

Ependyme lining the choroid plexus



Medium magnification