

Philosophy 1:

What is the least amount of
work I can do so I can get
out of here.

You vs Future You
There is a cost



Philosophy 2:

Today and Now

I will do something for my
future self.

Investment

4 slides

Thursday	Muscular artery and vein
Friday	Elastic artery
Saturday	Large vein
Sunday	Ductus thoracicus
Monday	Complete work
Tuesday/Wednesday	Revision

Date
Topic
slide description

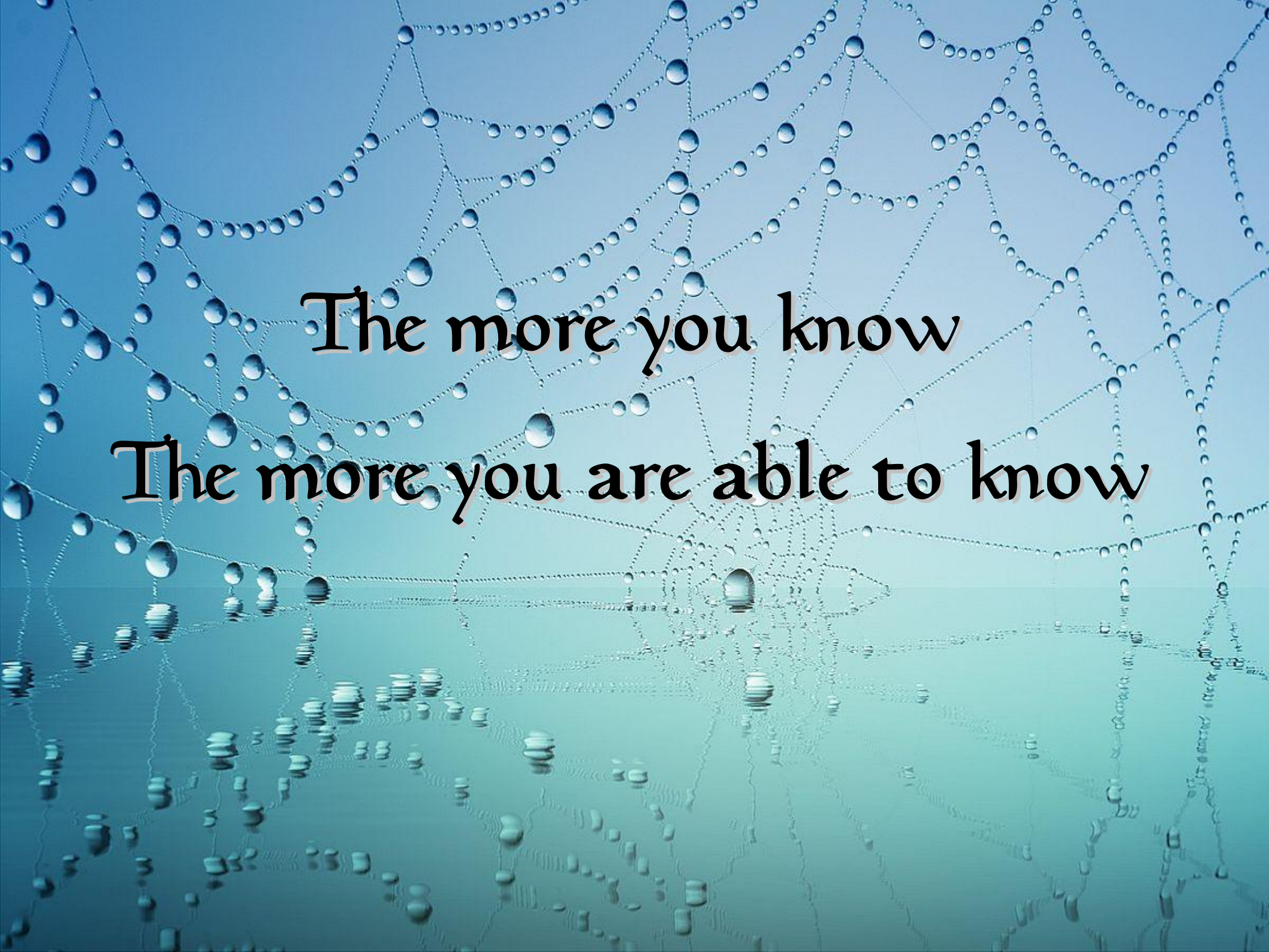
Create a context

slide 92 vs Large vein
which is more memorable?

Using tablets

PRINT!!!

and file
for disaster will happen



The more you know
The more you are able to know

Elaborate:

Tunica intima

∨

Epithelium = endothelium

Bulging/Flat

∨

Subendothelium

∨

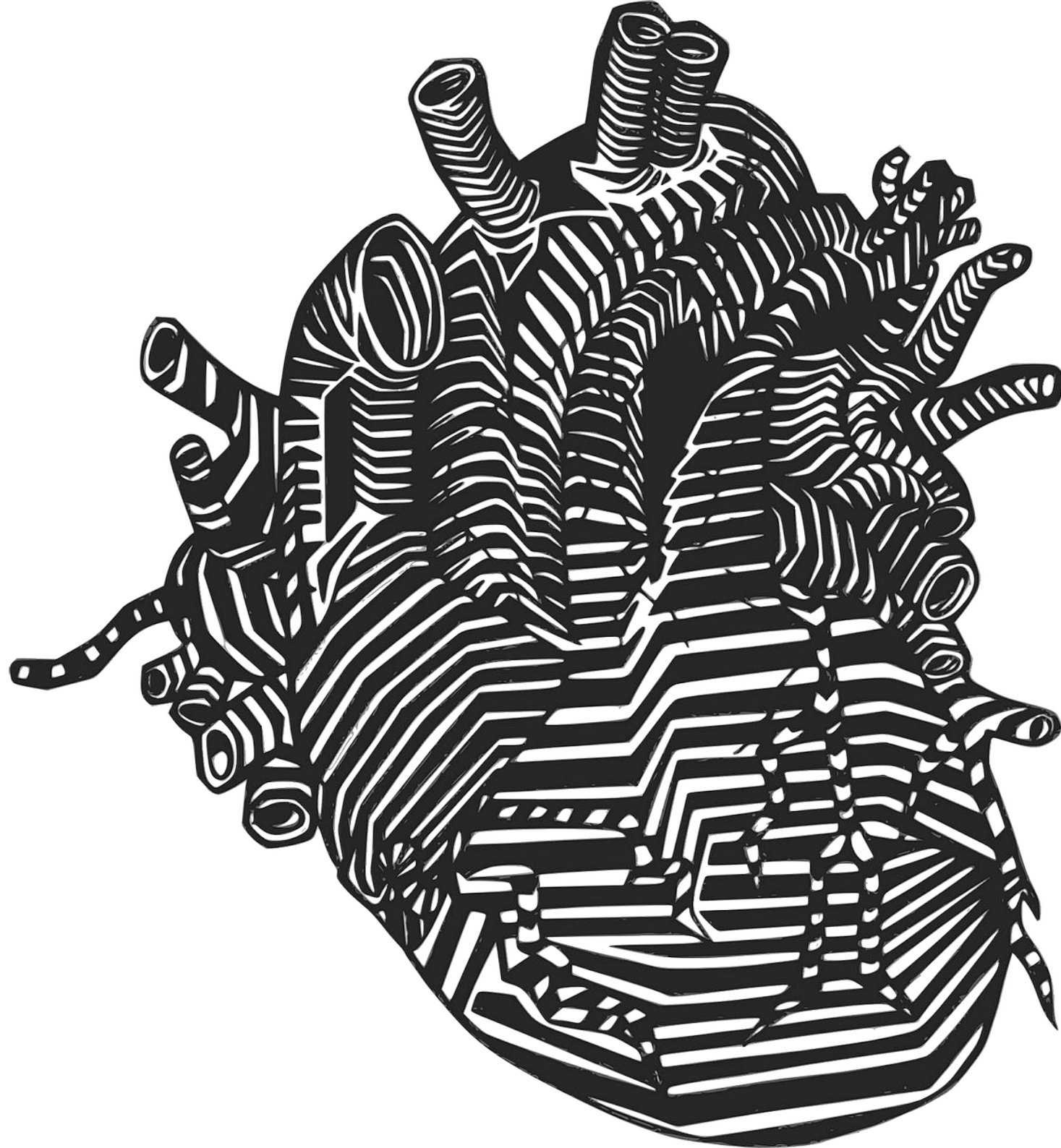
LEI

See X.Y

Content is connected

Concepts repeat

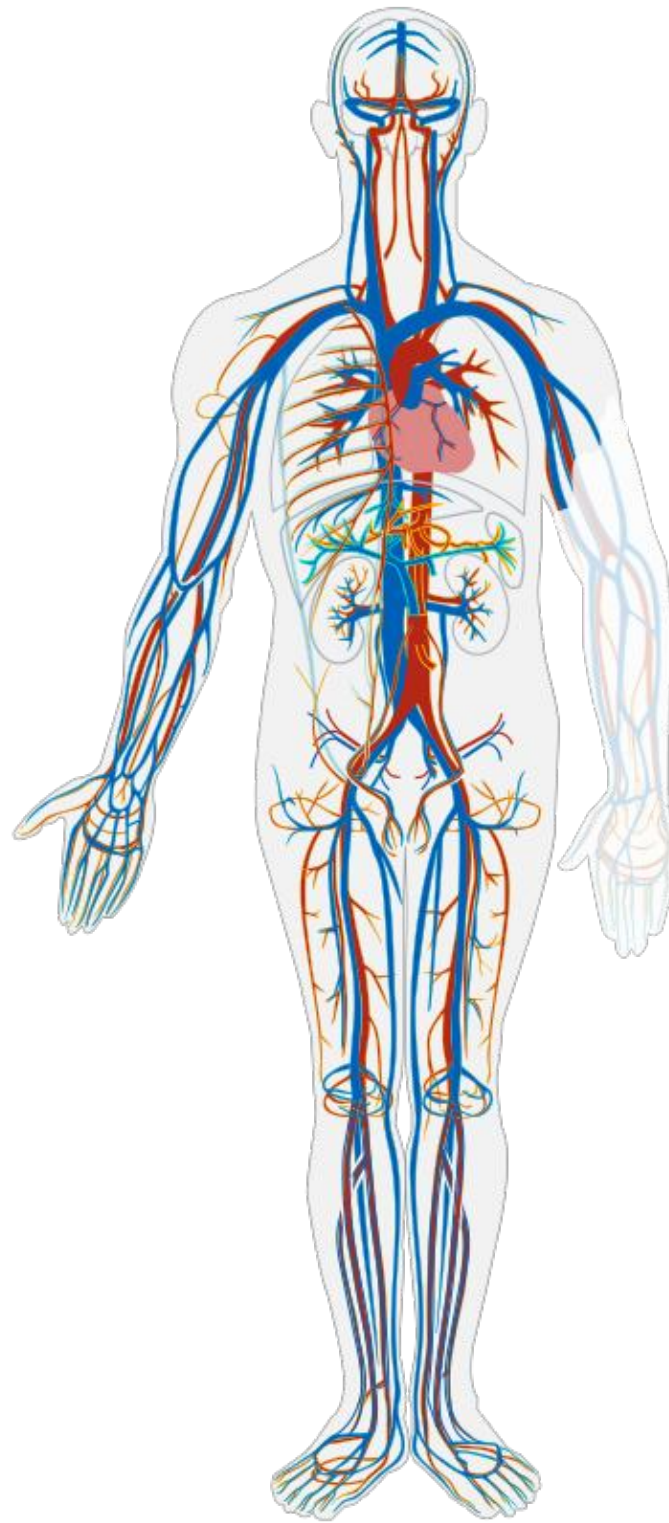
Existing knowledge matter



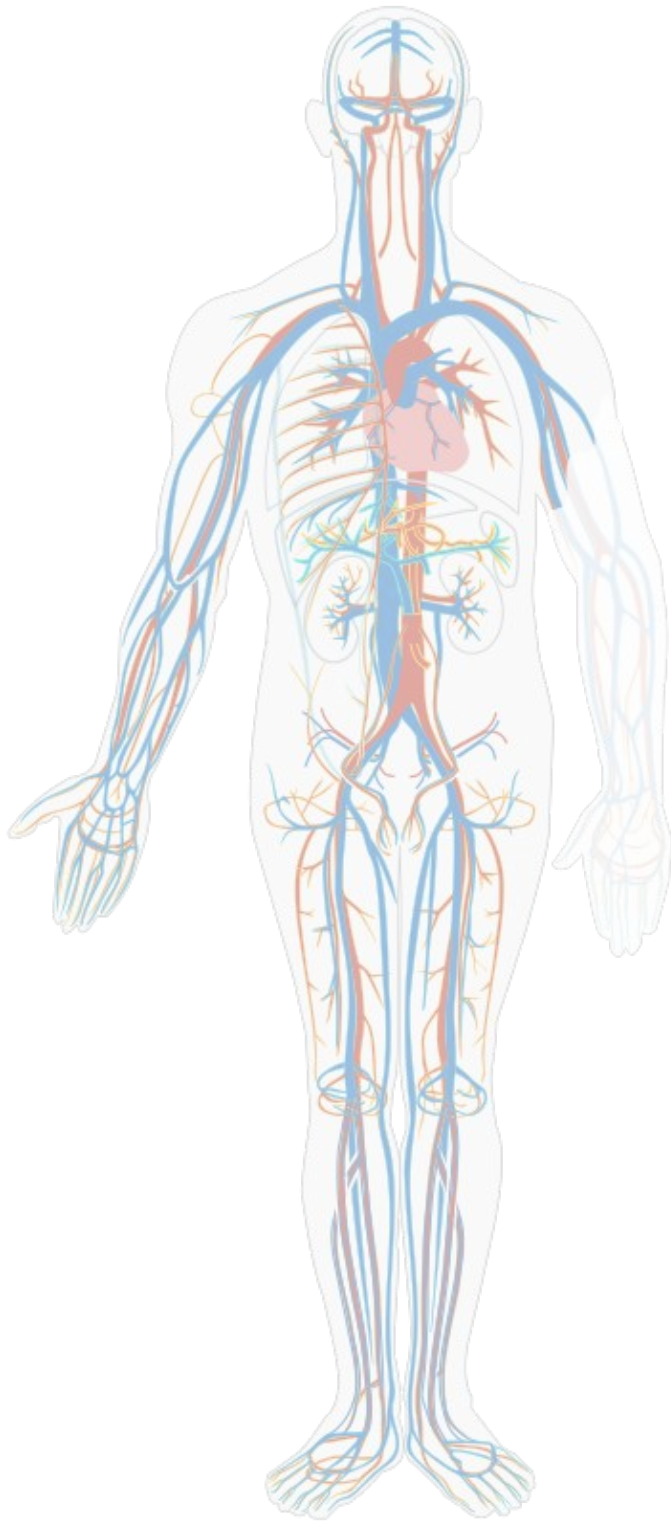
Retrieval Practise

Because it is what works to make it like cinnamon





Cardiovascular System



Transport system
of fluids in the body

Neurologic

Headaches
Dizziness
Encephalopathy
Guillain-Barré
Ageusia
Myalgia
Anosmia
Stroke

Renal

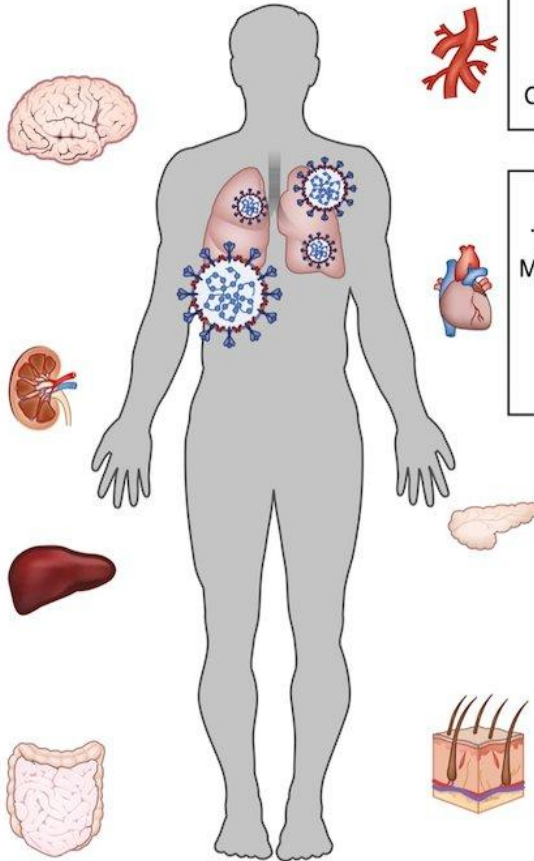
Acute kidney injury
Proteinuria
Hematuria

Hepatic

Elevated
aminotransferases
Elevated bilirubin

Gastrointestinal

Diarrhea
Nausea/vomiting
Abdominal pain
Anorexia



Thromboembolism

Deep vein thrombosis
Pulmonary embolism
Catheter-related thrombosis

Cardiac

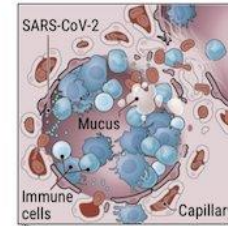
Takotsubo cardiomyopathy
Myocardial injury/myocarditis
Cardiac arrhythmias
Cardiogenic shock
Myocardial ischemia
Acute cor pulmonale

Endocrine

Hyperglycemia
Diabetic ketoacidosis

Dermatological

Petechiae
Livedo reticularis
Erythematous rash
Urticaria
Vesicles
Pernio-like lesions



1 Lungs

A cross section shows immune cells crowding an inflamed alveolus, whose walls break down during attack by the virus, diminishing oxygen uptake. Patients cough, fevers rise, and it takes more and more effort to breathe.

2 Liver

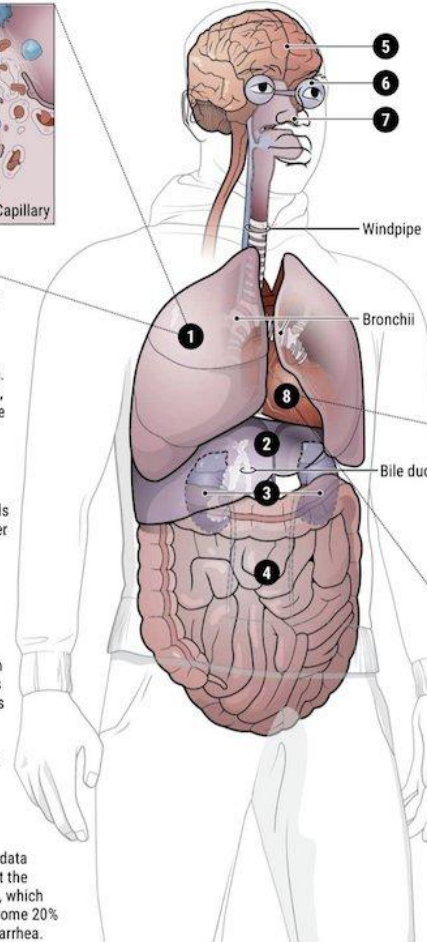
Up to half of hospitalized patients have enzyme levels that signal a struggling liver. An immune system in overdrive and drugs given to fight the virus may be causing the damage.

3 Kidneys

Kidney damage is common in severe cases and makes death more likely. The virus may attack the kidneys directly, or kidney failure may be part of whole-body events like plummeting blood pressure.

4 Intestines

Patient reports and biopsy data suggest the virus can infect the lower gastrointestinal tract, which is rich in ACE2 receptors. Some 20% or more of patients have diarrhea.



5 Brain

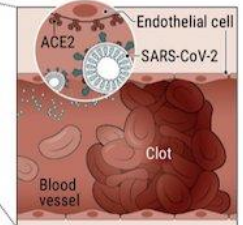
Some COVID-19 patients have strokes, seizures, mental confusion, and brain inflammation. Doctors are trying to understand which are directly caused by the virus.

6 Eyes

Conjunctivitis, inflammation of the membrane that lines the front of the eye and inner eyelid, is more common in the sickest patients.

7 Nose

Some patients lose their sense of smell. Scientists speculate that the virus may move up the nose's nerve endings and damage cells.



8 Heart and blood vessels

The virus (green) enters cells, likely including those lining blood vessels, by binding to ACE2 receptors on the cell surface. Infection can also promote blood clots, heart attacks, and cardiac inflammation.

Neurologic

Headaches
Dizziness
Encephalopathy
Guillain-Barré
Ageusia
Myalgia
Anosmia
Stroke

Renal

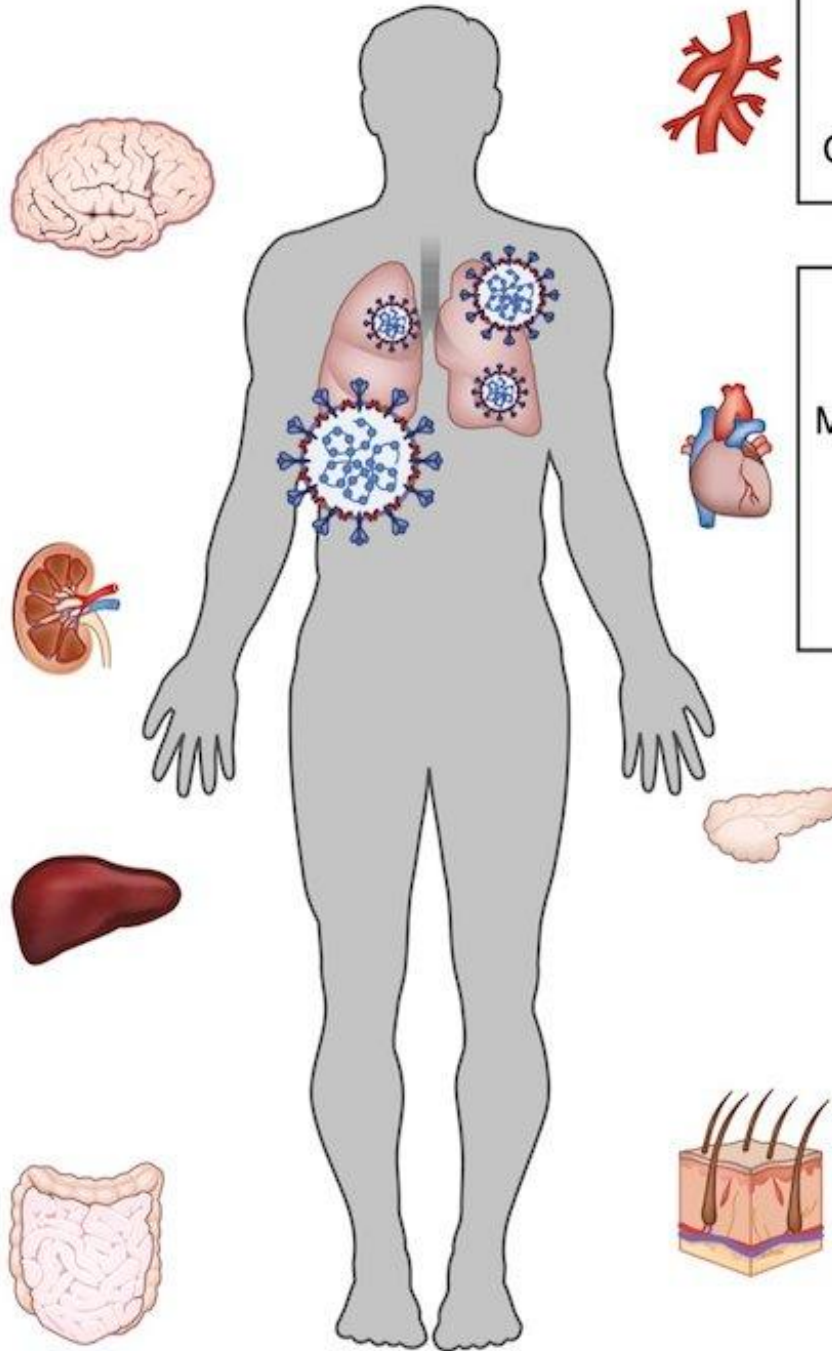
Acute kidney injury
Proteinuria
Hematuria

Hepatic

Elevated
aminotransferases
Elevated bilirubin

Gastrointestinal

Diarrhea
Nausea/vomiting
Abdominal pain
Anorexia



Thromboembolism

Deep vein thrombosis
Pulmonary embolism
Catheter-related thrombosis

Cardiac

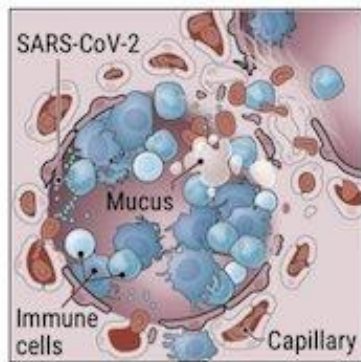
Takotsubo cardiomyopathy
Myocardial injury/myocarditis
Cardiac arrhythmias
Cardiogenic shock
Myocardial ischemia
Acute cor pulmonale

Endocrine

Hyperglycemia
Diabetic ketoacidosis

Dermatological

Petechiae
Livedo reticularis
Erythematous rash
Urticaria
Vesicles
Pernio-like lesions



1 Lungs

A cross section shows immune cells crowding an inflamed alveolus, whose walls break down during attack by the virus, diminishing oxygen uptake. Patients cough, fevers rise, and it takes more and more effort to breathe.

2 Liver

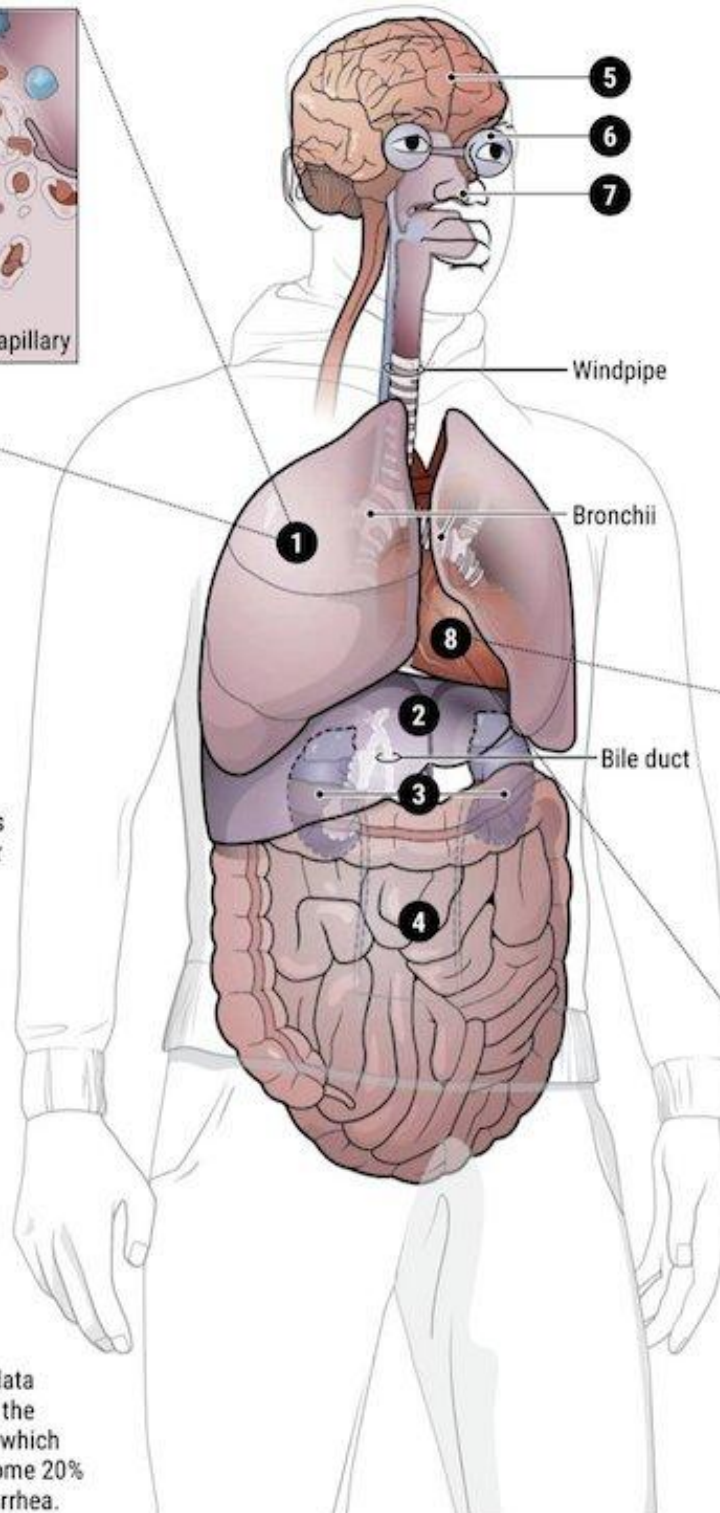
Up to half of hospitalized patients have enzyme levels that signal a struggling liver. An immune system in overdrive and drugs given to fight the virus may be causing the damage.

3 Kidneys

Kidney damage is common in severe cases and makes death more likely. The virus may attack the kidneys directly, or kidney failure may be part of whole-body events like plummeting blood pressure.

4 Intestines

Patient reports and biopsy data suggest the virus can infect the lower gastrointestinal tract, which is rich in ACE2 receptors. Some 20% or more of patients have diarrhea.



5 Brain

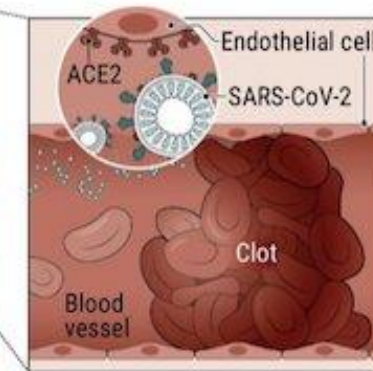
Some COVID-19 patients have strokes, seizures, mental confusion, and brain inflammation. Doctors are trying to understand which are directly caused by the virus.

6 Eyes

Conjunctivitis, inflammation of the membrane that lines the front of the eye and inner eyelid, is more common in the sickest patients.

7 Nose

Some patients lose their sense of smell. Scientists speculate that the virus may move up the nose's nerve endings and damage cells.



8 Heart and blood vessels

The virus (green) enters cells, likely including those lining blood vessels, by binding to ACE2 receptors on the cell surface. Infection can also promote blood clots, heart attacks, and cardiac inflammation.



NurseKelsey (she/her) 🌈

@nursekelsey

The first surge had so much kidney failure + respiratory failure. Did so much dialysis.

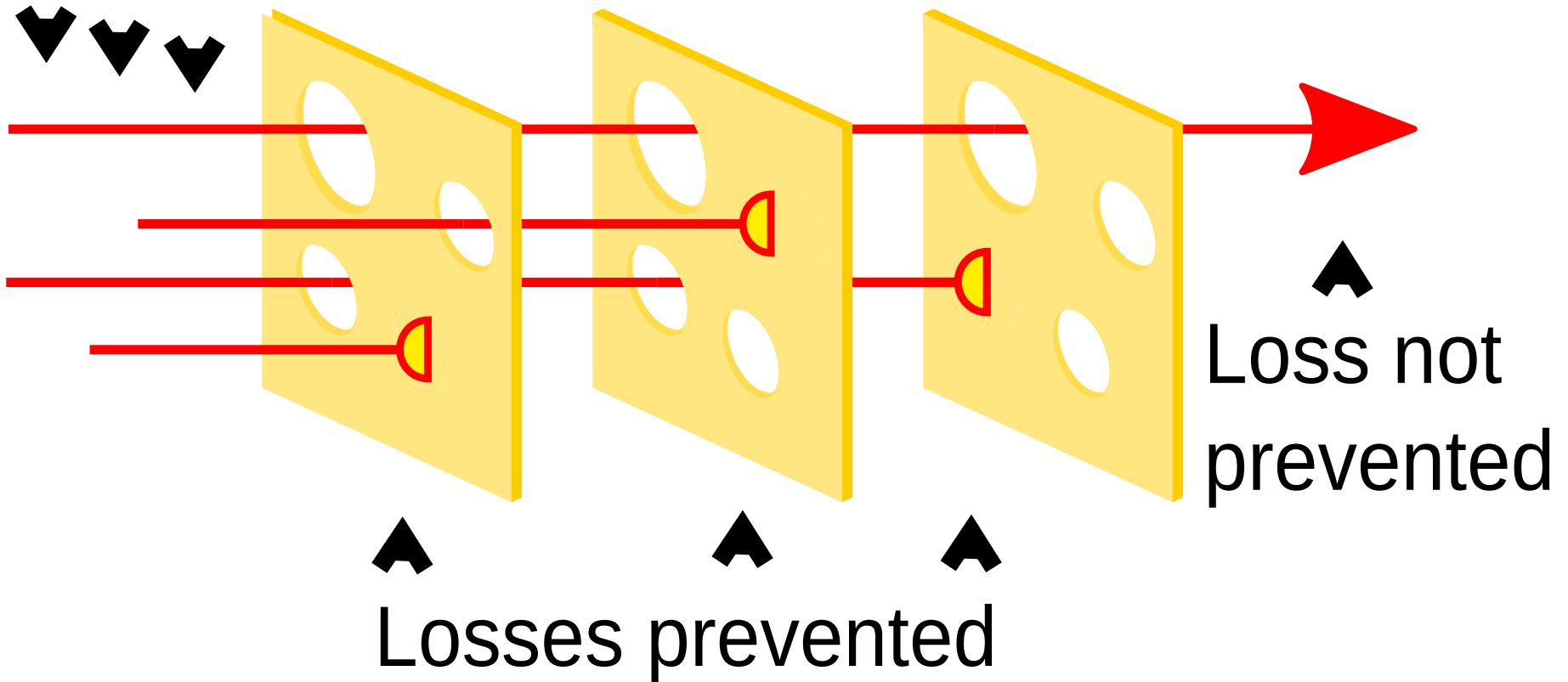
Delta was lung failure but less renal impact.

This surge seems less respiratory & more cardiac issues/heart failure/heart attacks/PEs.

THE EMMENTAL CHEESE MODEL

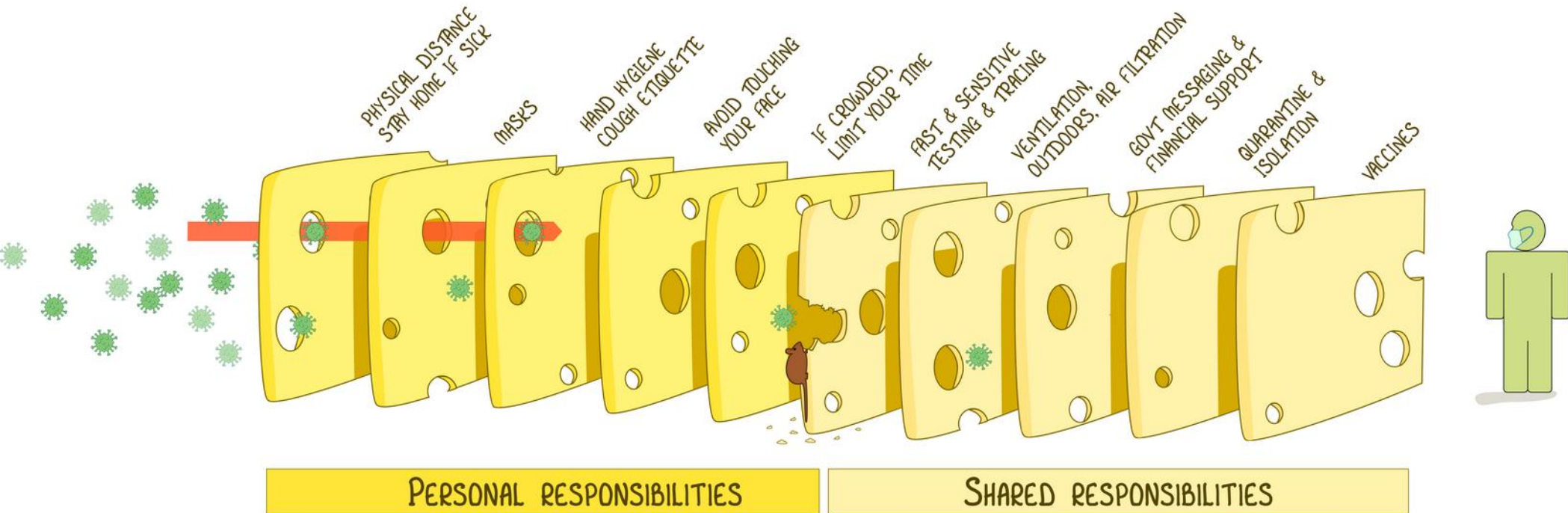
Protection: Swiss cheese model

Hazards



THE SWISS CHEESE RESPIRATORY VIRUS PANDEMIC DEFENCE

RECOGNISING THAT NO SINGLE INTERVENTION IS PERFECT AT PREVENTING SPREAD



EACH INTERVENTION (LAYER) HAS IMPERFECTIONS (HOLES).
MULTIPLE LAYERS IMPROVE SUCCESS.

IAN M MACKAY
VIROLOGYDOWNUNDER.COM
WITH THANKS TO JODY LANARD, KATHERINE ARDEN & THE UNI OF QLD
BASED ON THE SWISS CHEESE MODEL OF ACCIDENT CAUSATION, BY JAMES T REASON, 1990
VERSION 3.0
UPDATE: 24OCT2020

Words

adipose, adventitia, arteriole, artery, blood, bundle, capillary, capsule, cell, circular, collagen, compact, connective, continuous, cross, distribute, elastic, elastic, endothelium, erythrocyte, fenestrated, fiber, fine, flap, ganglion, hilus, inner, internal, interspersed, intima, laminae, large, layer, longitudinal, loose, lumen, lymph, lymphatic, media, medium, membrane, muscle, muscular, narrow, nerve, node, oblique, pericyte, perineurium, red blood cell, sinusoid, small, smooth, sphincter, sub-endothelium, sympathetic, terminal, thick, thin, tissue, transverse, tunica, unmyelinated, valve, vasa vasorum, vasomotor, vein, venule, vessel, wall

cells

erythrocyte

fat cell

nerve cell

pericyte

red blood cell

smooth muscle fiber

squamous cell

Tissues

adipose tissue
collagen fibres
elastic fibres
loose connective tissue
subendothelial connective tissue

Structures

arteriole, artery, capillary, capsule, continuous capillary, elastic laminae, endothelium, fenestrated capillary, internal elastic membrane, large vein, lumen, lymph node, lymph vessel, medium vein, muscular artery, nerve, nerve fiber, neurovascular bundle, perineurium, precapillary sphincter, sinusoidal capillary, sympathetic ganglion, tunica adventitia, tunica intima, tunica media, valve, vasa vasorum, vein, venule

Slides: Vessels

- Muscular artery and vein: Slide 69
- Muscular artery and vein: Slide 70
- Elastic artery: Slide 67
- Elastic artery: Slide 49
- Large vein: Slide 92
- Large vein: Slide 109
- Ductus thoracicus: Slide 75
- Ductus thoracicus: Slide 65

Slides: Accessory structure

- Semilunar valves in the blood vessels of cardiac muscle: Slide 47

Slides: Cardiac muscle

- Heart muscle (longitudinal section): slide 20
- Heart muscle (cross section): slide 77
- Heart muscle: slide 86

Question to ponder

- What would happen if ALL capillaries were filled with blood?
- How does “stuff”* get into and out of blood?
- *Stuff = gasses, nutrients, cells, molecules
- How does the type of epithelium in arteries, capillaries, veins and lymph vessels differ?
- Where does atherosclerosis happen?
- Where does aneurysms happen?

Comparison of arteries and veins

	Arteries	Veins
Direction of blood flow	Away from heart	Toward heart
General appearance	Rounded	Irregular, often collapsed
Pressure	High	Low
Wall thickness	Thick	Thin
Relative O ₂ concentration	High systemic Low pulmonary	Low systemic High pulmonary
Valves	Not present	Common limbs and veins inferior to heart

- Apply above framework to slides
- what is visible?
- what can be expected?5

Objective

- Compare and contrast the three tunics
- Distinguish between:
 - Elastic arteries and muscular arteries
 - Arteries and veins
- Identify capillaries
- Identify lymphatic vessels
- Identify nerves
- Identify small associated features
- Describe the functioning of the capillary bed
- Describe portal systems
- Describe end-arteries

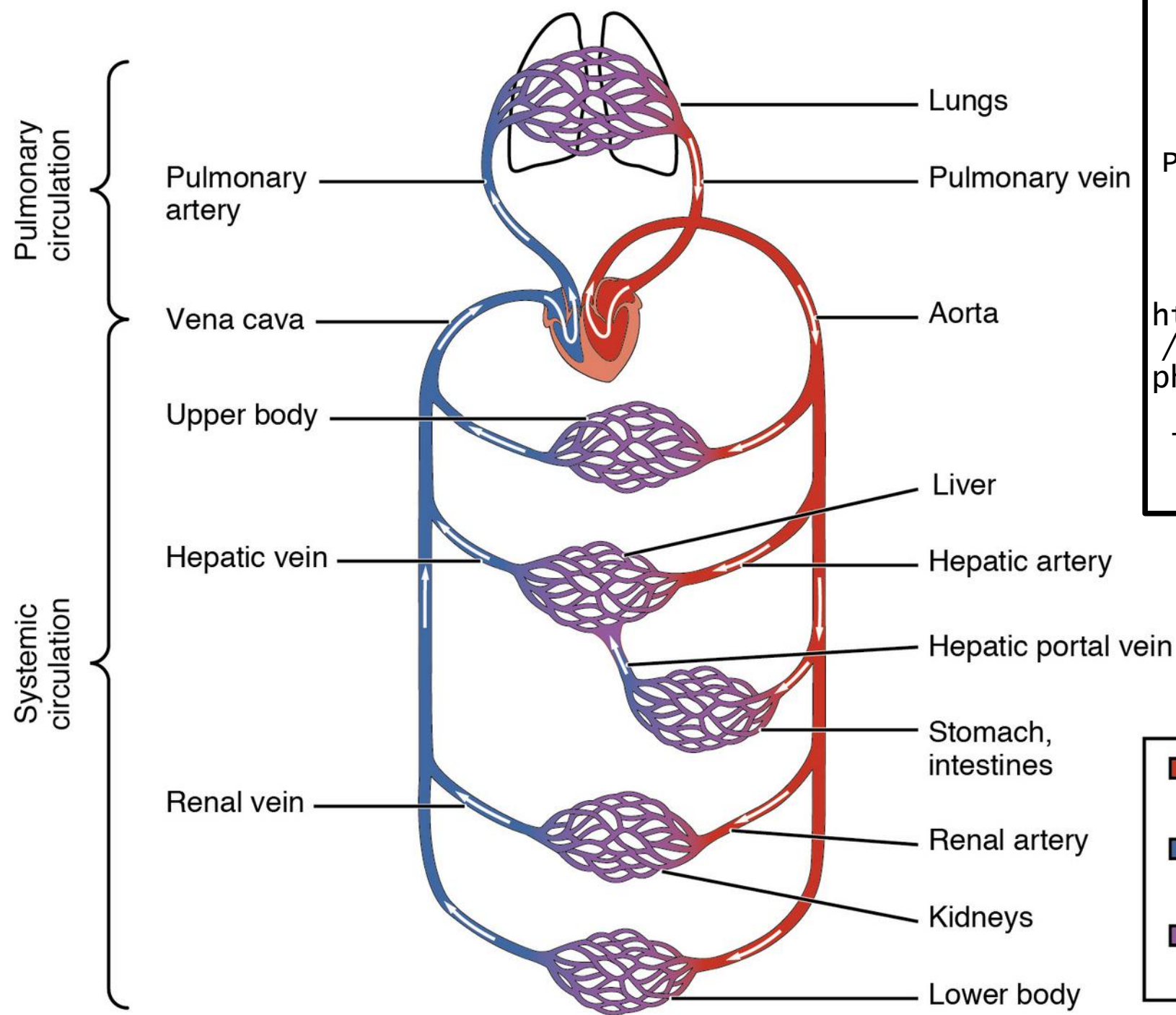
Cardiovascular system

- O₂ and nutrients are distributed by blood which the heart pumps through the blood vessels
- Lymphatic system collects surplus tissue fluid as lymph

Figure 20.2
Cardiovascular
Circulation

Anatomy and
Physiology 25 April
2013

OpenStax
CC-A 4.0;
[https://openstax.org/
books/anatomy-and-
physiology/pages/20-
1-structure-and-
function-of-blood-
vessels](https://openstax.org/books/anatomy-and-physiology/pages/20-1-structure-and-function-of-blood-vessels)



- Vessels transporting oxygenated blood
- Vessels transporting deoxygenated blood
- Vessels involved in gas exchange

Cardiovascular System 1/2

- Heart
 - Combined 2 sided pump
 - Cardiac muscle fibers
- Elastic arteries
 - Receive blood under pressure from heart
 - Elastic fibers
- Muscular arteries
 - Distribute blood
 - Smooth muscle
- Arterioles
 - Reduce pressure
 - Artery with narrow lumen

Cardiovascular System 2/2

- Capillaries
 - Facilitate interchange
 - Thin walls
- Metarterioles
 - Rapid bypass of capillaries
 - Blood pressure regulation
- Venules
 - Looks like wide capillaries
 - During acute inflammation produce plasma and leucocyte exudate
- Veins
 - Return blood to heart

General organisation

- Three concentric coats (tunics)
- Tunica intima
- Tunica media
- Tunica adventitia

Tunica intima

- Blood vessels
 - Lining membrane = endothelium
 - Underlying basement membrane (BM)
 - Variable amount subendothelial connective tissue (CT)
 - Internal elastic lamina
 - Absent some small vessels
- Heart
 - Tunica intima = endocardium
 - Endothelium and CT

Tunica media

- Blood vessels
 - Two components as concentric layers
 - Smooth muscle fibers
 - Elastic fibers
 - Absent in smaller vessels
- Heart
- Highly developed muscle layer
 - Myocardium

Tunica adventitia

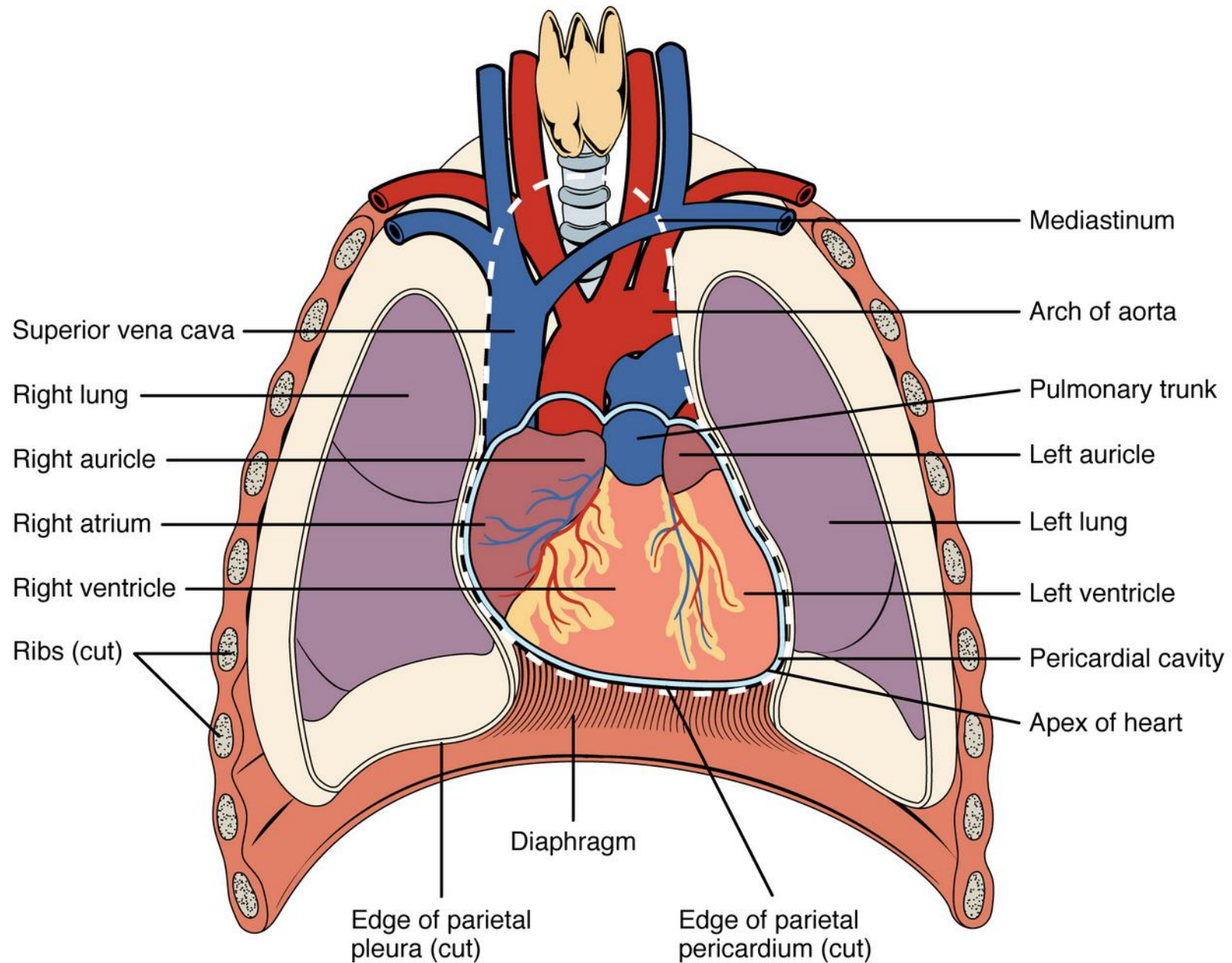
- Blood vessels
 - Loose CT
 - Some smooth muscle cells
 - Own blood vessels
 - Vasa vasorum
- Heart
 - Epicardium
 - CT + mesothelium

Heart

- Endocardium = tunica intima
 - Endothelium
 - BM
 - Loose CT
 - Dense CT
 - Fat cells
 - Branches of impulse conducting system
 - Merge with endomysium of myocardium
- Myocardium = tunica media
 - Cardiac muscle fibers
 - Endomysial loose CT
 - Contains capillaries and lymphatics
- Epicardium
 - Fibroelastic CT
 - Blood vessels, lymphatics, Nerve fibers, fat tissue
 - Blends with endomysium
 - Mesothelium
 - Squamous epithelial cells
- Pericardial cavity
- Pericardium
- Serous pericardium
 - Mesothelial serous lining
- Fibrous pericardium
 - Fibro-elastic external layer

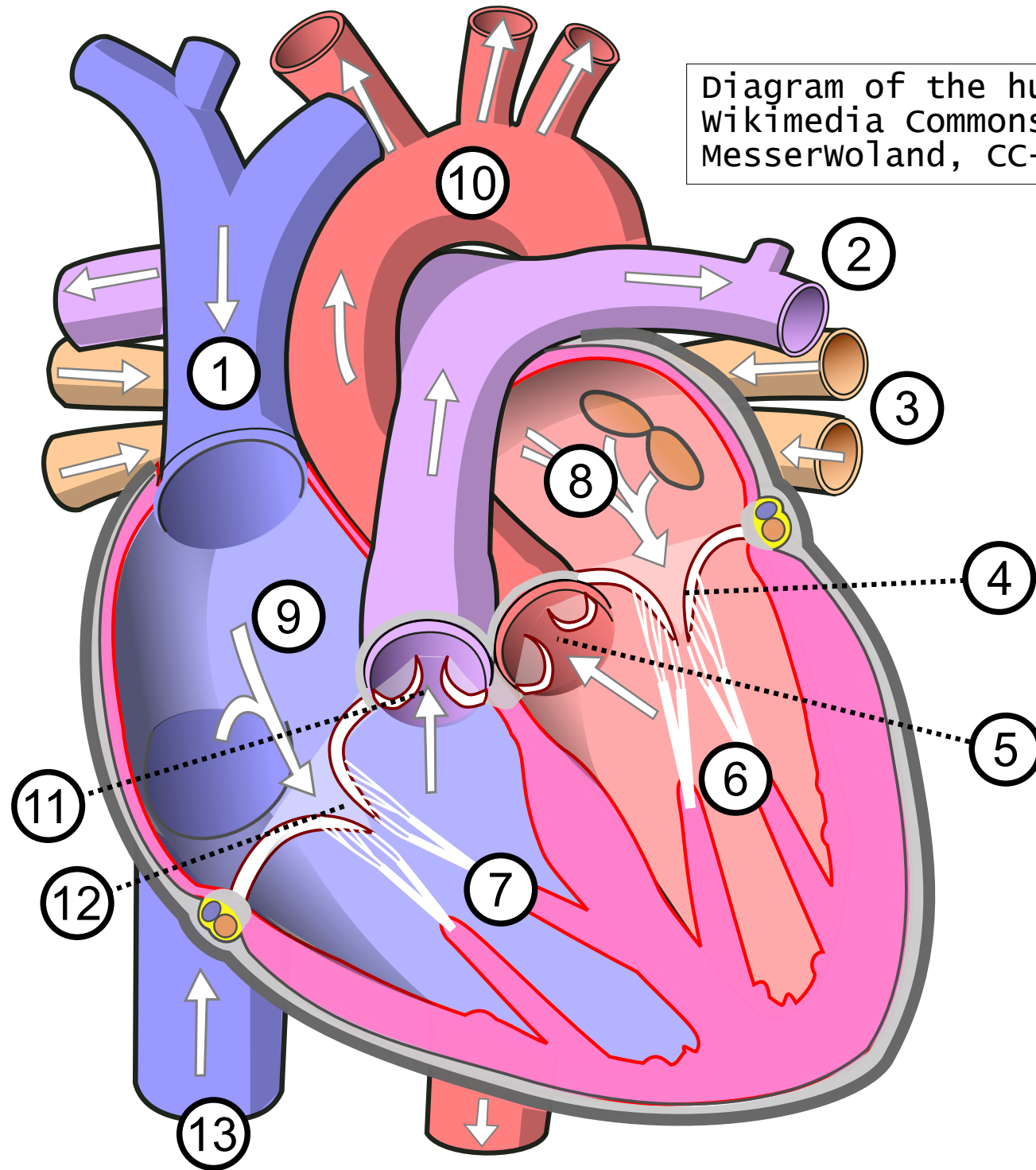
Figure 19.2: Position of the heart in the thorax.
Note the borders of the pericardium.

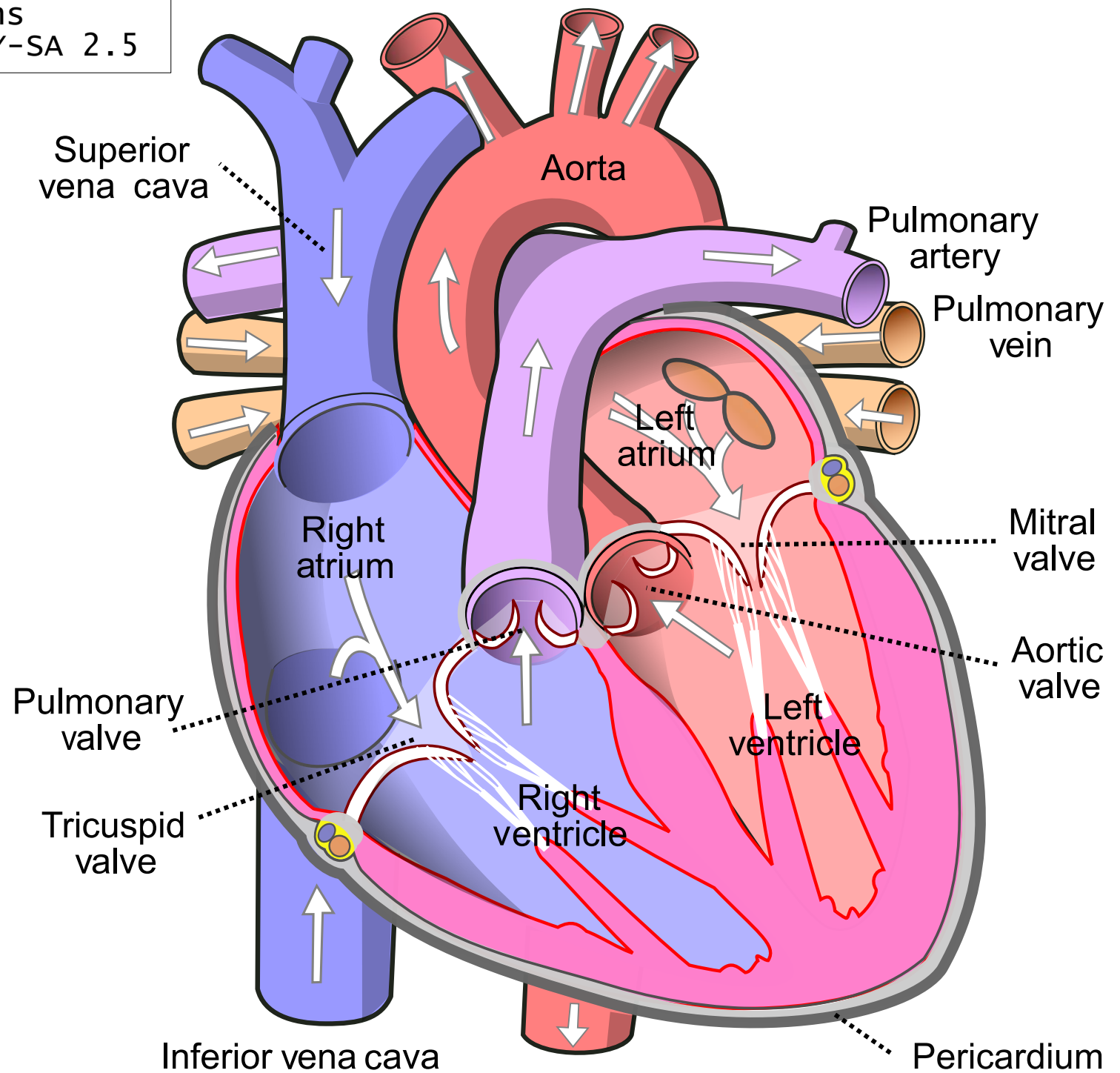
Anatomy and Physiology 25 April 2013; OpenStax; CC-A 4.0;
<https://openstax.org/books/anatomy-and-physiology/pages/19-1-heart-anatomy>



Identify the parts of the heart.

Diagram of the human heart from
wikimedia Commons by
Messerwoland, CC-BY-SA 2.5





05/03/2008 12:54:14
Octave
Frek.: 1.7 MHz/3.5 MHz
FPS: 19.8
Dybde: 16.0 cm

L

T

R

B

5

15

Animation showing a moving echocardiogram; a 3D-loop of a heart viewed from the apex, with the apical part of the ventricles removed and the mitral valve clearly visible. Due to missing data the leaflet of the tricuspid and aortic valve is not clearly visible, but the openings are. To the left are two standard two-dimensional views taken from the 3D dataset.

From Wikimedia Commons
by Kjetil Lenes, CC-BY-SA 3.0

1:1 HR 76

05/03/2008 12:54:14
Octave
Frek.: 1.7 MHz/3.5 MHz
FPS: 19.8
Dybde: 16.0 cm

L

T

R

B

5

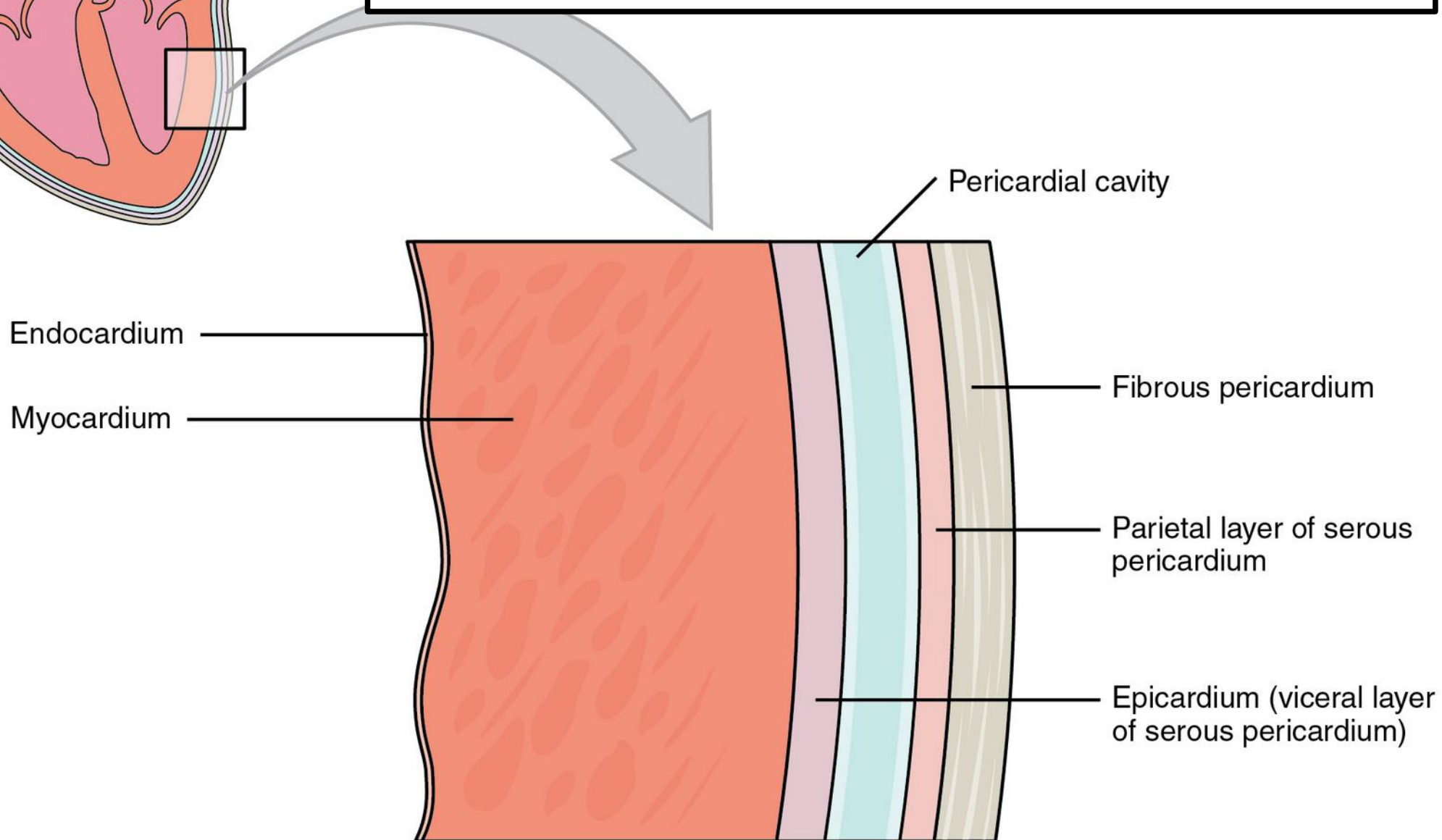
10

15

1:1 HR 76

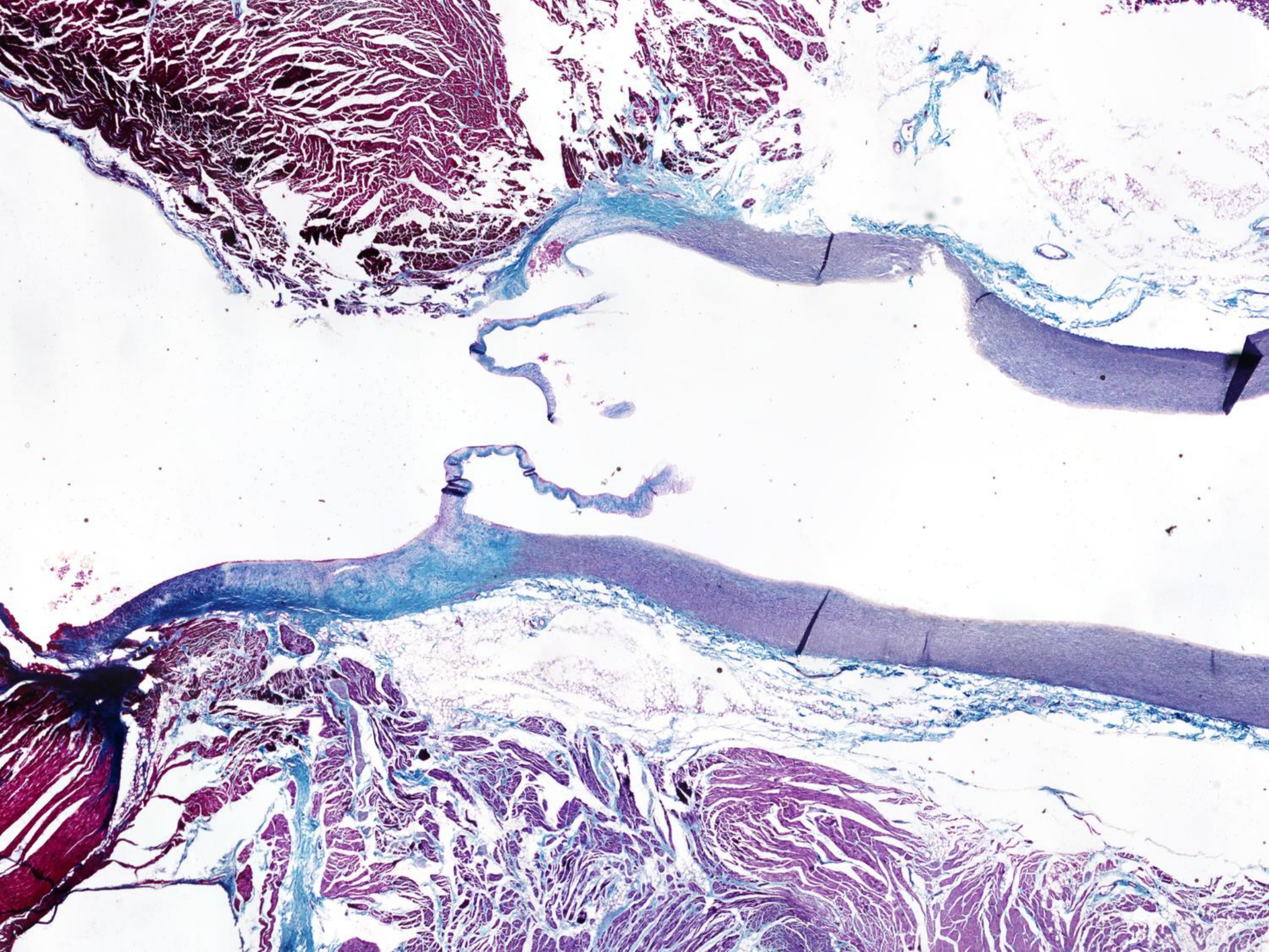
Figure 19.5 Pericardial Membranes and Layers of the Heart wall. The pericardial membrane that surrounds the heart consists of three layers and the pericardial cavity. The heart wall also consists of three layers. The pericardial membrane and the heart wall share the epicardium.

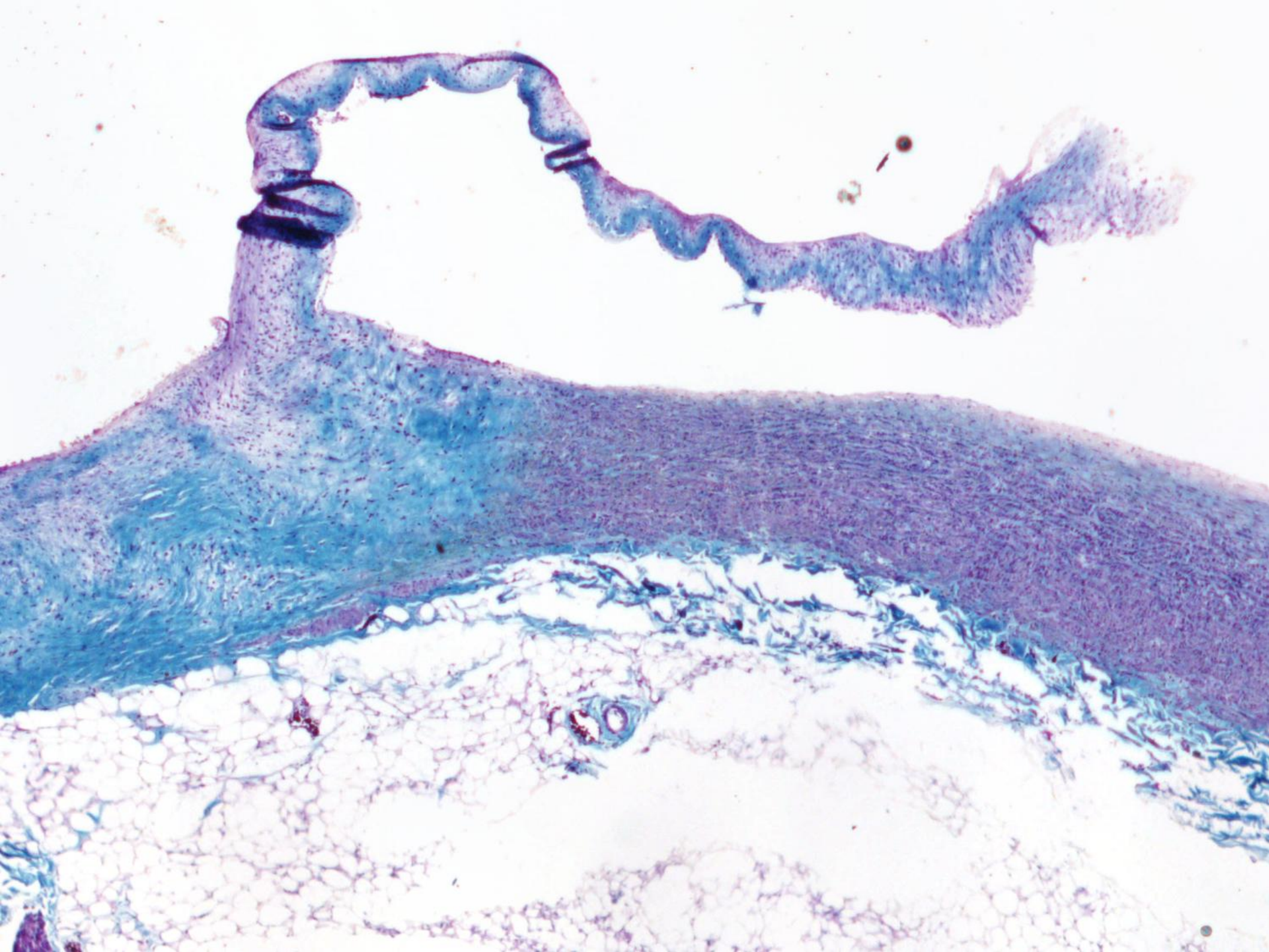
Anatomy and Physiology 25 April 2013; OpenStax; CC-A 4.0;
<https://openstax.org/books/anatomy-and-physiology/pages/19-1-heart-anatomy>



valves

- Flap of intima
- Core
- Irregular dense CT
- Without blood vessels
- Some elastic fibers
- Covered with endothelium





Arteries vs Veins

	Arteries	Veins
Wall thickness	Thick	Thin
Size lumen	Narrow	Wide
Shape lumen	Rounded	Irregular, often collapsed

- Three layers not always visible
- Elastic arteries
 - Ventricular contraction = systolic blood pressure (BP)
 - Diastolic BP = interim pressure maintained by elastic arteries
- Muscular arteries
 - Distribute blood volume appropriate to requirements at destination
- Layers best seen in muscular arteries

Muscular artery

- Intima
 - Thin
 - Endothelium
 - BM
 - Thin subendothelial layer
 - Internal elastic lamina
 - Conspicuous wavy pink layer
- Media
 - Thick
 - Layers concentric smooth muscle
 - Interspersed with some elastic fibers
 - External elastic lamina
 - Less conspicuous fenestrated layer elastin
- Adventitia
 - Thickness vary but close to tunica media
 - Elastic fibres with some collagen
 - Contains vasa vasorum and lymphatics

Elastic artery

- Intima
 - Thick = $\frac{1}{4}$ of wall of aorta
 - Pale staining
 - Endothelium
 - Fenestrated elastic laminae mixed with elastic fibres
 - Smooth muscle fibres and some fibroblasts
 - Internal elastic lamina = first elastic lamina
- Media
 - Thick
 - Fenestrated elastic laminae \uparrow with age
 - Between laminae smooth muscle fibres that produce matrix
 - Outer part supplied by vasa vasorum
 - Inner part diffusion from lumen
 - Indistinct external elastic lamina
- Adventitia
 - Thin
 - Elastic and collagen fibres
 - Lymphatic capillaries and vasa vasorum

Arterioles

- Diameter < 100µm
- Wall thick relative to lumen (vs venule)
- Intima
 - Endothelium
 - BM
 - Apposed internal elastic lamina
- Media
 - One/Two layers smooth muscle
 - Inconspicuous external elastic lamina
- Adventitia
 - Few elastic and collagen fibres

Elastic artery

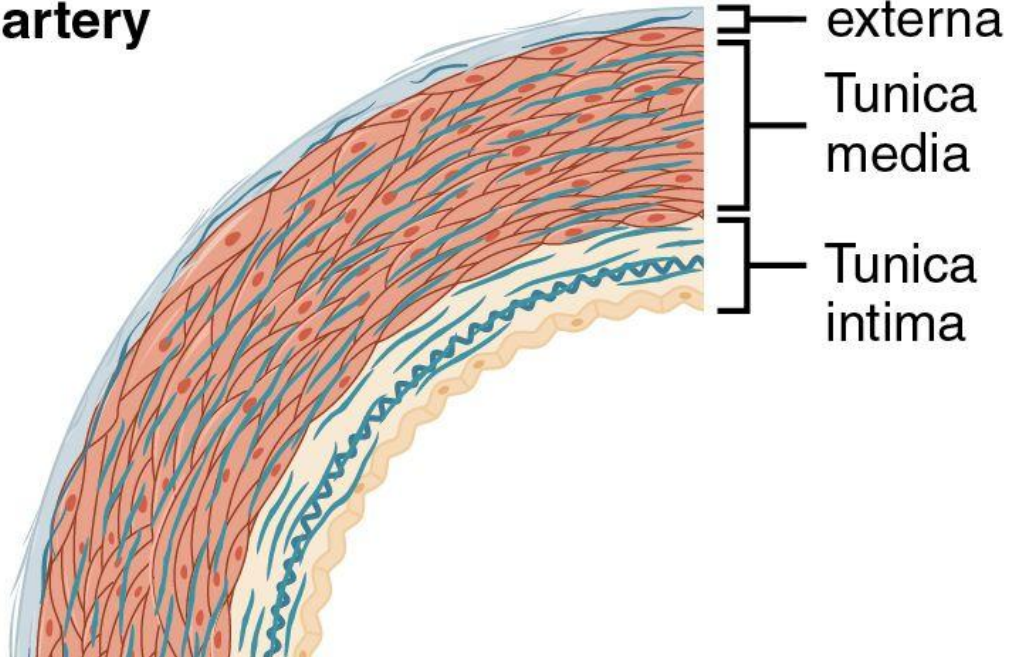
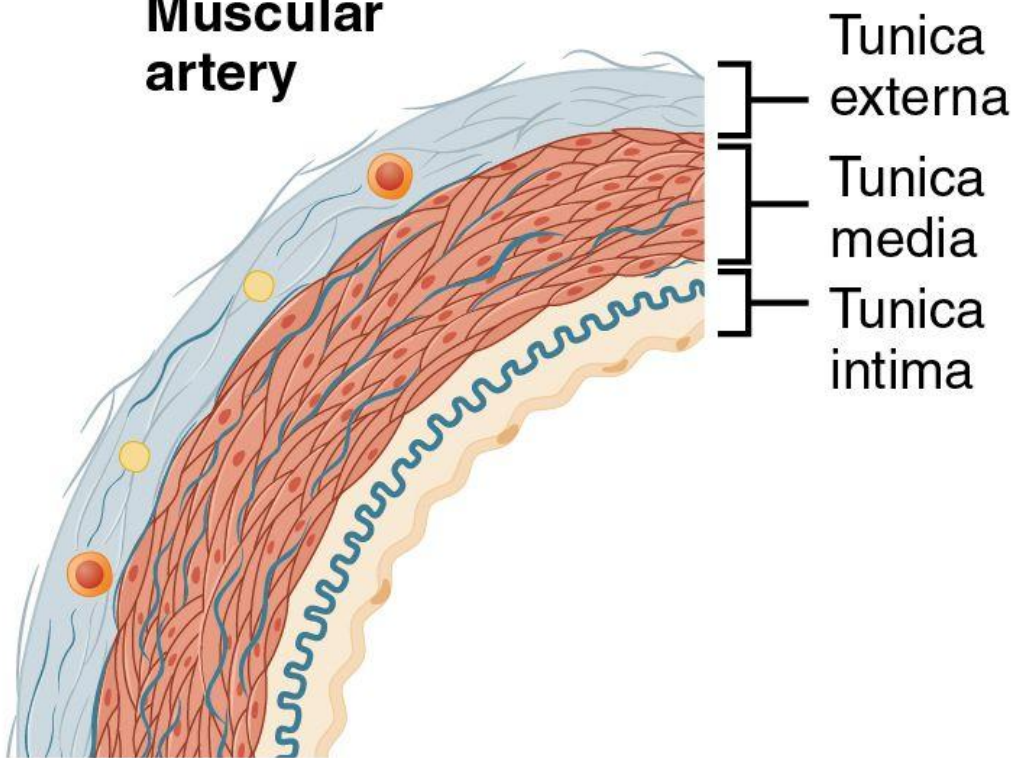


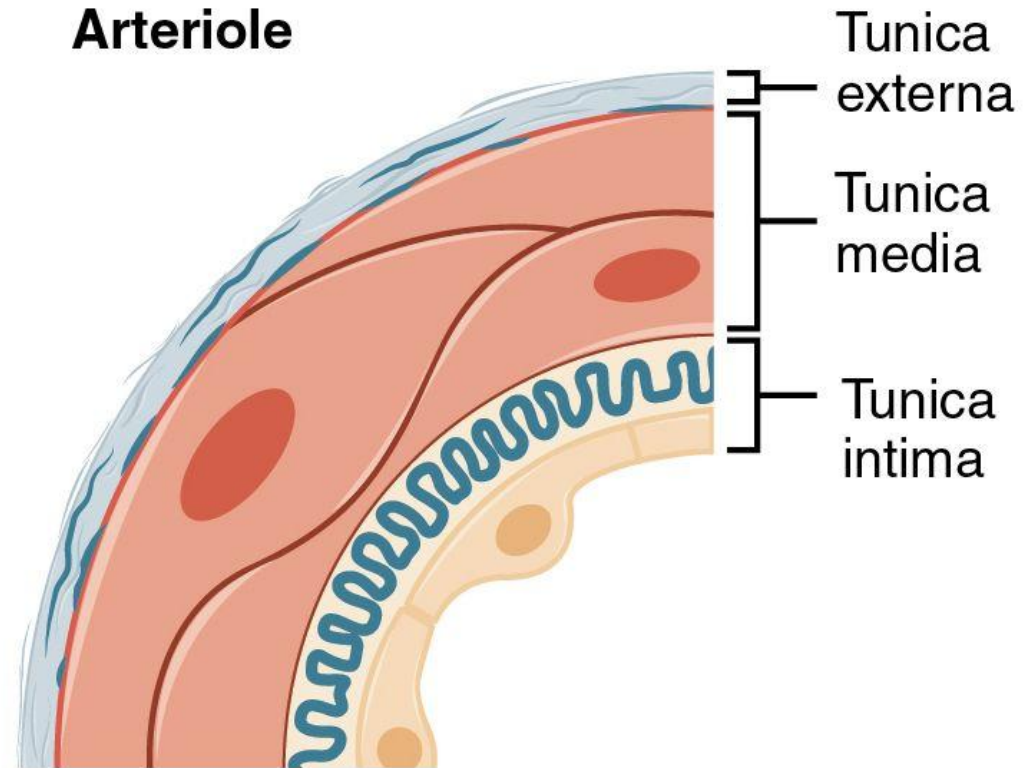
Figure 20.4 Types of Arteries and Arterioles. Comparison of the walls of an elastic artery, a muscular artery, and an arteriole is shown. In terms of scale, the diameter of an arteriole is measured in micrometers compared to millimeters for elastic and muscular arteries.

Anatomy and Physiology 25 April 2013; OpenStax; CC-A 4.0; <https://openstax.org/books/anatomy-and-physiology/pages/20-1-structure-and-function-of-blood-vessels>

Muscular artery



Arteriole



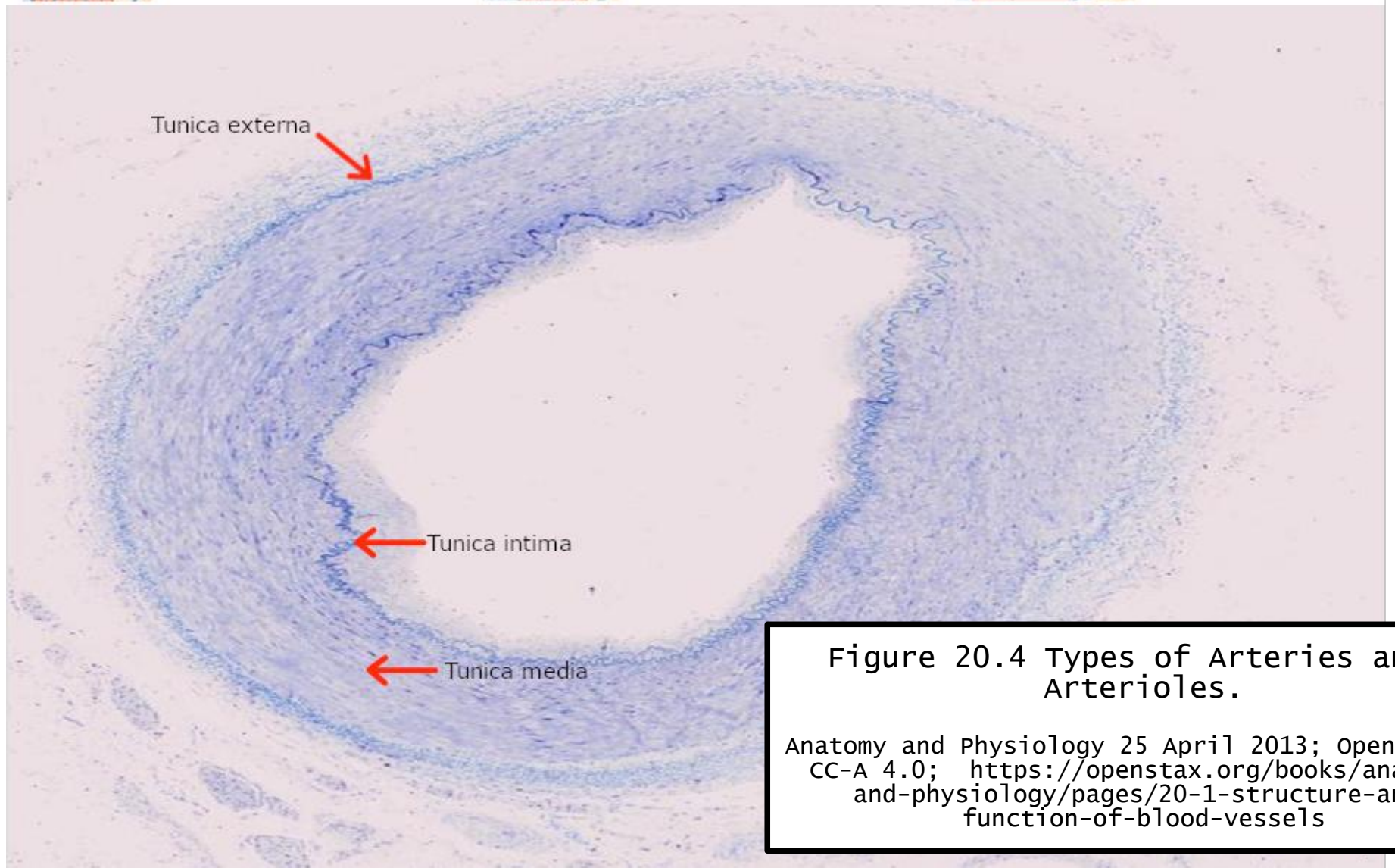
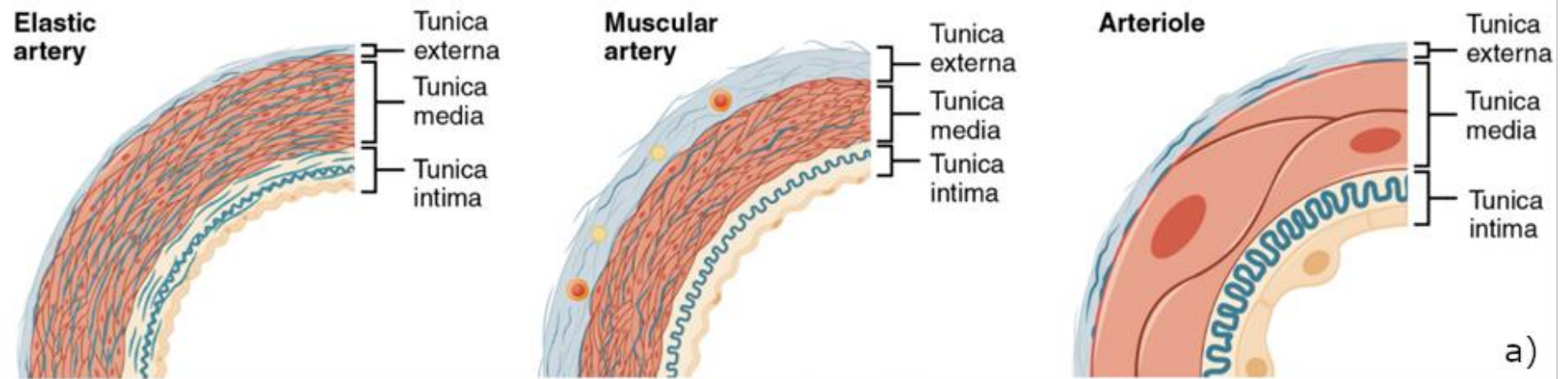
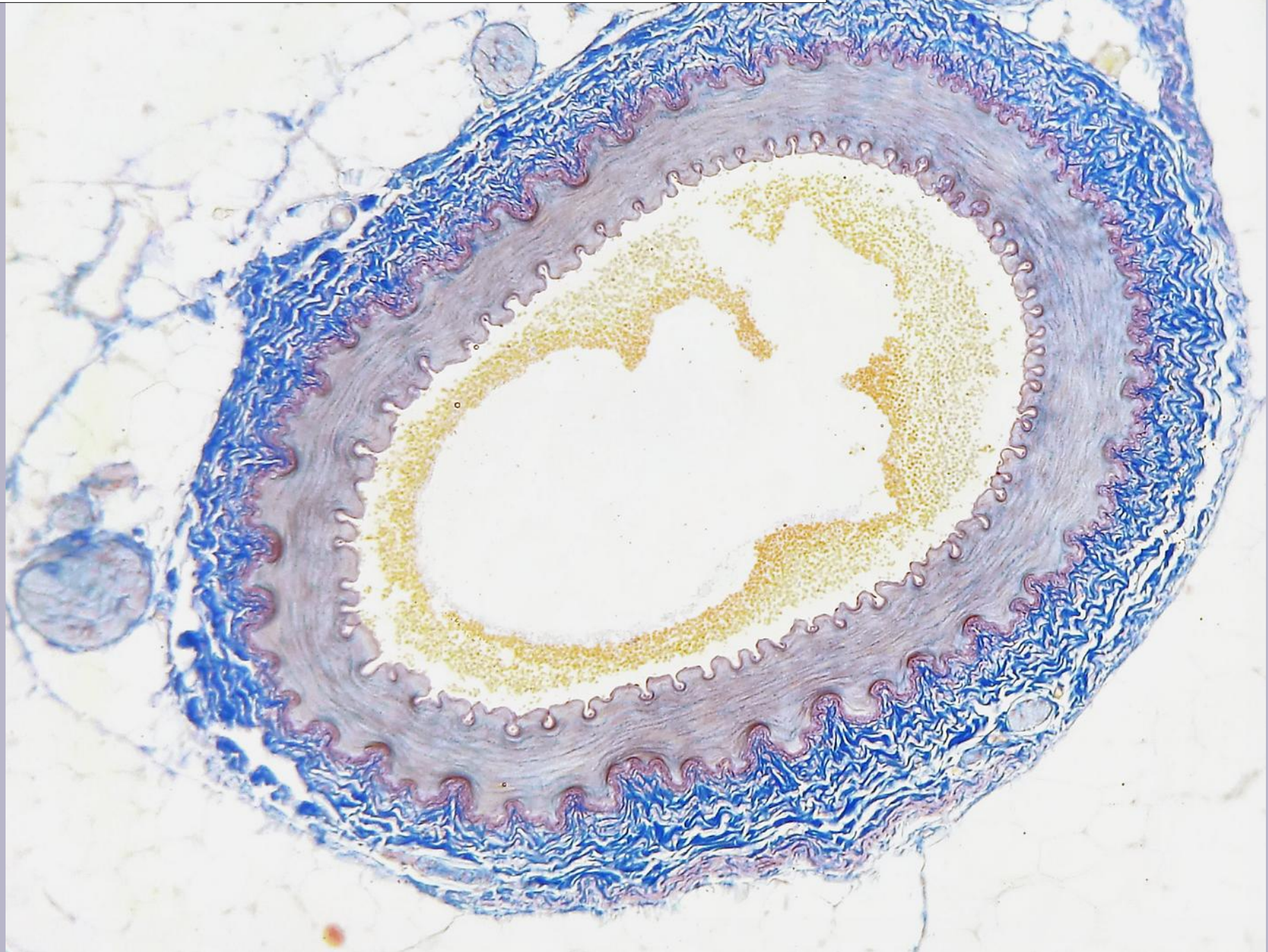


Figure 20.4 Types of Arteries and Arterioles.

Anatomy and Physiology 25 April 2013; OpenStax; CC-A 4.0; <https://openstax.org/books/anatomy-and-physiology/pages/20-1-structure-and-function-of-blood-vessels>

Muscular artery:
Thin intima with conspicuous internal elastic lamina.
Thick media and external elastic lamina.
Adventitia equal to media.

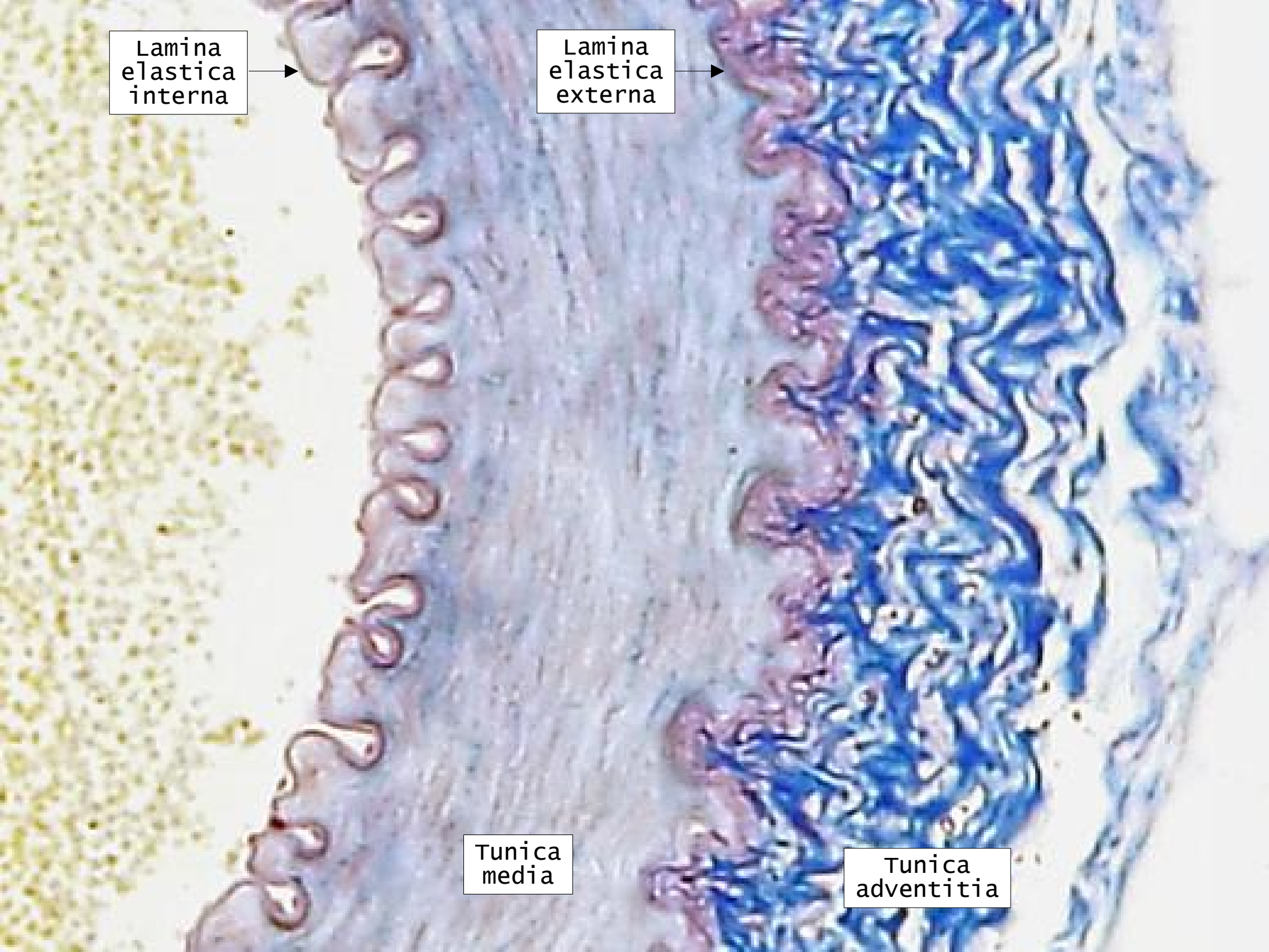


Lamina
elastica
interna

Lamina
elastica
externa

Tunica
media

Tunica
adventitia



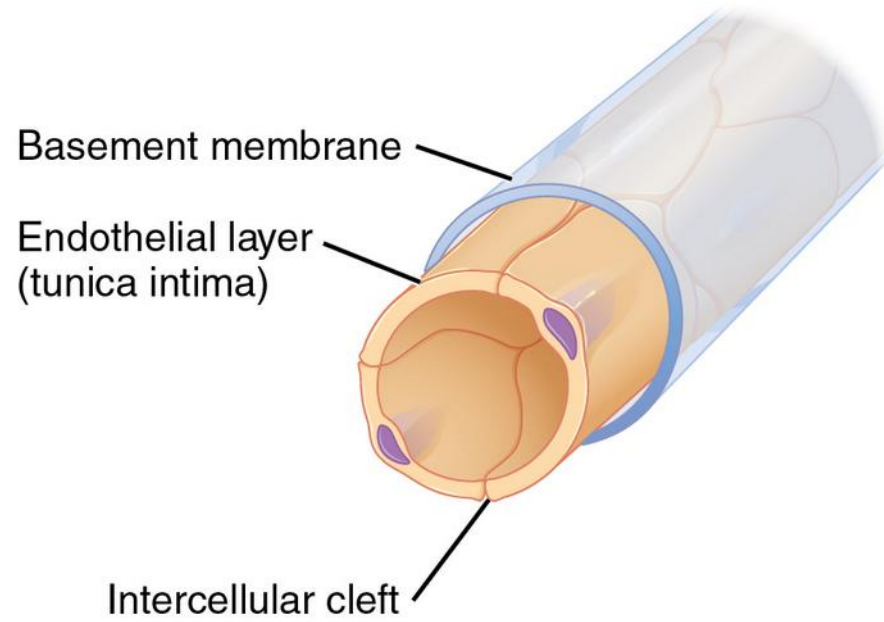
Capillaries

- Small thin walled diameter 8 – 10µm
- Slightly wider than red blood cells
- Intima
 - Lined with endothelium
 - Resting on BM
 - Lateral margins connected with tight junctions
 - Do not extend around entire perimeter
 - Slit-like intercellular clefts
 - Tissue fluid and small molecules can pass through
 - Brain: entire perimeter = blood-brain barrier with astrocytes
 - Scattered pericytes
 - Involved with blood-vessel growth
 - Endo+BM+Pericytes = tunica intima
- No Media
- Adventitia with little CT

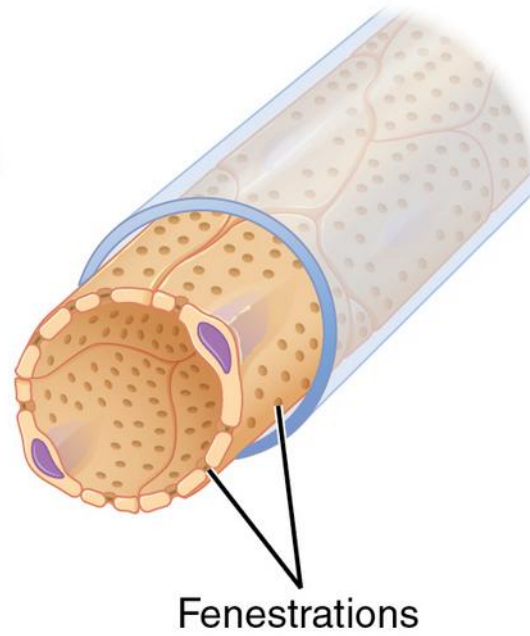
Capillaries

- Three types
- Continuous
 - Most parts
 - Endothelium uninterrupted
 - Allow passage water and ions and small molecules
- Fenestrated
 - Circular fenestrations (windows) in cytoplasm
 - More permeable varies according to location
 - Larger molecules
 - Small intestine, kidneys, endocrine organs
- Sinusoids
 - Thin-walled with wide lumen
 - Associated population of macrophages
 - Extensive intercellular gaps
 - Incomplete BM
 - Large molecules can pass
 - Plasma proteins and cells
 - Bone marrow, liver, spleen, lymph nodes, endocrine organs

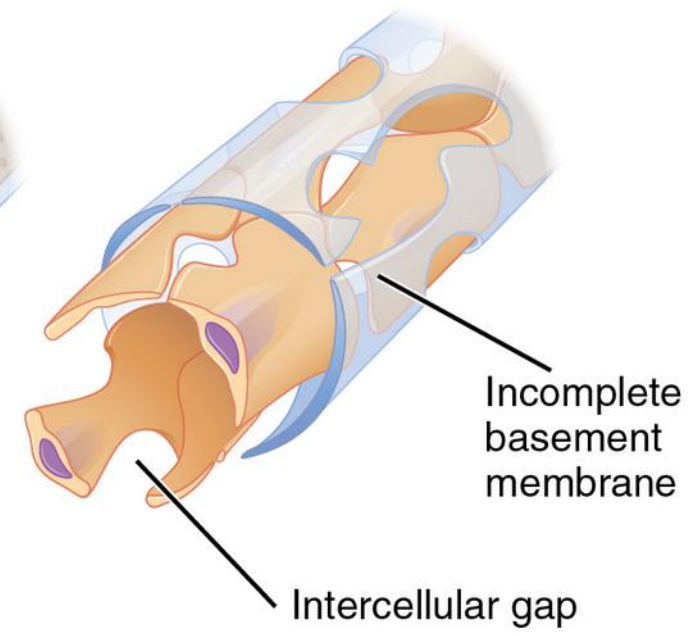
Continuous

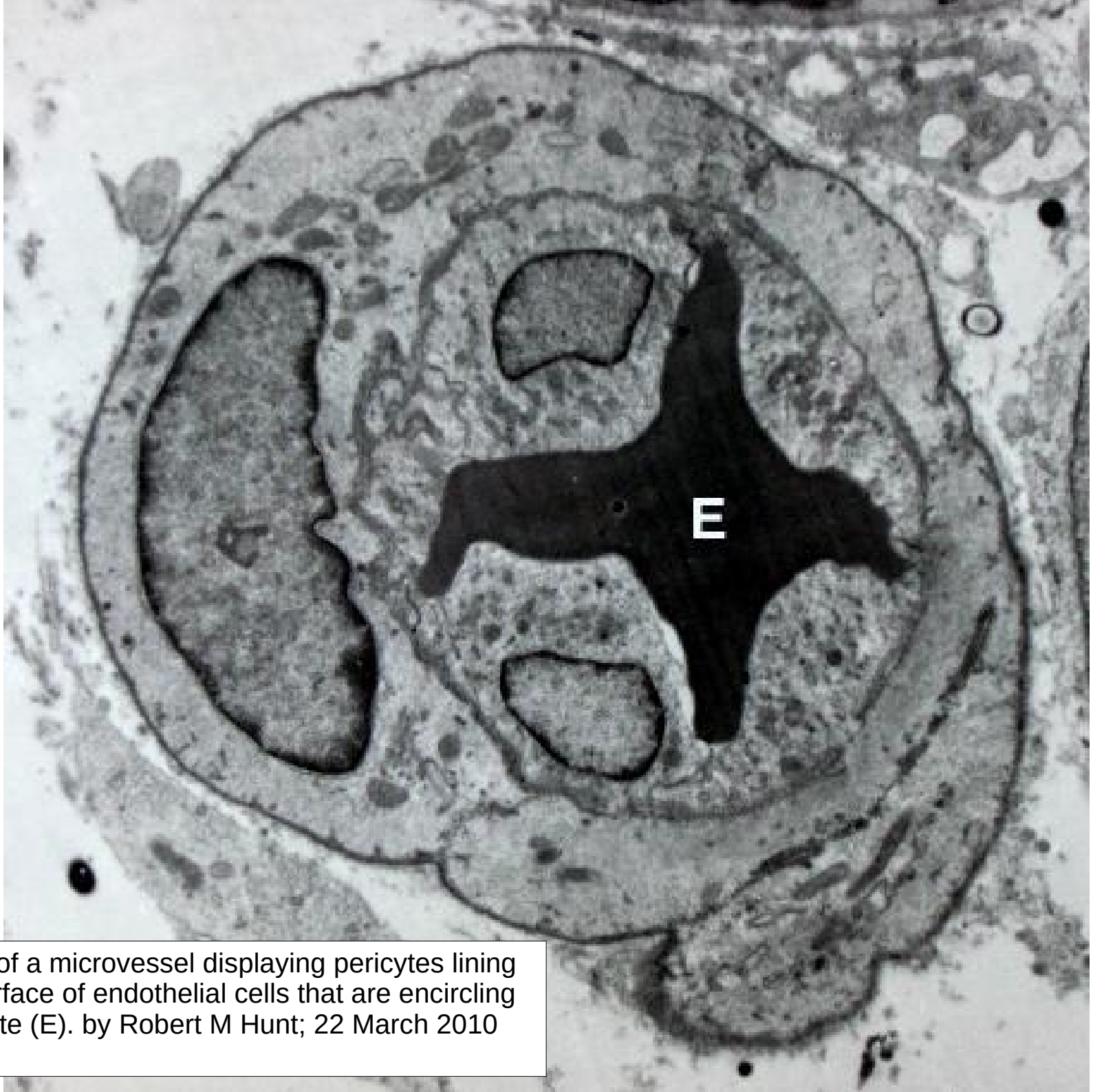


Fenestrated



Sinusoid

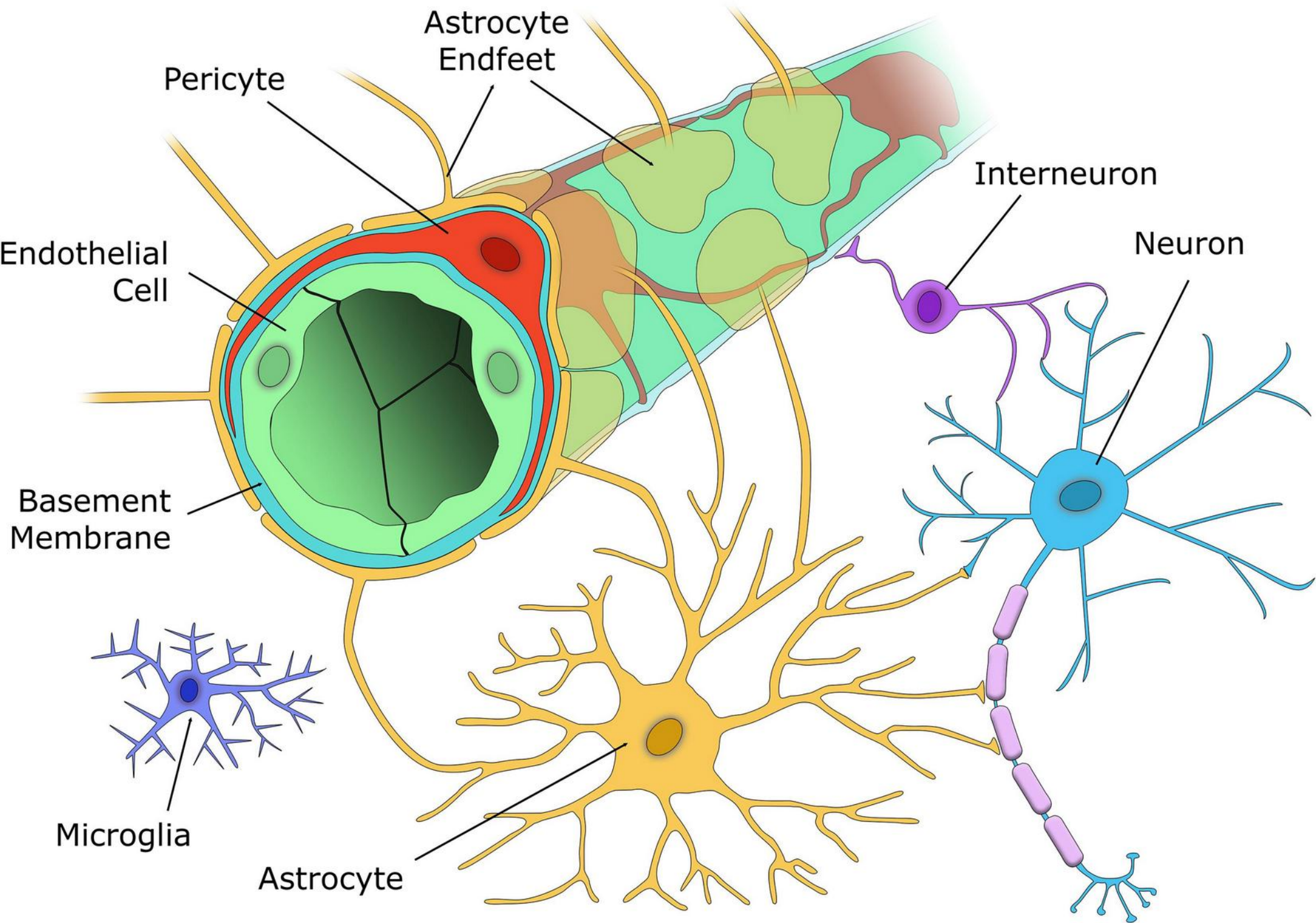


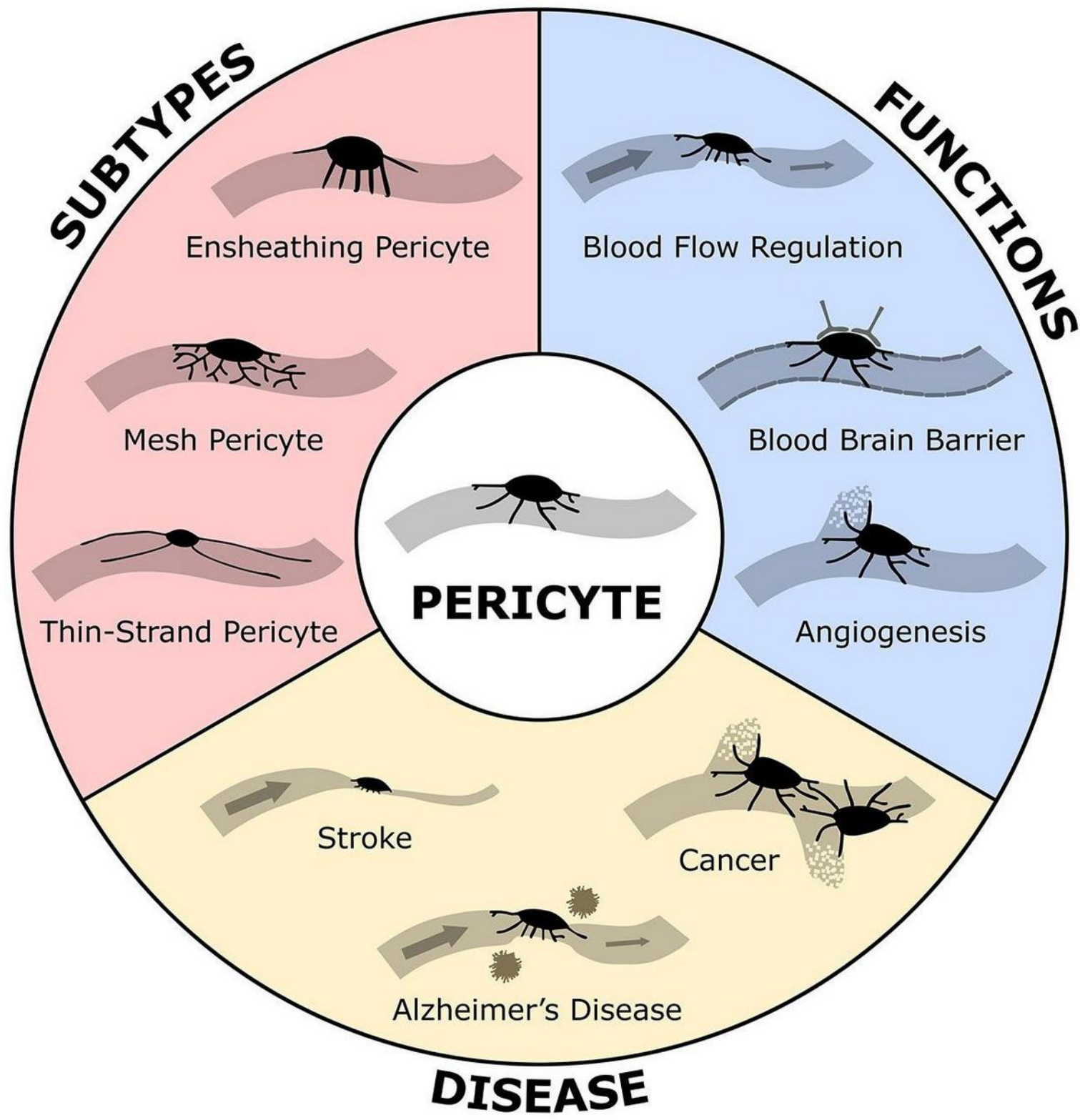


TEM image of a microvessel displaying pericytes lining the outer surface of endothelial cells that are encircling an erythrocyte (E). by Robert M Hunt; 22 March 2010
CC-A 3.0

TEM image of a capillary in the the pancreas. There is a red blood cell within the capillary. The capillary lining consists of long, thin endothelial cells, connected by tight junctions. The image shows fenestration of these endothelial cells.

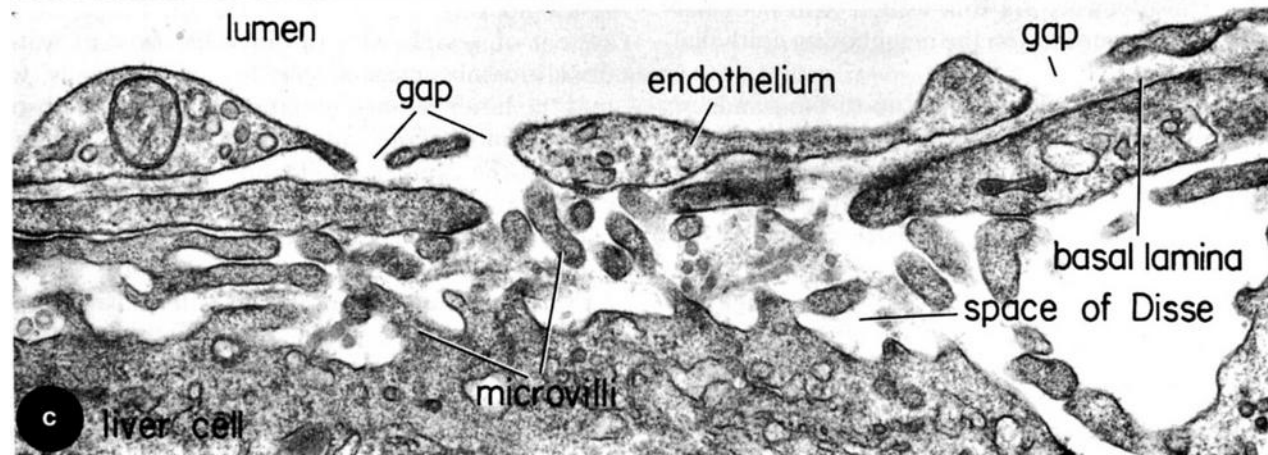
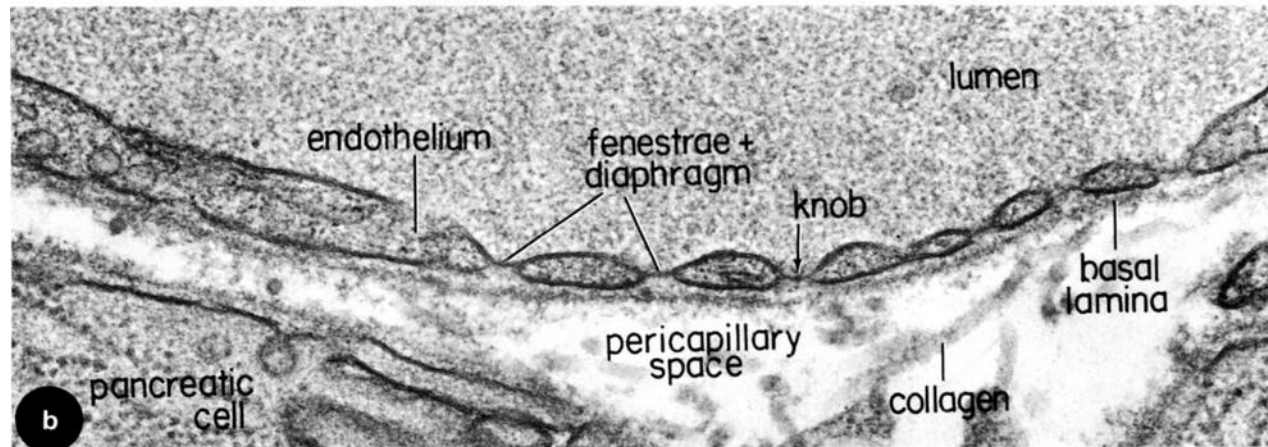
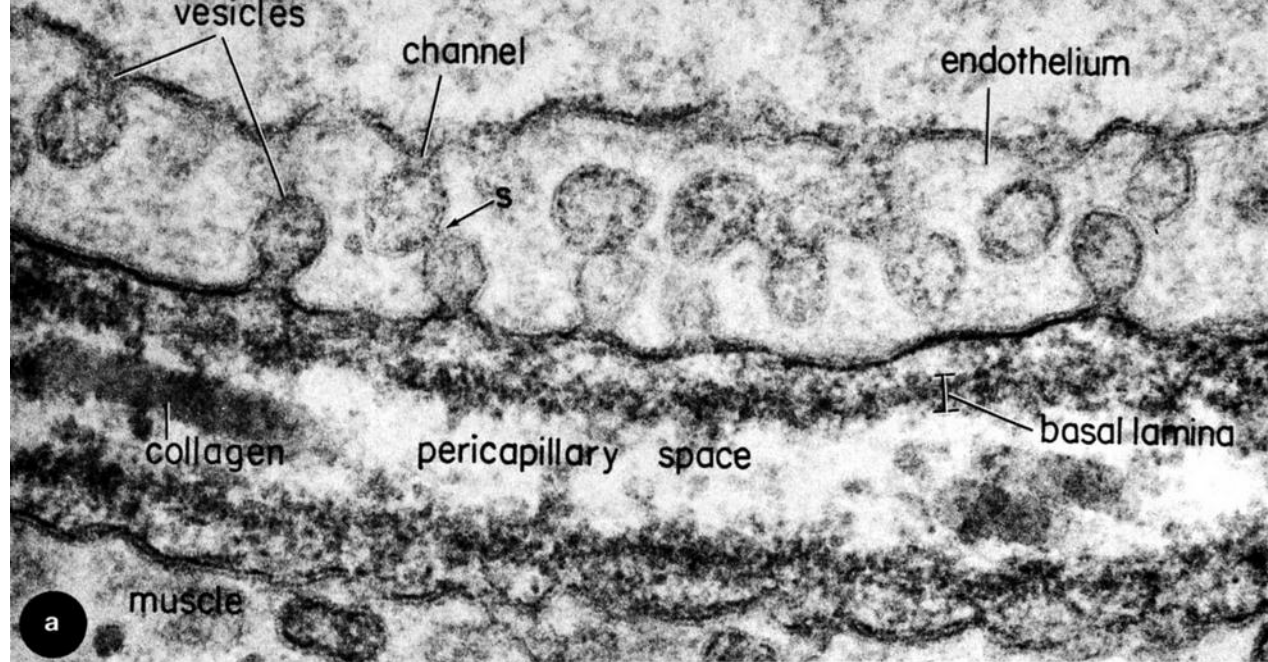






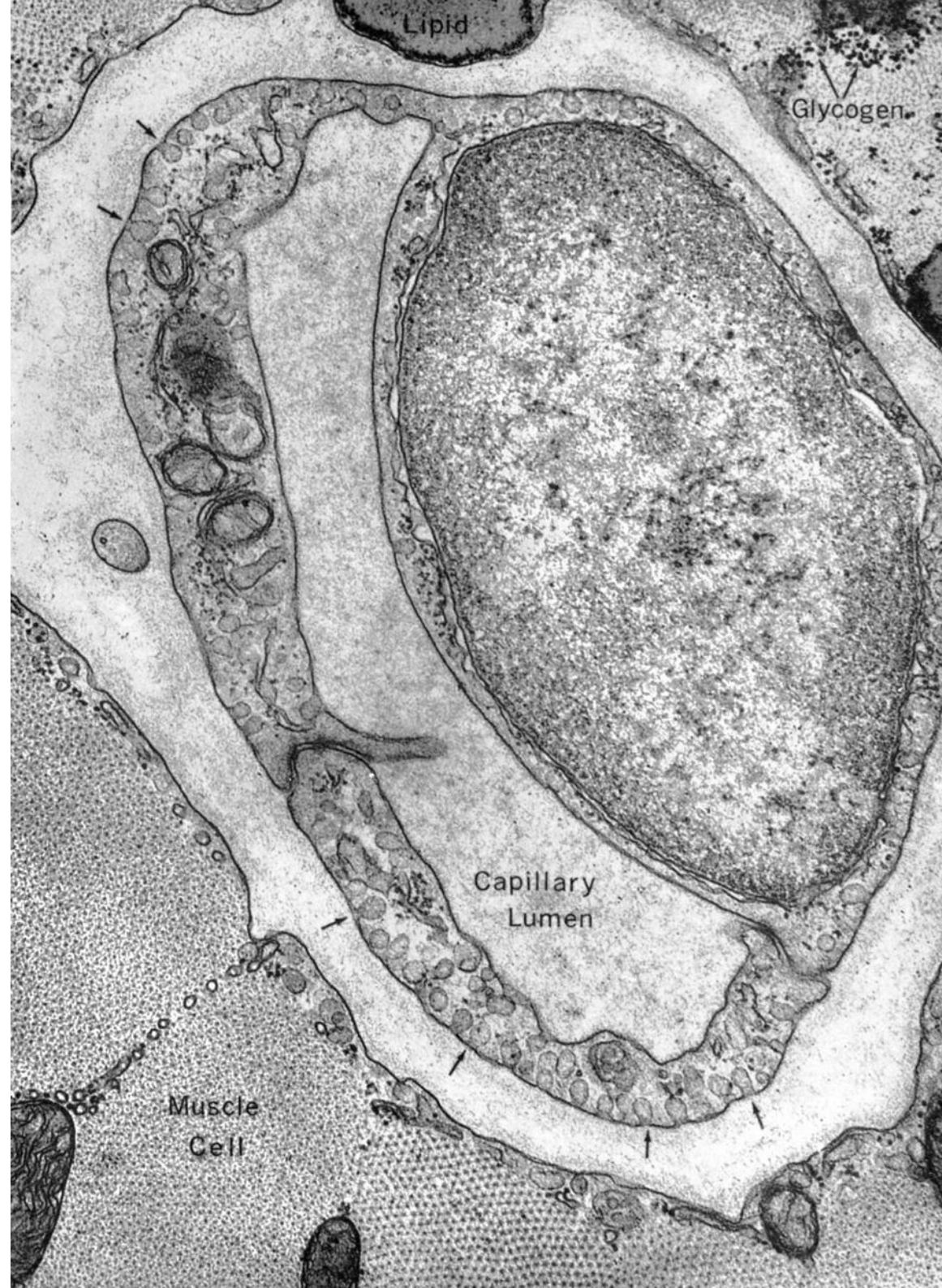
Three types of blood capillaries are differentiated by the continuity of the endothelial cell and the basal lamina. A, continuous capillary; b, fenestrated capillary; c, discontinuous capillary (sinusoid). Rat diaphragm, pancreas and liver, respectively.

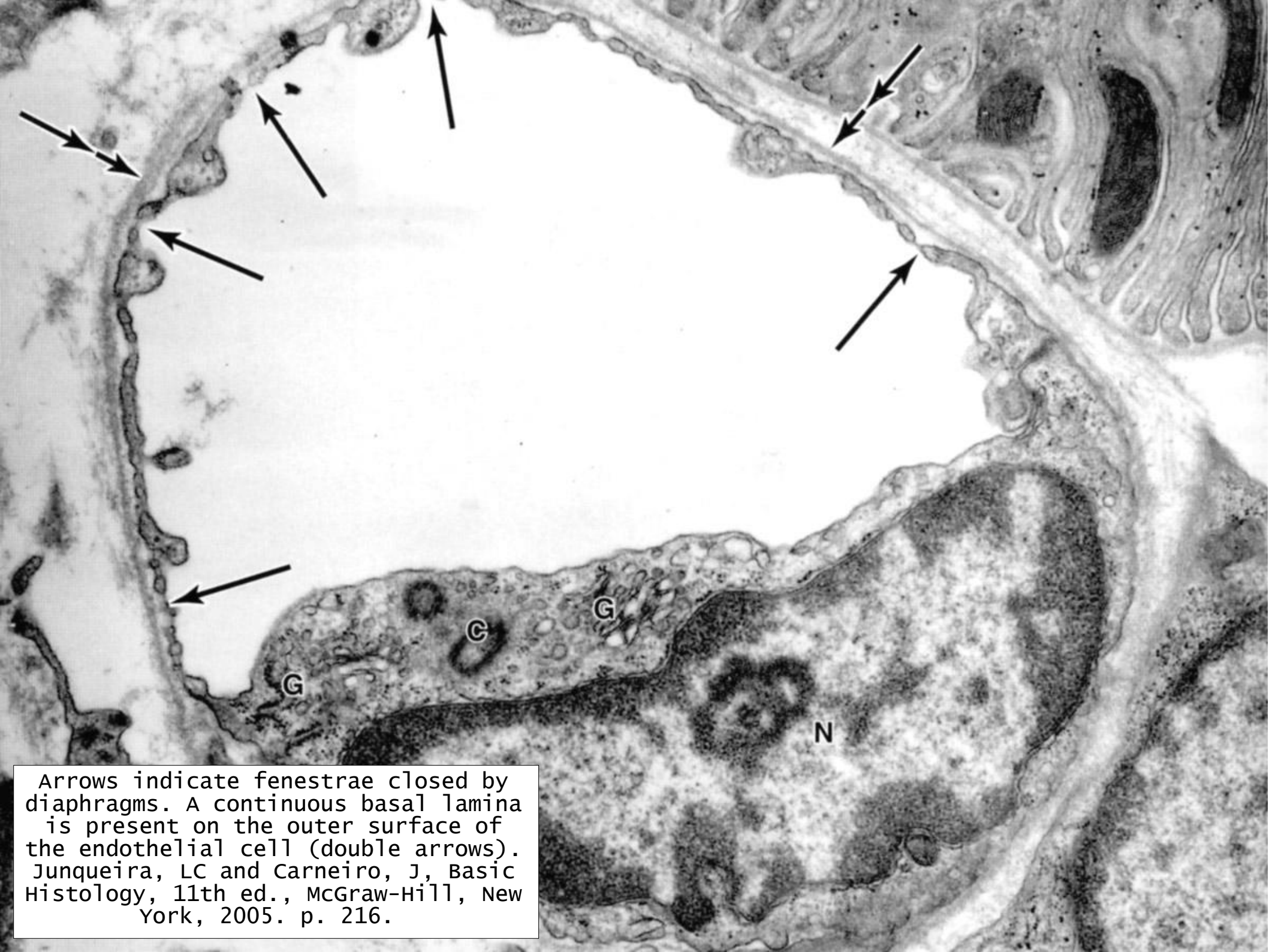
Weiss, L. ed., Cell and Tissue Biology, 6th ed., Urban & Schwarzenberg, Baltimore, 1988, p. 381.



Endothelial cells of continuous capillaries are joined by tight junctions and a continuous basal lamina.

Fawcett DW, The Cell: An Atlas of Fine Structure, WB Saunders, Philadelphia, 1966, p. 403.

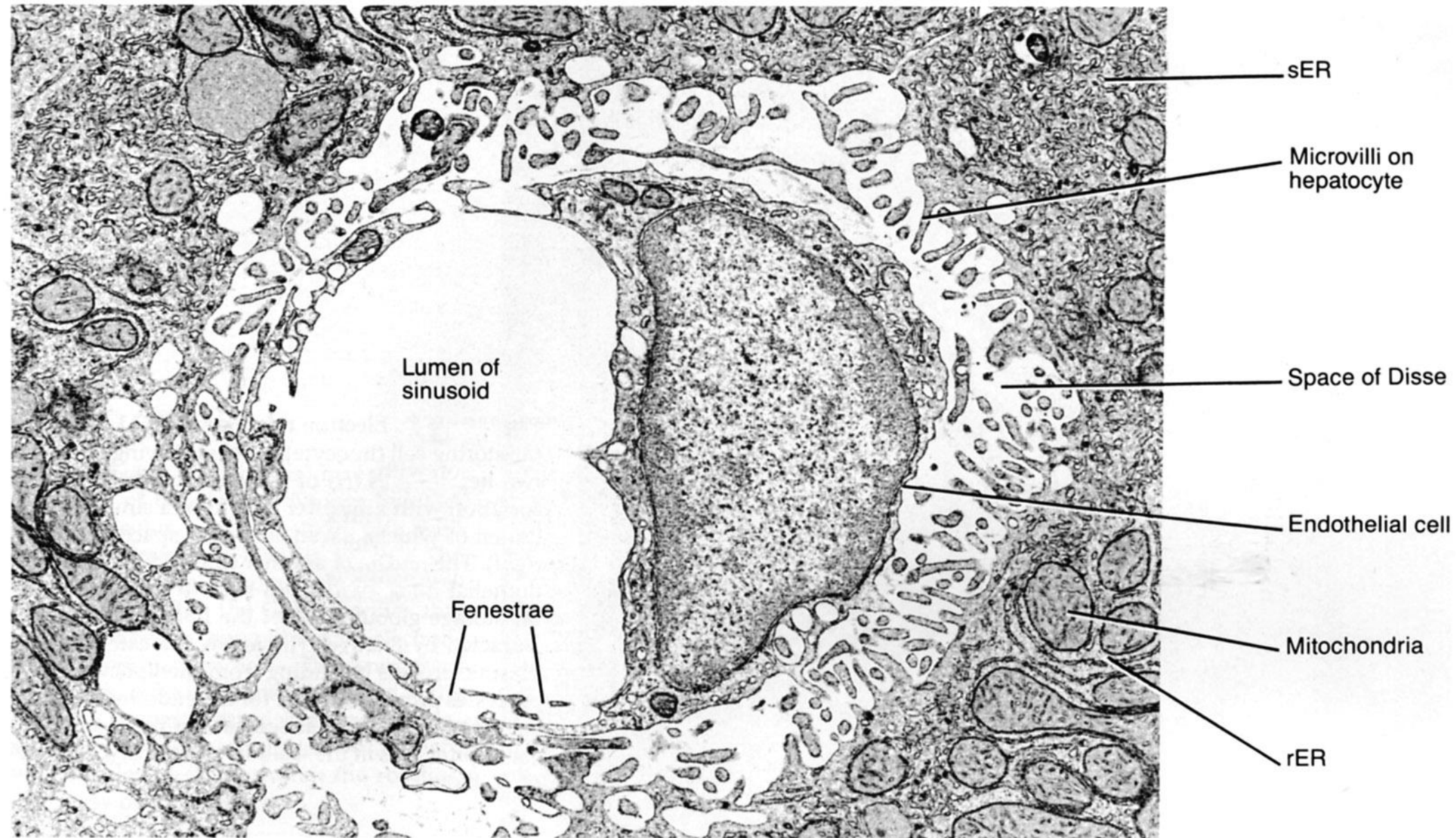


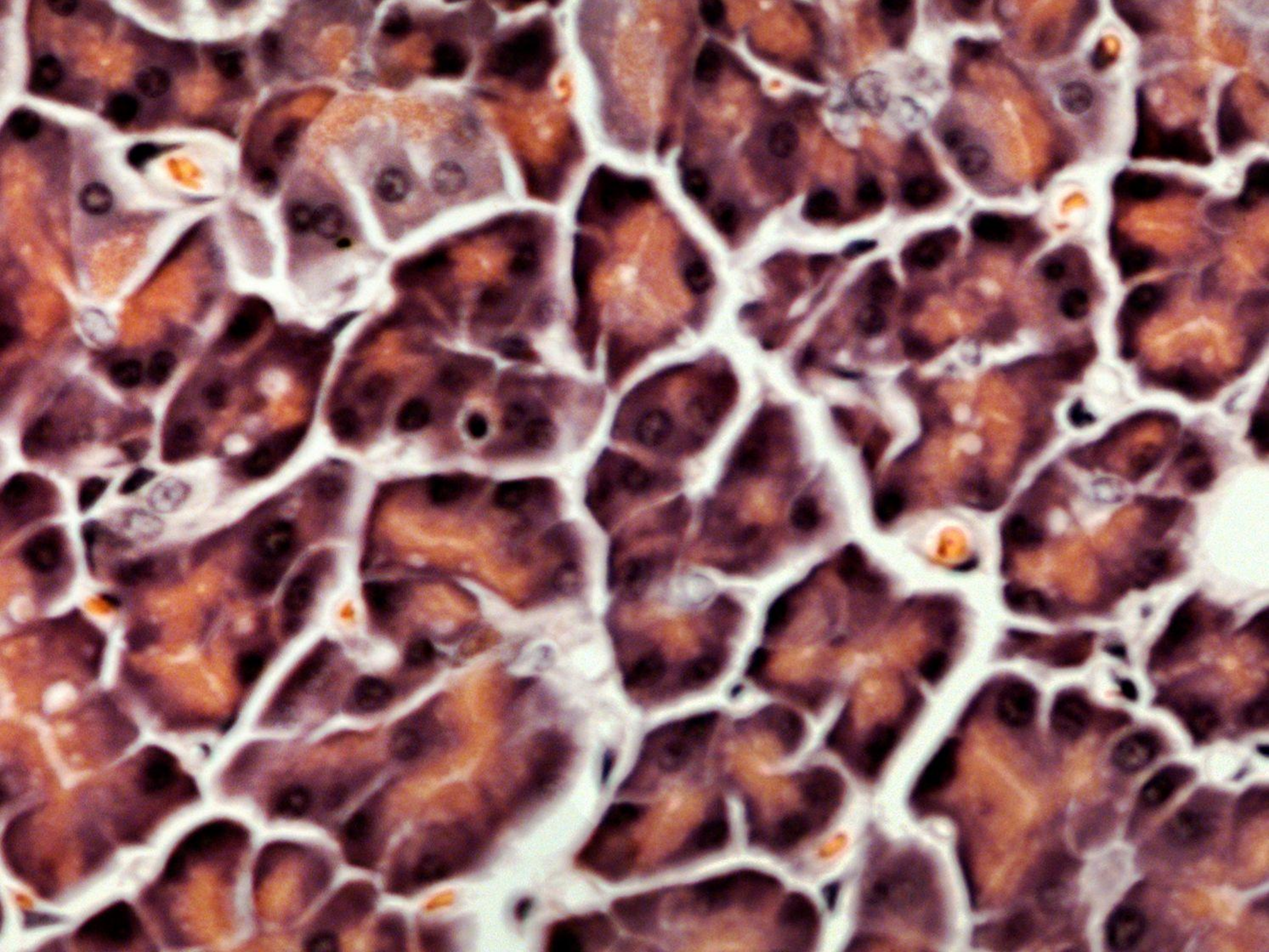


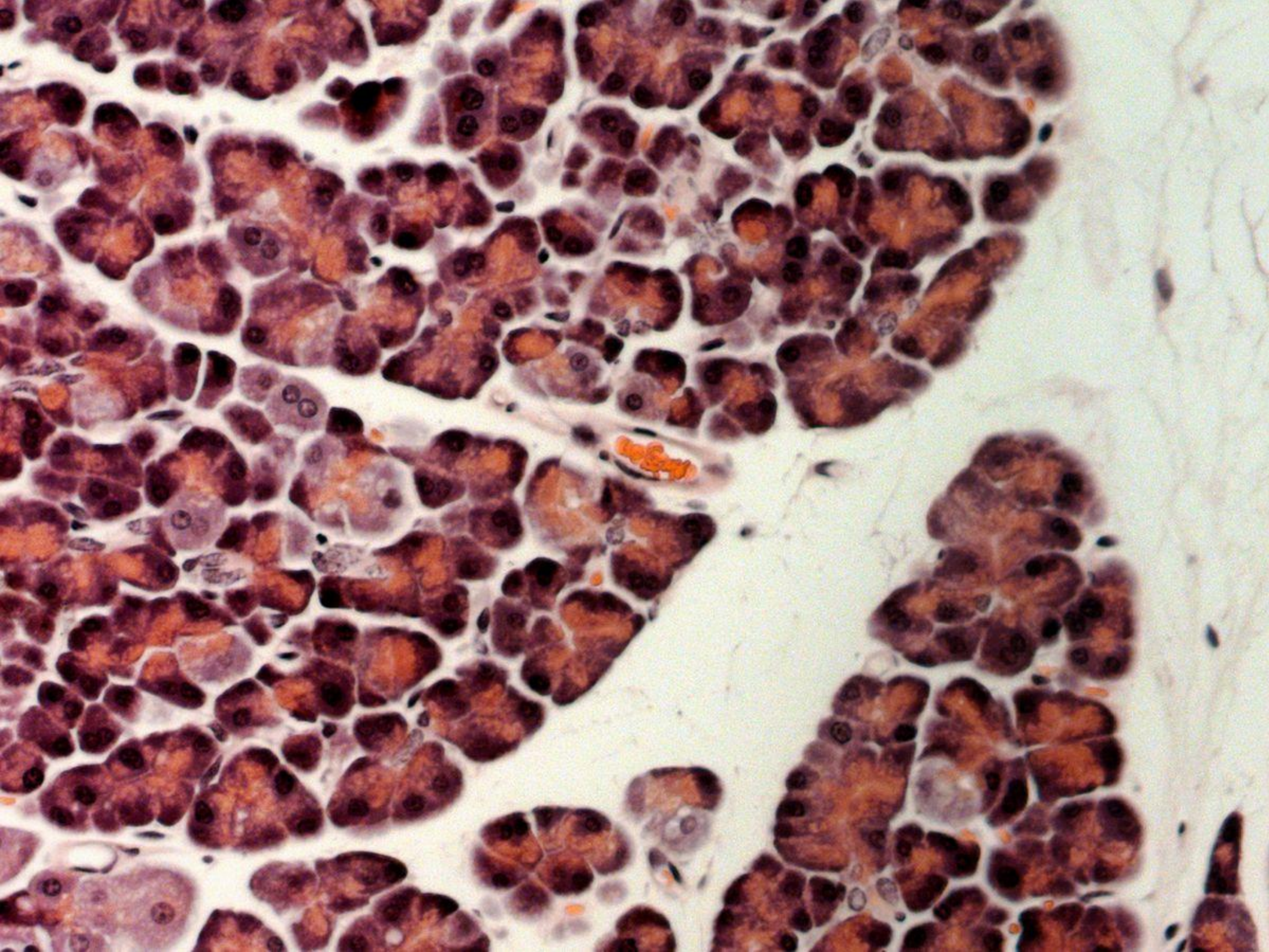
Arrows indicate fenestrae closed by diaphragms. A continuous basal lamina is present on the outer surface of the endothelial cell (double arrows). Junqueira, LC and Carneiro, J, Basic Histology, 11th ed., McGraw-Hill, New York, 2005. p. 216.

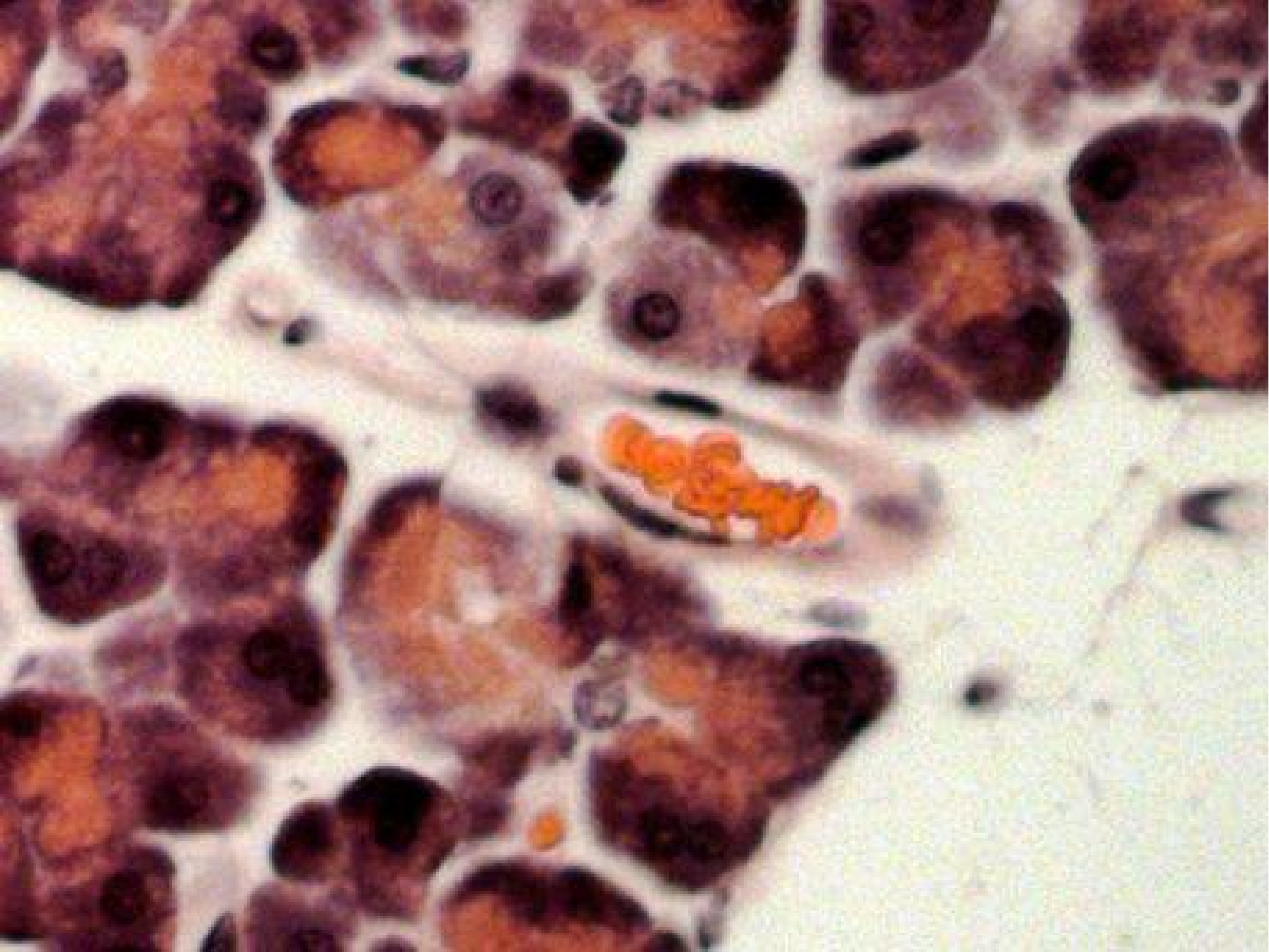
open fenestrae are visible in the endothelial cell cytoplasm of the liver sinusoid.

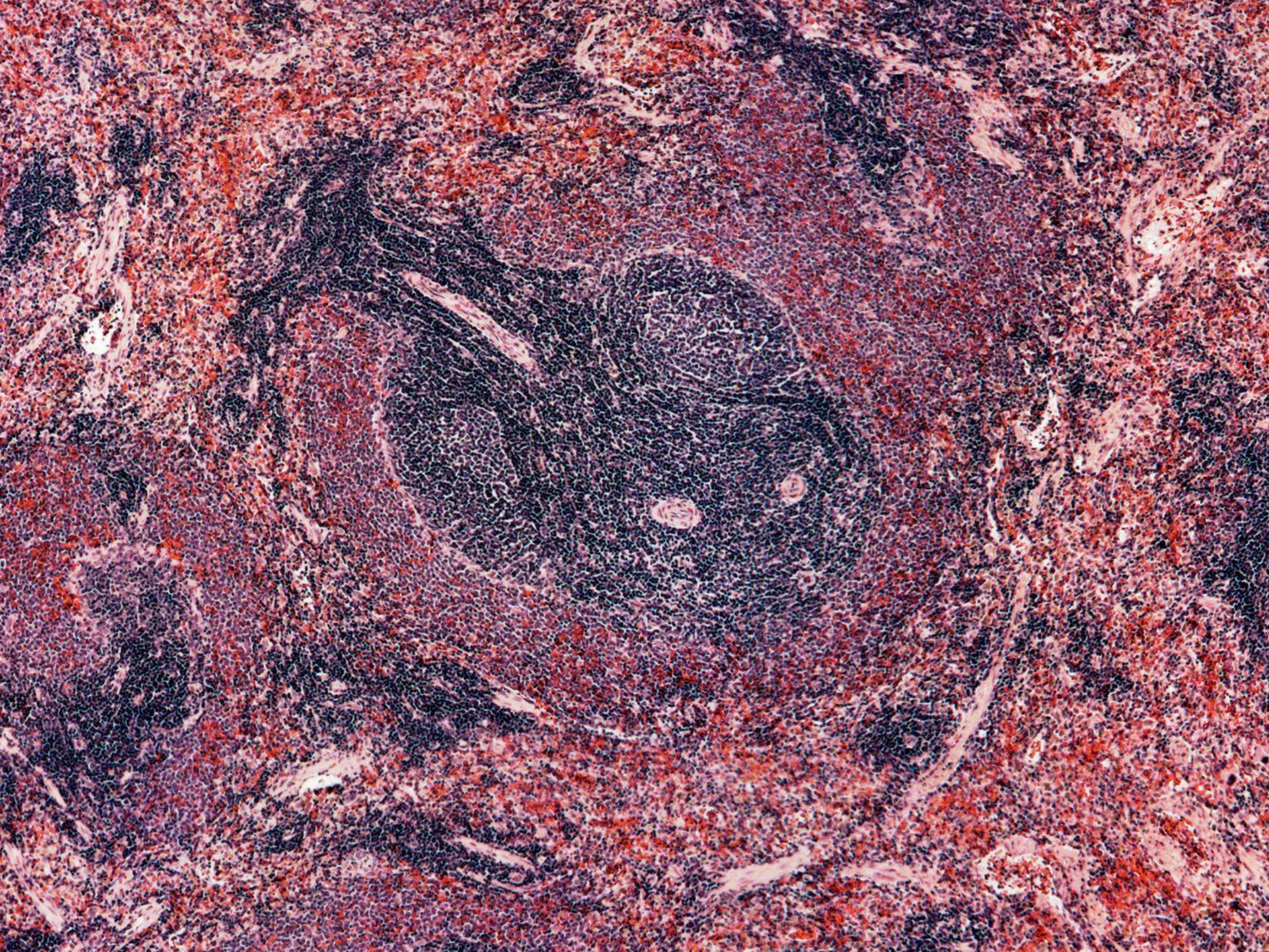
Cormack, D.H. Ham's Histology, 9th ed., Lippincott, Philadelphia, 1987, p. 531.

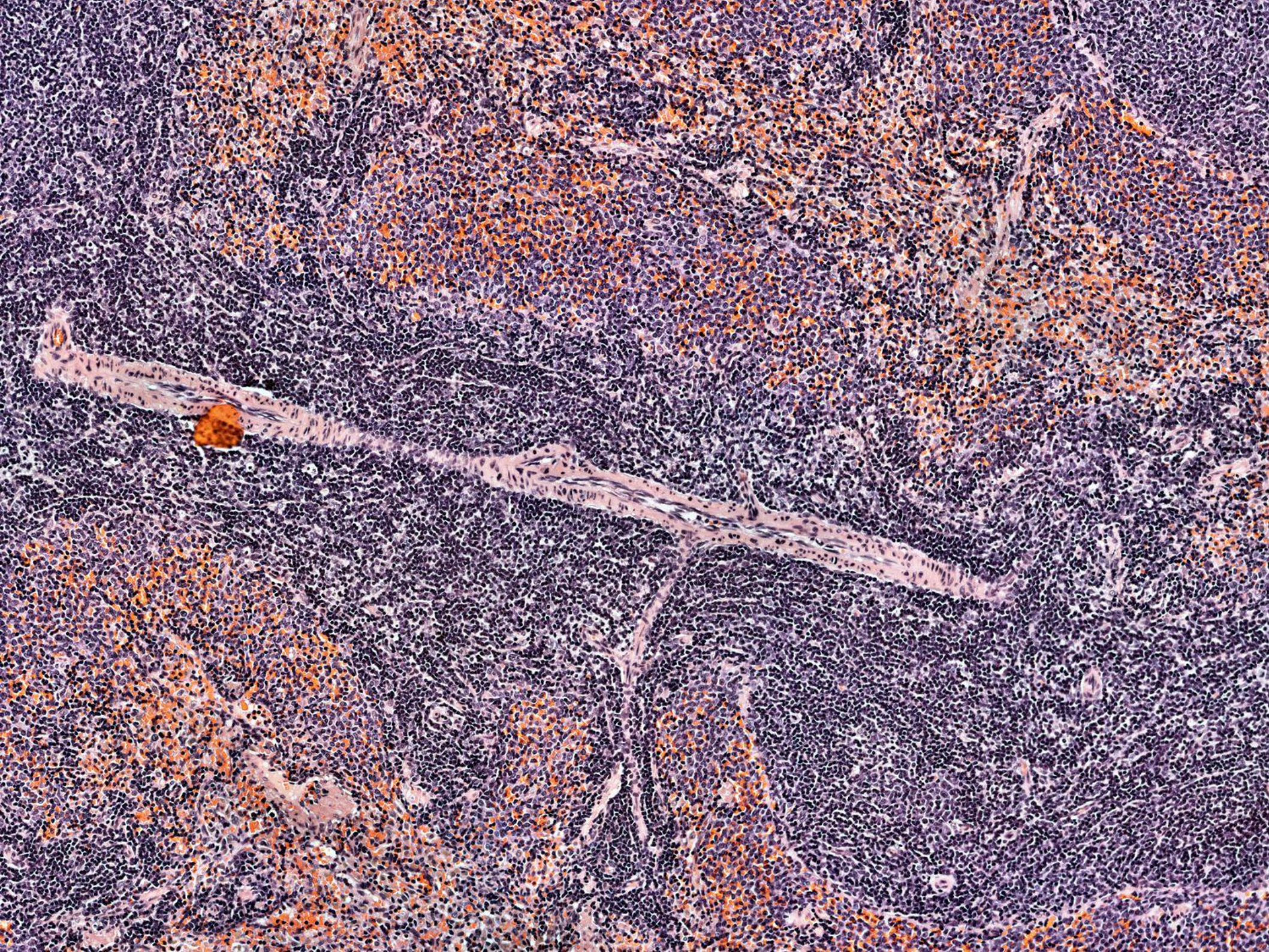


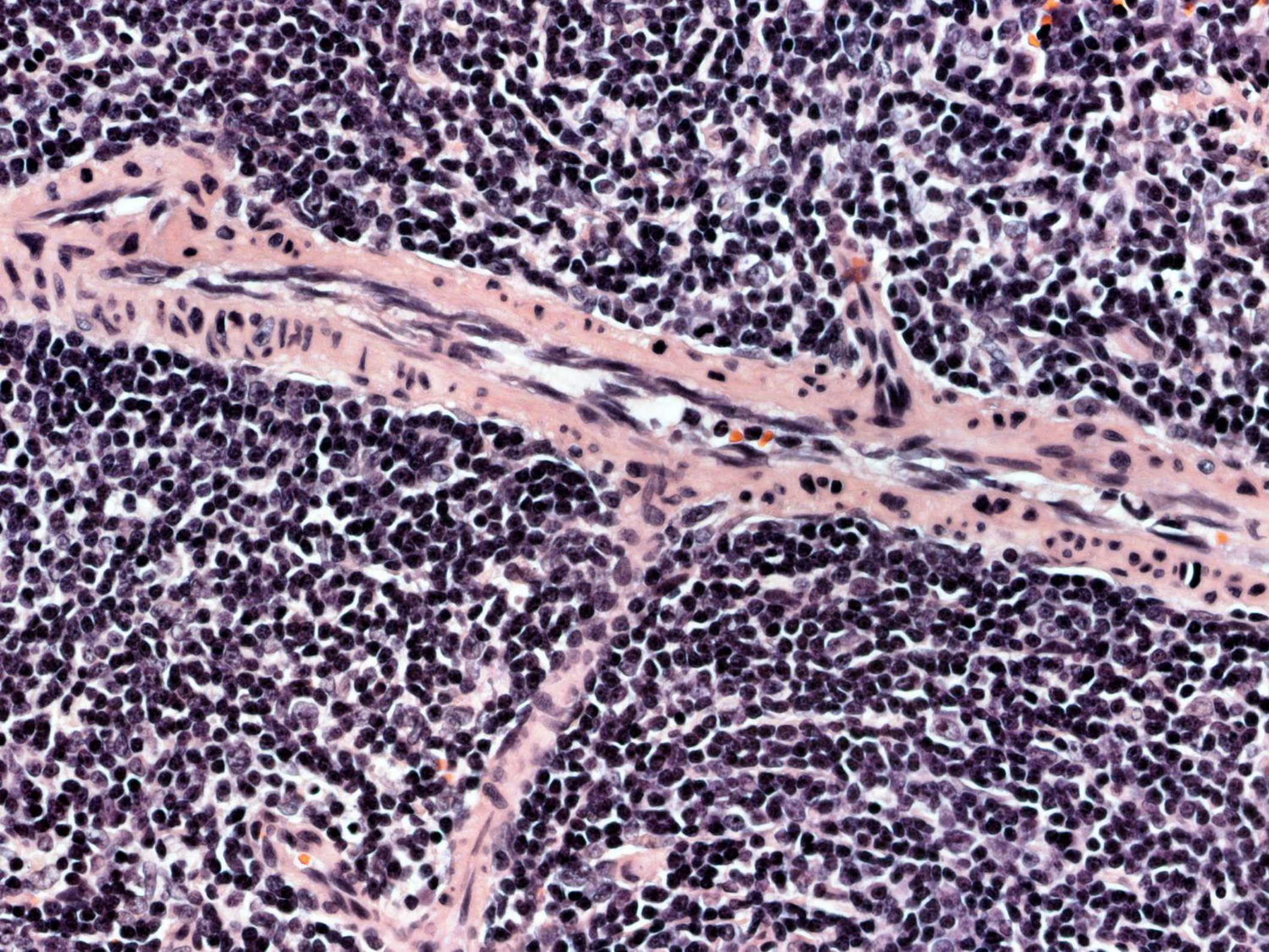


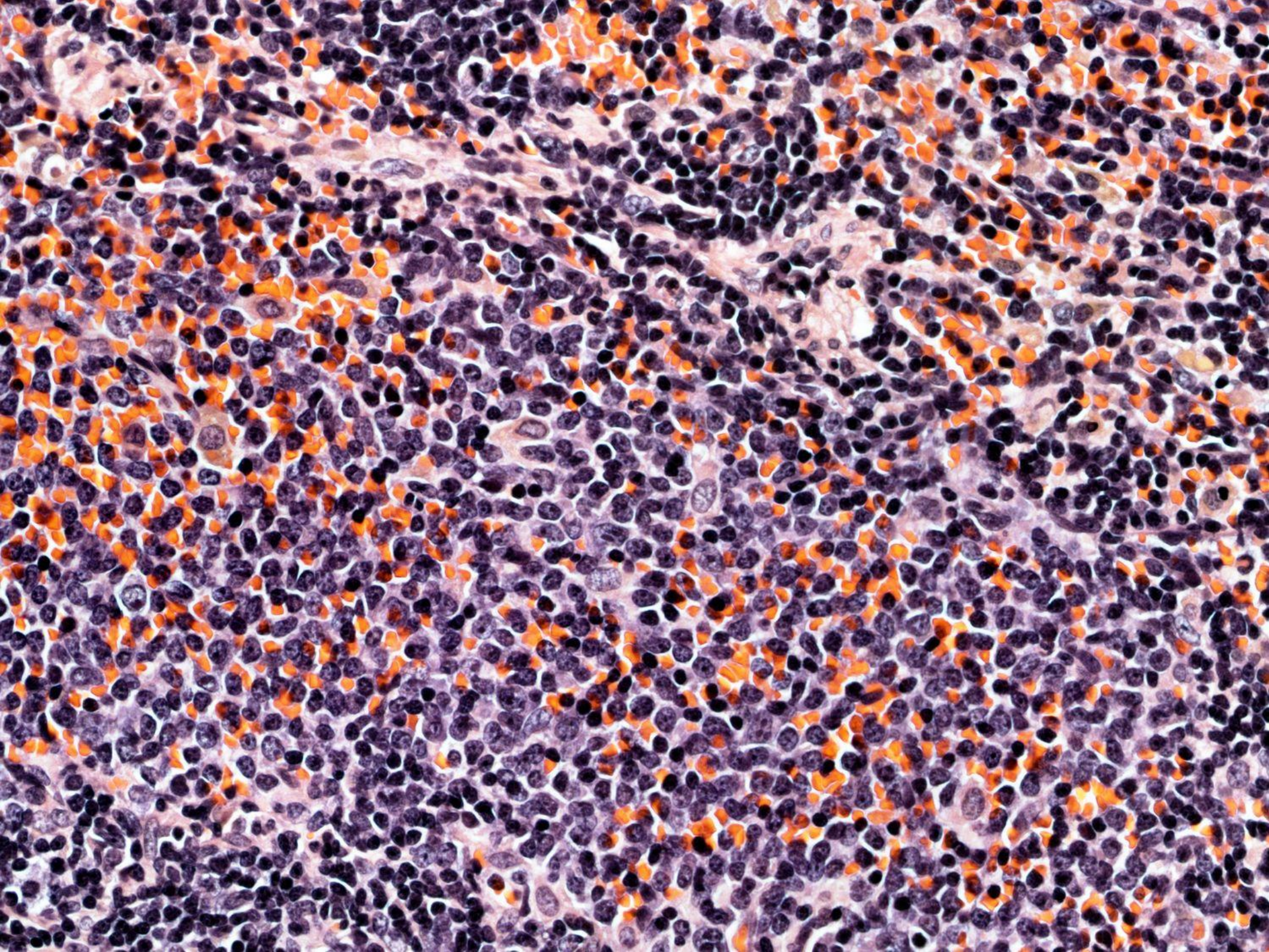


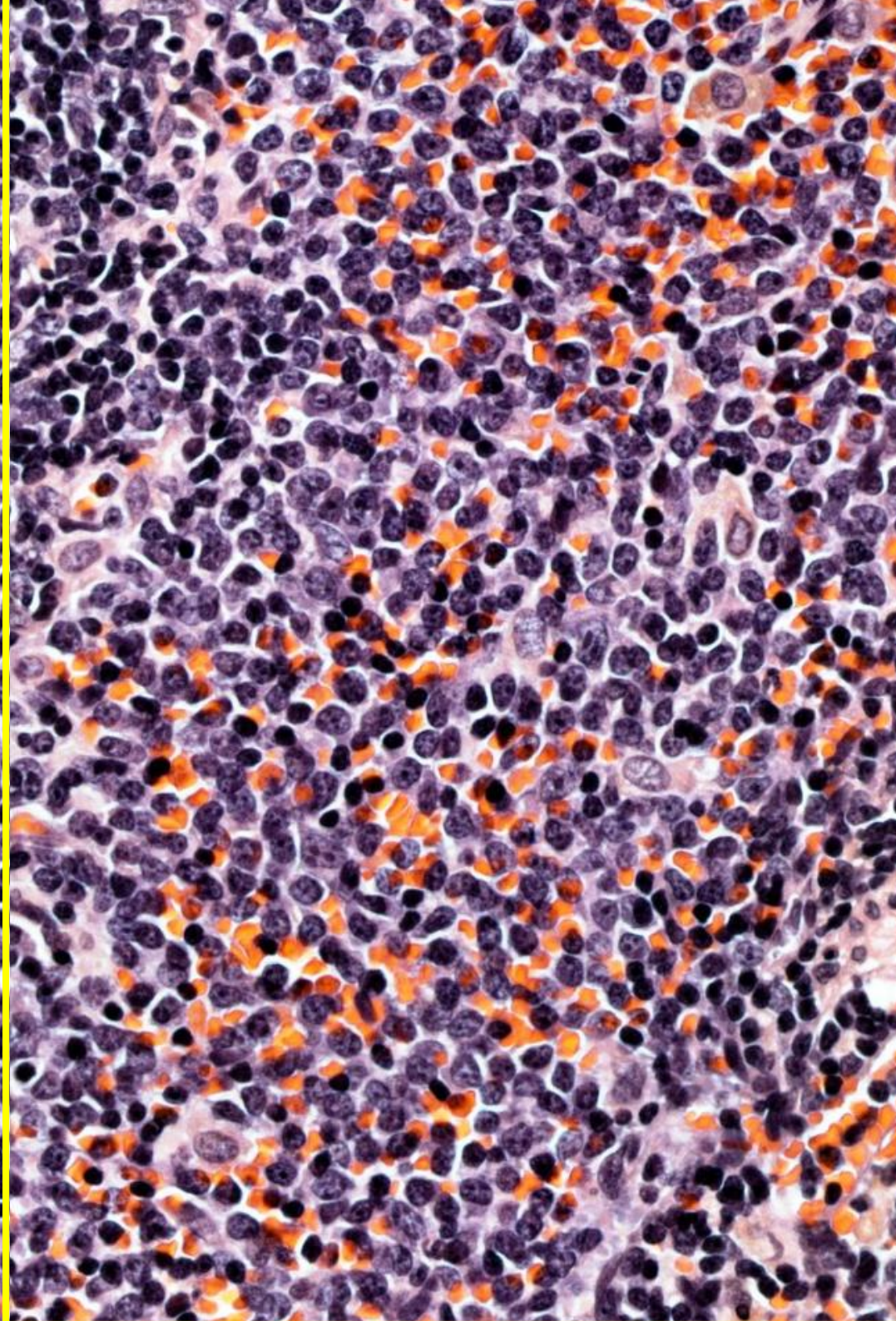
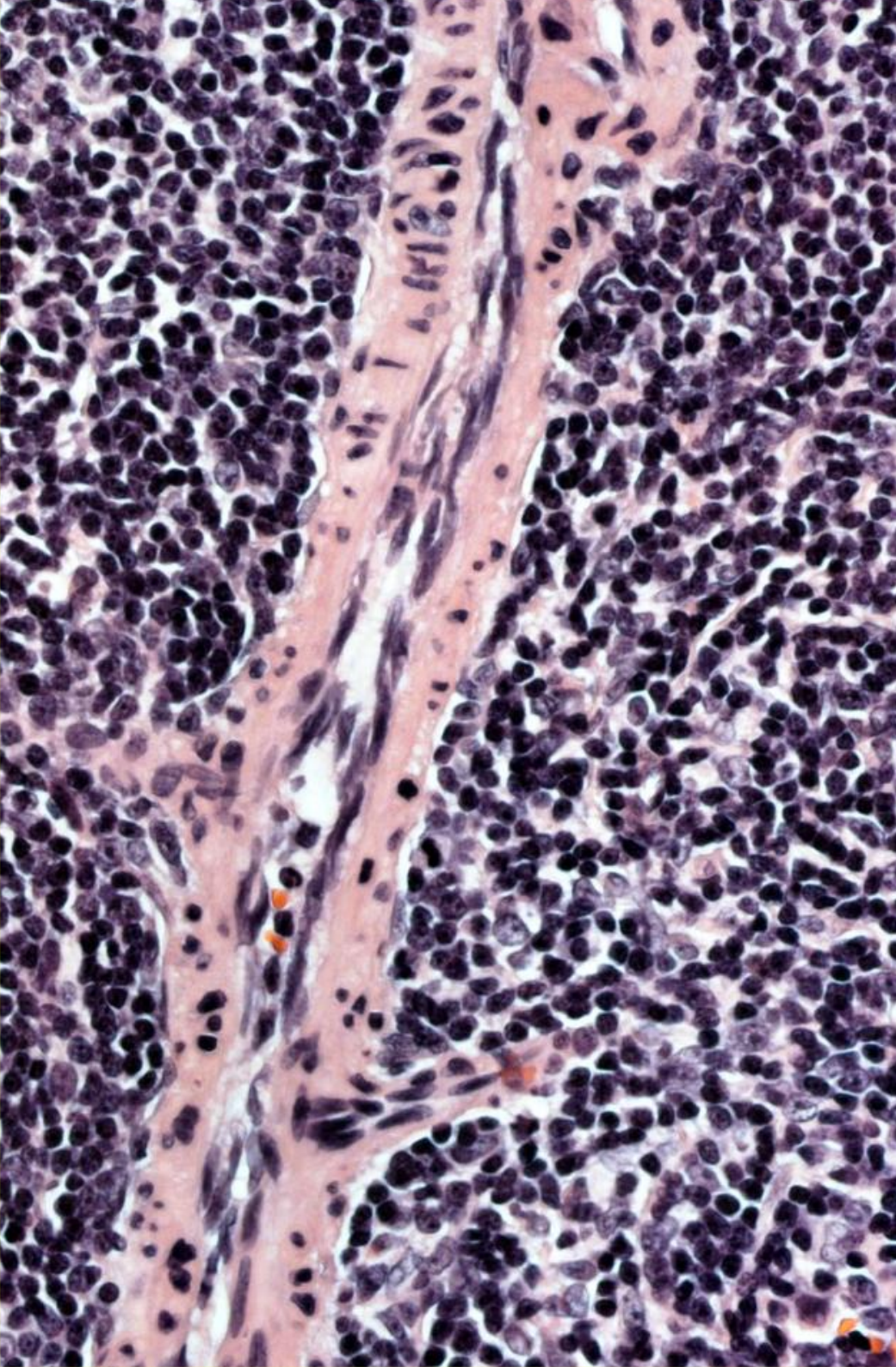










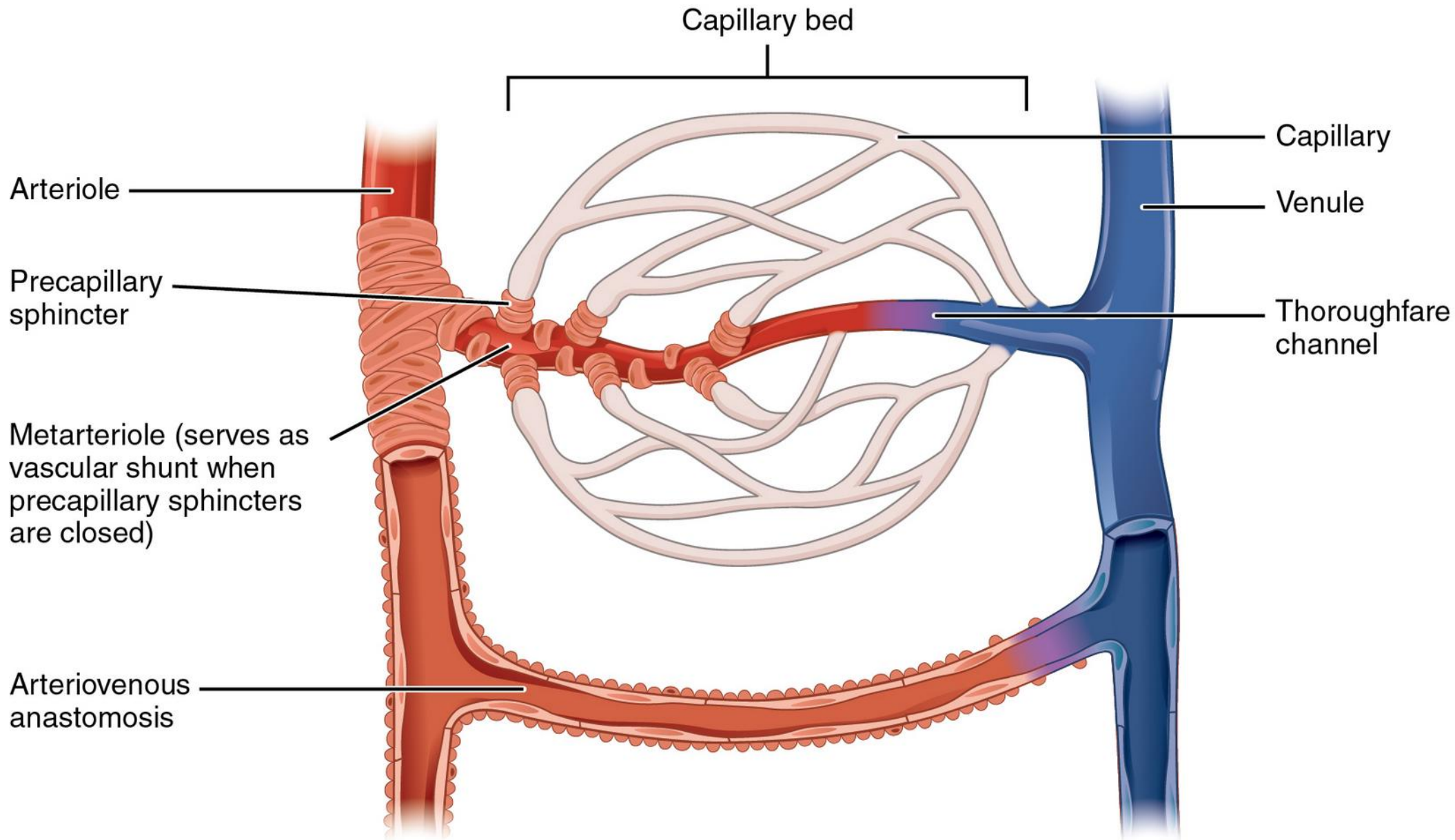


Metarterioles

- Looks like wide capillaries
- Structure
 - Endothelium
 - Discontinuous layer smooth muscle cells
- Connect arteriole direct to venule
 - At origin of capillary is pre-capillary sphincter
 - Constrict – channel blood past capillary bed

Figure 20.6 In the capillary bed, arterioles give rise to metarterioles. Precapillary sphincters located at the junction of a metarteriole with a capillary regulate blood flow.

Anatomy and Physiology 25 April 2013; openStax; CC-A 4.0; <https://openstax.org/books/anatomy-and-physiology/pages/20-1-structure-and-function-of-blood-vessels>



Venules

- Slightly wider
- Thin walled
- Receive capillaries and metarterioles
- Acute inflammation
- Leak plasma and leucocytes

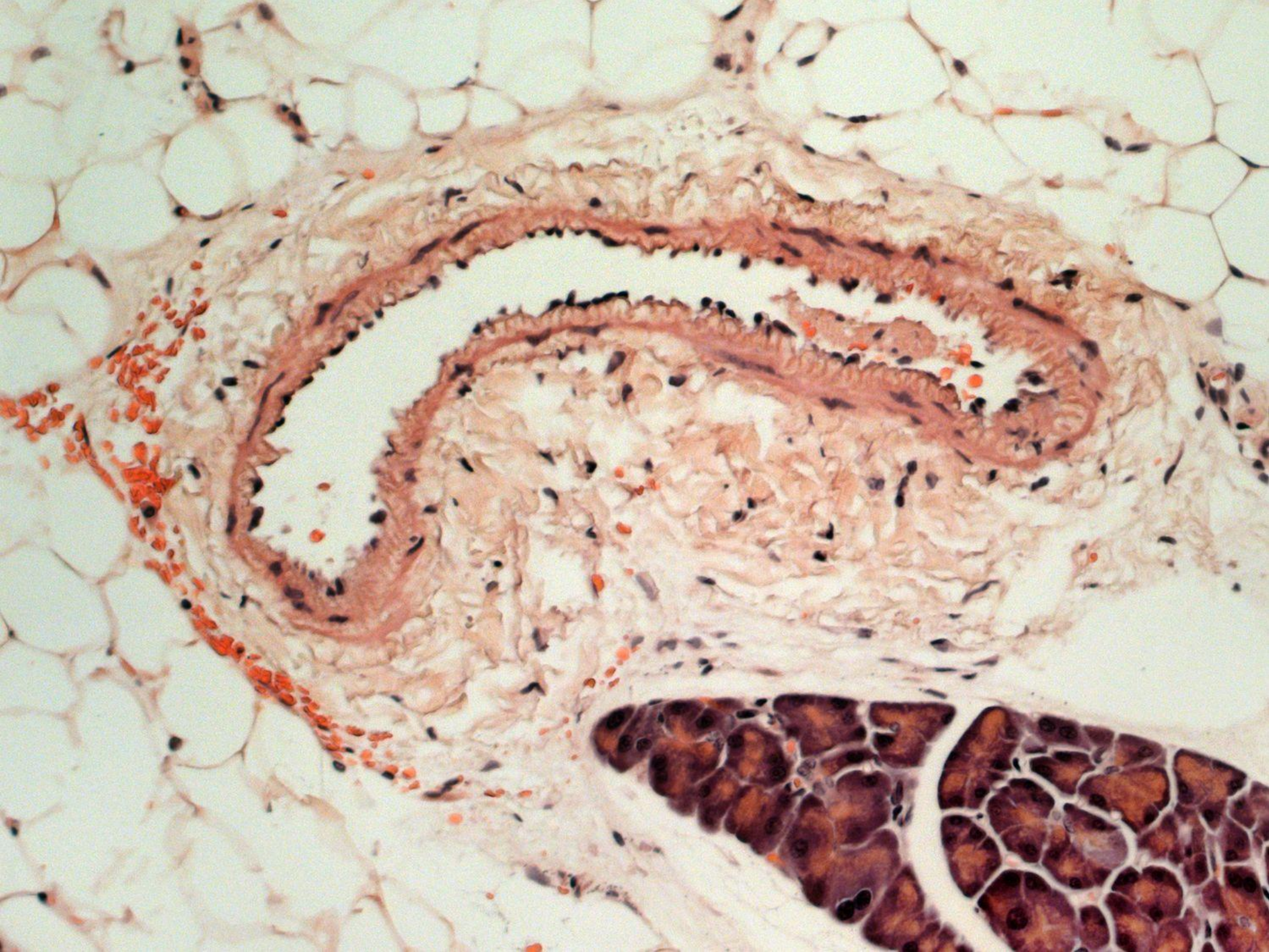


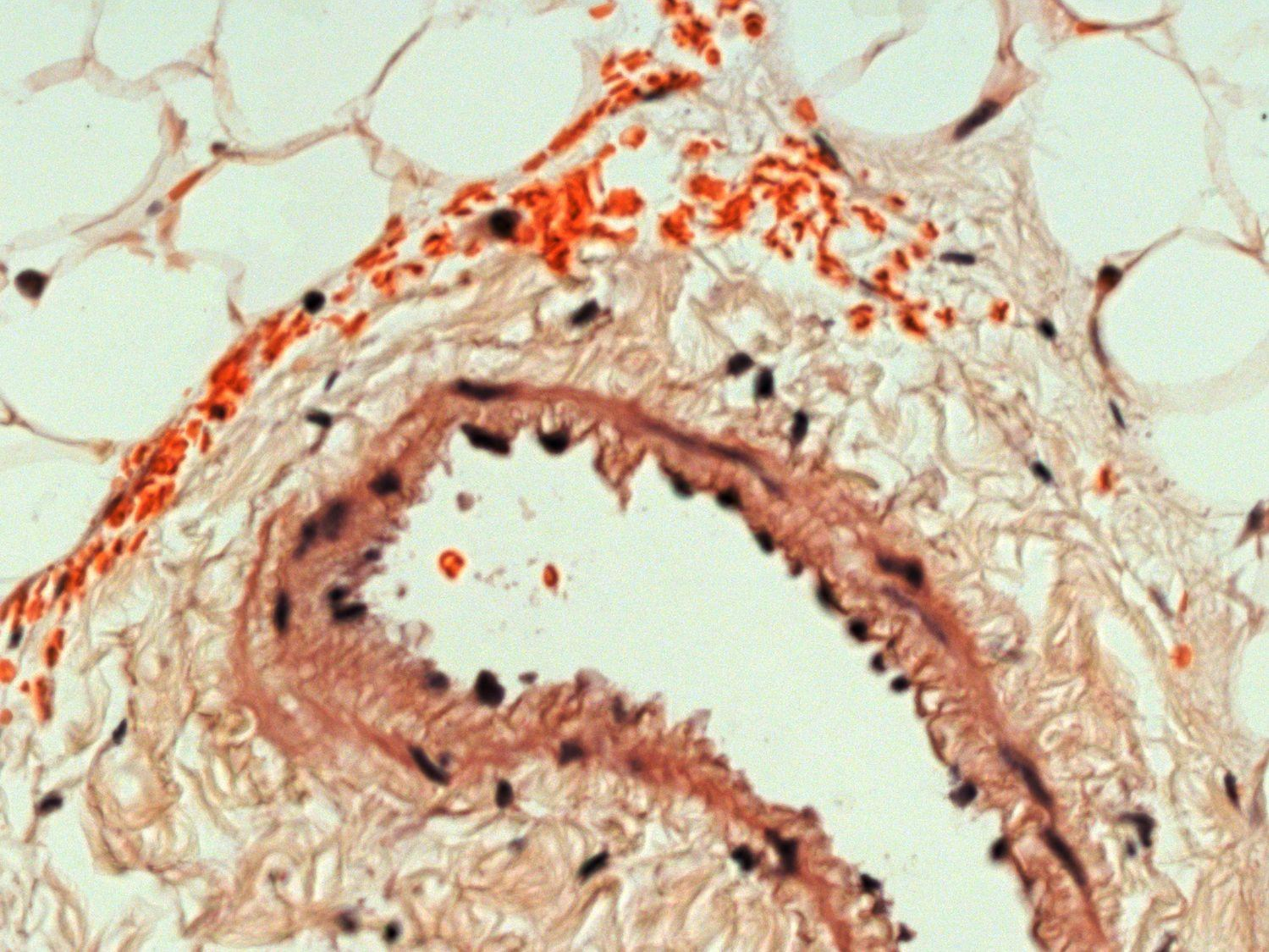
Veins

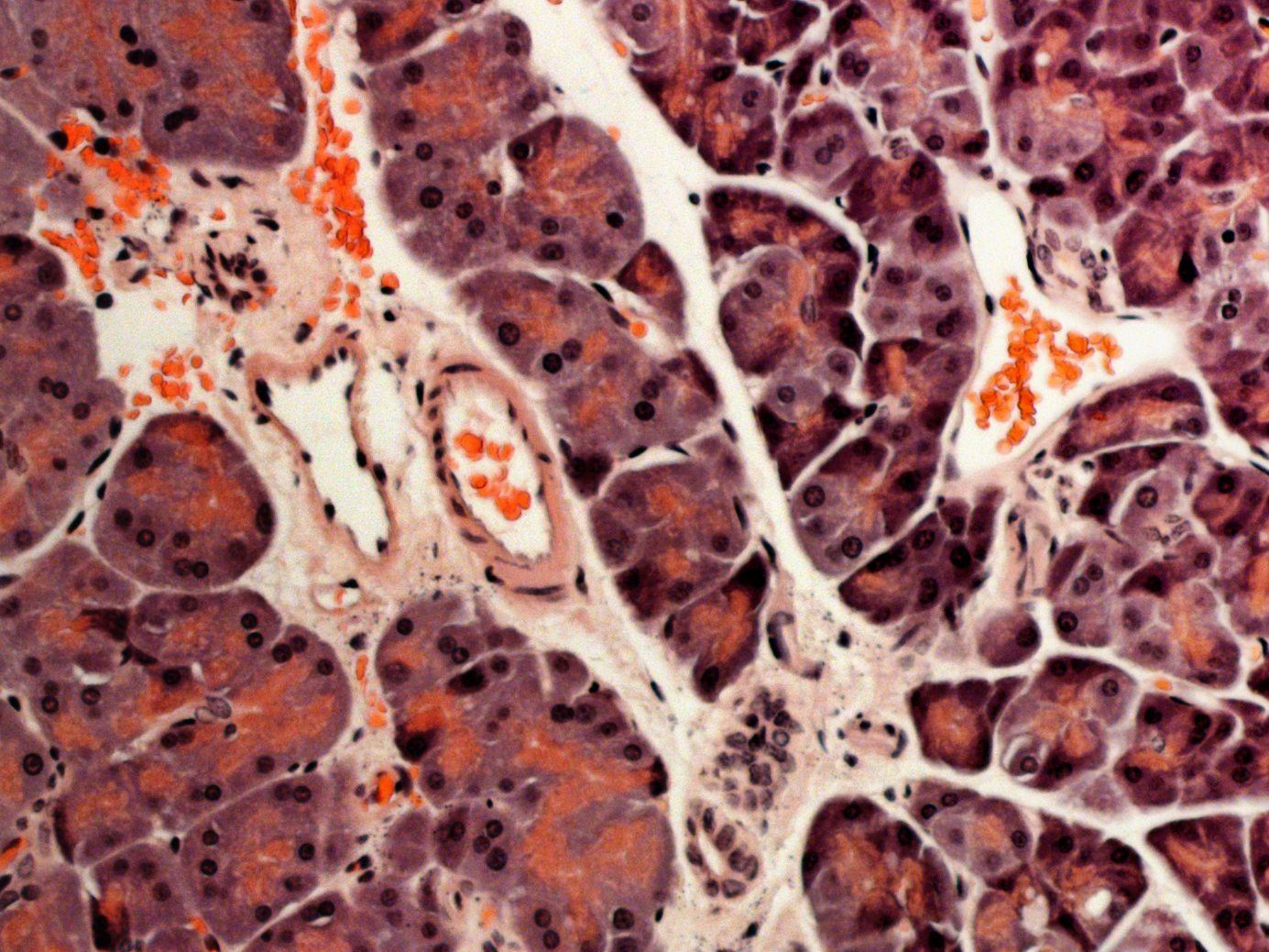
- Thin walled
- Wide lumen
- Flattened in sections
- Internal and external elastic laminae inconspicuous
- Small, medium and large are similar

Small and medium Veins

- Intima
 - Thin
 - Endothelium
 - BM
 - Trace CT
 - Meager internal elastic lamina
 - Sometimes valves
- Media
 - Few circular layers smooth muscle
 - Exception = veins of limbs and below heart
 - Thick
 - Resist distension from gravity
- Adventitia
 - Thickest
 - Collagen and elastic fibres
 - Fibroblasts
 - Smooth muscle cells







Large Veins

- Intima
 - Thin
 - Endothelium
 - BM
 - Trace CT
 - Meager internal elastic lamina
 - Sometimes valves
- Media
 - Poorly developed layers circular smooth muscle
- Adventitia
 - wide bundles longitudinal bundles smooth muscle in larger veins example vena cava inferior

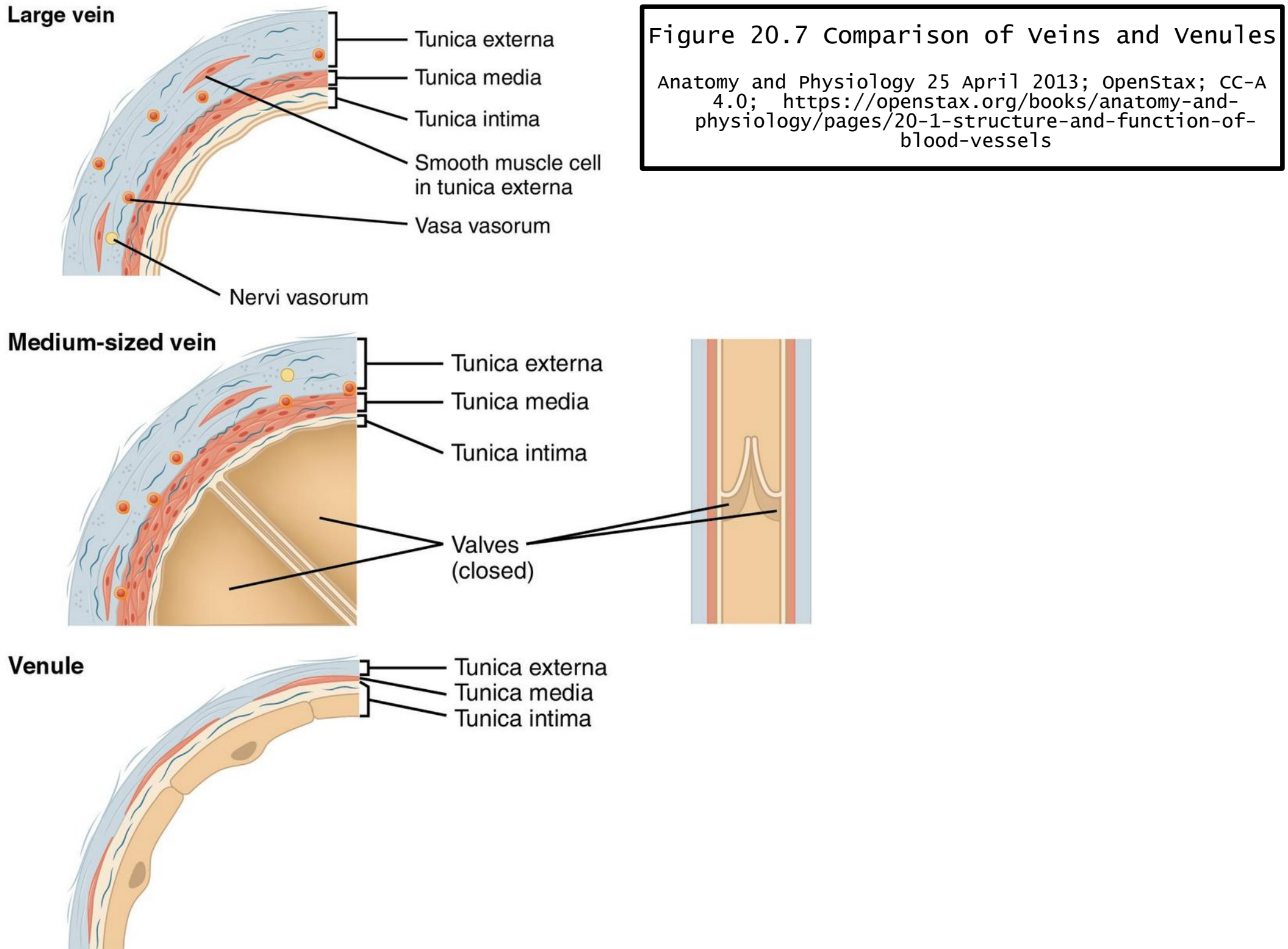
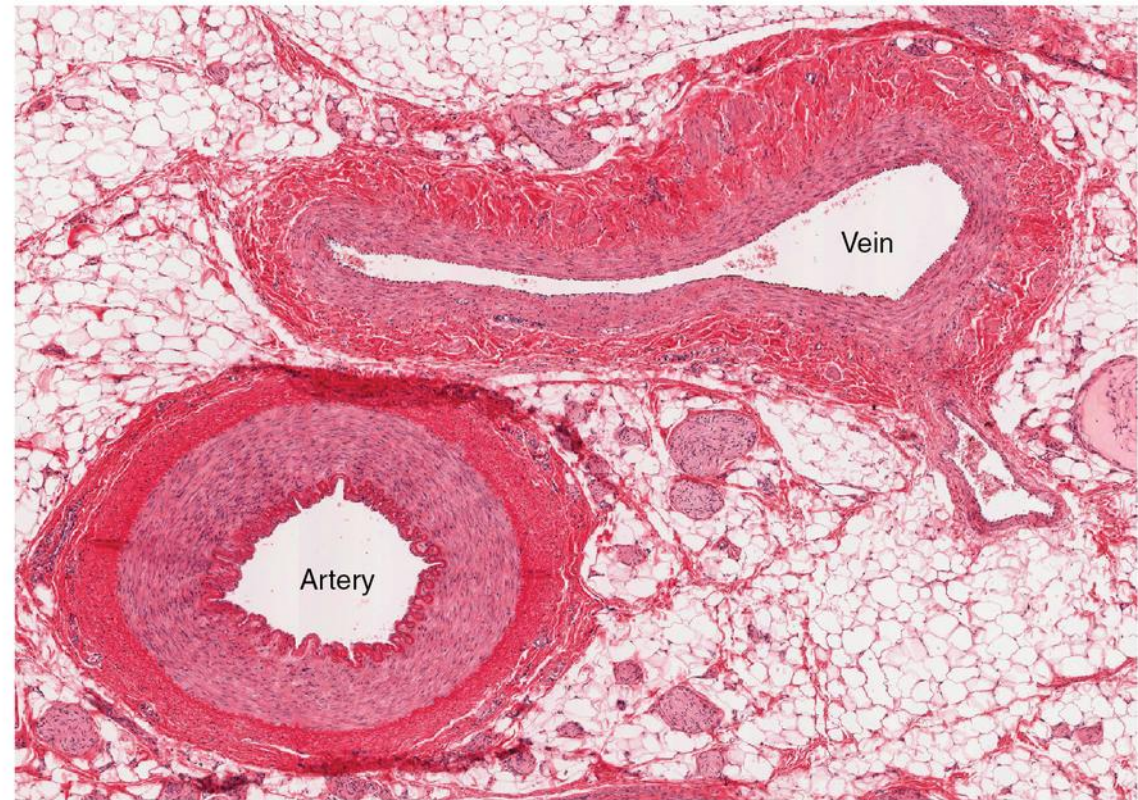
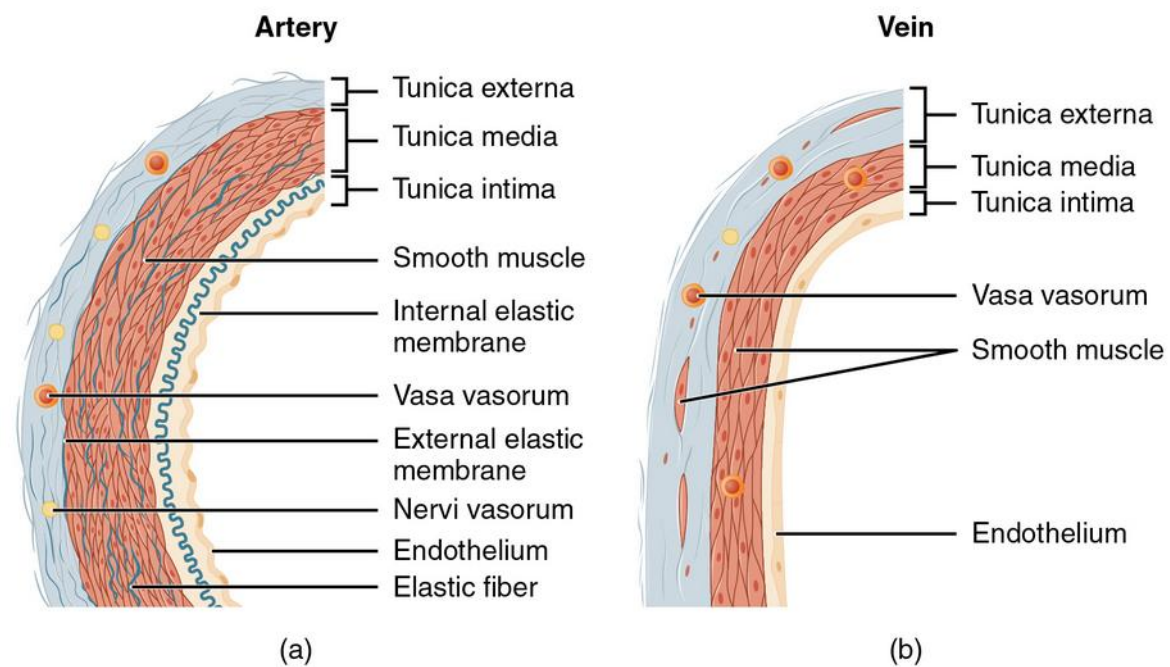




Figure 20.3 structure of Blood Vessels (a) Arteries and (b) veins share the same general features, but the walls of arteries are much thicker because of the higher pressure of the blood that flows through them. (c) A micrograph shows the relative differences in thickness.

Anatomy and Physiology 25 April 2013;
OpenStax; CC-A 4.0;
<https://openstax.org/books/anatomy-and-physiology/pages/20-1-structure-and-function-of-blood-vessels>



(c)

Lymphatic System

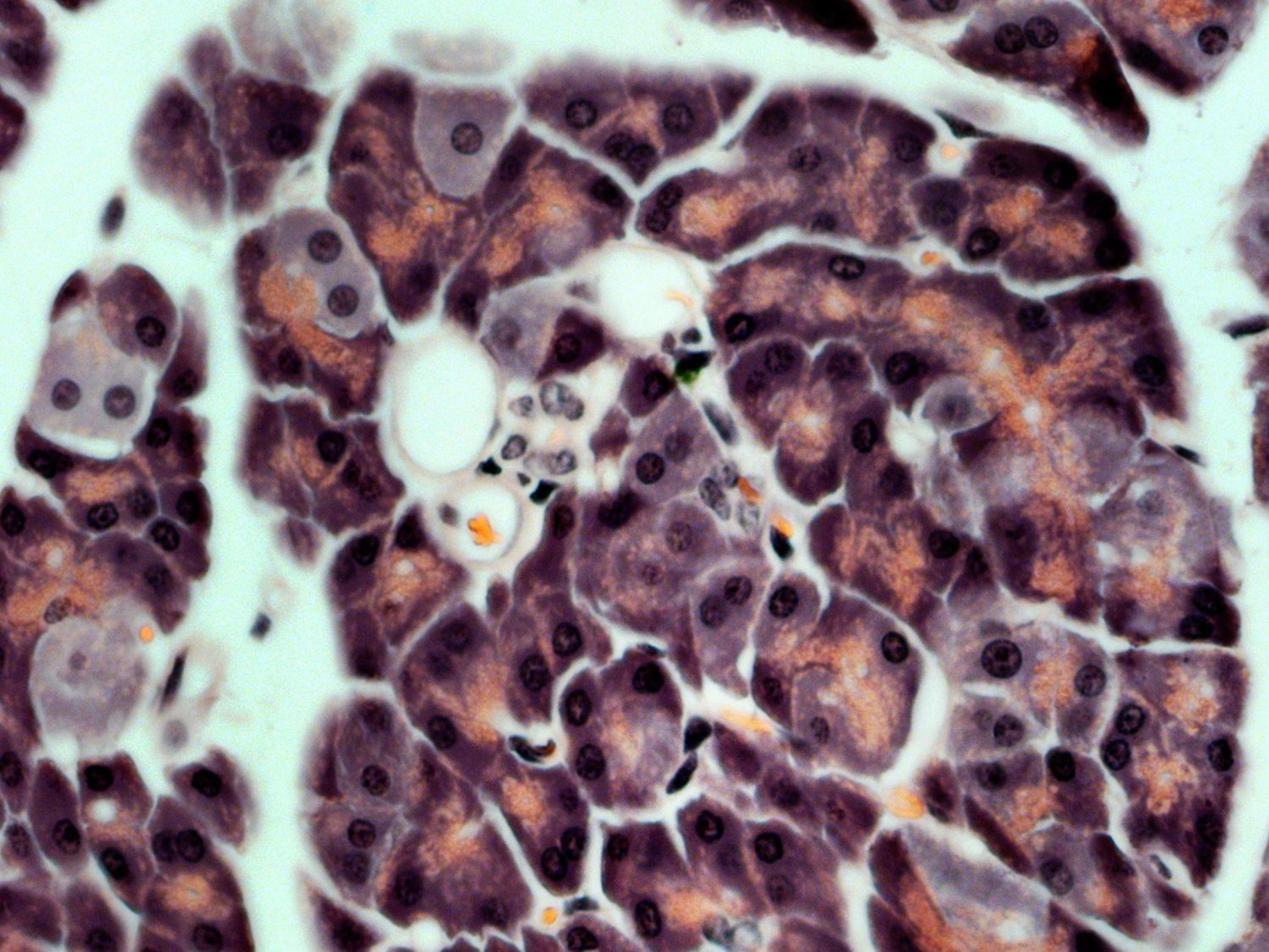
- Collects excess tissue fluid
- Filters through lymph nodes
- Return to blood
- Start as blind-ending vessels

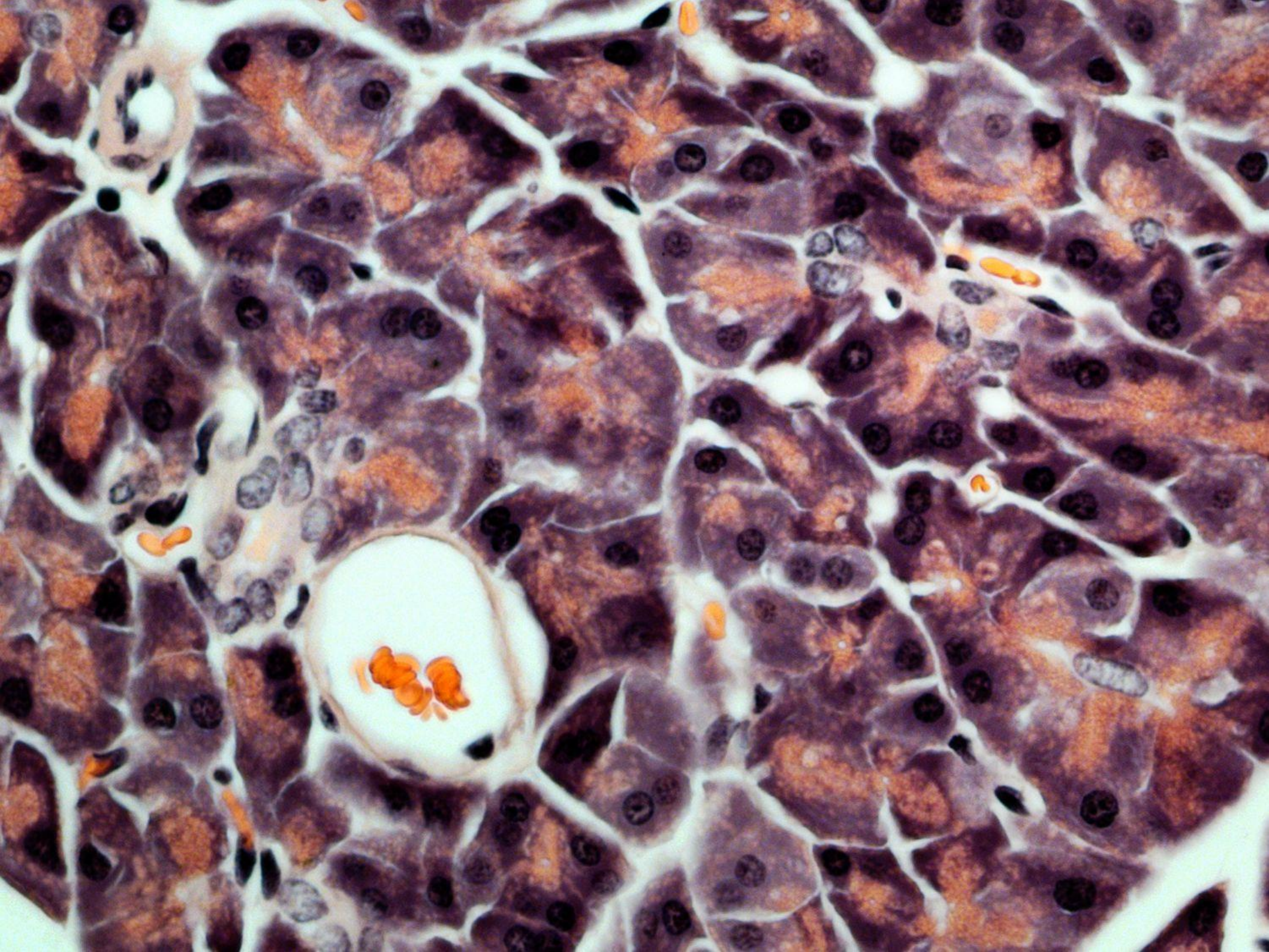
Lymphatic Capillaries

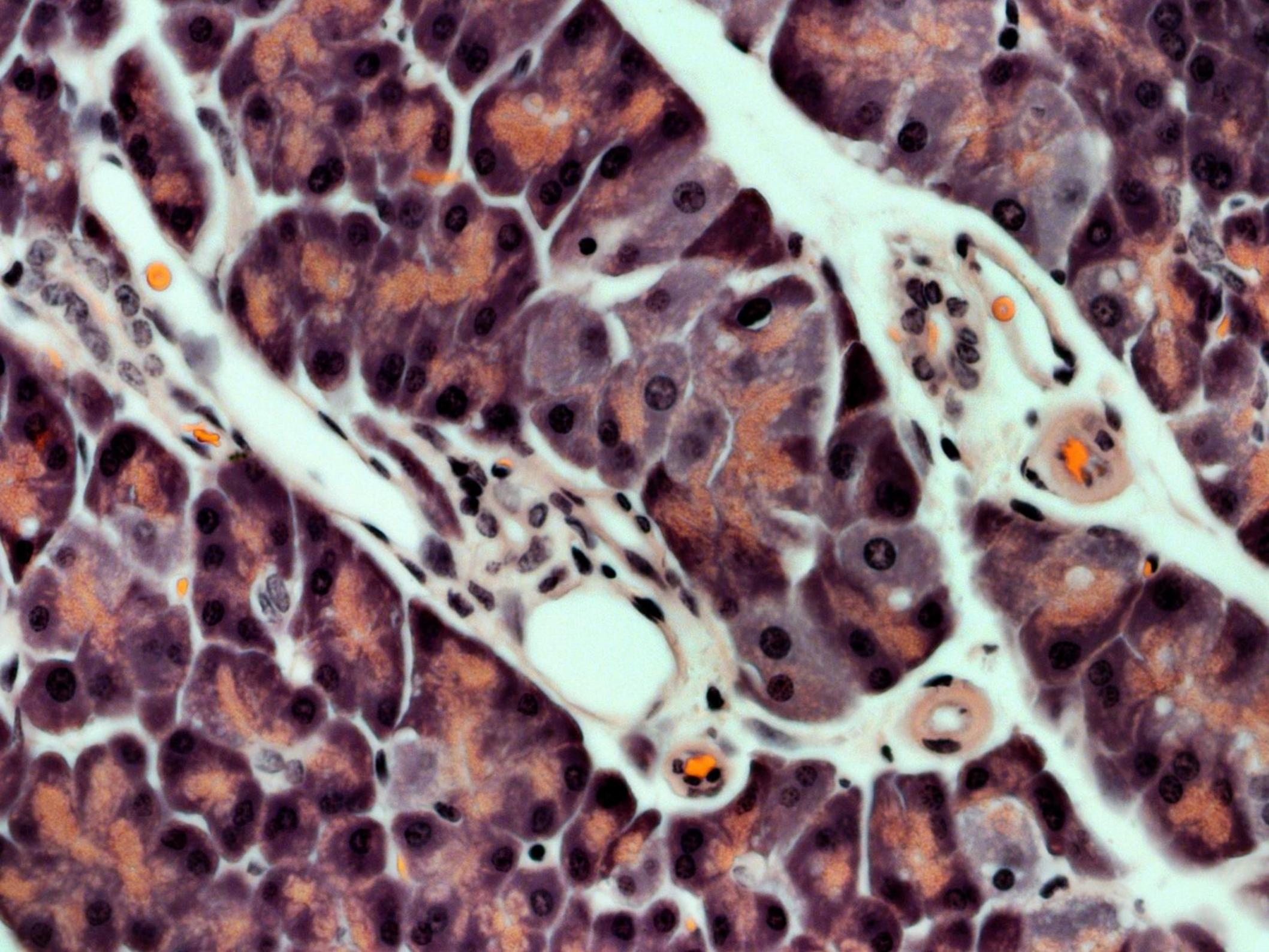
- Lined with endothelium
- BM incomplete or absent
- Allows macromolecules to enter
- No associated pericytes
- Wider than blood capillaries
 - Collagen anchors in surrounding tissue
 - Keep vessels open with oedema

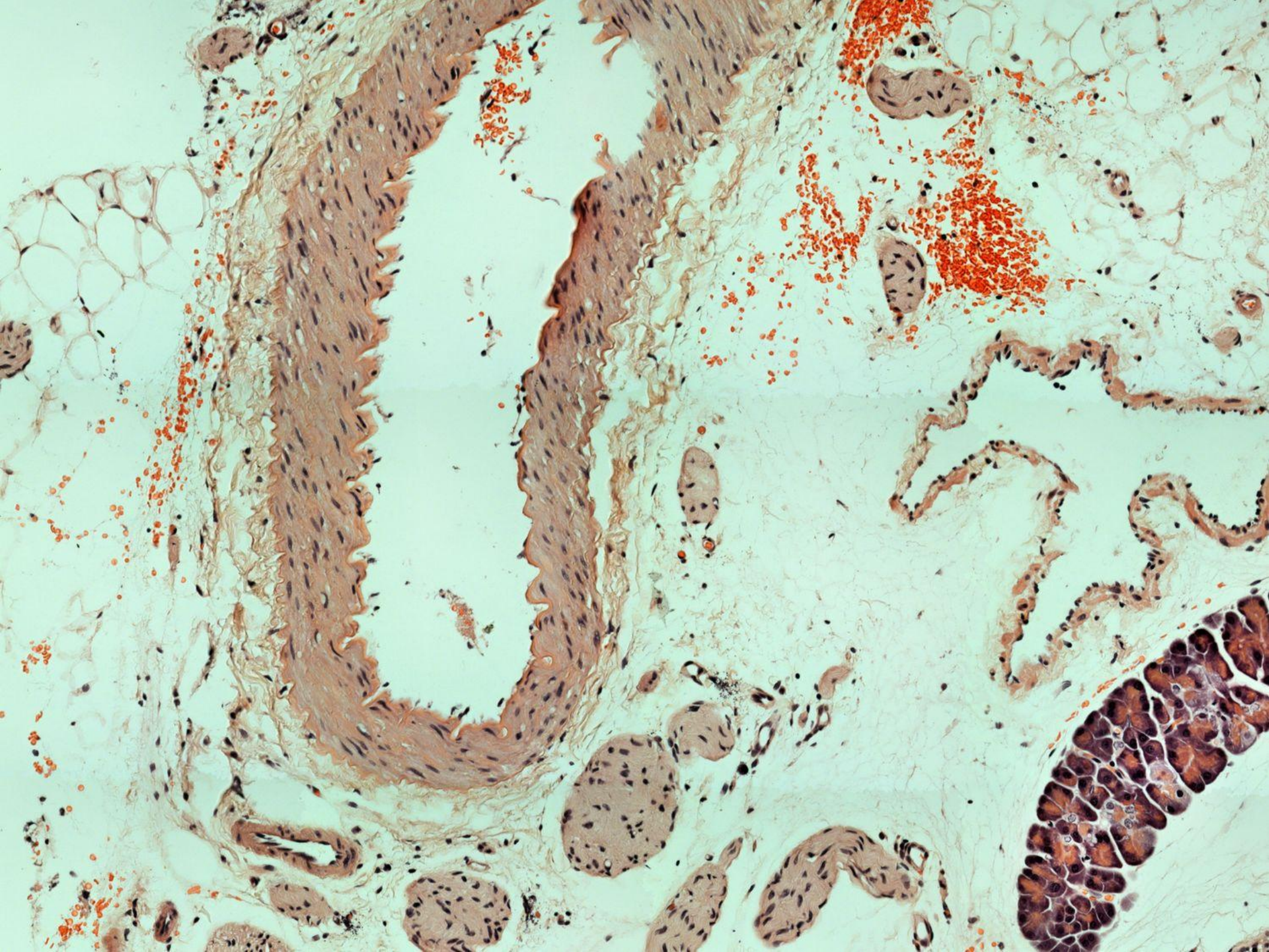
Lymphatic Vessels

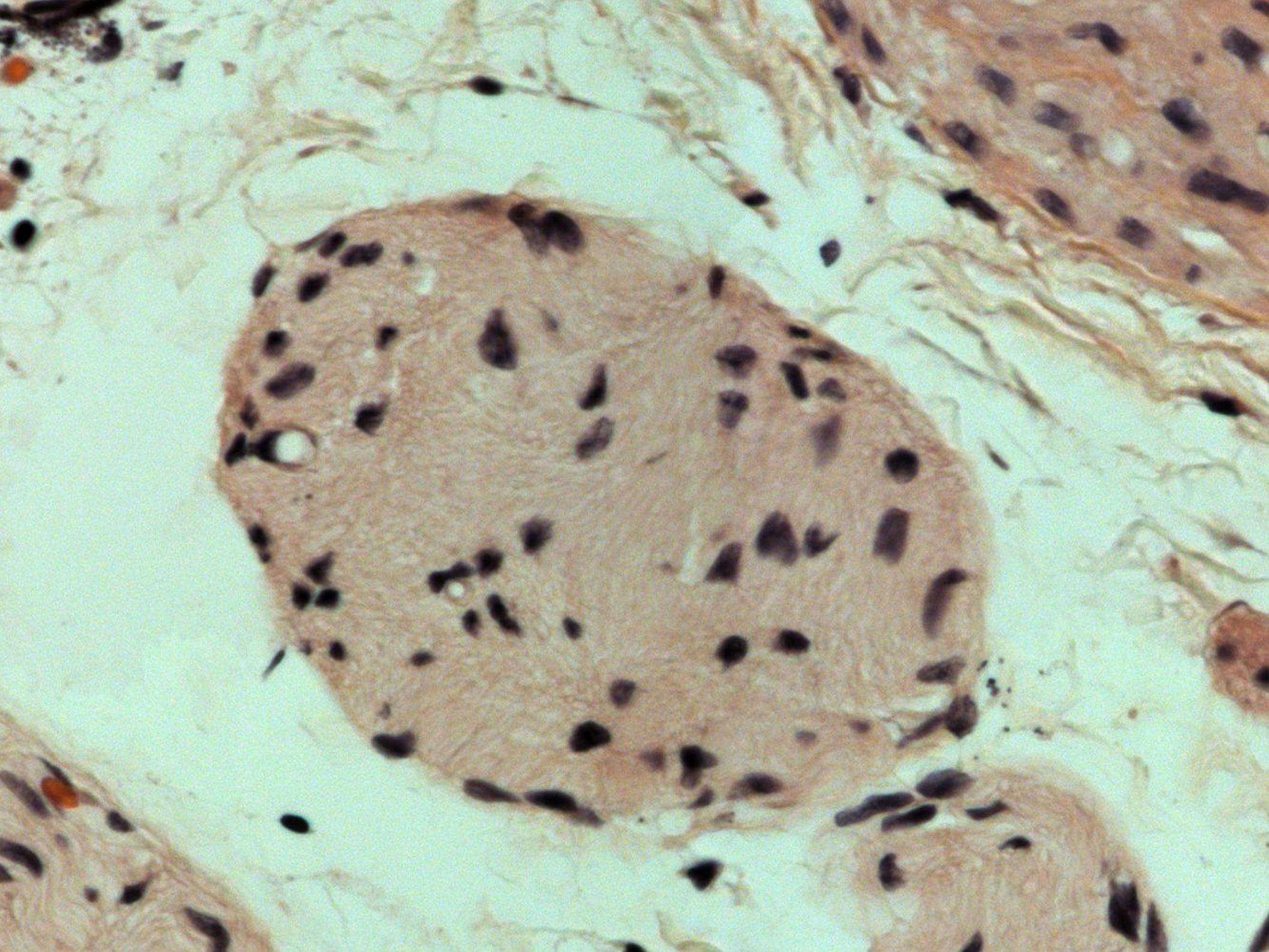
- No blood cells in lumen
- Similar to small and medium veins
- Endothelium
- Thin external coat of loose CT
- Medium and large lymphatics 3 coats
- Difficult to distinguish layers
- Intima
 - Endothelium and elastic fibres
- Media and Adventitia
 - Smooth muscle cells and CT fibres

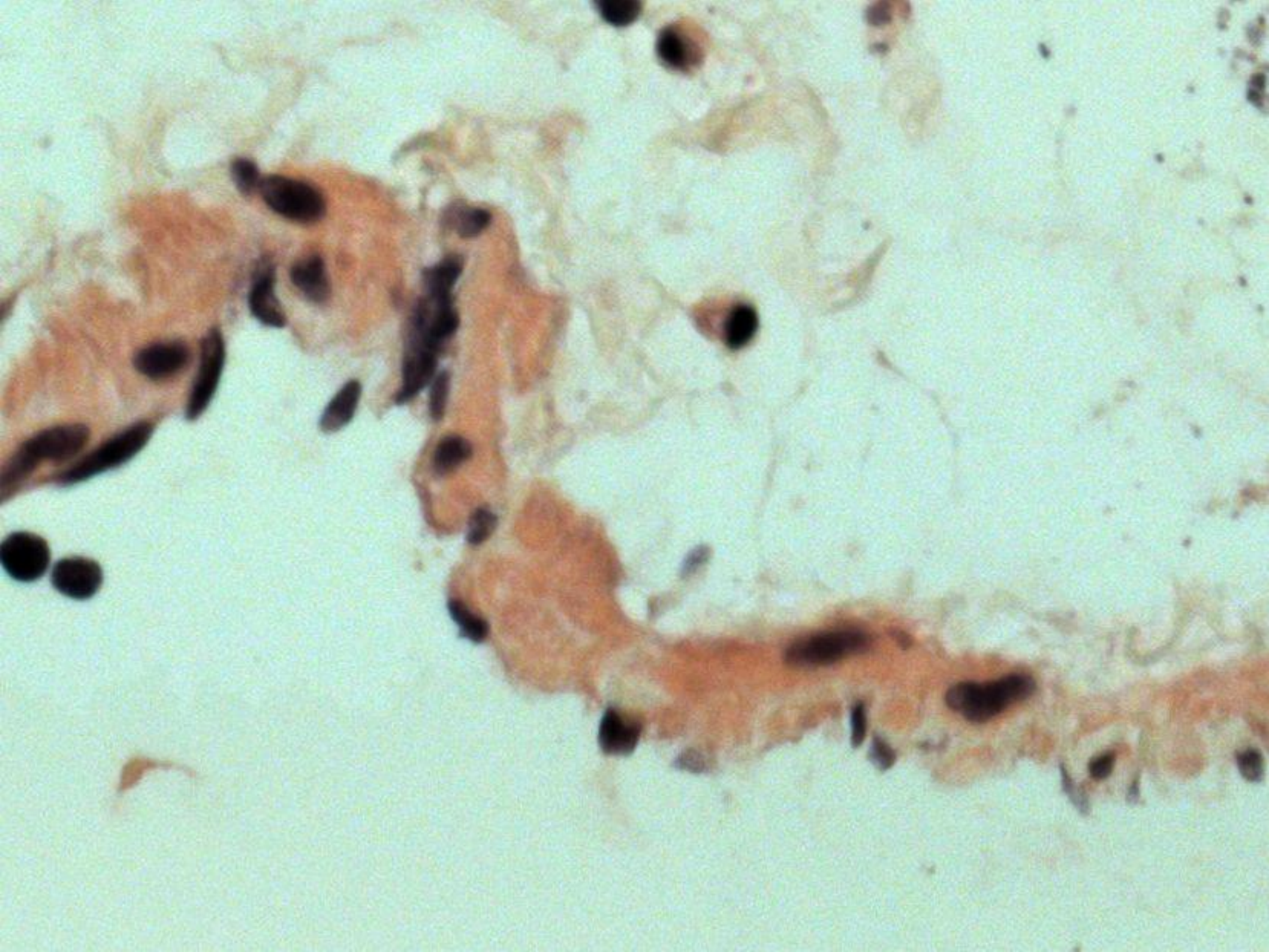


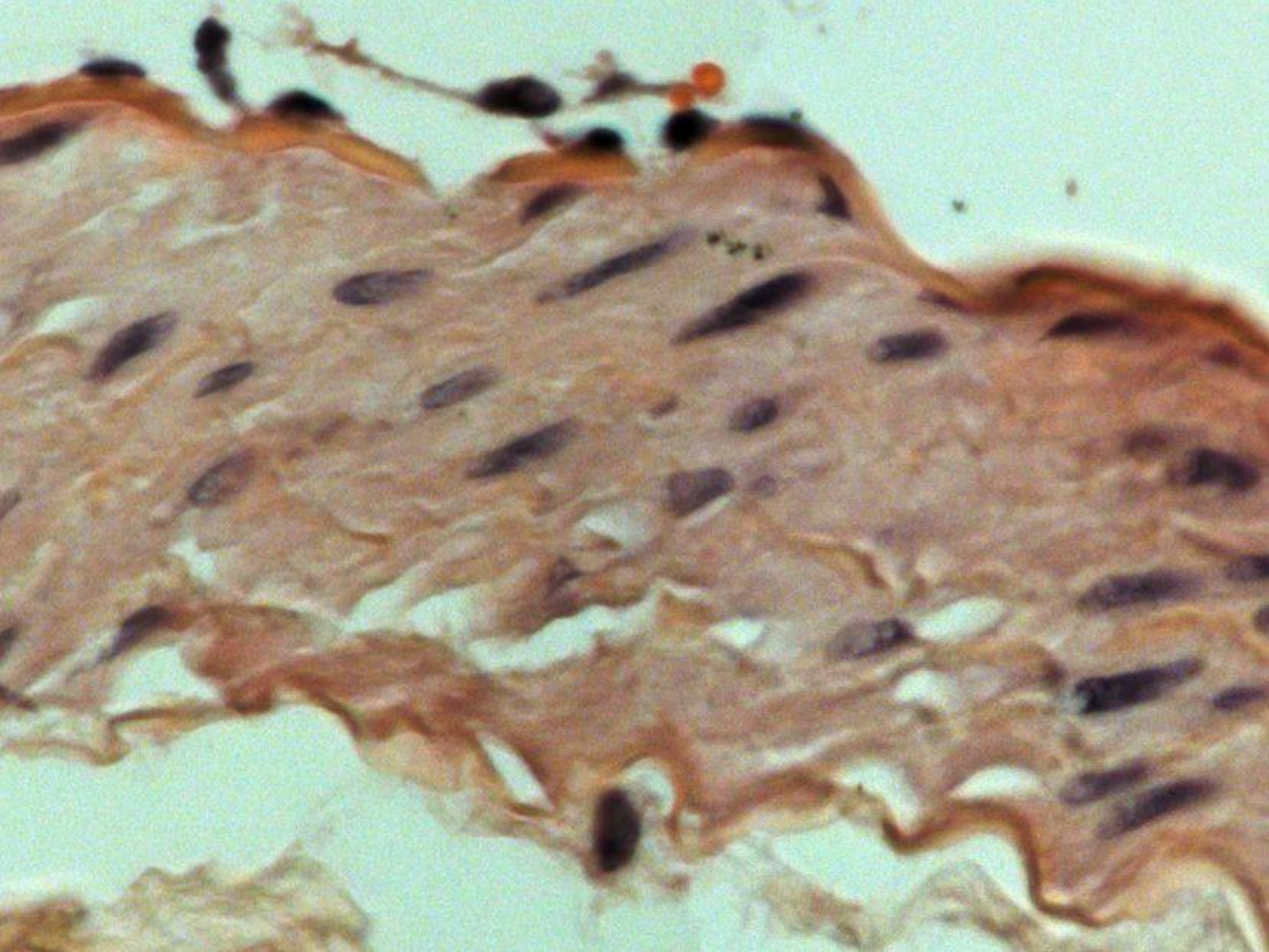


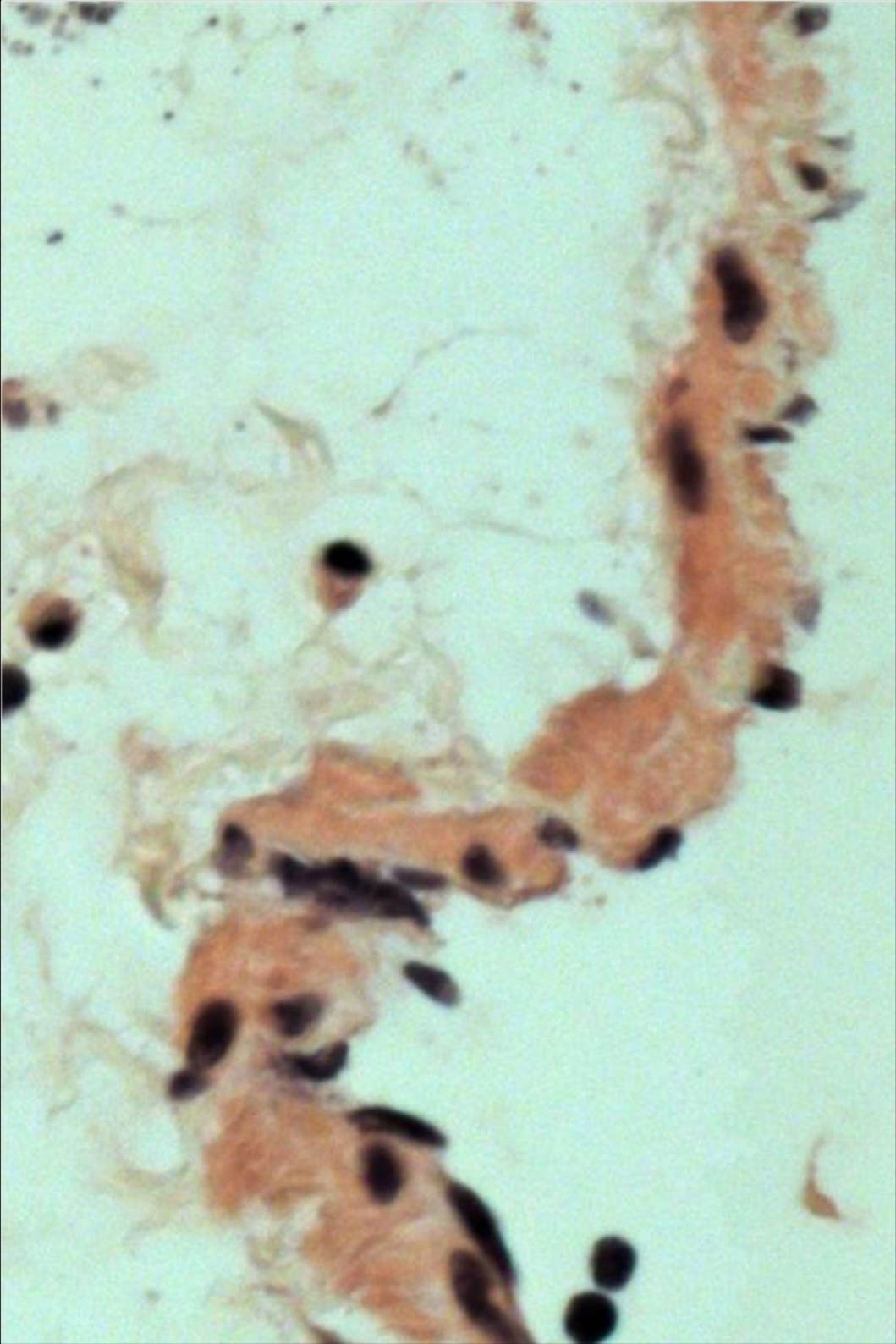
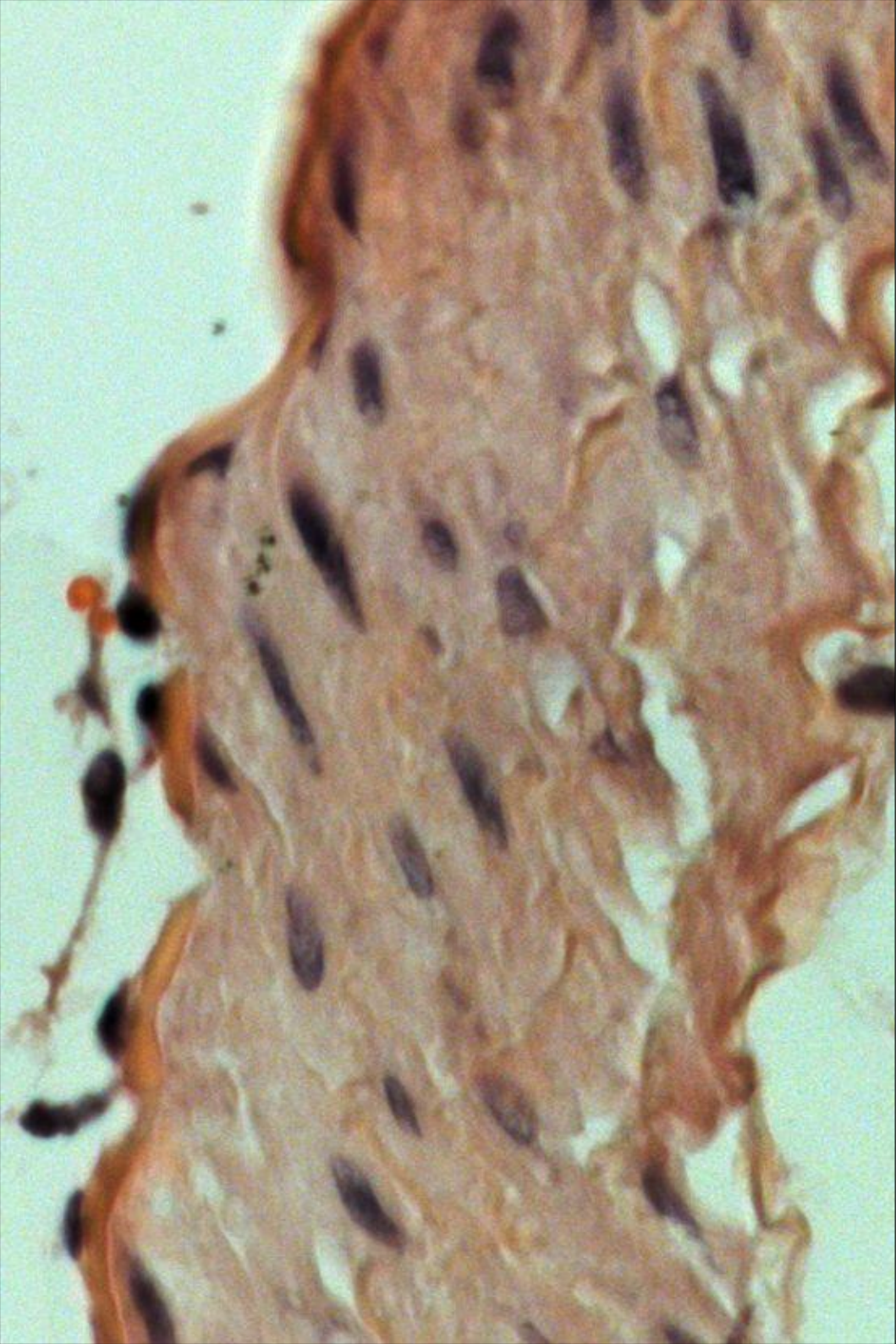












Muscular artery & vein

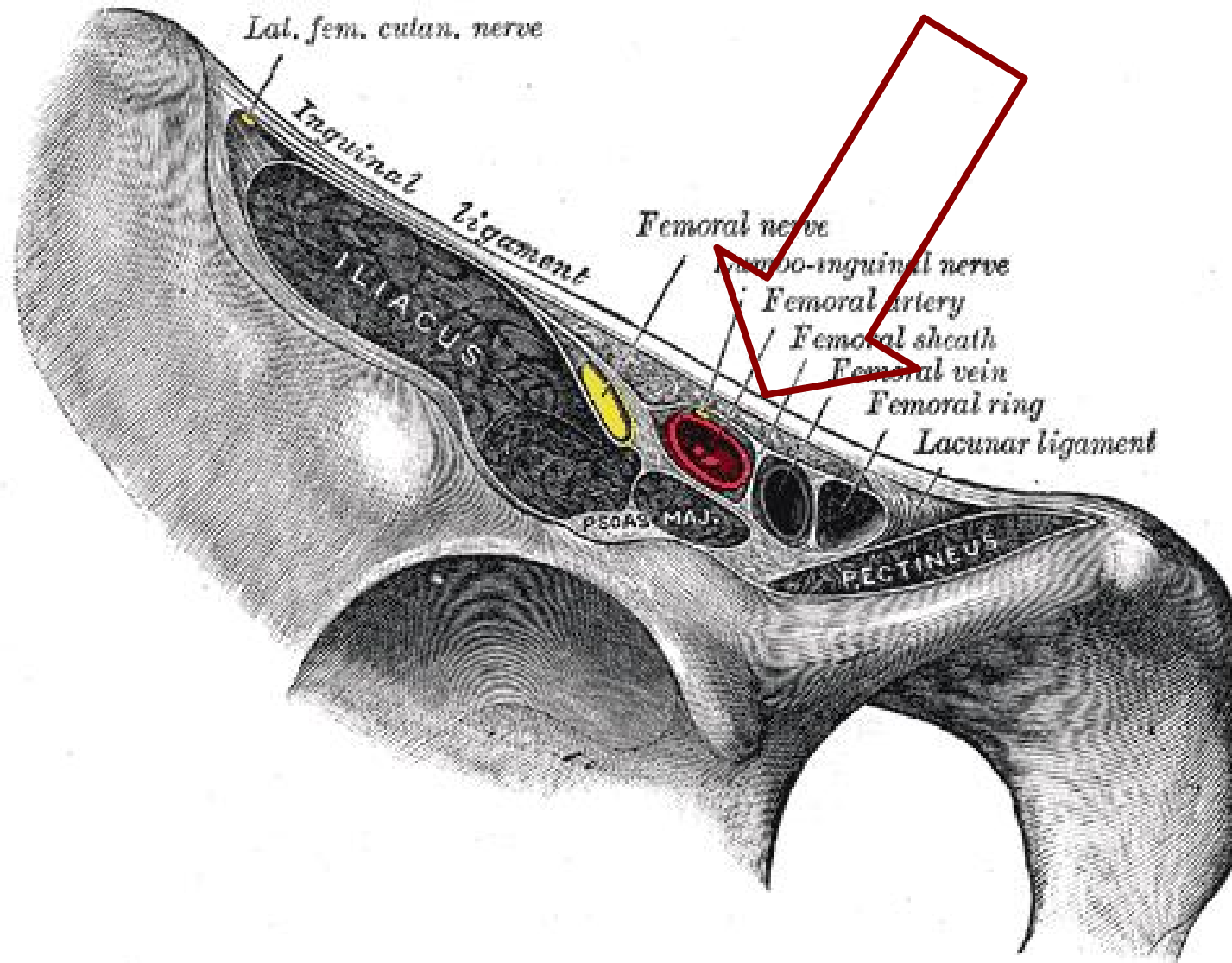
Slides 69 & 70

Majority

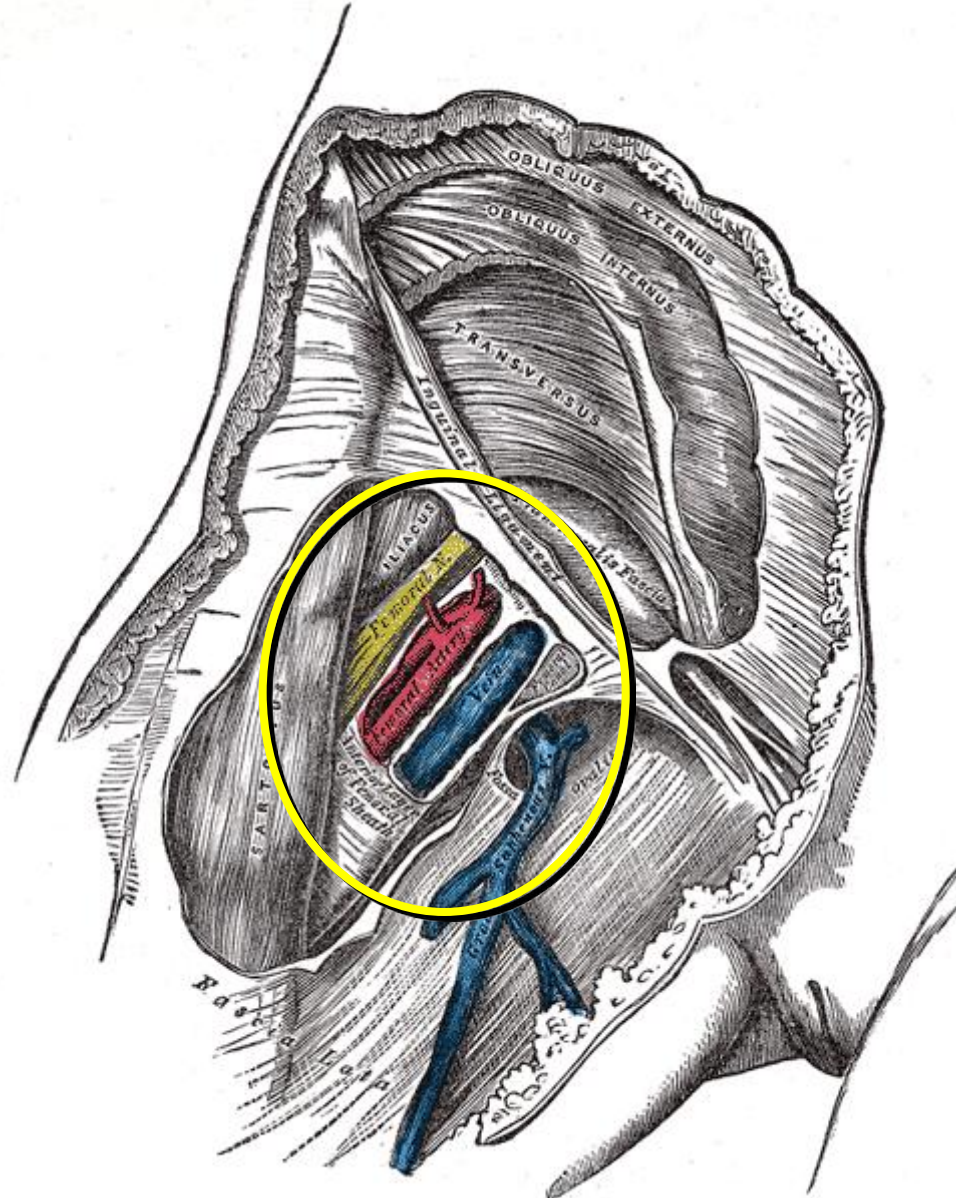
Macroscopic anatomy

- Holds true at the microscopic level
- Blood vessels in sheath
- Artery + Vein + Nerve + Lymphatics
- Example femoral sheath

Femoral sheath



This anatomical illustration shows the right half of a human pelvis from the front. The iliacus muscle is shown originating from the anterior superior iliac spine and inserting into the lesser trochanter of the femur. The psoas major muscle is shown originating from the lumbar vertebrae and inserting into the greater trochanter of the femur. The femoral artery and vein are shown running along the anterior surface of the femur, enclosed in the femoral sheath. A yellow circle highlights the femoral sheath, which contains the femoral artery and vein. The femoral artery is shown in red, and the femoral vein is shown in blue. The femoral nerve is shown in yellow, running along the posterior surface of the femur. The femoral sheath is shown in white. The femoral artery is shown branching into the profunda femoris artery and the circumflex femoral artery. The femoral vein is shown branching into the profunda femoris vein and the circumflex femoral vein. The femoral nerve is shown branching into the saphenous nerve and the obturator foramen nerves. The femoral sheath is shown as a white, fibrous structure that encloses the femoral artery and vein. The femoral artery is shown as a red, branching structure. The femoral vein is shown as a blue, branching structure. The femoral nerve is shown as a yellow, branching structure. The femoral sheath is shown as a white, fibrous structure that encloses the femoral artery and vein. The femoral artery is shown branching into the profunda femoris artery and the circumflex femoral artery. The femoral vein is shown branching into the profunda femoris vein and the circumflex femoral vein. The femoral nerve is shown branching into the saphenous nerve and the obturator foramen nerves.



Blood and nerve bundle

Nerve

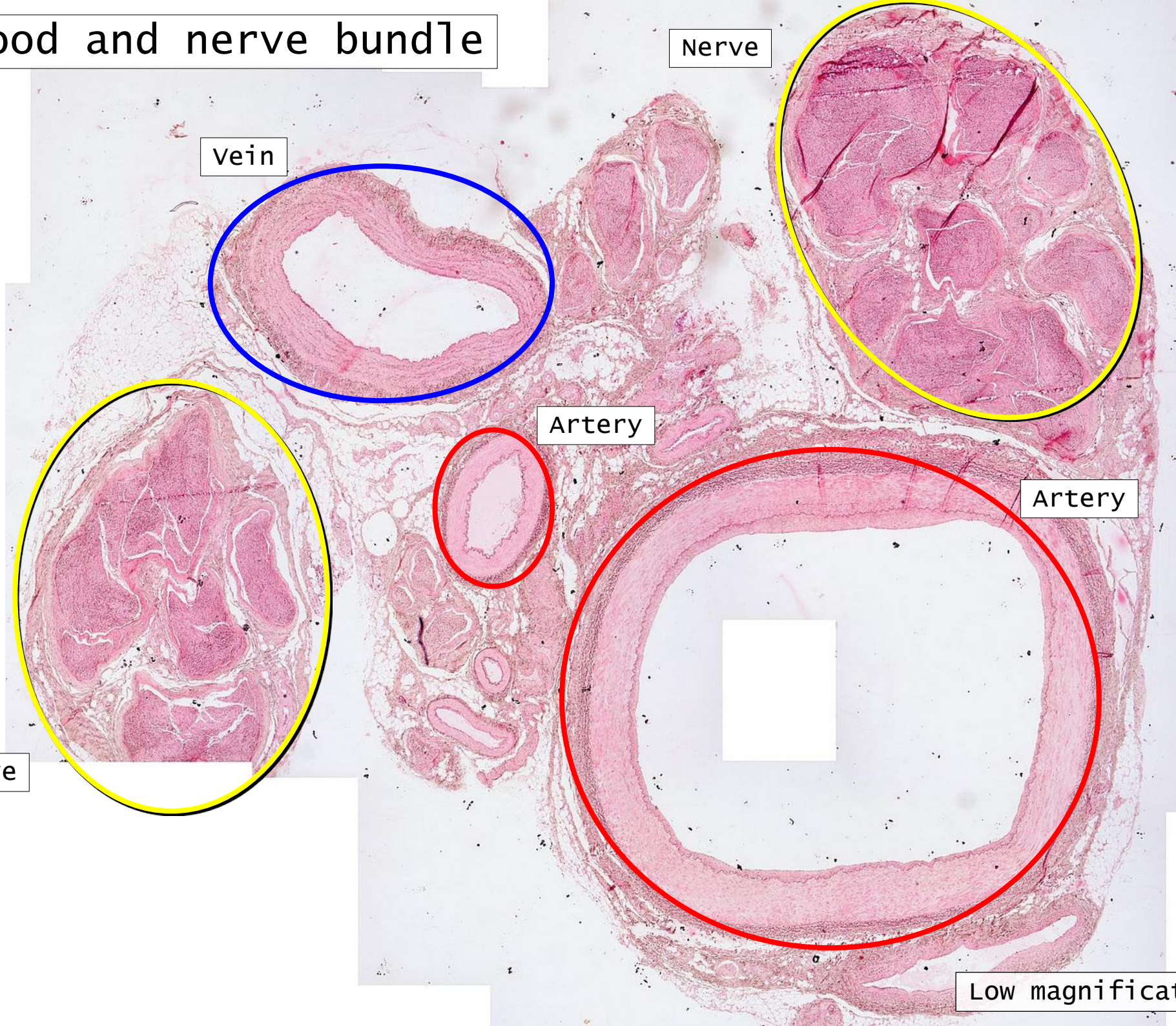
Vein

Artery

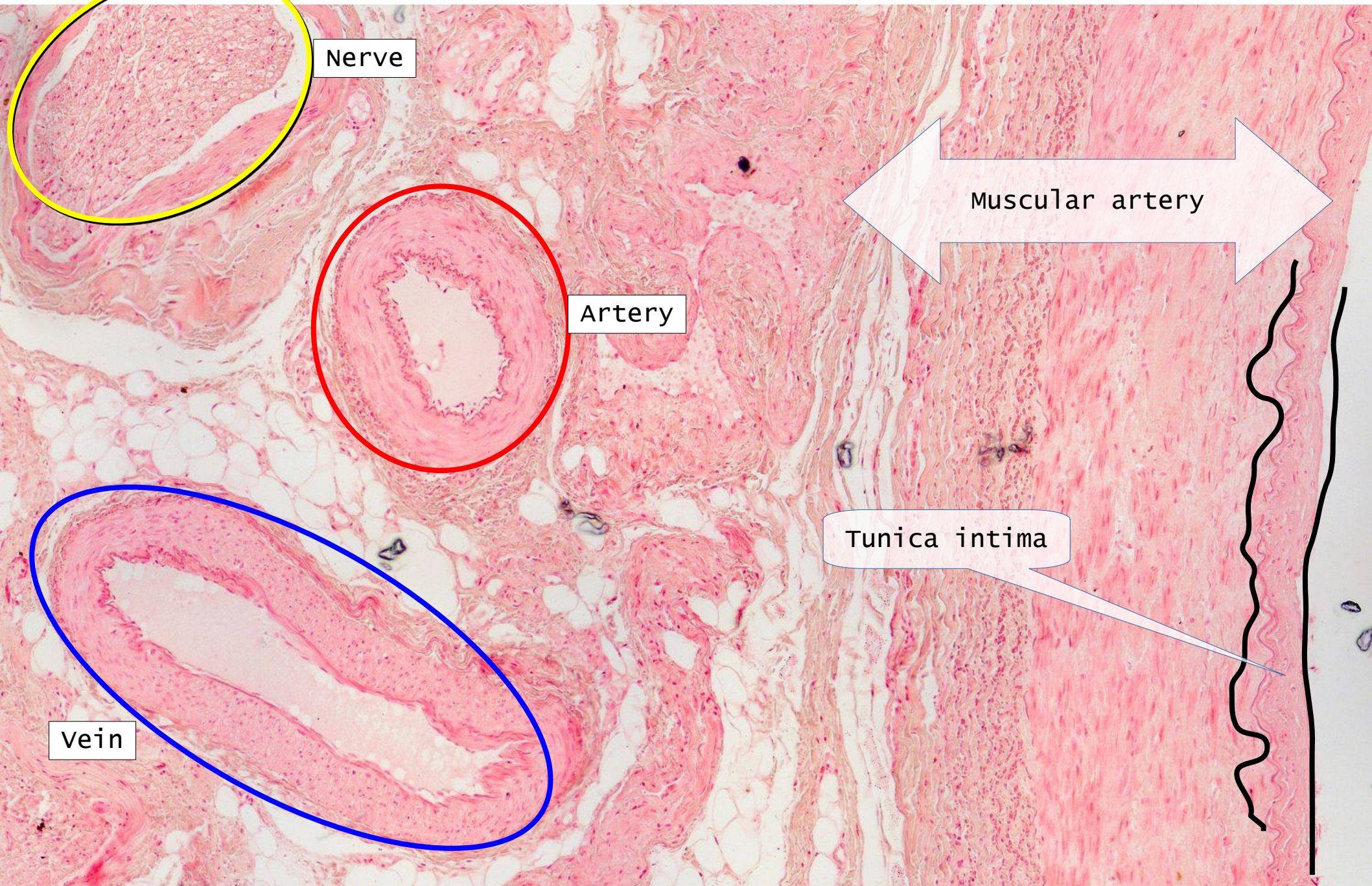
Artery

Nerve

Low magnification



Blood and nerve bundle



Medium magnification

Muscle artery

Lamina elastica interna

Tunica media

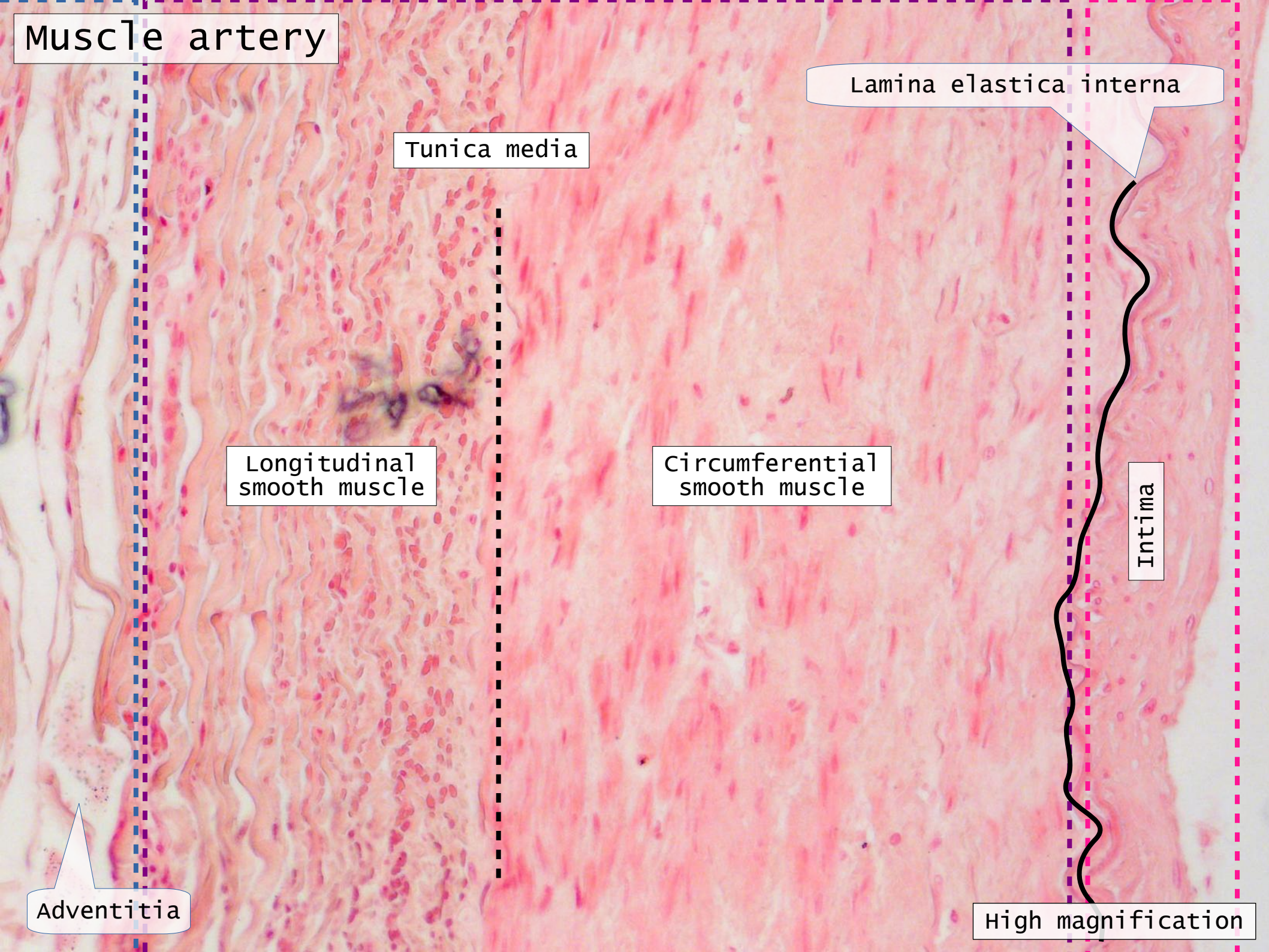
Longitudinal
smooth muscle

Circumferential
smooth muscle

Intima

Adventitia

High magnification

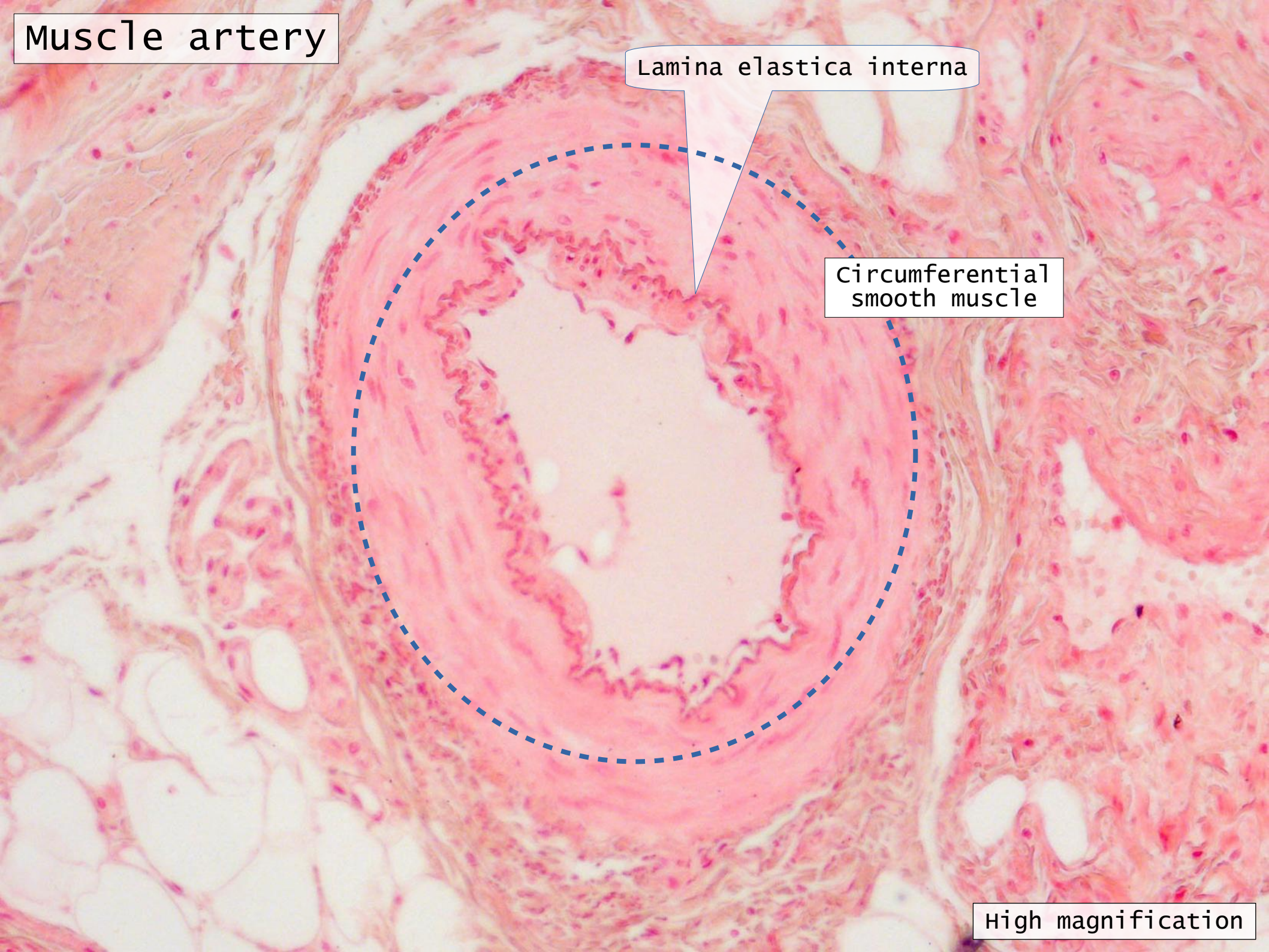


Muscle artery

Lamina elastica interna

Circumferential
smooth muscle

High magnification



Wall of muscle artery

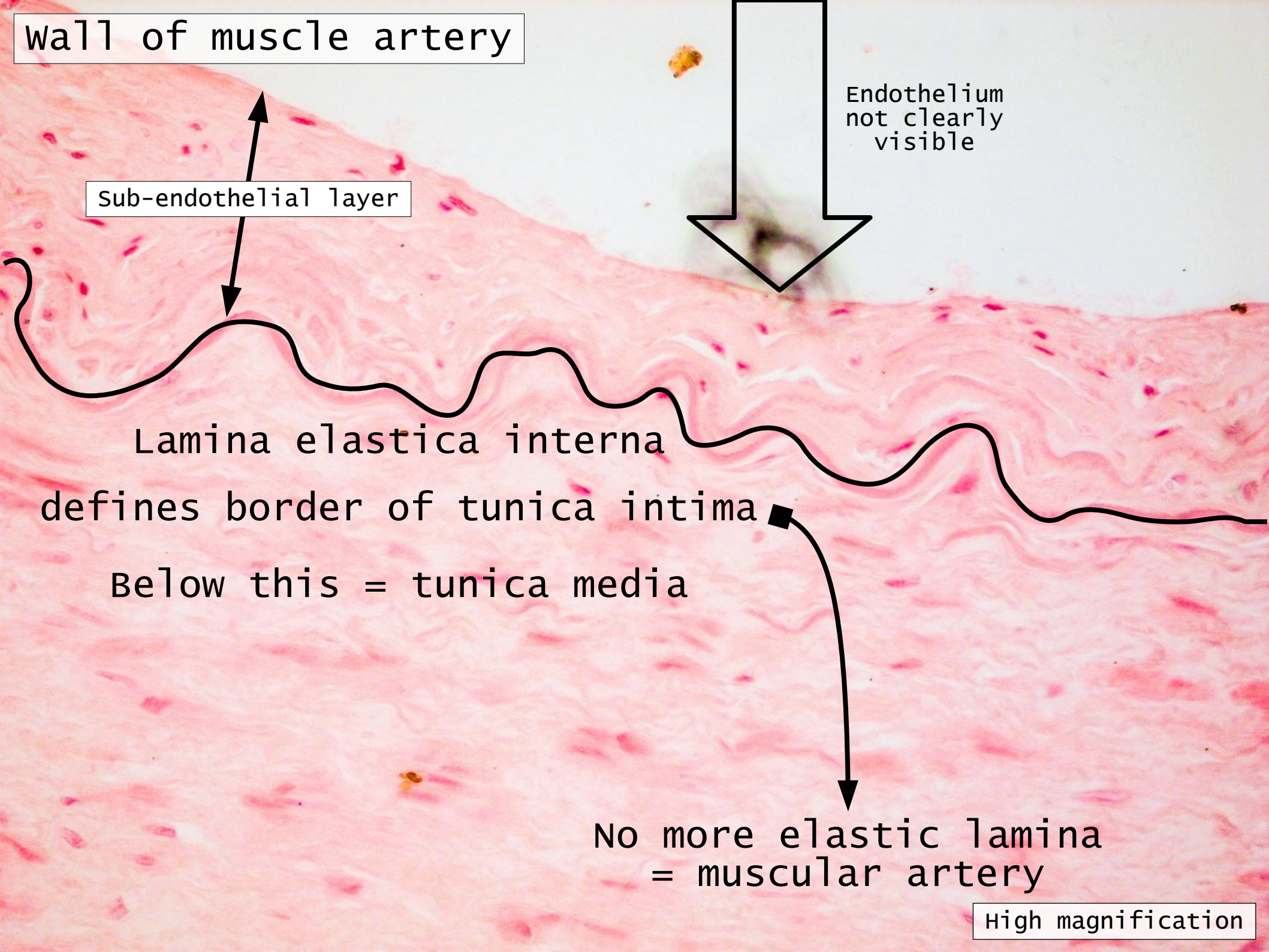
Endothelium
not clearly
visible

Sub-endothelial layer

Lamina elastica interna
defines border of tunica intima
Below this = tunica media

No more elastic lamina
= muscular artery

High magnification



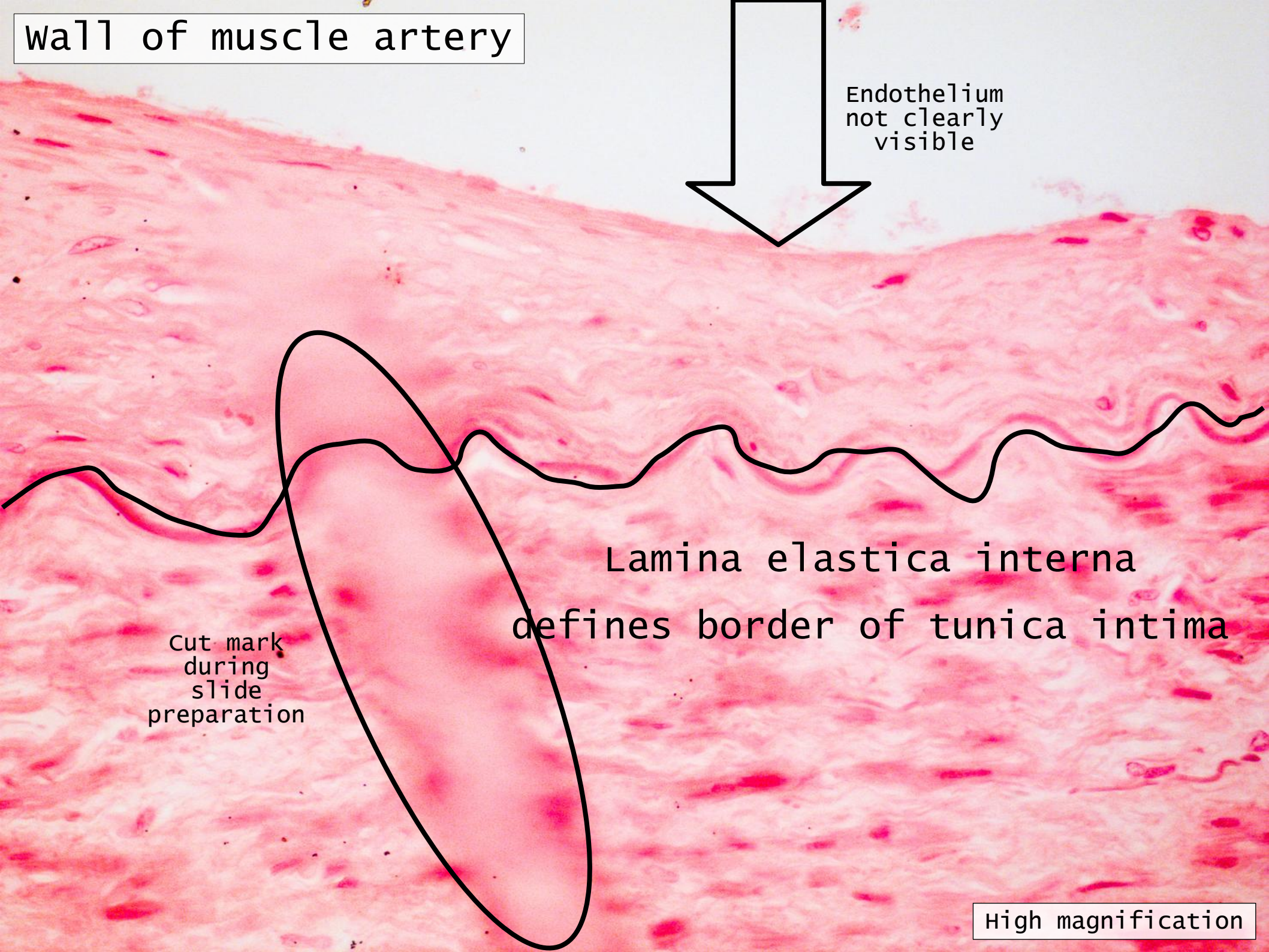
Wall of muscle artery

Endothelium
not clearly
visible

Lamina elastica interna
defines border of tunica intima

Cut mark
during
slide
preparation

High magnification



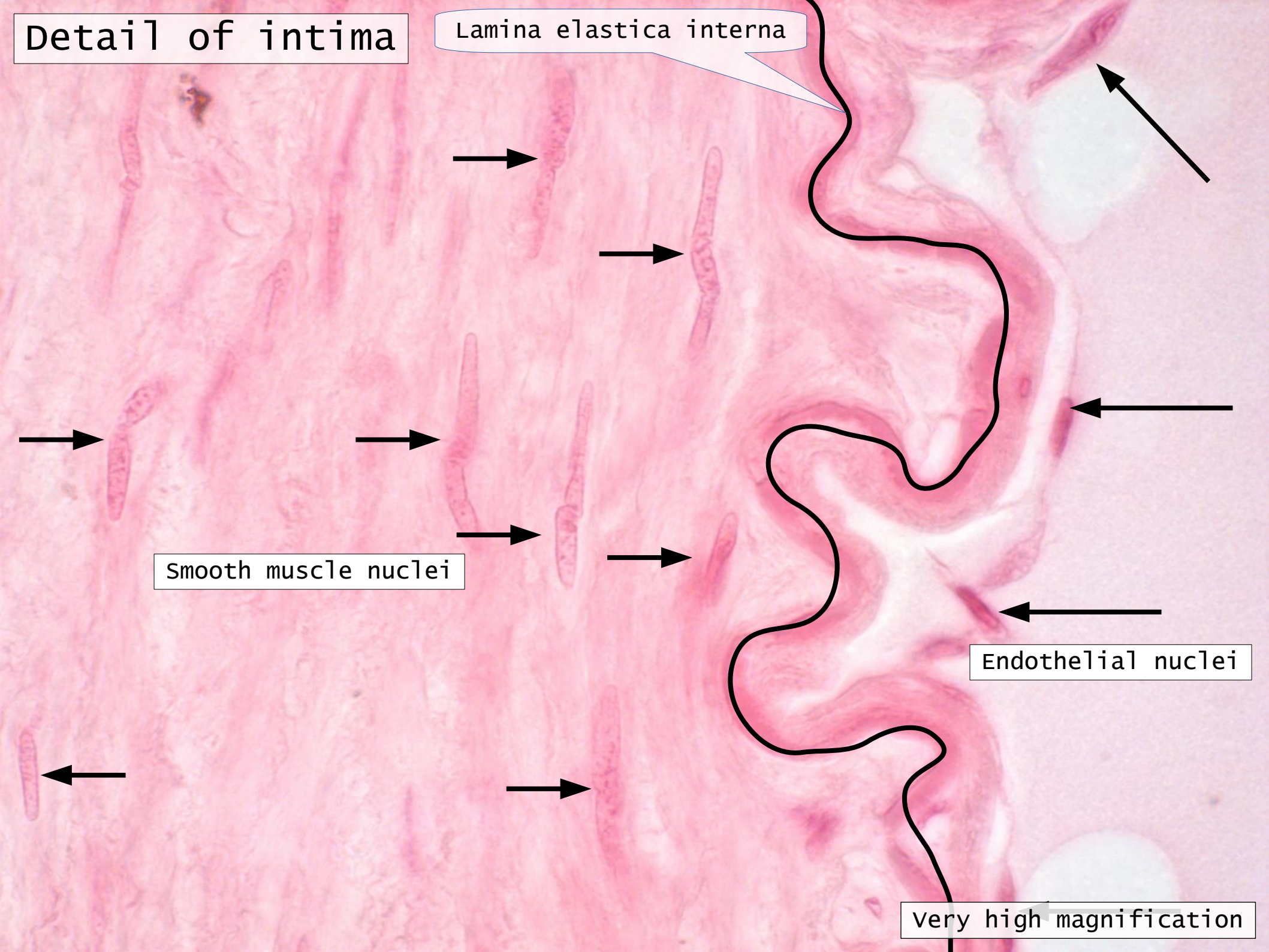
Detail of intima

Lamina elastica interna

Smooth muscle nuclei

Endothelial nuclei

very high magnification



Large vein

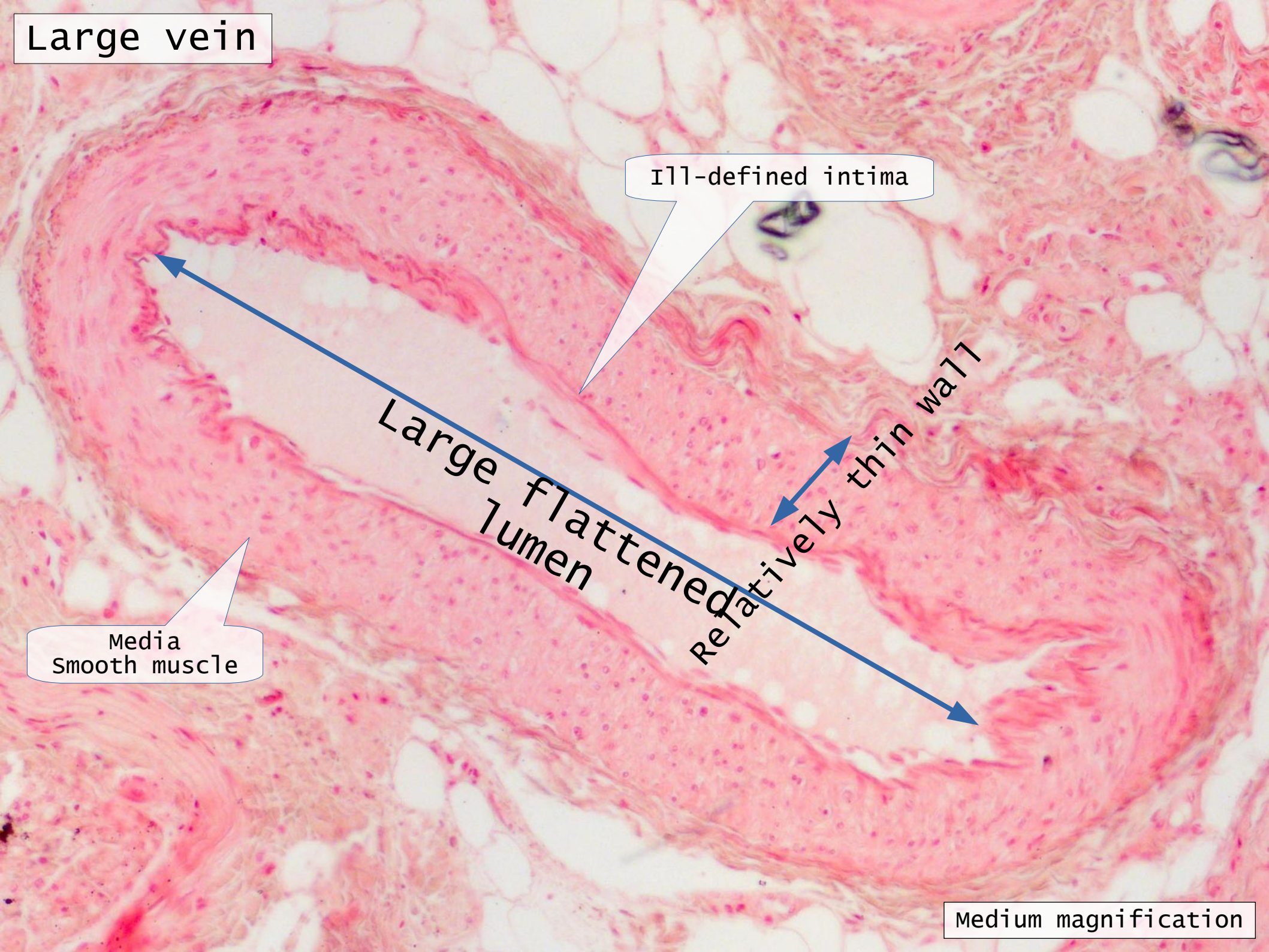
Ill-defined intima

Large flattened lumen

Relatively thin wall

Media
Smooth muscle

Medium magnification

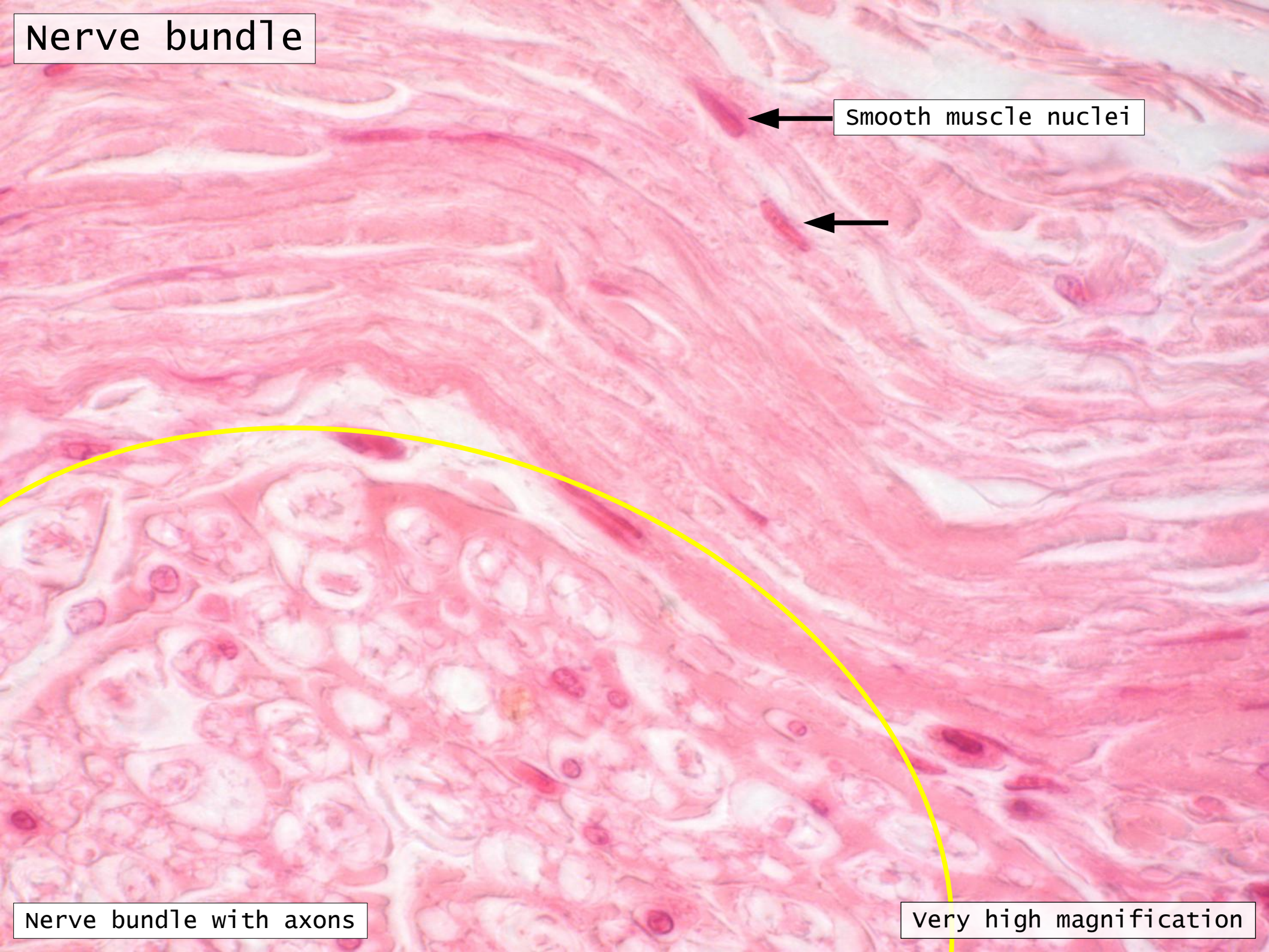


Nerve bundle

Smooth muscle nuclei

Nerve bundle with axons

very high magnification



Axons

Axons

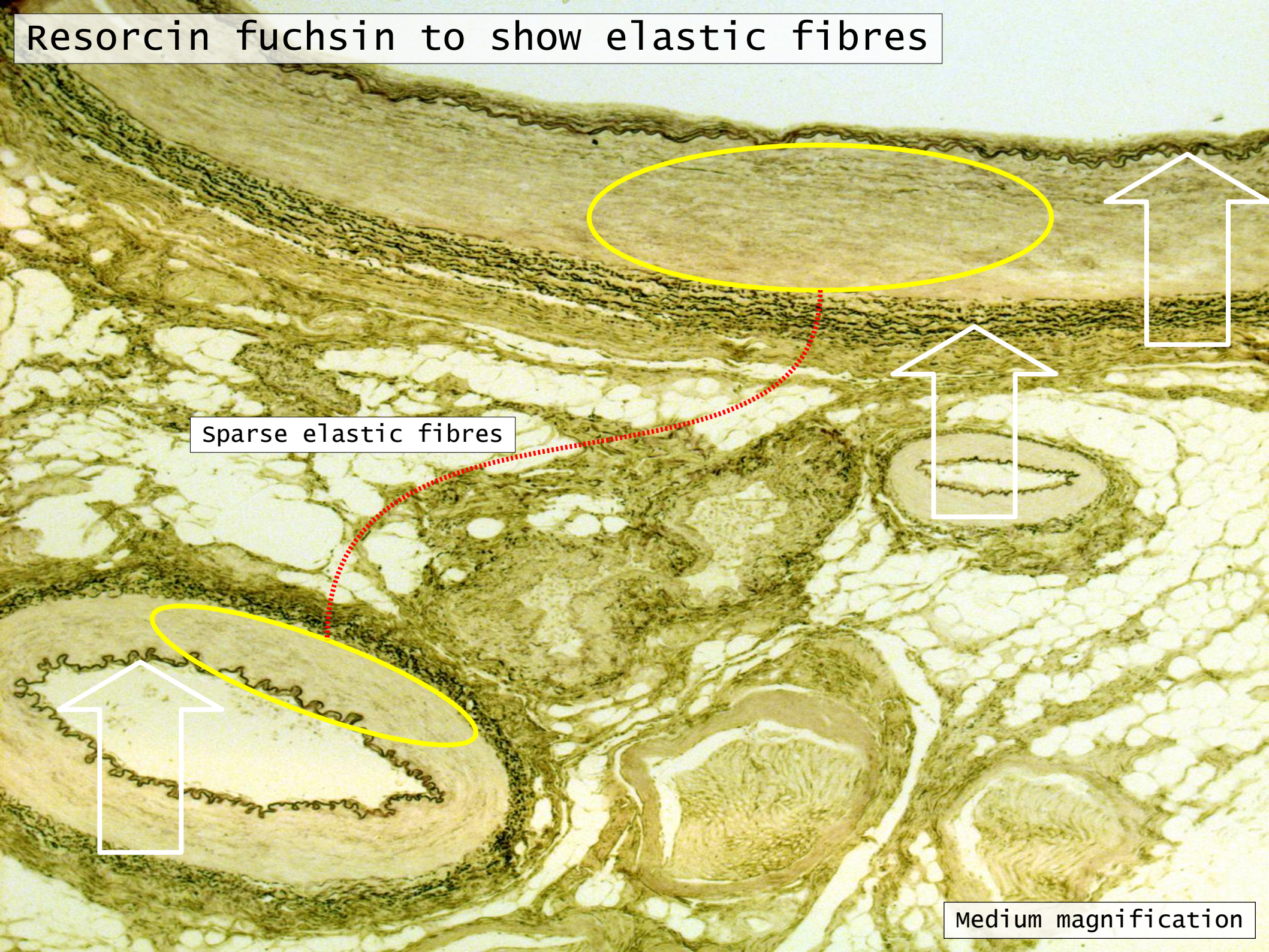
Nuclei of support cells

Schwann cells in
peripheral nerves

very high magnification



Resorcin fuchsin to show elastic fibres



sparse elastic fibres

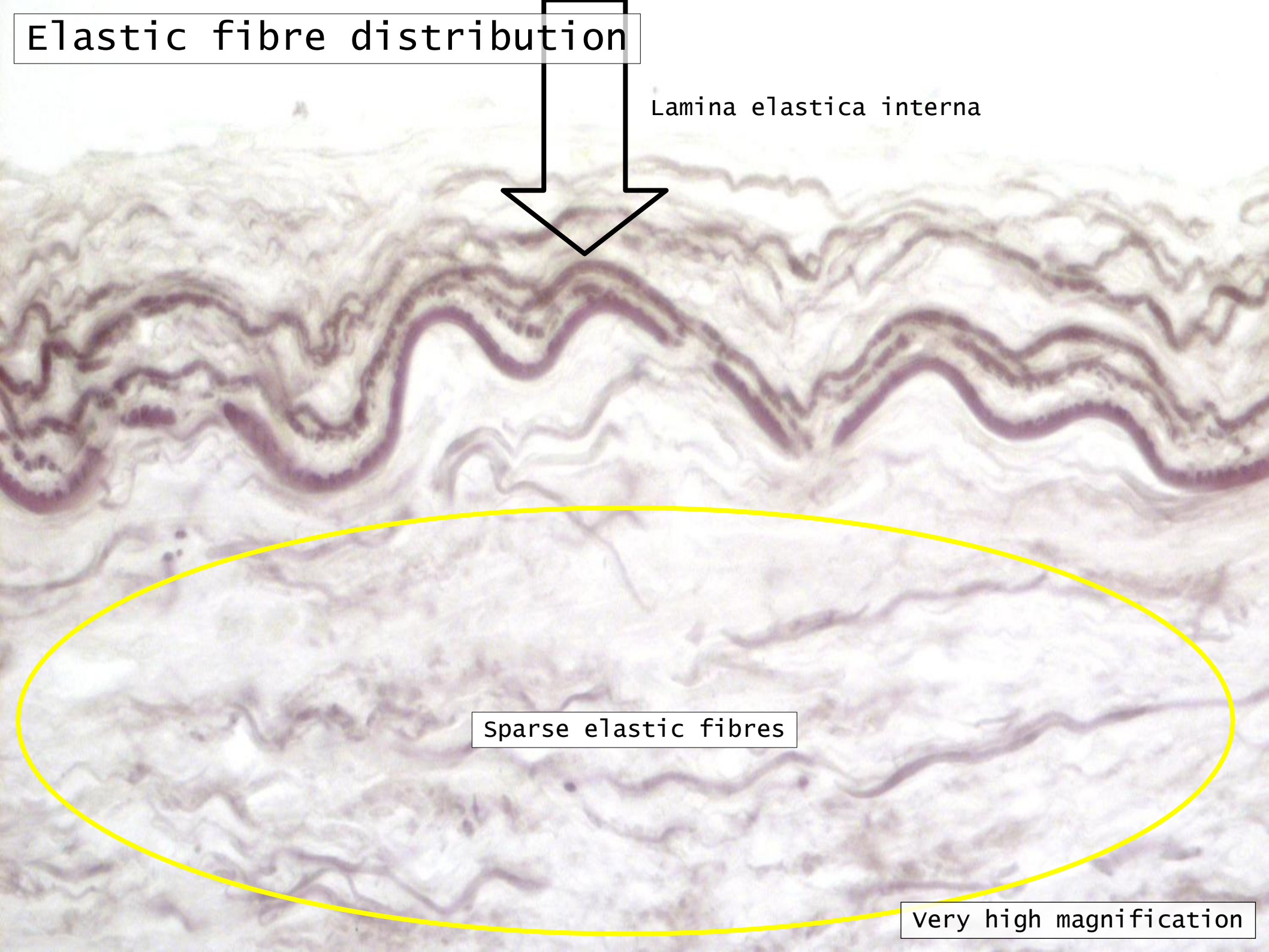
Medium magnification

Elastic fibre distribution

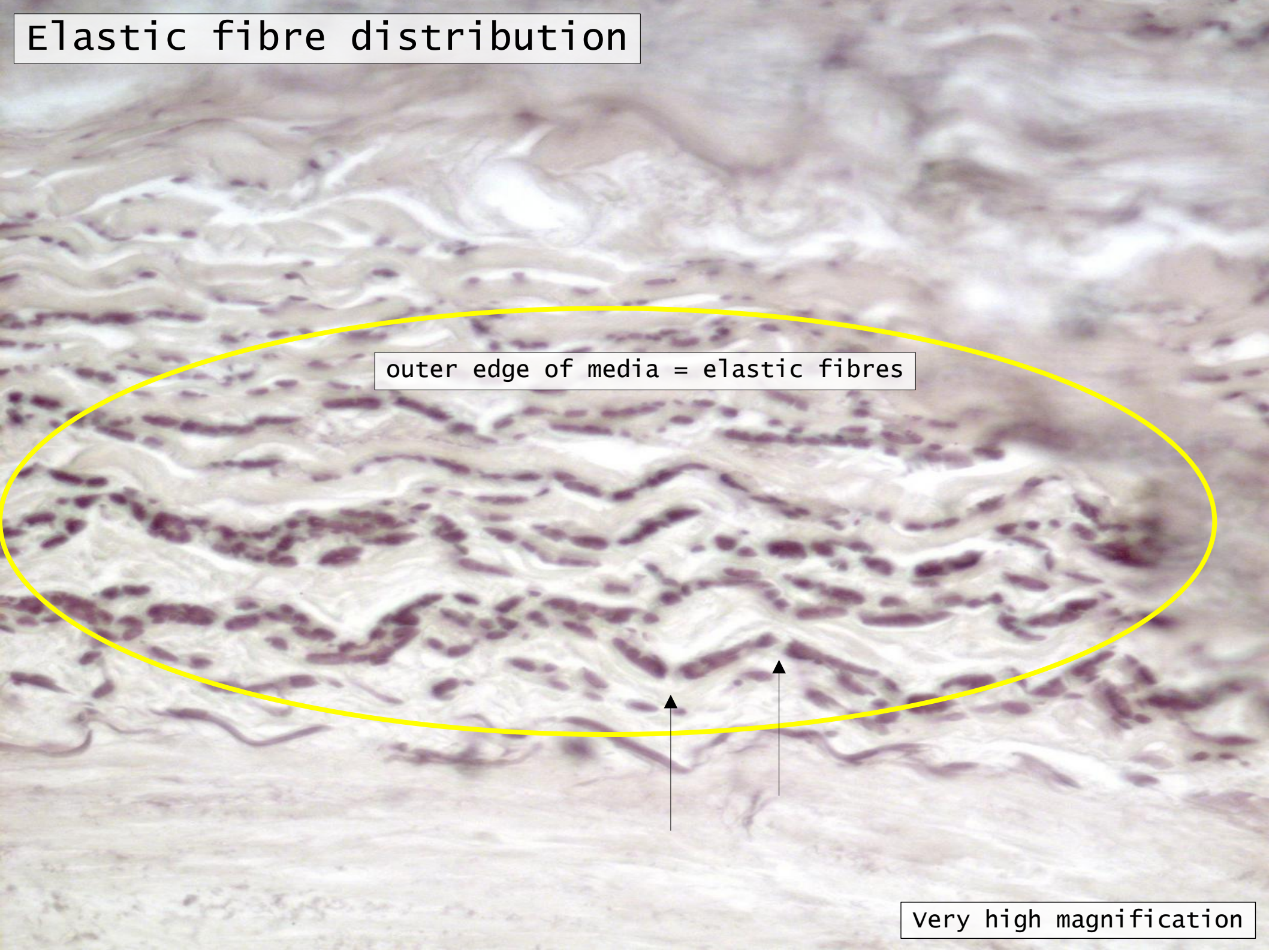
Lamina elastica interna

sparse elastic fibres

very high magnification



Elastic fibre distribution



outer edge of media = elastic fibres

This histological image shows a tissue section with a prominent layer of elastic fibers, which appear as dark purple, wavy, and somewhat clumped structures. A large yellow oval highlights a specific region of this layer. Two black arrows point upwards from the bottom edge of the oval, indicating the outer edge of the media. The overall texture is fibrous and complex.

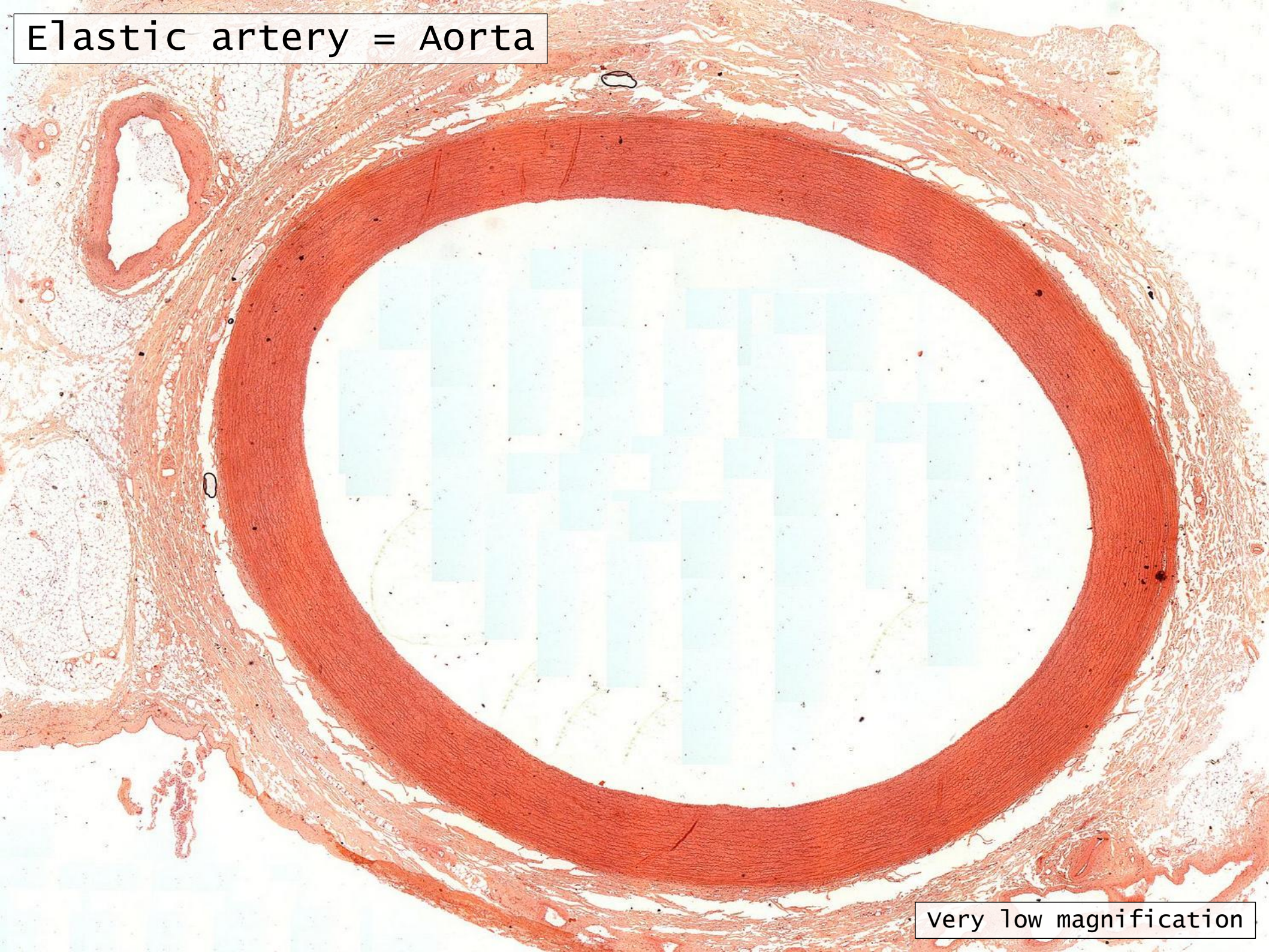
very high magnification

Elastic artery

Slides 67 & 49

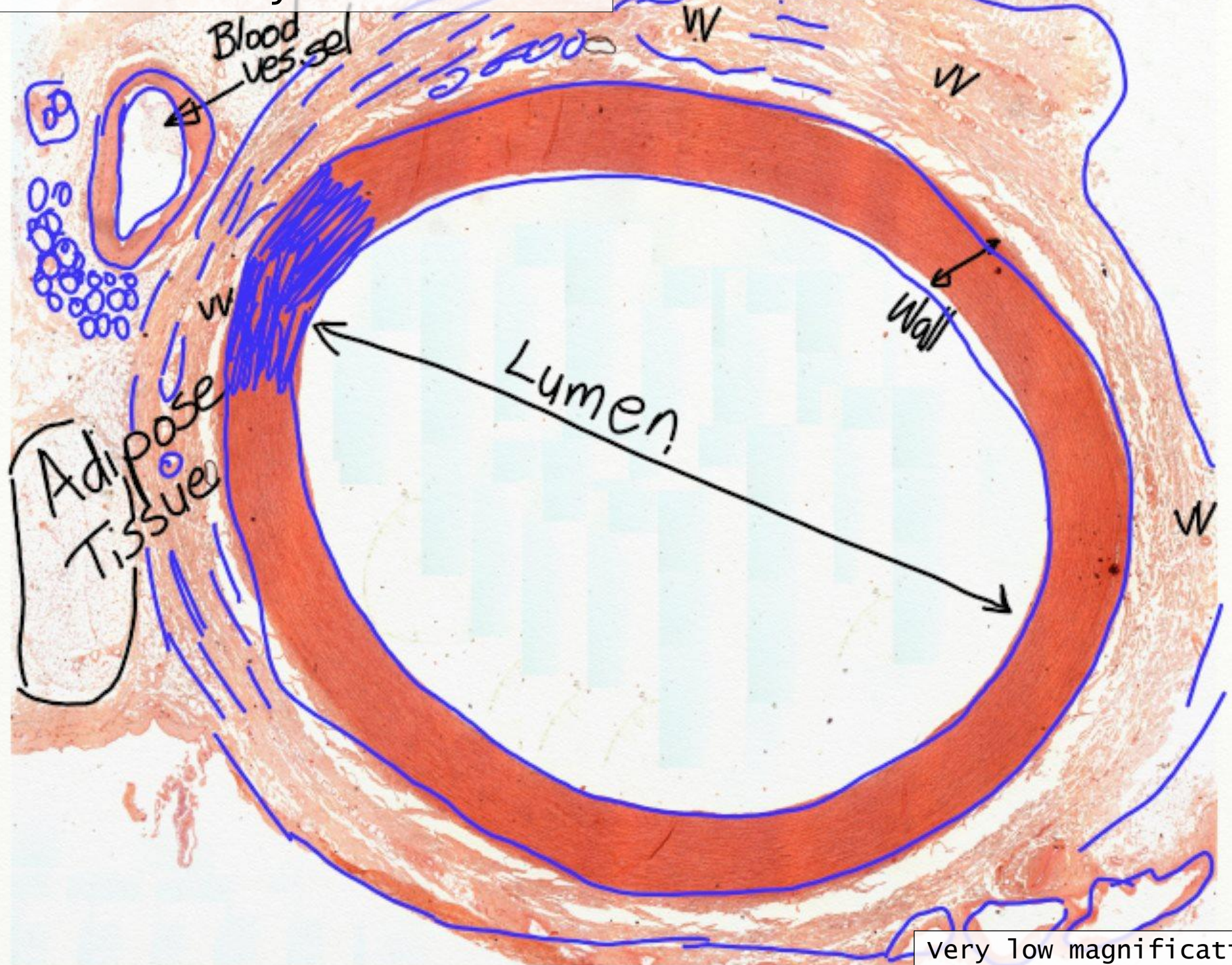
Aorta

Elastic artery = Aorta



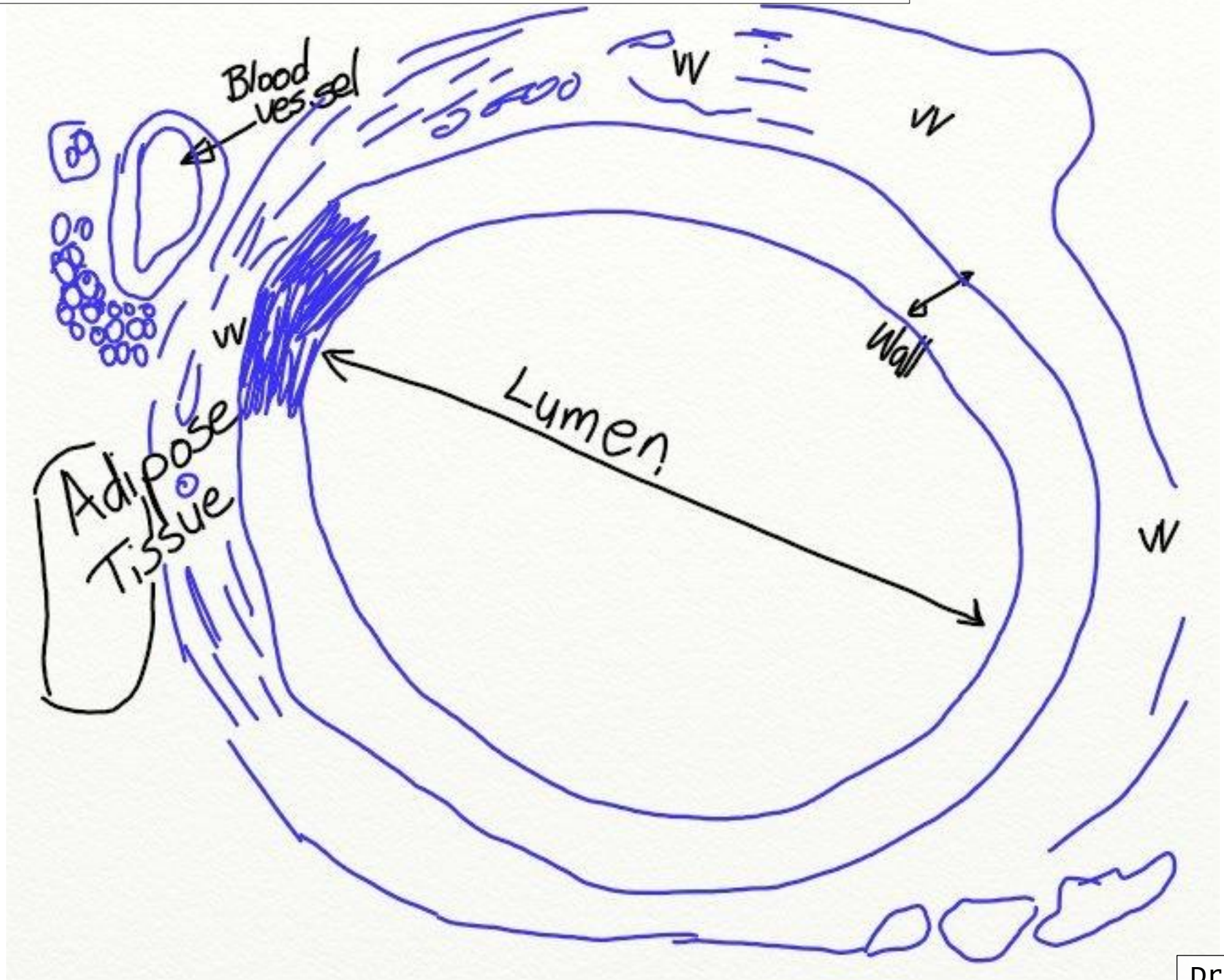
very low magnification

Elastic artery with labels



very low magnification

Drawing of elastic artery with labels



Layers of elastic artery

Adventitia

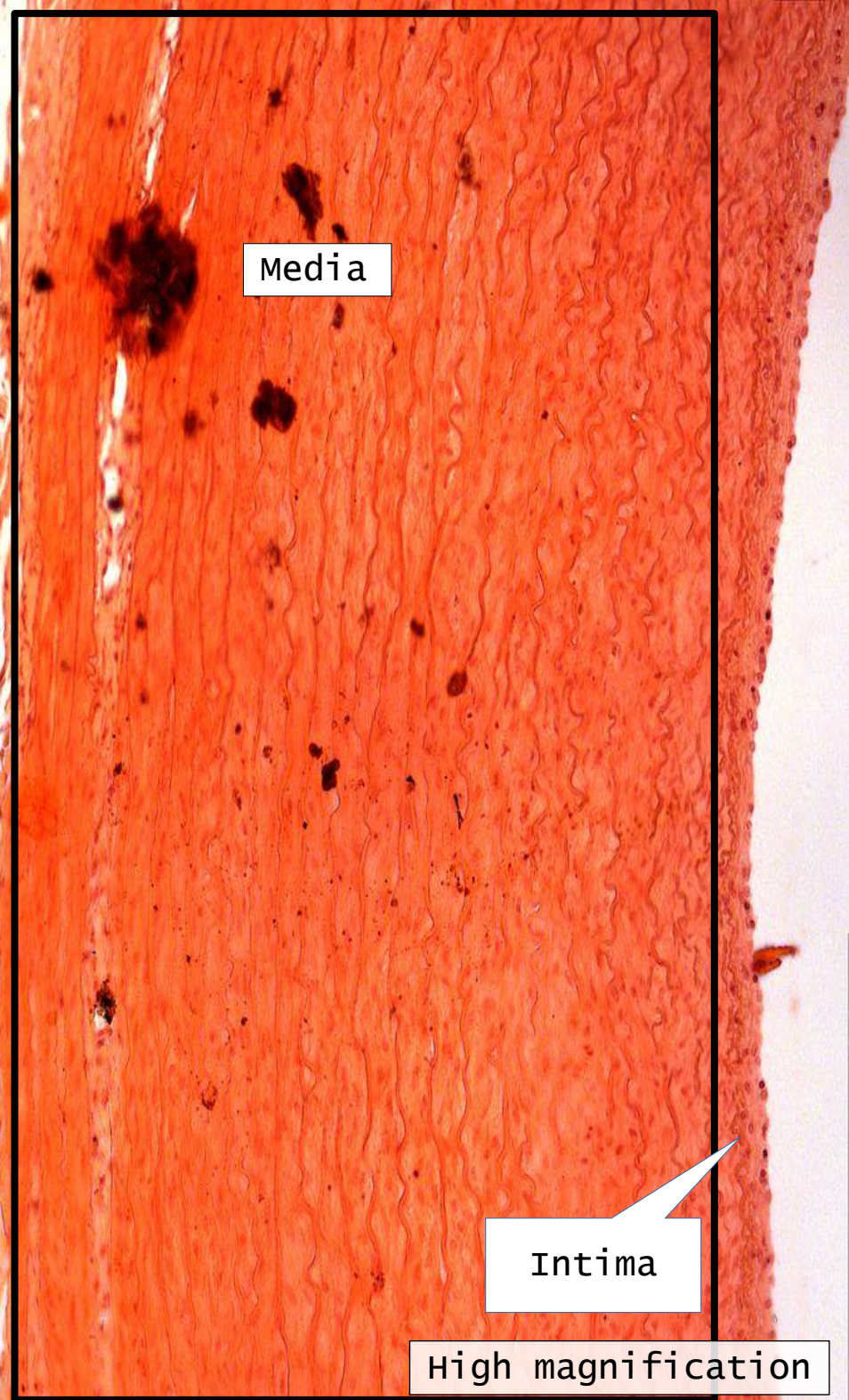
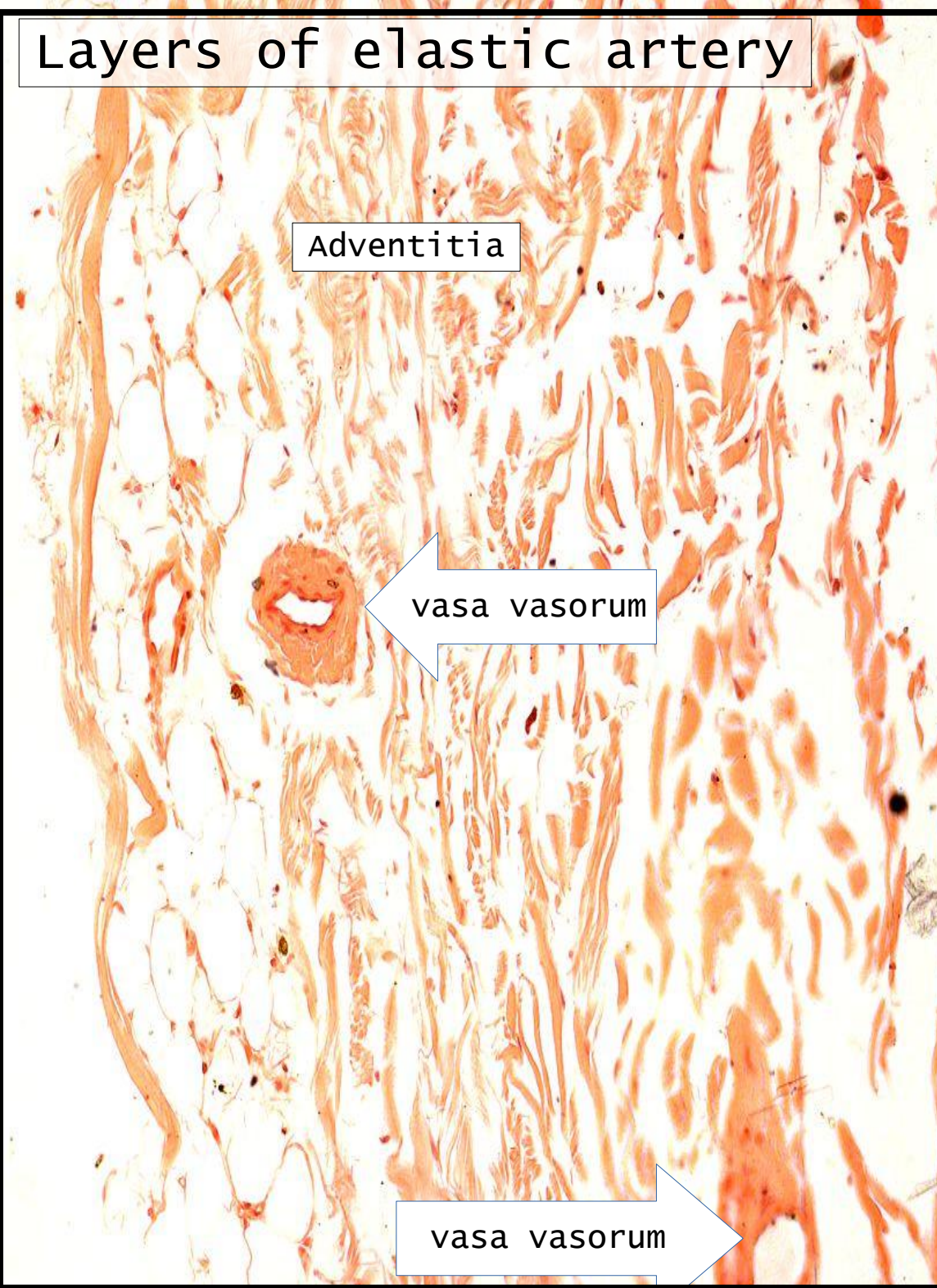
vasa vasorum

vasa vasorum

Media

Intima

High magnification



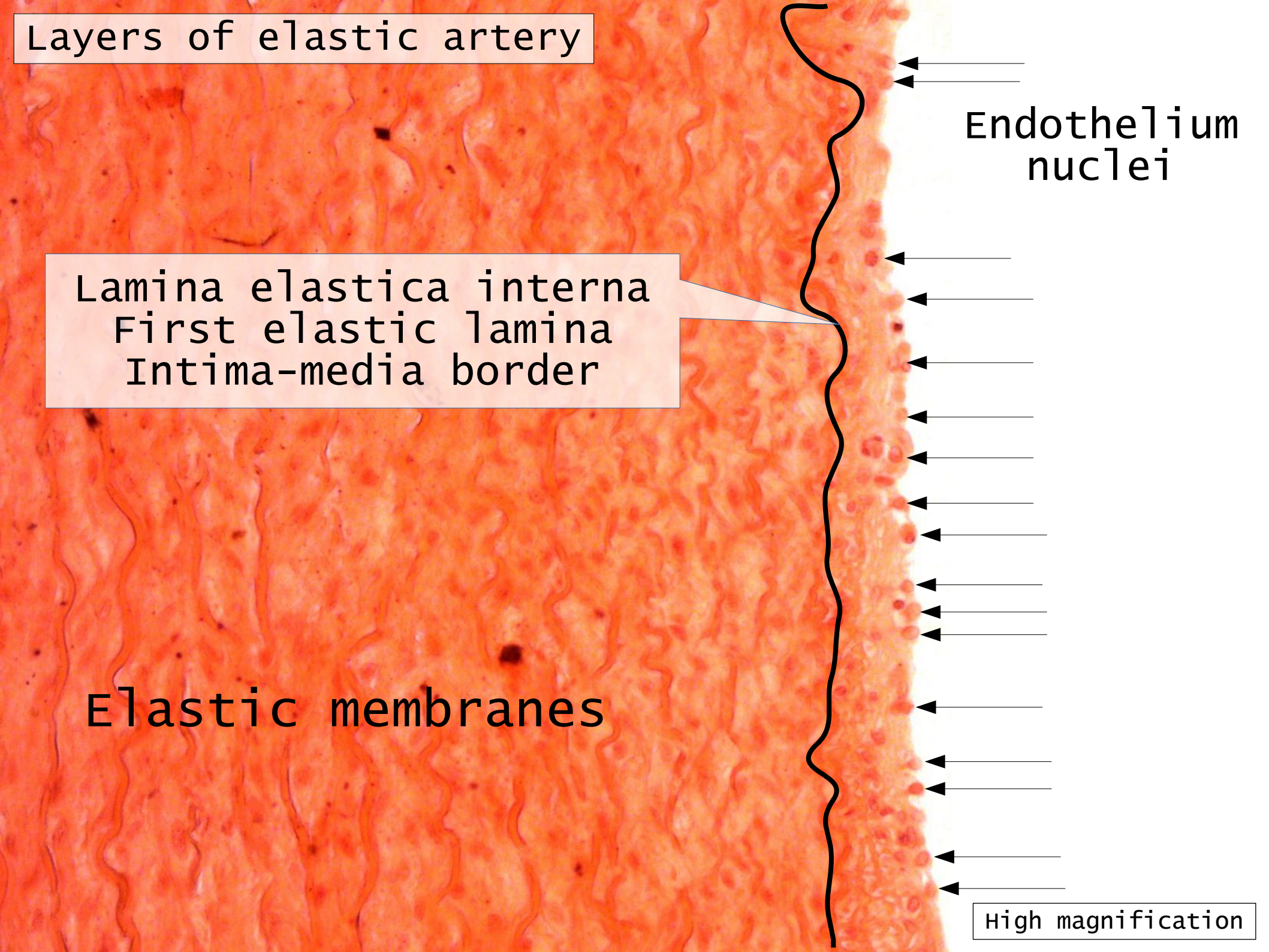
Layers of elastic artery

Endothelium
nuclei

Lamina elastica interna
First elastic lamina
Intima-media border

Elastic membranes

High magnification



Blood vessels of blood vessels



A histological micrograph showing adipose tissue. The tissue is composed of numerous large, pale, polygonal adipocytes with thin, dark borders. In the upper left, there are two prominent blood vessels with thick, eosinophilic walls. A blue arrow points from the text 'vasa vasorum' to these vessels. The overall background is a light pinkish-white color.

vasa vasorum

adipose tissue
collection of fat cells

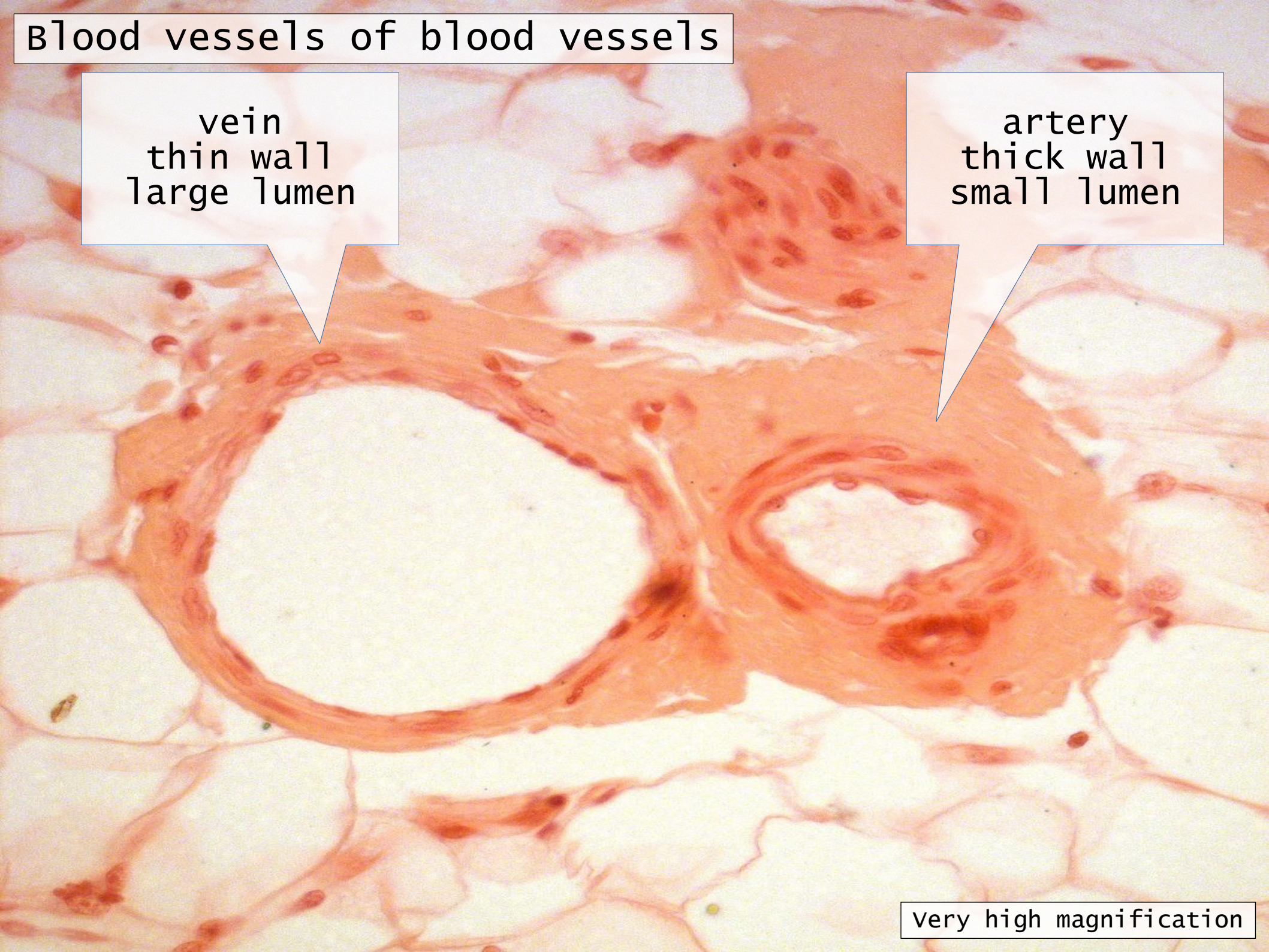
very high magnification

Blood vessels of blood vessels

vein
thin wall
large lumen

artery
thick wall
small lumen

very high magnification



Resorcin fuchsin to show elastic fibres



A histological section of an artery stained with Resorcin fuchsin. The image shows the internal elastic lamina on the left, followed by the tunica intima, the media (labeled with a bracket), and the tunica externa on the right. The media is characterized by numerous elastic fibers, which are stained dark purple. The tunica externa is composed of dense, irregular connective tissue. The overall structure is a cross-section of a blood vessel.

media

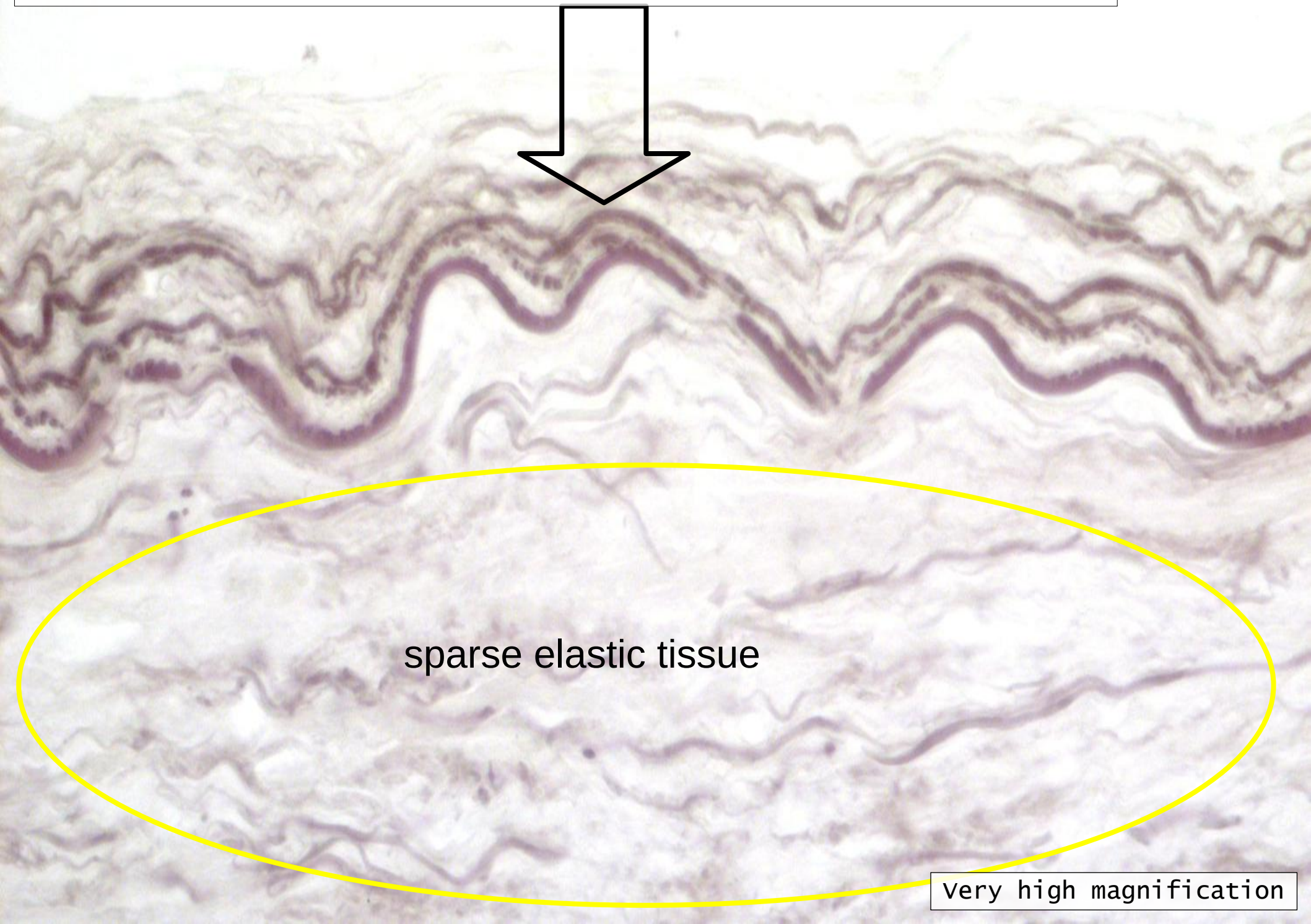
Medium magnification

Resorcin fuchsin to show elastic fibres

DENSE ELASTIC TISSUE

very high magnification

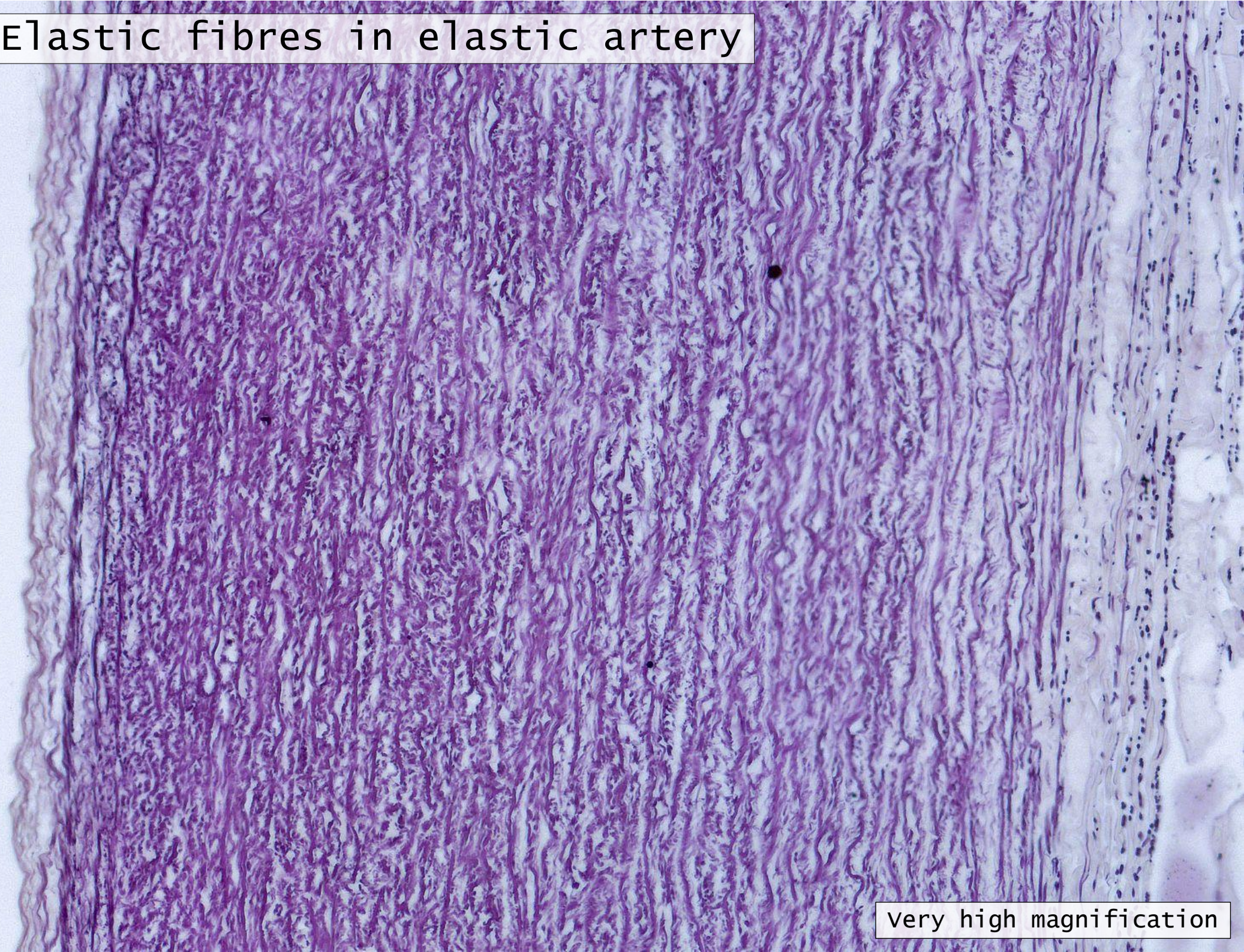
Elastic fibre distribution in muscular artery



sparse elastic tissue

very high magnification

Elastic fibres in elastic artery



very high magnification

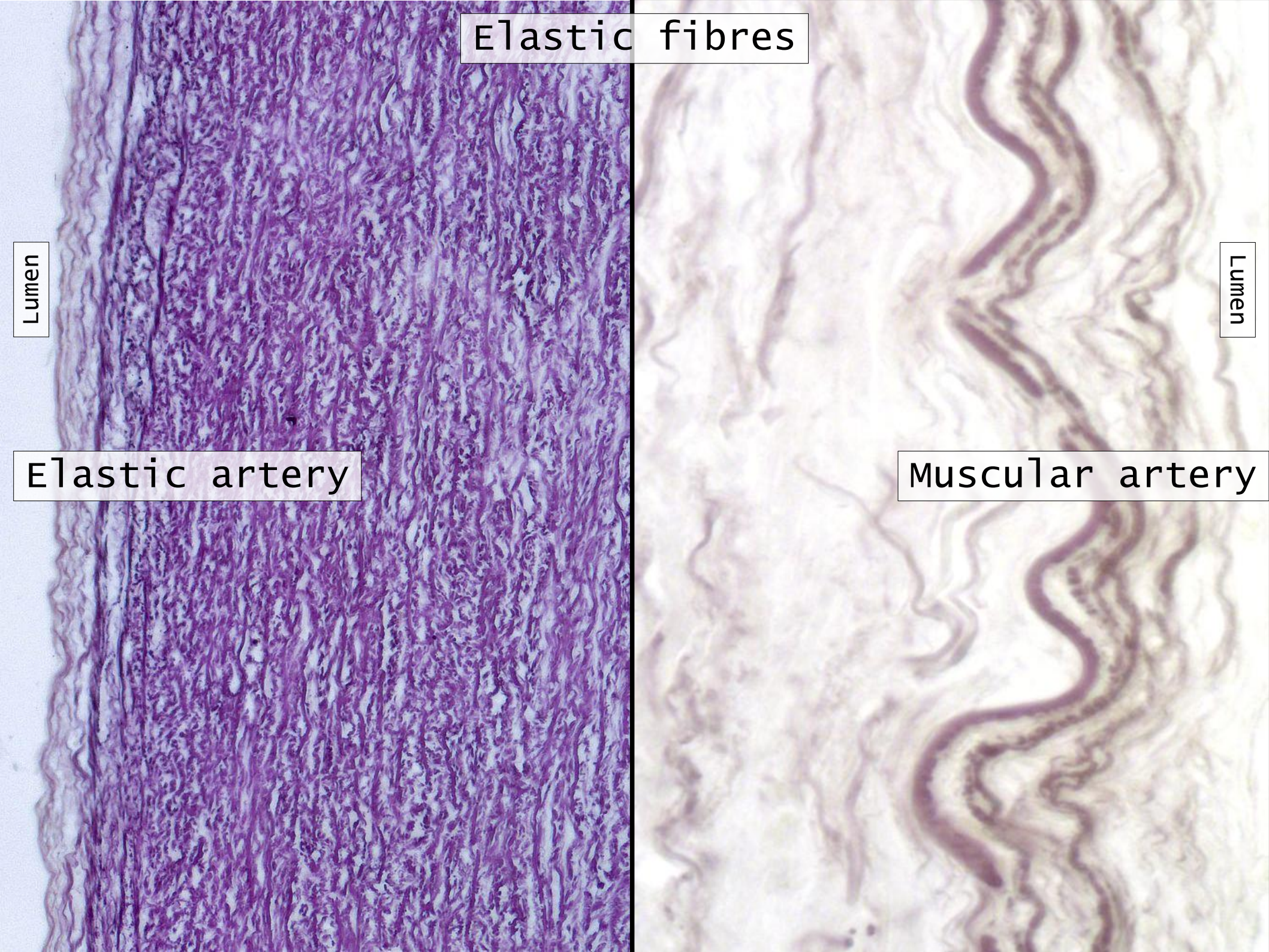
Elastic fibres

Lumen

Elastic artery

Lumen

Muscular artery

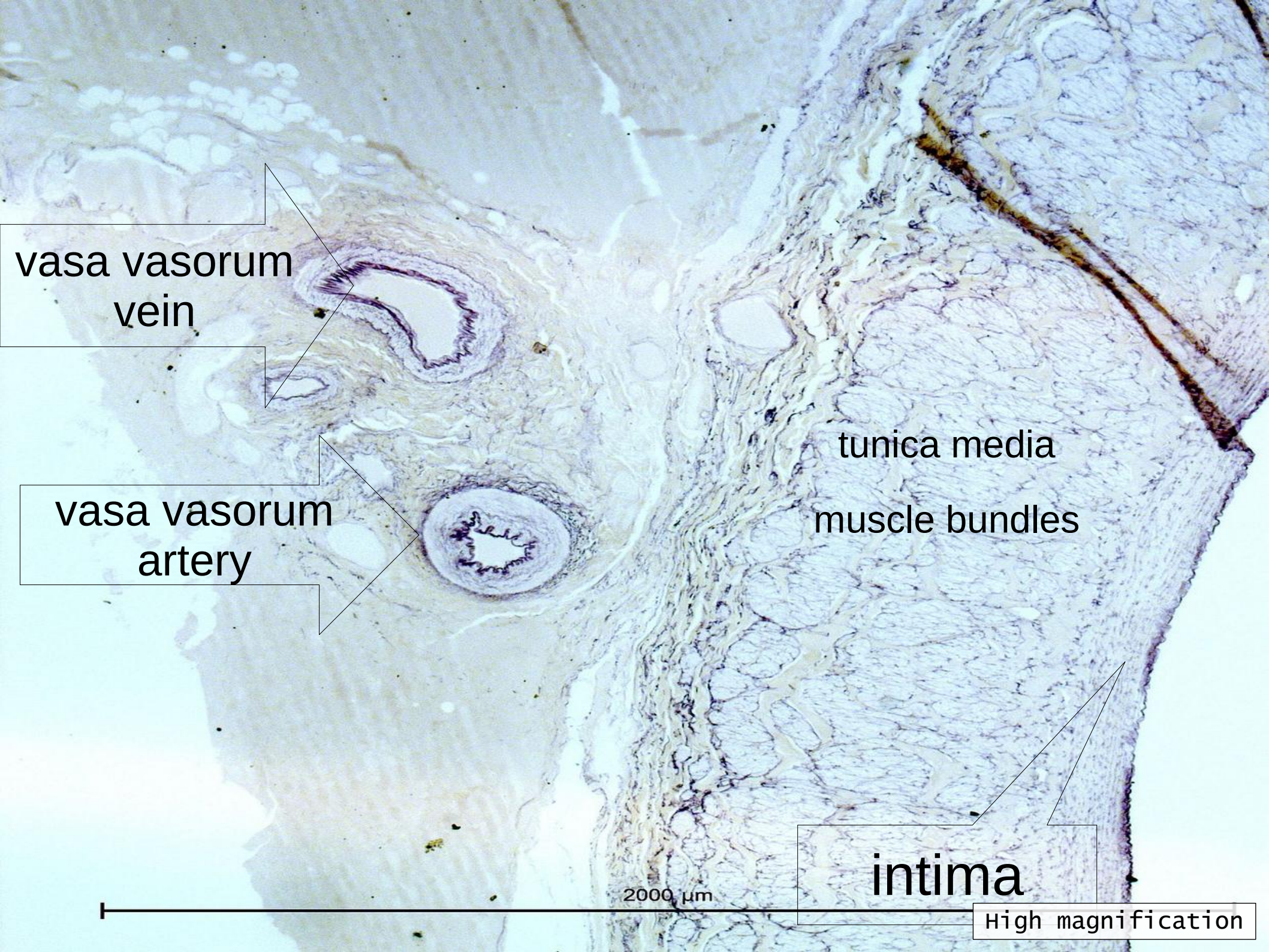


Large Vein

Slides 92 & 109



very low magnification



vasa vasorum
vein

vasa vasorum
artery

tunica media
muscle bundles

intima

2000 μm

High magnification

A histological section of tissue, likely a blood vessel wall, stained with Masson's trichrome. The tissue shows a dense network of collagen fibers (stained blue) and elastic fibers (stained red). The overall structure is fibrous and layered. A yellow arrow with a black outline points to the outer edge of the tissue section on the right side.

elastic fibres very few

High magnification

Ductus thoracicus

slides 65 & 75

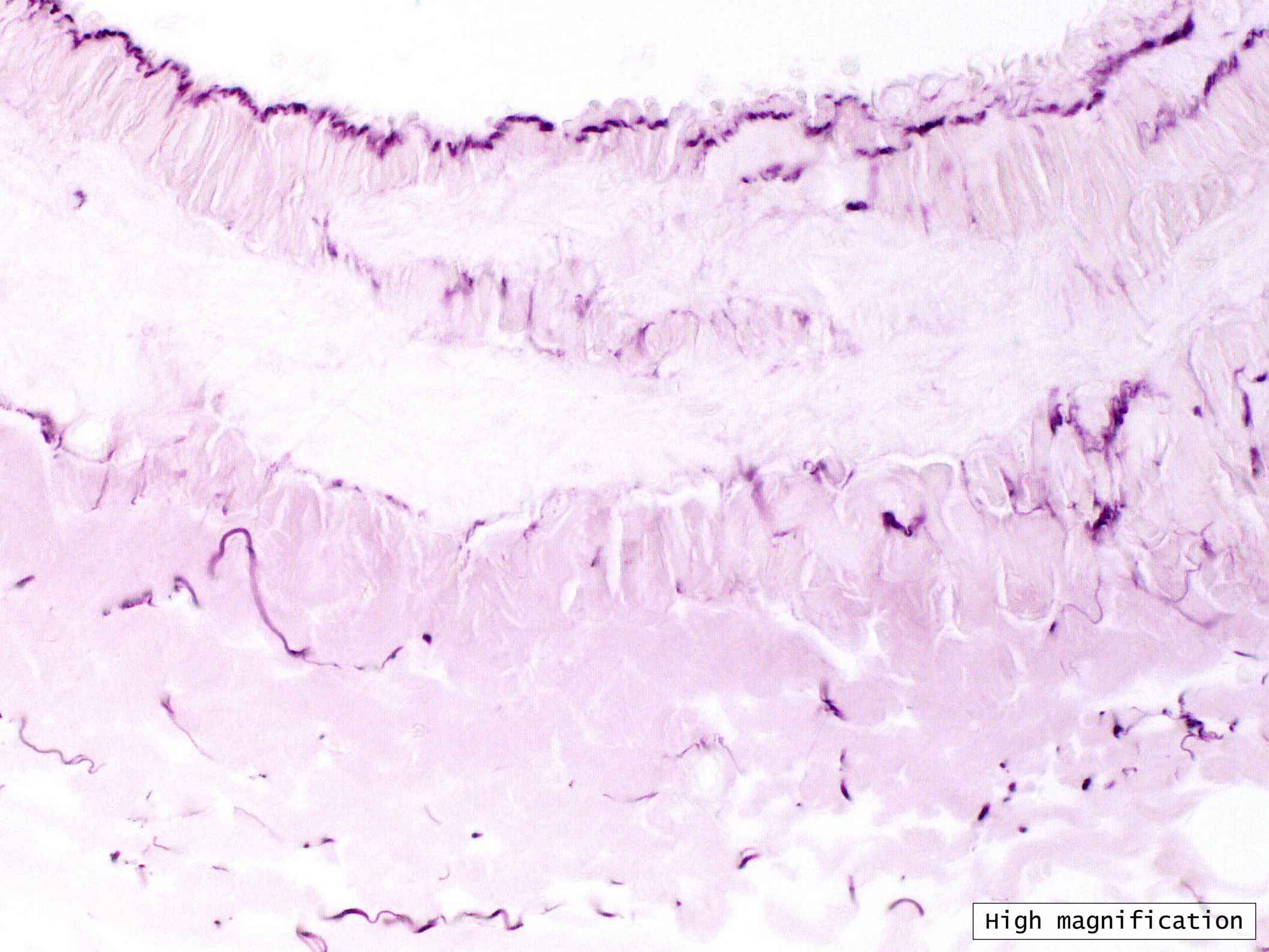


very low magnification

A histological section of smooth muscle tissue stained with hematoxylin and eosin (H&E). The image shows numerous elongated, spindle-shaped smooth muscle cells with centrally located, elongated nuclei. The fibers are arranged in an irregular, interlacing pattern, which is characteristic of smooth muscle. The overall color is pink, with some darker purple areas where the nuclei are more densely packed.

Smooth muscle fibres – irregular arrangement

High magnification

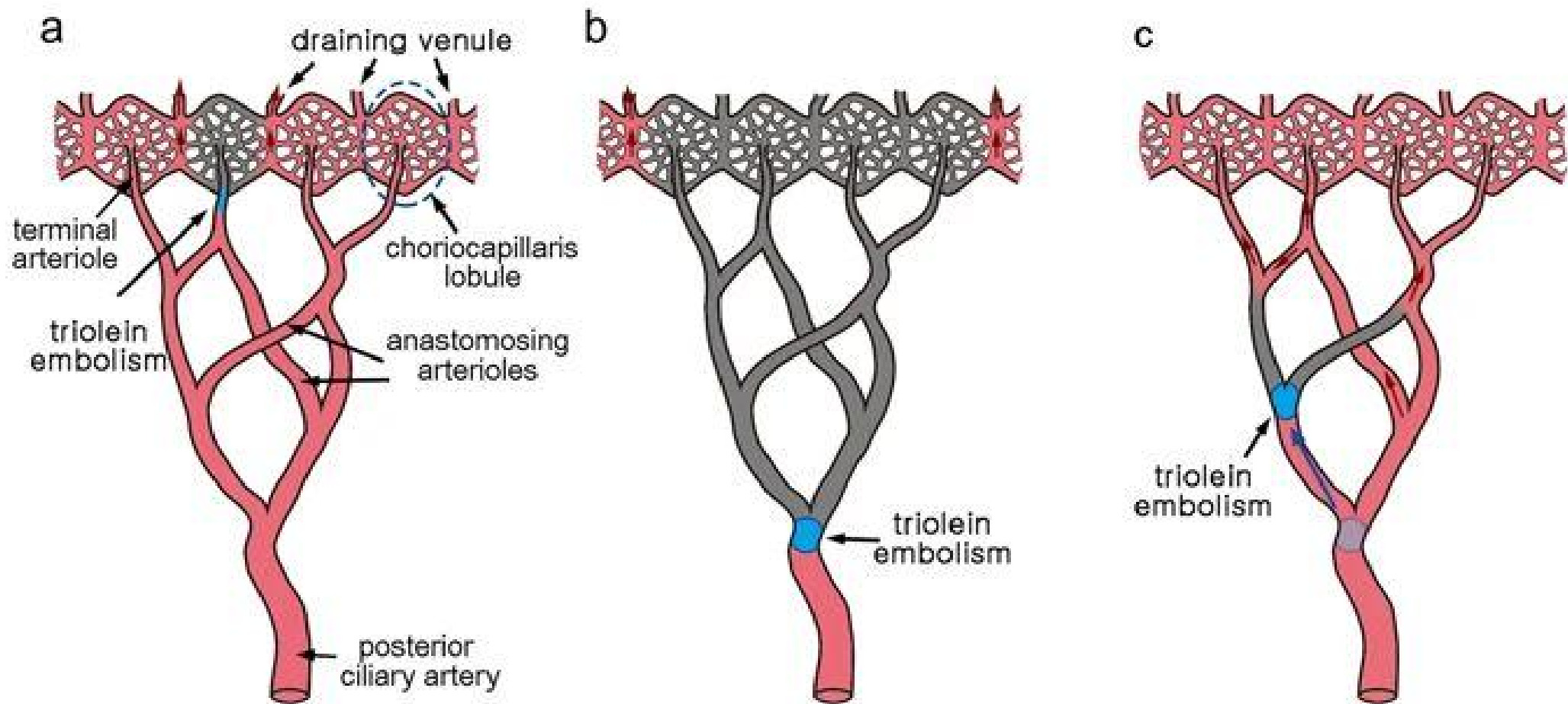


High magnification

what are end arteries?

A functional end-arterial model of the choroidal circulation.

From Lee, J.E., Ahn, K.S., Park, K.H. et al. Functional end-arterial circulation of the choroid assessed by using fat embolism and electric circuit simulation. *Sci Rep* 7, 2490 (2017). <https://doi.org/10.1038/s41598-017-02695-z> CC-A 4.0



End arteries

- Normal histology
- Pathology – necrosis
- Symptom – chest pain
- Diagnosis – Myocardial infarct
- What happened – heart attack

End arteries

- Heart
- Brain
- Eye
- Kidney

End artery

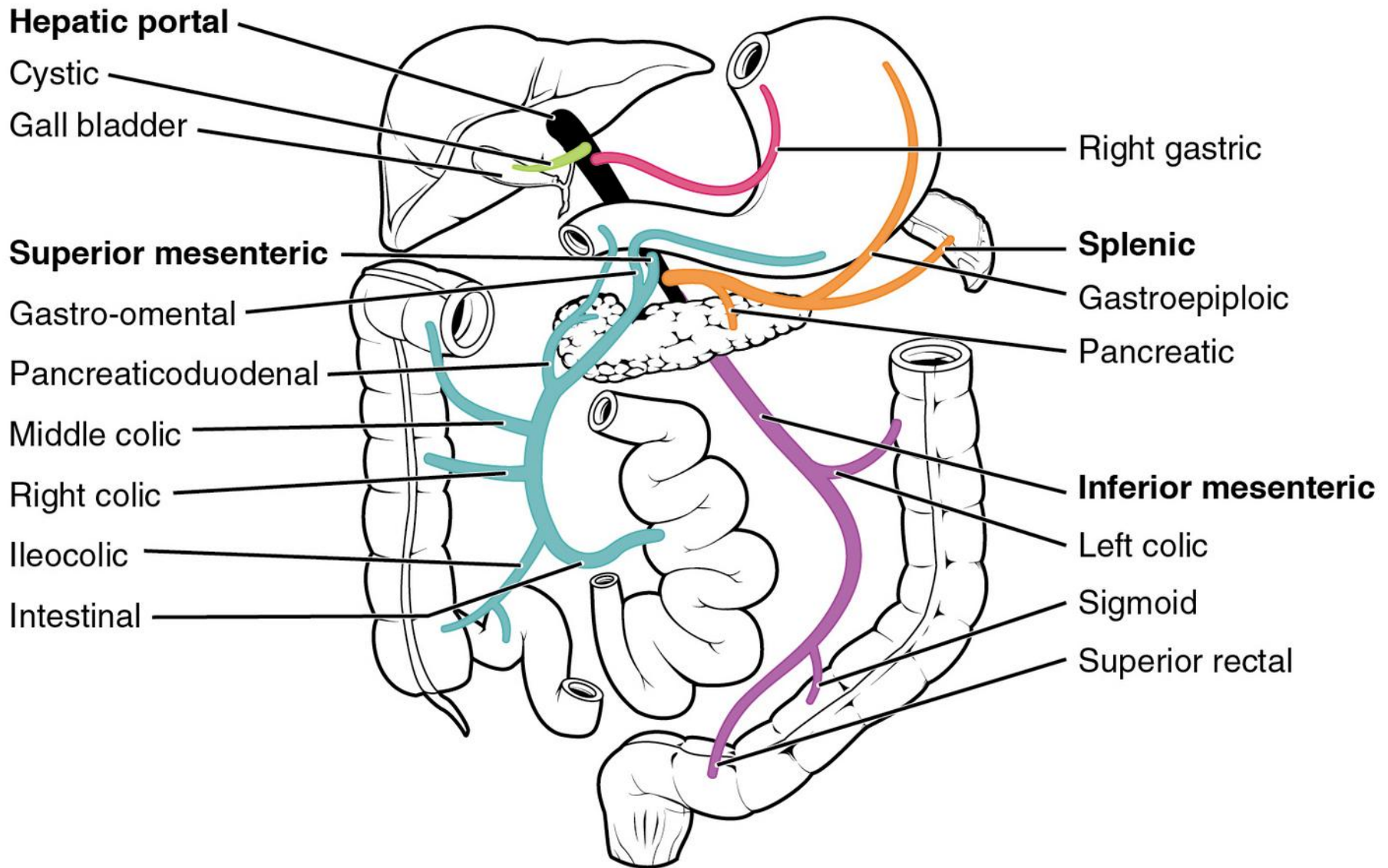
- Heart - Heart attack
- Brain - Stroke
- Eye - Blindness
- Kidney - Kidney ~~attack~~ failure

Portal System

Begin and Ends
In capillaries

Figure 20.43 Hepatic Portal System. The liver receives blood from the normal systemic circulation via the hepatic artery. It also receives and processes blood from other organs, delivered via the veins of the hepatic portal system.

Anatomy and Physiology 25 April 2013; OpenStax; Creative Commons Attribution License 4.0;
<https://openstax.org/books/anatomy-and-physiology/pages/20-5-circulatory-pathways>



Portal system

- Hepatic portal system
- Hypophyseal portal system

Cardiovascular System

Complete the Tasks

Tasks are in Red Blocks

Arteries + Veins + Lymph vessels

Cardiac muscle - revision

Coming up: Respiratory System

