

A scanning electron micrograph (SEM) showing a cross-section of a blood vessel. The central lumen is filled with numerous red blood cells, which appear as bright red, biconcave discs. The vessel wall is composed of a thick, greenish-yellow layer of connective tissue, showing a complex, fibrous structure with various folds and indentations. The overall appearance is highly detailed and textured.

Kardiovaskulární systém

Obecná stavba

Tunica intima

Endotel

Bazální lamina

Subendotelová vrstva

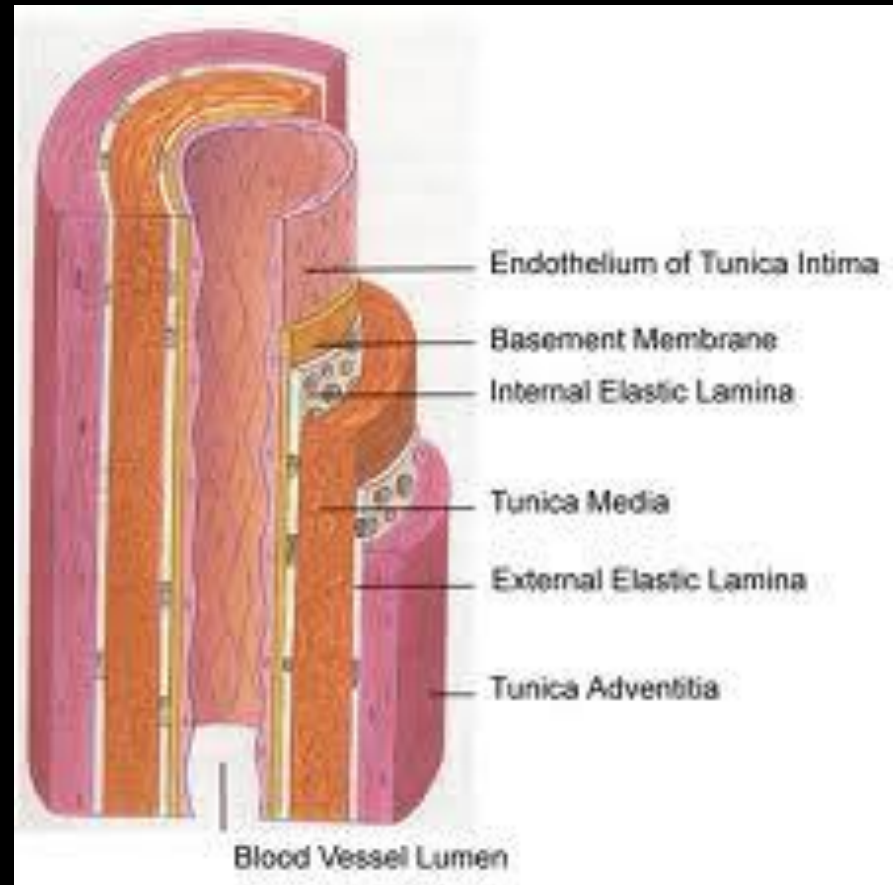
Tunica media

(Membrana elastica interna)

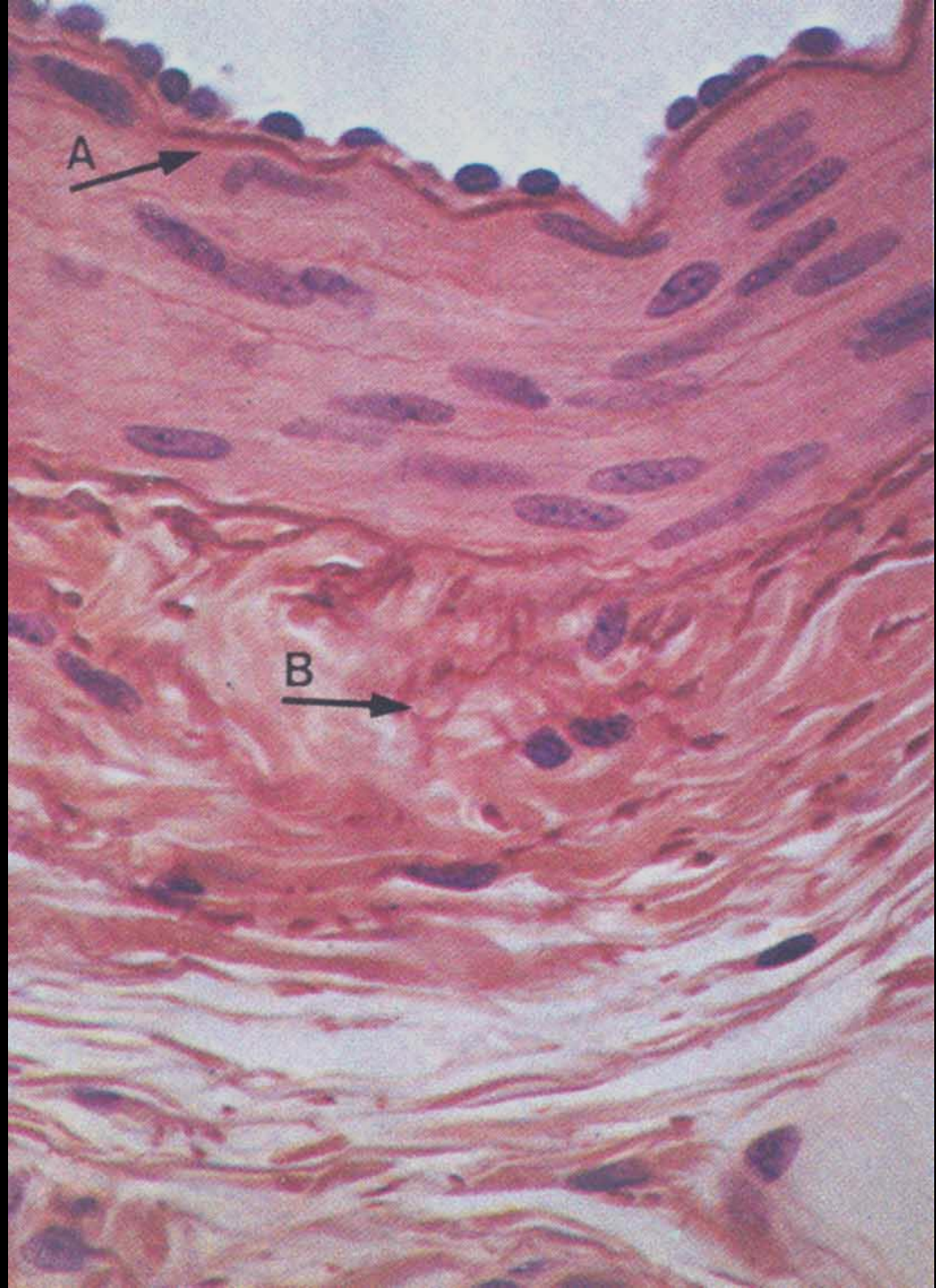
Hladký sval

(Membrana elastica externa)

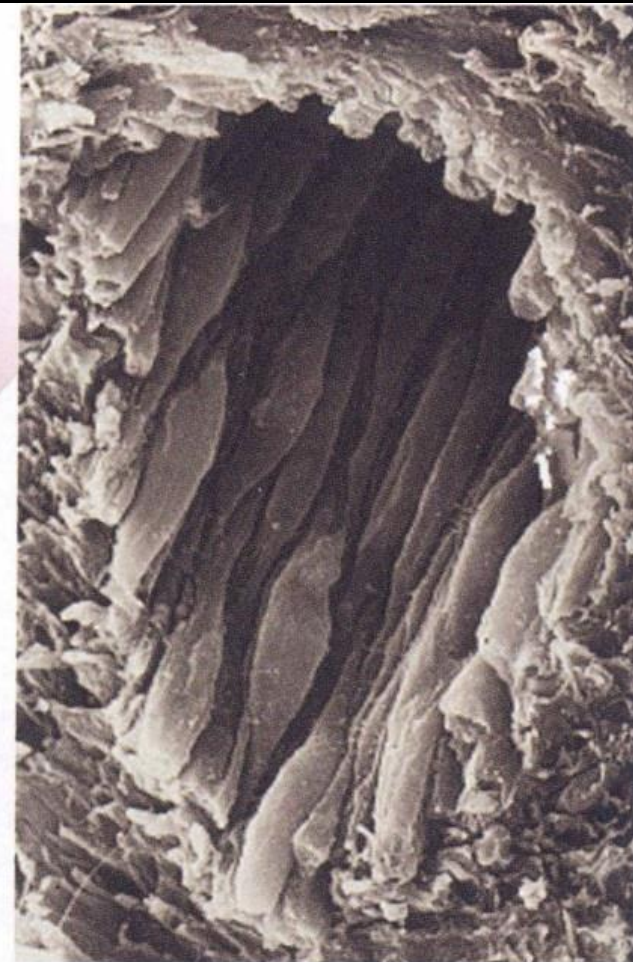
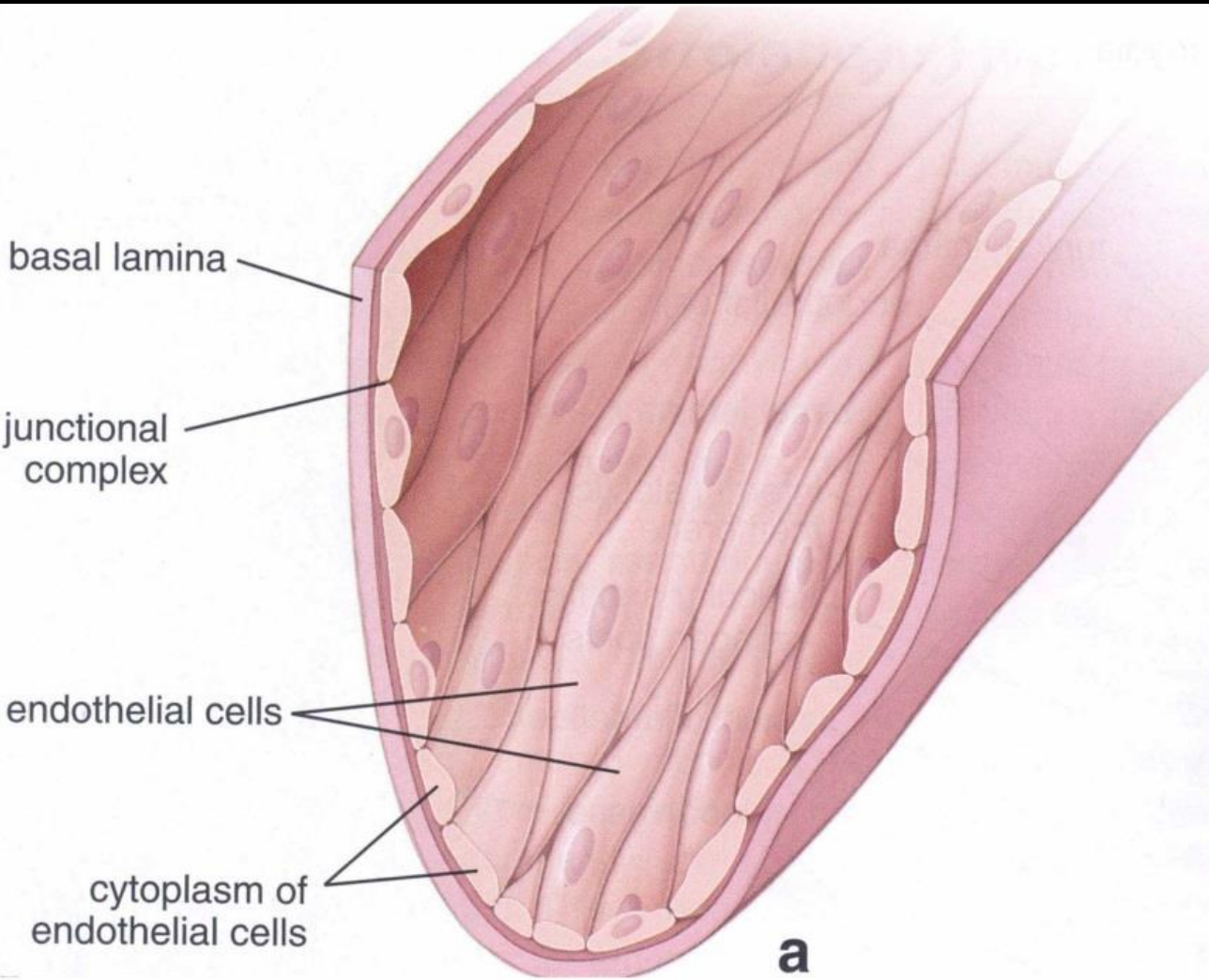
Tunica adventitia

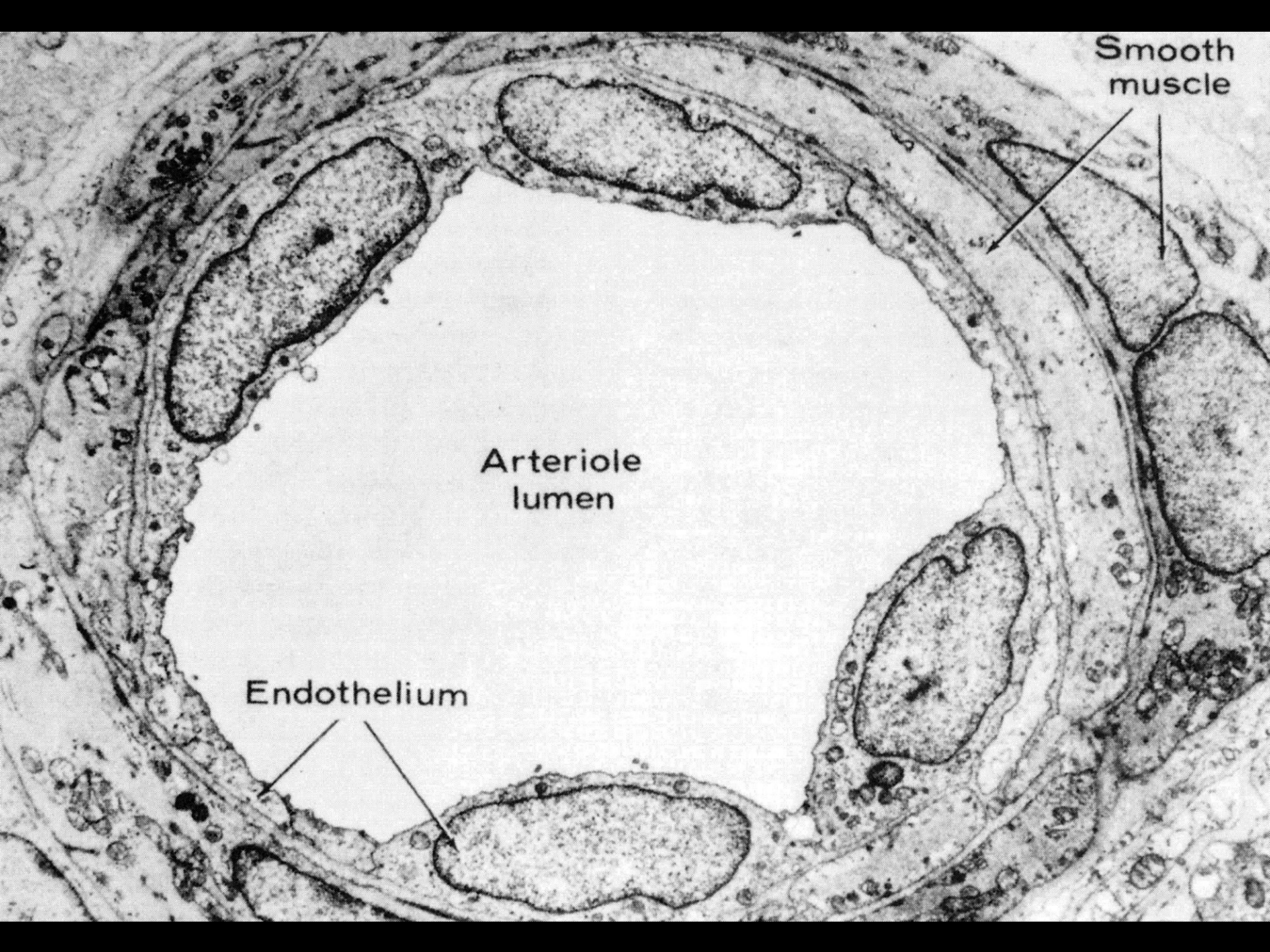


Tunica intima



Endotel

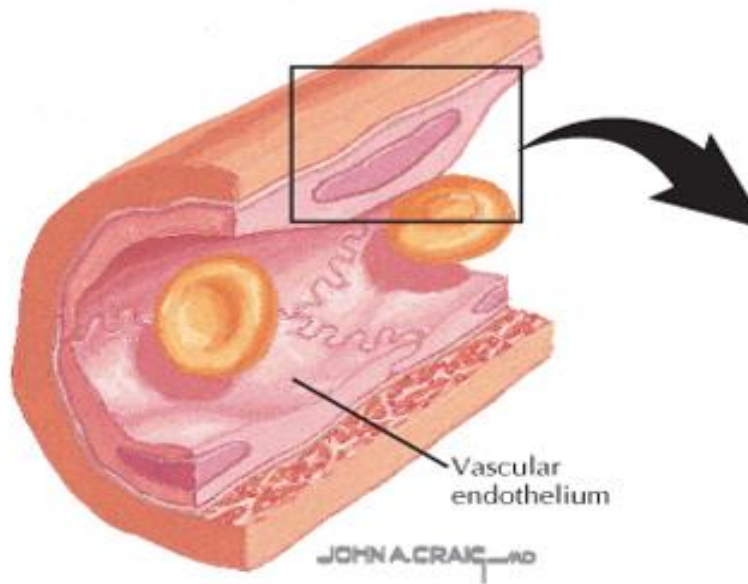




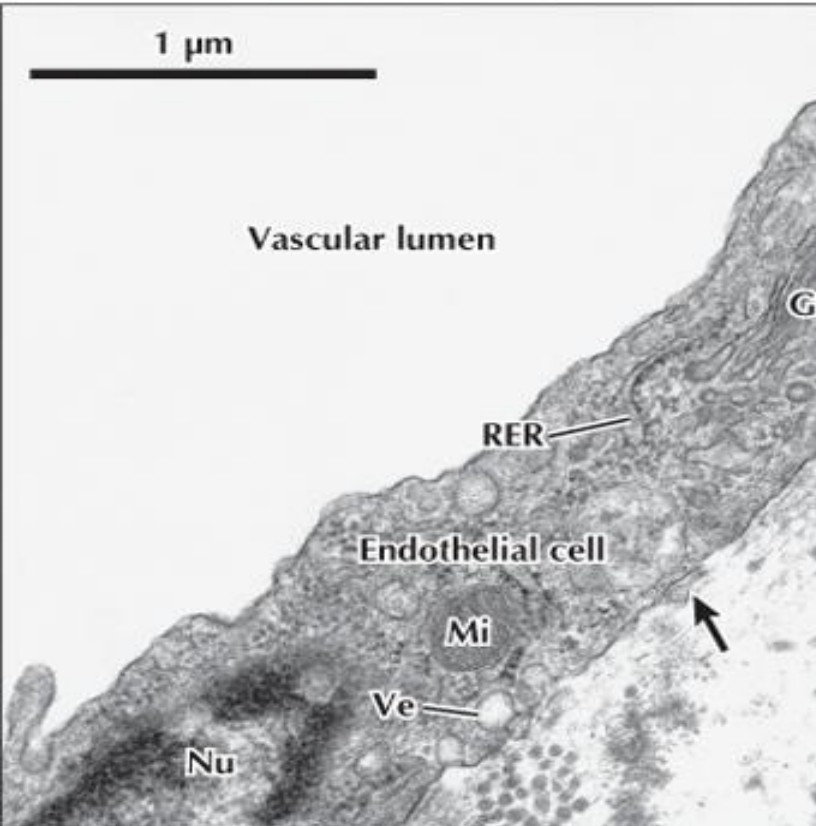
Smooth muscle

Arteriole lumen

Endothelium



1 μ m



povrchové molekuly

- CD 31 (PECAM), CD 34, CD 106 (VCAM-1)
- P-selektiny E-selektiny

konverze

- angiotensinu I na II

inaktivace

- bradykininu
- serotoninu
- prostaglandinů
- noradrenalinu
- trombinu

lipolýza

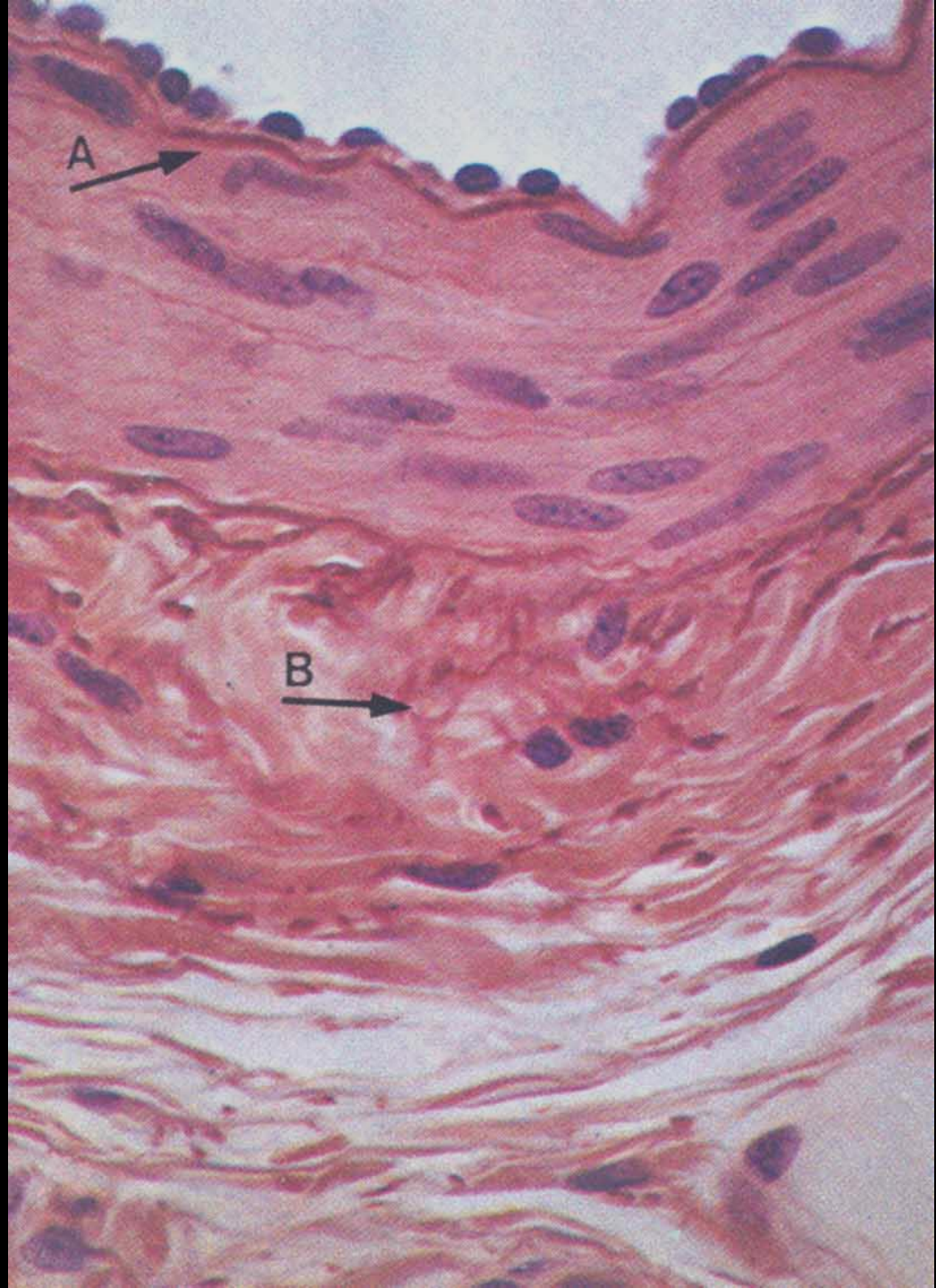
sekrece

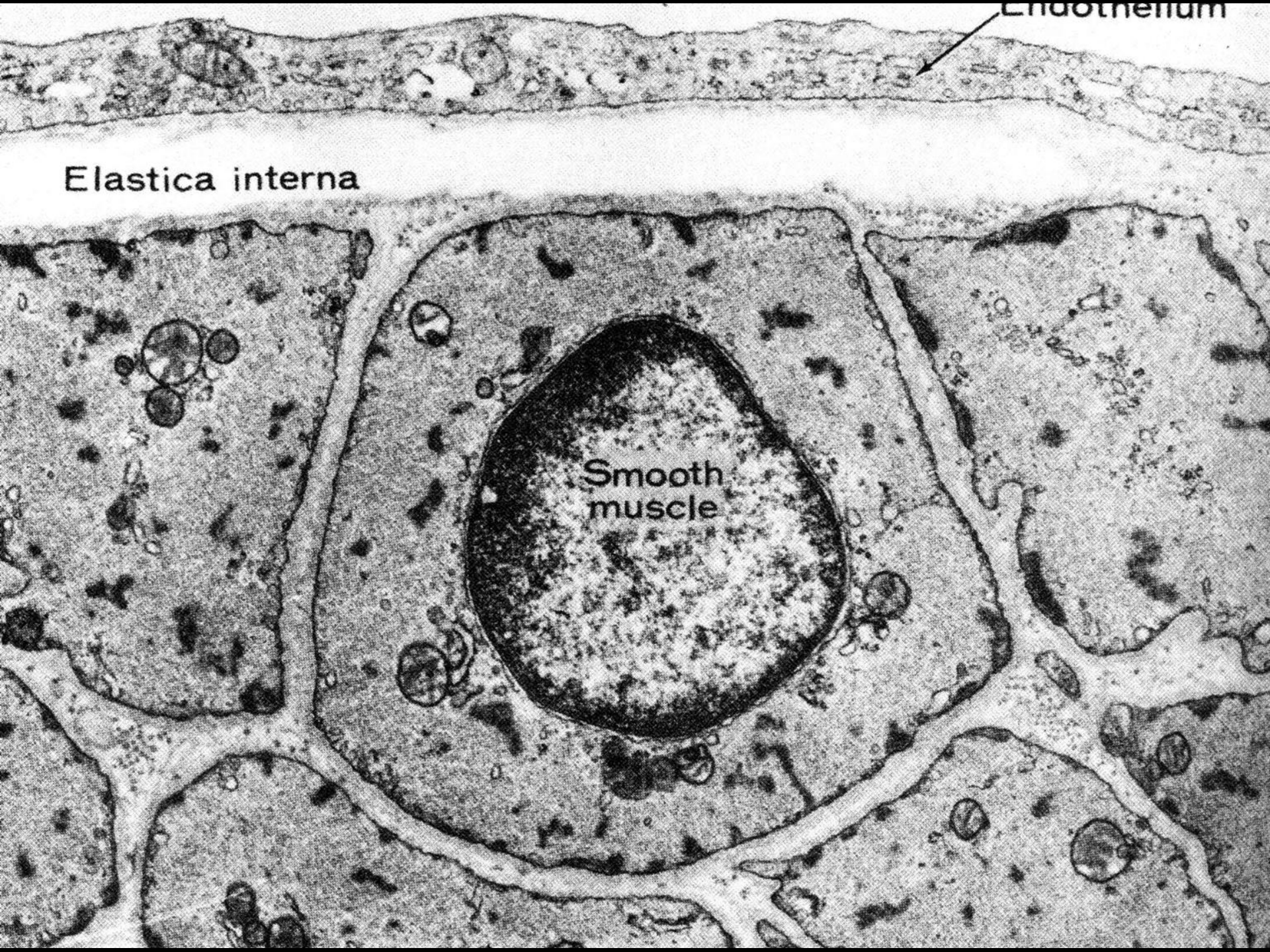
- vasoaktivní faktory
 - endoteliny (ET)
 - NO (eNOS, iNOS)
- antitrombogenní faktory
 - trombomodulin, prostacyclin
- protrombogenní faktory
 - von Willebrandův faktor (Weibelova-Paladeho granula - arterioly)
- mezibuněčná hmota
 - kolagen, biglykan, versikan



Occluding
junction

Tunica media





Endothelium

Elastica interna

Smooth muscle

Tunica adventitia





Smooth muscle

Axon

Axons

Collogen of the adventitia

Elastica externa

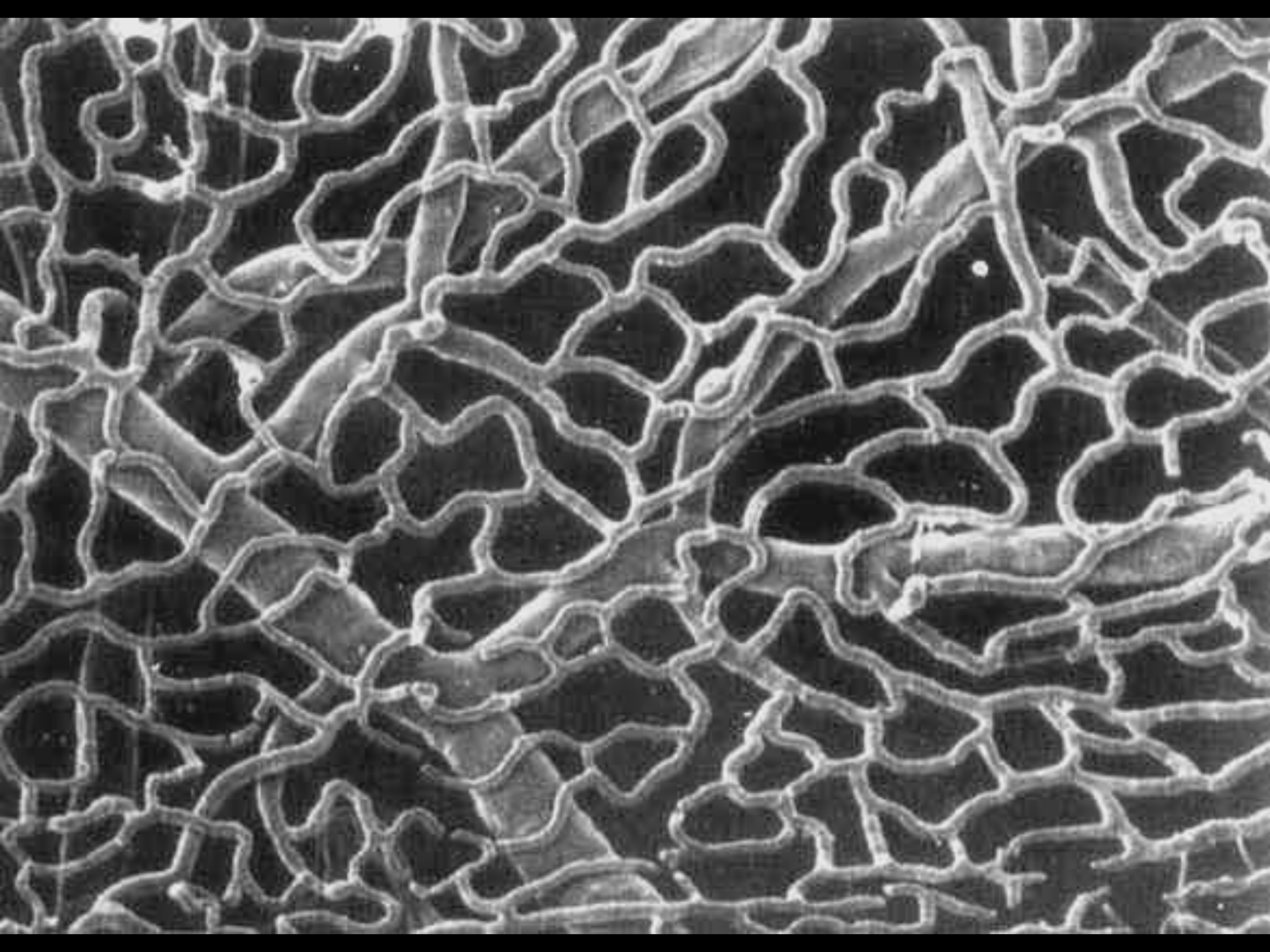
Kapiláry

průměr 7-9 μm

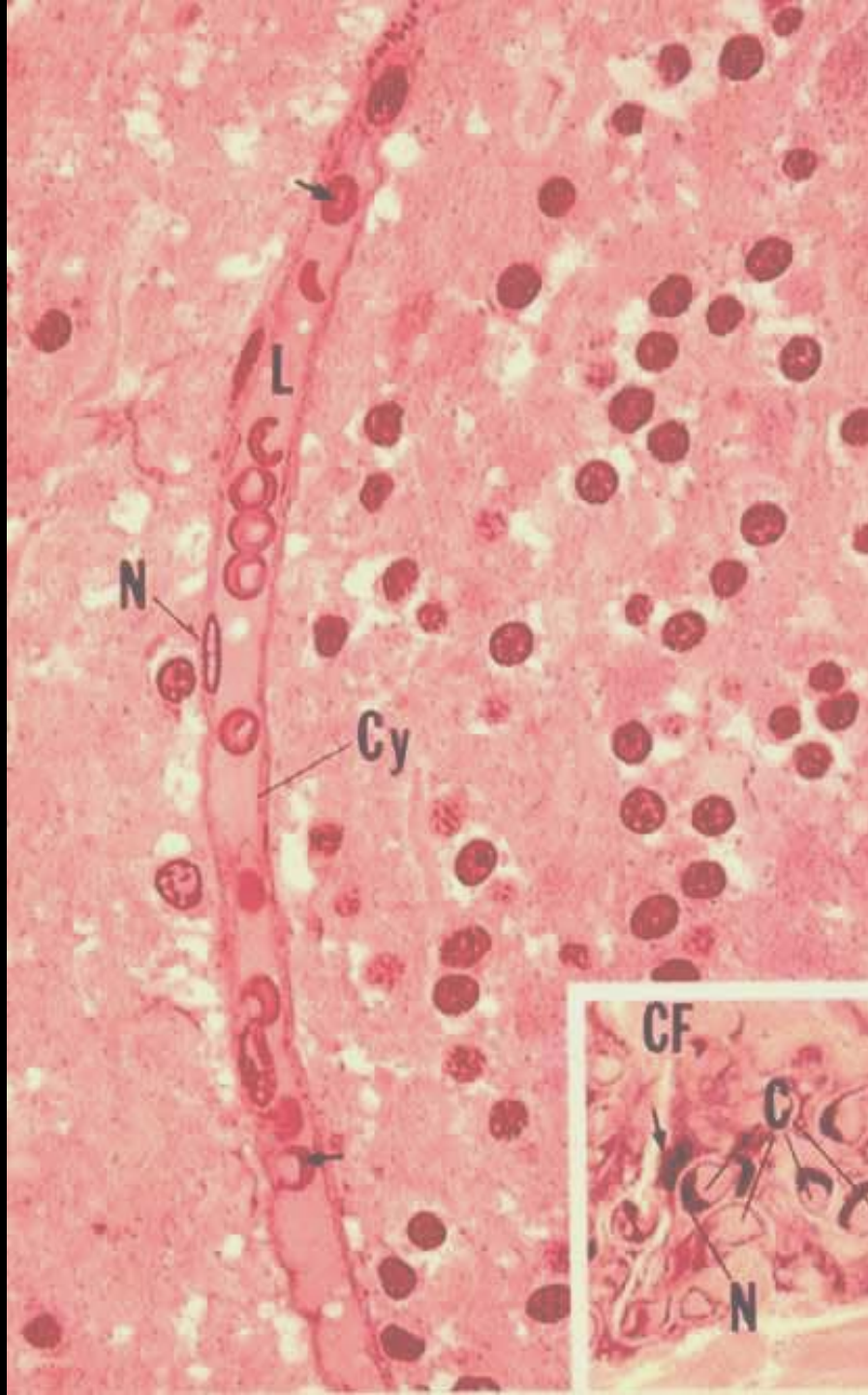
délka 0,25 - 1 mm

(dřeň ledvin, kůra nadledvin až 50 mm)

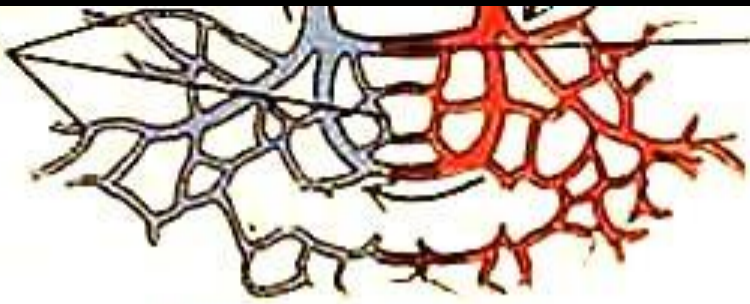
celková délka 96.000 km







Capillaries A.V. anastomosis



Microcirculatory Bed

Venules

Arterioles

Smooth-muscle cells

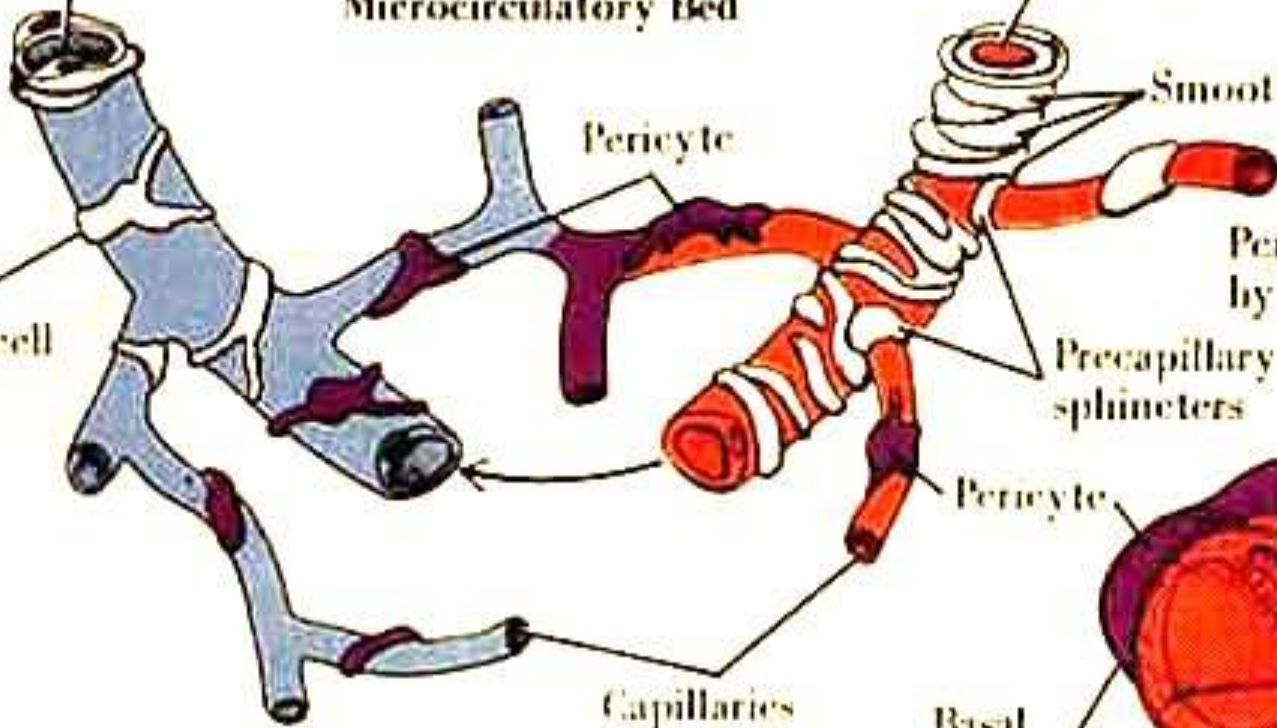
Pericyte

Pericyte covered by basal lamina

Smooth-muscle cell

Precapillary sphincters

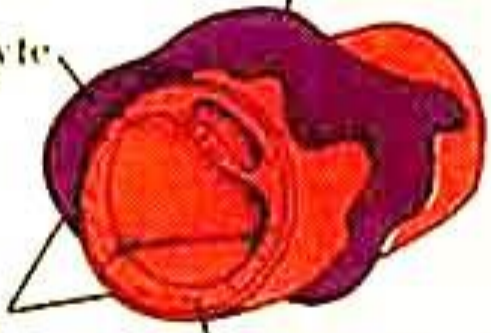
Pericyte



Capillaries

Basal lamina

Endothelial cell



kapiláry - typické

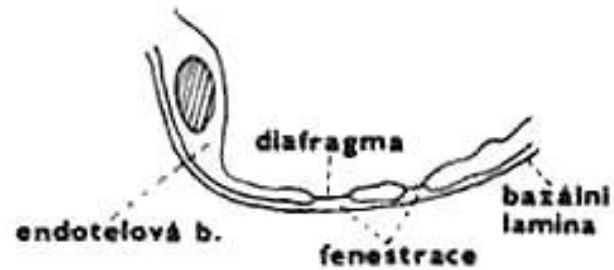
1. KAPILÁRY

A. typické

a) se souvislou endotelovou výstelkou



b) fenestrovaná

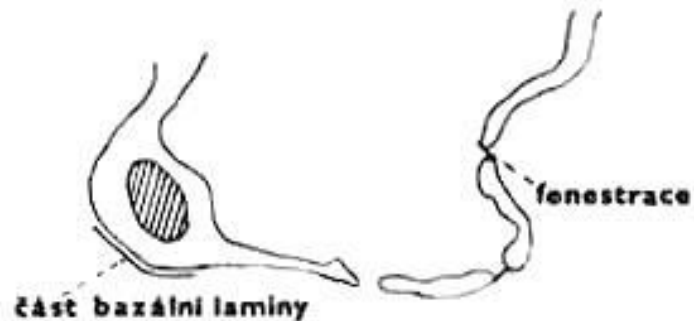


c) s póry



B. atypické

sinusoida

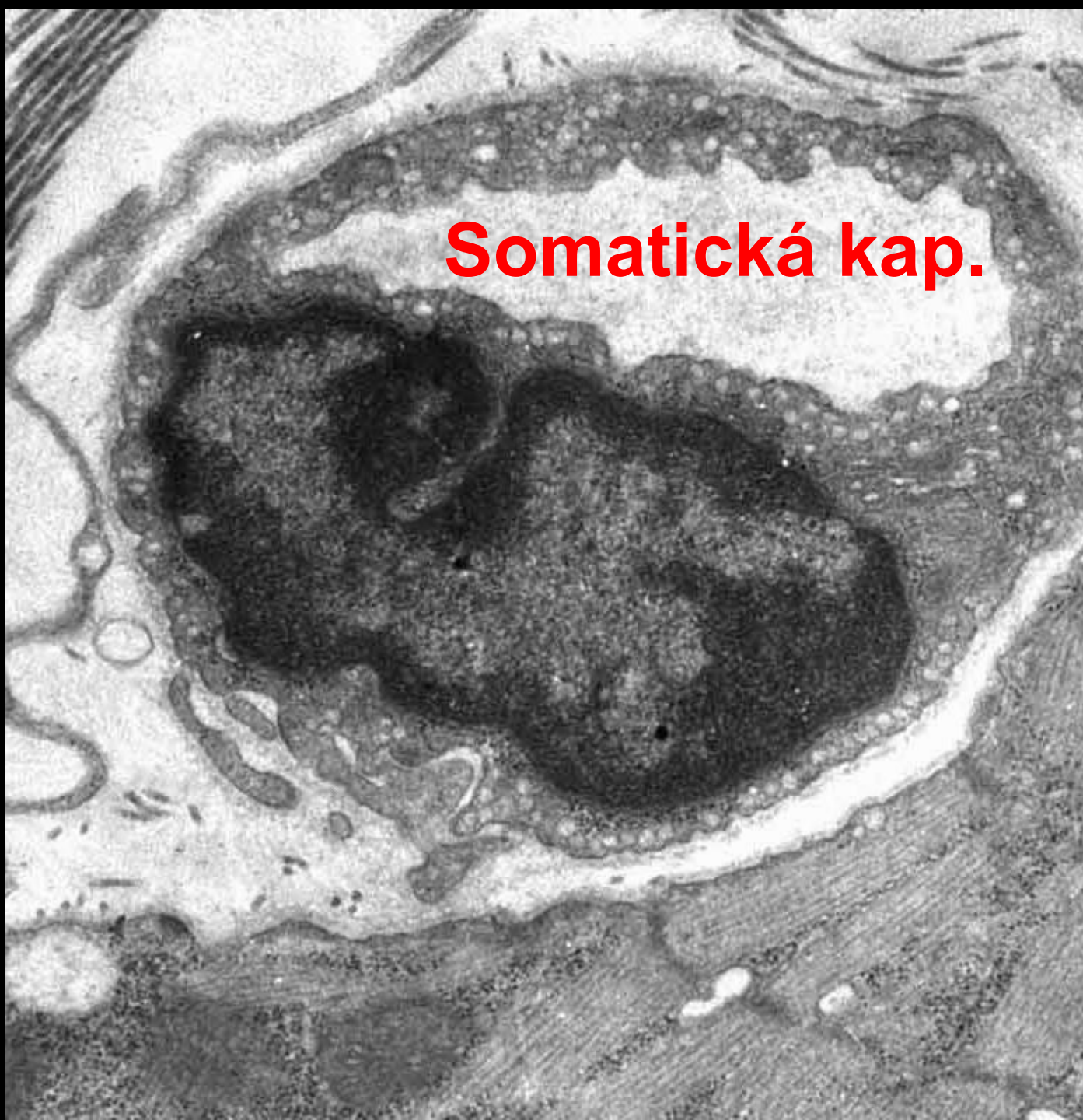


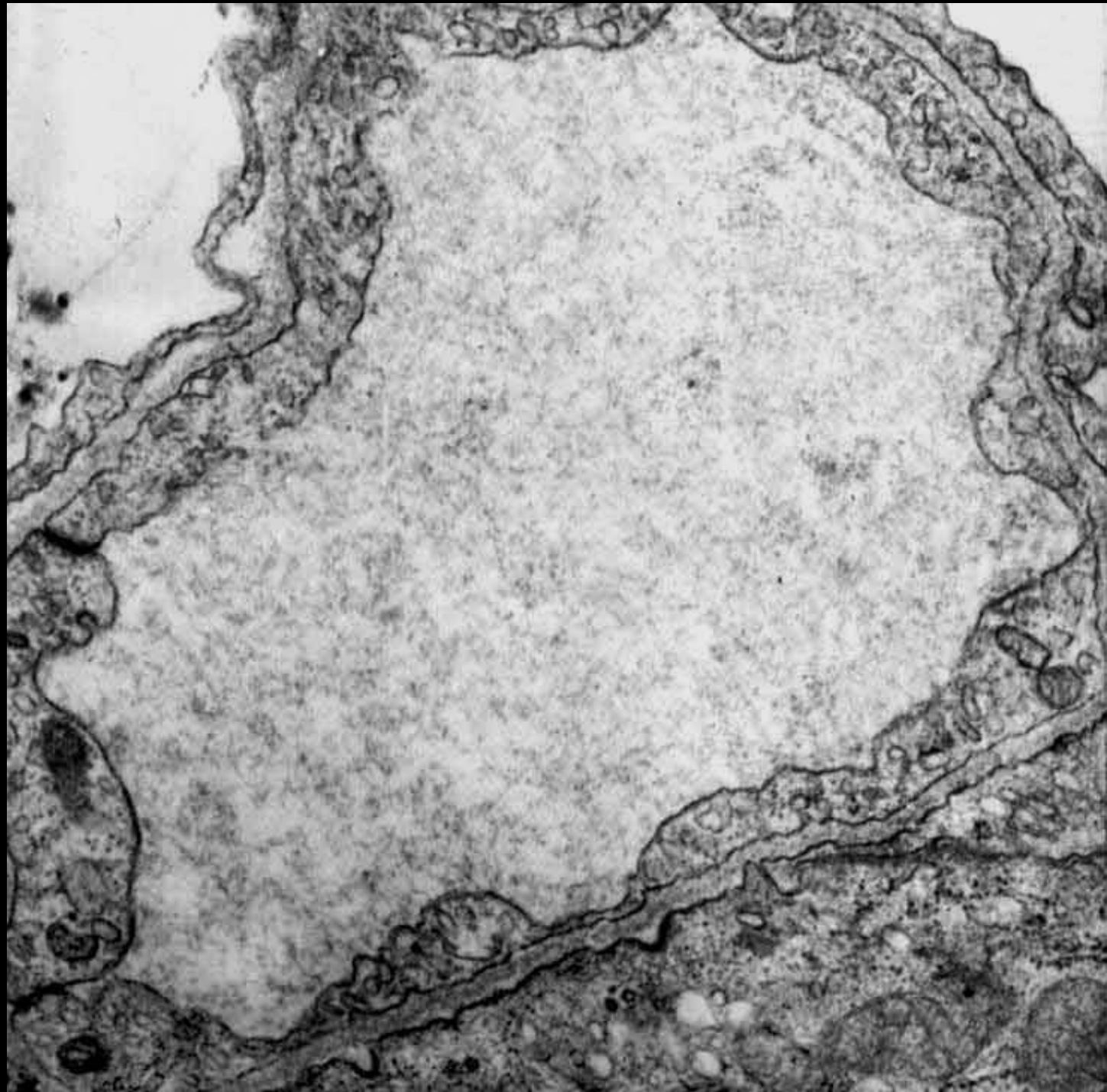
somatické

viscerální

- atypické

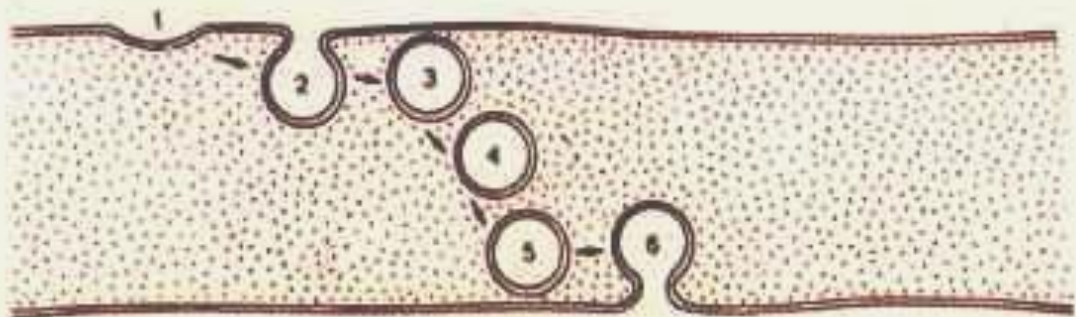
Somatická kap.



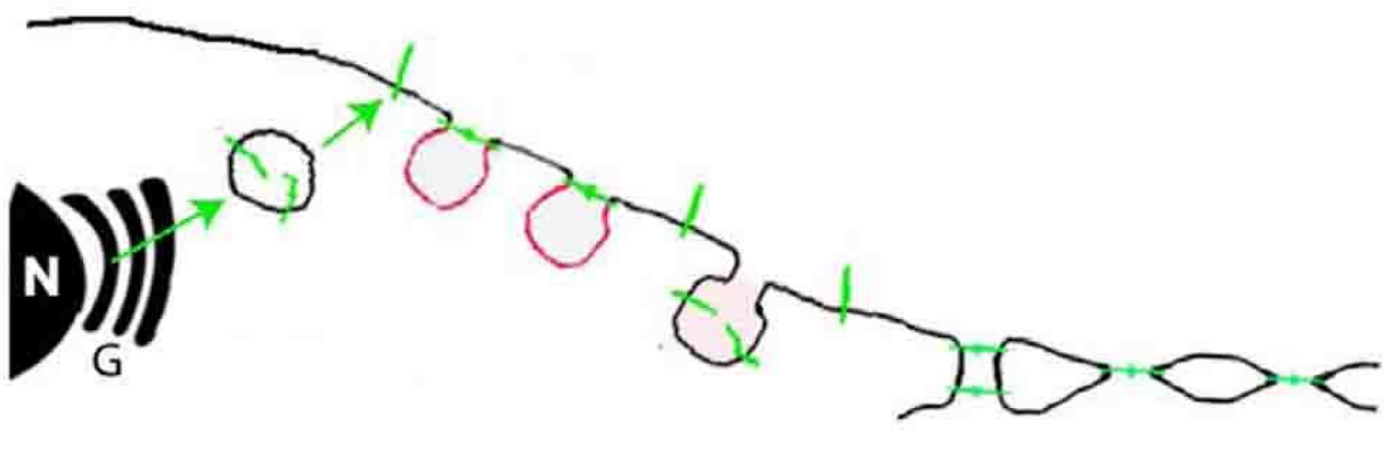
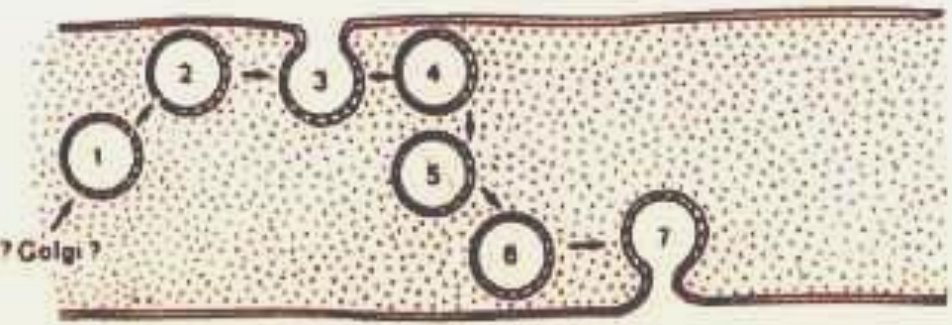





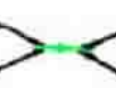
This electron micrograph shows a cross-section of a fenestrated endothelium. The central feature is a fenestration, a narrow opening between two endothelial cells. The fenestration is lined by a thin layer of cytoplasm and contains a small, electron-dense structure, likely a diaphragm. The surrounding endothelial cells are characterized by their thin, flattened morphology and the presence of numerous small, circular fenestrae. The overall appearance is that of a highly permeable barrier, typical of the blood-brain barrier or the placental barrier.

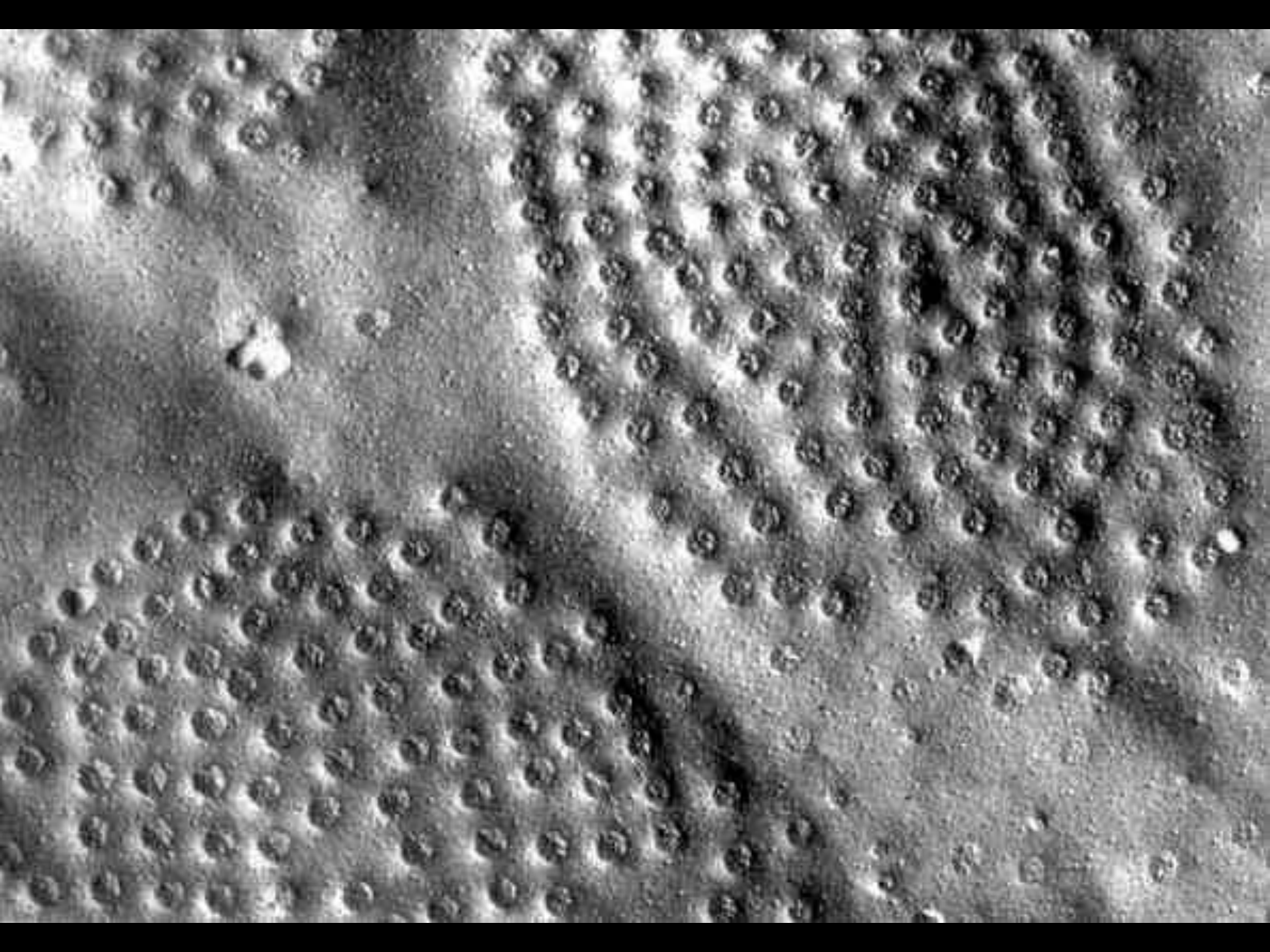
Fenestrace

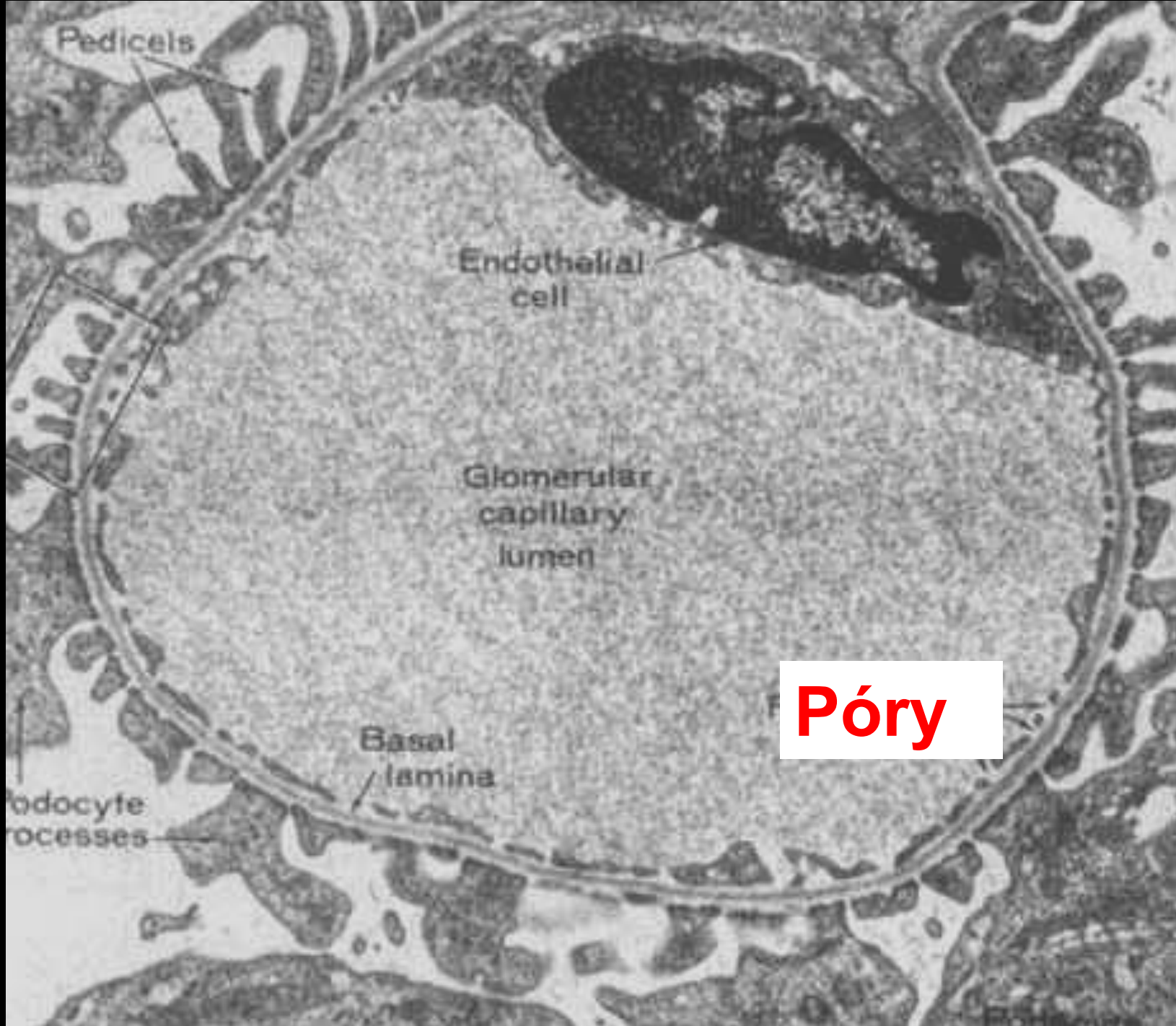


FUSION-FISSION WITHOUT MIXING OF VESICLE AND PLASMA MEMBRANES

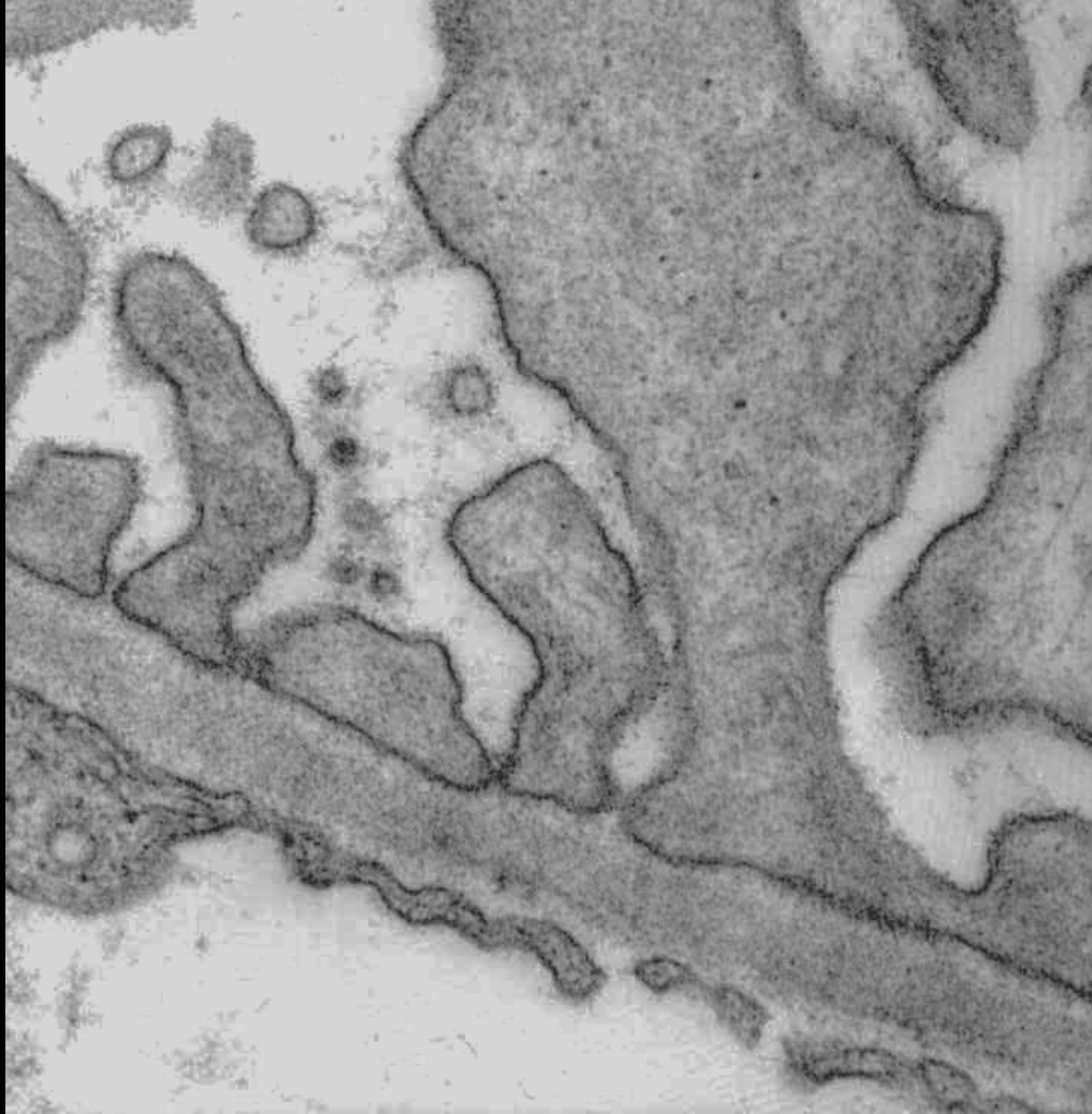


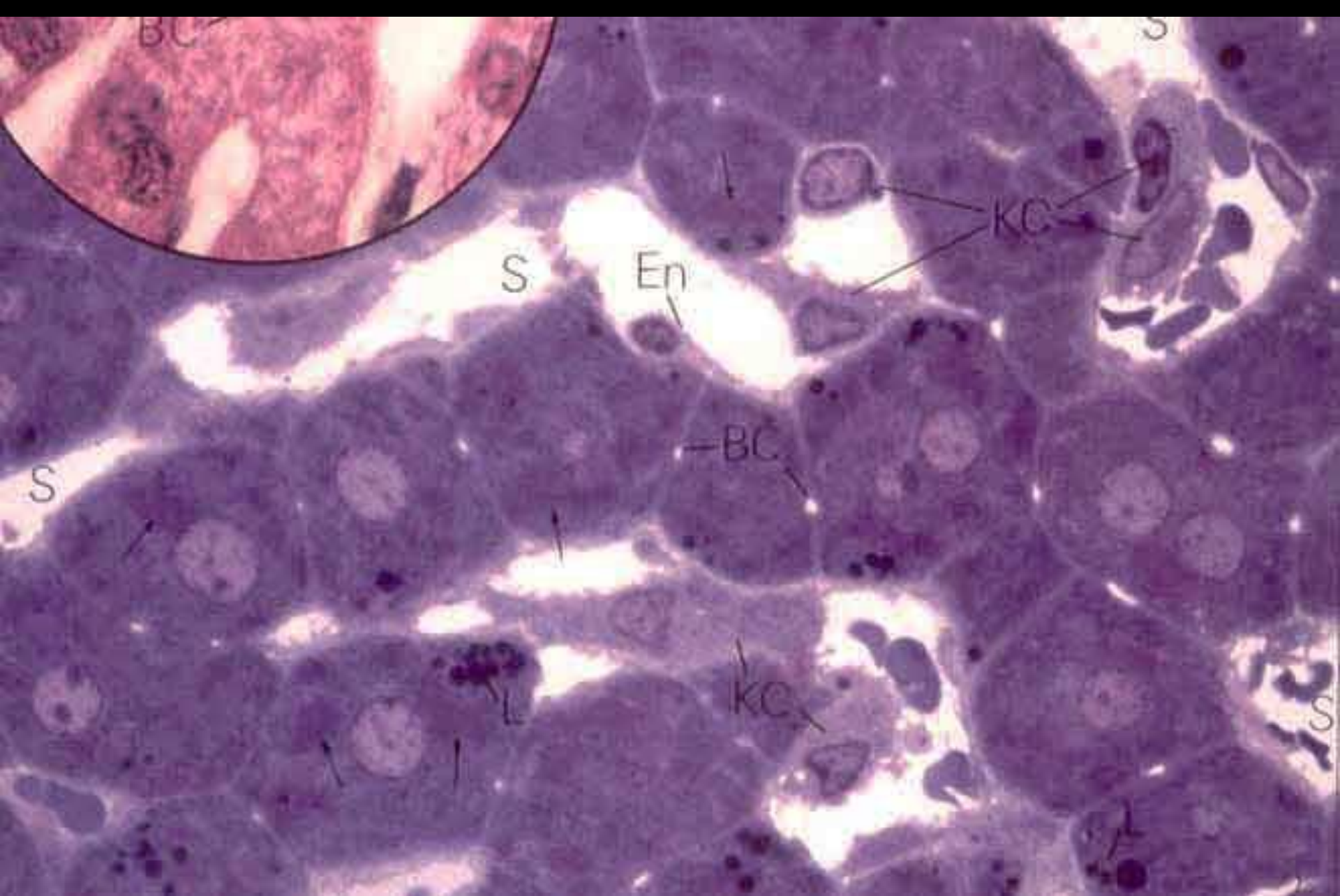
-  Diaphragm
-  Caveolae
-  TEC
-  Fenestrae





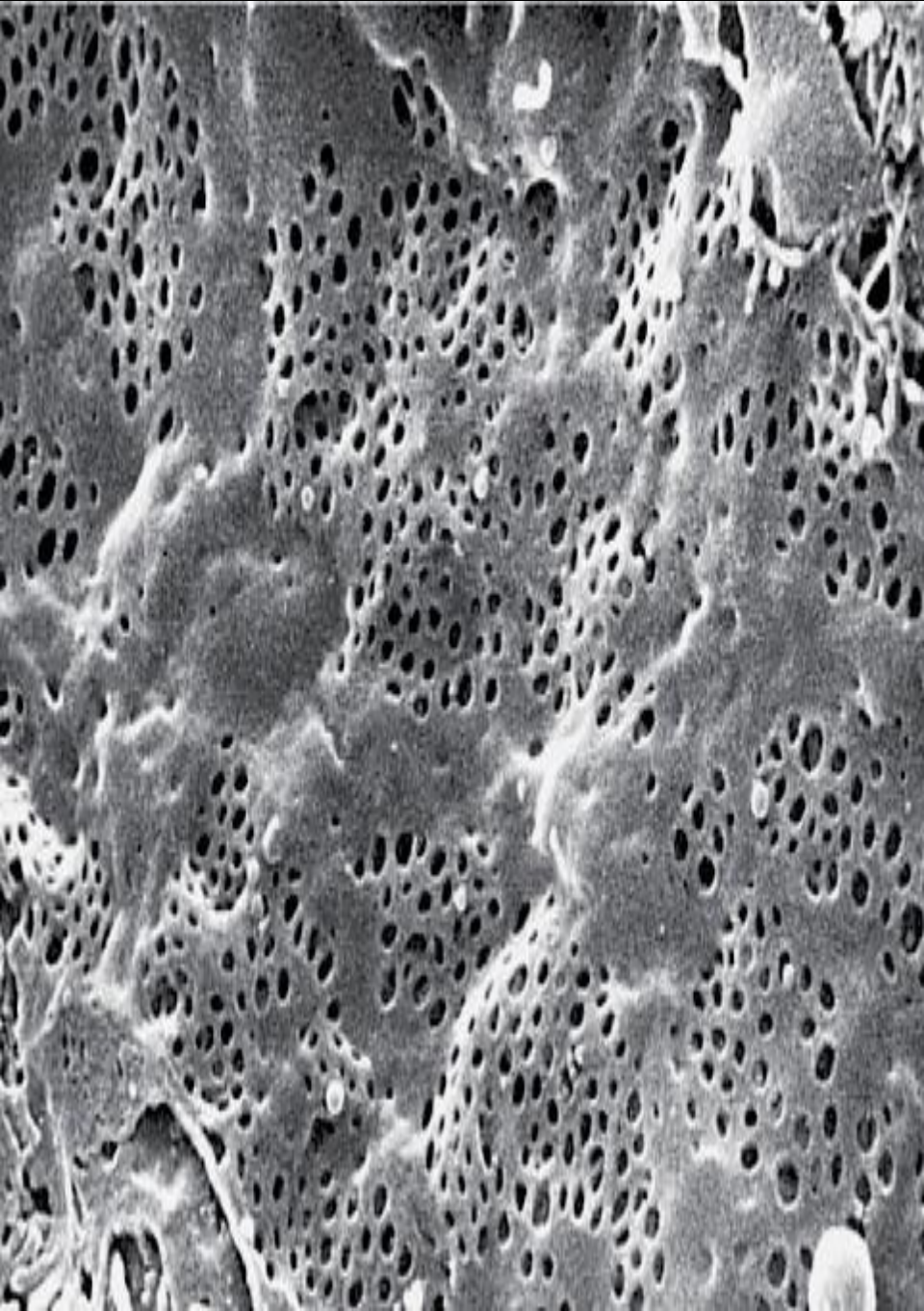
Póry



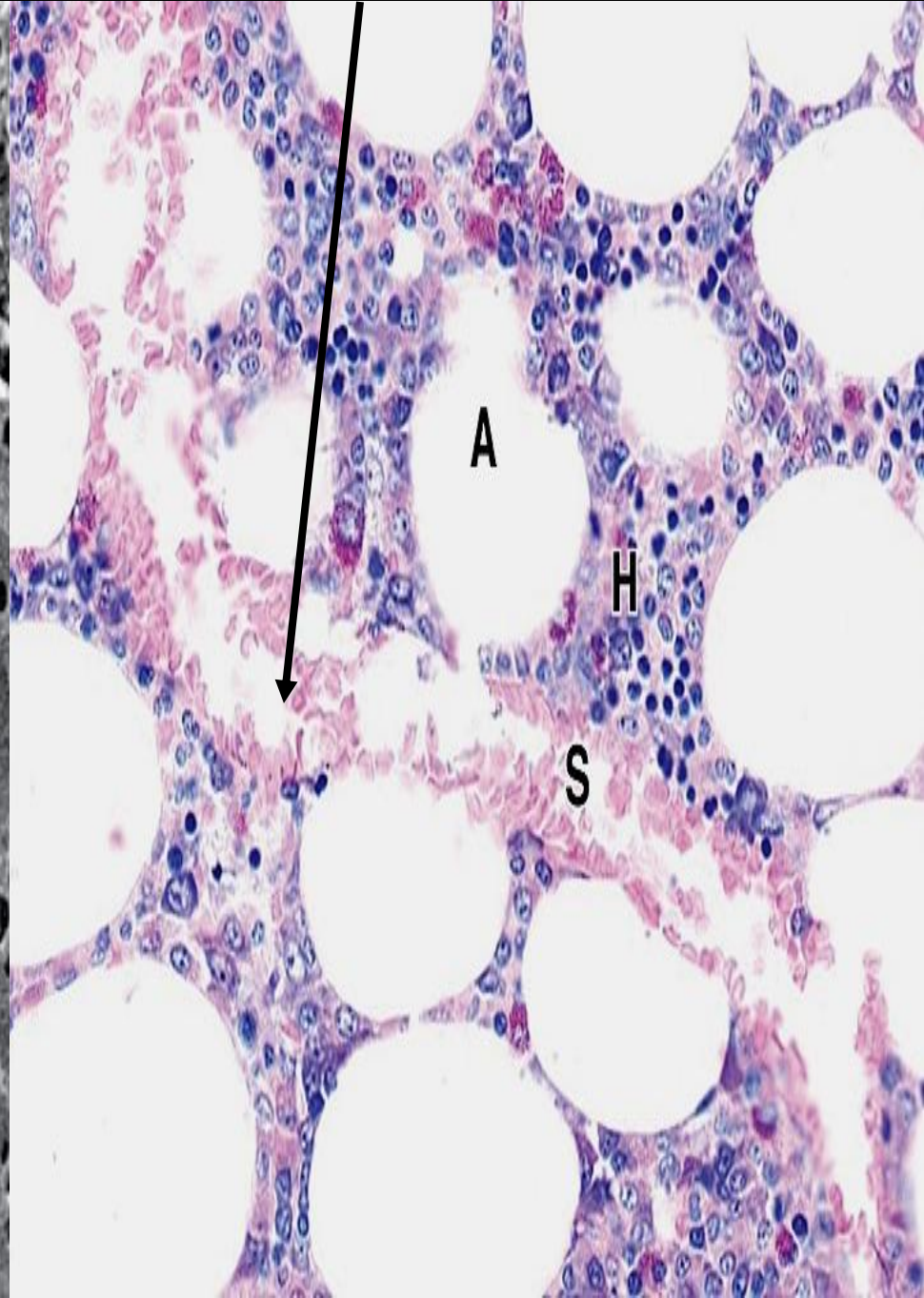


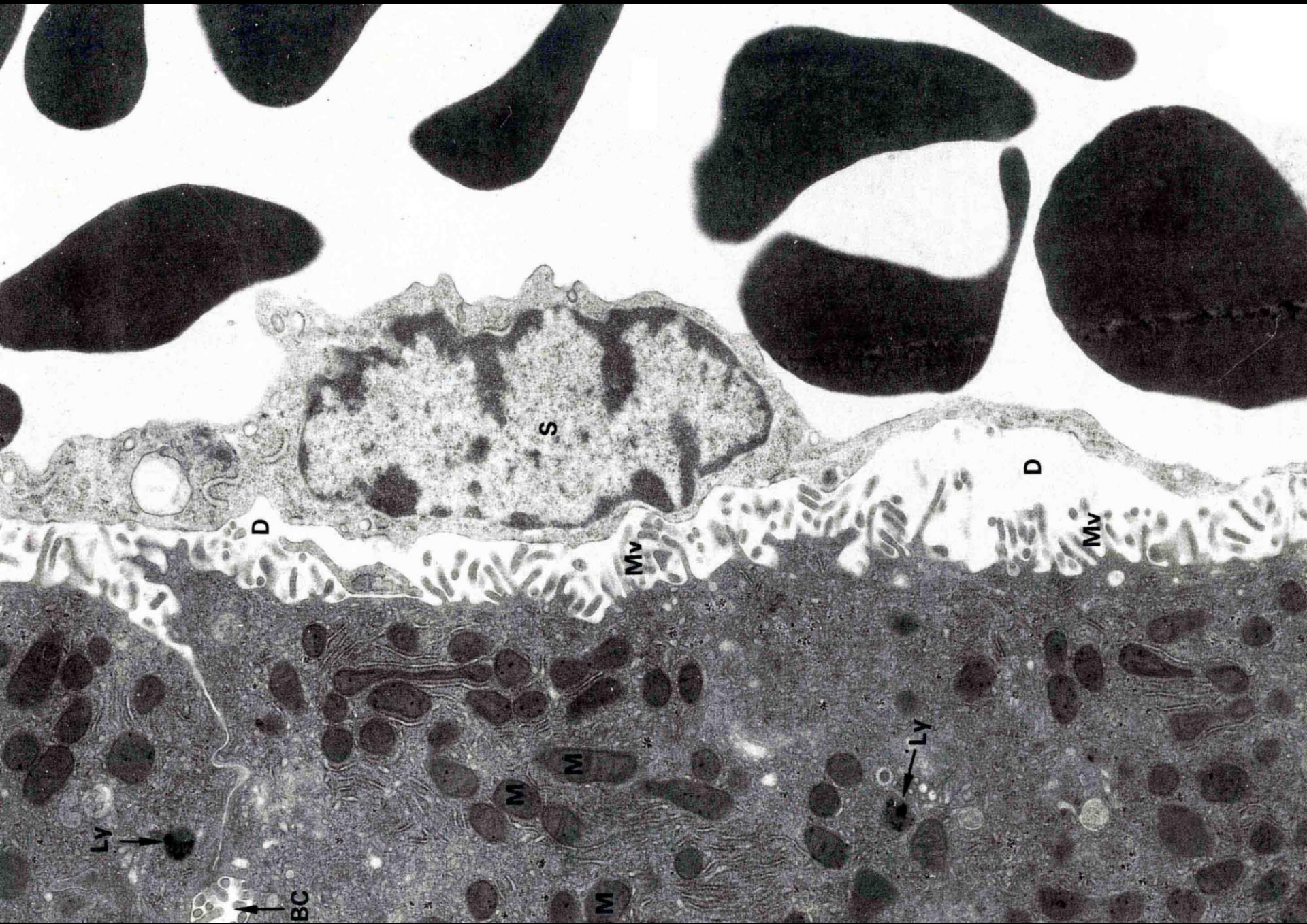
Sinusoidy (až 40 μm)

Endotel sinusoidy – fenestrace (póry)

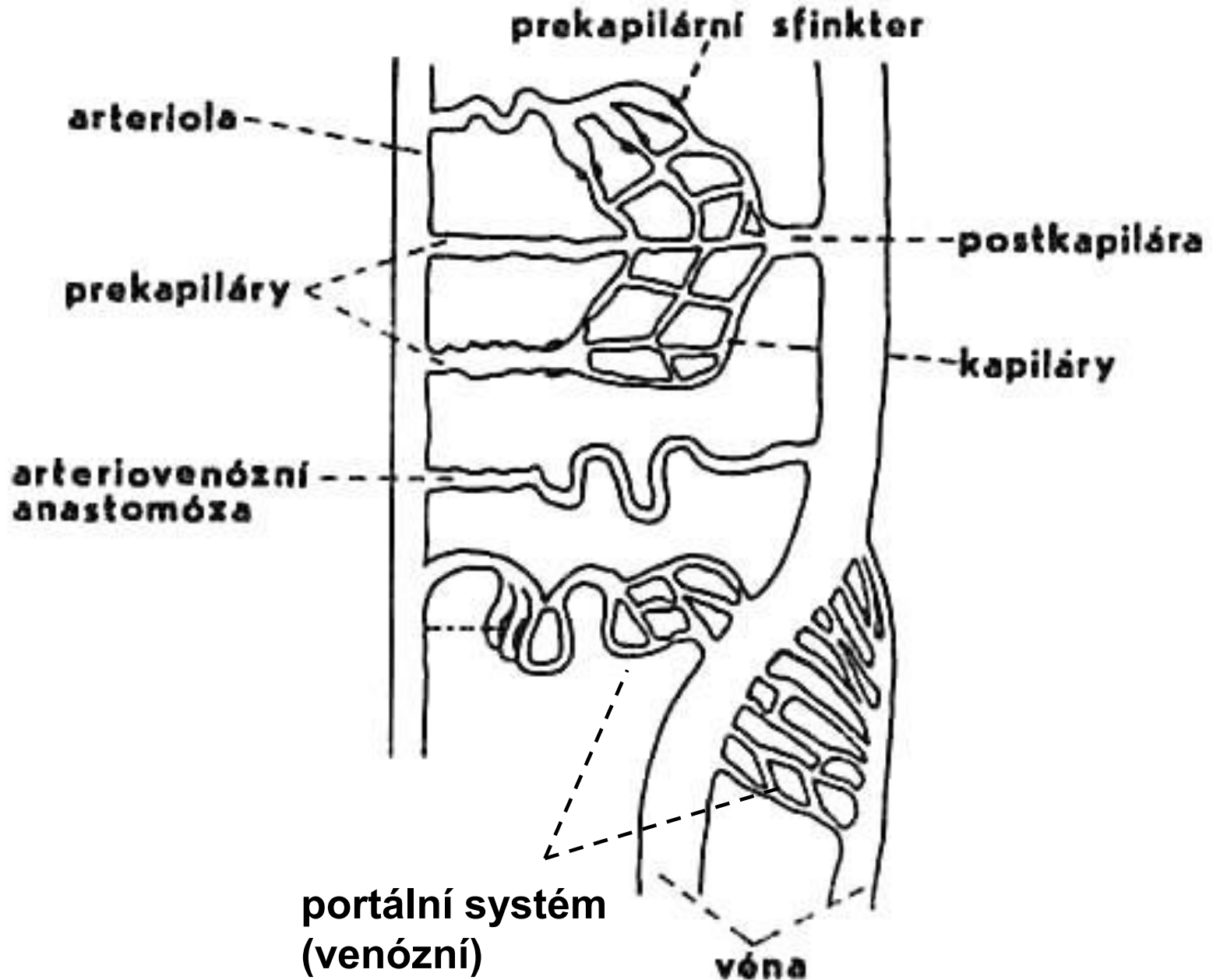


Sinusoida v kostní dřeni





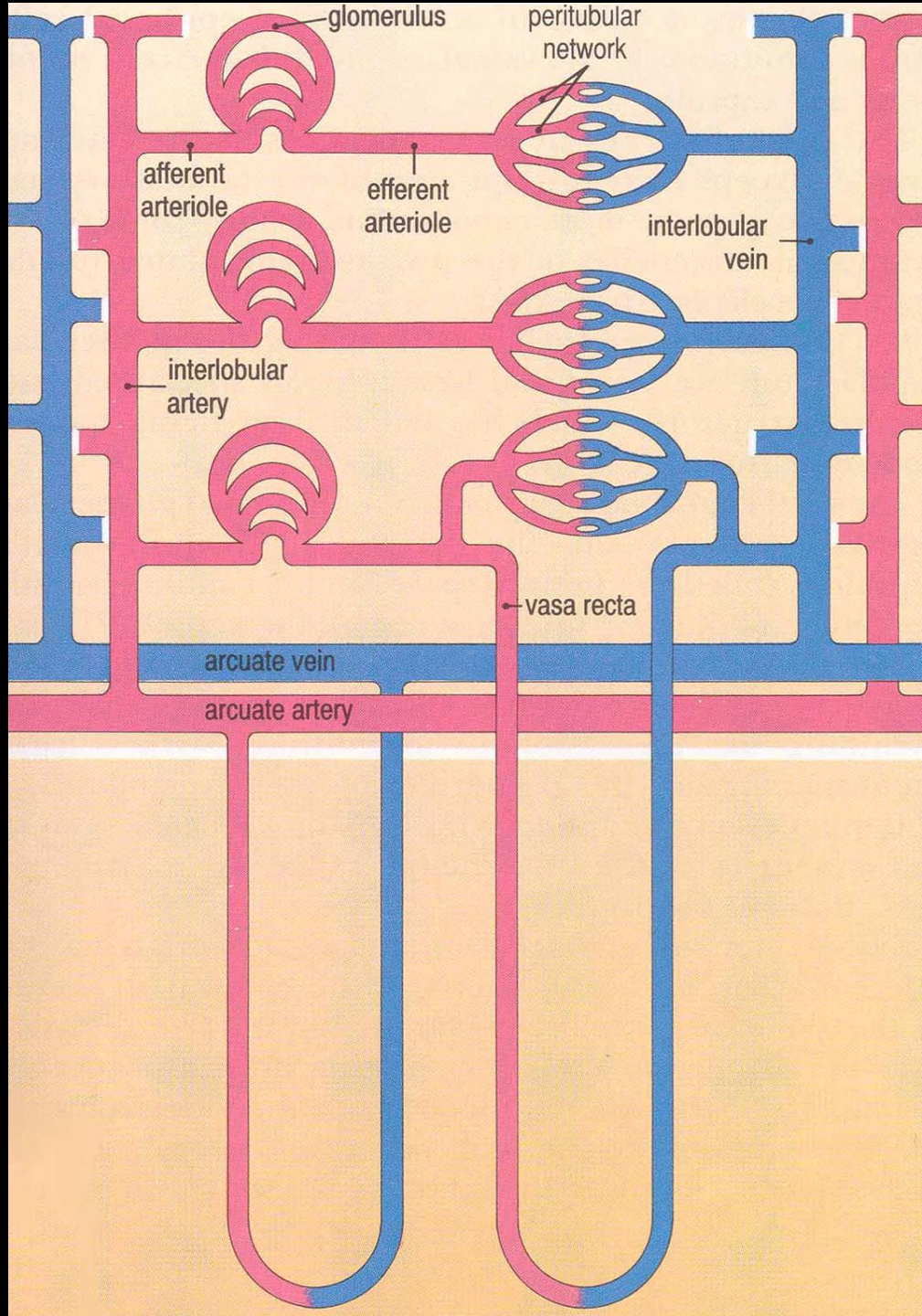
TYPY CIRKULACE



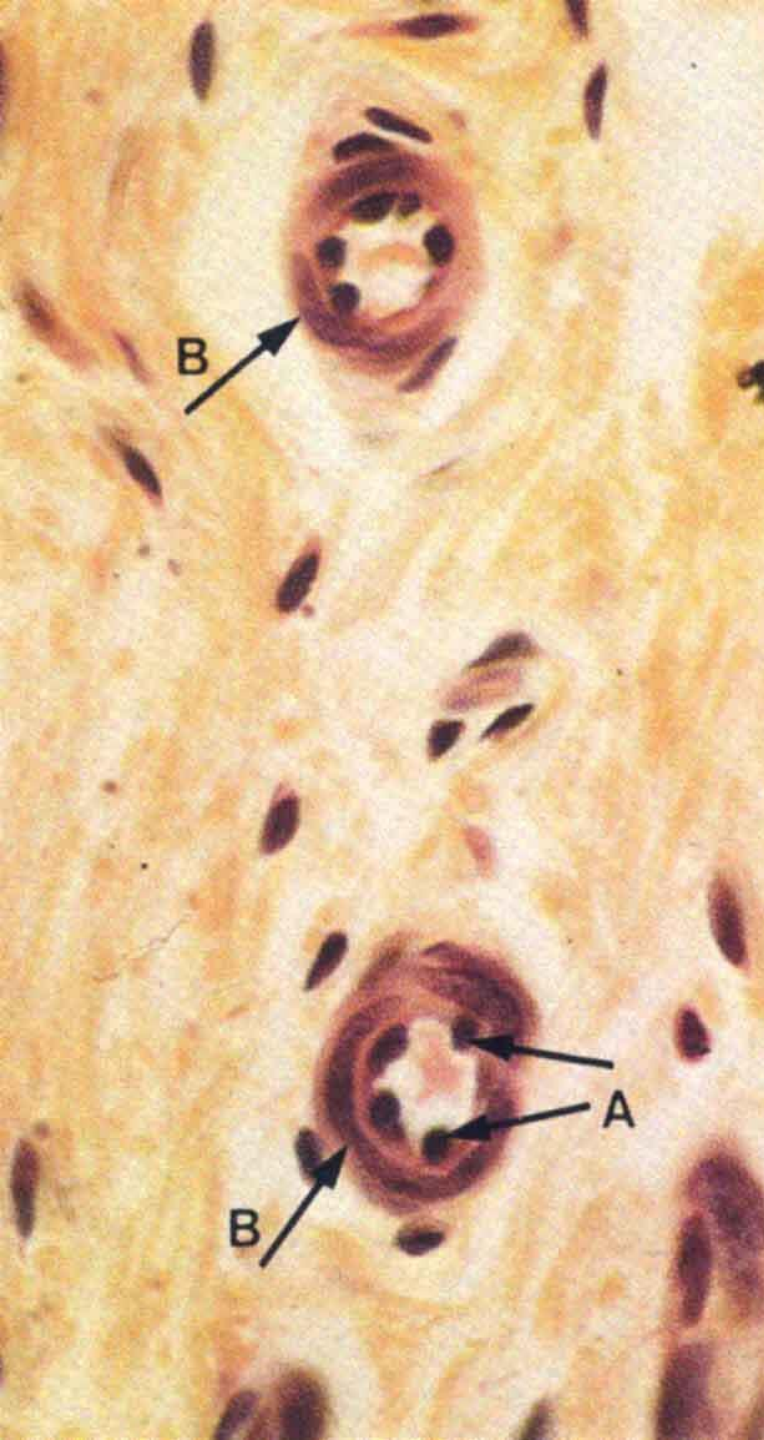
AV anastomóza



Portální systém (arteriální)

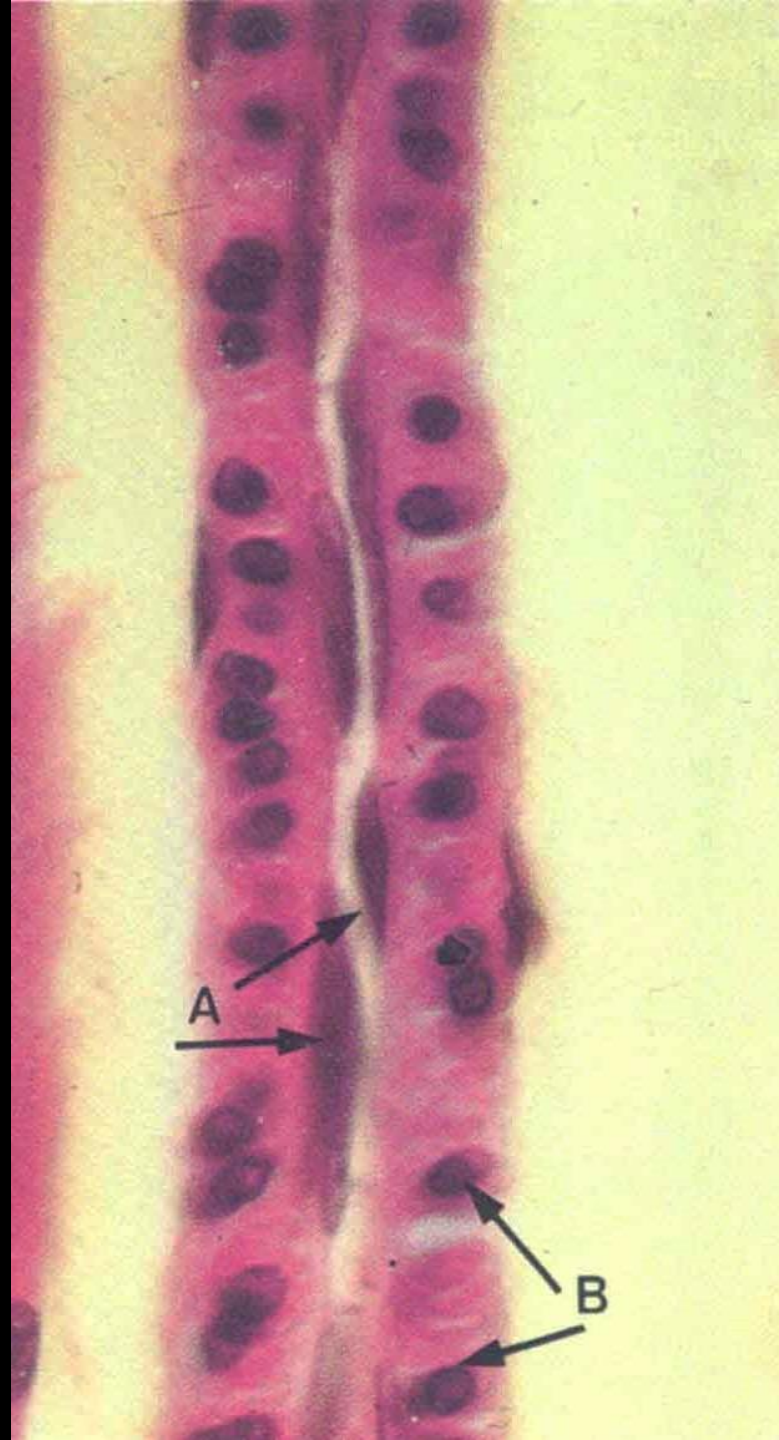


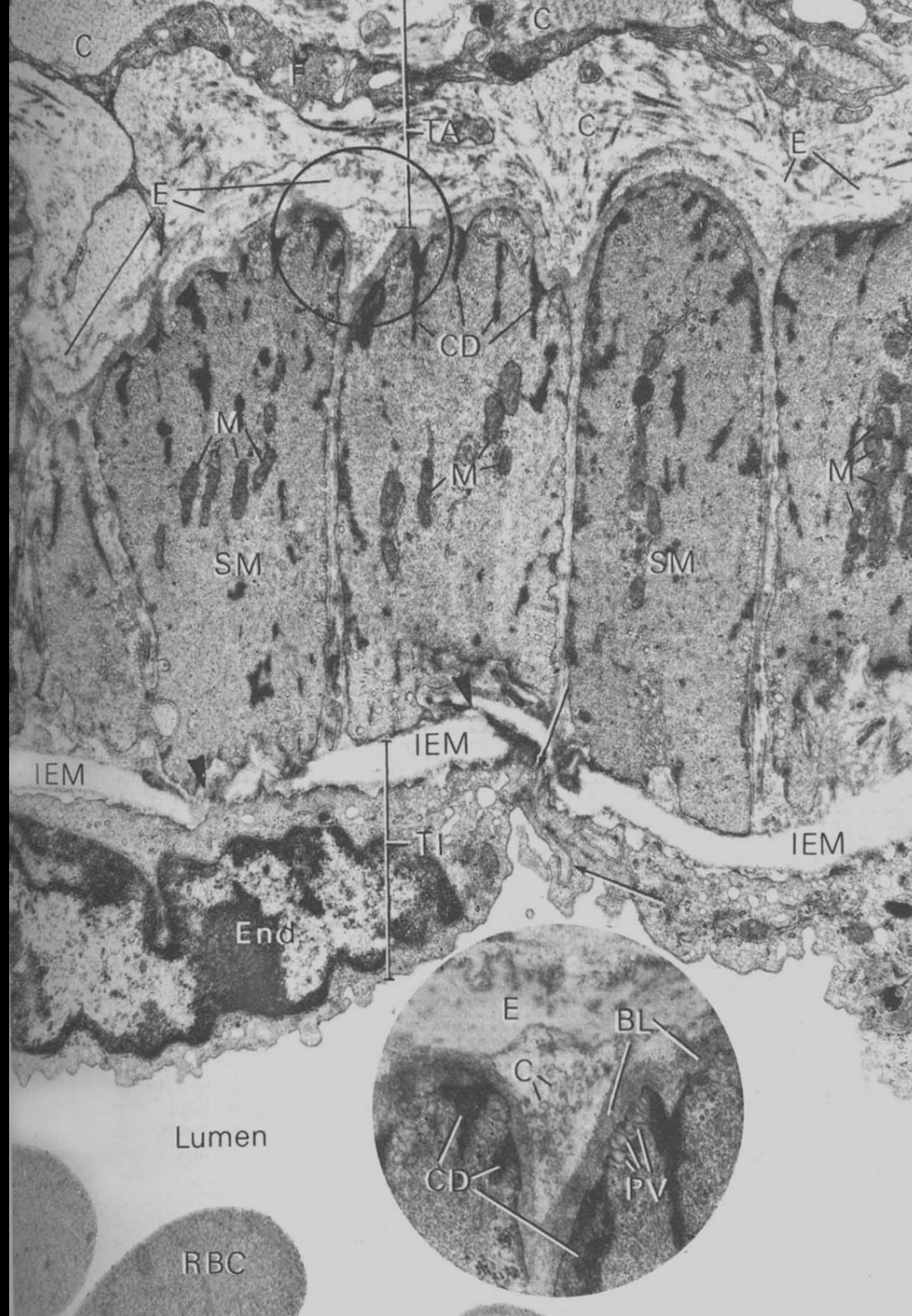
Tepny (artérie)



Arterioly

do
500 μm



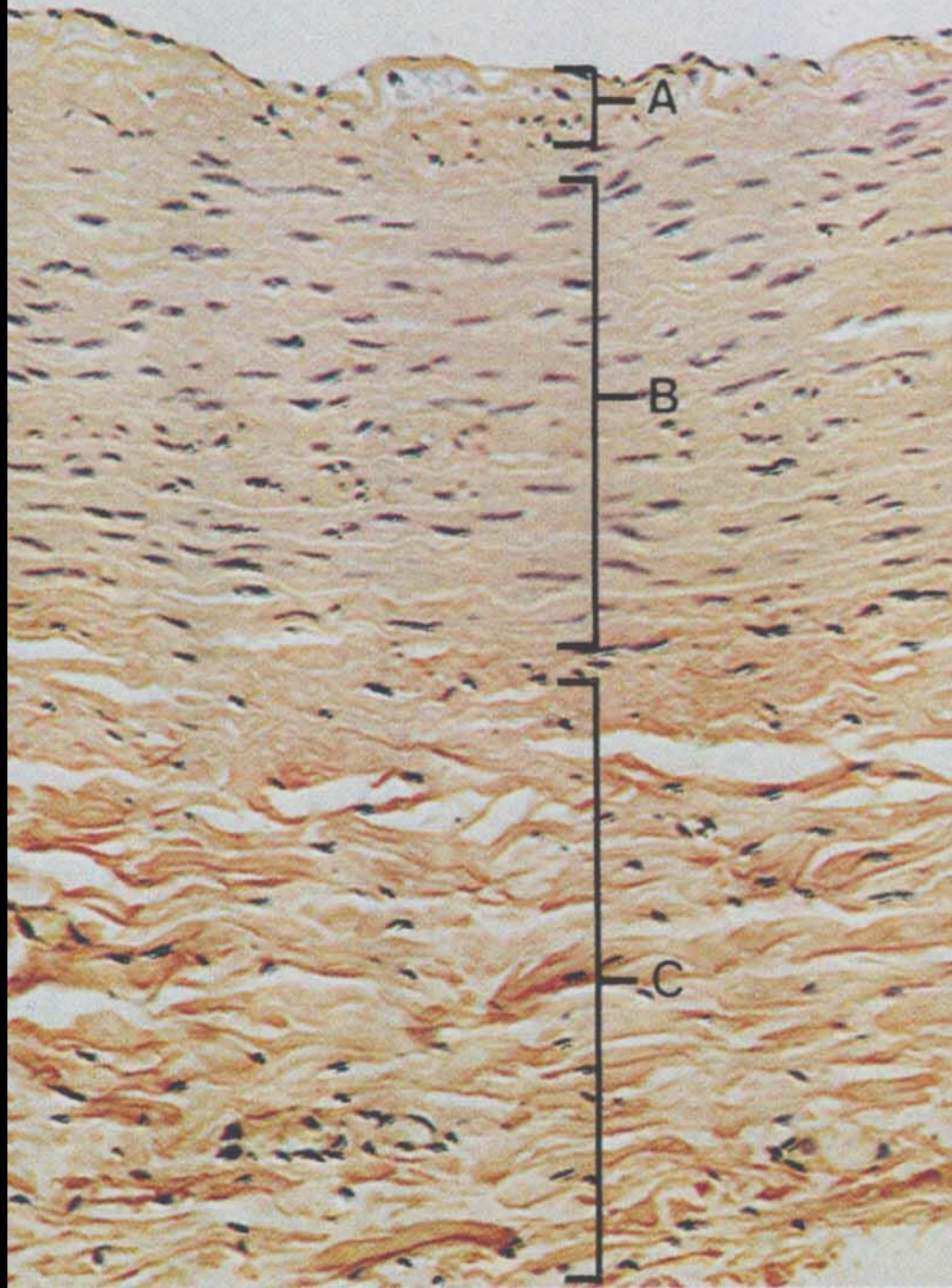


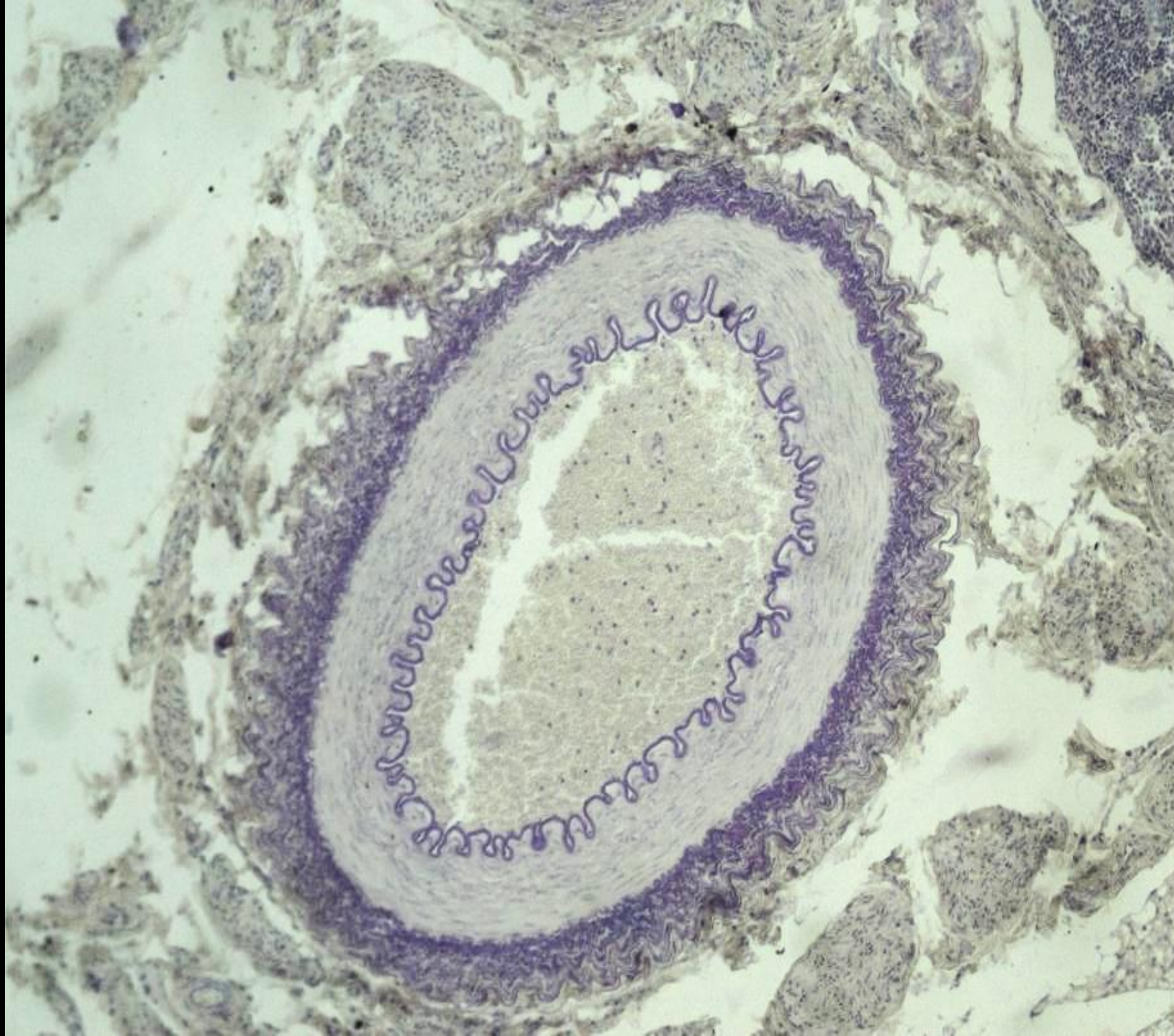
**Weibelova-
Paladeho
granula**

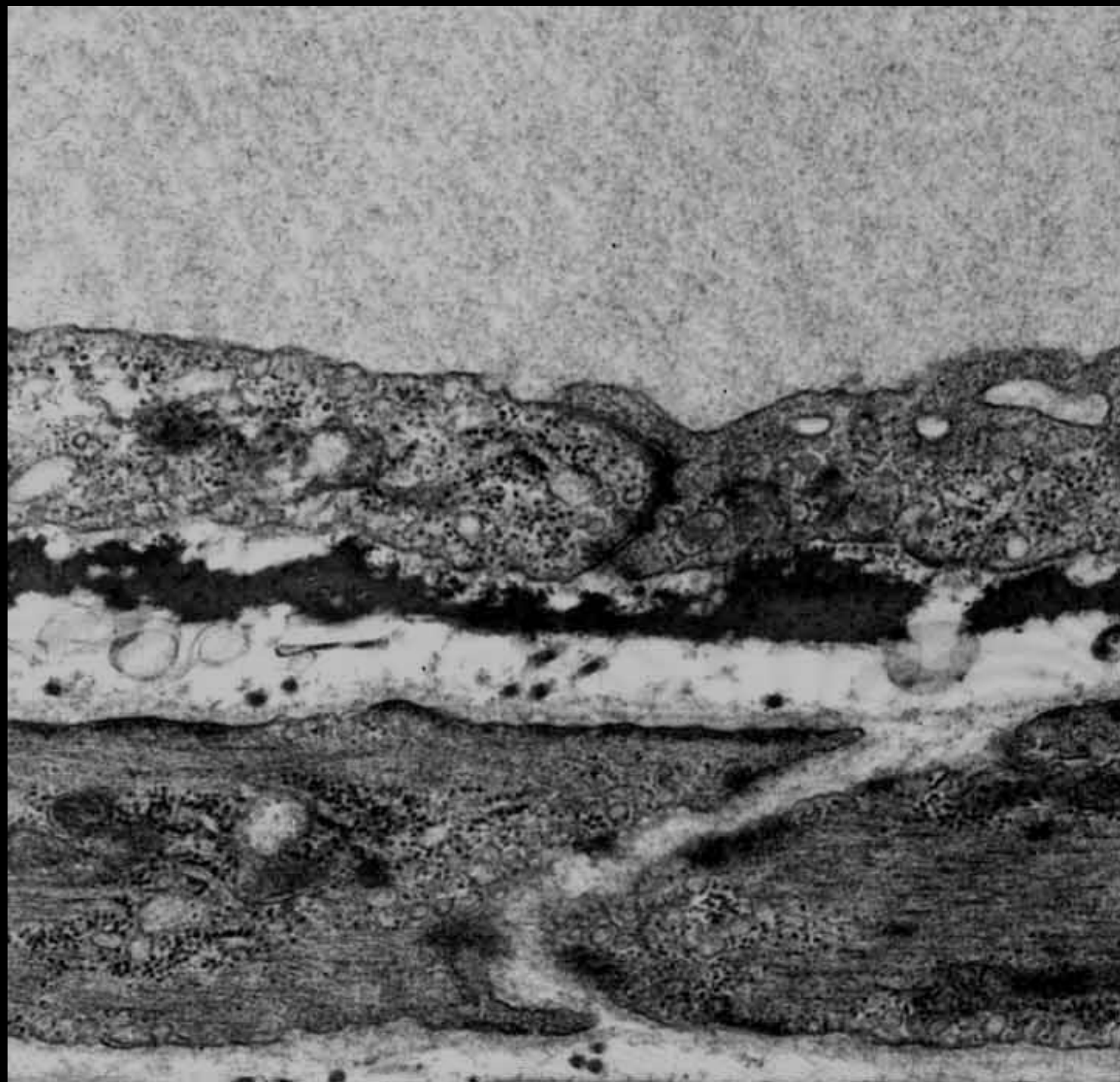




**Artérie svalového typu (malé a střední)
0,5 - 2 mm; 2 - 10 mm**

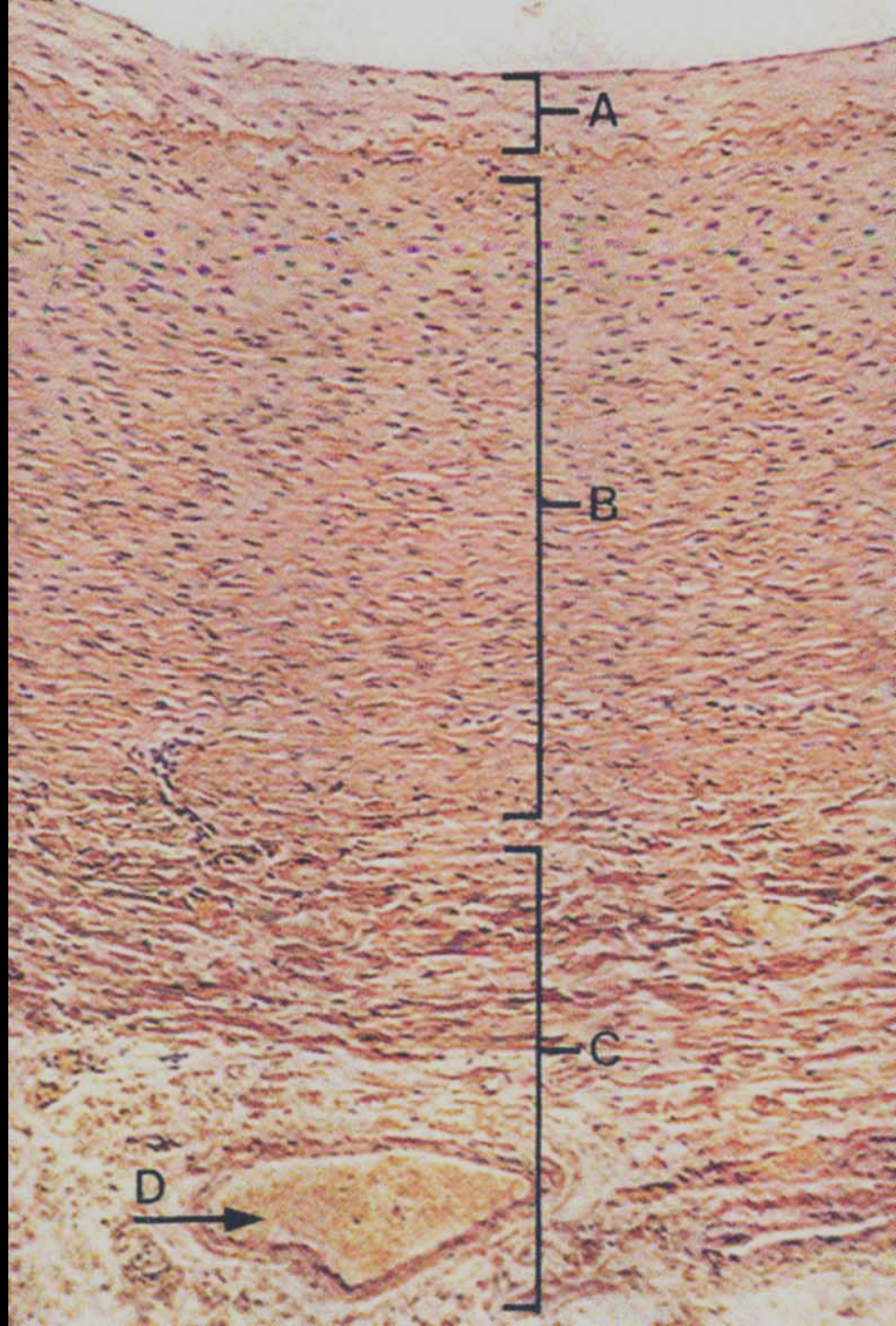


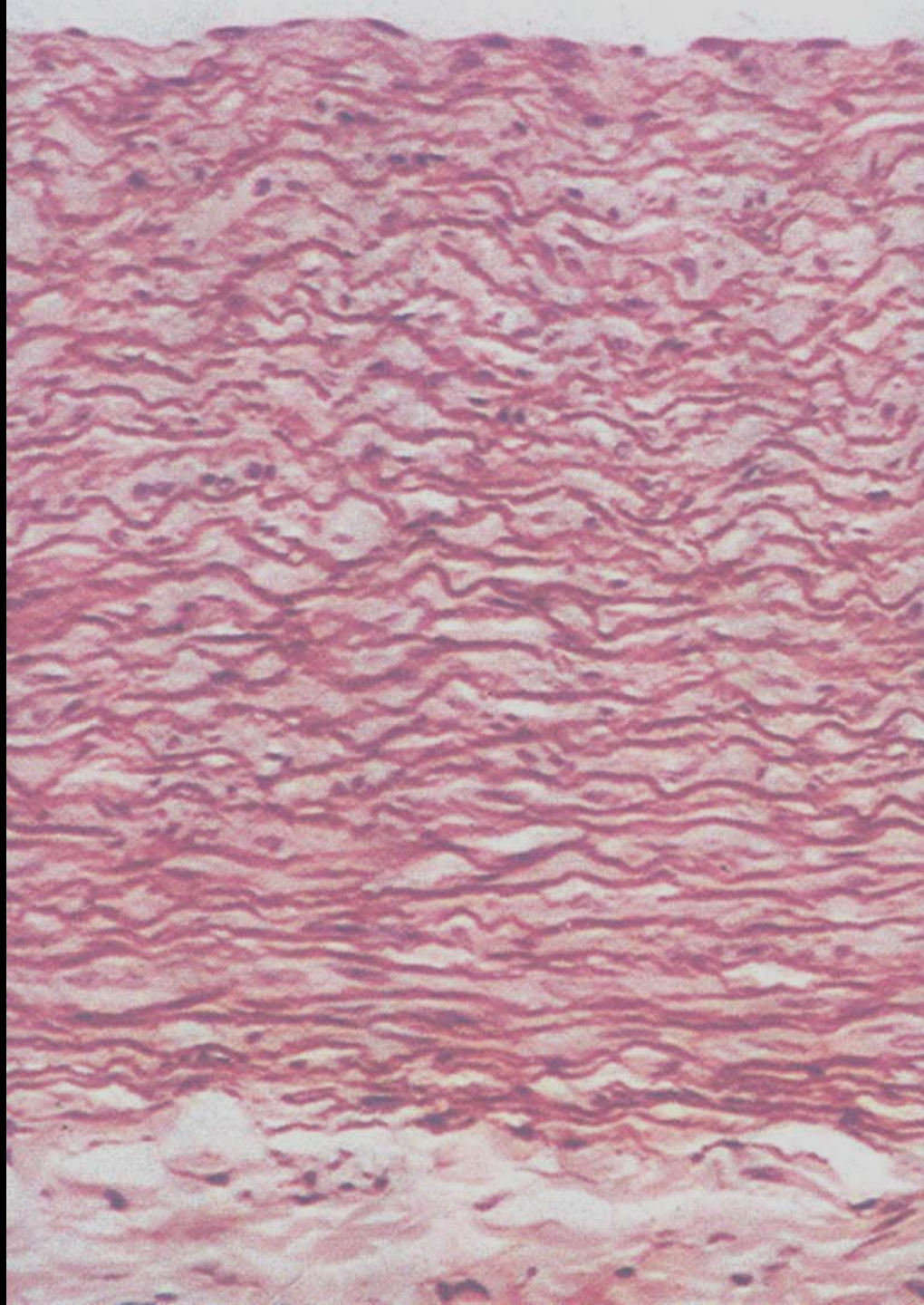


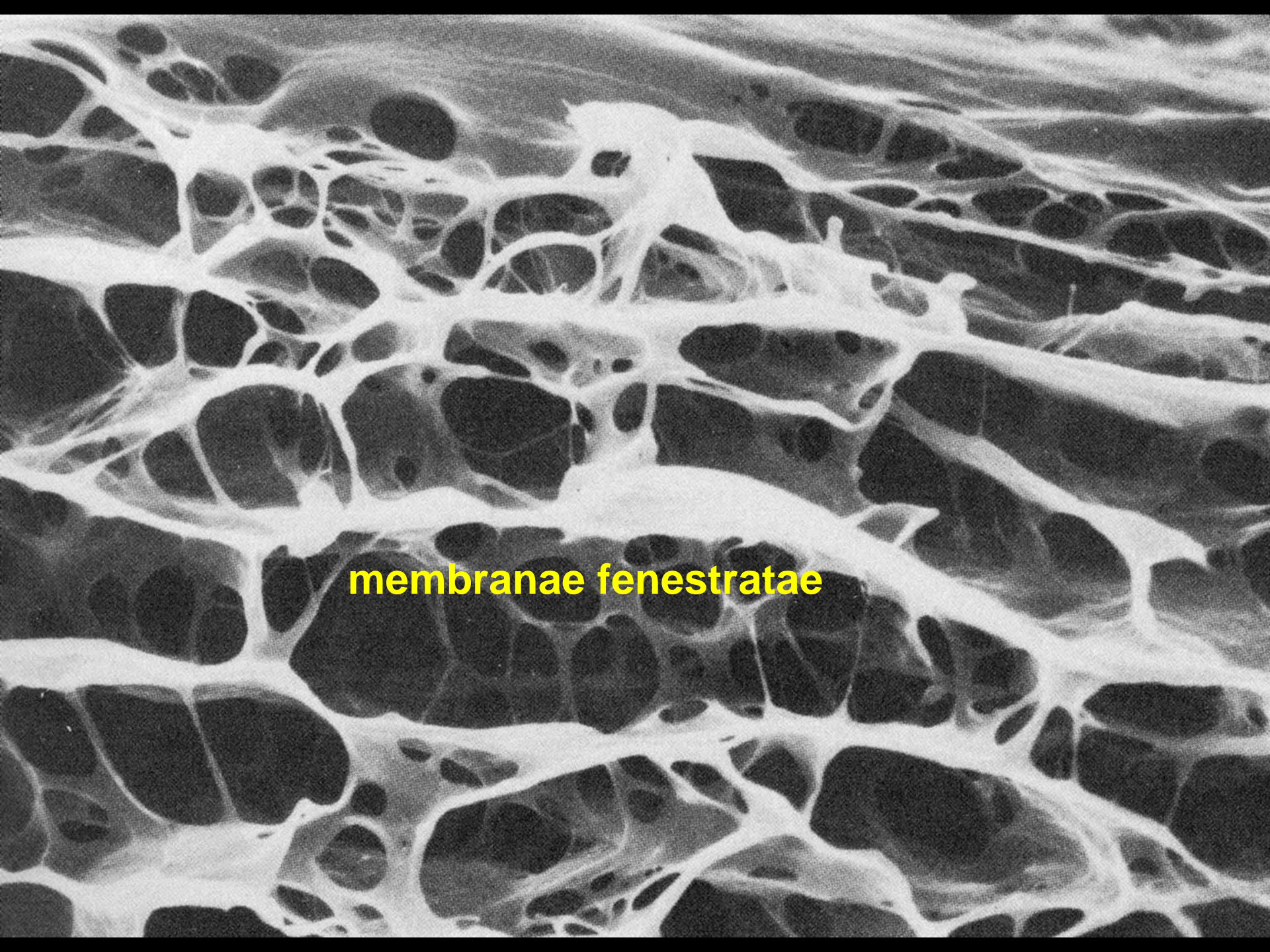


**Artérie
elastického
typu**

přes 1 cm



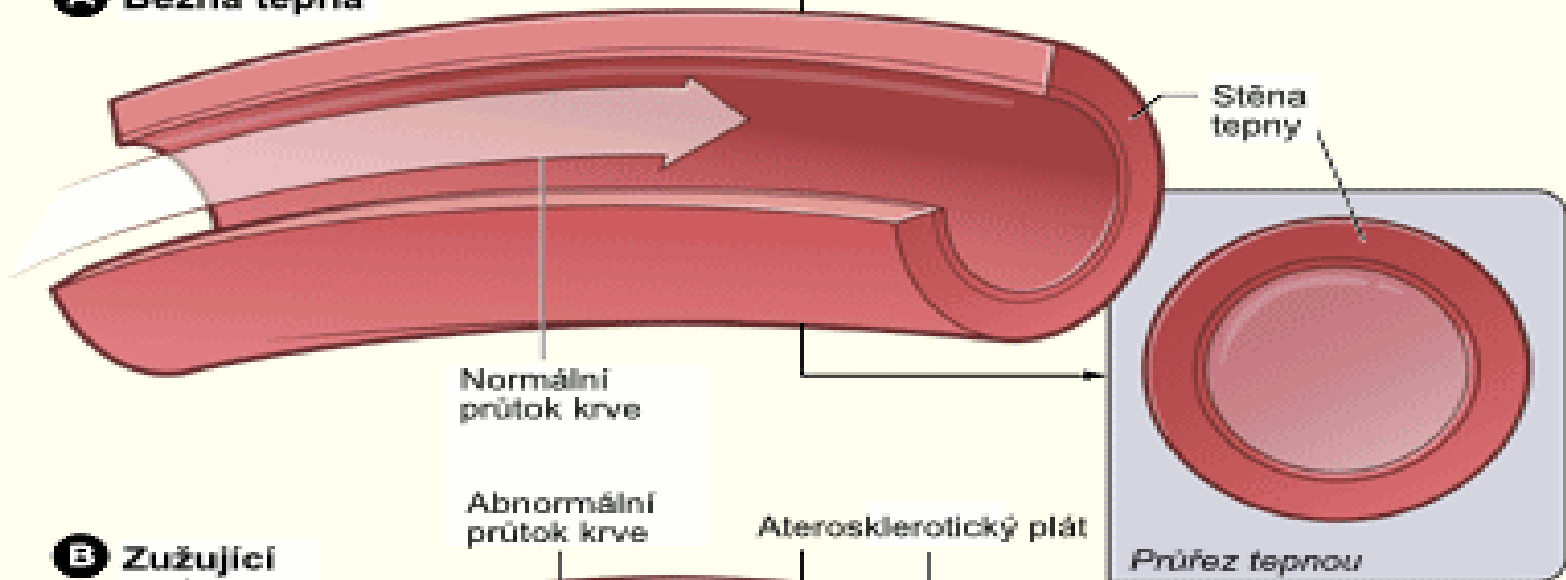




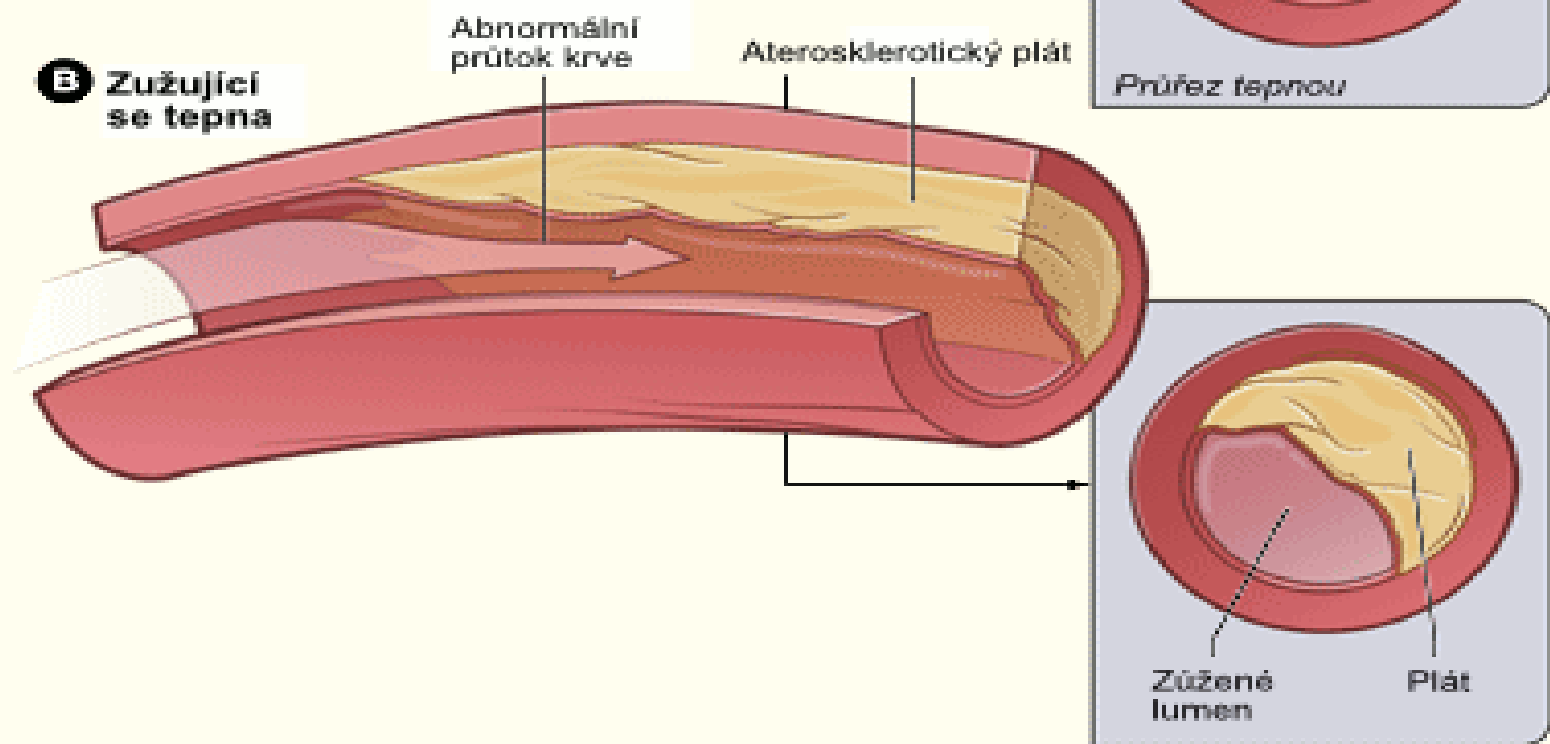
membranae fenestratae

Ateroskleróza

A Běžná tepna



B Zuzující se tepna



ENDOTHELIAL DYSFUNCTION

NOMANCLATURE AND MAIN HISTOLOGY

SEQUENCES IN PROGRESSION OF ATHEROSCLEROSIS

EARLIEST ONSET

MAIN GROWTH MECHANISM

CLINICAL CORRELATION

Initial lesion

- histologically "normal"
- macrophage infiltration
- isolated foam cells

Fatty streak

mainly intracellular lipid accumulation

Intermediate lesion

- intracellular lipid accumulation
- small extracellular lipid pools

Atheroma

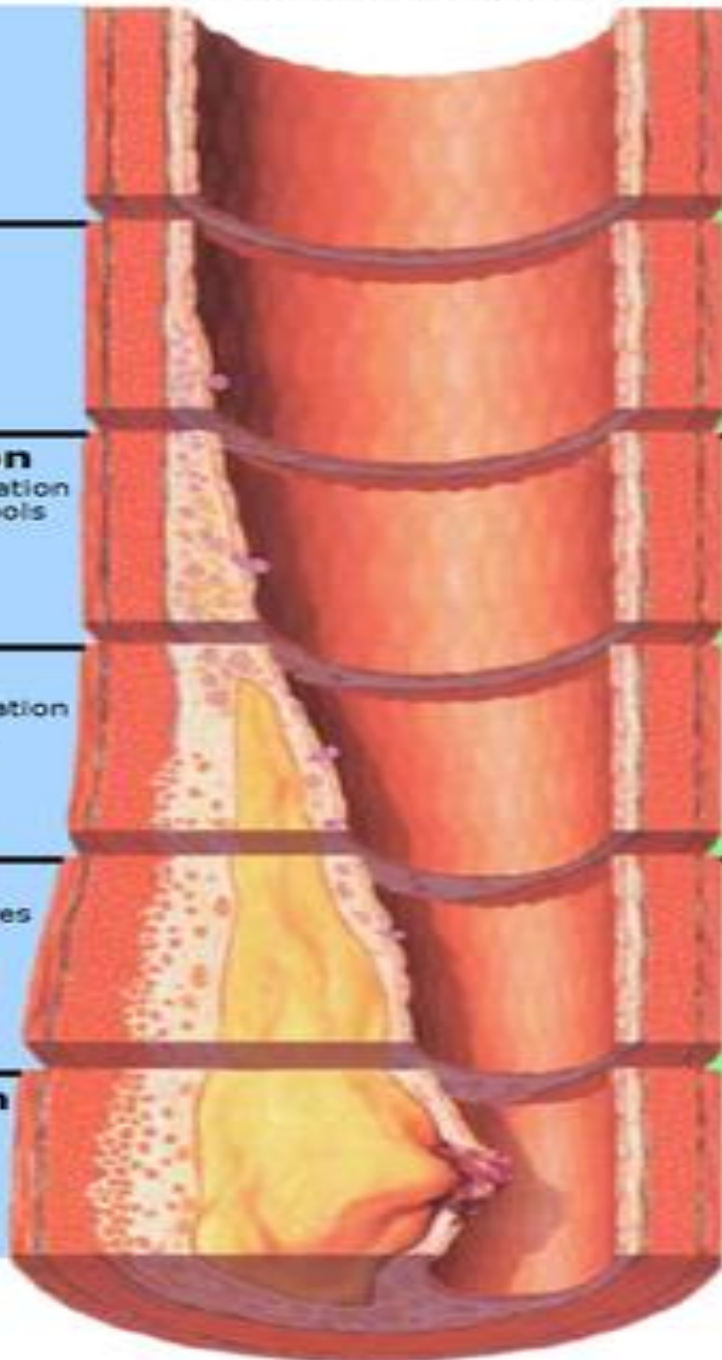
- intracellular lipid accumulation
- core of extracellular lipid

Fibroatheroma

- single or multiple lipid cores
- fibrotic/calcific layers

Complicated lesion

- surface defect
- hematoma-hemorrhage
- thrombosis



from first decade

from third decade

from fourth decade

growth mainly by lipid addition

increased smooth muscle and collagen increase

thrombosis and/or hematoma

clinically silent

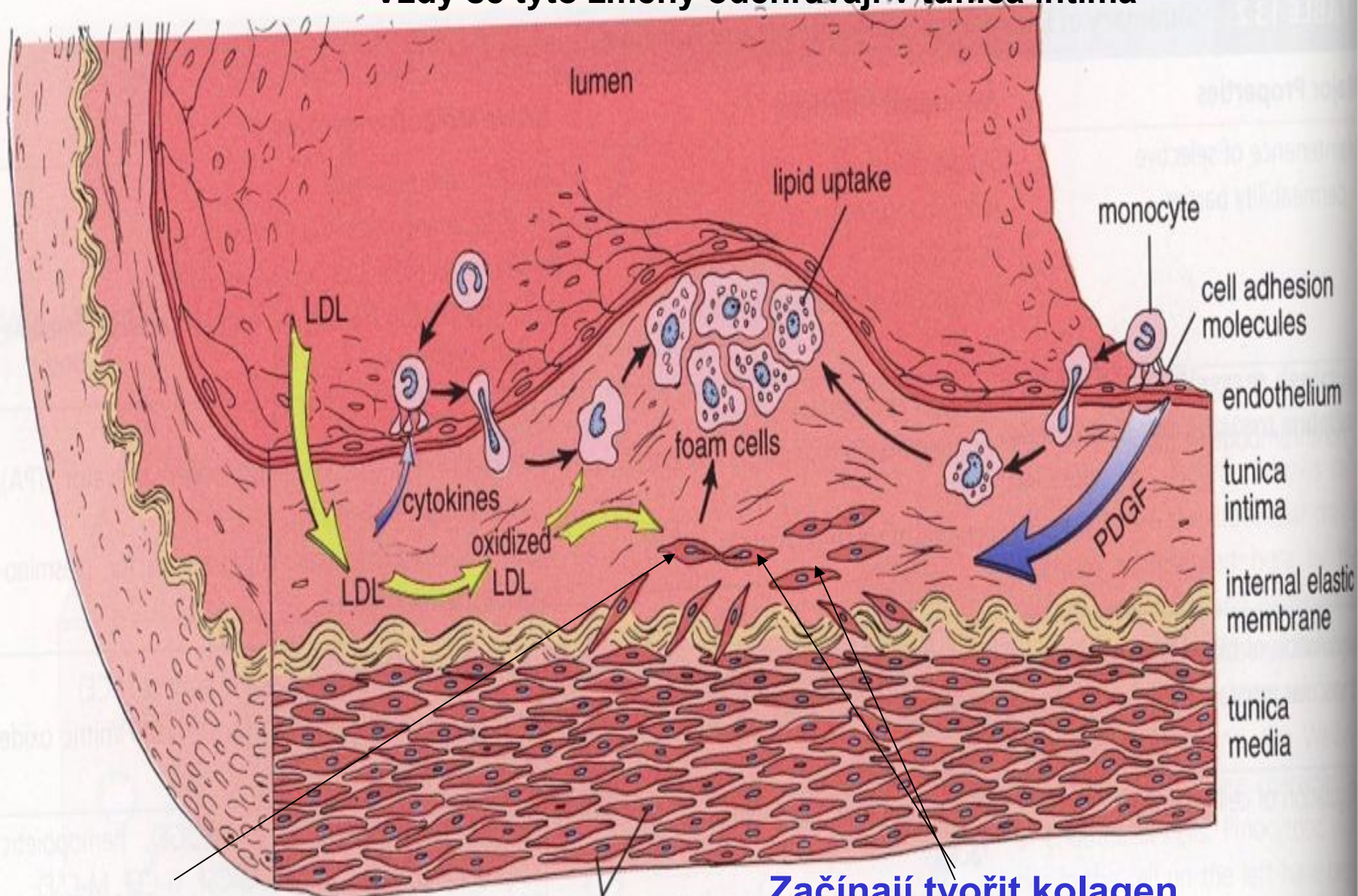
clinically silent or overt

Nejčastější lokalizace postižení

- **1/ Koronární tepny:** ischemická choroba srdeční / angina pectoris - při úplném uzavření tepny – **infarkt myokardu**
- **1. místo** – příčina úmrtí v ČR!!!!!!!
- **2/ Mozkové tepny:** náhlá cévní mozková příhoda / **mozková mrtvice**
- **3. místo** – příčina úmrtí v ČR!!!!!!!
- **3/ Tepny dolních končetin** – postupný rozvoj uzavírání tepen (claudicatio intermittens – bolestivá únava v lýtku při chůzi).
- **4/ Art. mesenterica superior** - záchvatovité poruchy střevní motility

Počátek aterosklerotických změn

Vždy se tyto změny odehrávají v tunica intima



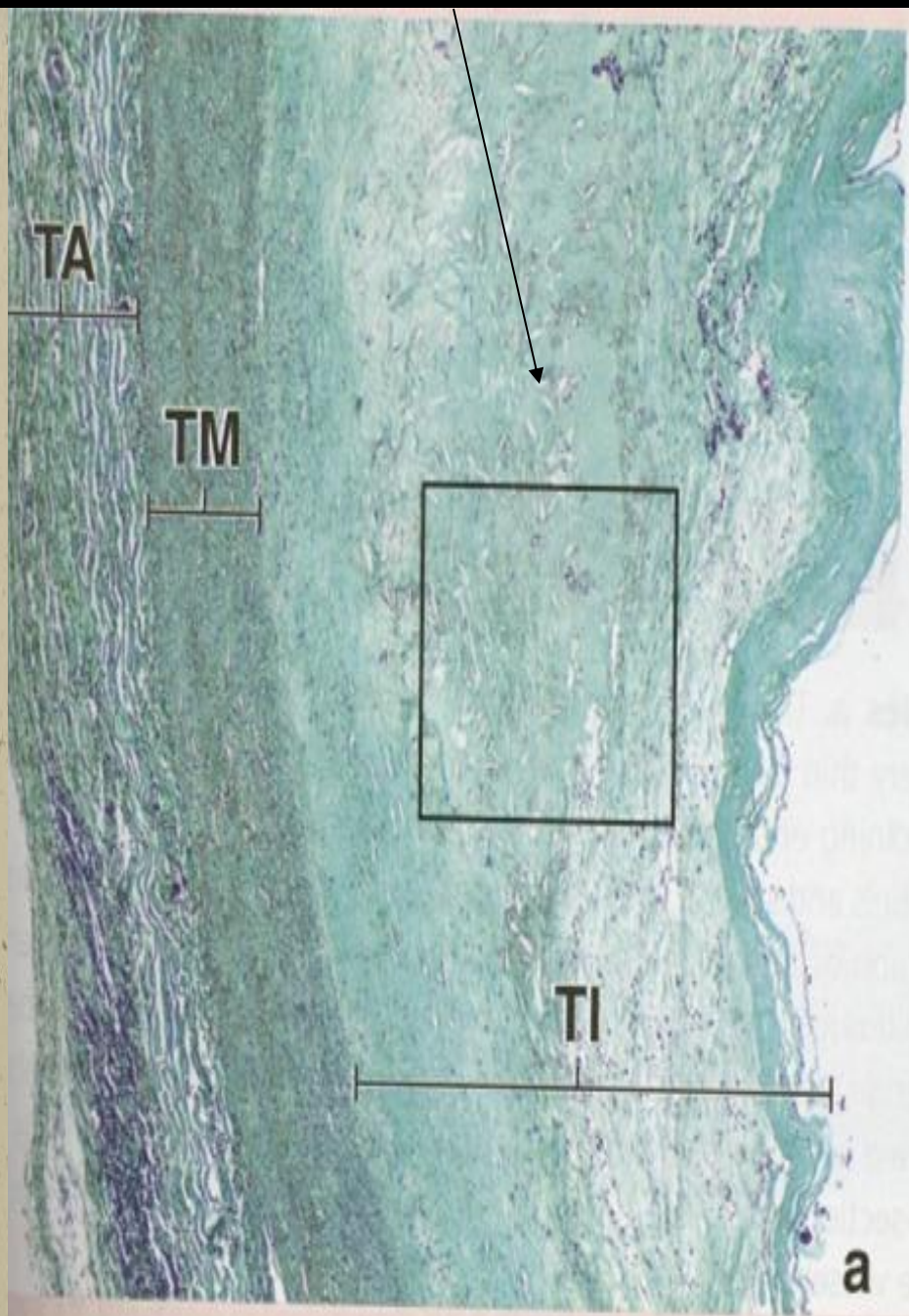
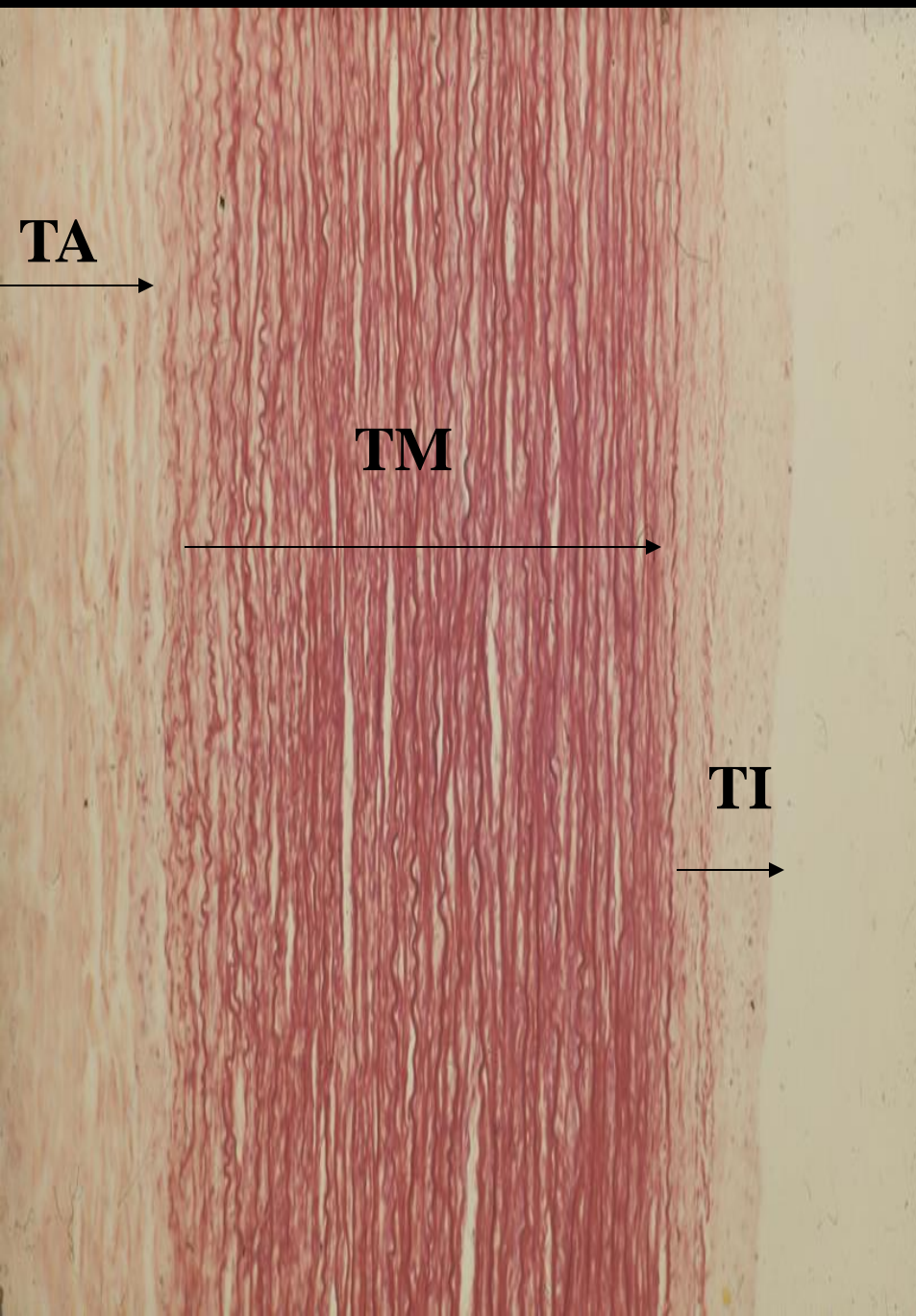
HI. svalové buňky

smooth muscle cells

Začínají tvořit kolagen,
elastin, amorfni hmotu

Normální stěna artérie elast. typu

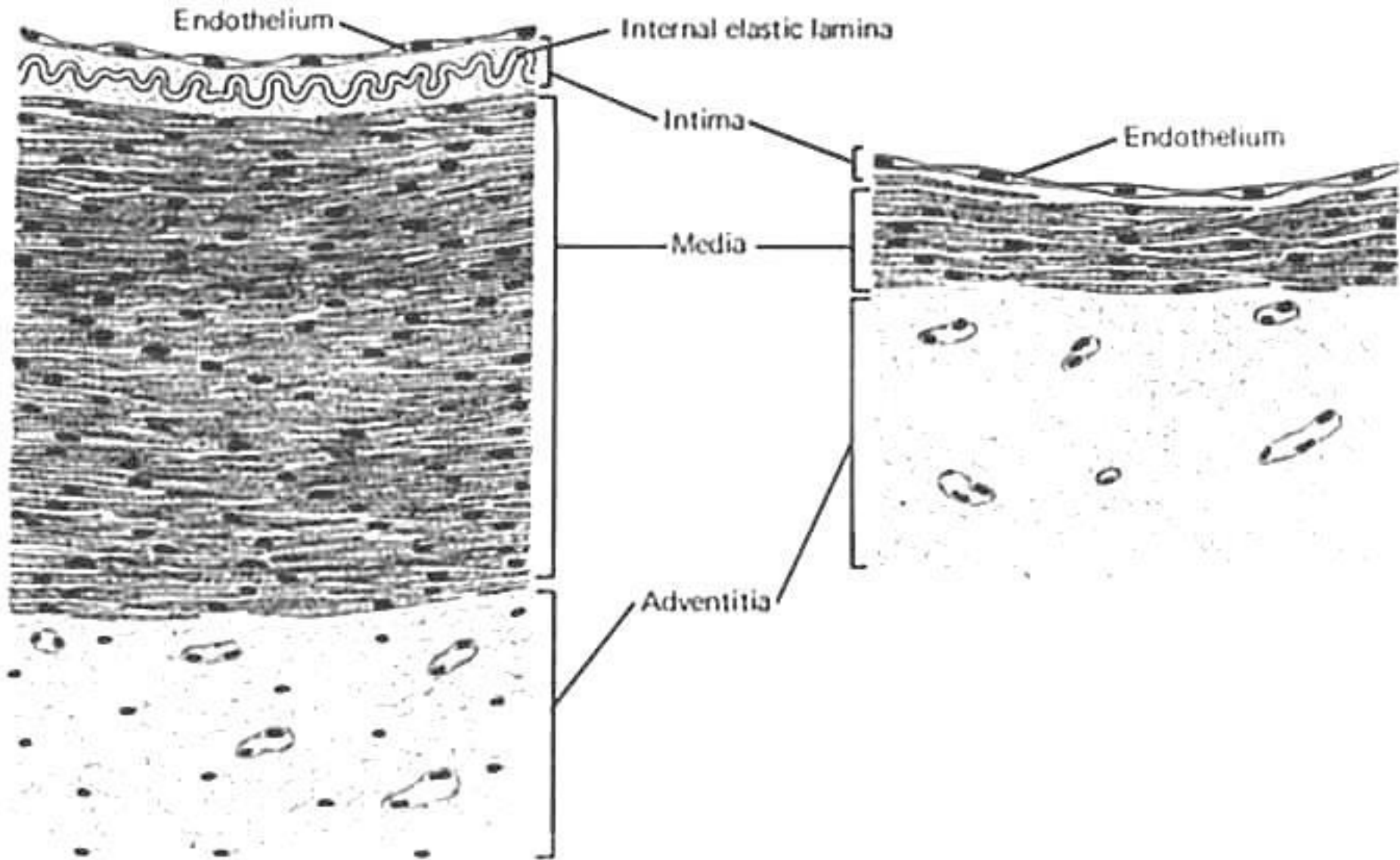
Fibrózní plát v silné tunica intima

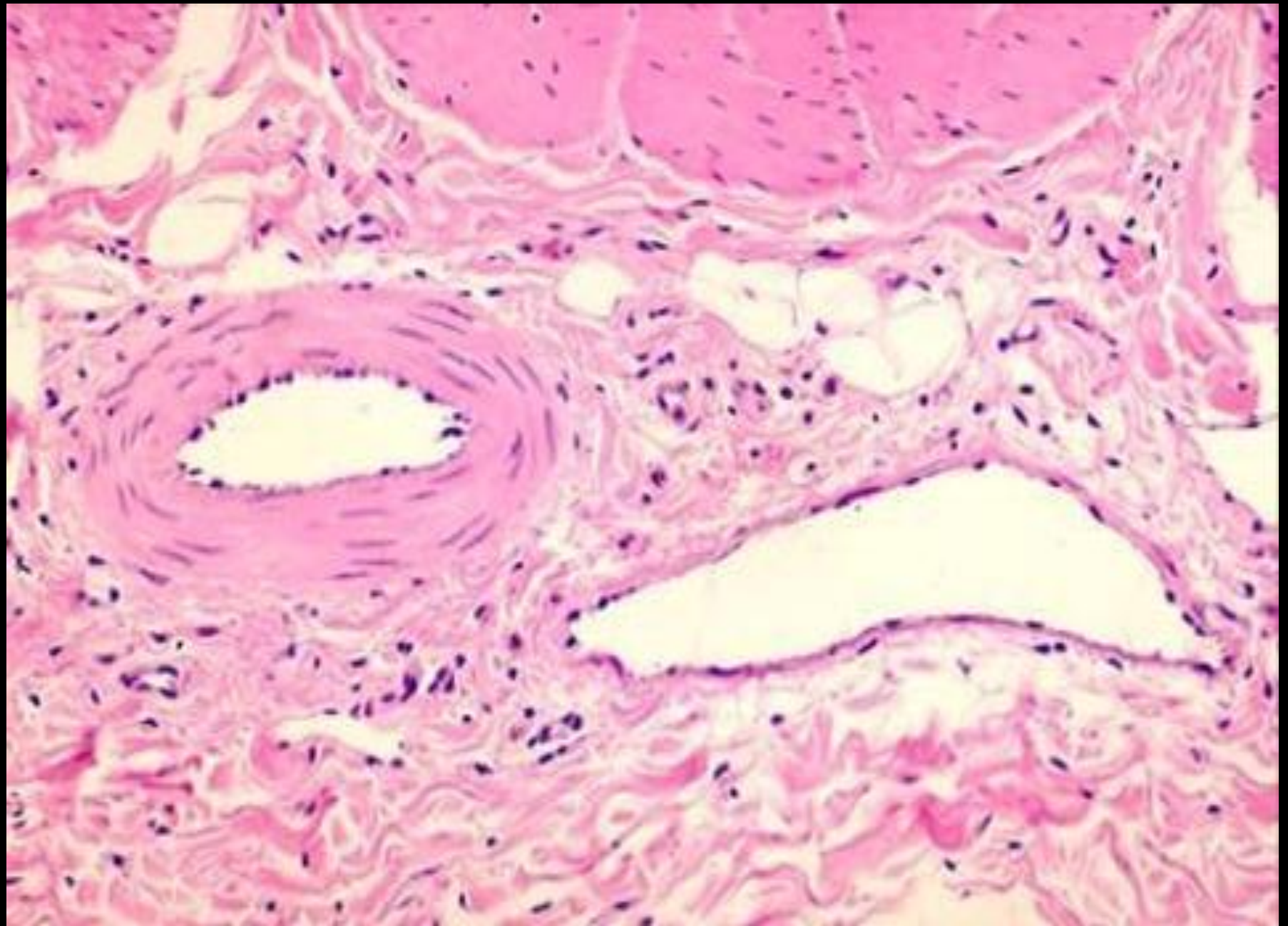


Žíly (vény)

tepna

žíla

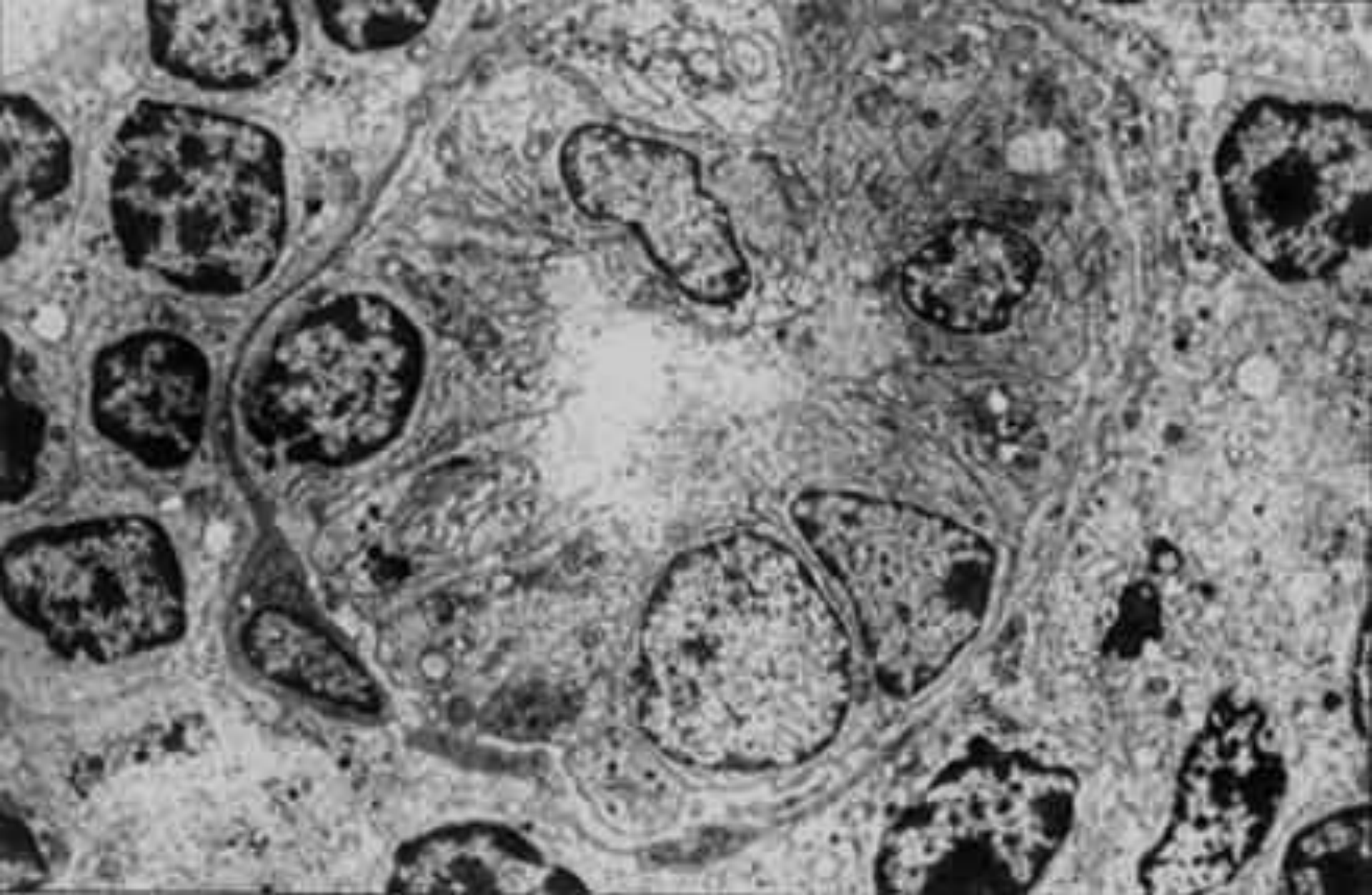




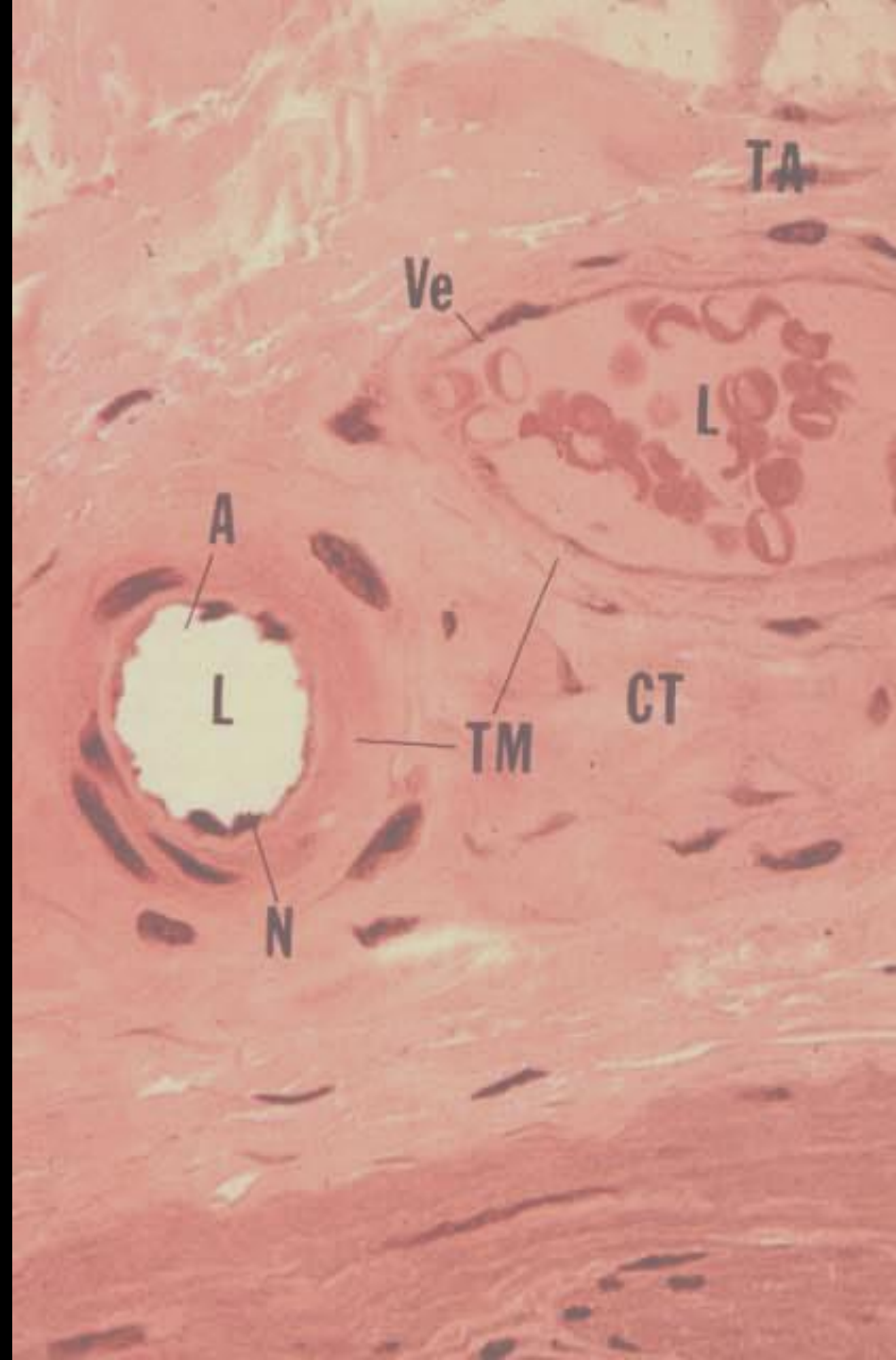
Venuly

- postkapilární < 50 μm
- sběrací 50 - 100 μm
- muskulární 100 - 200 μm
- venuly 200 μm - 1 mm

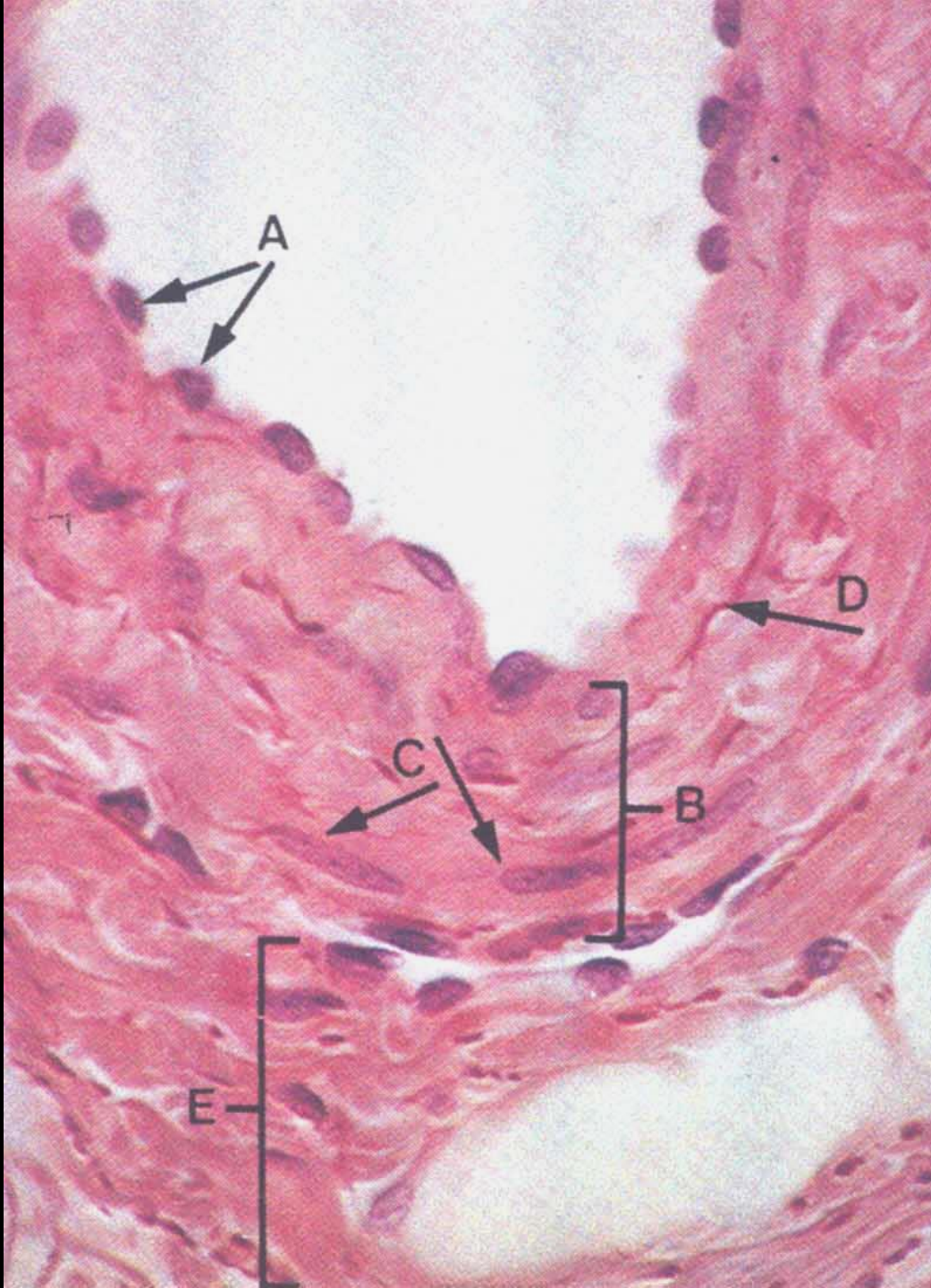




postkapilární venula s vysokým endotelem

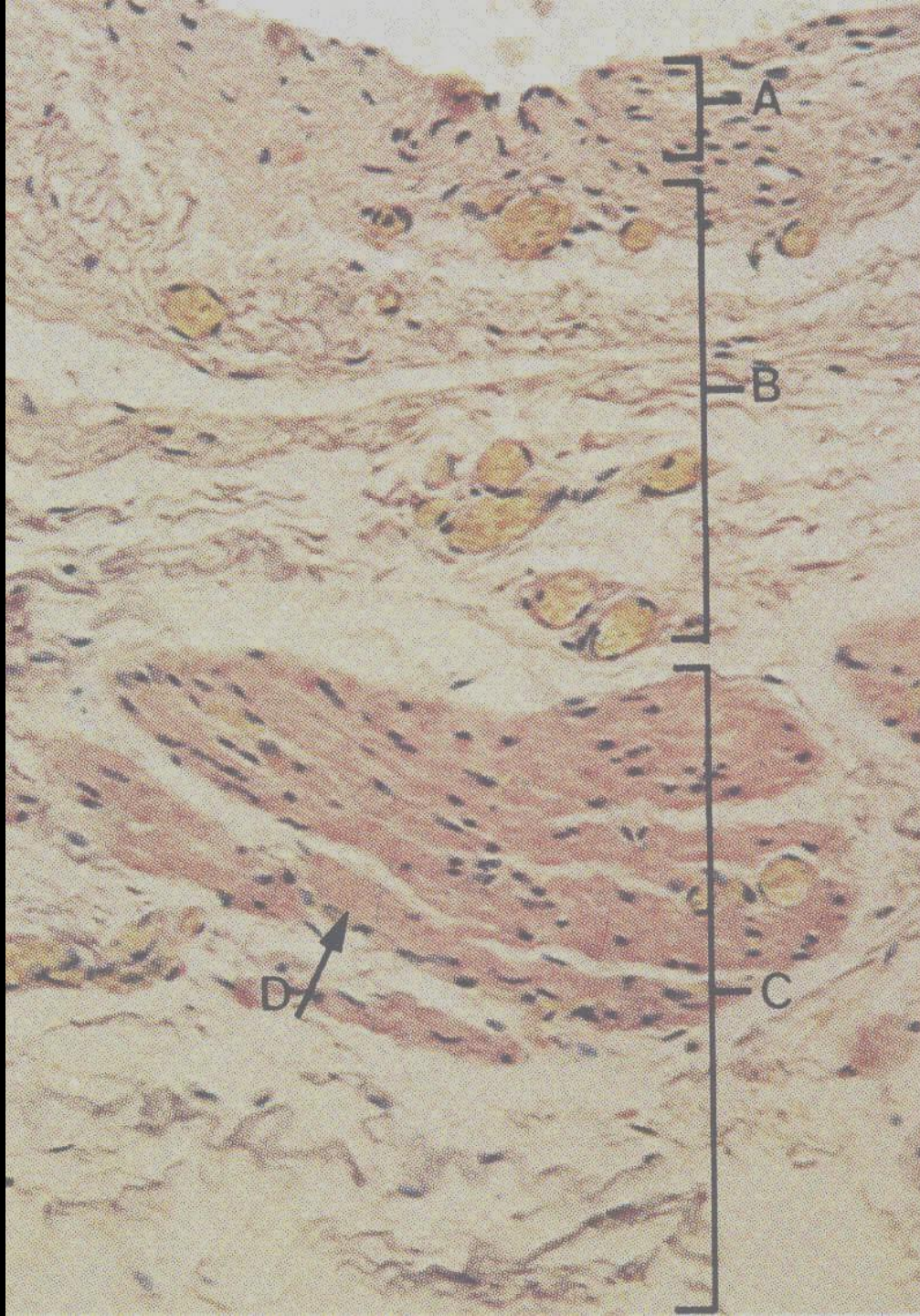


**sběrací
venula**



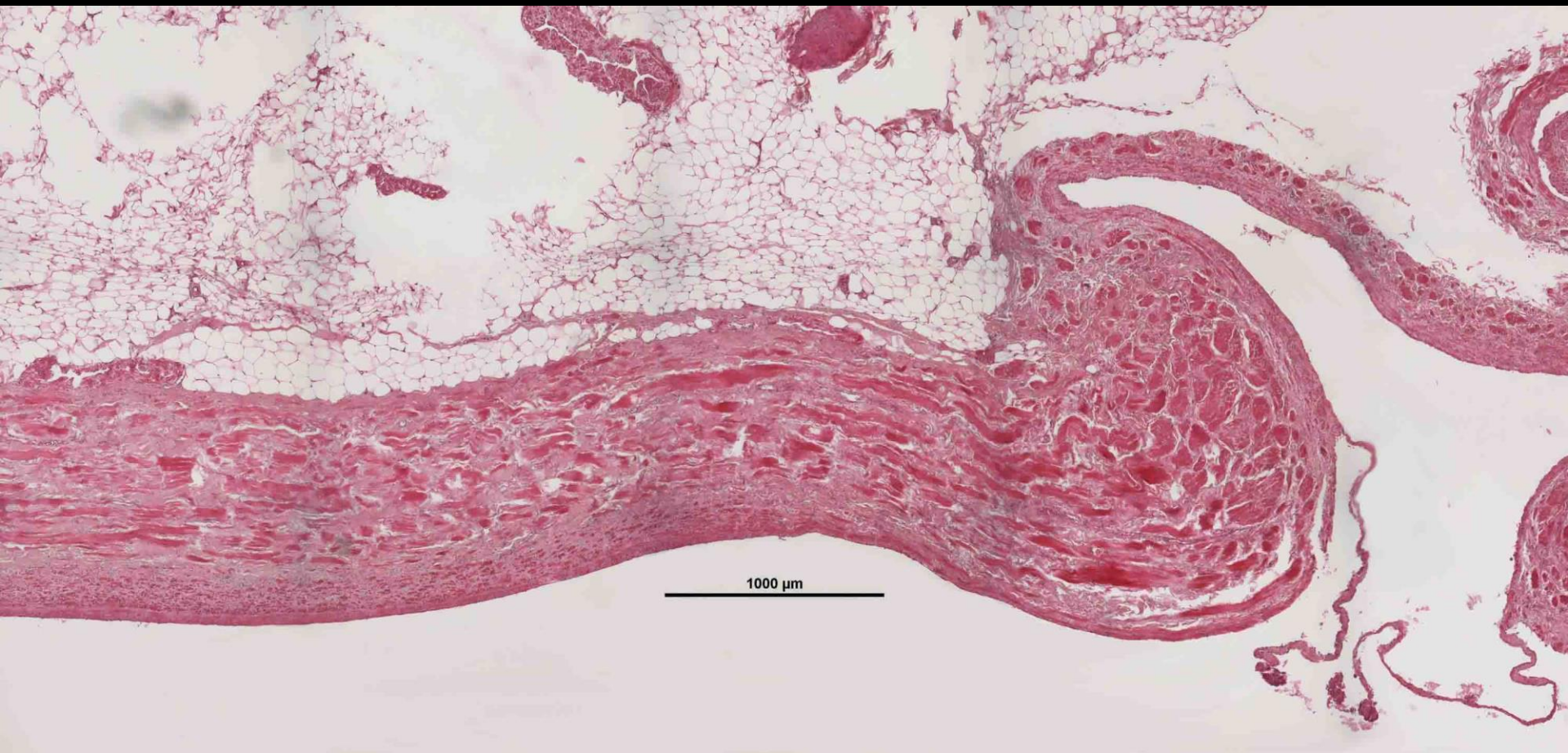
**malé a
střední vény**

1 až 9 mm

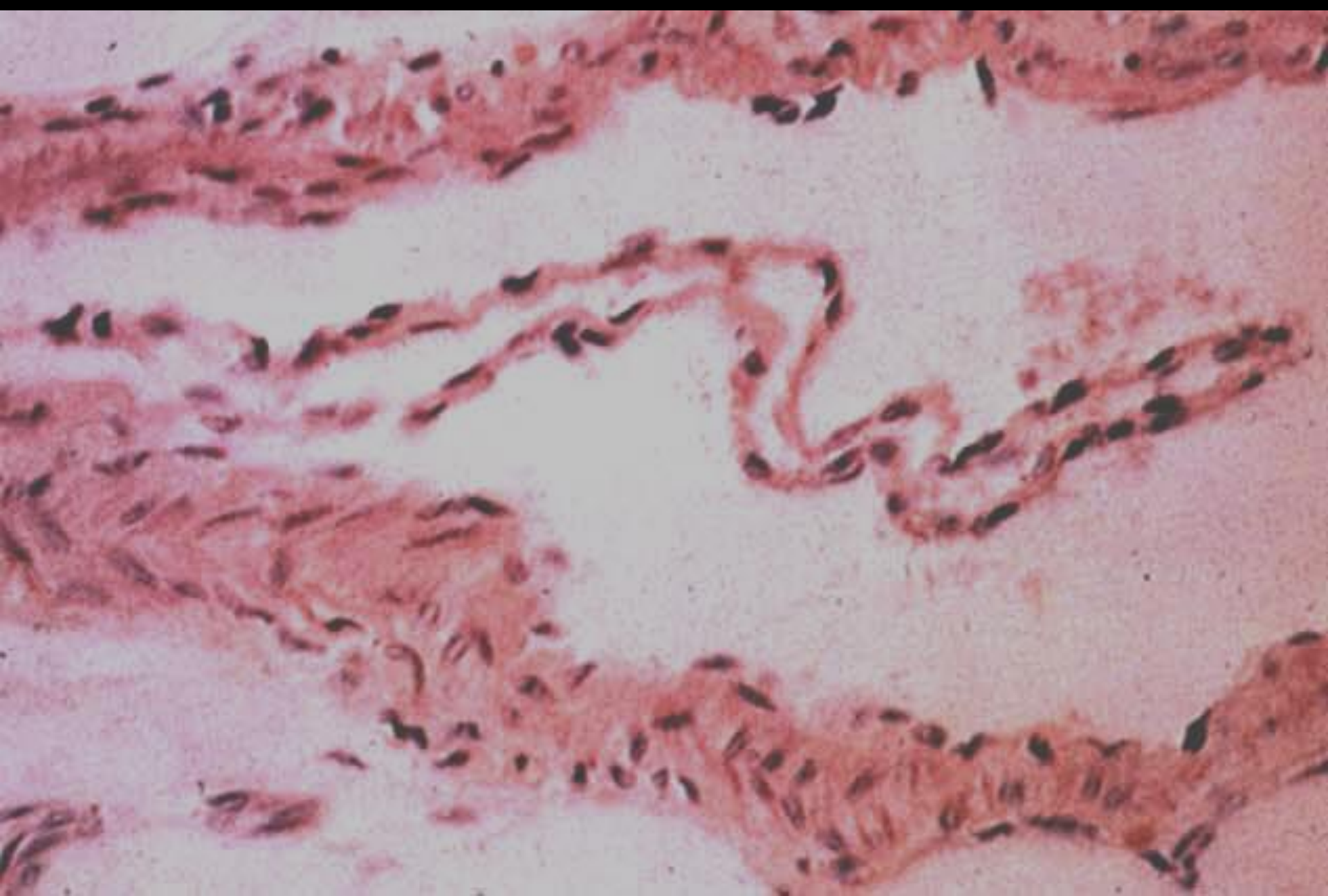


velké vény

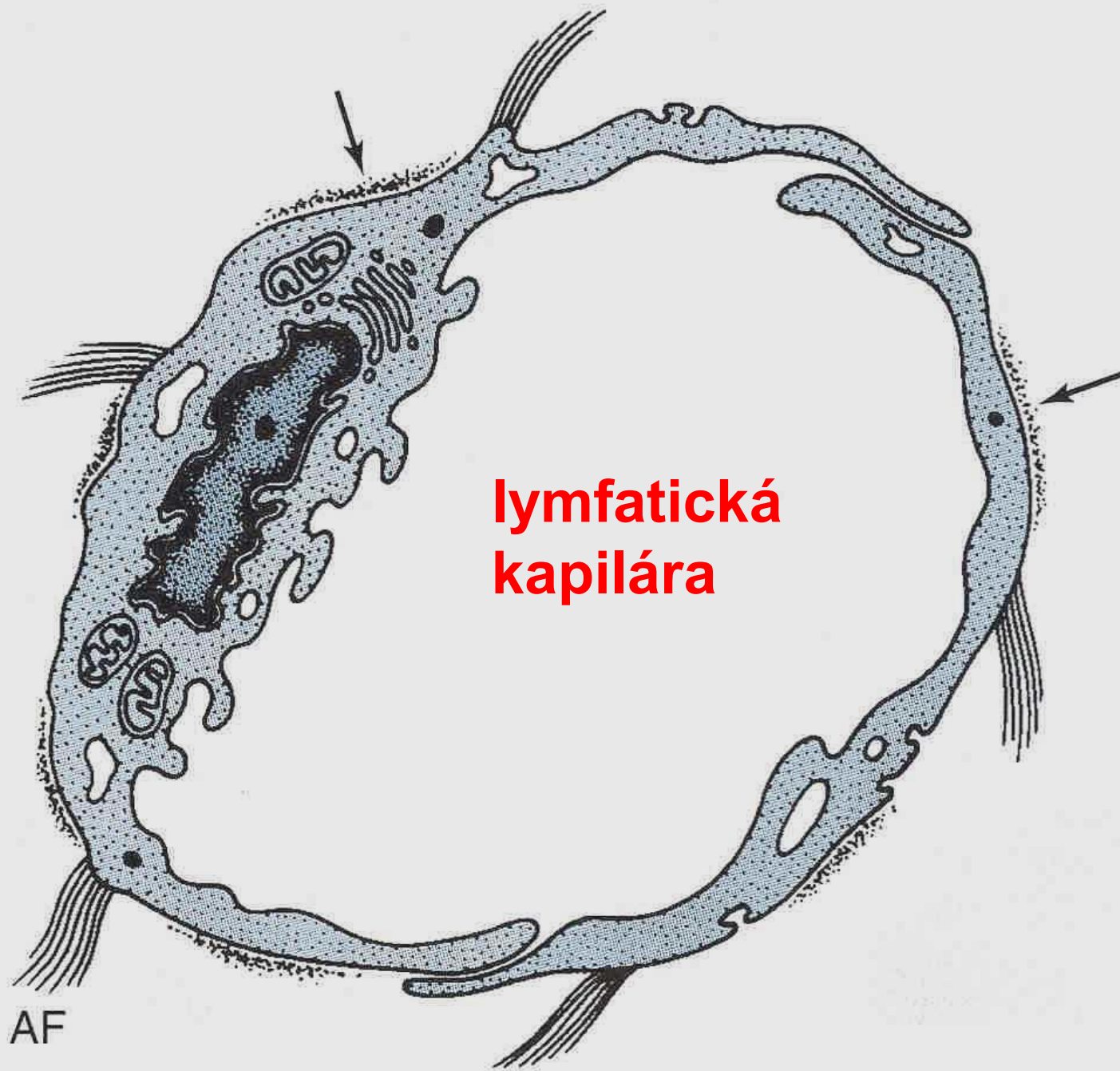
10 mm a více



1000 μm

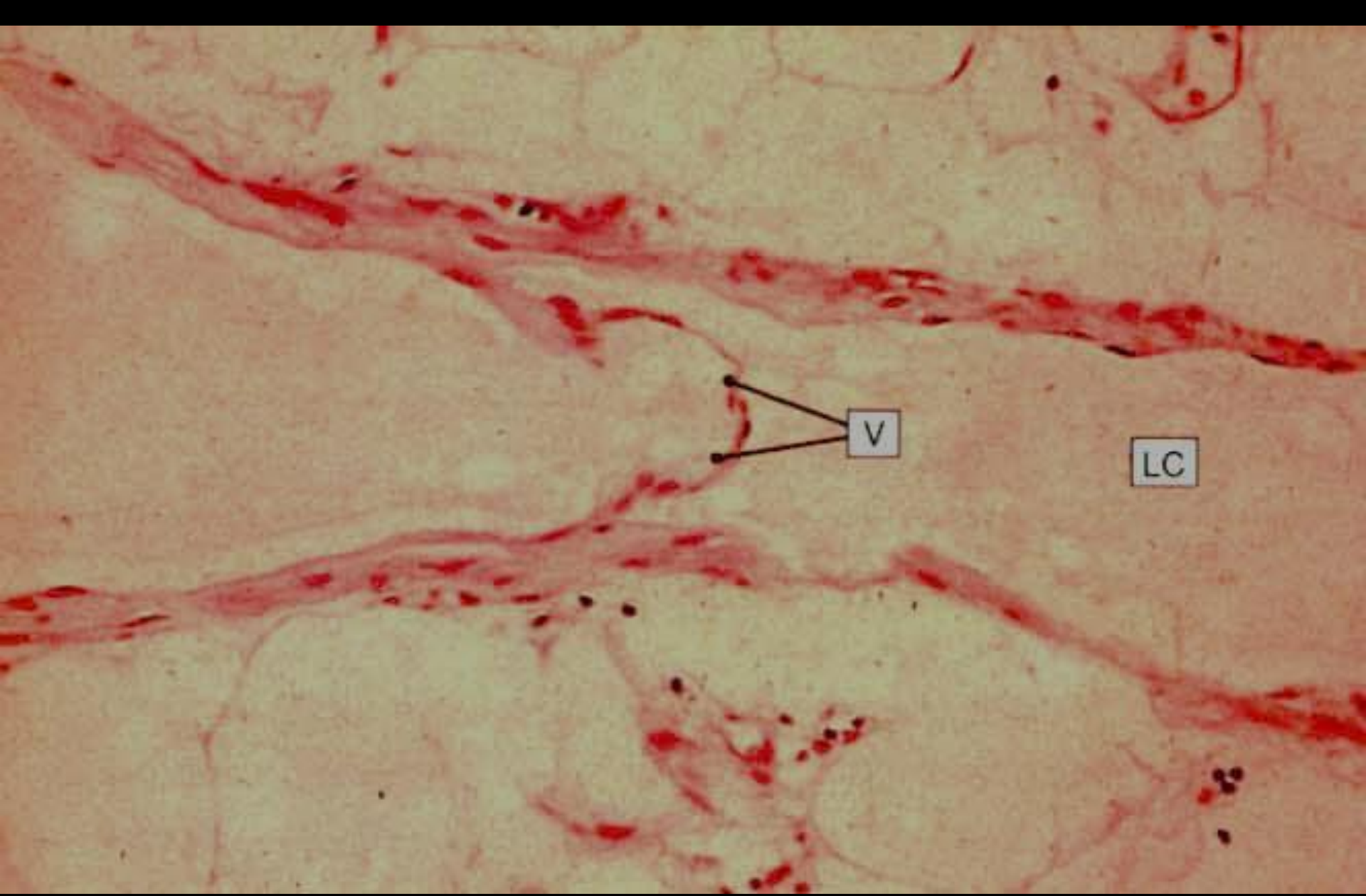


Lymfatické cévy



**lymfatická
kapilára**

AF



větší lymfatická céva

Srdce

endokard

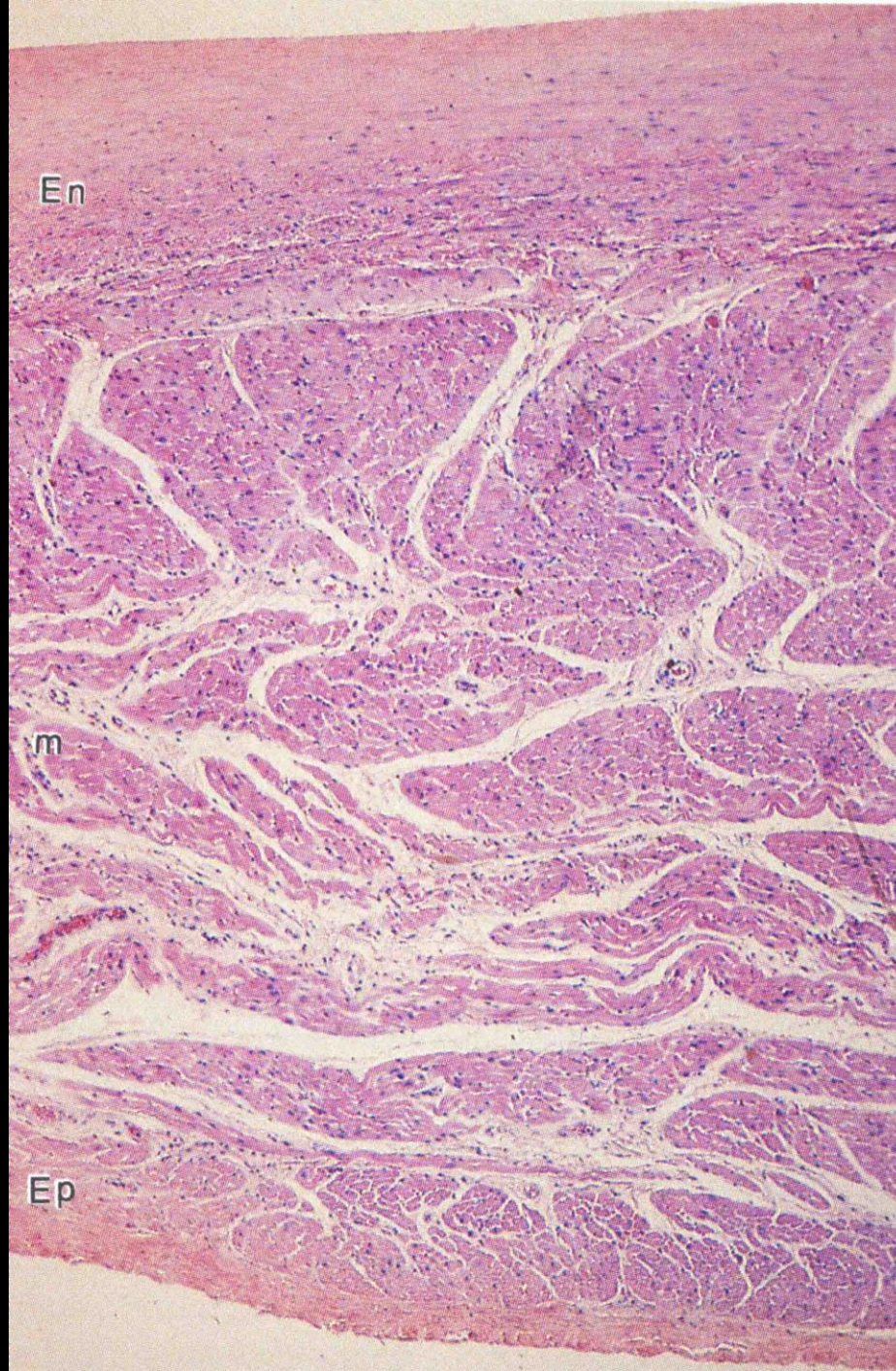
En

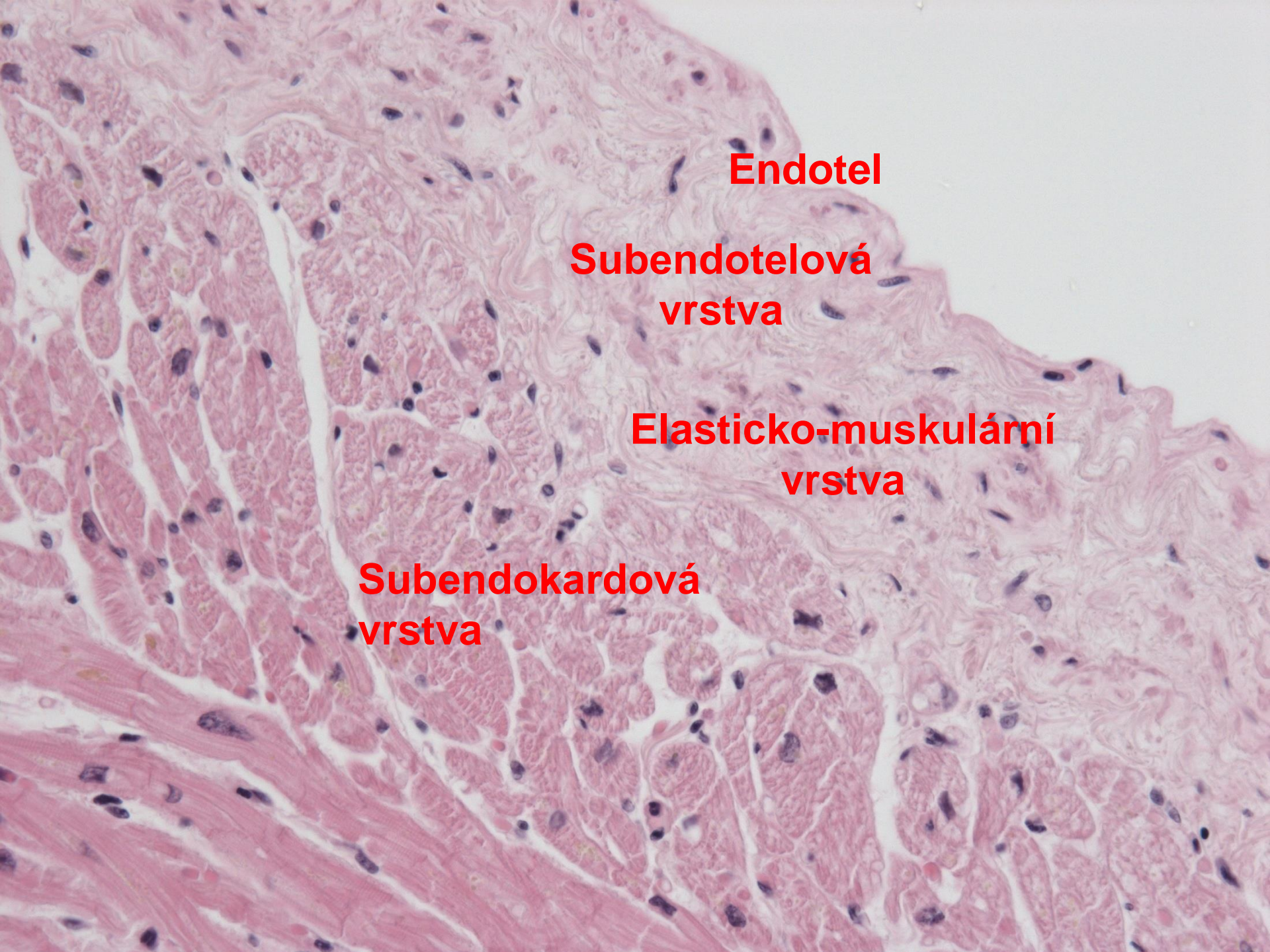
myokard

m

epikard

Ep



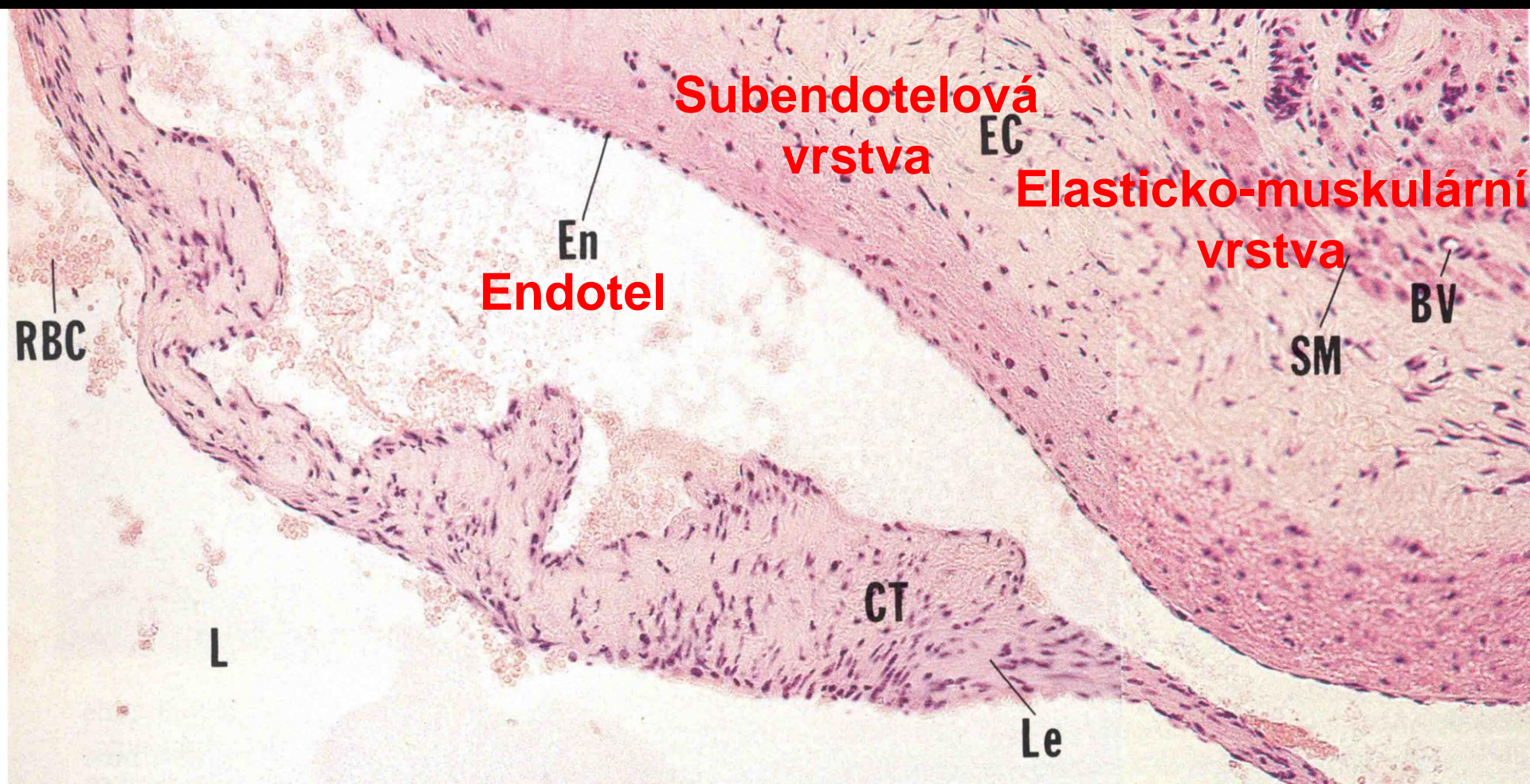


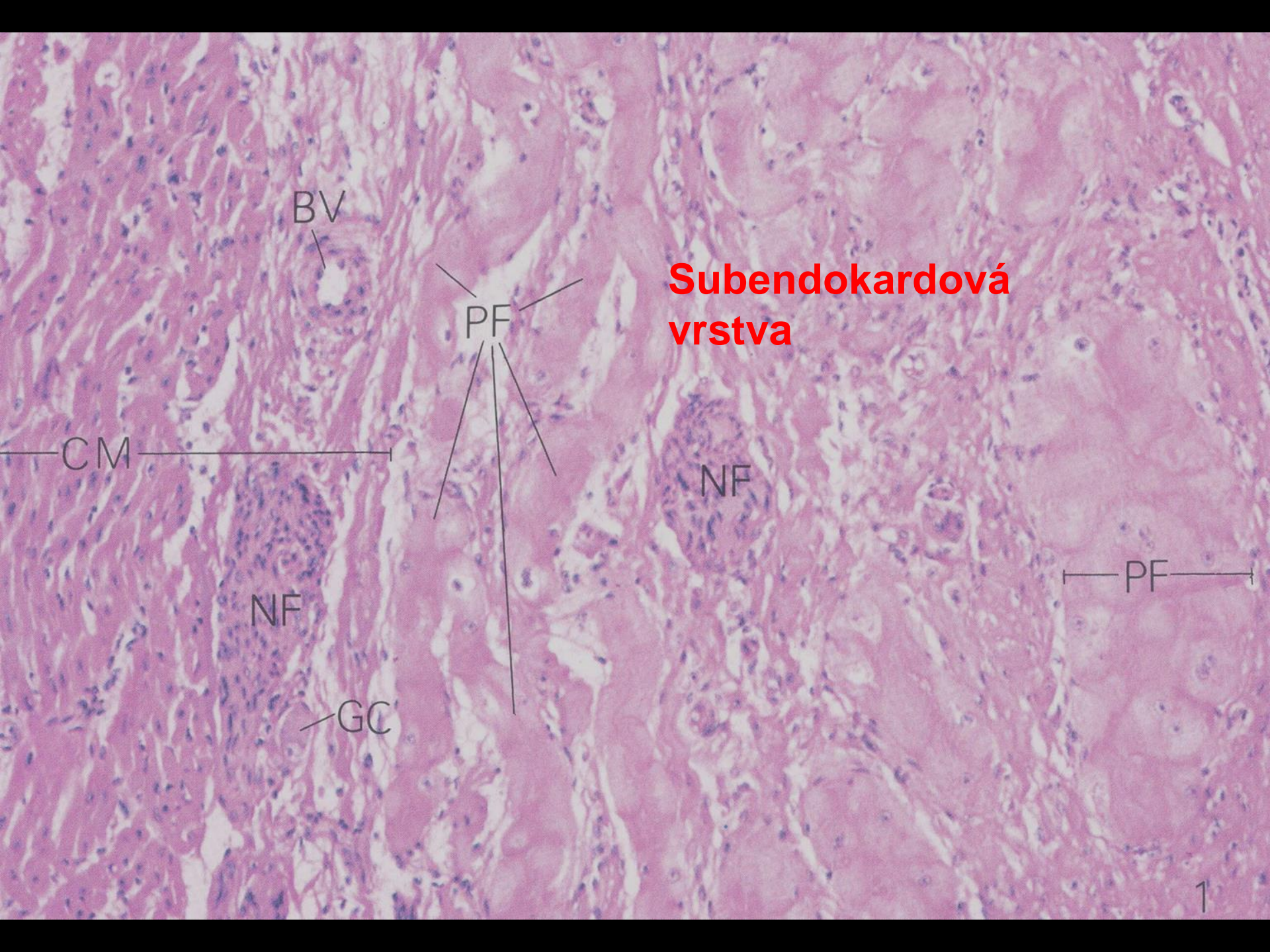
Endotel

**Subendotelová
vrstva**

**Elasticko-muskulární
vrstva**

**Subendokardová
vrstva**





BV

**Subendokardová
vrstva**

PF

CM

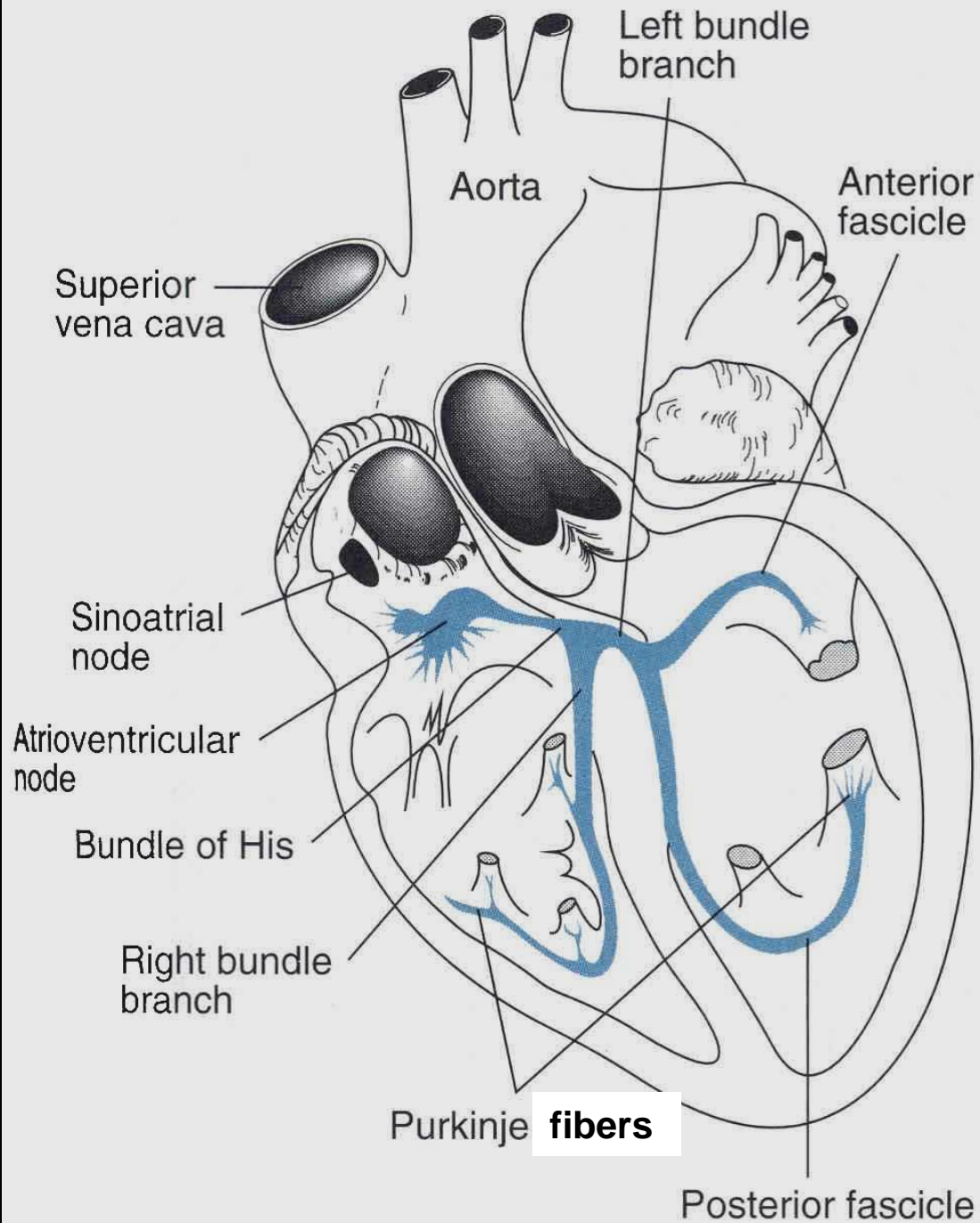
NF

NF

PF

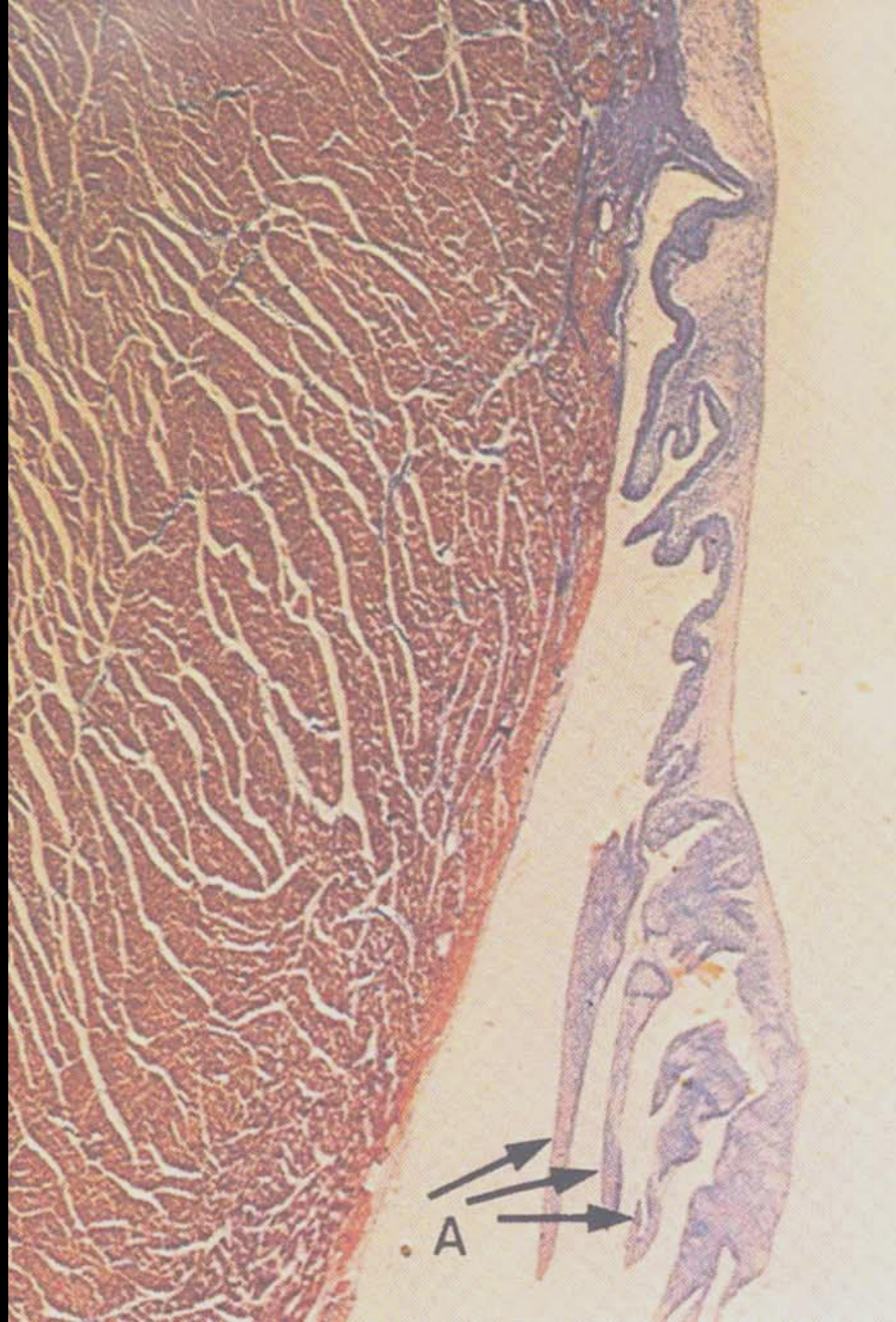
GC

Převodní systém srdeční





**Purkyňovo
vlákno**

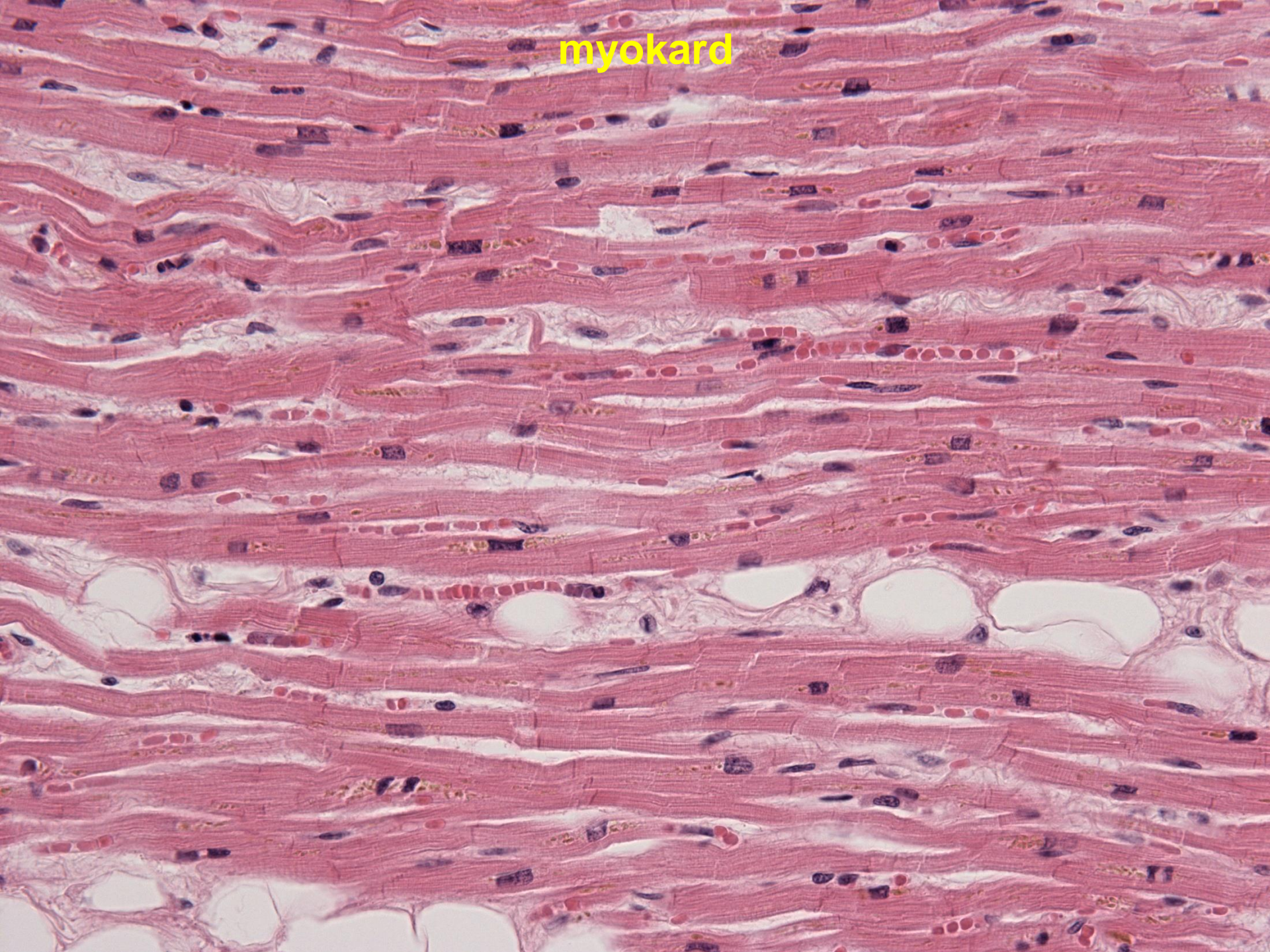


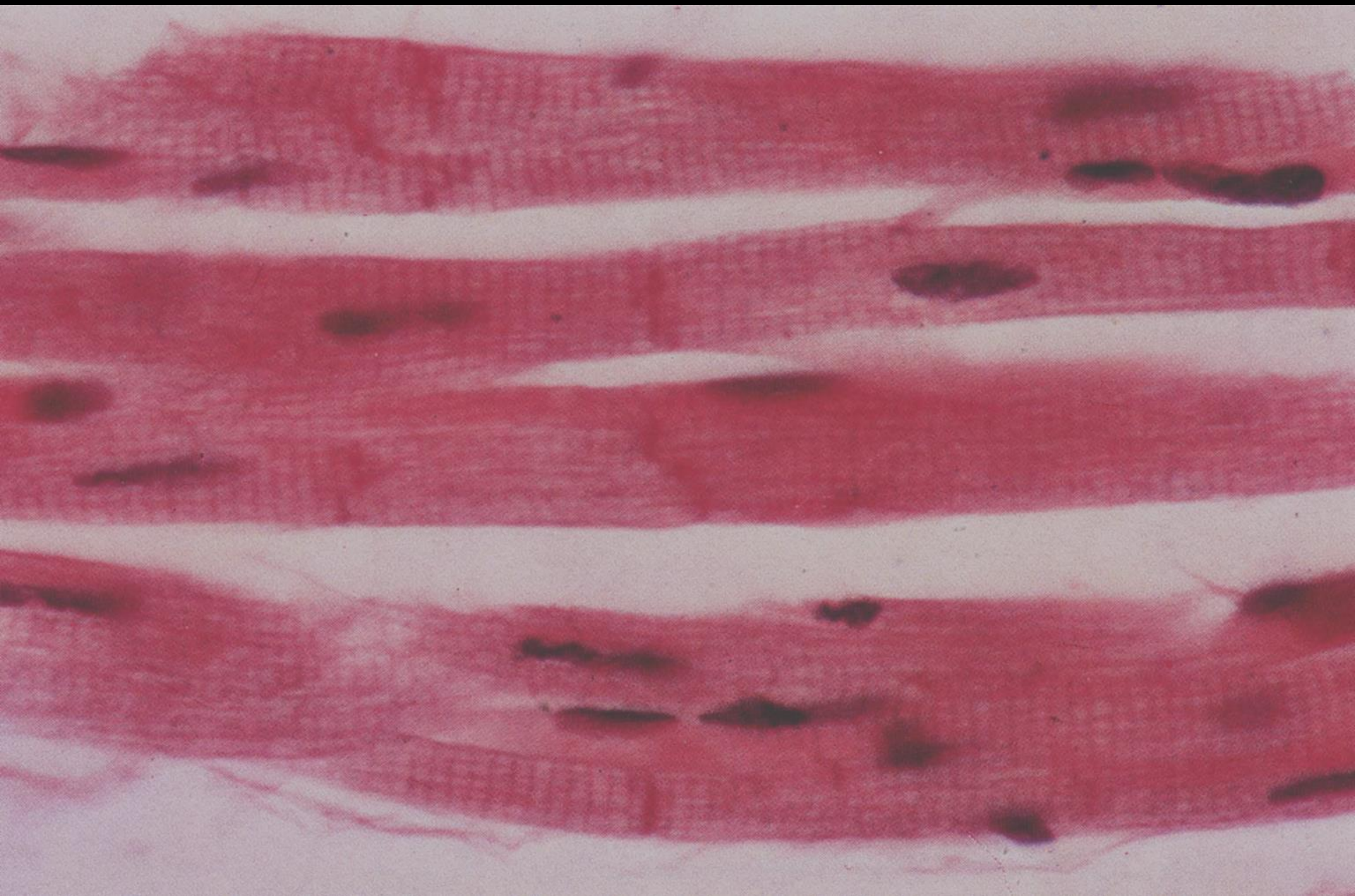
AV chlopeň



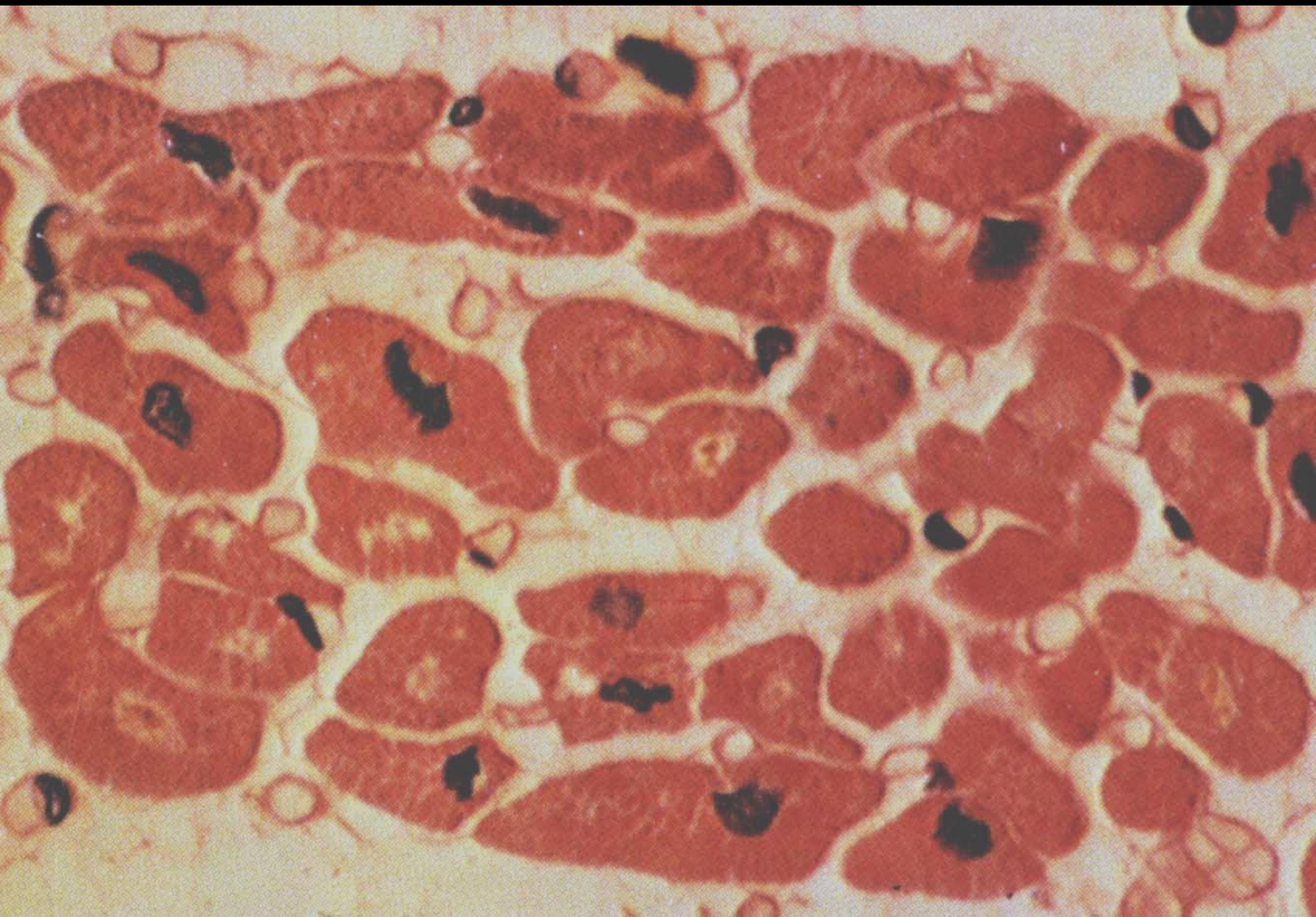
**poloměsíčitá
chlopeň**

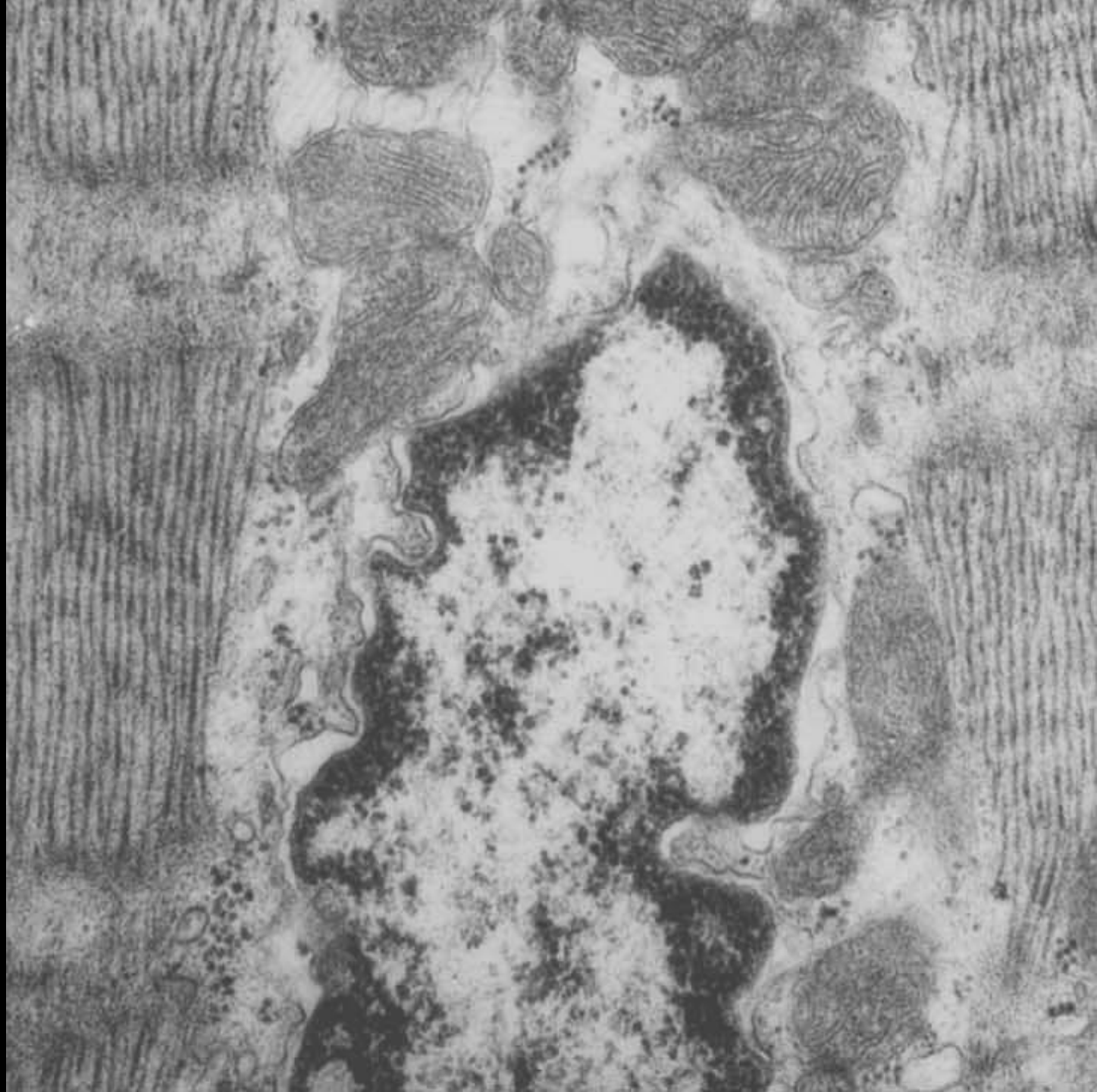
myokard

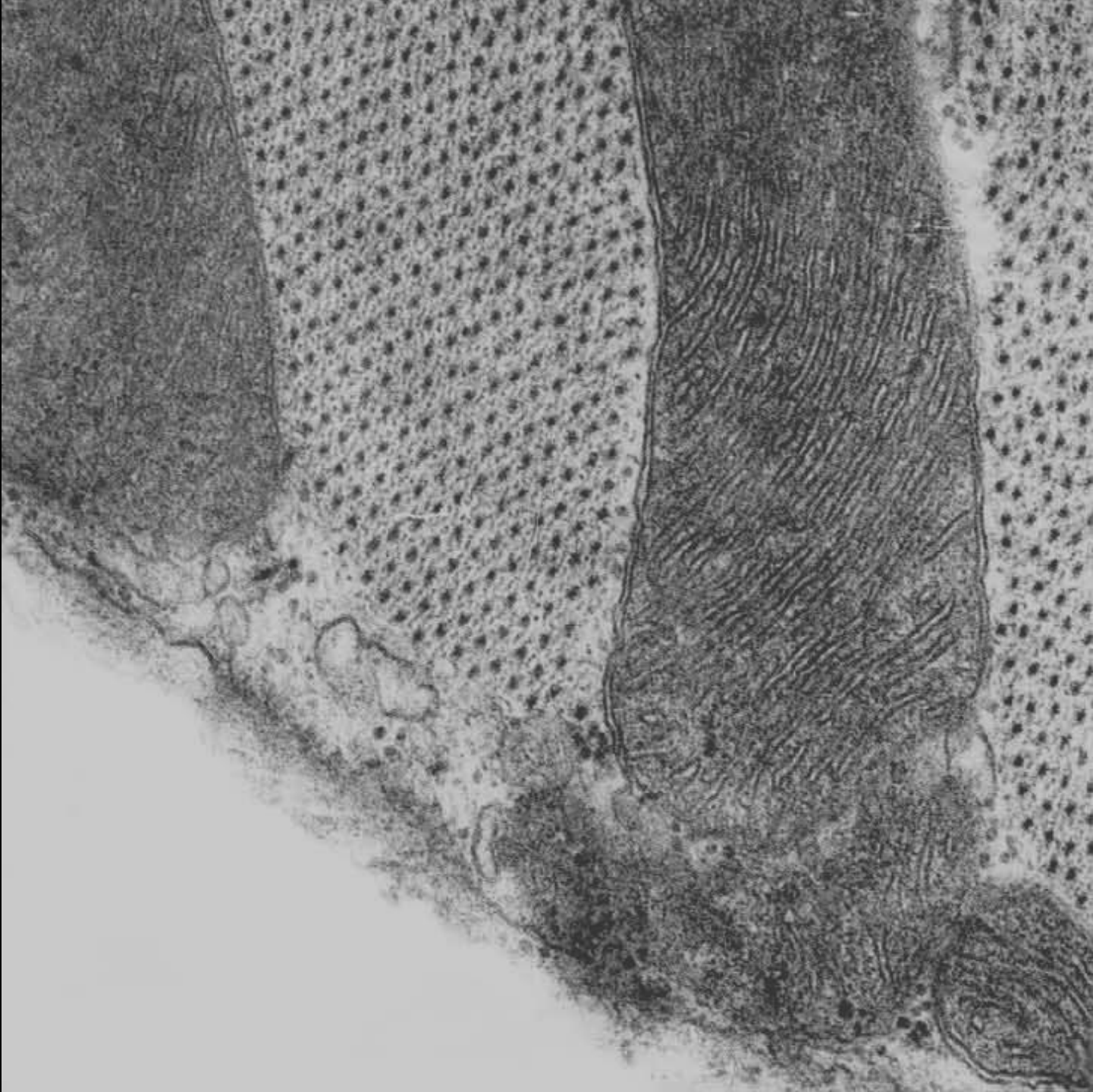




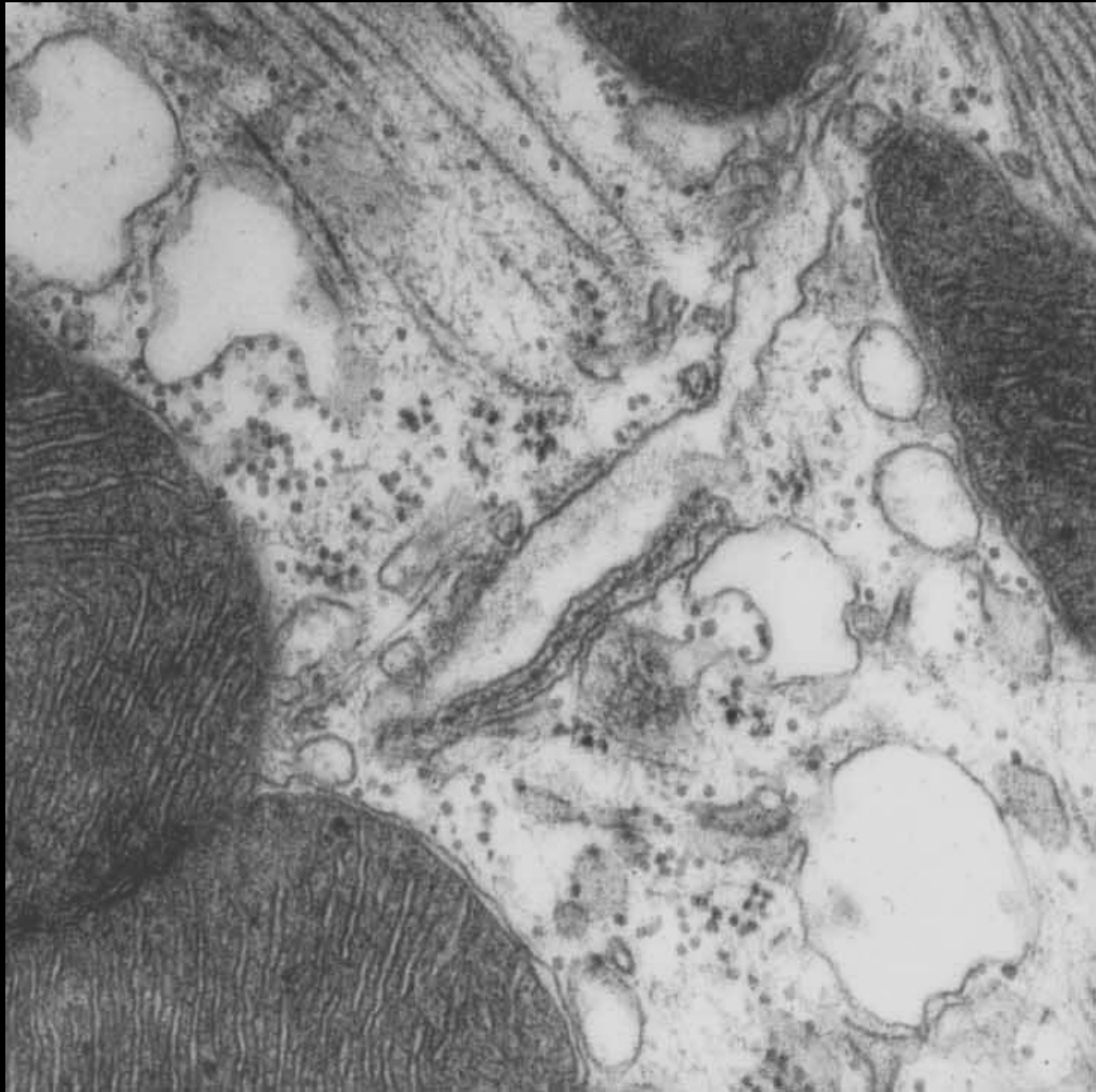


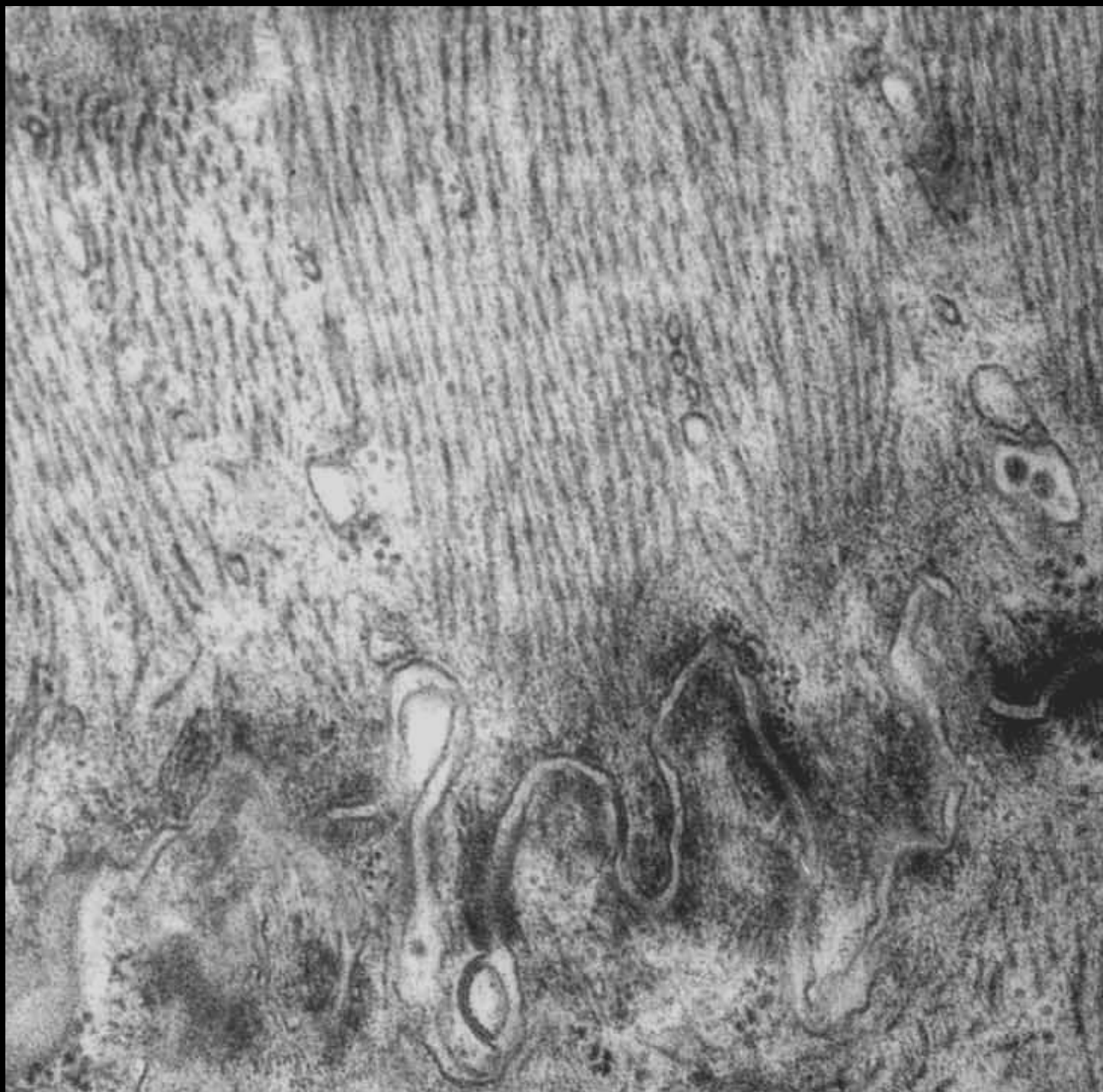




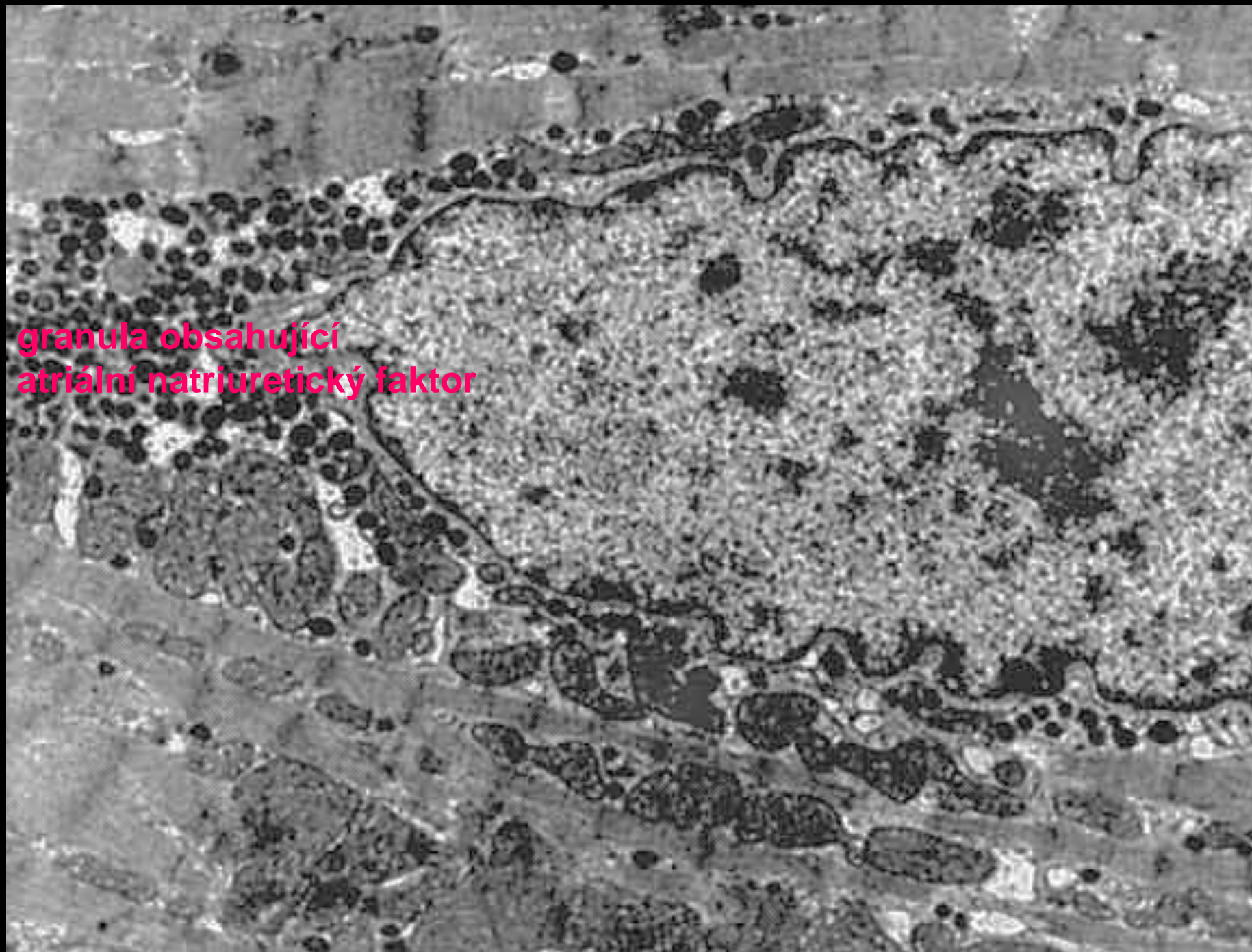




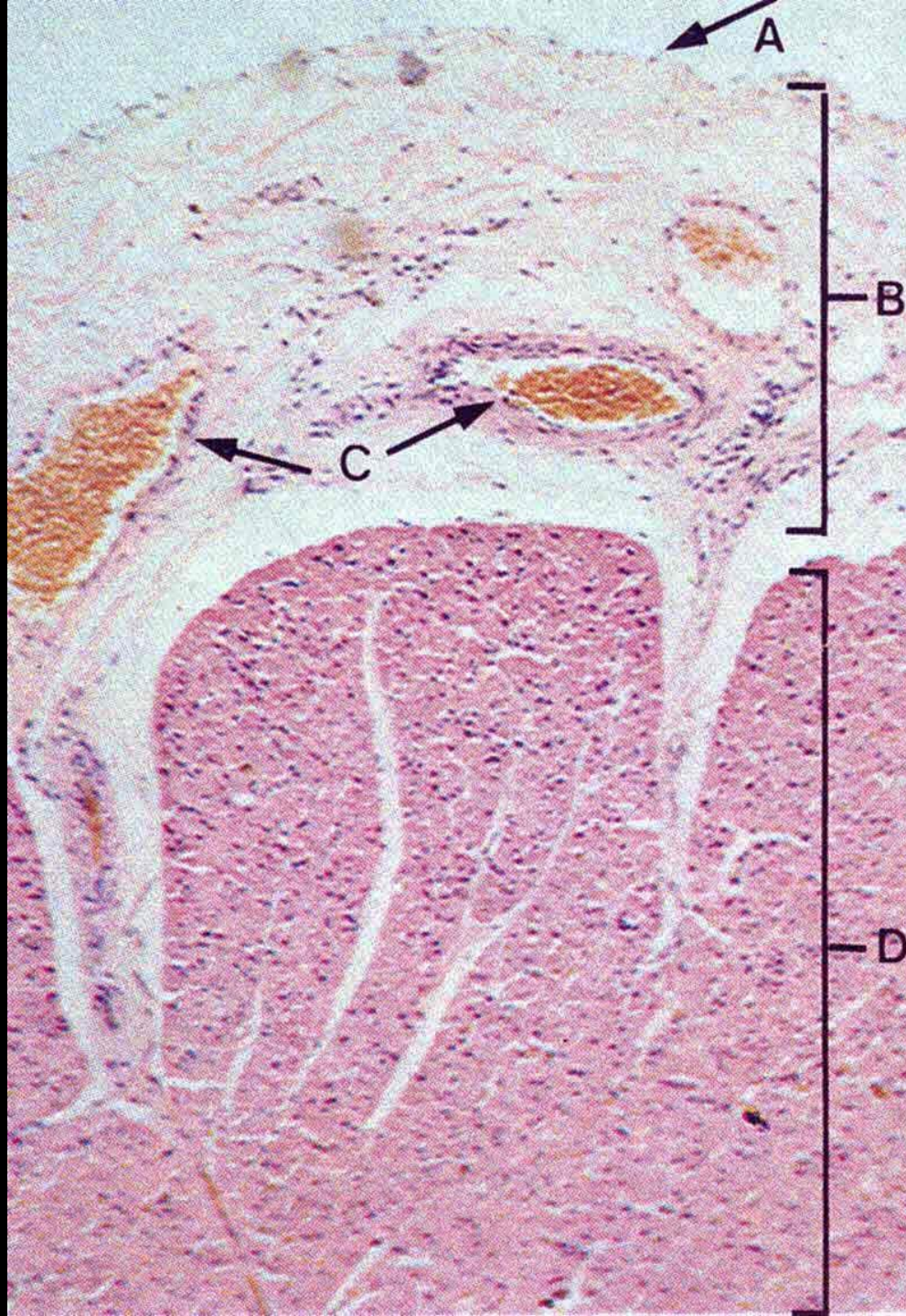


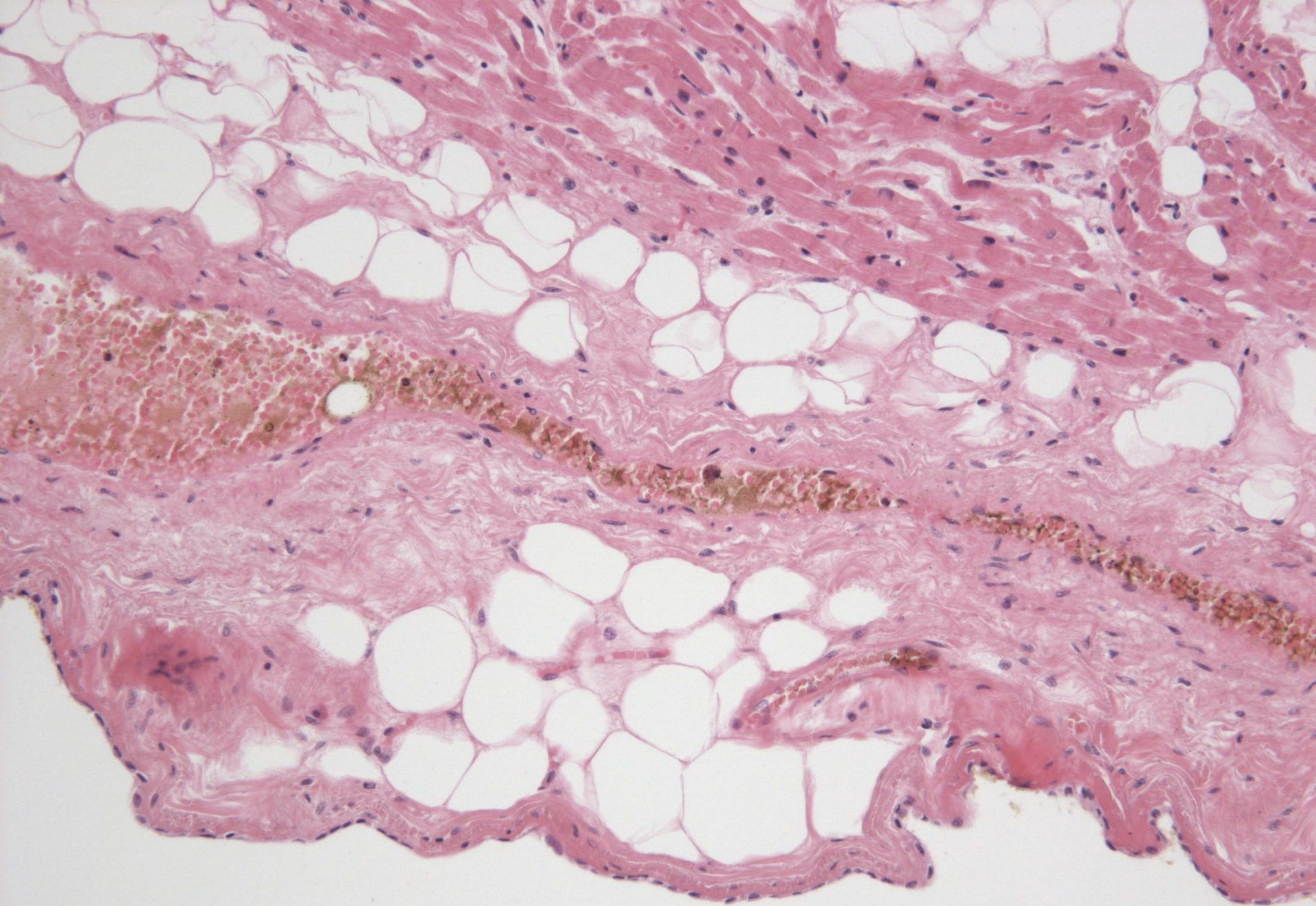


granula obsahující
atriální natriuretický faktor



epikard





Intramurální infarkt v přepážce a částečně v zadní stěně komory
Změny na kardiomyocytech – vývoj během několika desítek minut.
Po několika hodinách jsou již změny nevratné, po 3 – 6 hodinách
nekrotické ložisko
je vidět makroskopicky – typické barvy

