

# Pojivová tkáň

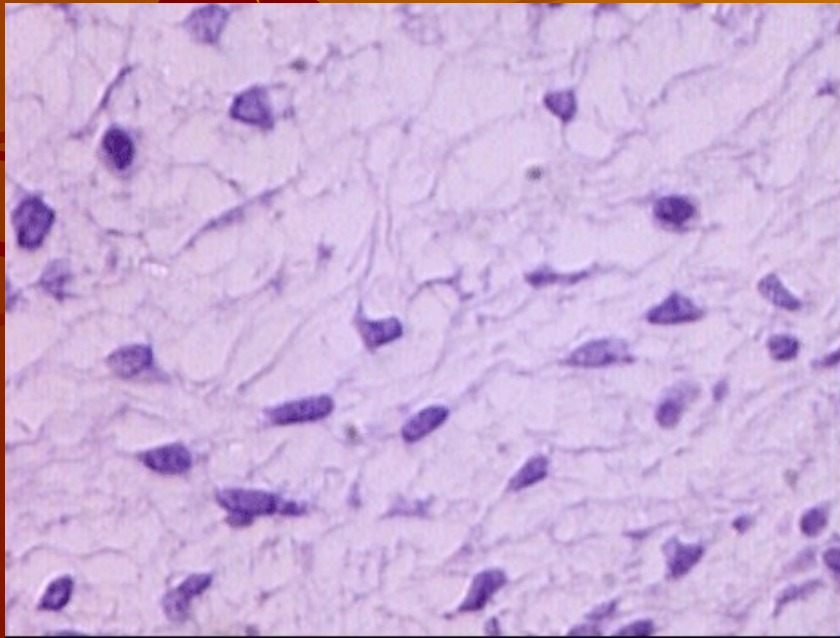
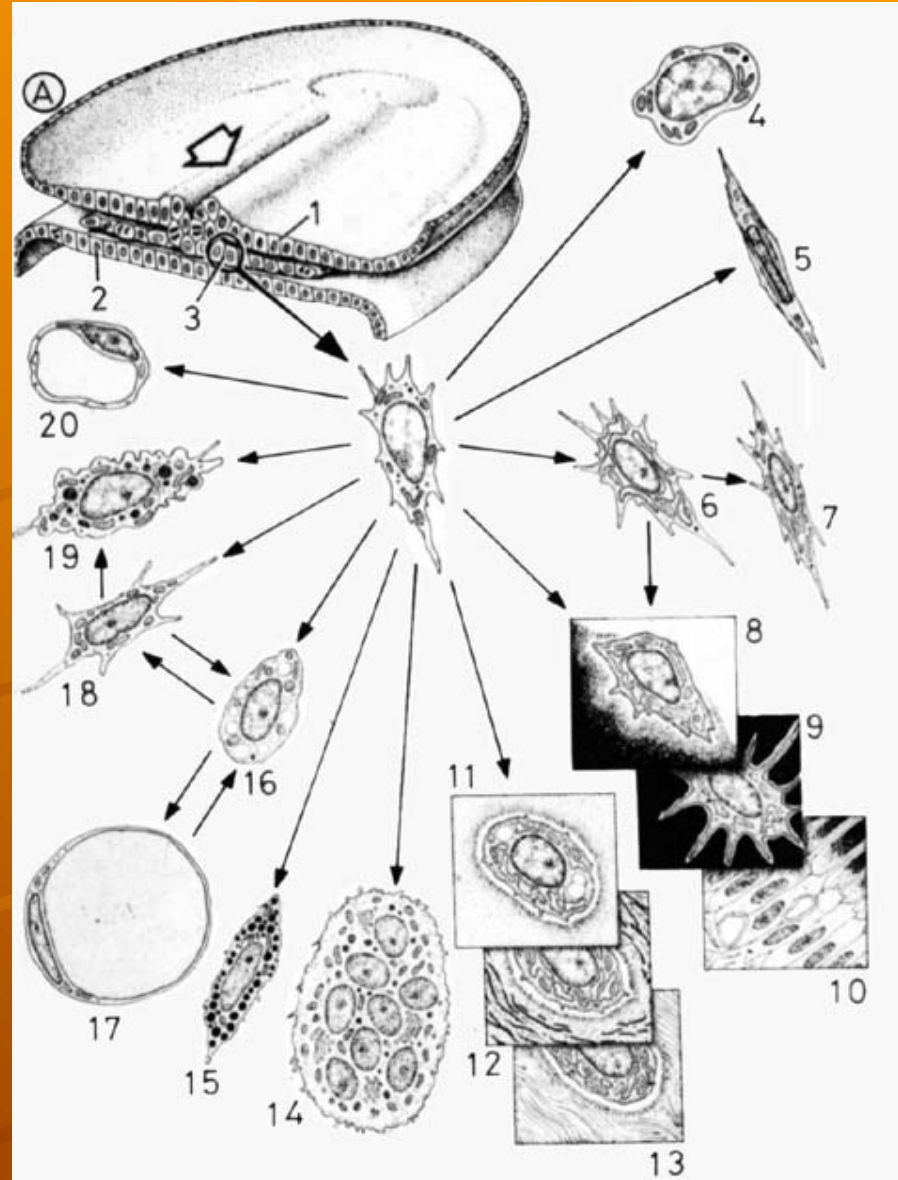
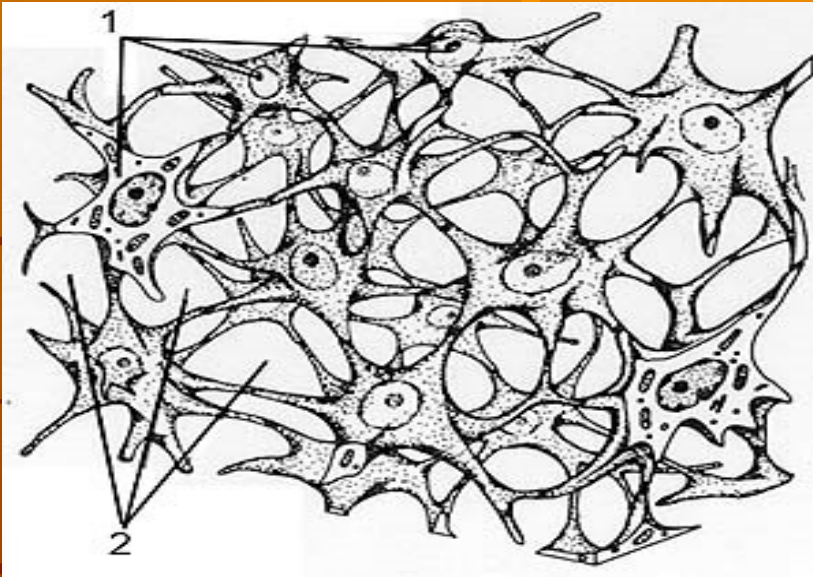
**Vazivo**

**Chrupavka**

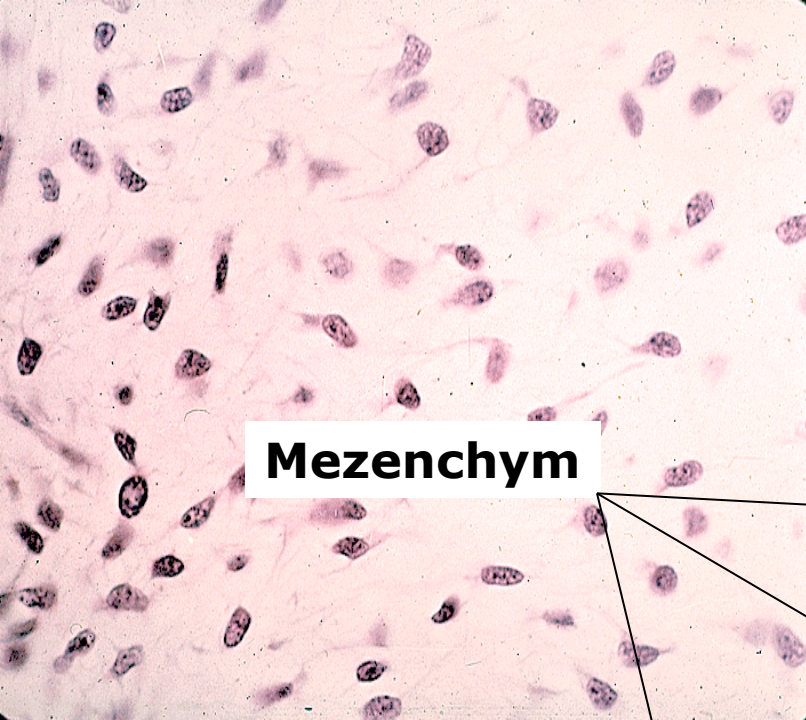
**Kost**



# Mezenchym







**Mezenchym**



**Vazivo**



**Kost**



**Chrupavka**

# Původ a funkce

■ Původ – mezenchym

■ Funkce:

- **nutritivní** (krevní cévy, difuze živin)
- **protektivní** – imunocompetentní buňky a produkce protilátek
- **pojivová** – spojení tkání, výplň mezi orgány
- **mechanická** (podpůrná a mechanická ochrana orgánů – *v lebce, v hrudním koši, v pánvi*)

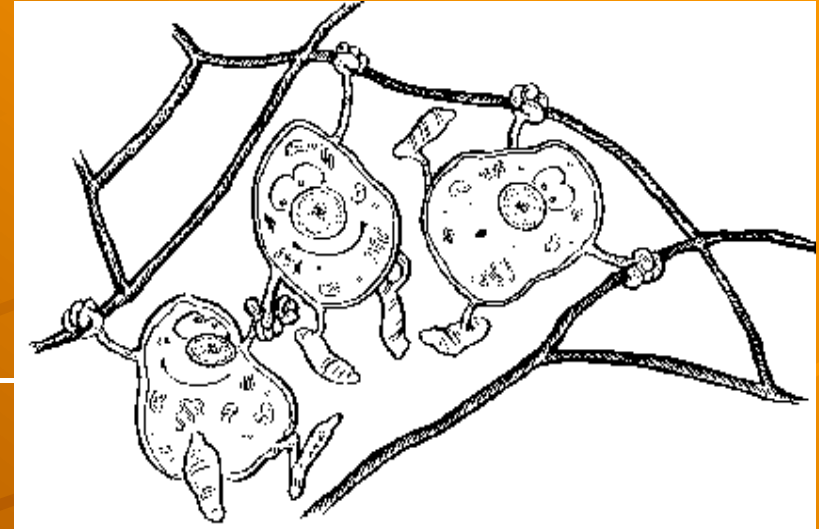


# Pojivová tkáň

✚ Vazivo

✚ Chrupavka

✚ Kost



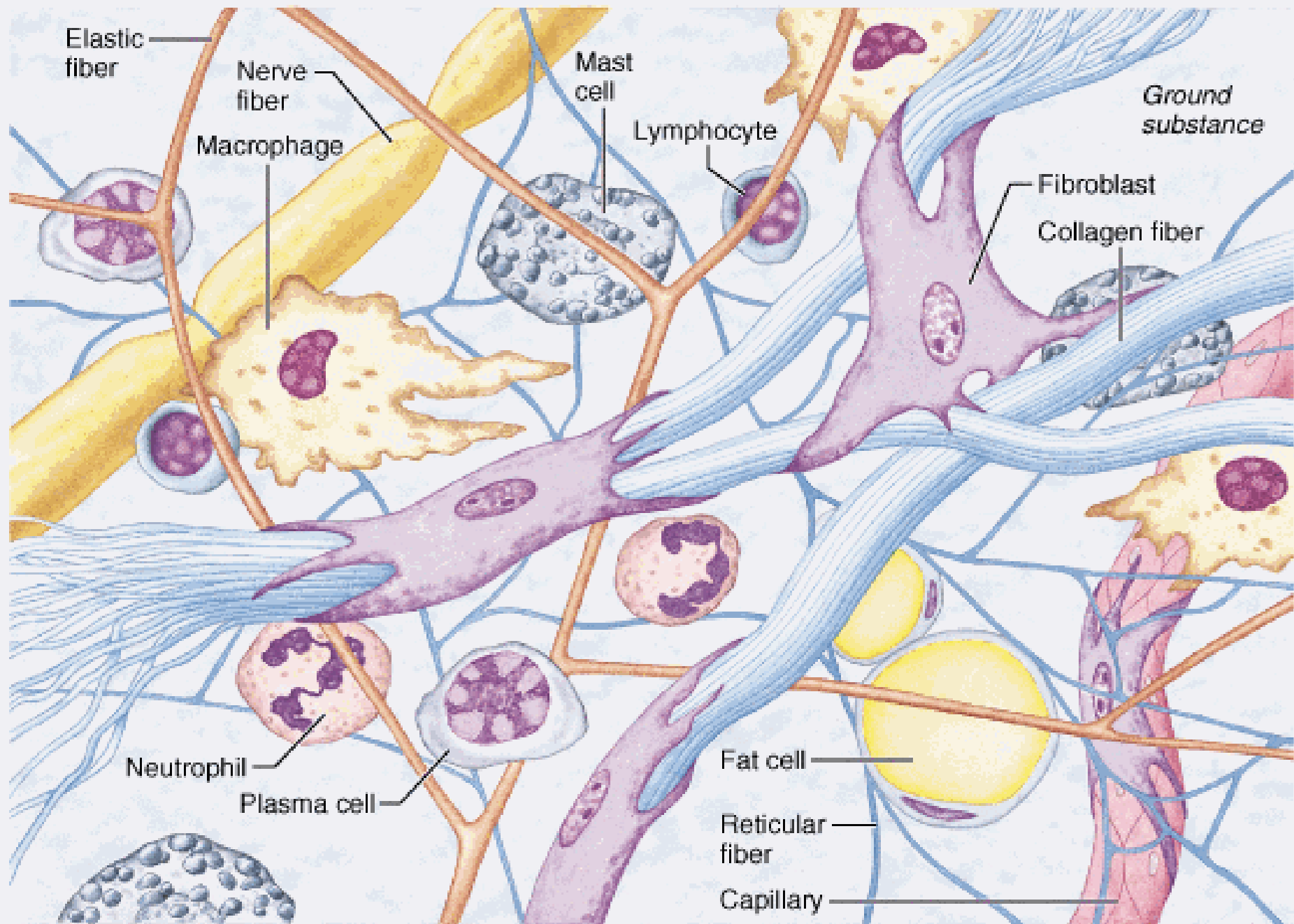
✚ Obecná stavba:

- buňky

- mezibuněčná  
hmota

→ vlákna

→ základní amorfní  
substance





# Vazivo

■ Buňky

fixní  
volné (bloudivé)

■ Vlákna

kolagenní  
elastická  
retikulární

■ Základní amorfní hmota



# Vazivo - buňky

## FIXNÍ BUŇKY

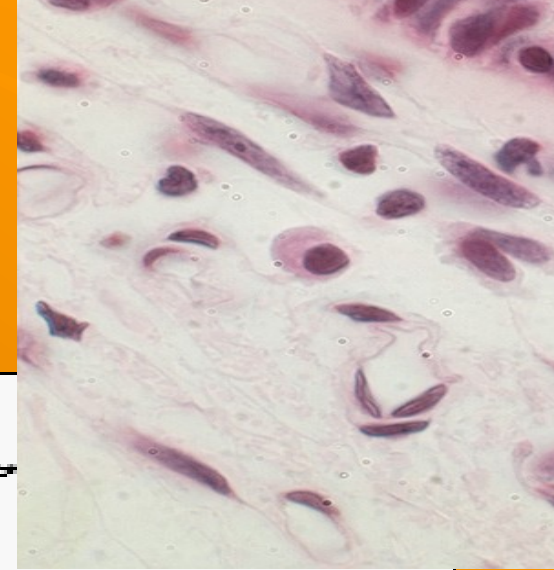
- ▣ Fibroblasty, fibrocyty
- ▣ Retikulární bb.
- ▣ Tukové bb.
- ▣ Pigmentové bb.
- ▣ Nediferencované bb.

## MOBILNÍ BUŇKY

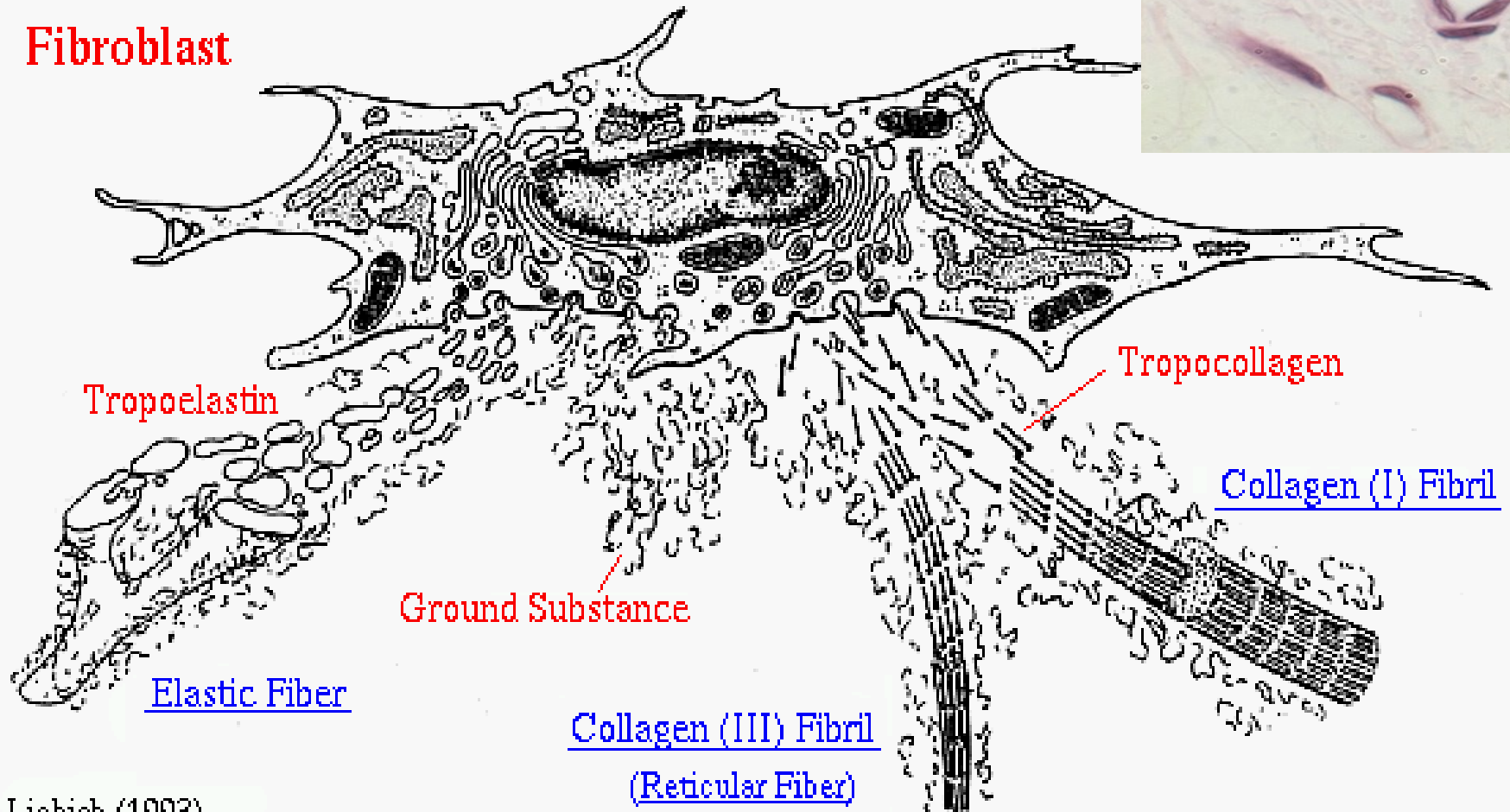
- ▣ Histiocyty  
    ▣ Makrofagy
- ▣ Žírné bb.  
    (heparinocyty)
- ▣ Plazmatické bb.
- ▣ Leukocyty



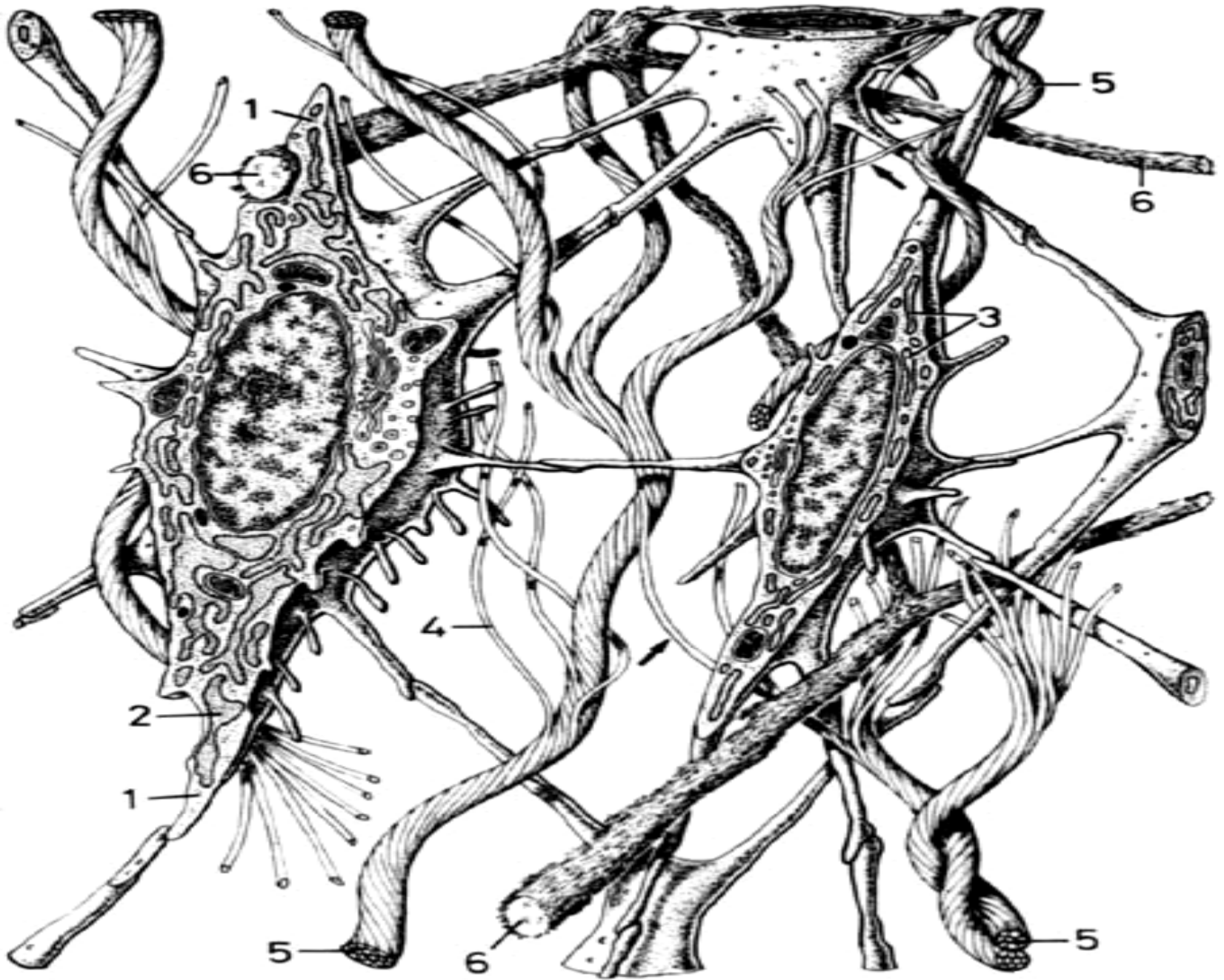
# Fibroblasty, fibrocyty



## Fibroblast



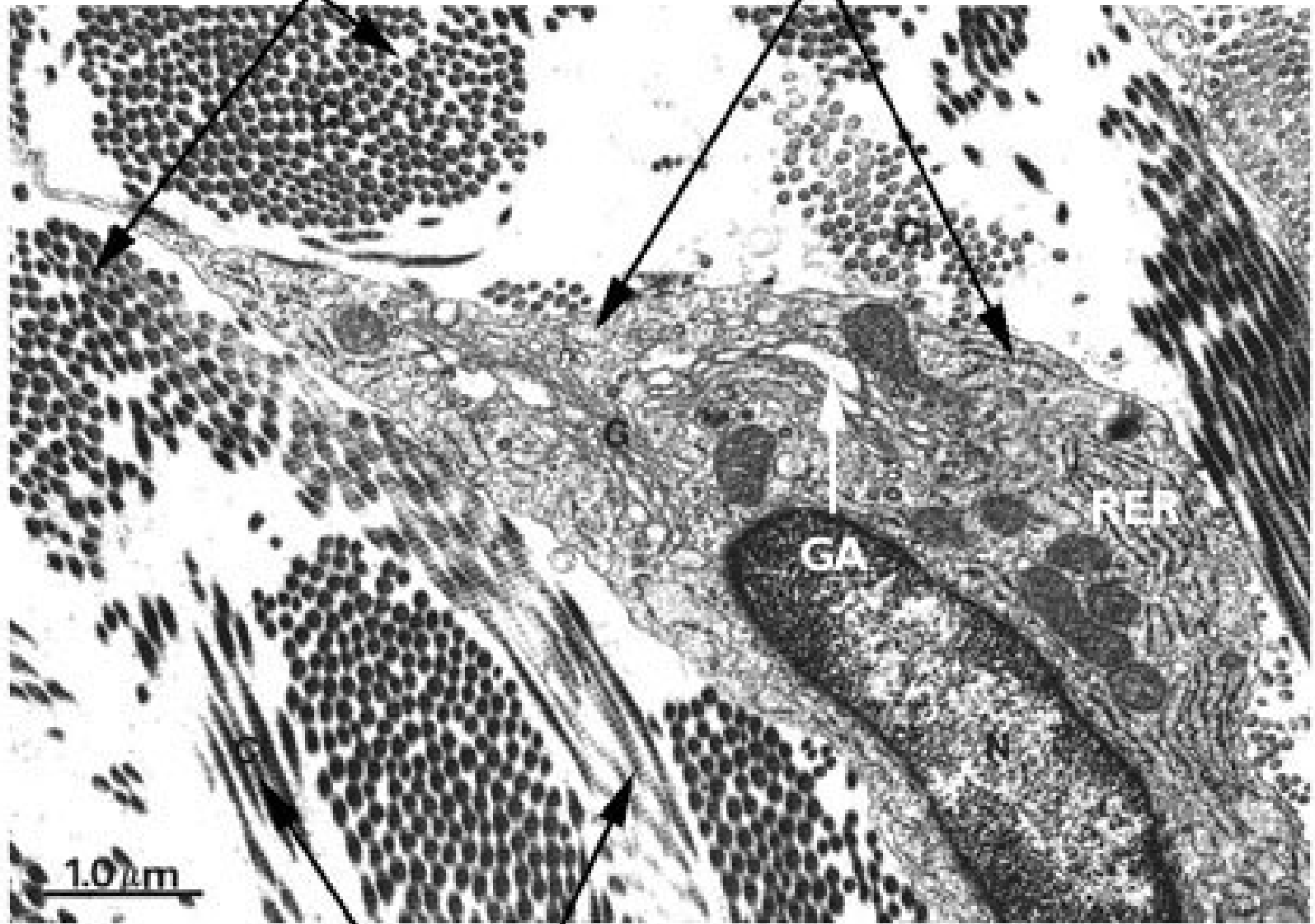
Liebich (1993)





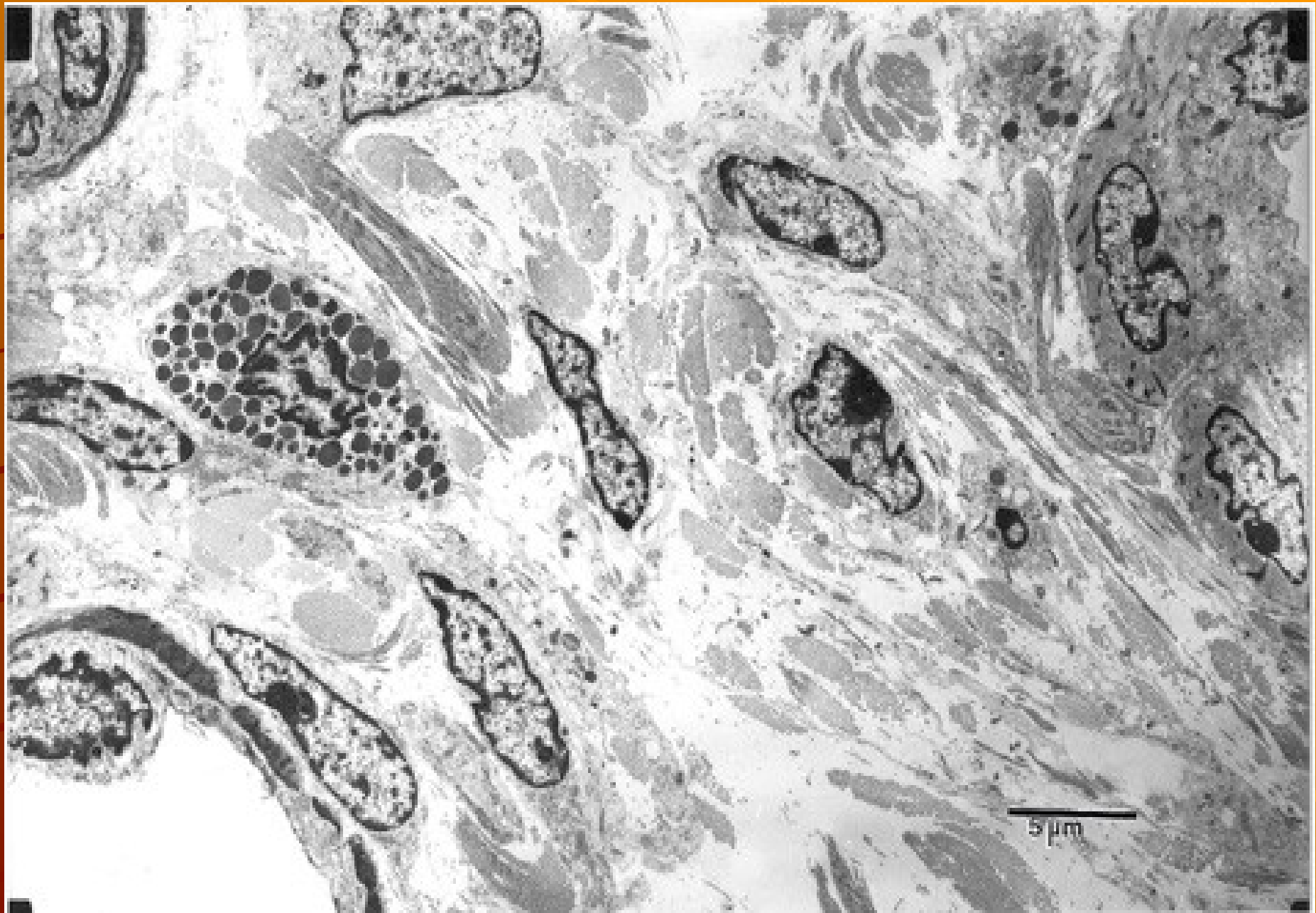
**Collagen fibers in  
cross-section**

**Fibroblast in active state**

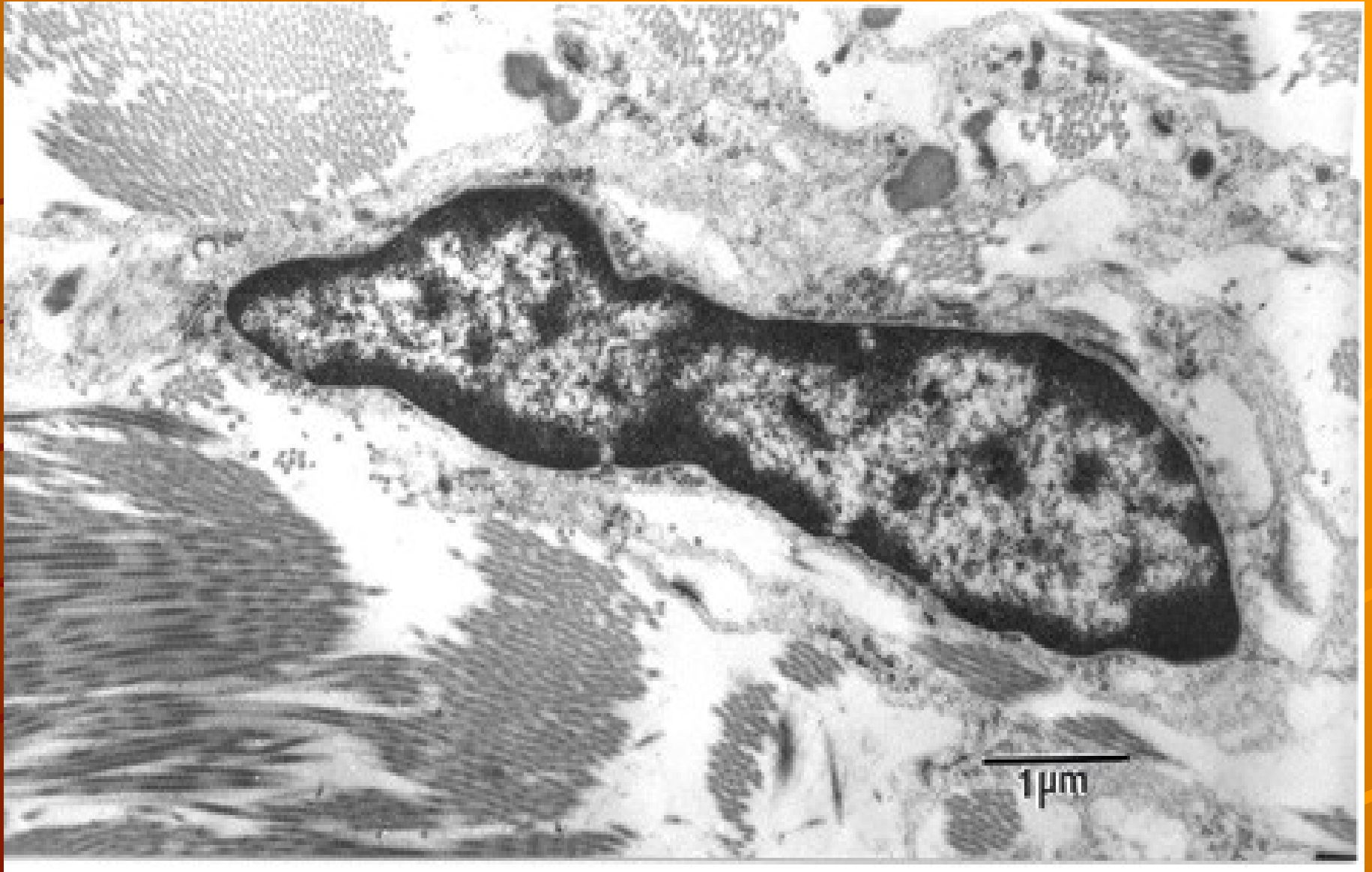


**Collagen fibers in  
longitudinal section**

# Fibroblasty a žírná buňka

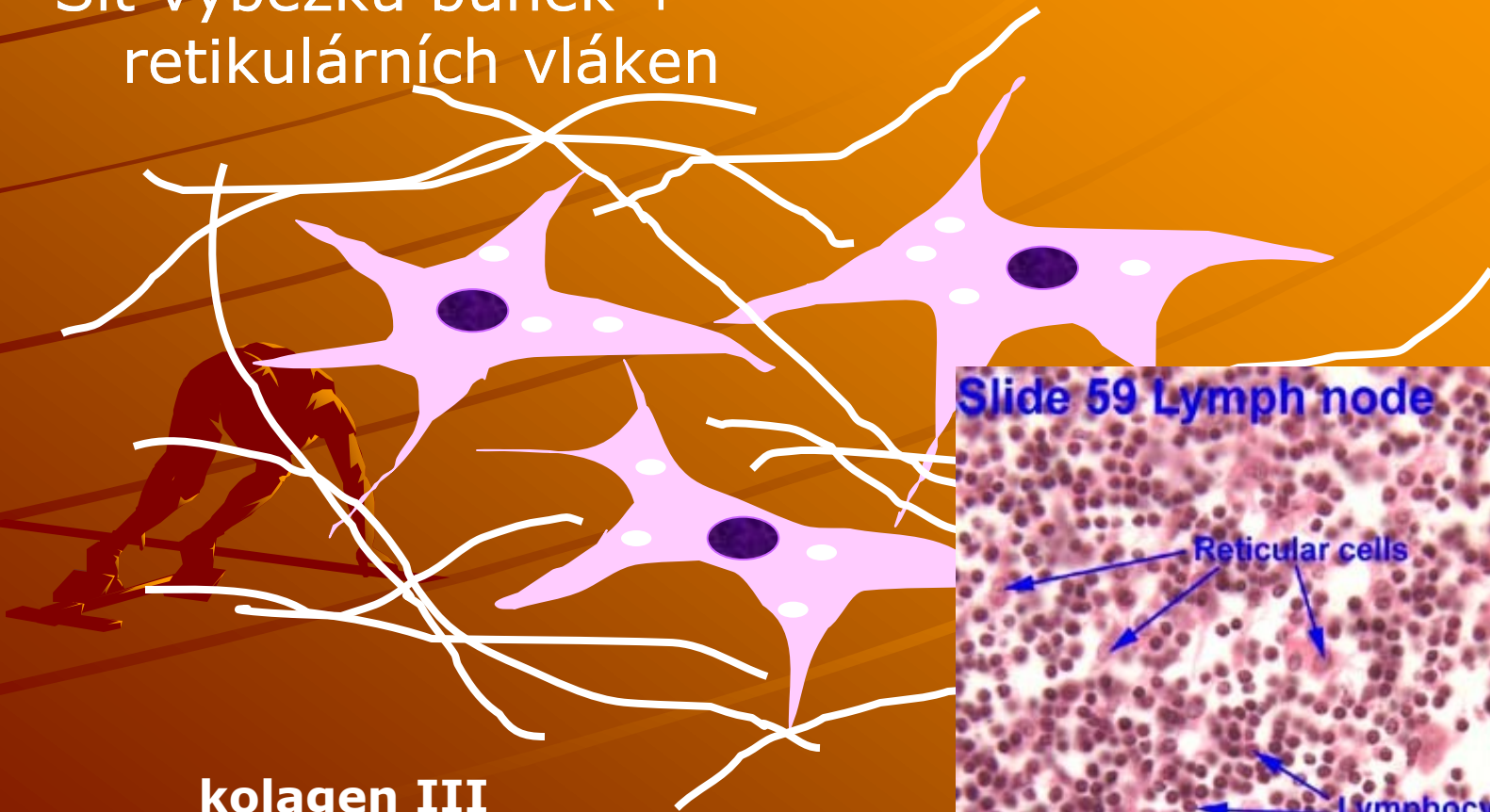


# Fibroblast



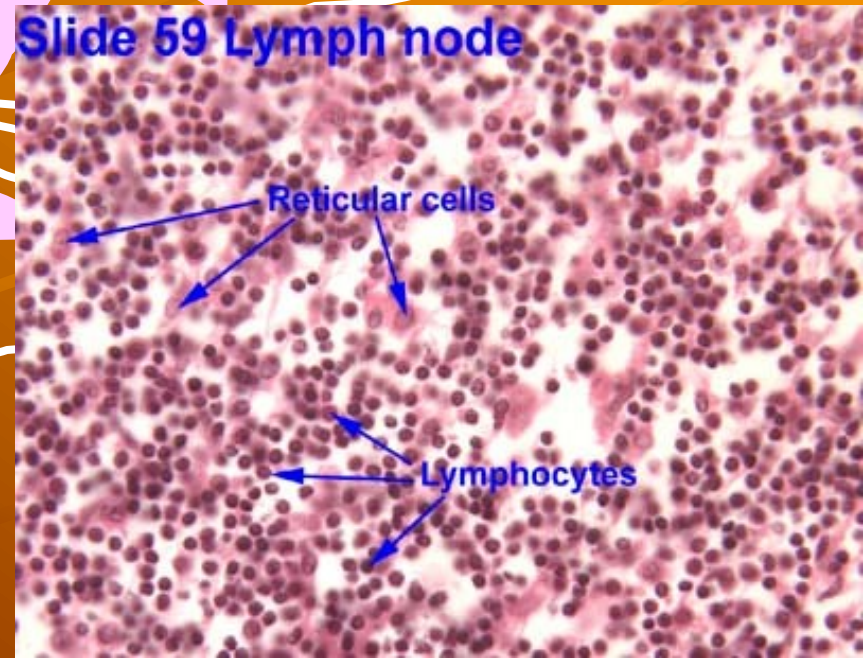
# Retikulární buňka

Síť výběžků buněk +  
retikulárních vláken



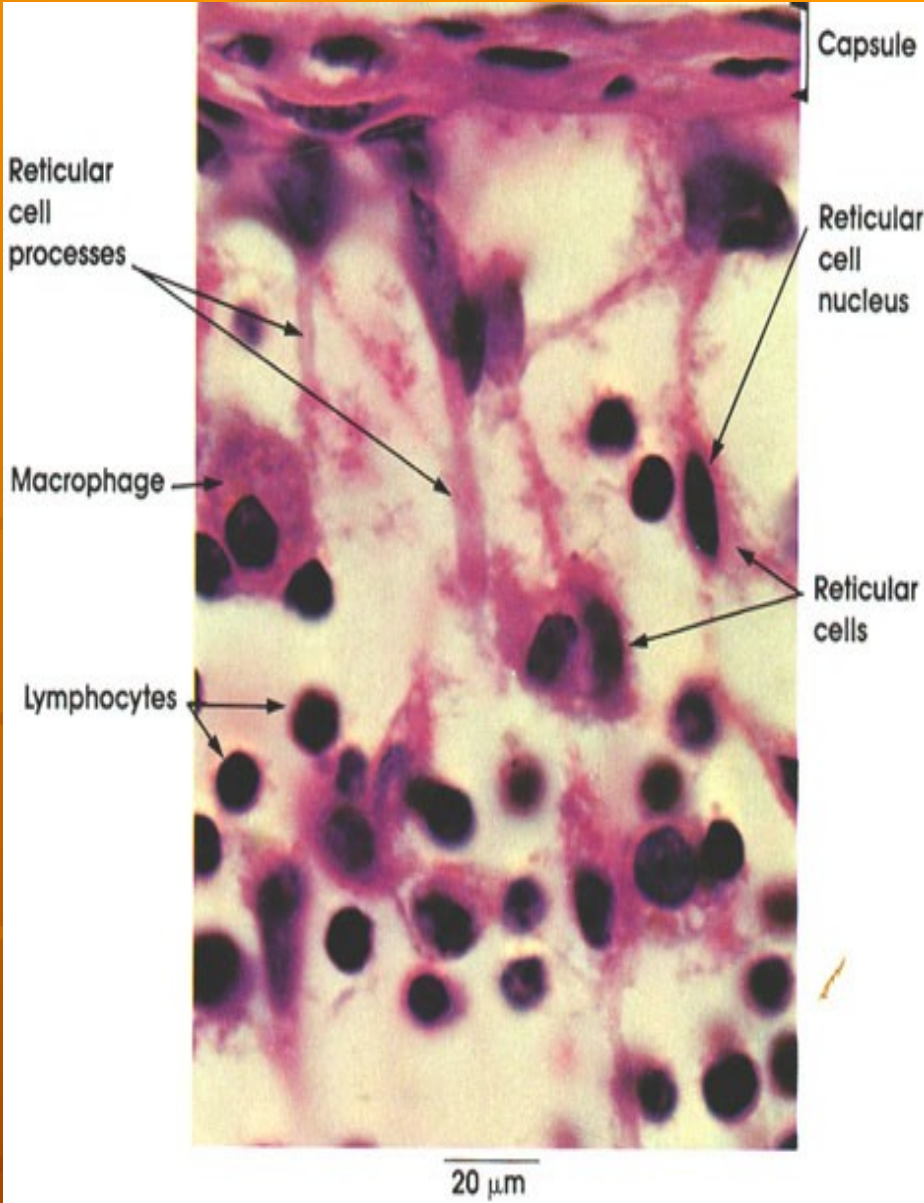
**kolagen III**

Slide 59 Lymph node





**H&E - subcapsular sinus**



# Tukové buňky

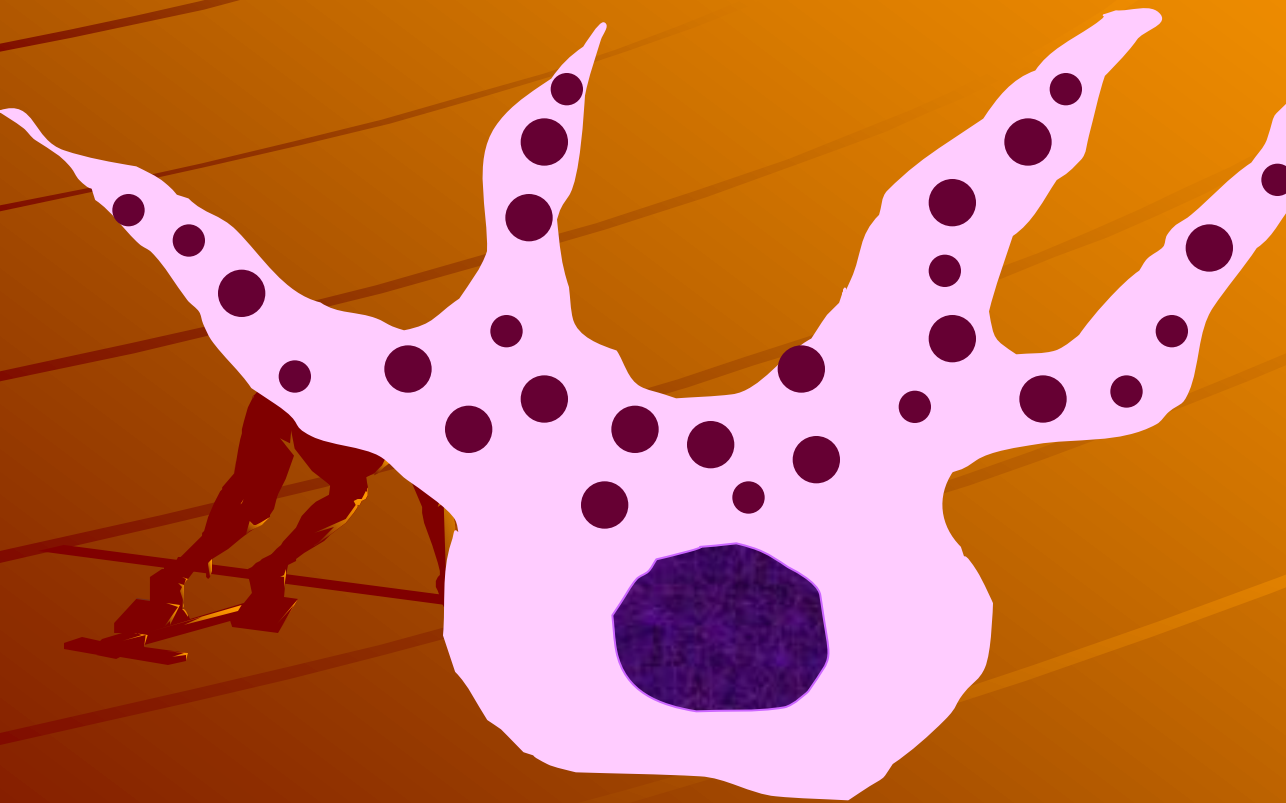
univakuolární  
(bílá tuk. tkáň)

multivakuolární  
(hnědá tuk. tkáň)

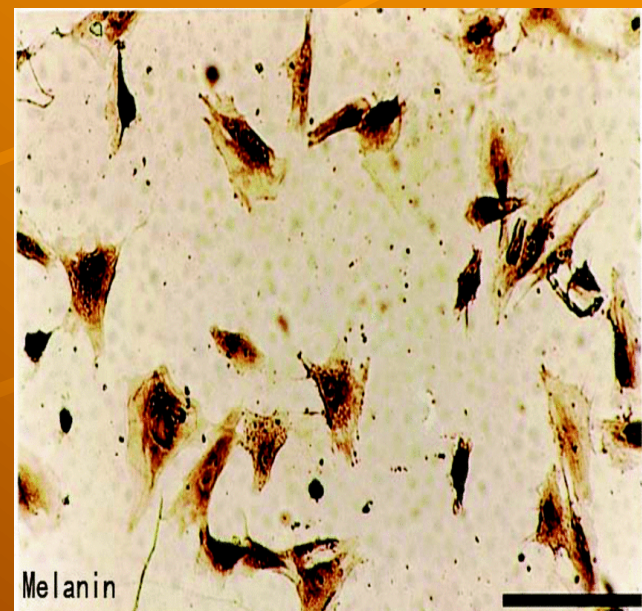
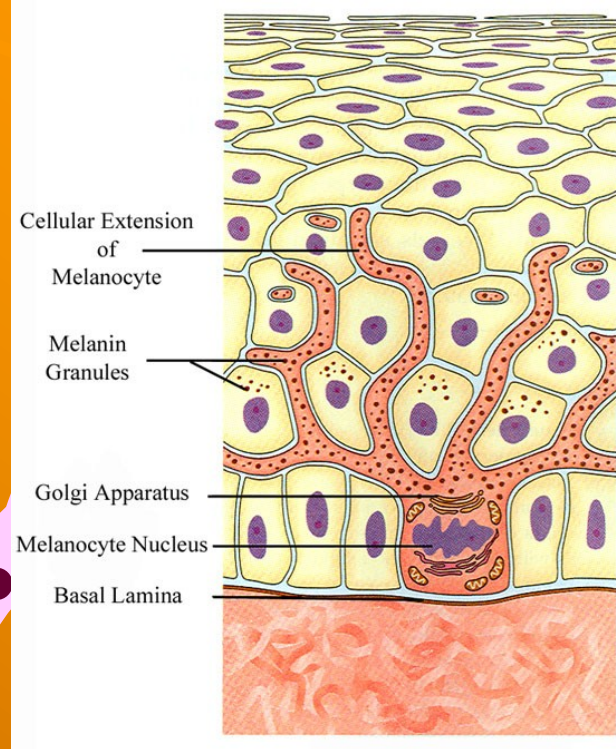


Lipidové kapky

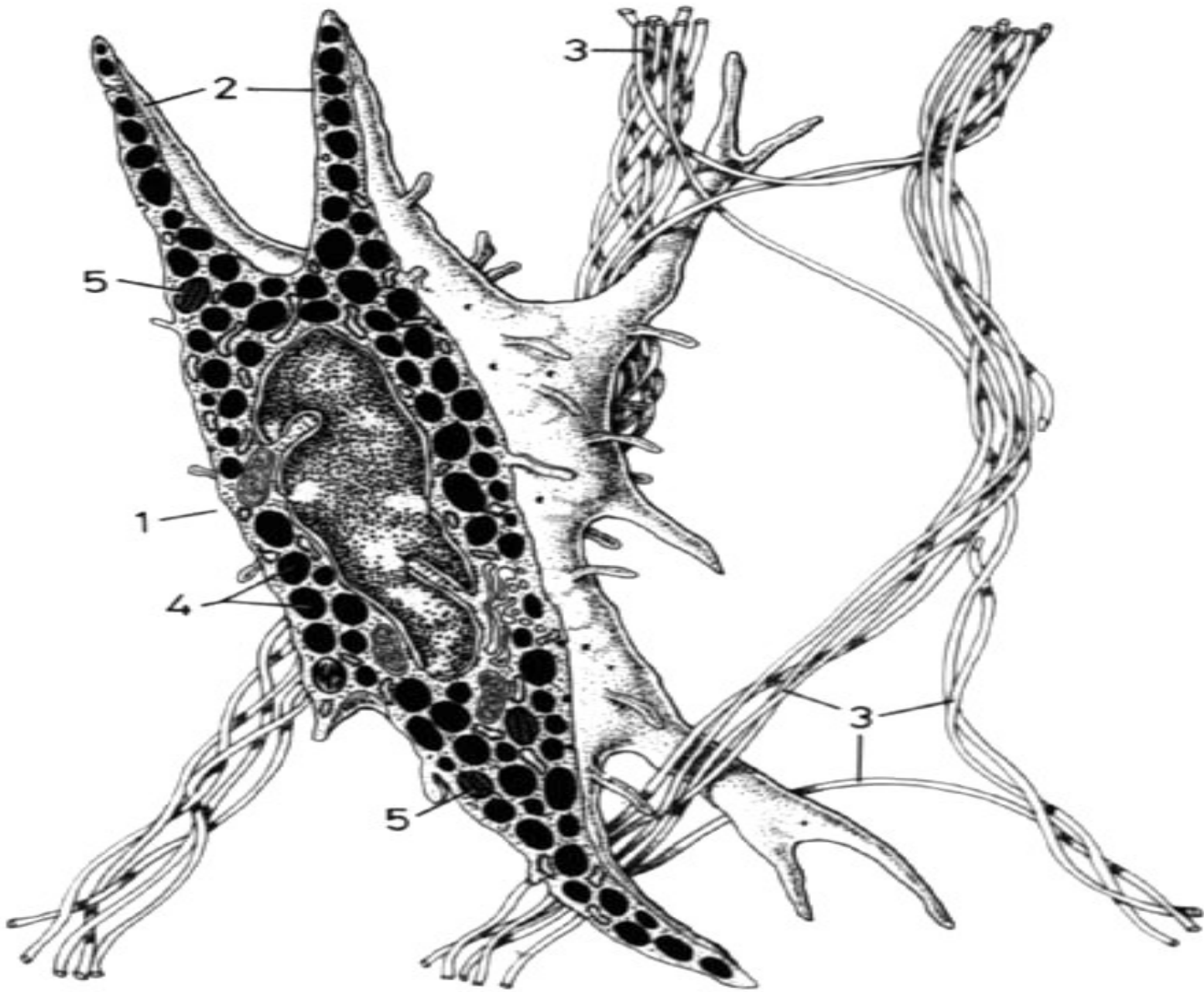
# Pigmentové buňky



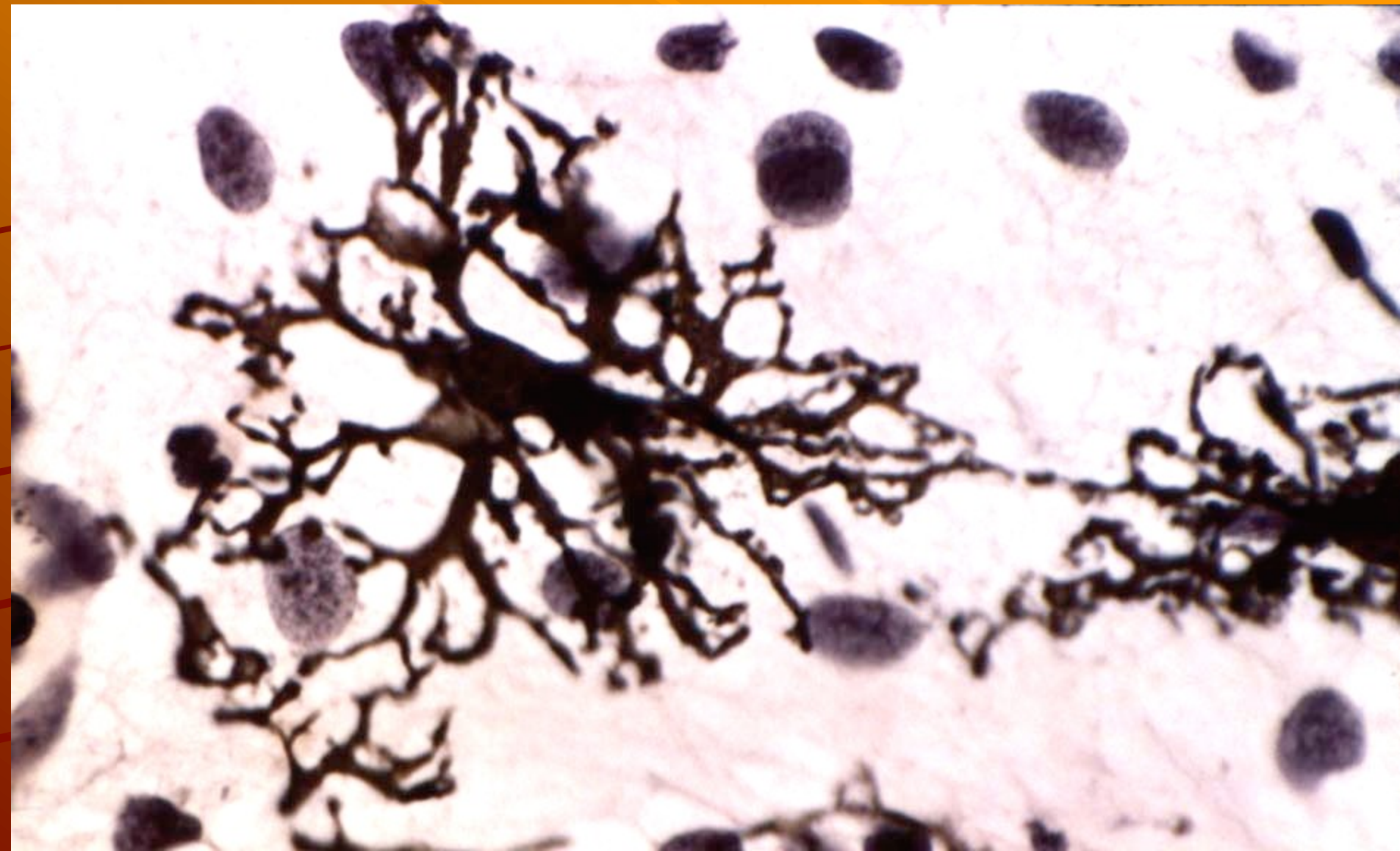
neuroektodermový původ





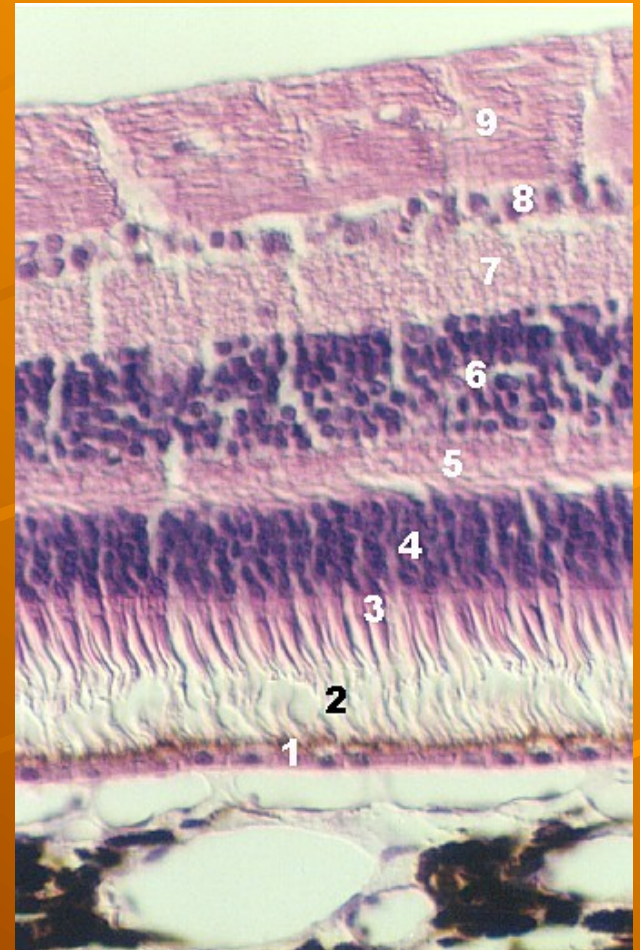
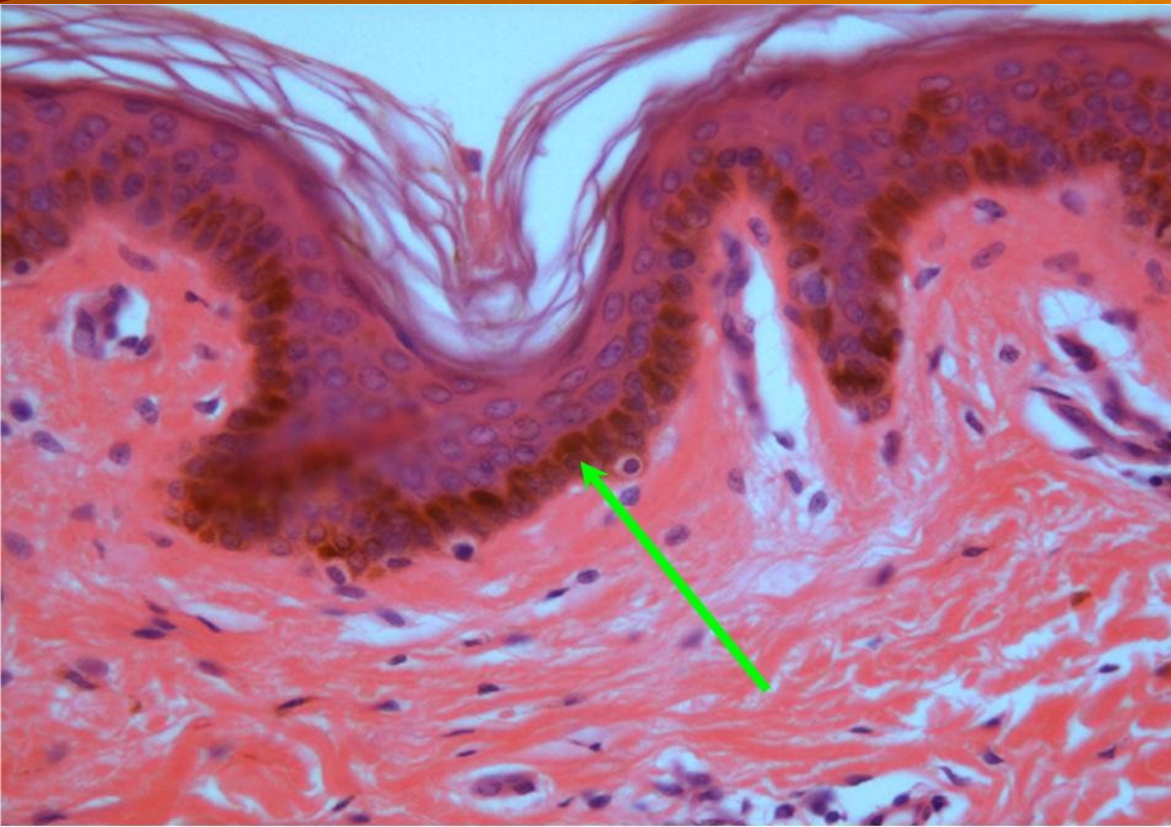






# Pigmentové buňky

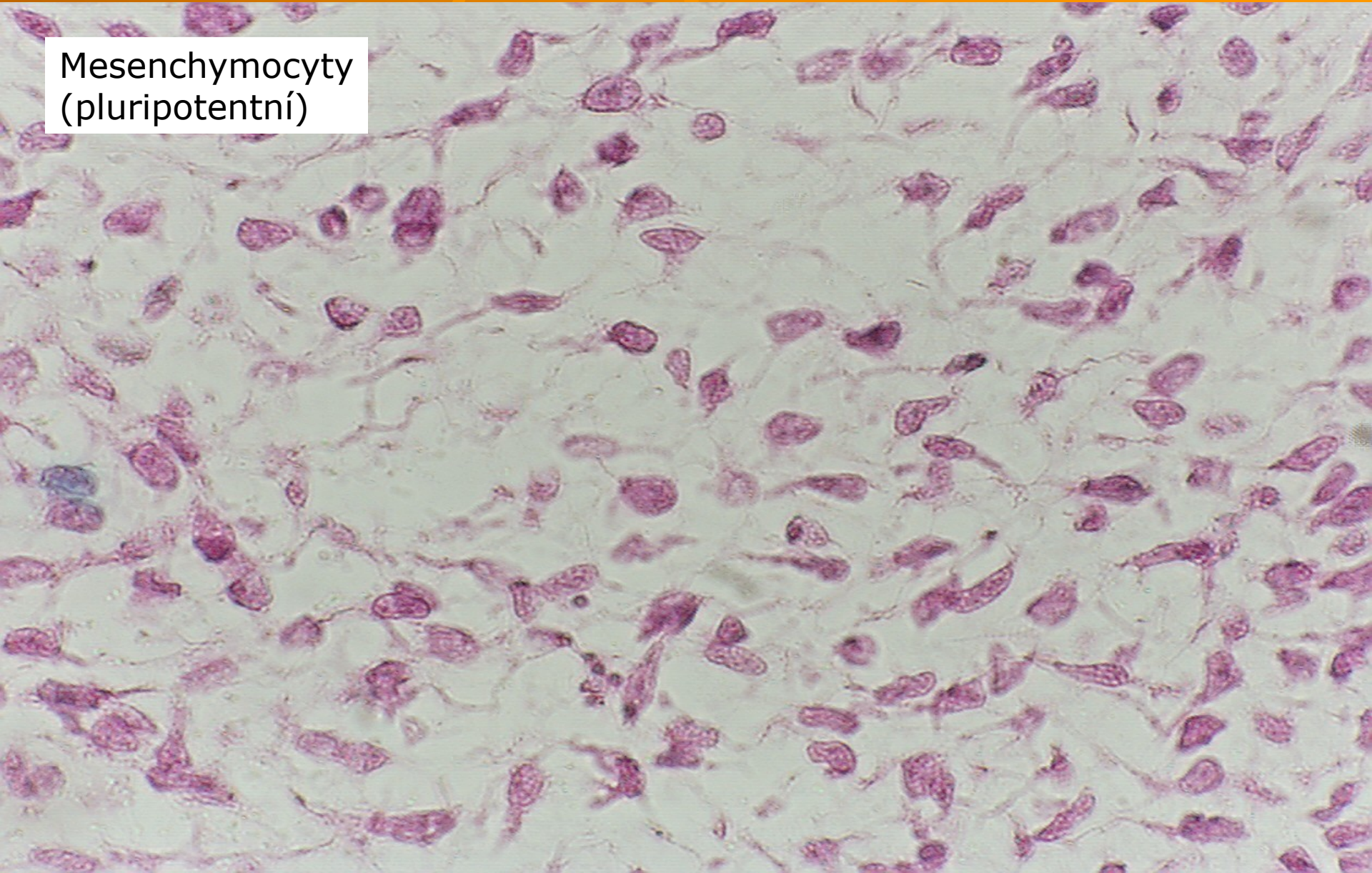
- ☒ Melanocyty s melanosomy
- ☒ Neuroektodermového původu
- ☒ Duhovka, cévnatka...





# Mezenchymové buňky

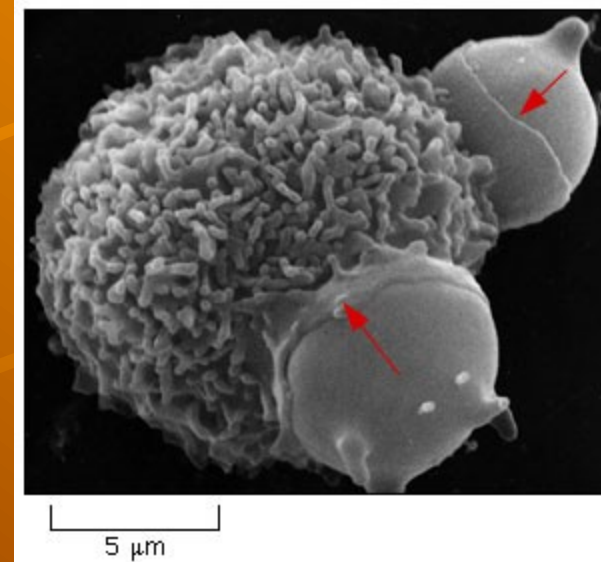
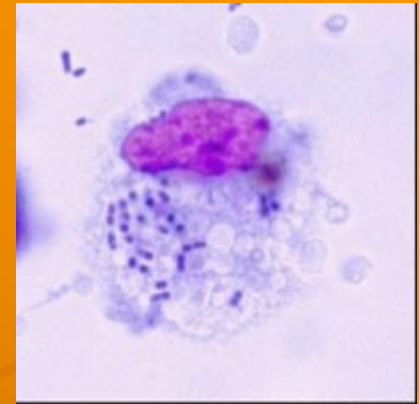
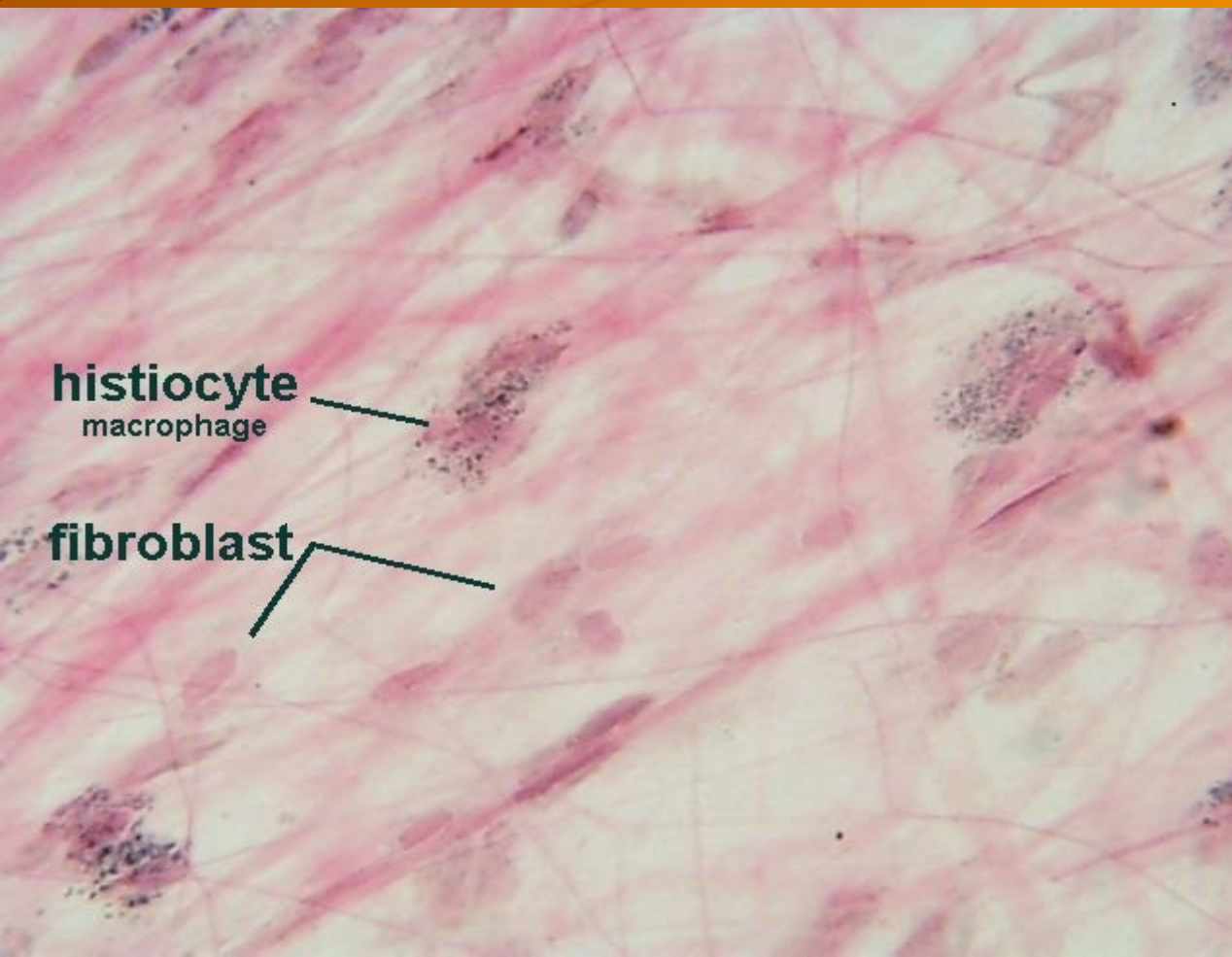
Mesenchymocyty  
(pluripotentní)



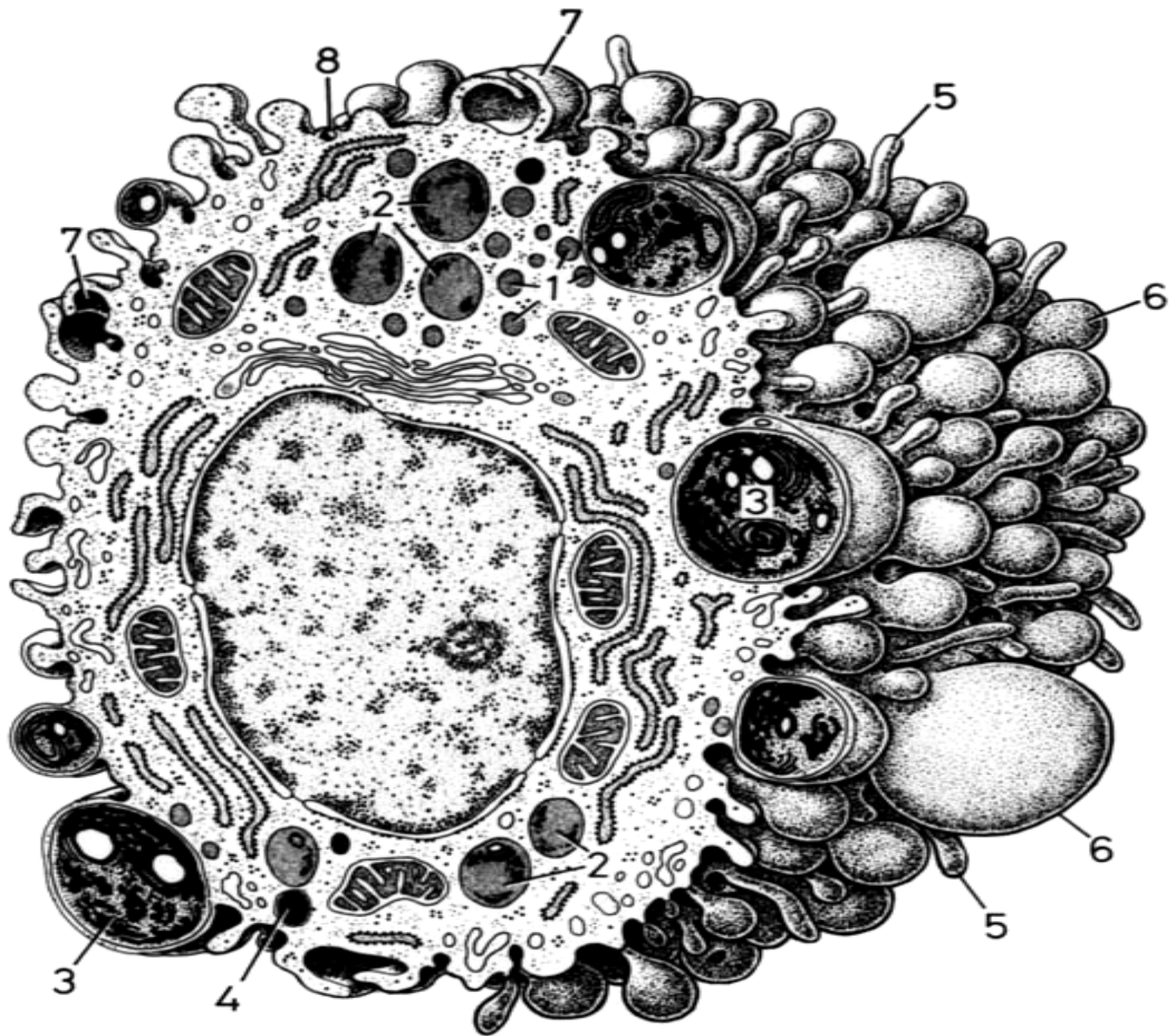


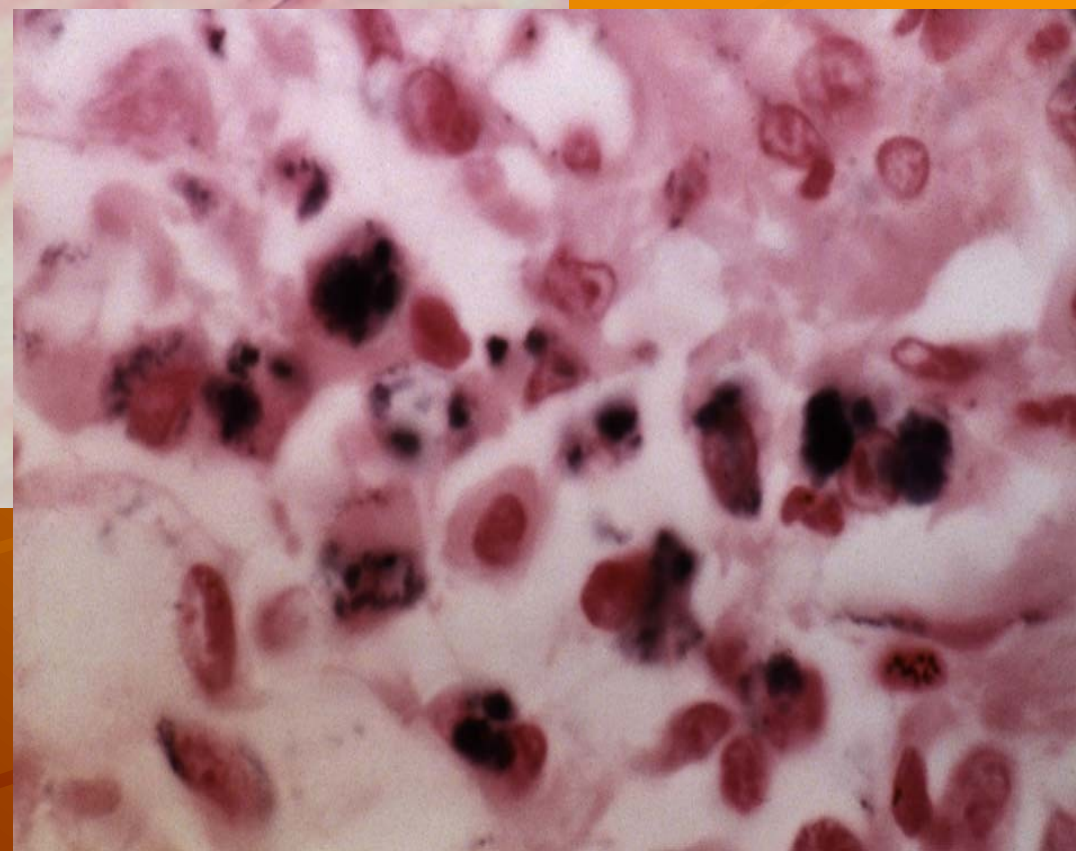
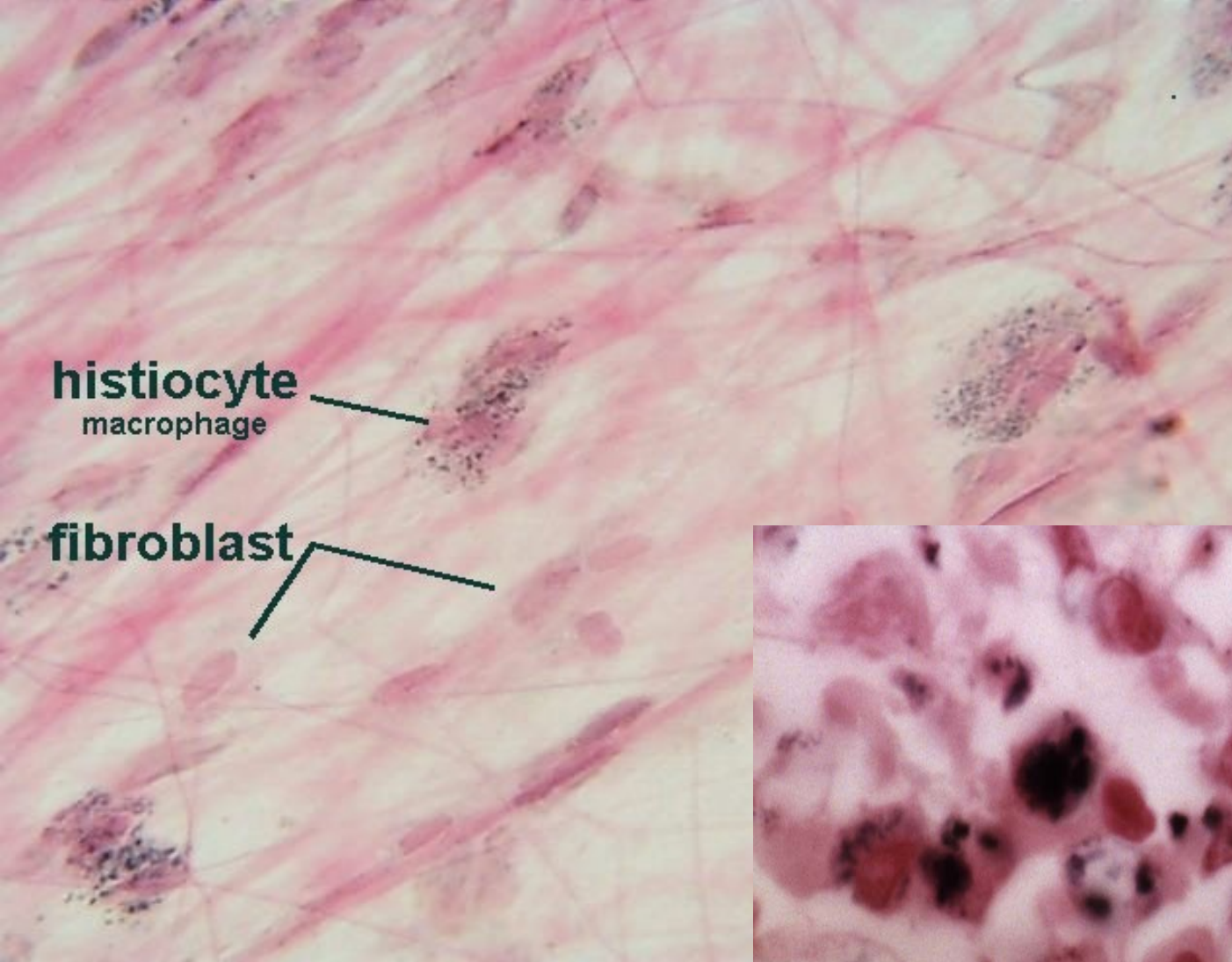
# Histiocyty $\Rightarrow$ makrofágy (patří k monocyto-makrofágovému systému)

## fagocytóza



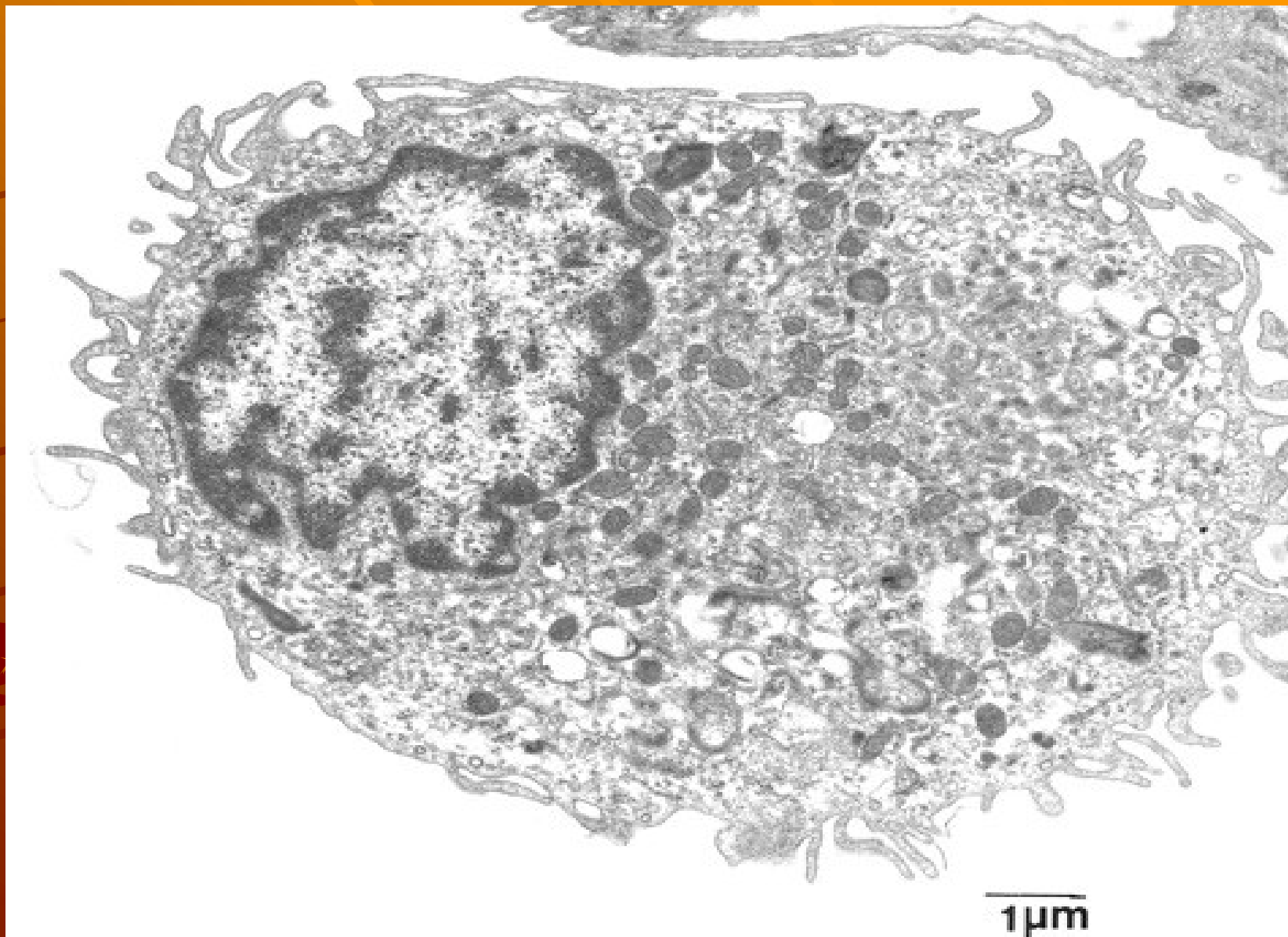






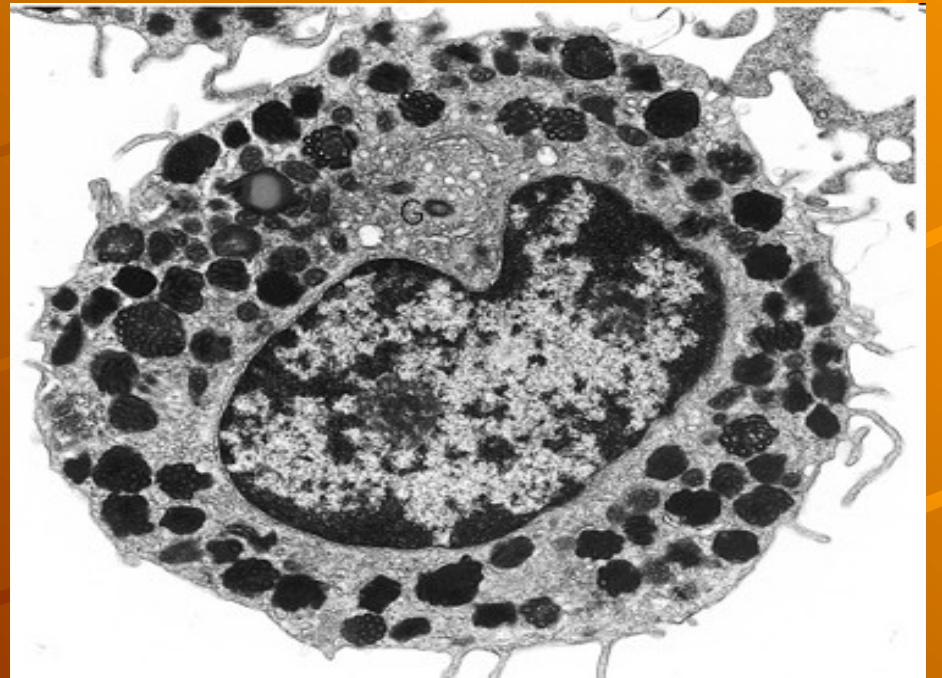


# Makrofág (plíce)

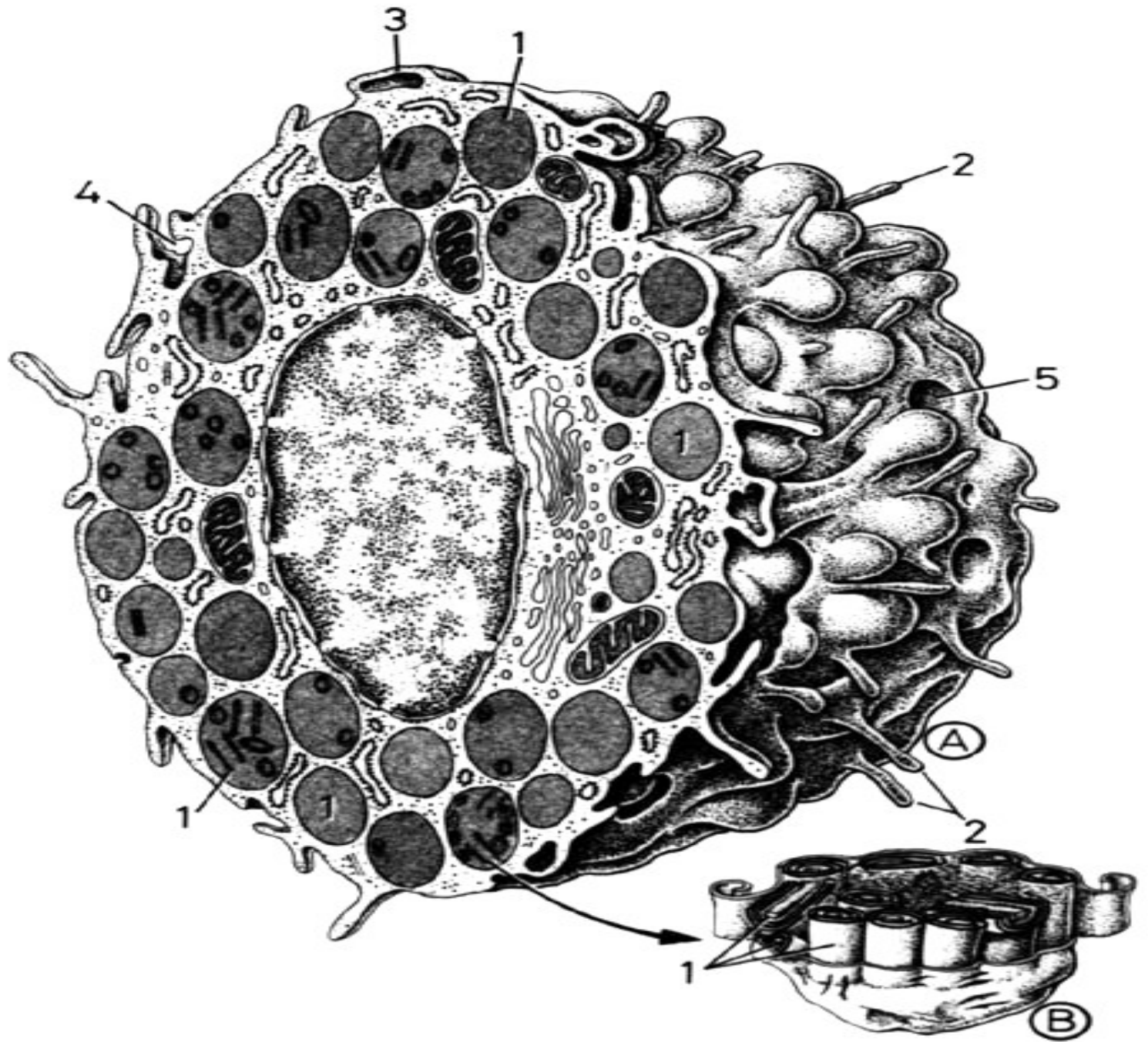


# Žírné buňky

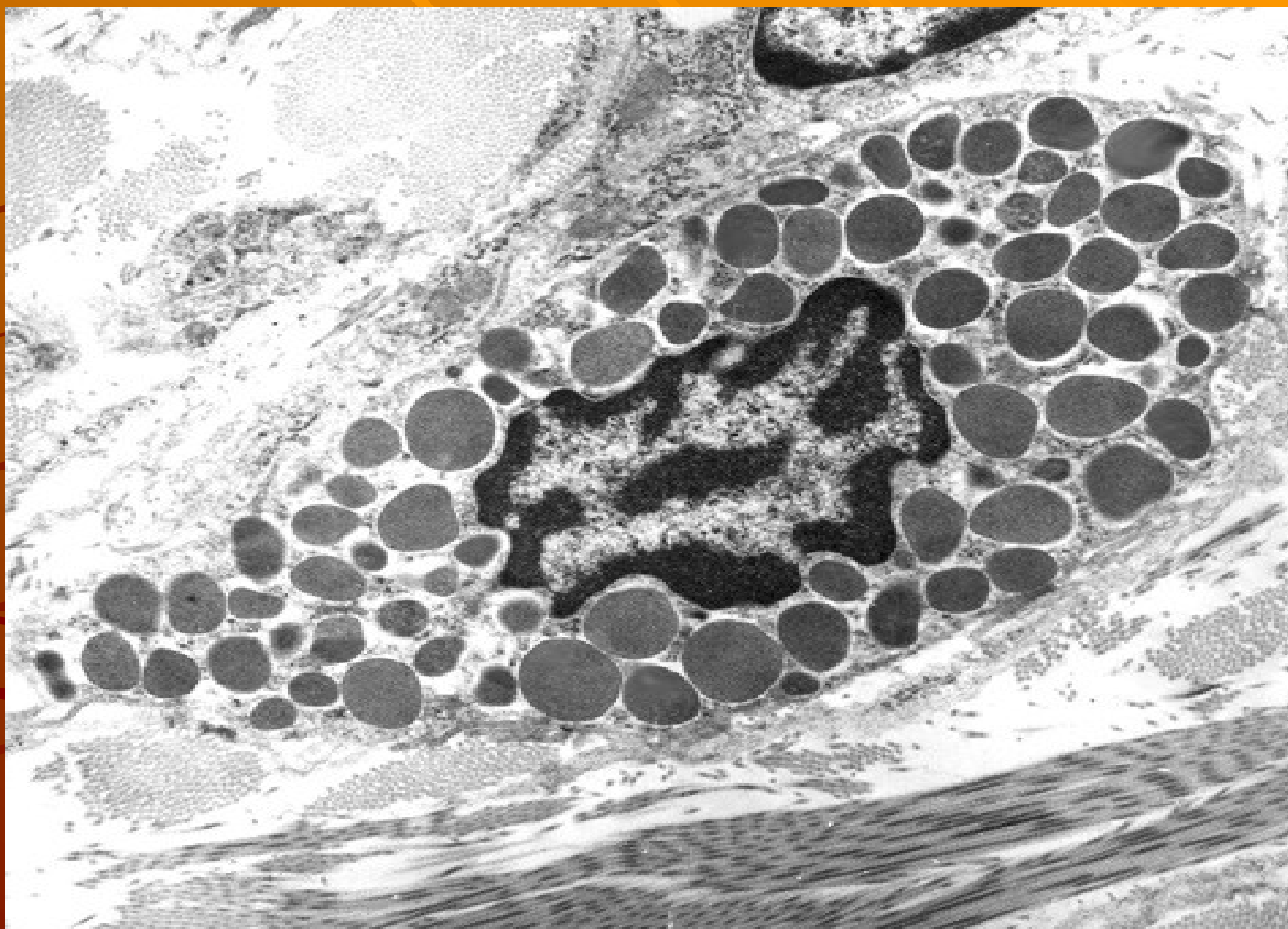
heparin, histamin  
– mediatory zánětu





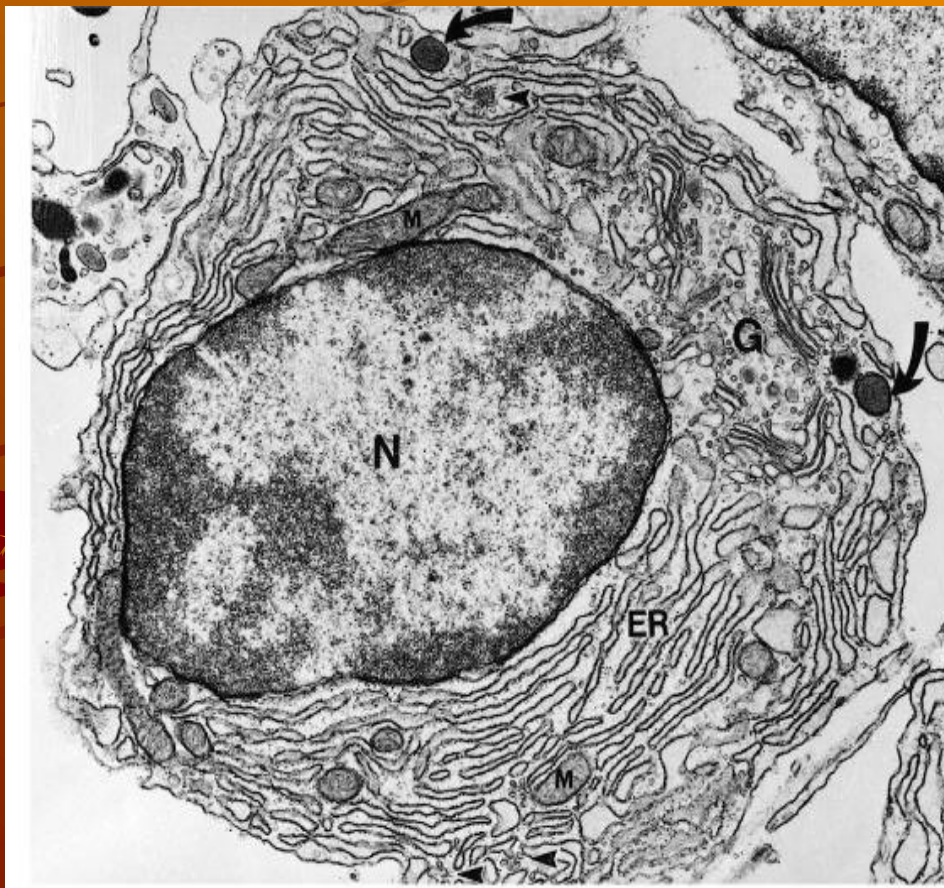


# Žírná buňka

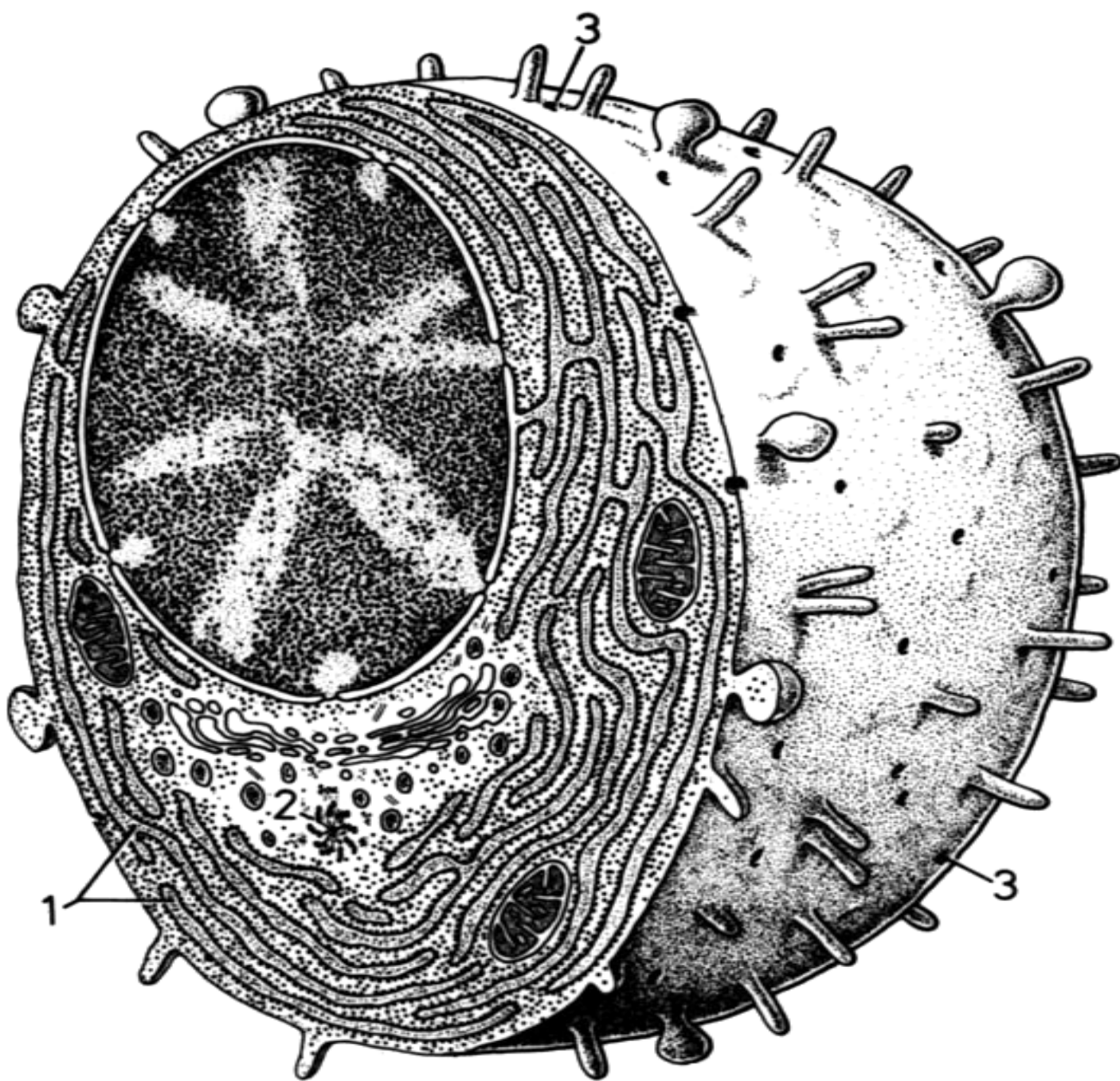


# Plazmatické buňky (vznikají z B-lymfocytů)

Tvoří protilátky (imunoglobuliny)

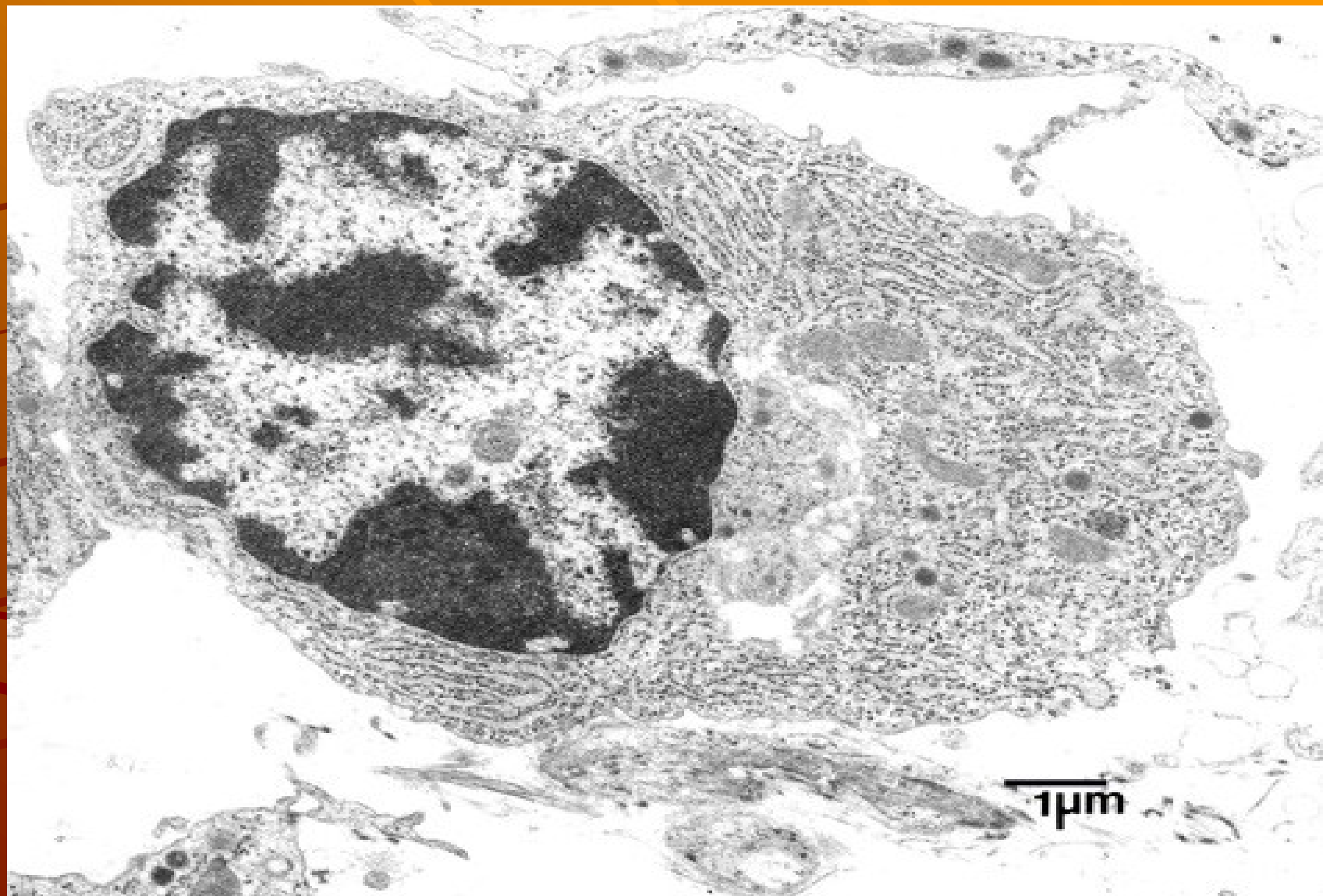


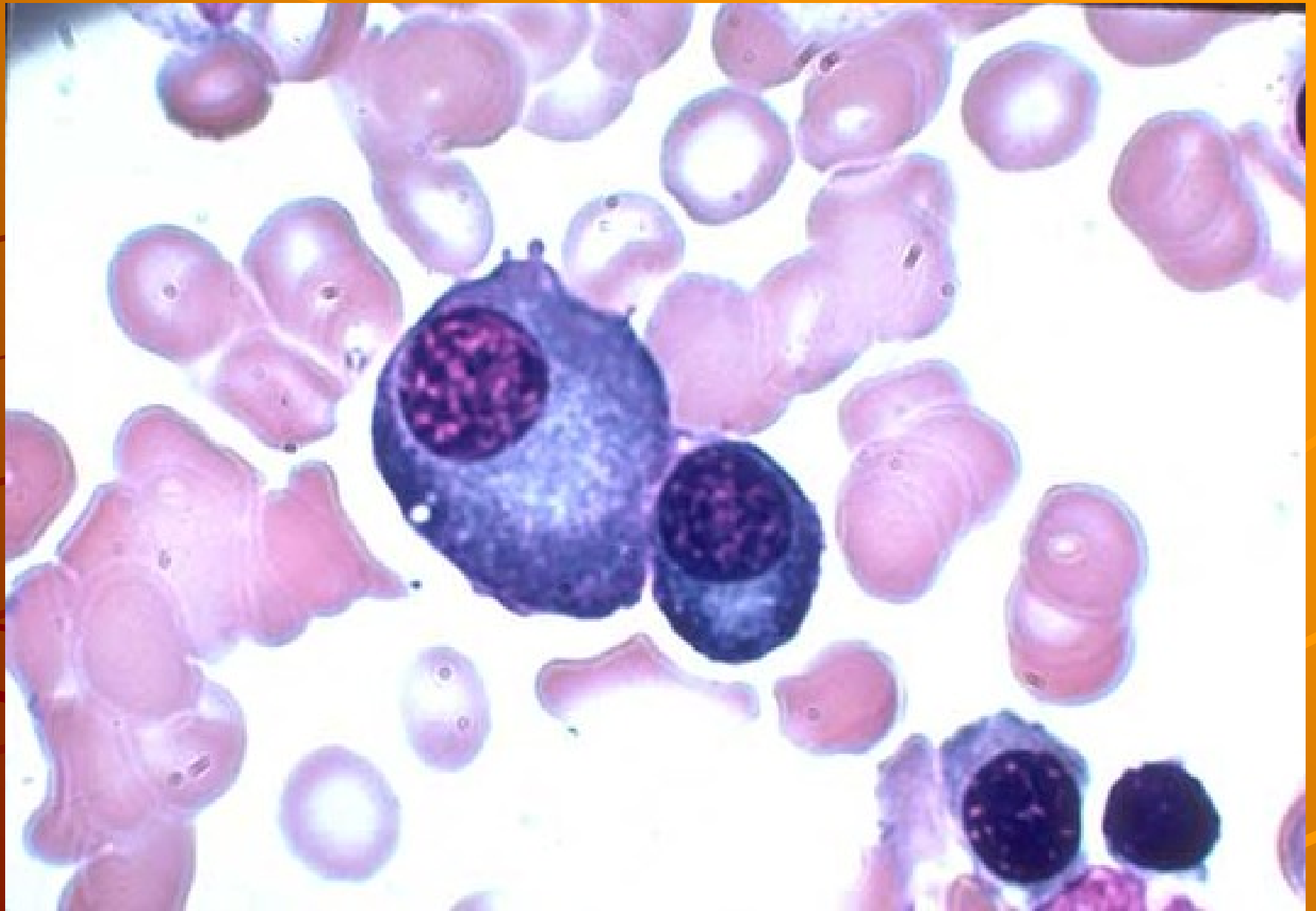






# Plazmatická buňka





# Základní amorfní substance

Homogenní, bezbarvá, transparentní, rosolovitá

 **glykosaminoglykany** (kys.hyaluronová, chondroitinsulfát, dermatansulfát, keratansulfát, heparansulfát)

 **proteoglykany** (syndecan, fibroglycan, agrecan)

 **glykoproteiny** (fibronektin, laminin, chondronektin, osteonektin, osteopontin)

 **H<sub>2</sub>O, ionty**



# GLYKOSAMINOGLYKANY (kyselé mukopolysacharidy)

- ◆ ***Lineární polymery hexosaminů***  
(glukosamin, galaktosamin) **a**  
***uronových kyselin*** (kys.glukuronová)
- ◆ *Nesulfatované* (kys. hyaluronová)
- ◆ *Sulfatované* (chondroitin 4- a 6- sulfát,  
dermatansulfát, keratansulfát,  
heparansulfát)

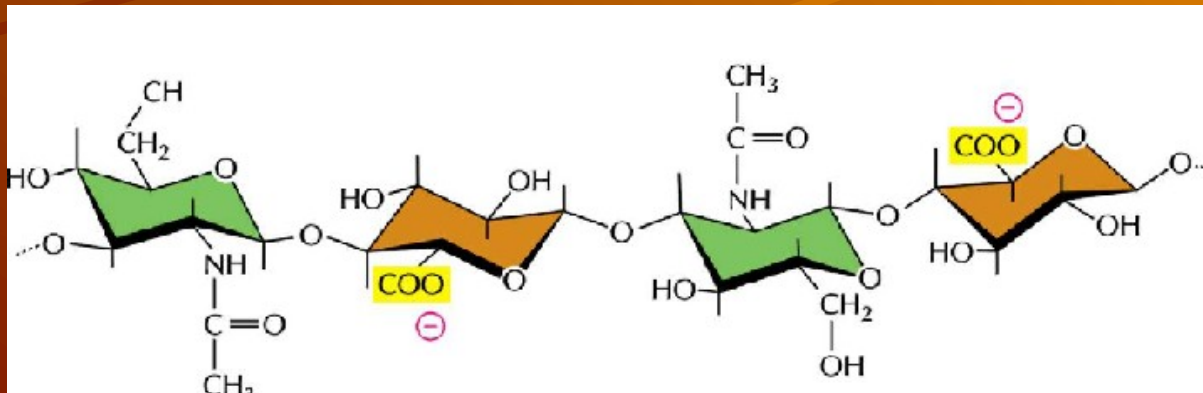
# Glykosaminoglykany nesulfatované

## ◆ HYALURONOVÁ kyselina

■ N-acetylglukosamin a glukuronová kys.

■ Výskyt:

- ◆ Rosolovité vazivo pupečníku
- ◆ Komorový mok
- ◆ Synoviální tekutina



# Glykosaminoglykany sulfatované

- ◆ Chondroitin 4-sulfát

- ◆ Chondroitin 6-sulfát

- ◆ Chrupavka, kost, velké cévy

- ◆ Dermatansulfát

- ◆ Kůže, šlachy, srdeční svalovina

- ◆ Keratansulfát

- ◆ Typ I – stroma rohovky

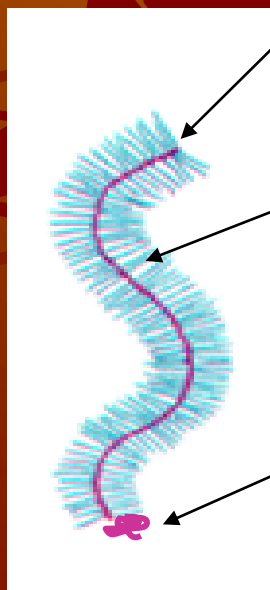
- ◆ Typ II – chrupavka a disci intervertebrales





# PROTEOGLYKANY

- ◆ Bílkoviné jádro + sulfatované GAG
- ◆ Aggrecan - chrupavka
- ◆ Syndecan
- ◆  roglycan



řetězce GAG

protein jádra  
N-konec



C-konec  
proteinu jádra  
proteoglykanu

vazebný  
glykoprotein

hyaluronát



# GLYKOPROTEINY

liší se strukturně od proteoglykanů  
proteinové jádro + oligosacharidy

- ◆ Fibronektin
- ◆ Chondronektin
- ◆ Laminin
- ◆ Osteokalcin, osteopontin

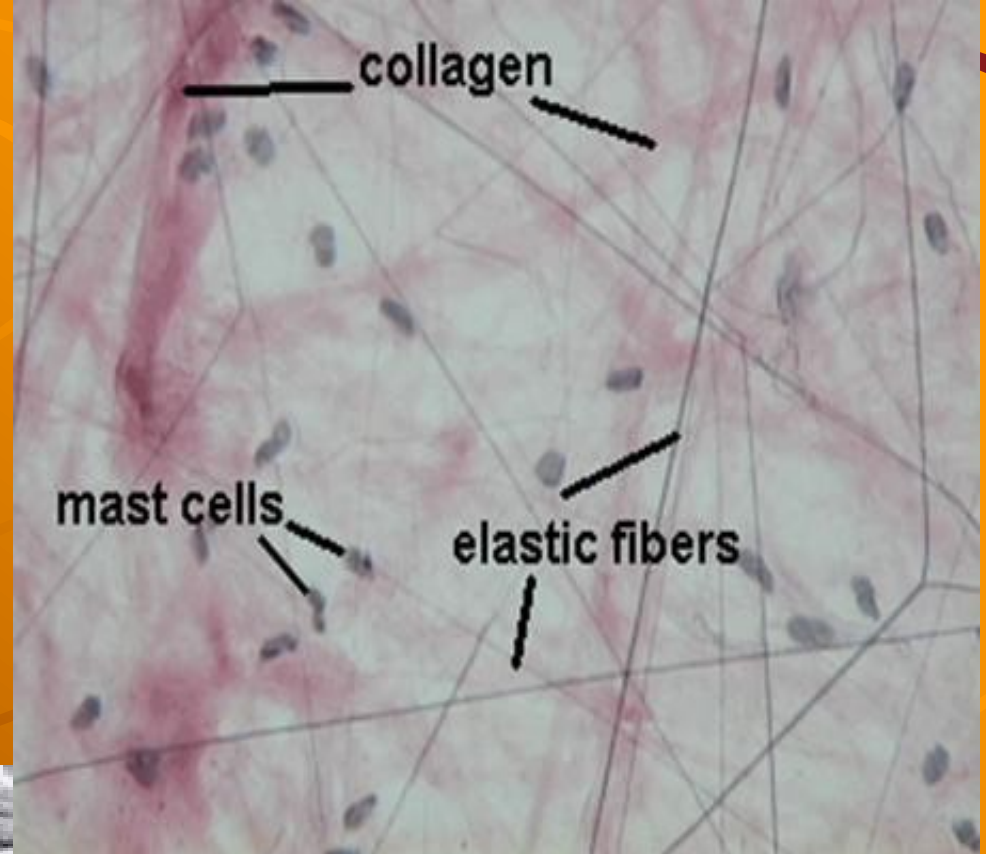
# Vlákná

polypeptidové řetězce

✚ kolagenní

✚ retikulární

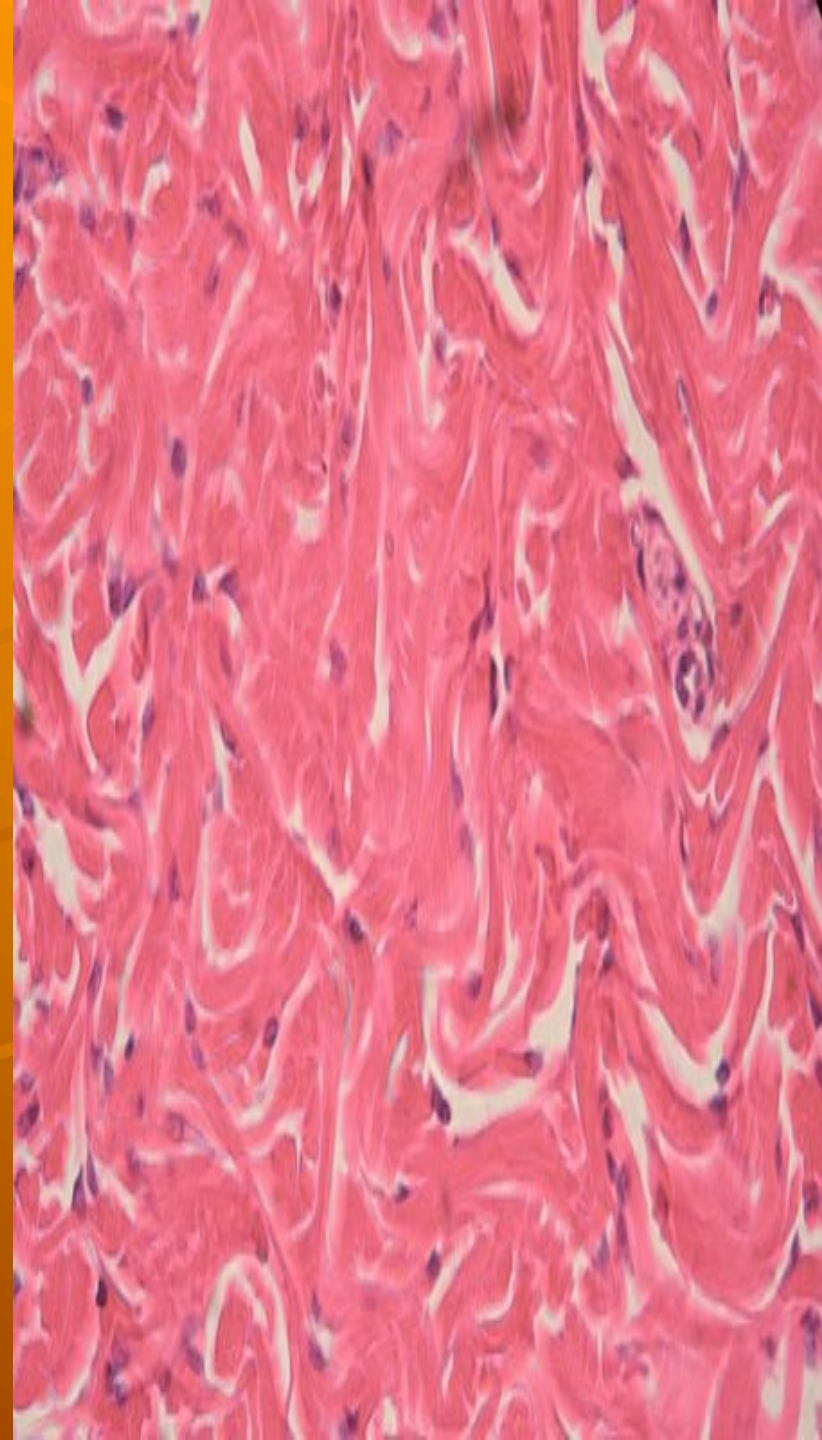
✚ elastická

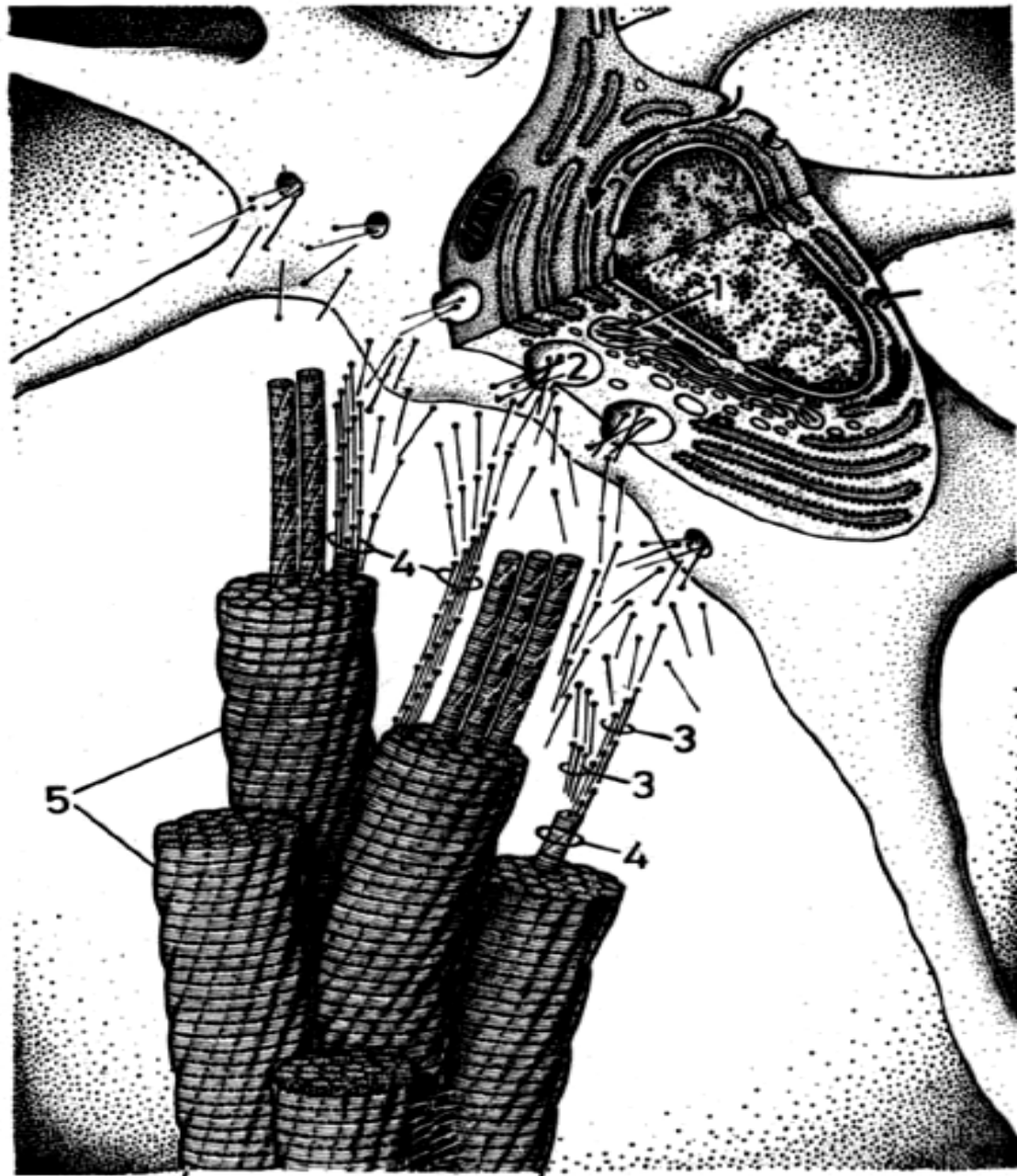




# Kolagenní vlákna

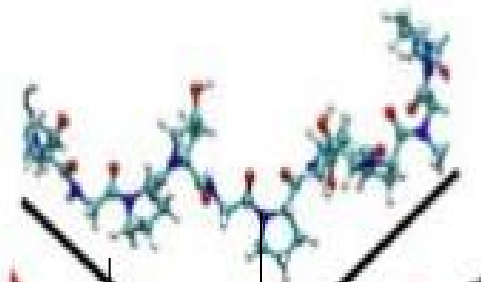
- „bílá“, pevná a silná, nepružná
- 1 – 20  $\mu\text{m}$   $\varnothing$
- kolagen
- ve svazcích
- kolagenáza – digestivní enzym
- varem denaturují - kliš
- acidofilní (HE – růžově, kyselý fuchsin – červeně, šafrán – žlutě, anilinová modř – modře)





# Kolagenní vlákna

amino acids  
~1 nm



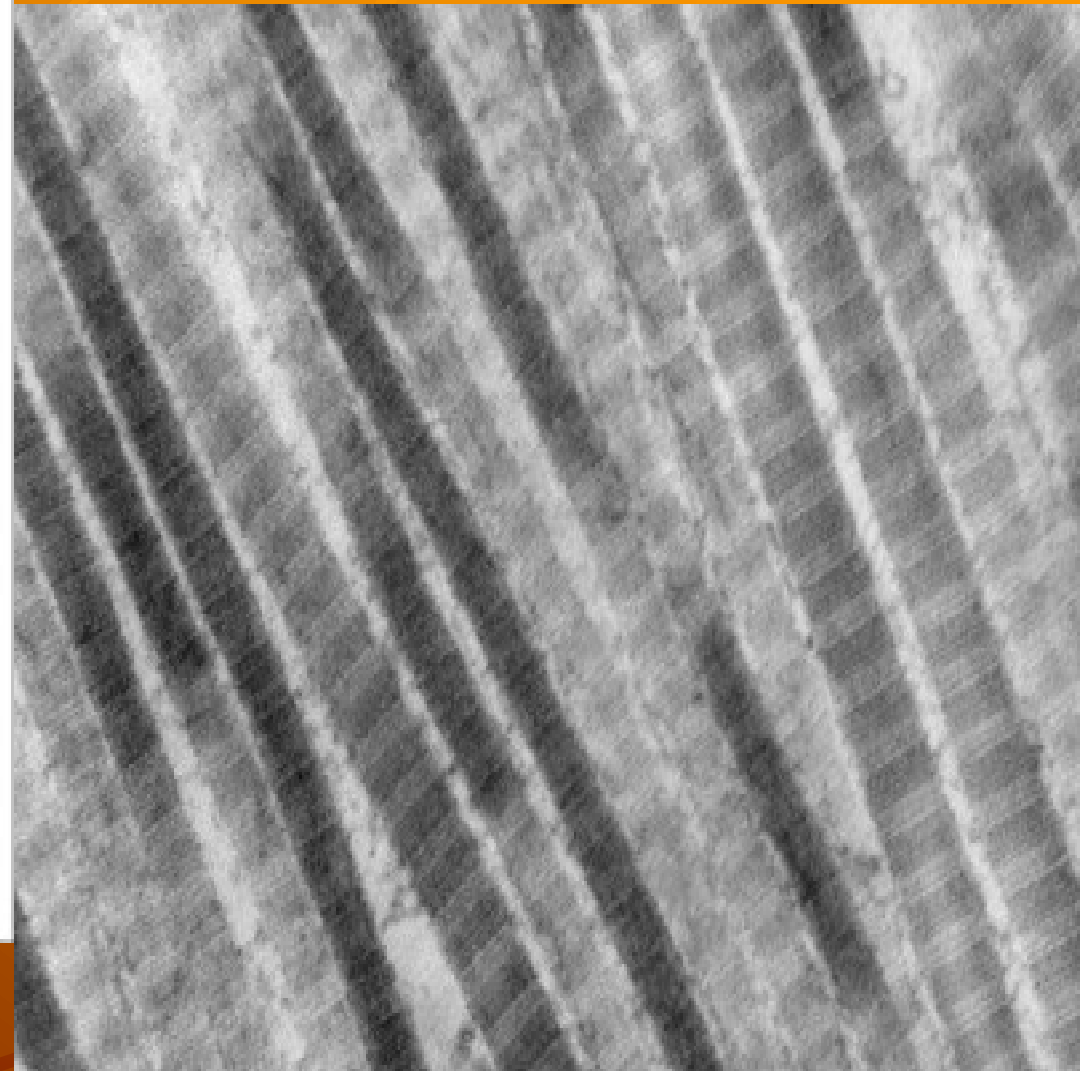
tropocollagen  
~300 nm



fibrils  
~1 μm



fibers  
~10 μm

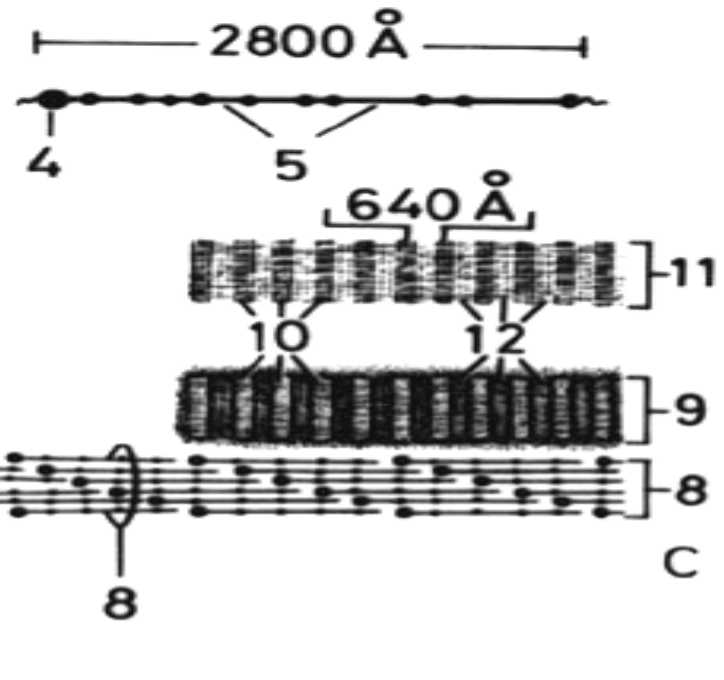
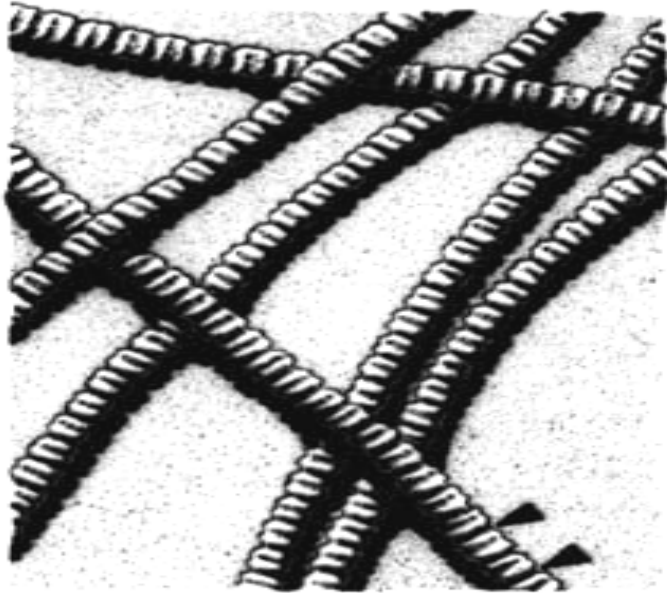
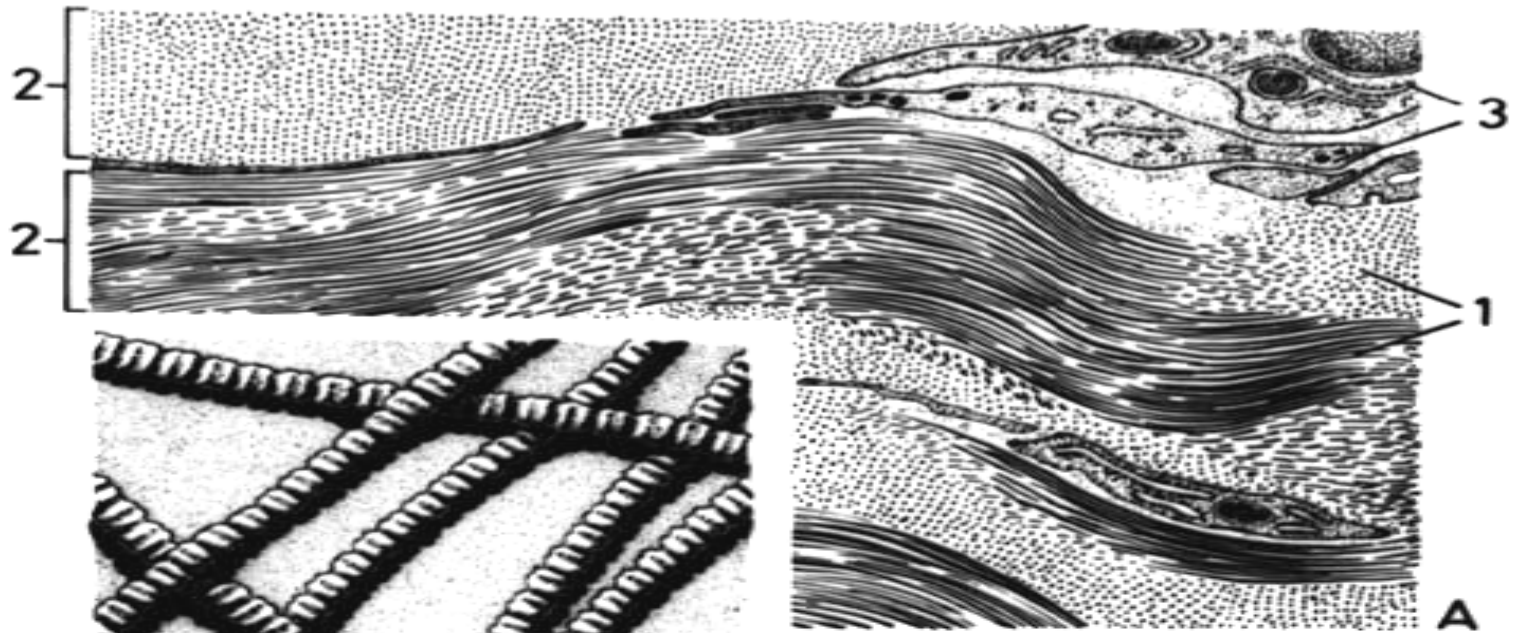


50 nm

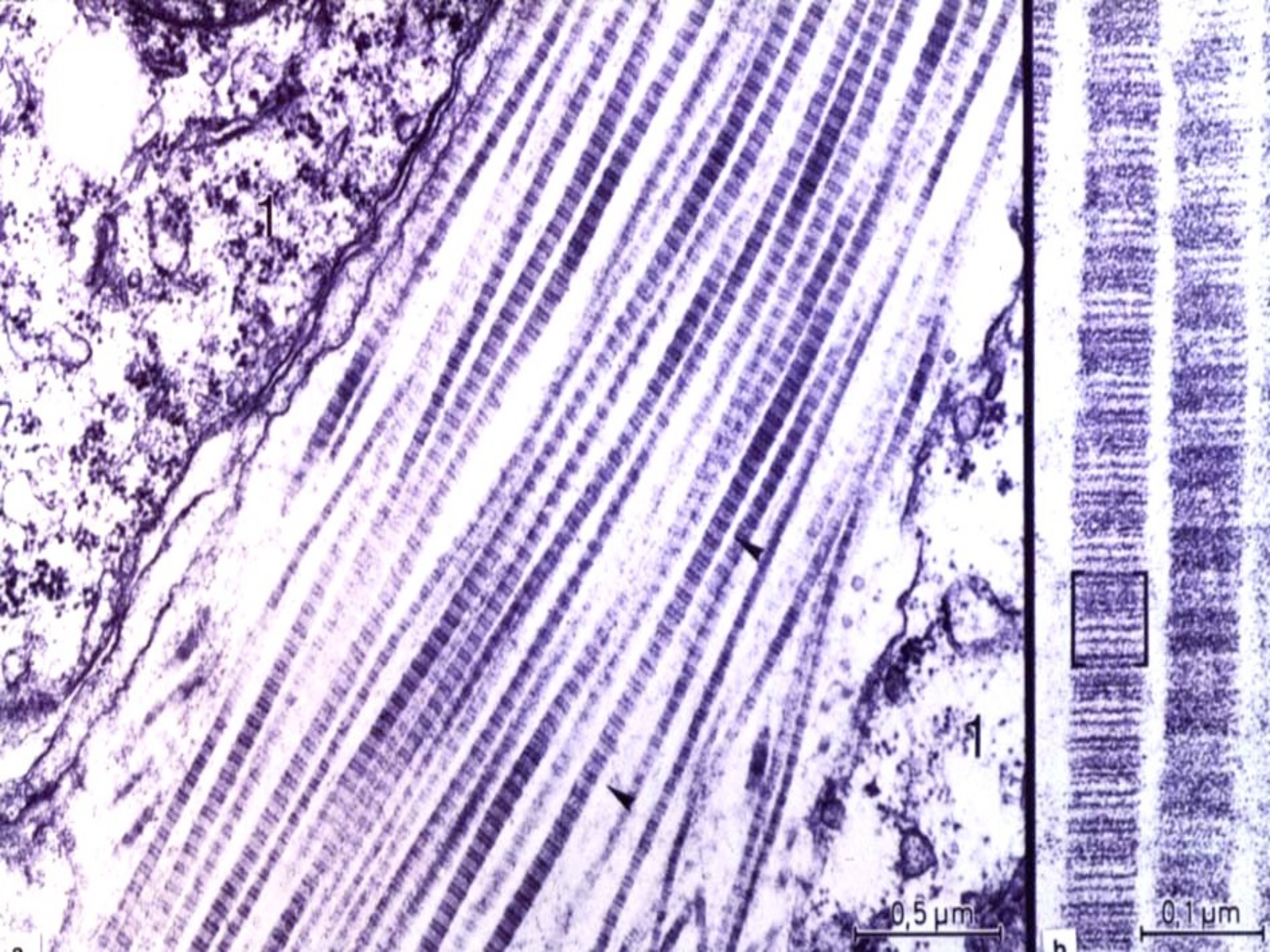
OWLungTEM

1/7/0 REMF











# Typy kolagenu

## výskyt a produkující buňky

I – nejčastější – fibroblasty, osteoblasty, odontoblasty

II – v chrupavce – chondroblasty

III – retikulární vlákna – retikulární bb.

IV – „amorfní“, netvoří vlákna – epitelové bb.

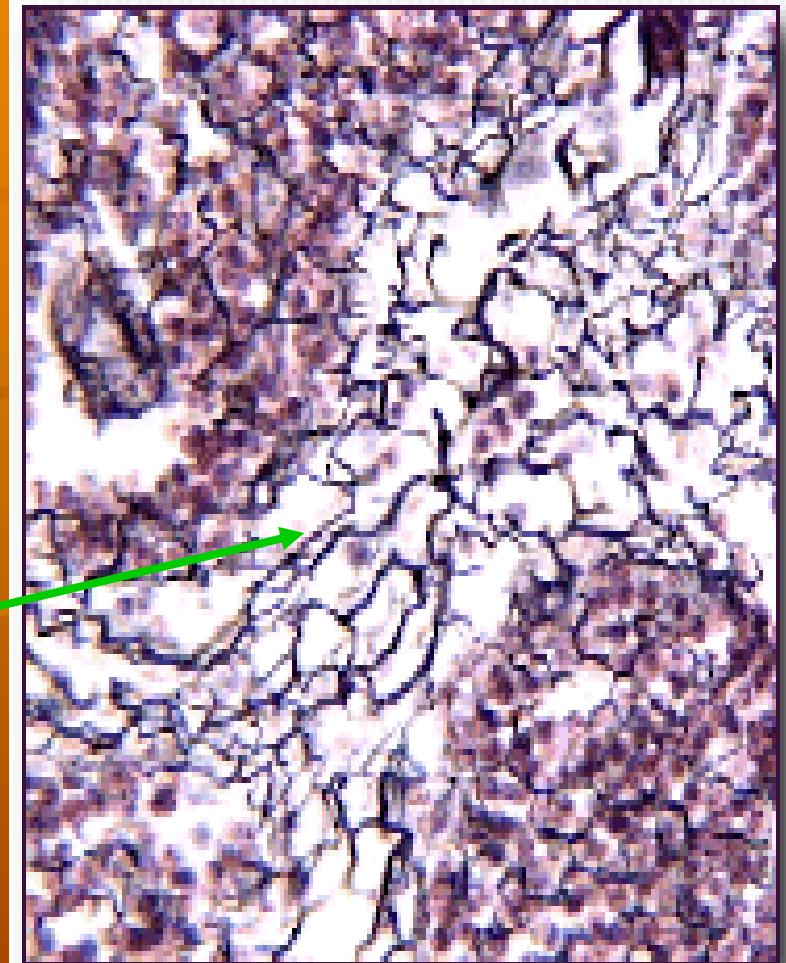
Cca 40 typů kolagenu





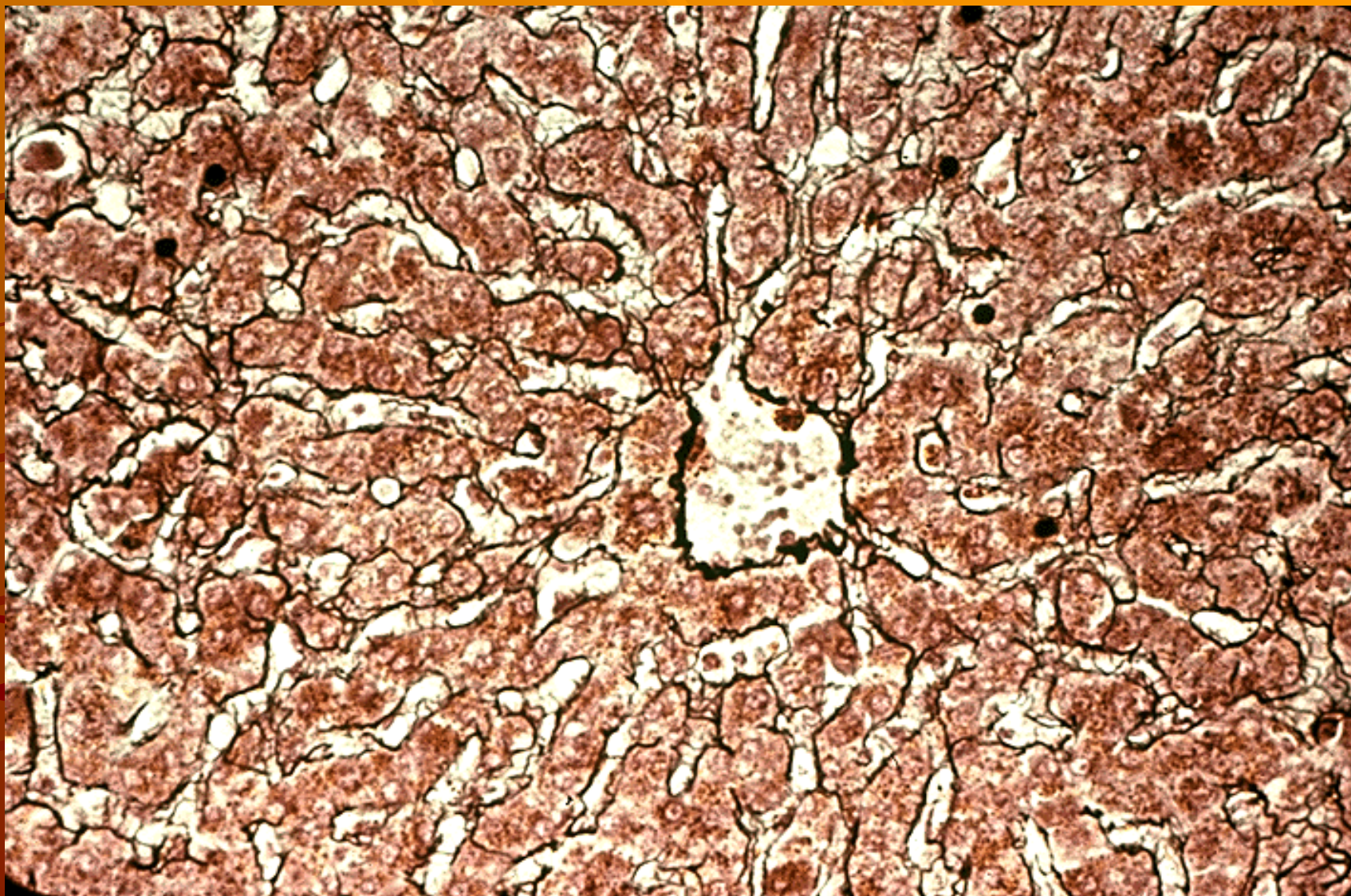
# Retikulární vlákna

- kolagen III
- jemná síť (reticulum) = podpůrná složka měkkých tkání a síť pro jiné buňky (játra, kostní dřeň, lymfatické orgány)
- argyrofilie (impregnace solemi Ag)
- 0.5 – 2  $\mu\text{m}$   $\varnothing$





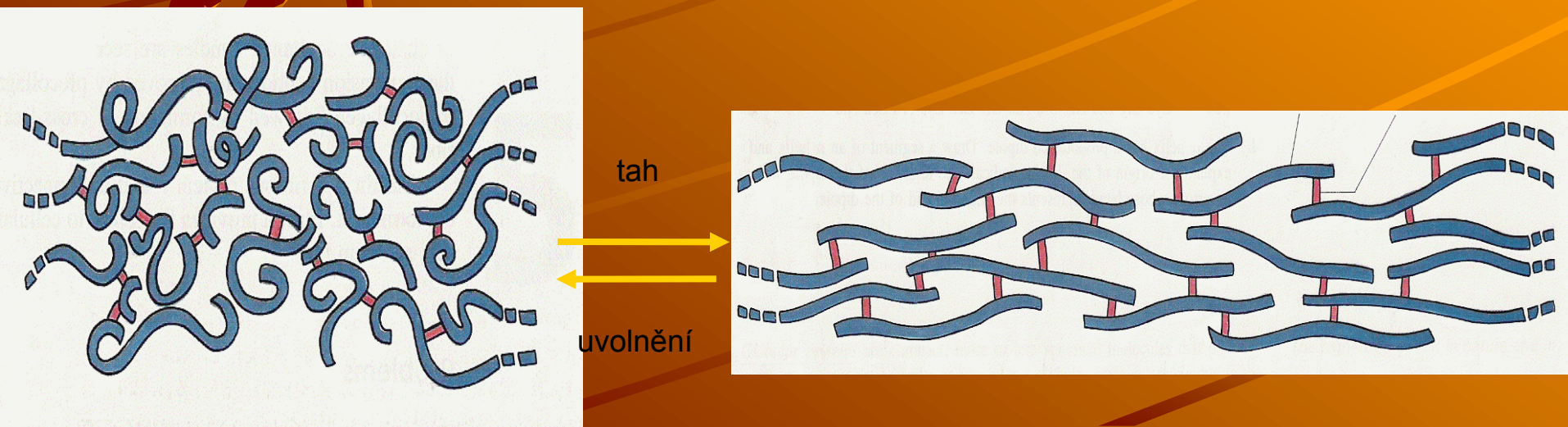
## Retikulární vlákna (játra)





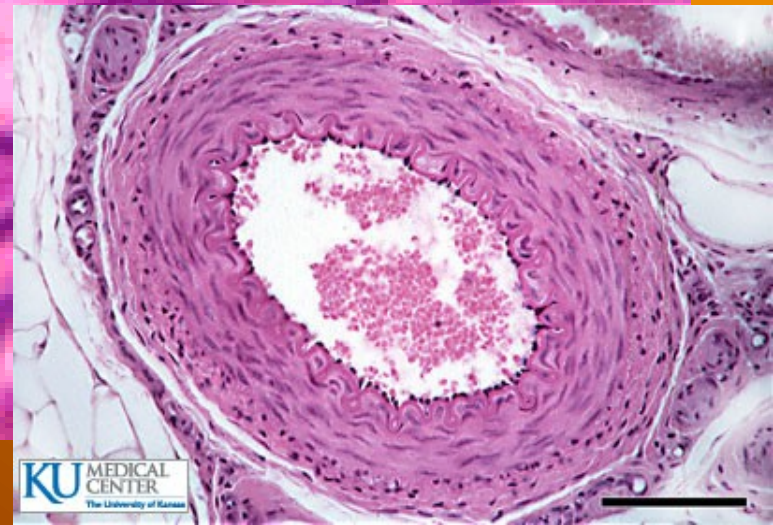
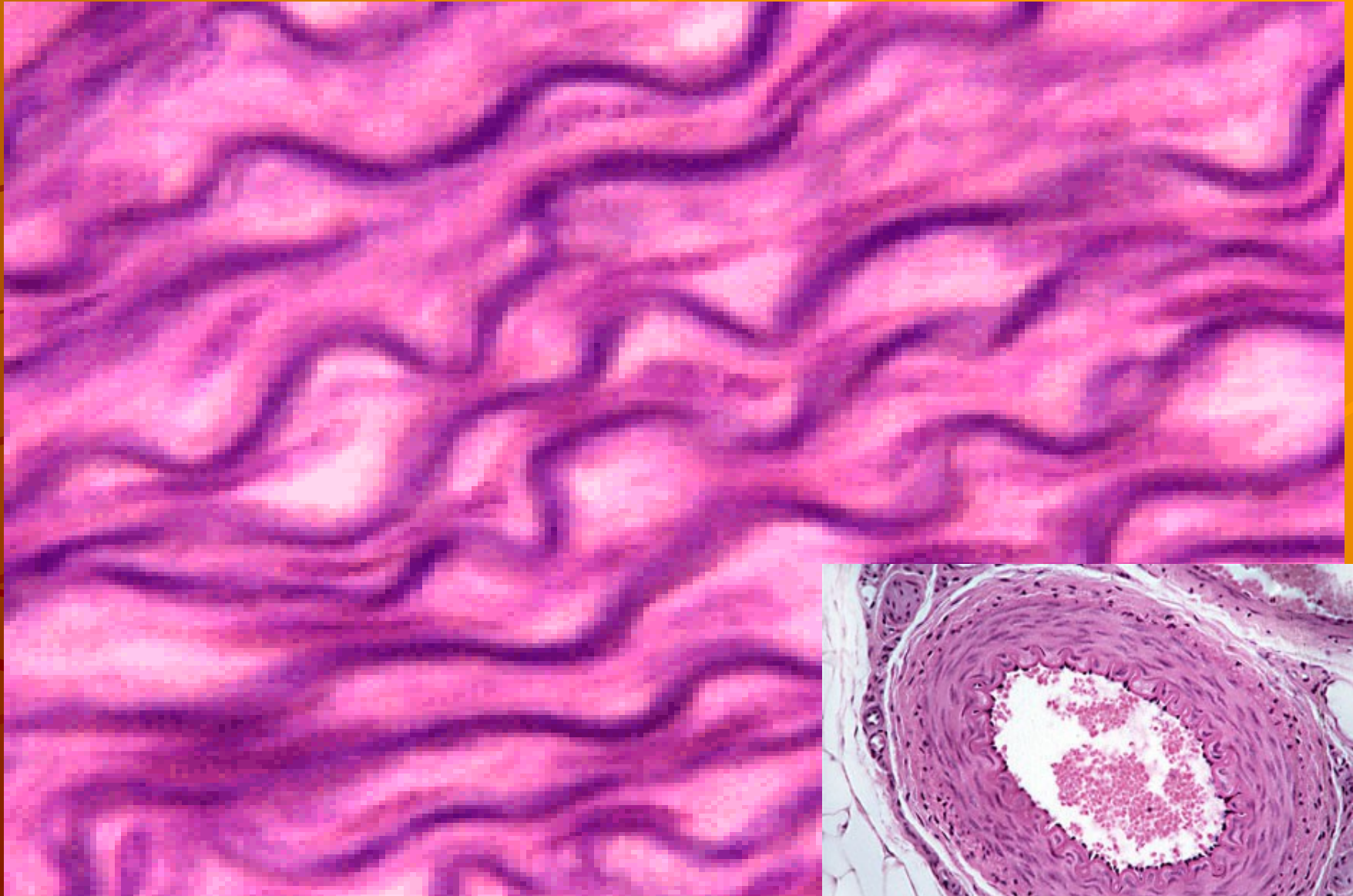
# Elastická vlákna

- „žlutá“ - protein elastin - produkt fibroblastů a hladkých svalových buněk ve stěně cév
- 1-4 (12)  $\mu\text{m}$   $\emptyset$
- prodloužení až 1.5 x,
- elasticita
- (orcein nebo resorcin-fuchsin)





# Svazky elastických vláken (stěna arterie)



# Výskyt:

Vazy

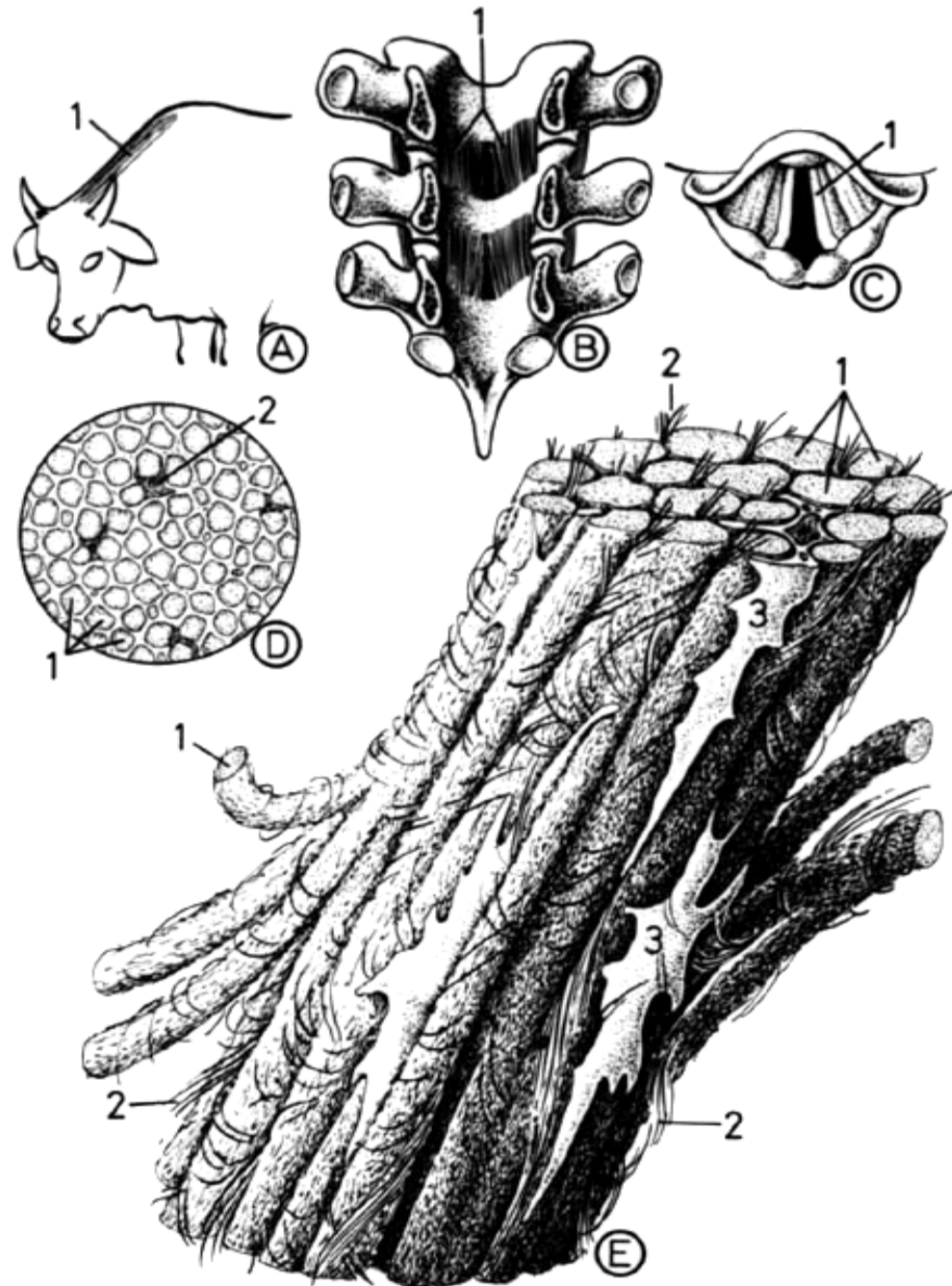
ligamenta flava

ligamenta vocalia

ligamentum nuchae

Stěna cév:

membranae fenestratae



# Klasifikace vaziv

■ Závisí na poměru a uspořádání buněk, vláken a zákl. amorfní hmoty:

■ zákl. hmota  $\Rightarrow$  „měkká konzistence“

■ vlákna  $\Rightarrow$  „tuhá konzistence“

■ uspořádání vláken  $\begin{cases} \rightarrow \text{pravidelné} \\ \rightarrow \text{nepravidelné} \end{cases}$



# Typy vaziv

■ Mezenchym

■ Rosolovité v. (Whartonův rosol)

■ Kolagenní v.

→ řídké

→ husté

→ neuspořádané

→ uspořádané

■ Retikulární v.

■ Elastické v.

■ Tukové v.

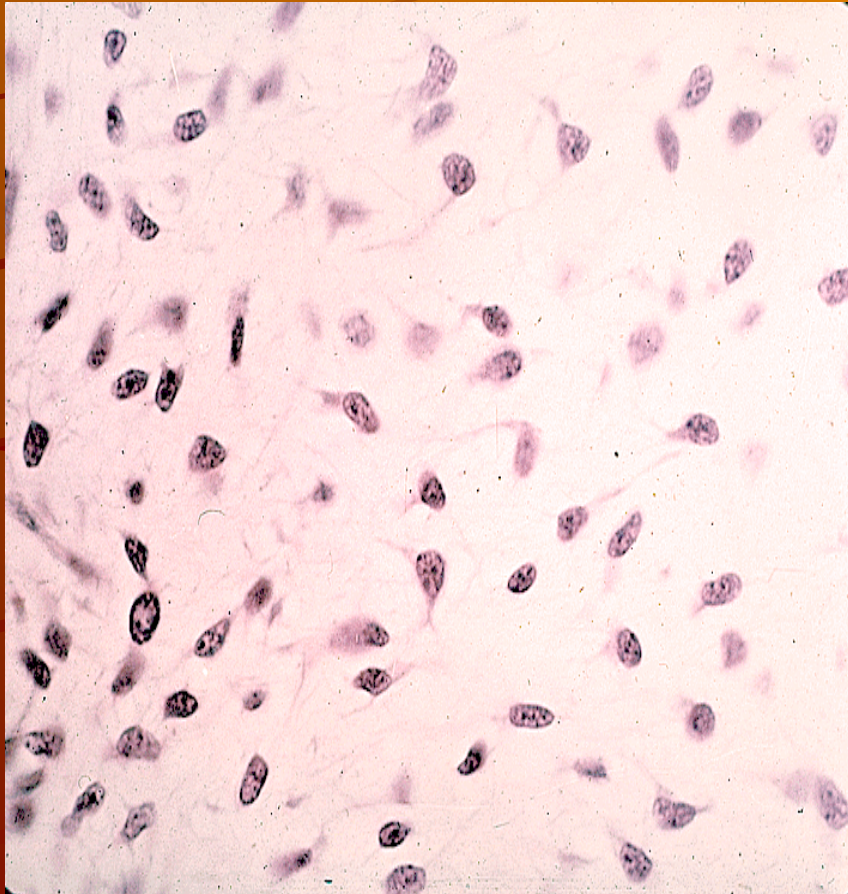
→ bílé

→ hnědé



# Mezenchym

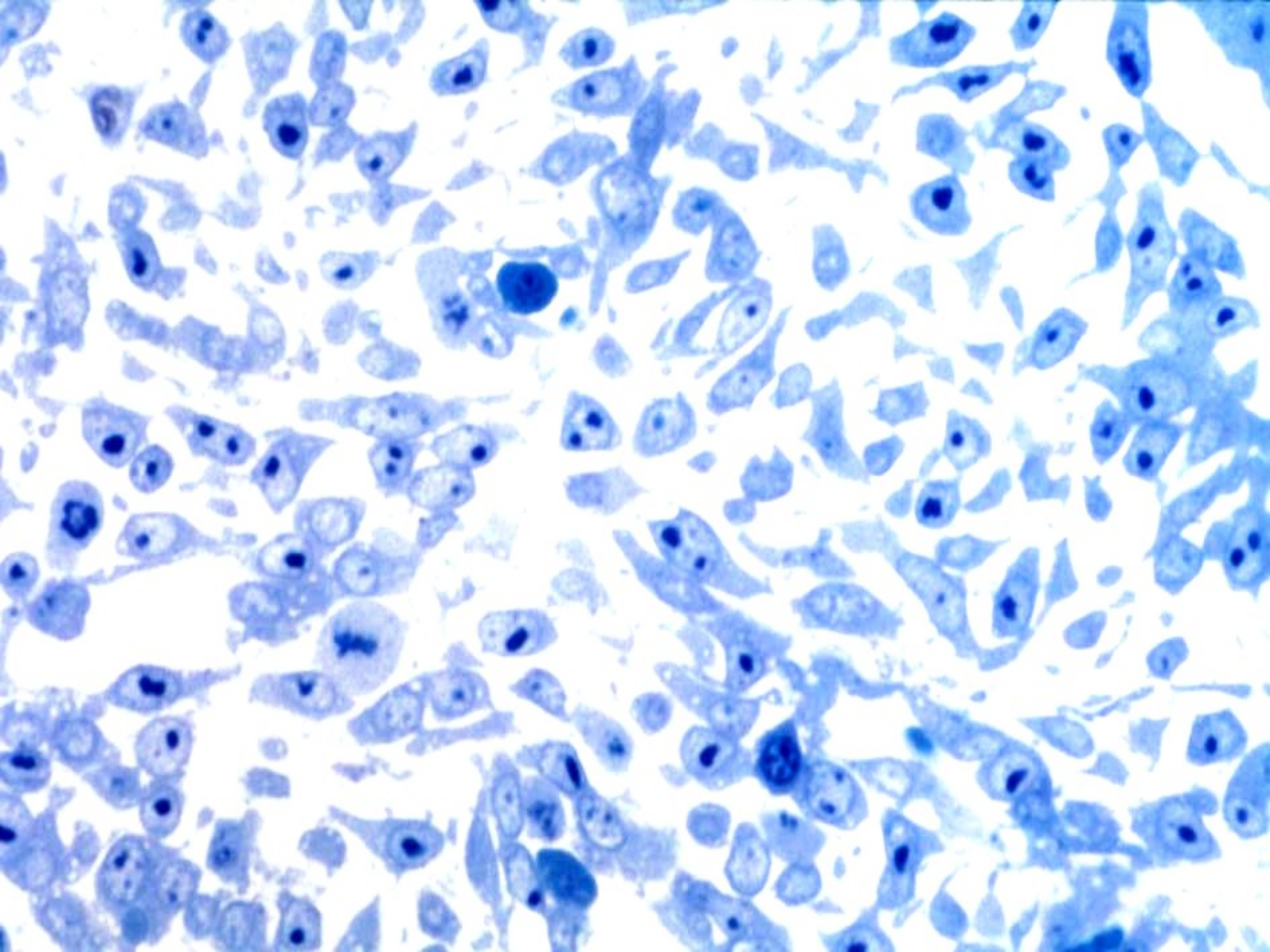
embryonální vazivo



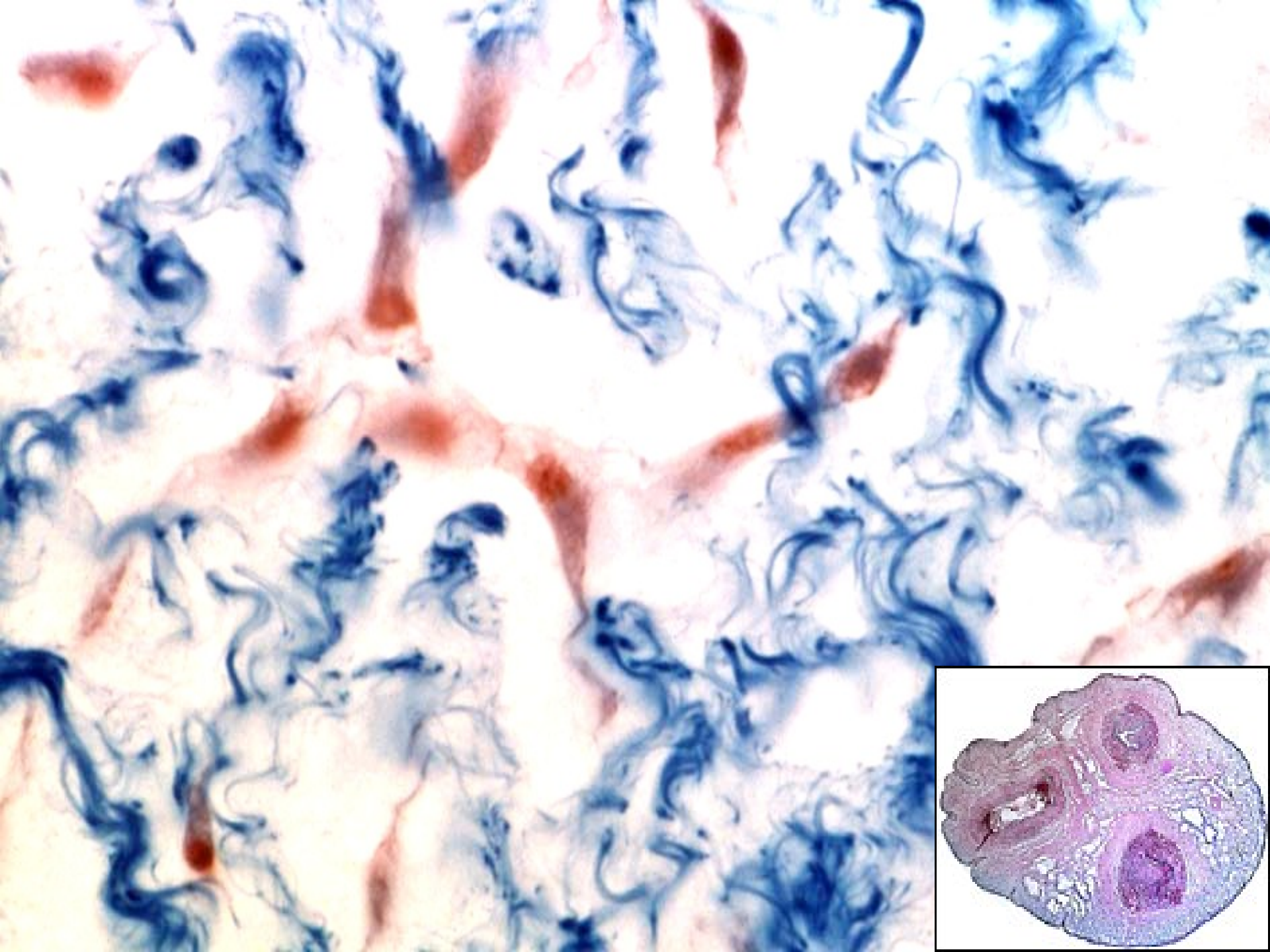
# Rosolovité v.

pupečník, zubní pulpa



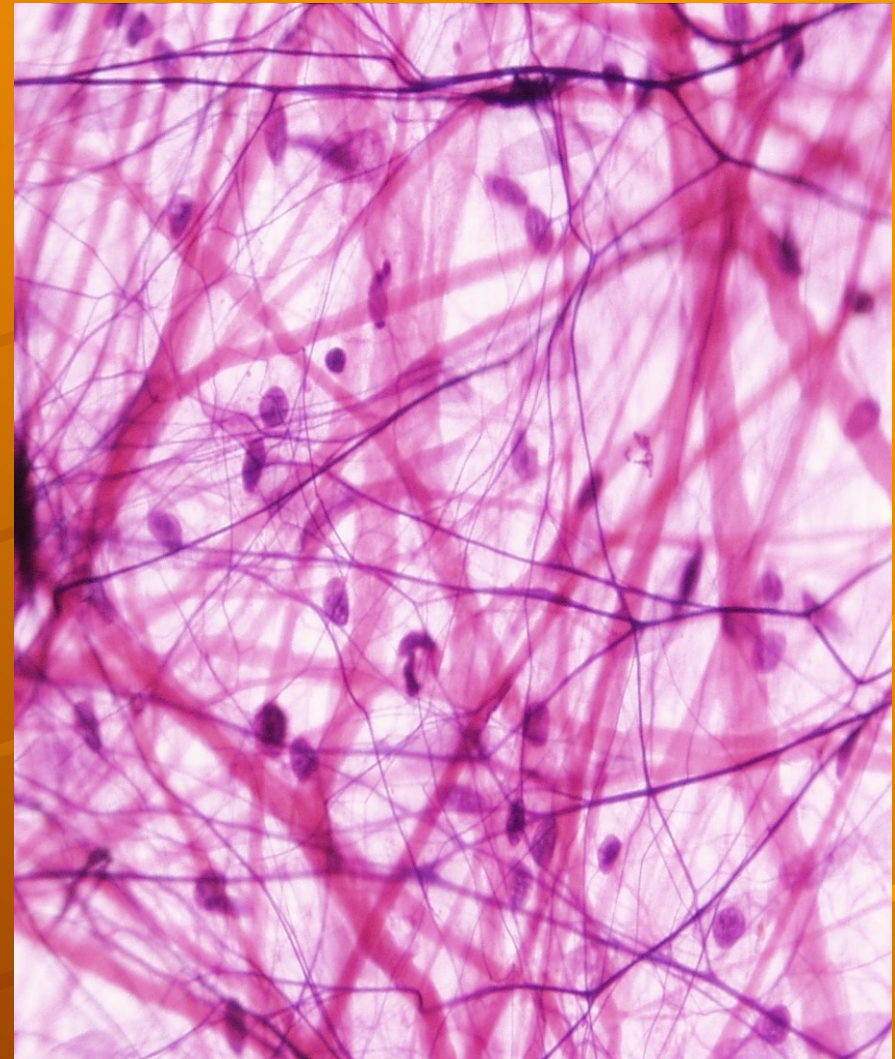
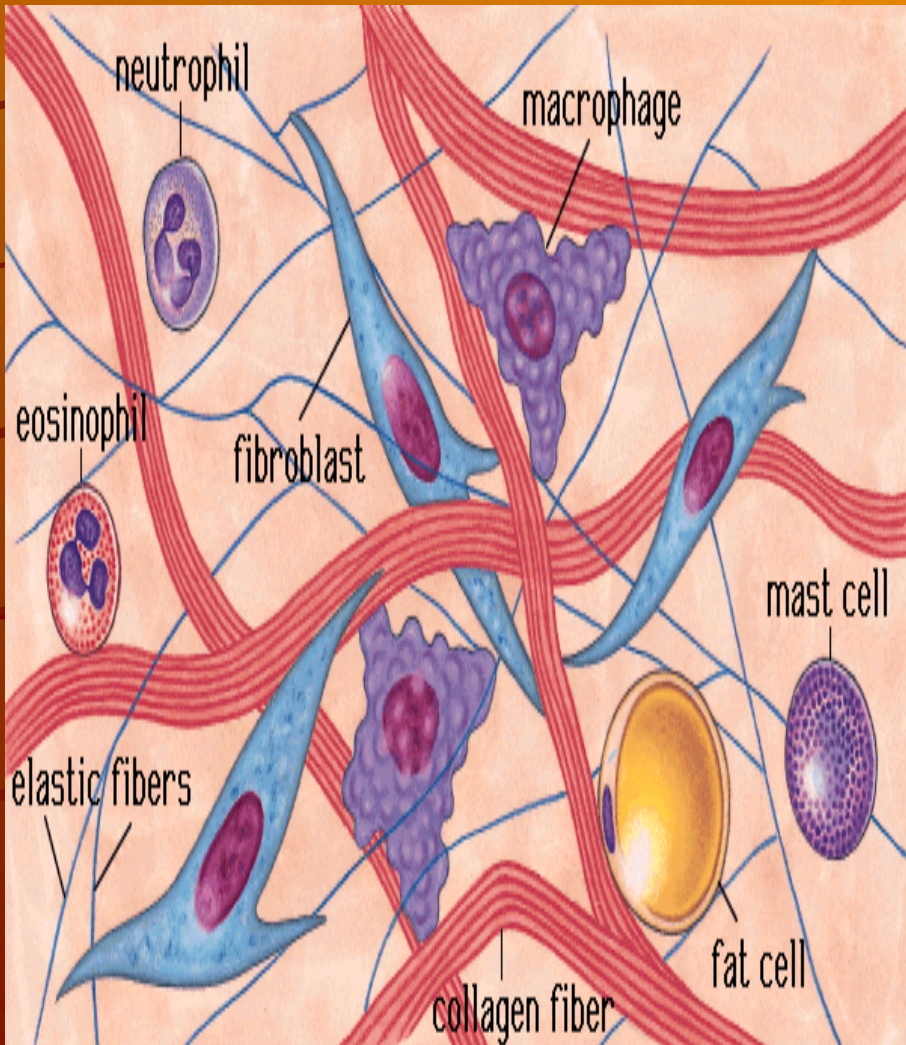








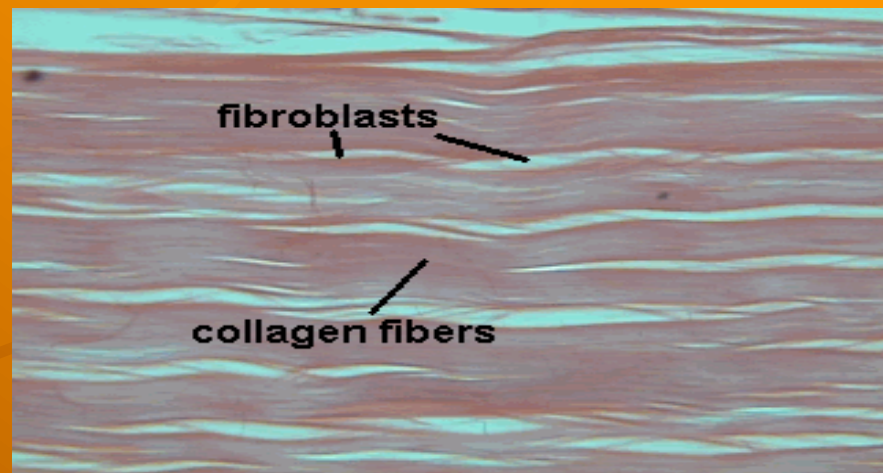
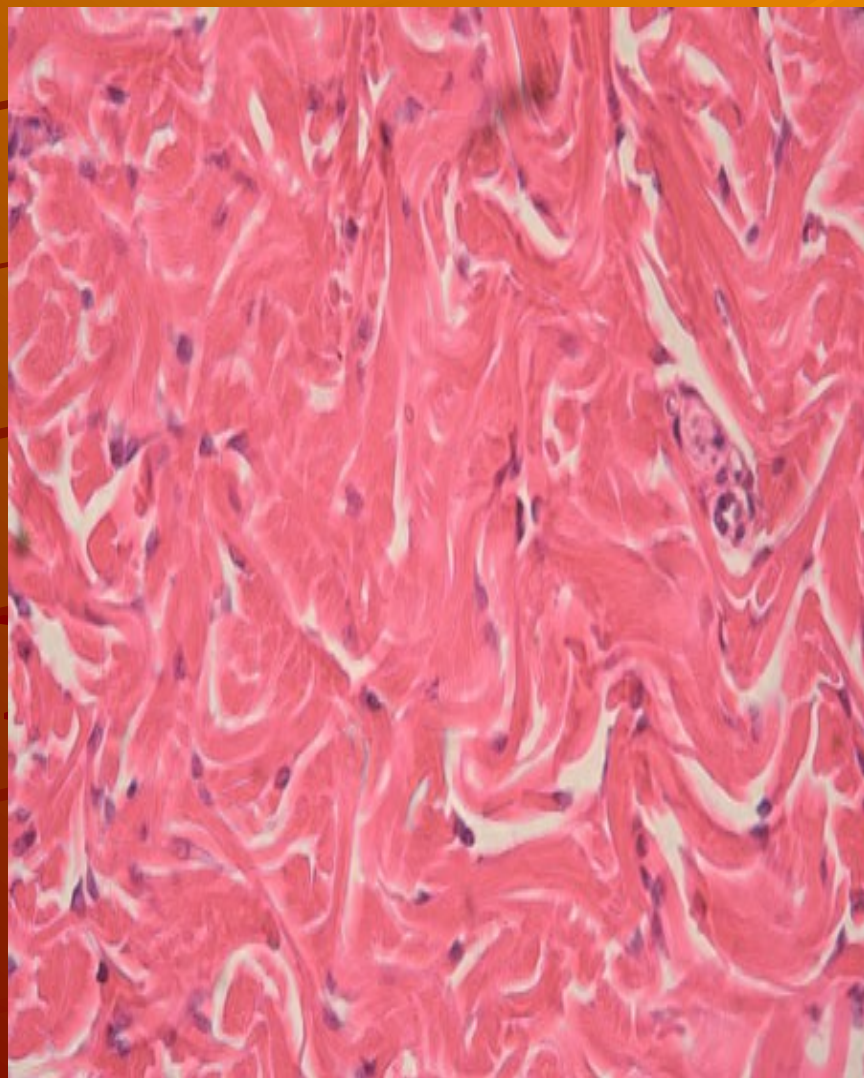
# Kolagenní v. řídké



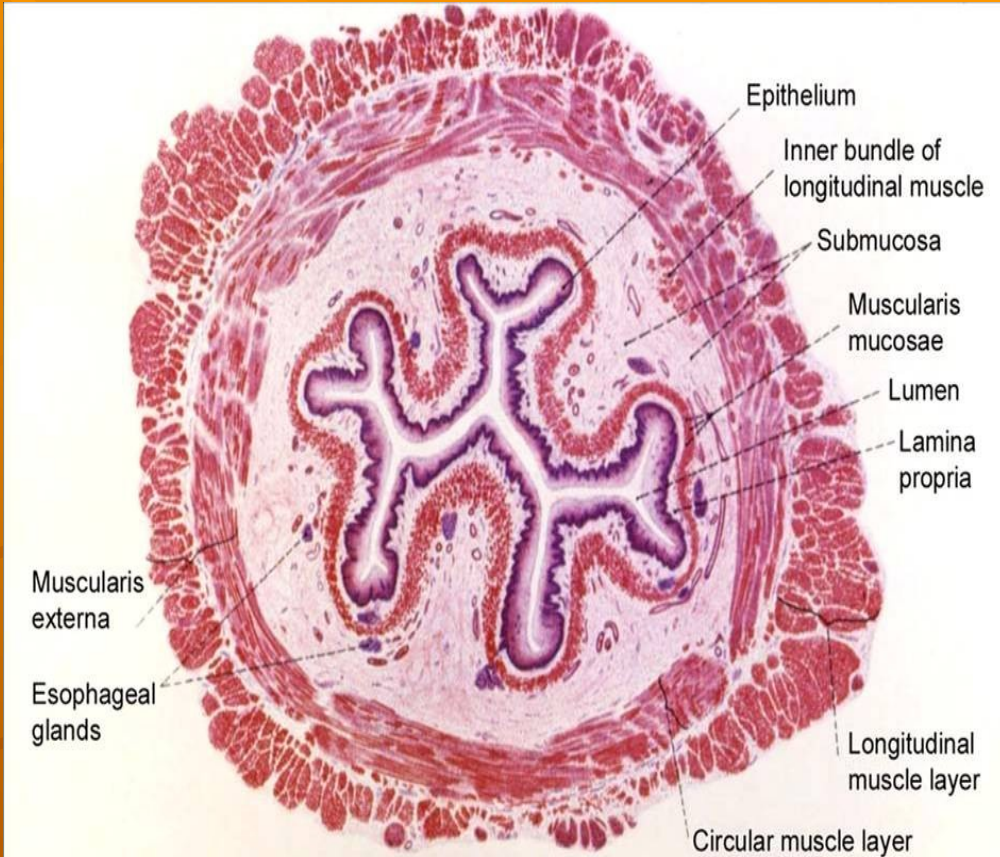
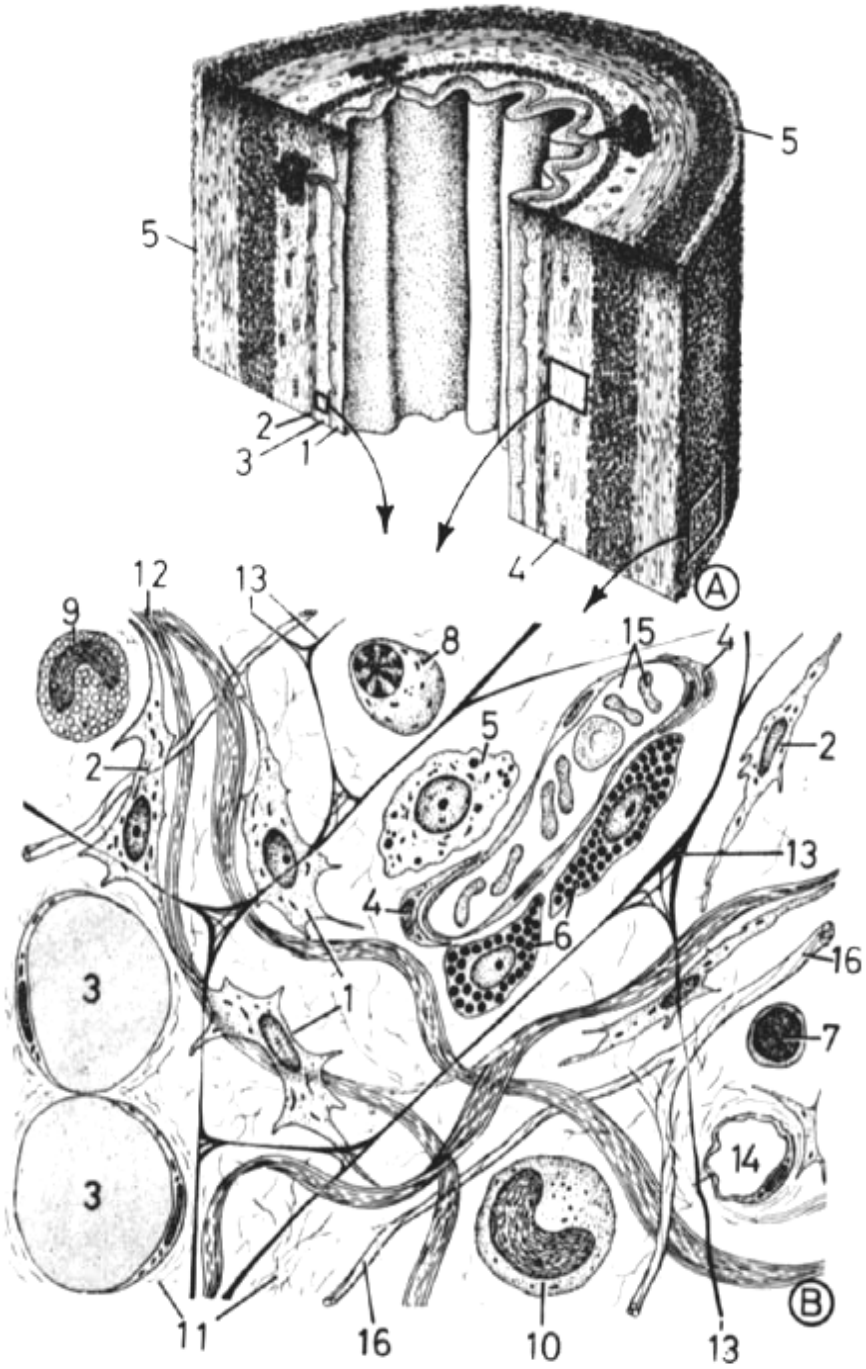


# Kolagenní v. husté

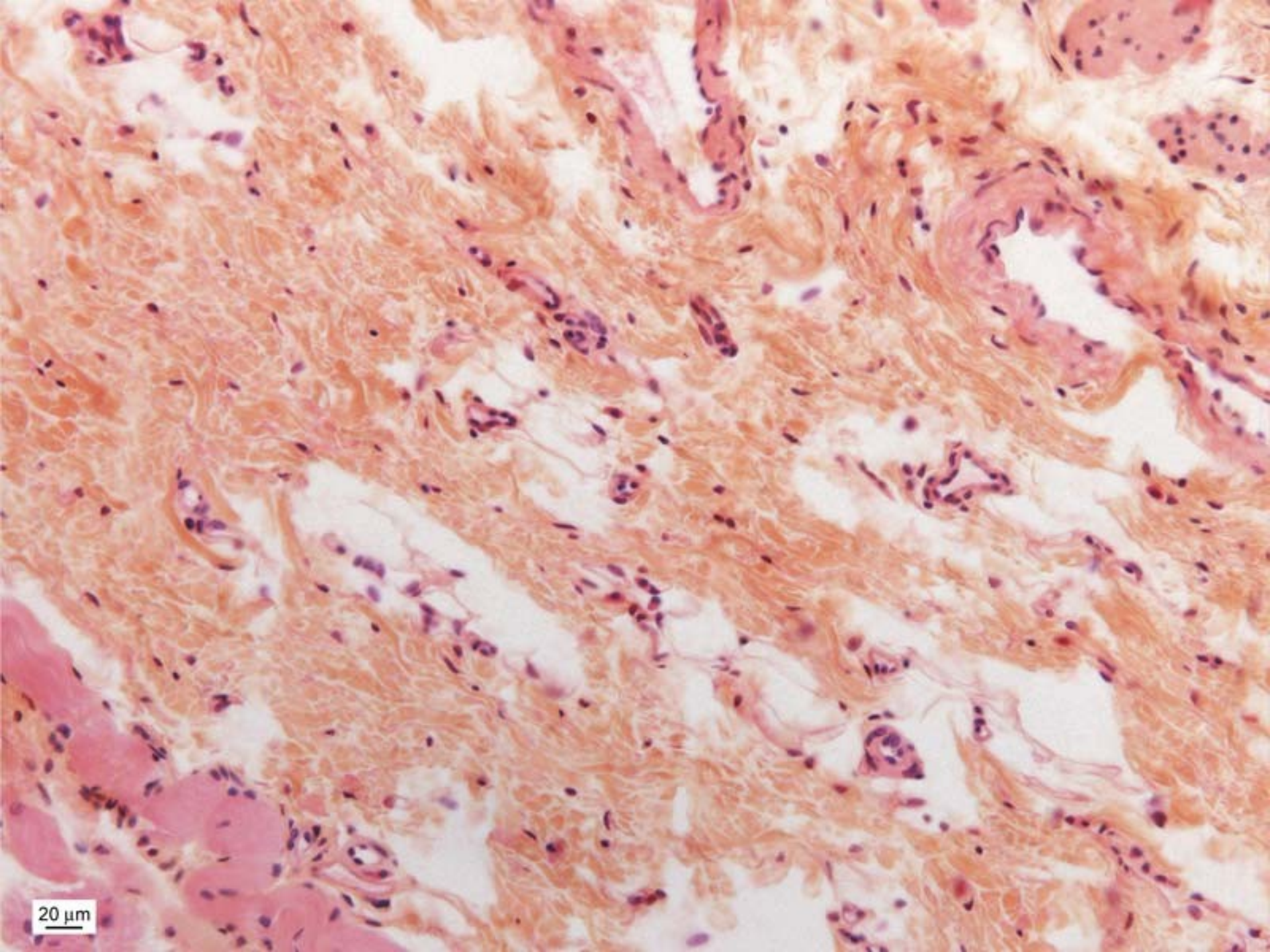
- neuspořádané
- uspořádané





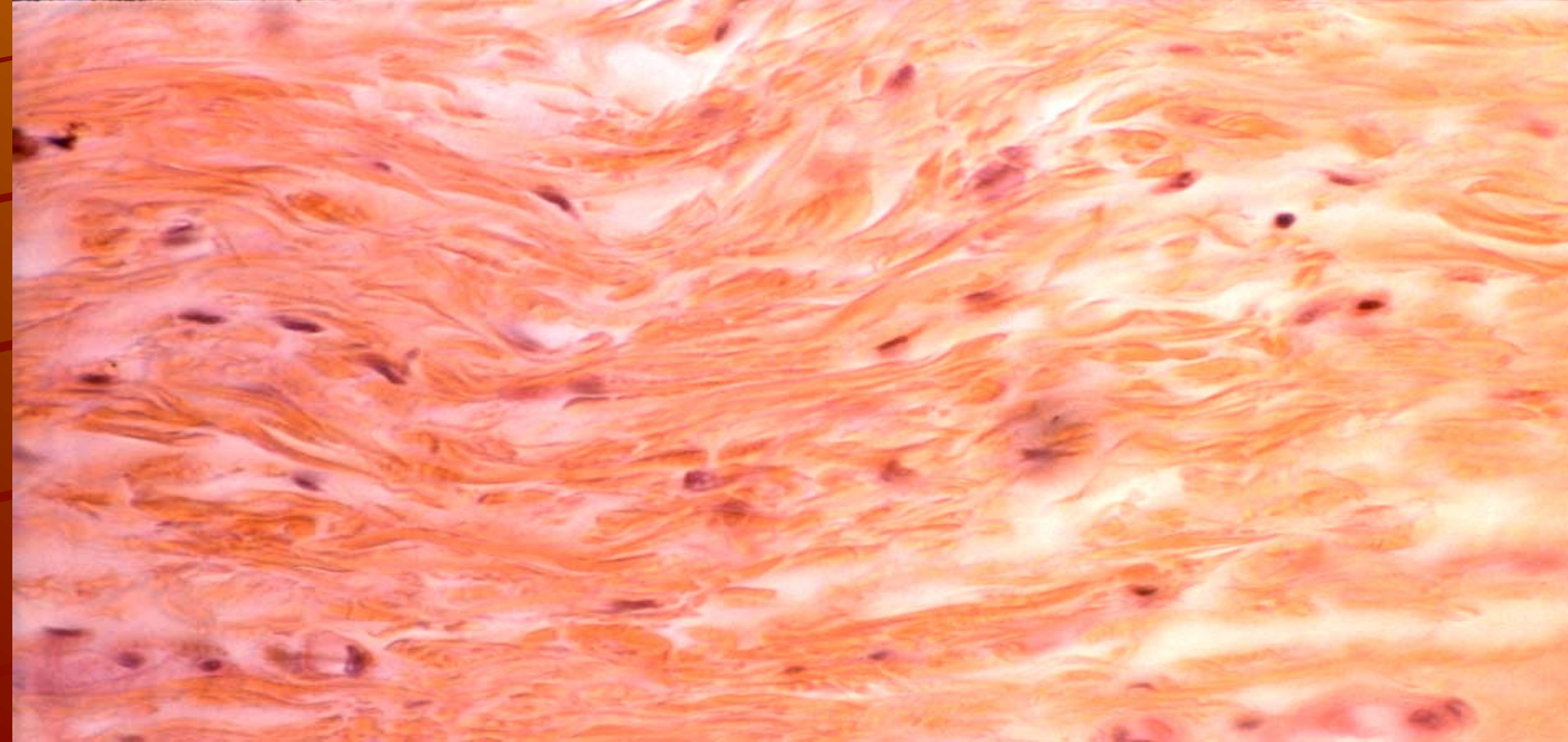
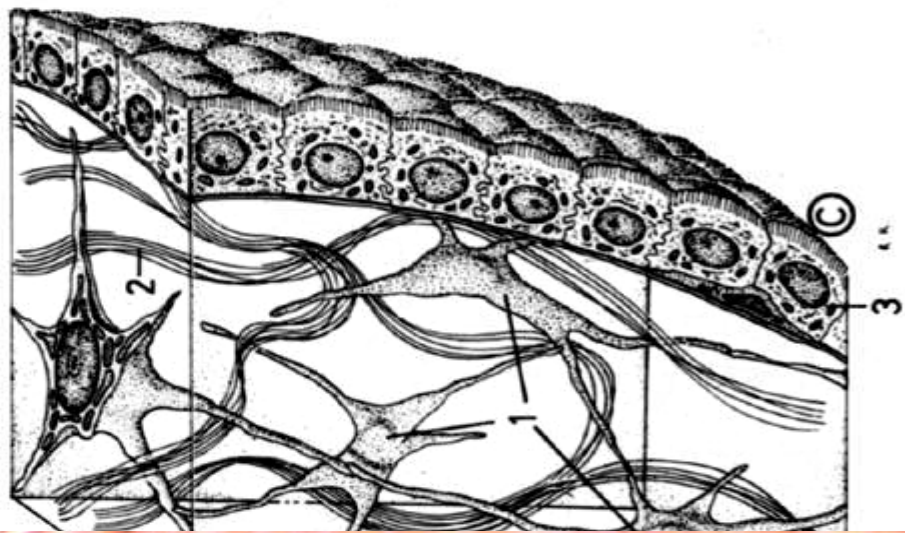




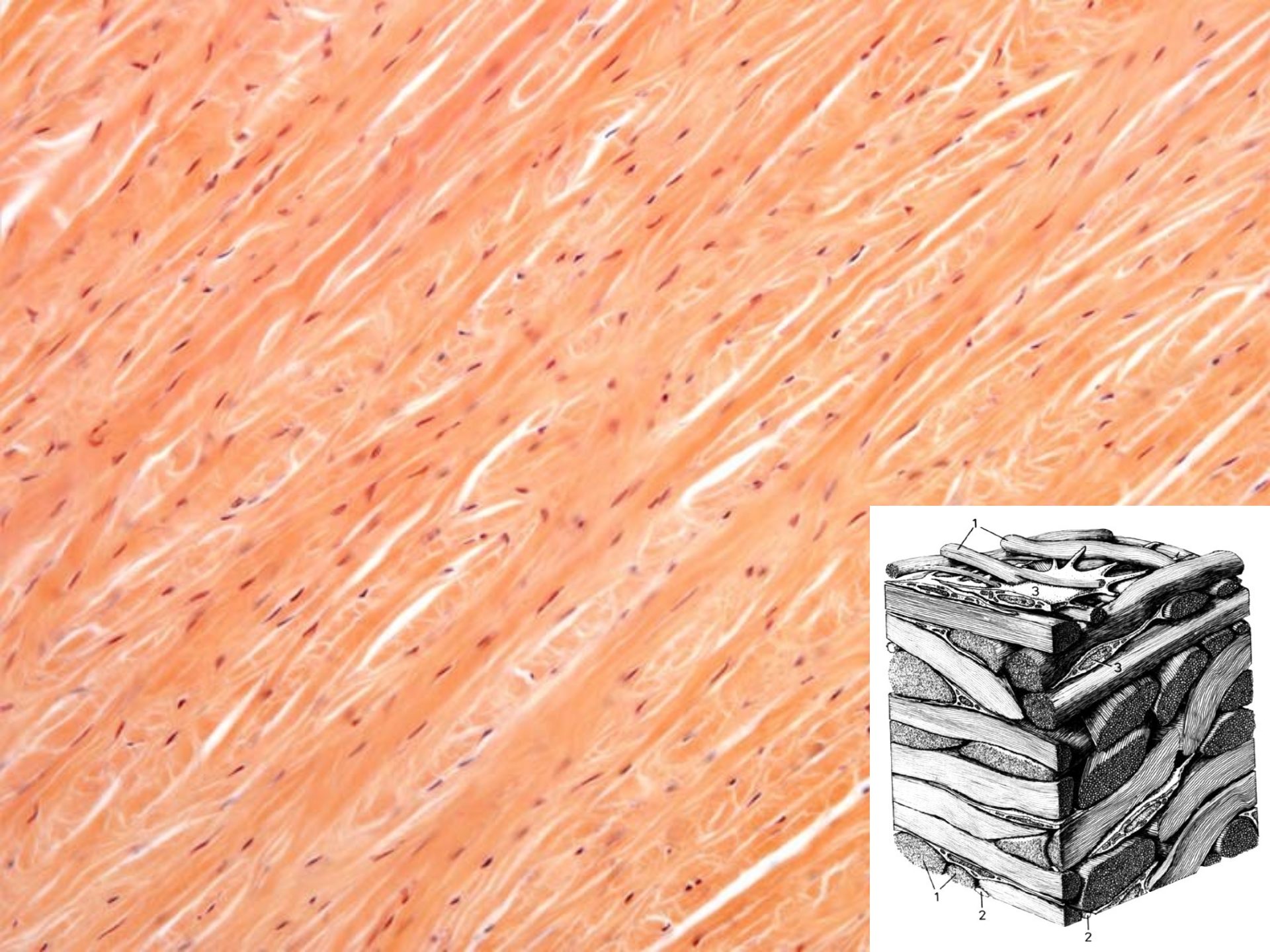


20 μm

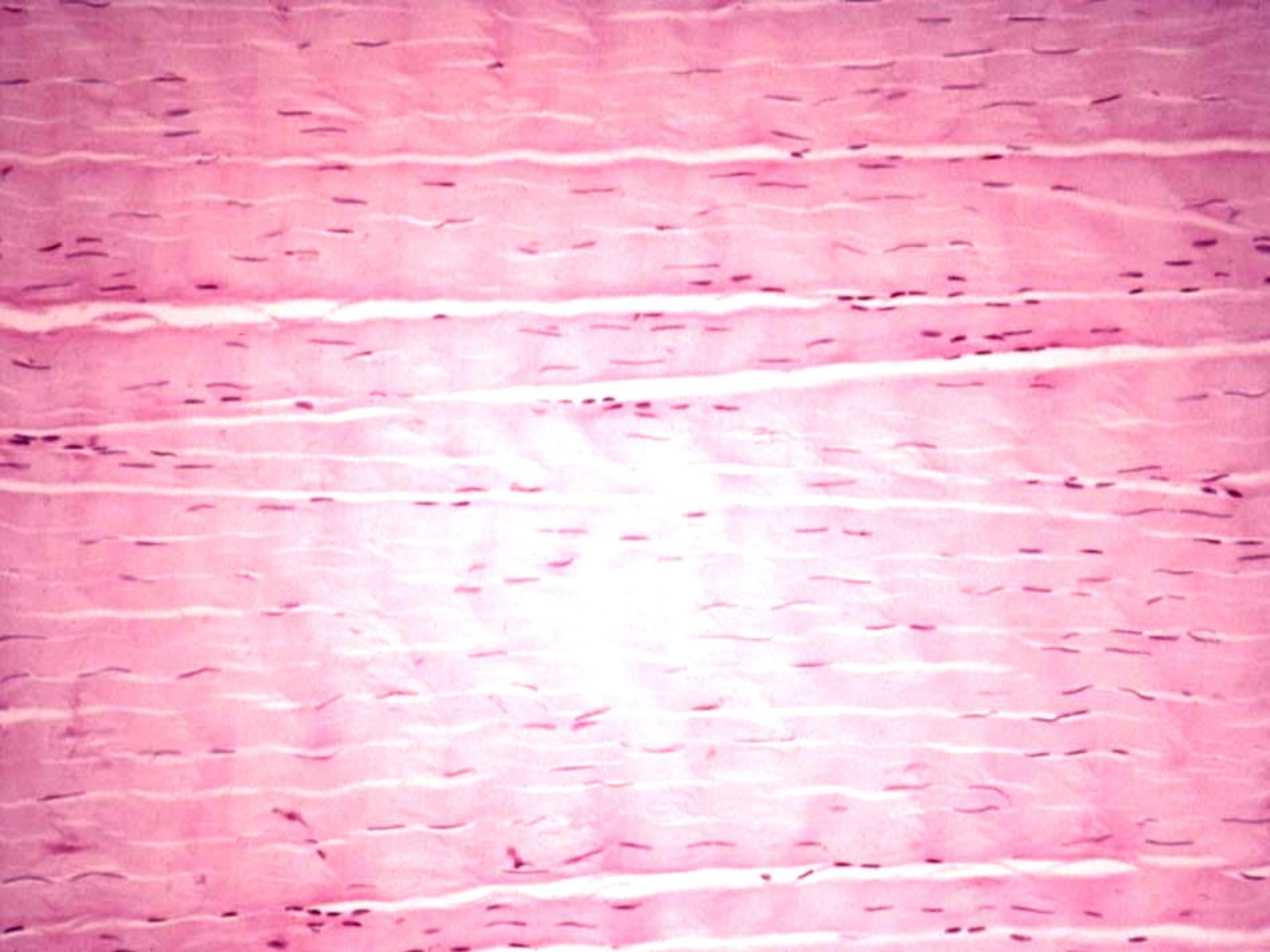






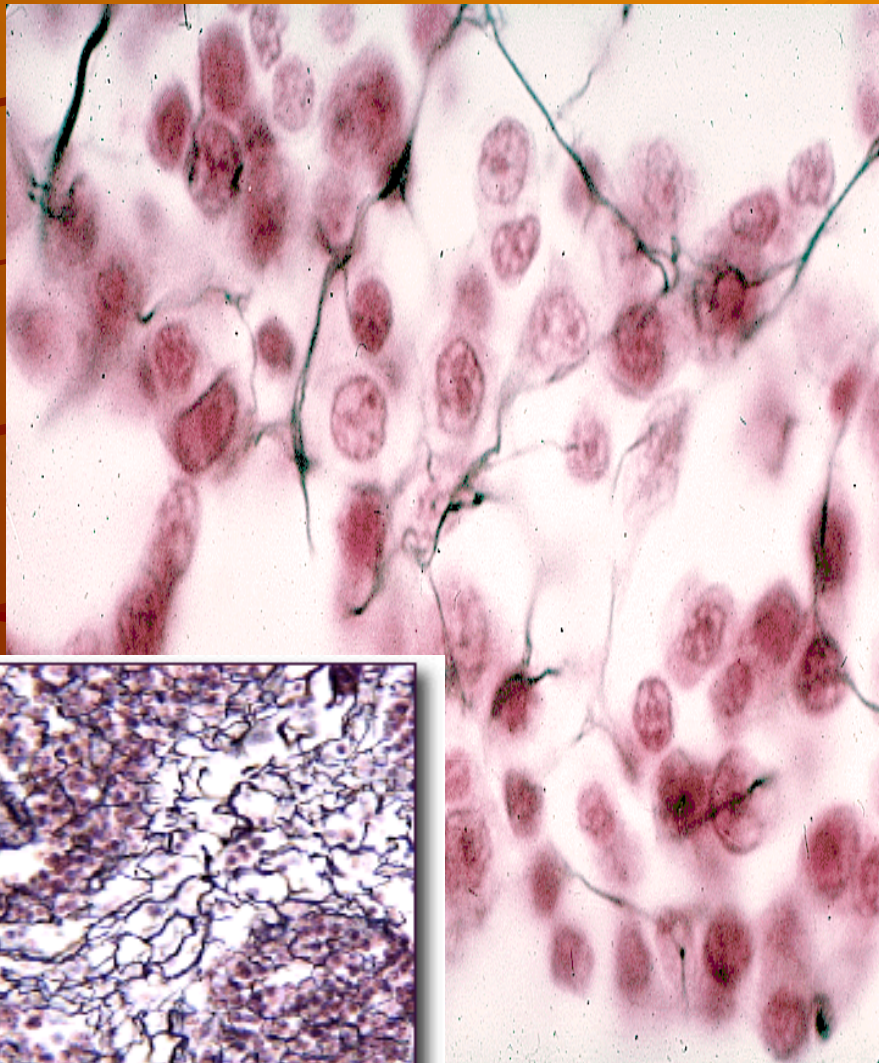




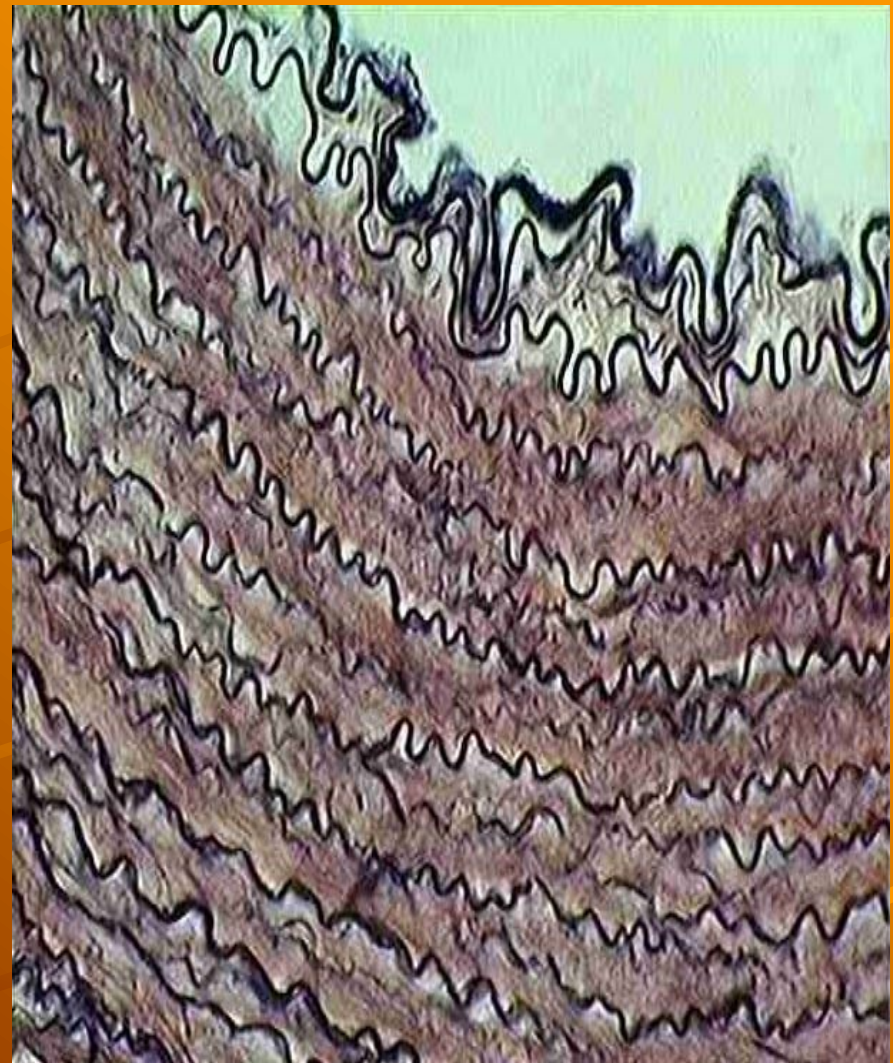




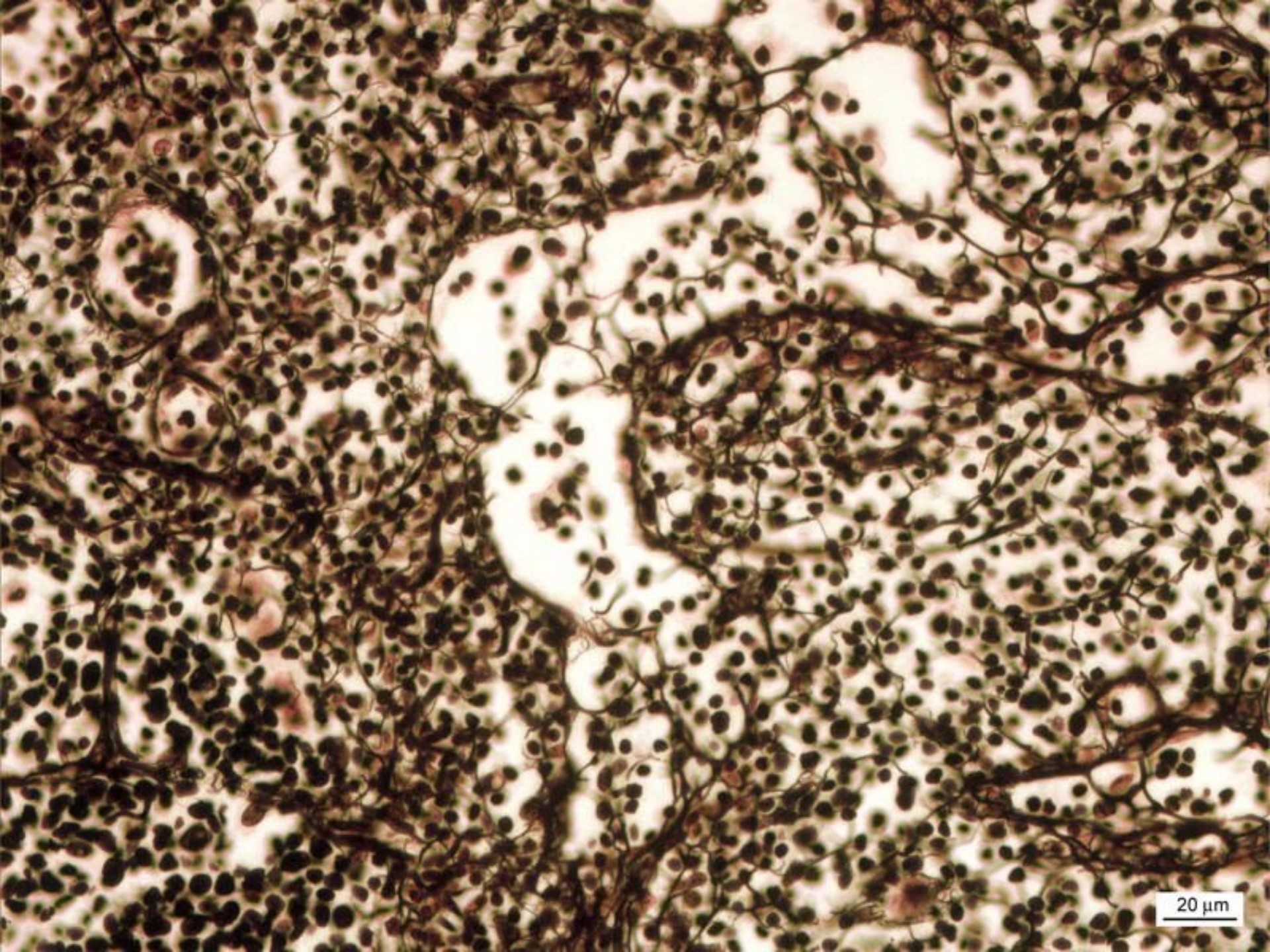
# Retikulární v.



# Elastické v.

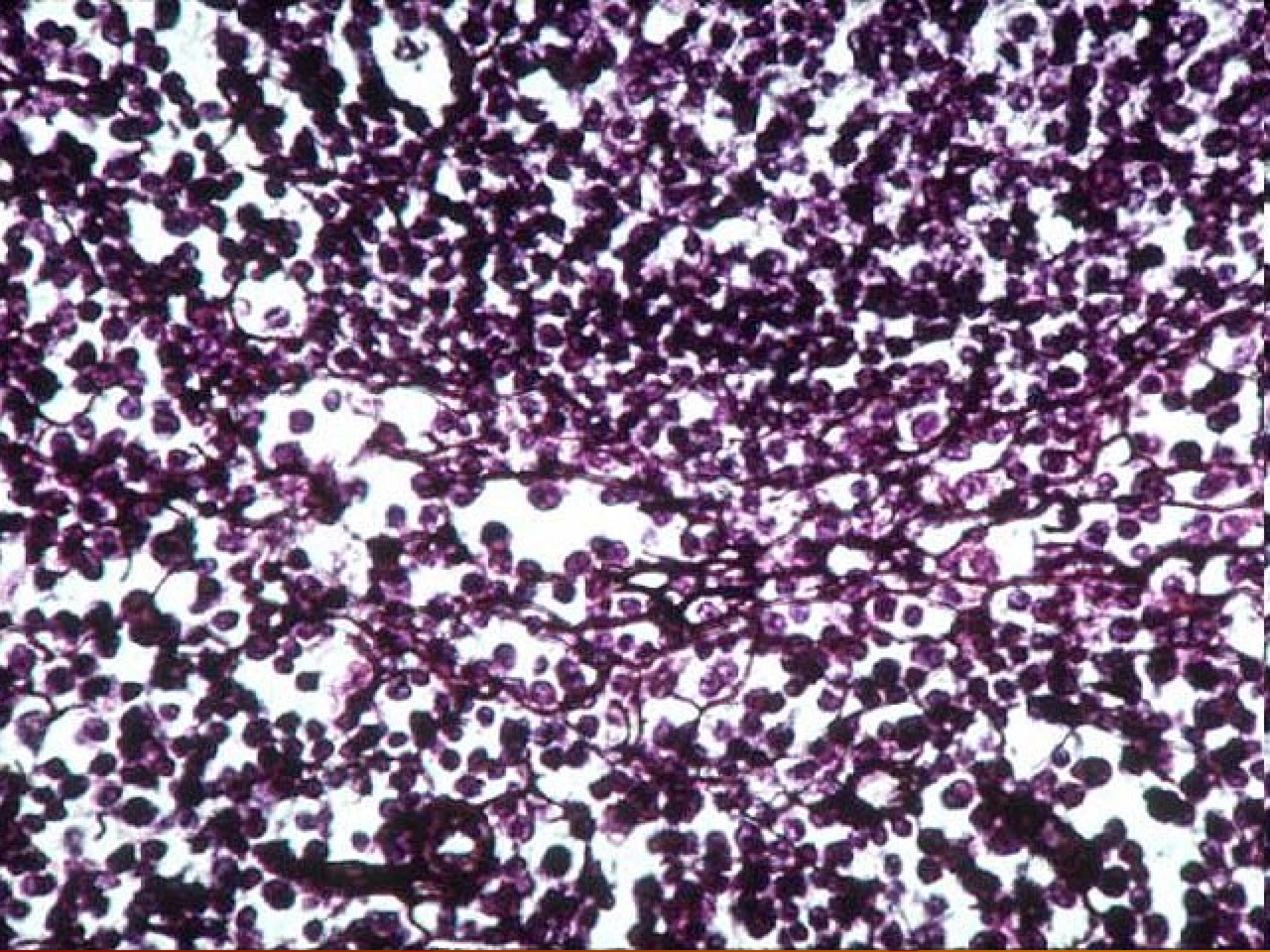


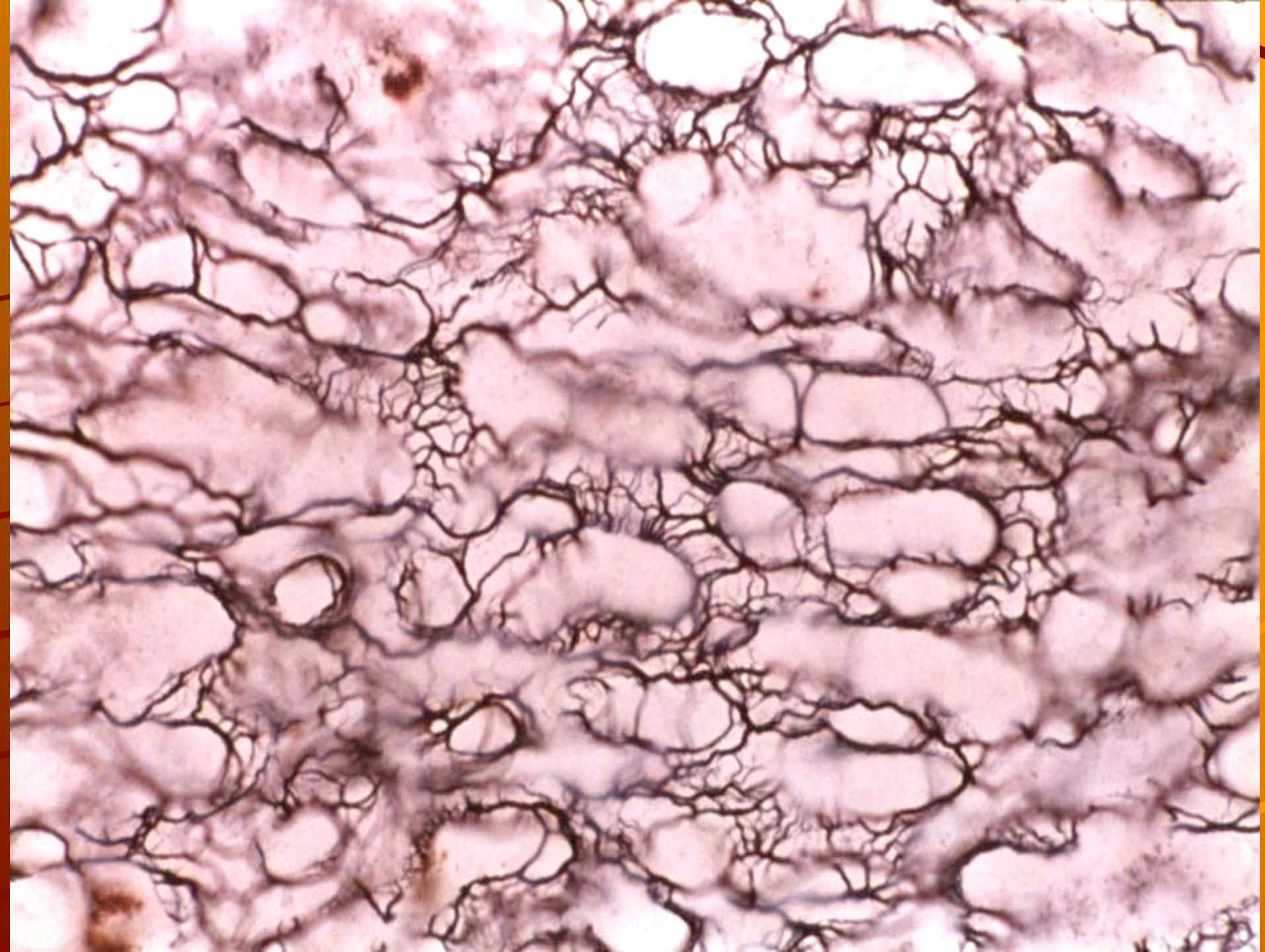




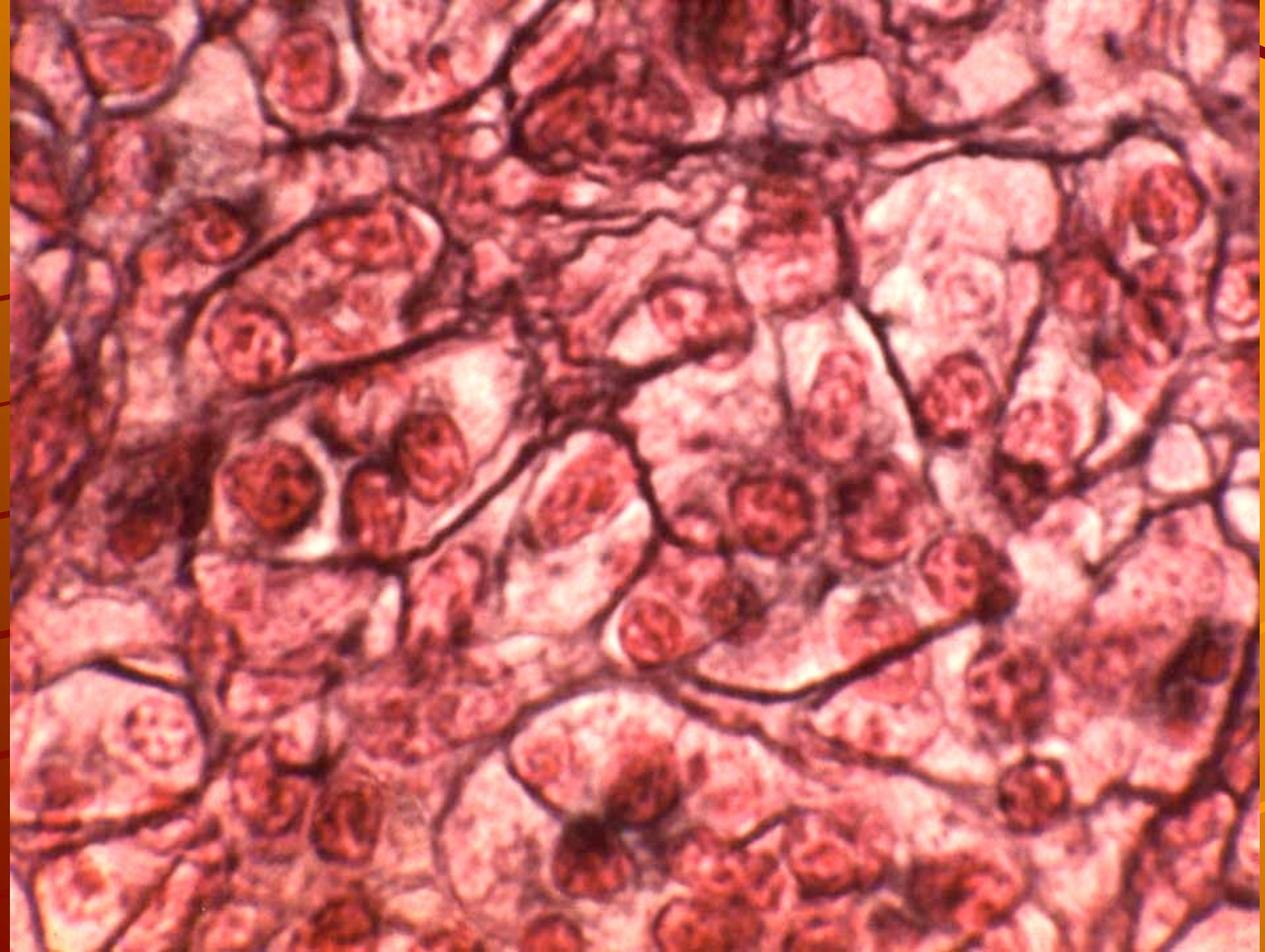
20 μm



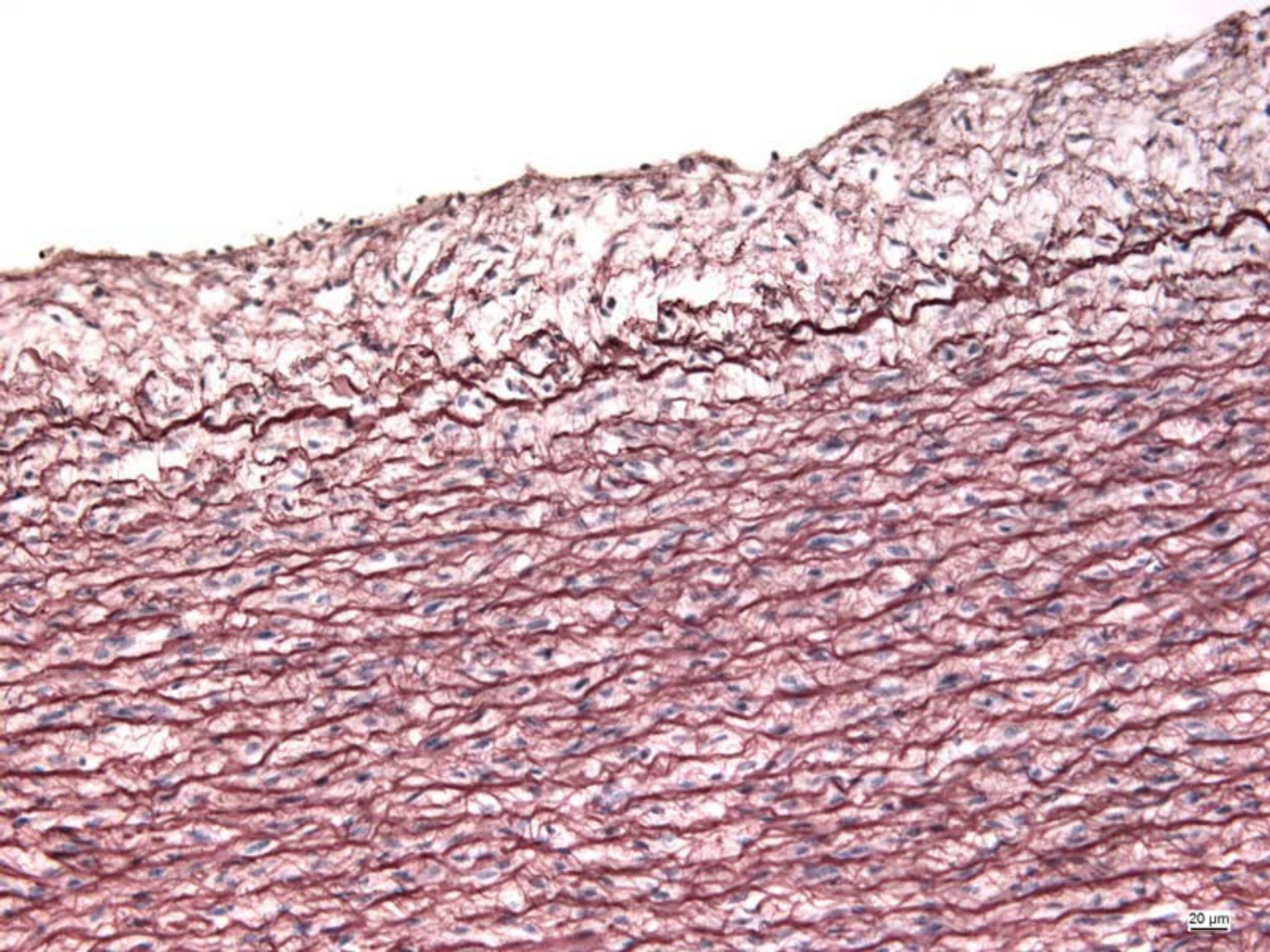






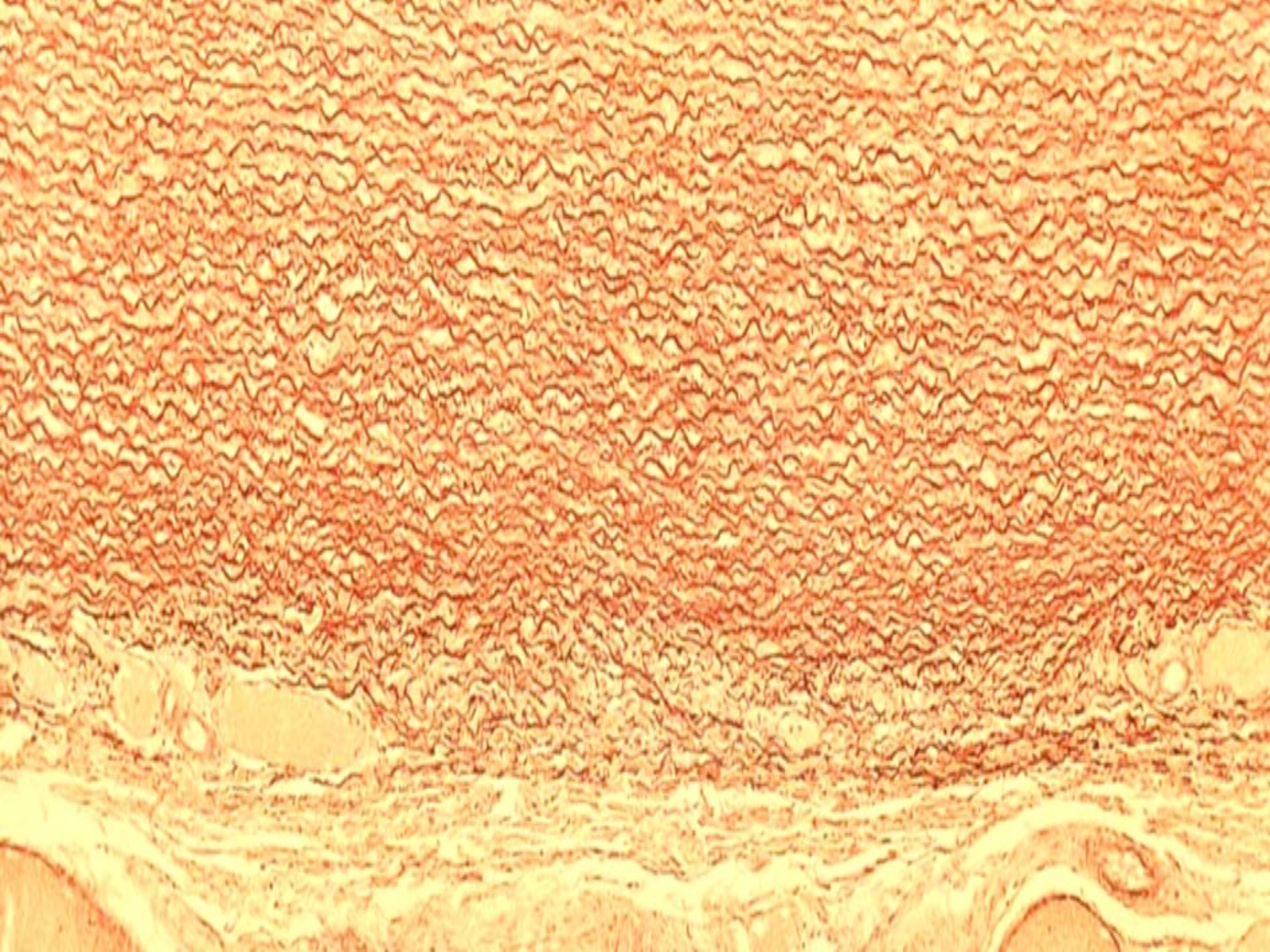






20  $\mu$ m







Tukové v.

hnědé

bílé

