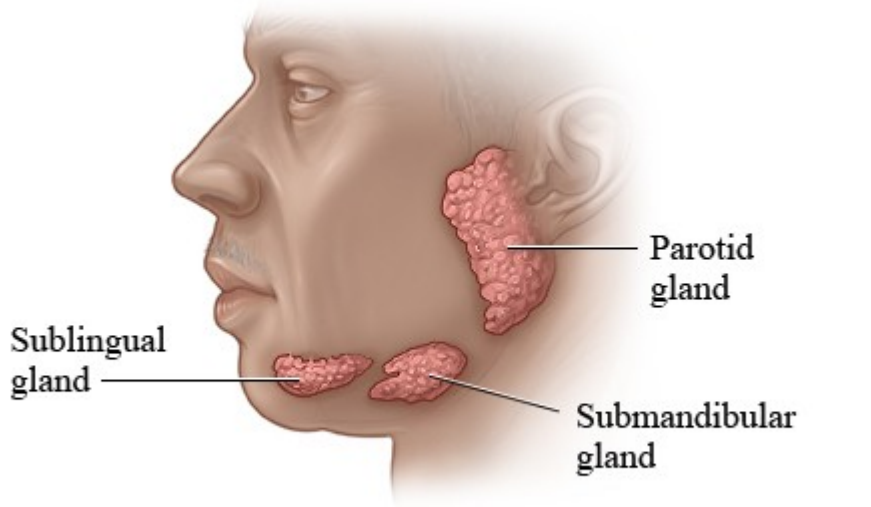
Practice 2

Major salivary glands

Tooth – introduction

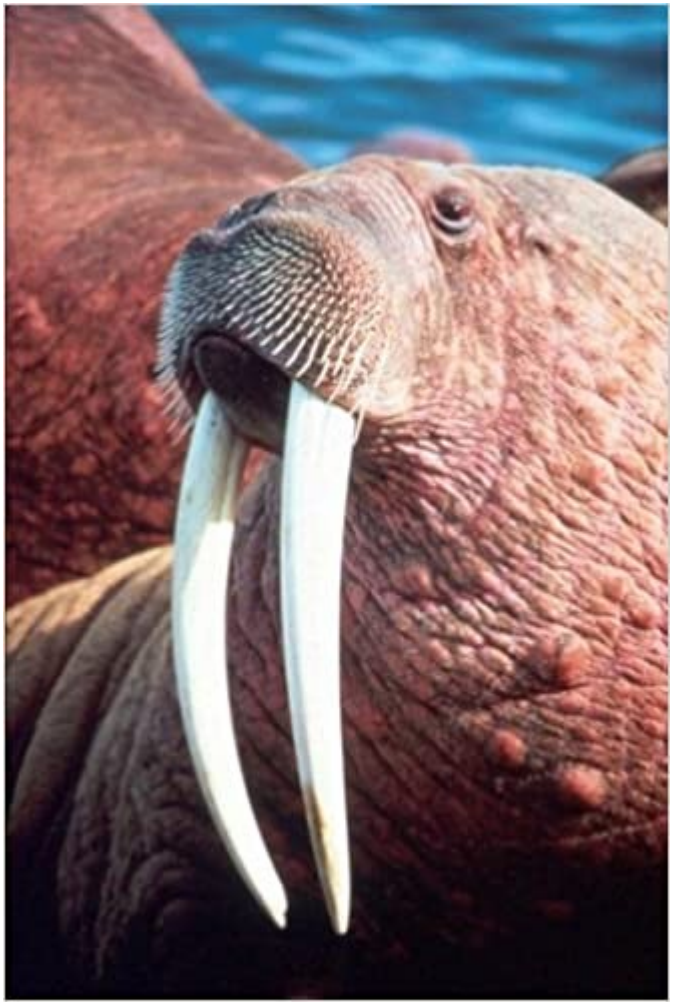


Mihule

(lamprey, cyclostomata)

Babirusa

Tusks

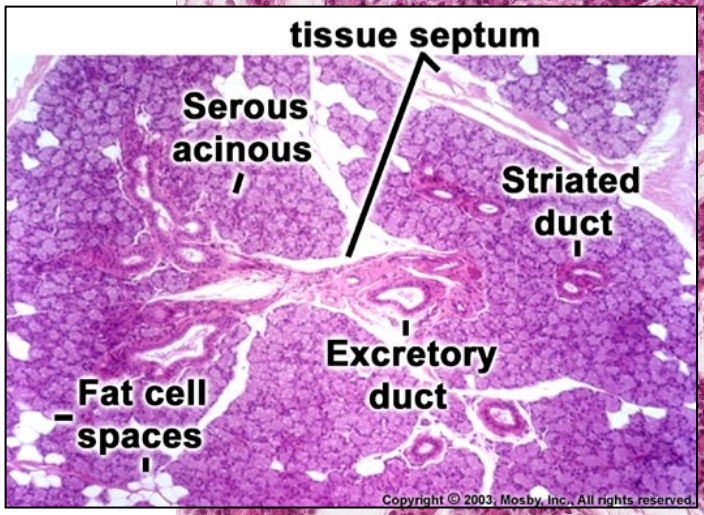


Struktura slinných žláz

Ligaments – capsule, septa, connective tissue

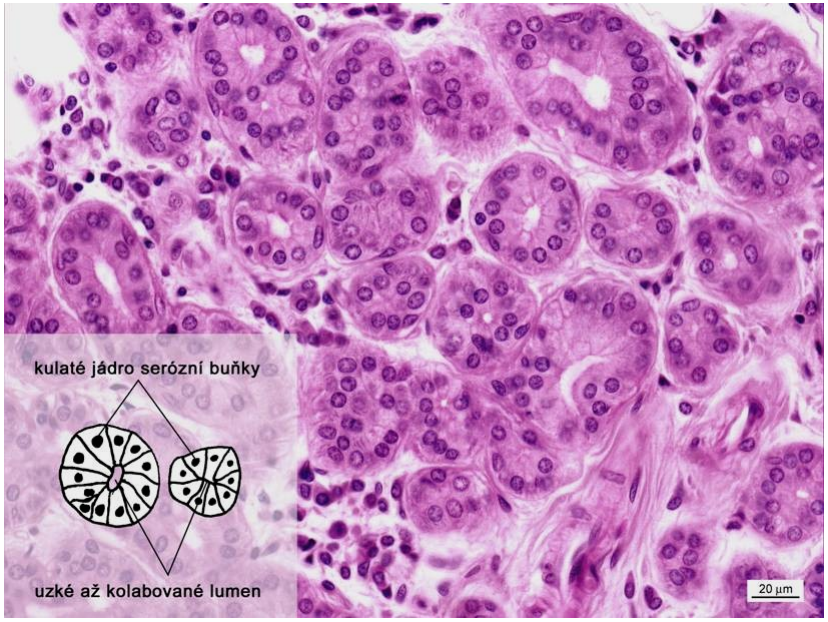
Parenchyma – lobules

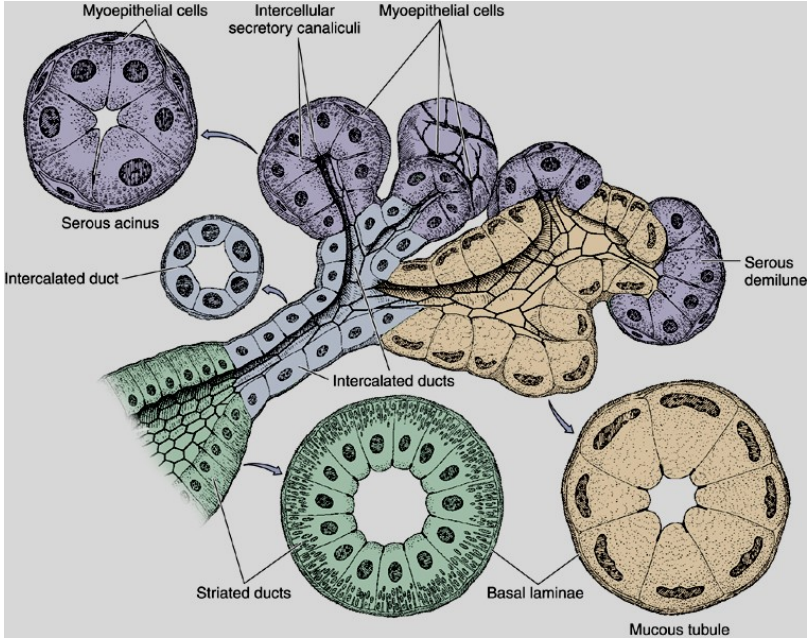
- **secretory compartments:** serous acins, mucinous tubules or tubules with Gianuzzi lunules
- **ducts**: intercalated and striated ducts (interlobular and main in v septa between lobules)



Serous acini

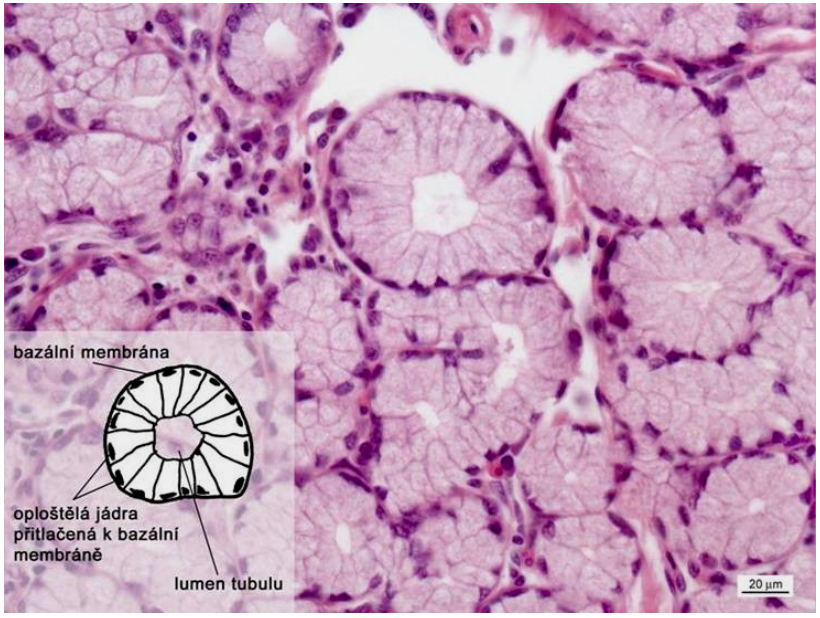
BM, myoepithelial and serous cells



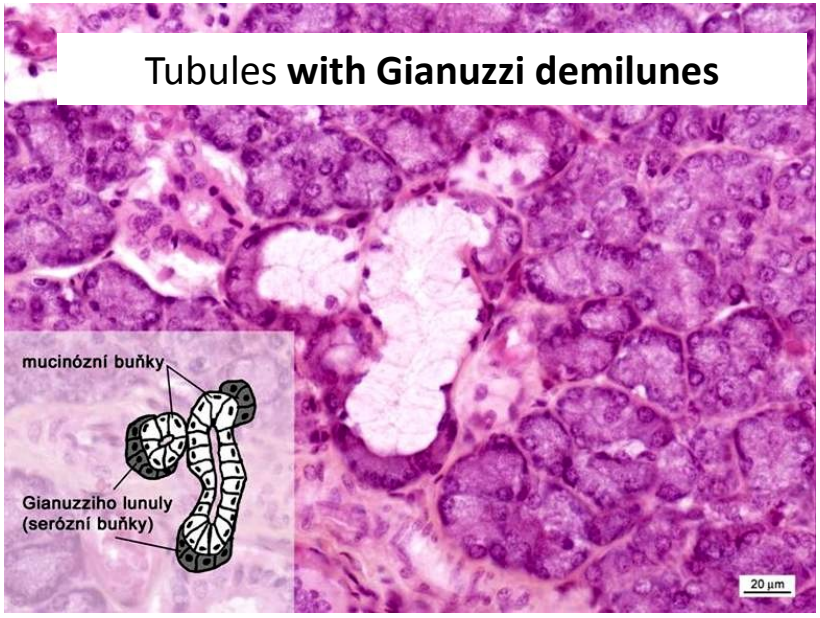


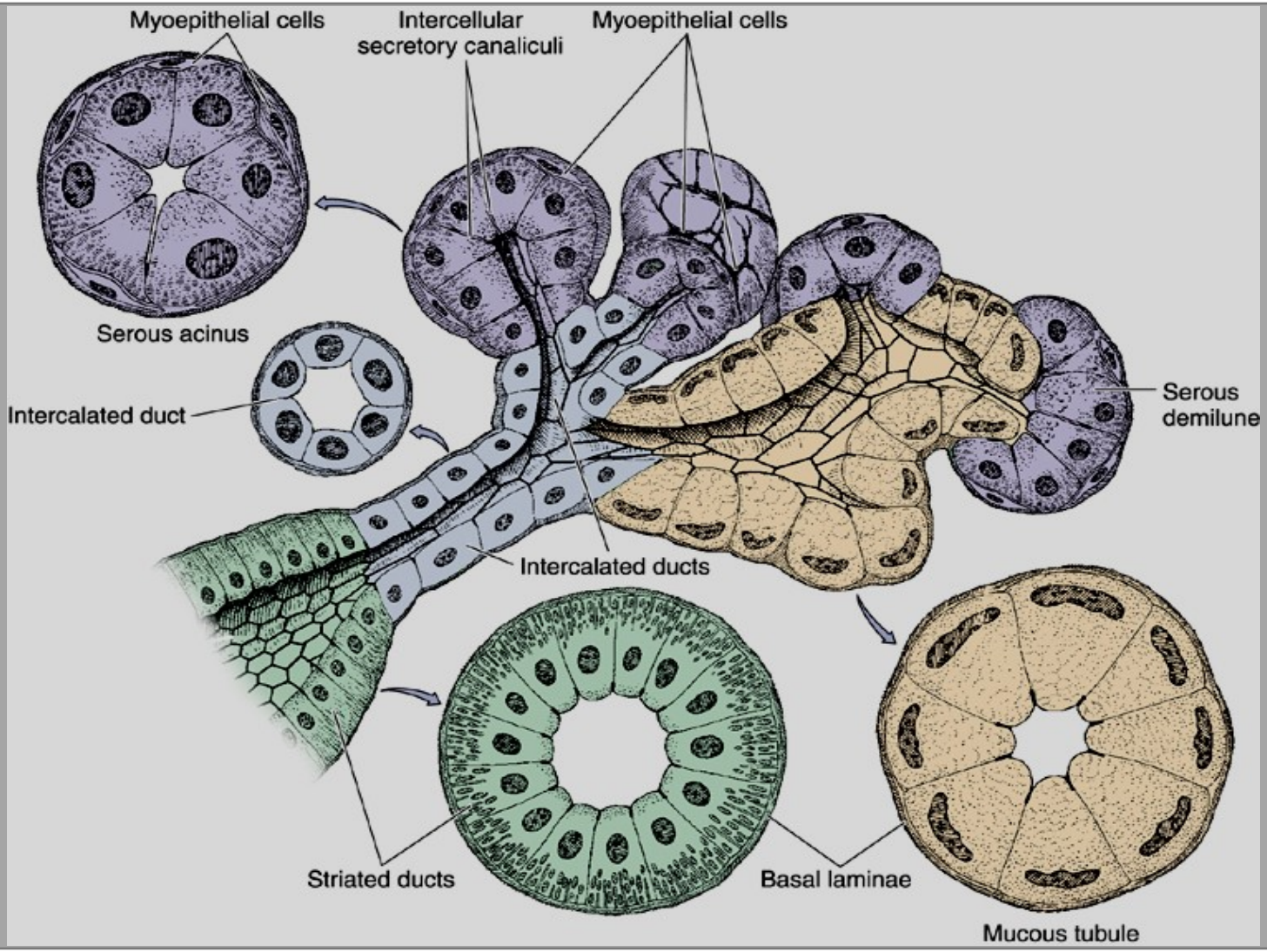
Mucinous tubules

BM, myoepithelial and mucinous cells



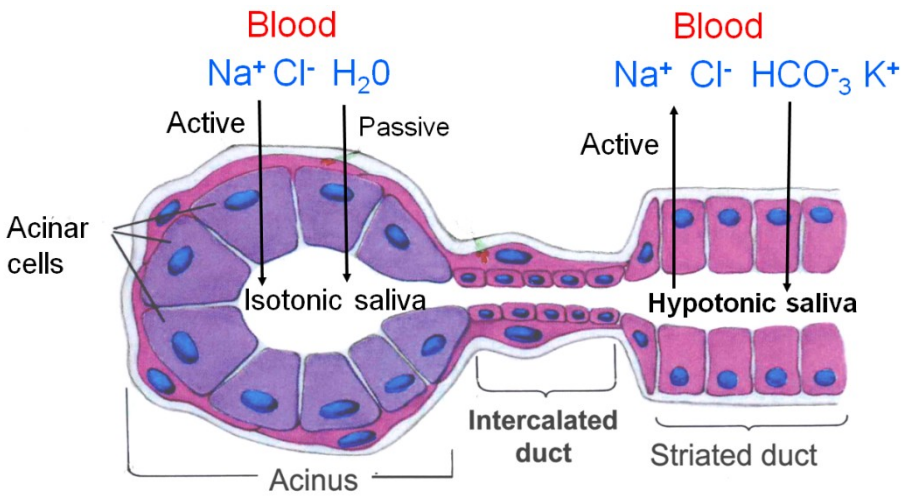
Tubules **with Gianuzzi demilunes**

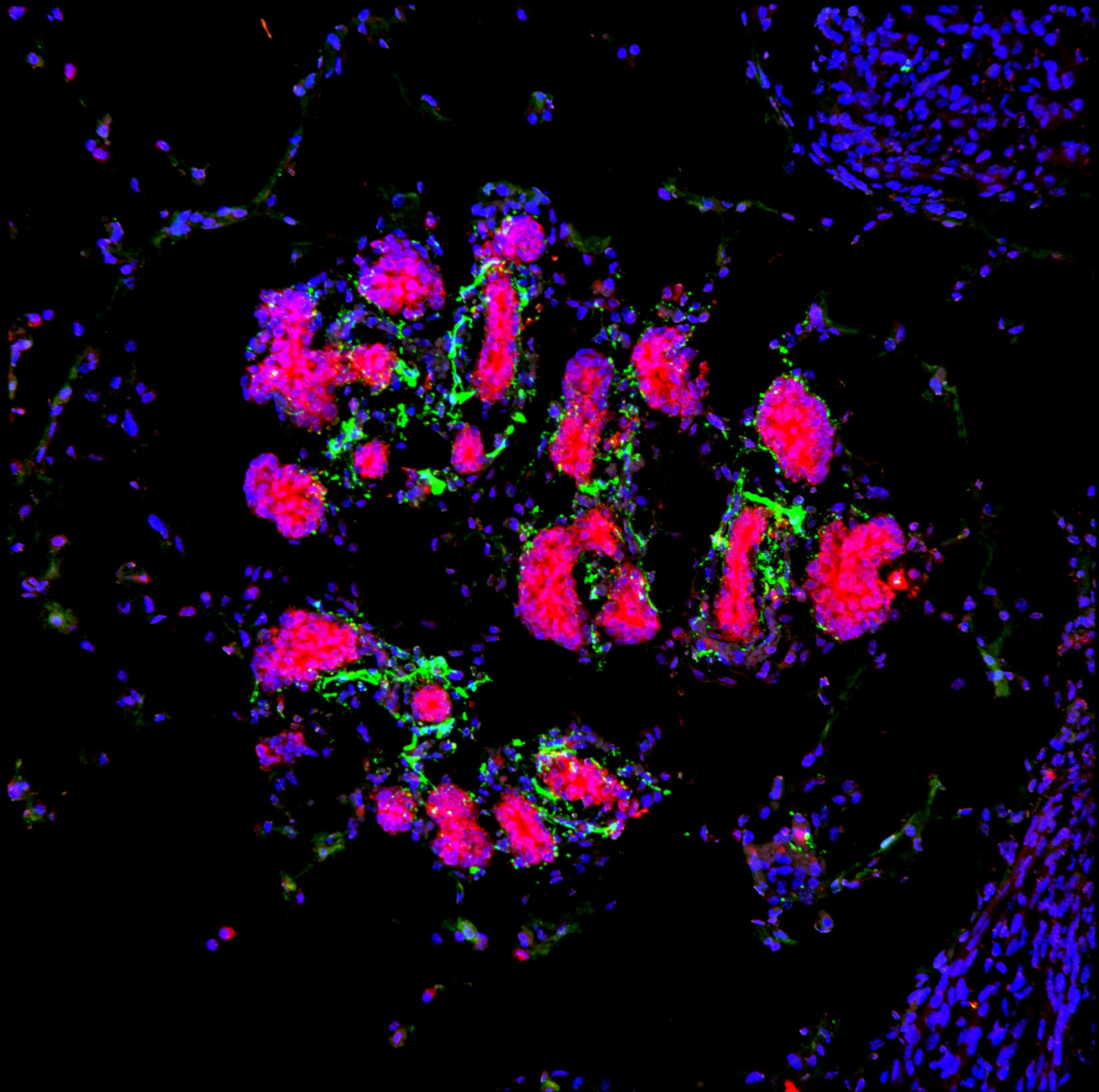



Myoepithelial cells
Intercellular secretory canaliculi
Myoepithelial cells
Serous acinus
Intercalated duct
Serous demilune
Intercalated ducts
Striated ducts
Basal laminae
Mucous tubule

Myoepithelial cells

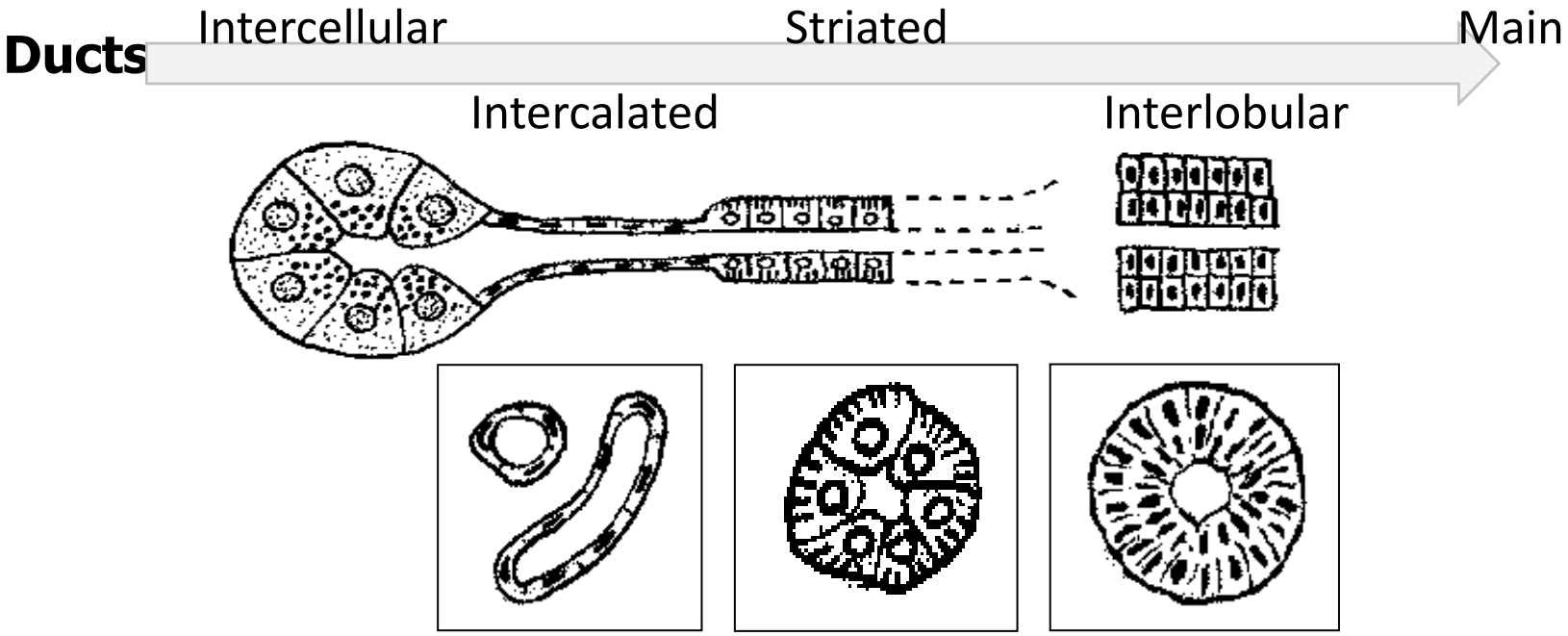
- Ectomesenchymal origin
- Contraction
- Desmosomes
- Vegetative control





Salivary ducts types

- **Intercelual** *(they do not have their own wall, intercellular space)*
- **Intercalated** *(simple squamous ep., only serous and mixed glands)*
- **Striated** *(simple cuboidal/low columnar ep.; basal labyrinth ➔ striation)*
- **Interlobular** *(simple – stratified columnar ep., in septs)*
- **Main** *(stratified columnar ep.)*



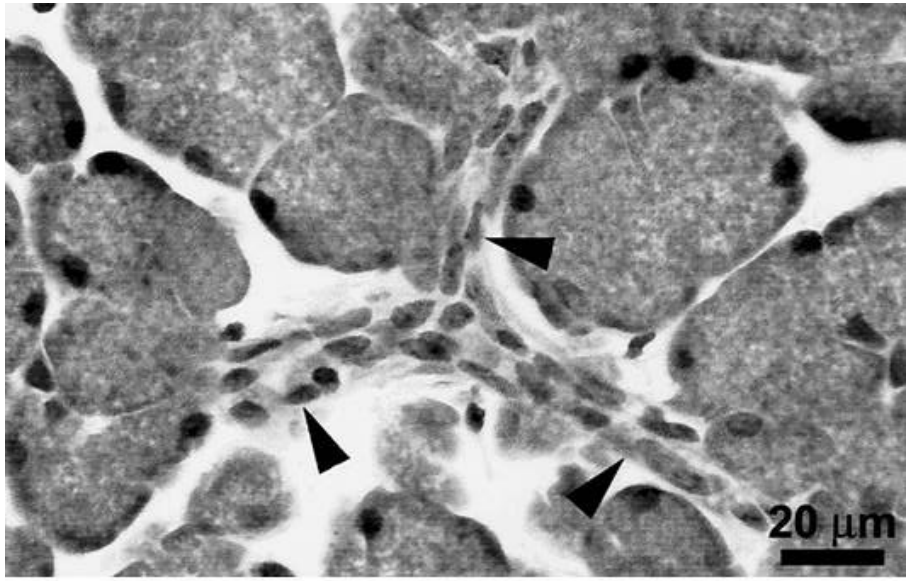
Intercalated ducts

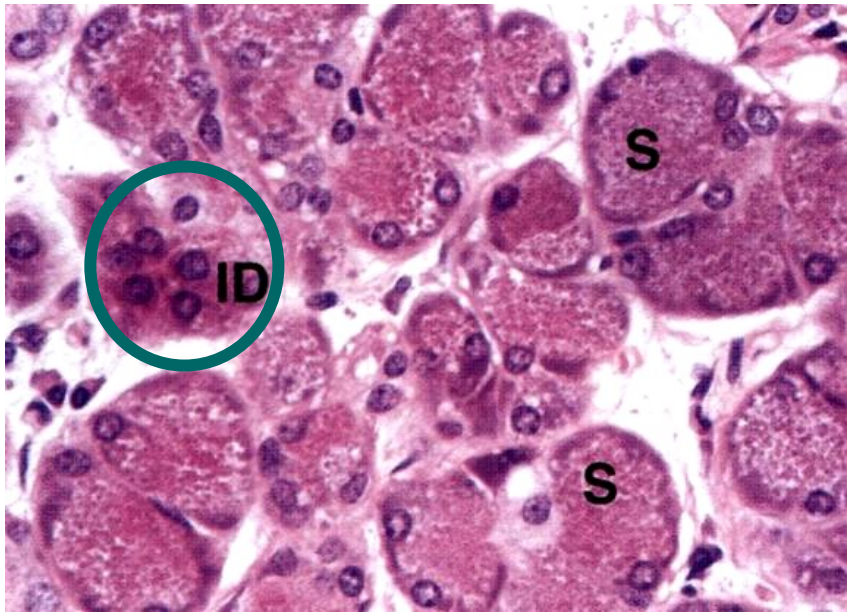
Narrow and thin-walled channel, collapsed on slides

Wall: basal membrame, myoepithelial cells and simple squamouse to low cubic ep.

Numerous in serous type of glands

(cells of intercalated ducts secrete to saliva macromolecular substances: lysozym + lactoferin)





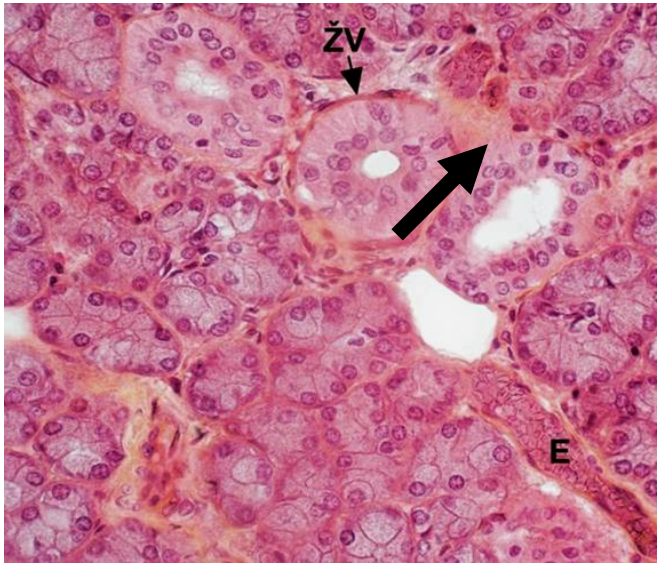
Striated ducts

Wider than the intercalated ducts (easy to find), usually in the middle of lobe

Wall: Basal membrane and simple cuboidal/low columnar ep.

Microvilli on apexes and an bases characteristic striation (basolateral labyrinth)

In the cytoplasm of cytokeratin filaments

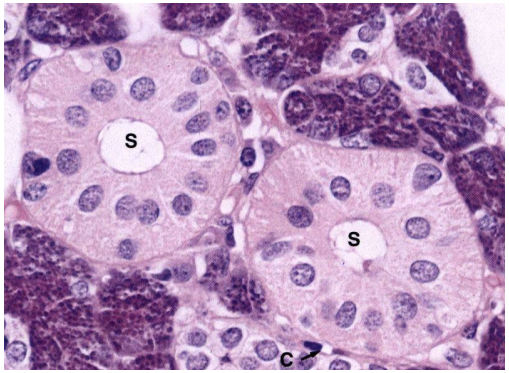


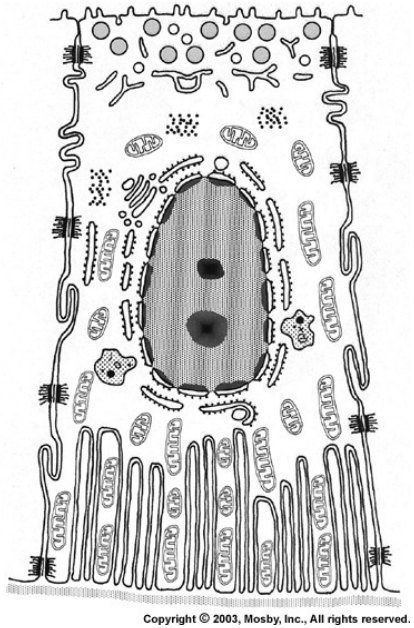
The cells of striated ducts regulate the content of water and electrolytes (Na+, K+, Cl-, Ca2+, Mg2+, HCO3-) in the secretion.

Resorption of Na+, and Cl-

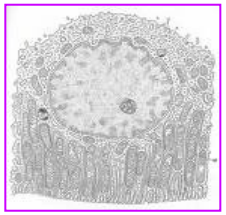
Secretion of K+ and HCO3-

nerve control

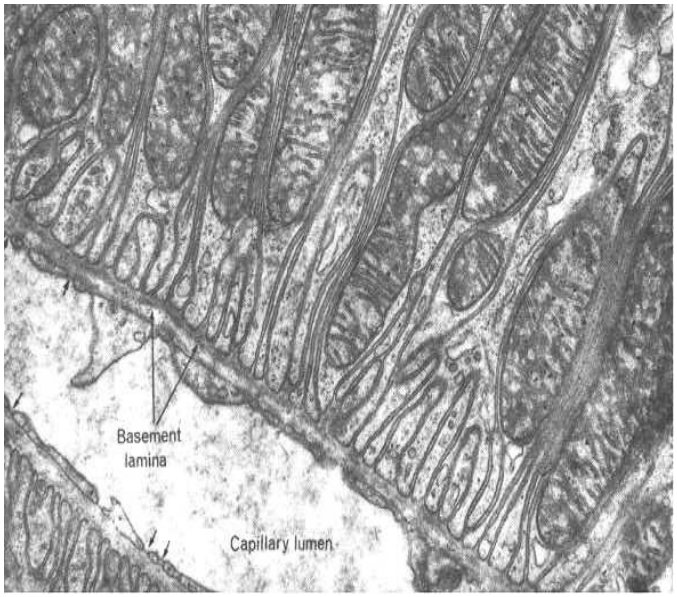


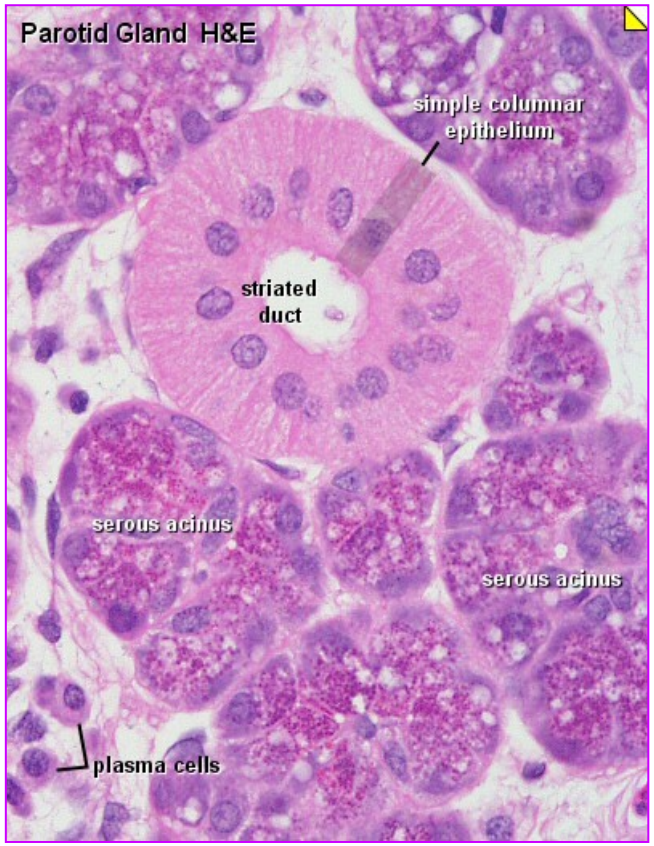


Striated duct – basal labyrinth



Epithelial cell





Base of epithelial cell:
Invagintion of cytoplasmic membrane,
numerous mitochondria

Interlobular and main ducts

Interlobular ducts

Located in fibrous septae between the lobes (columnar or stratified columnar epithelium)

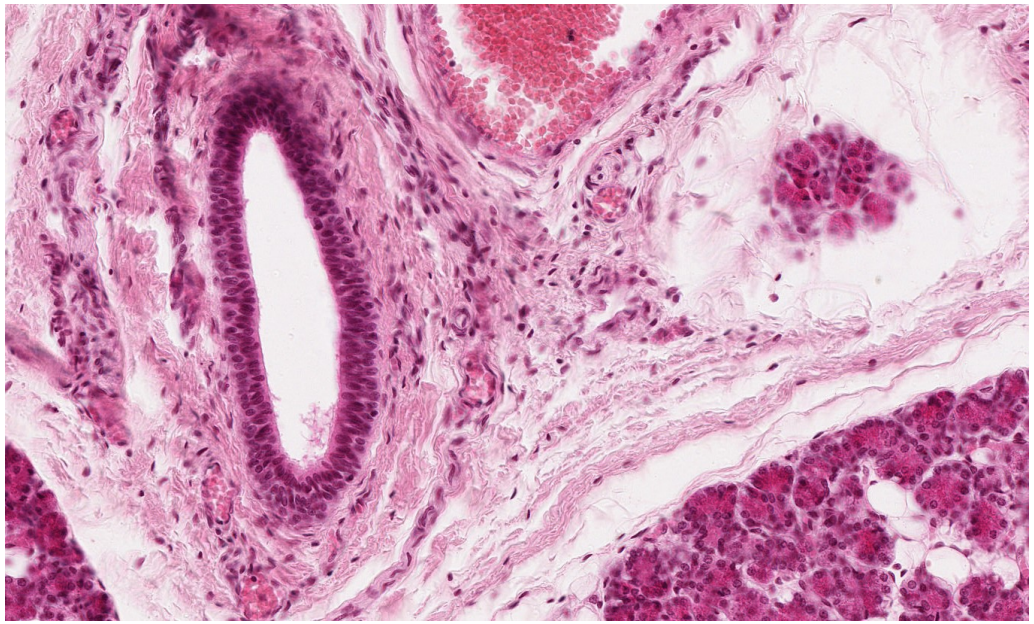
They are formed by the **connection of several striated ducts**

Lined by a **high single-layer columnar** and in the terminal sections also **a stratified columnar** epithelium

Main ducts

Stratified columnar ep. with goblet cells

Ductus parotideus
Ductus submandibularis
Ductus sublinguales (major et minores)

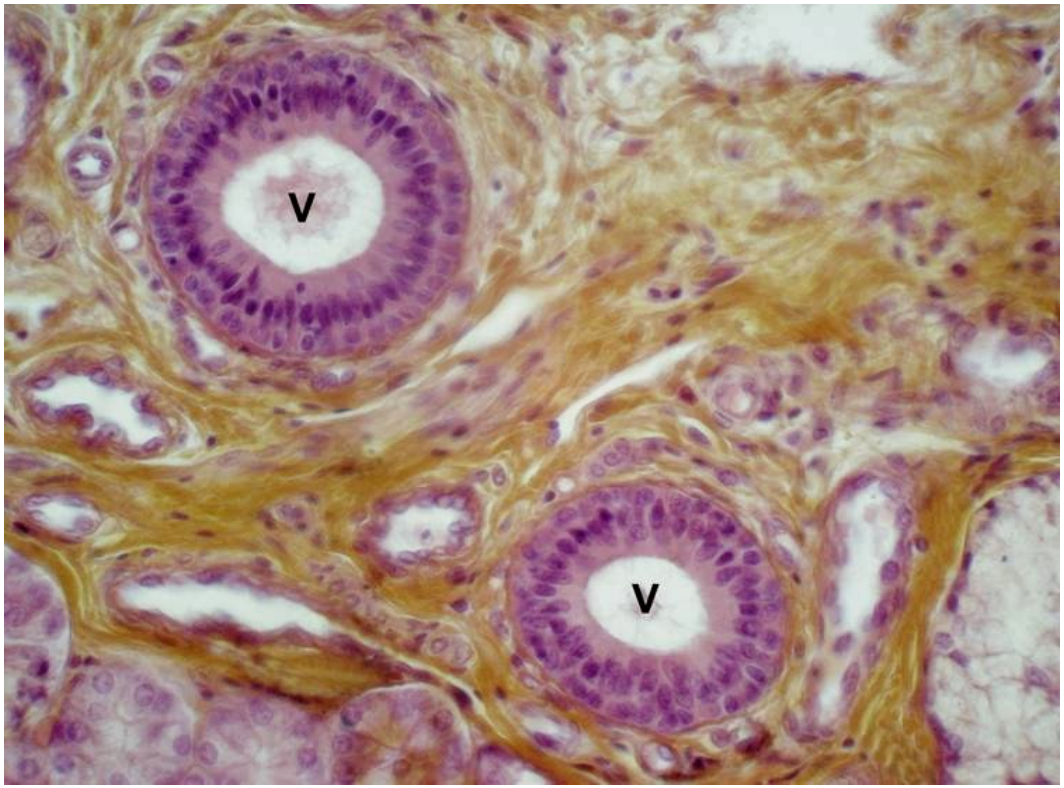


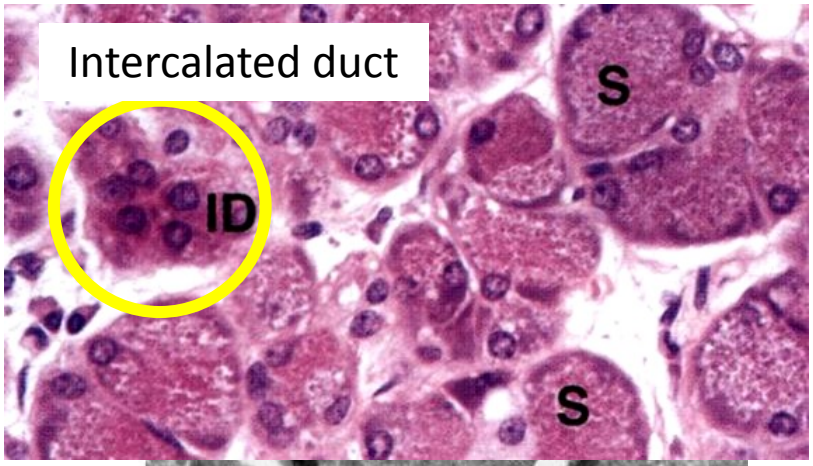
Main ducts

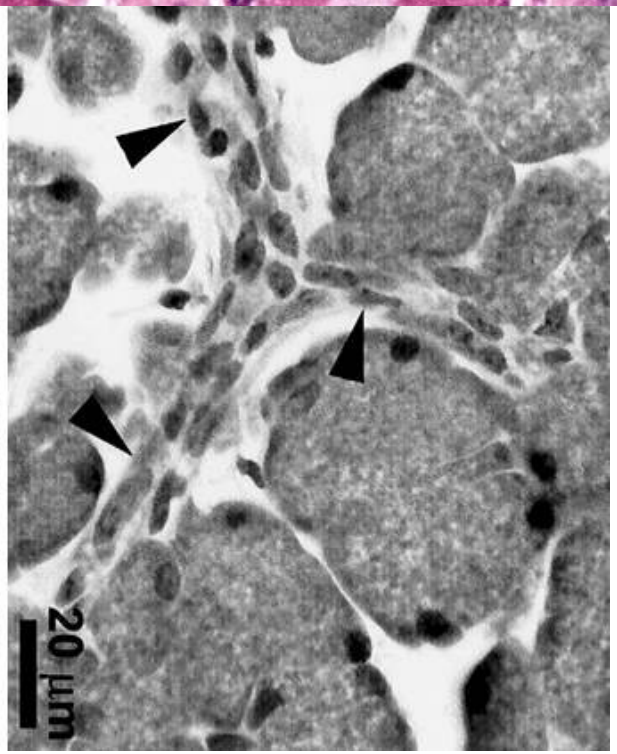
Stratified columnar ep.

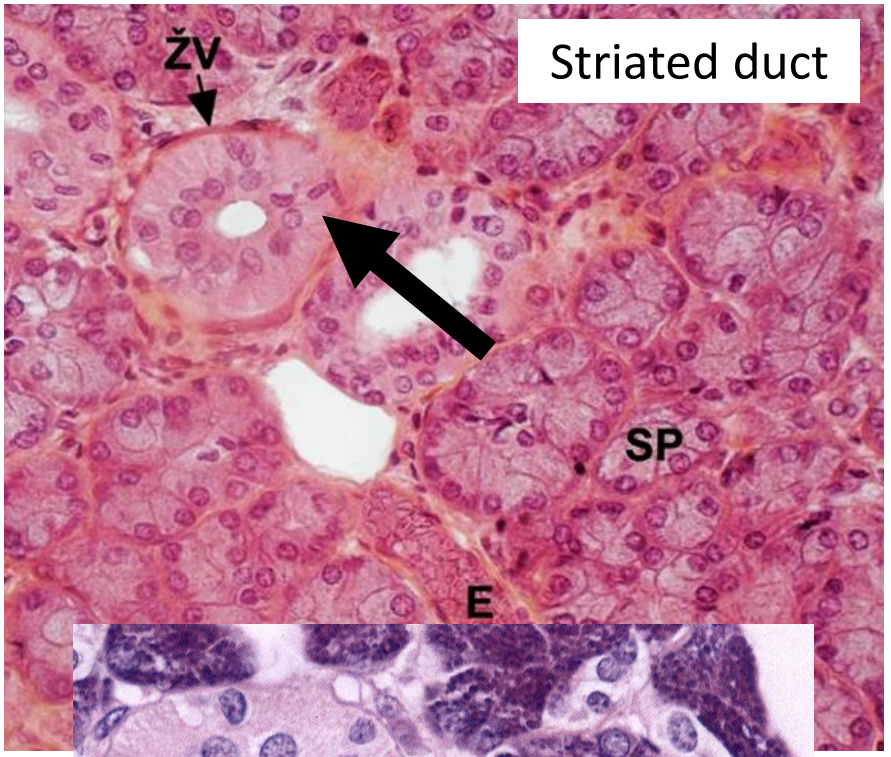
In epithelium **Goblet cells**

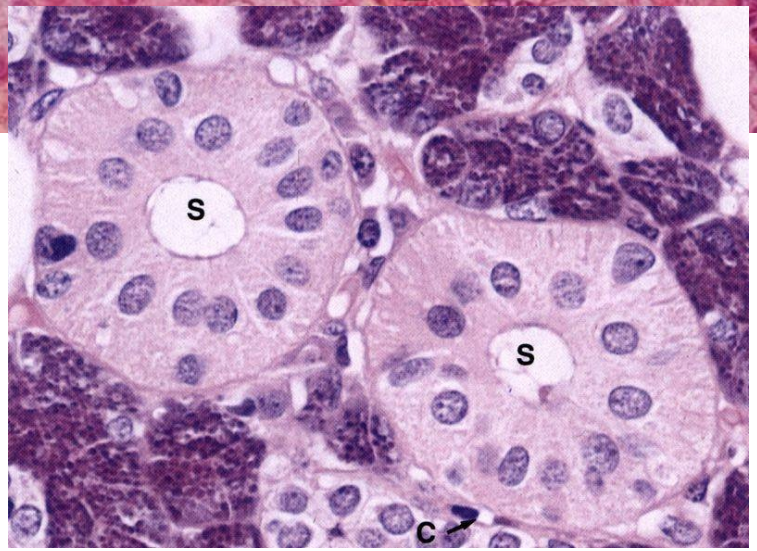
Wall supported by the dense collagenous connective tissue and smooth muscle cells

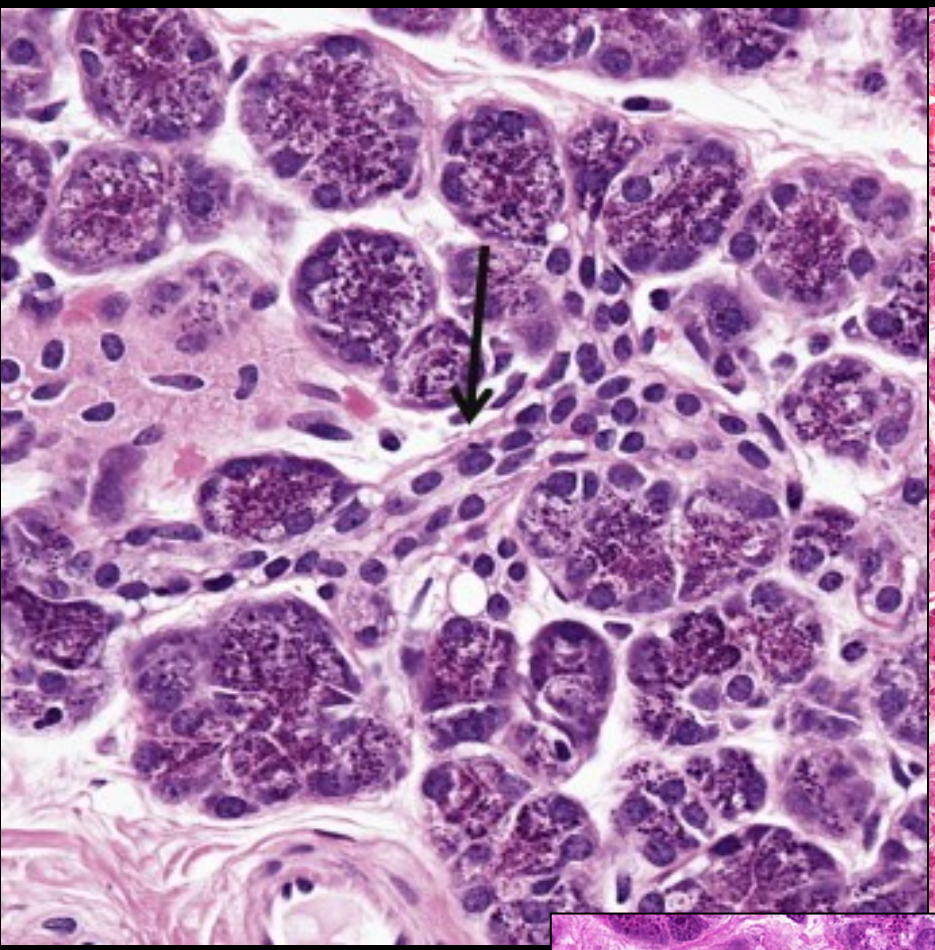


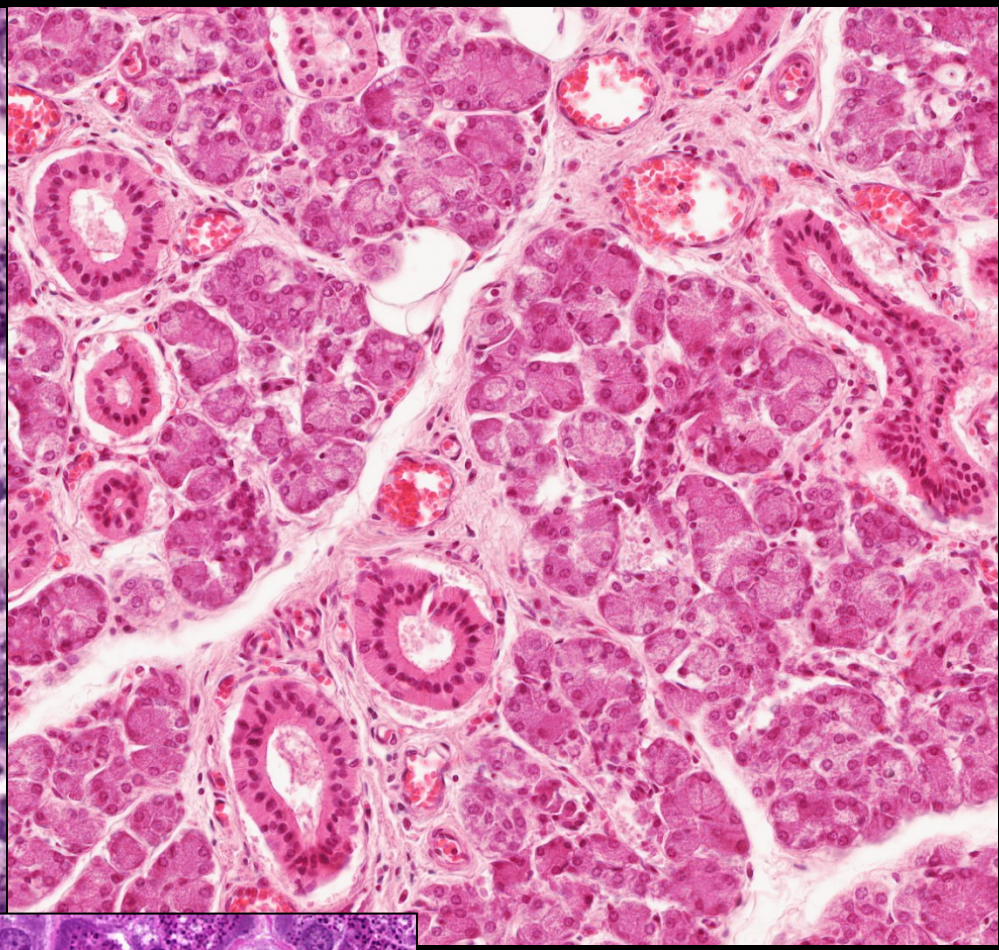


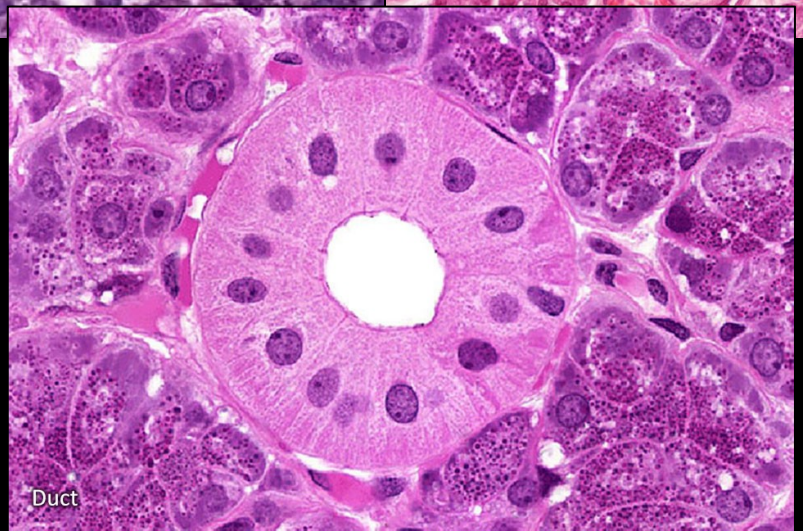




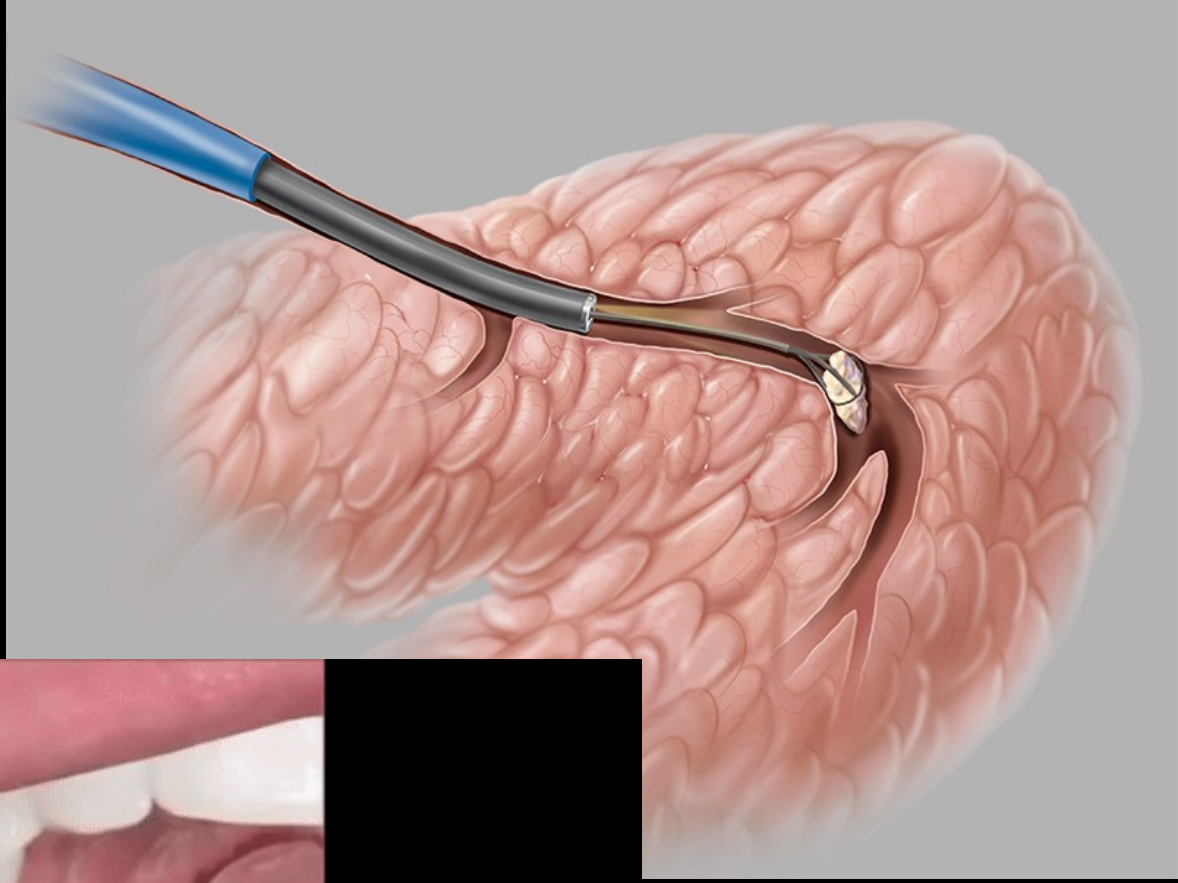


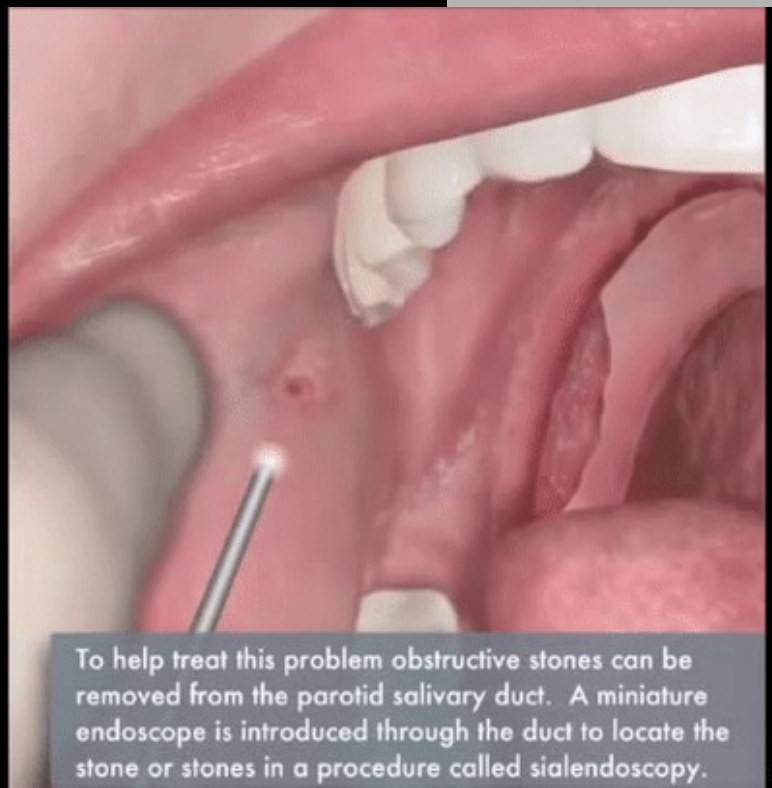





Duct

Sialendescopy

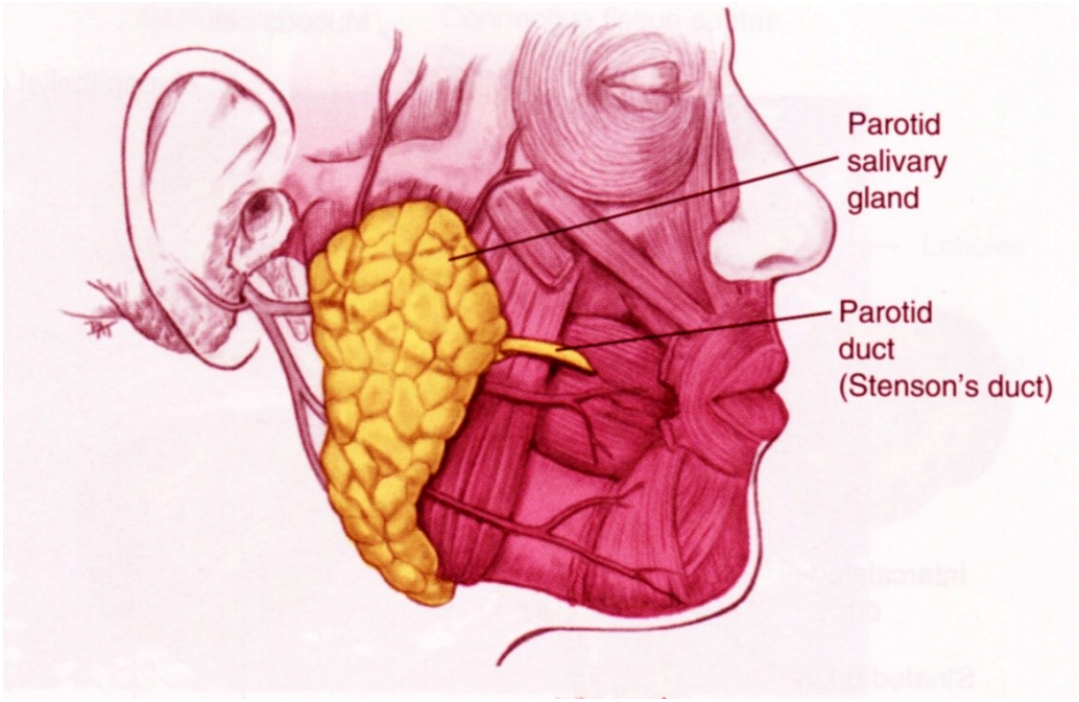


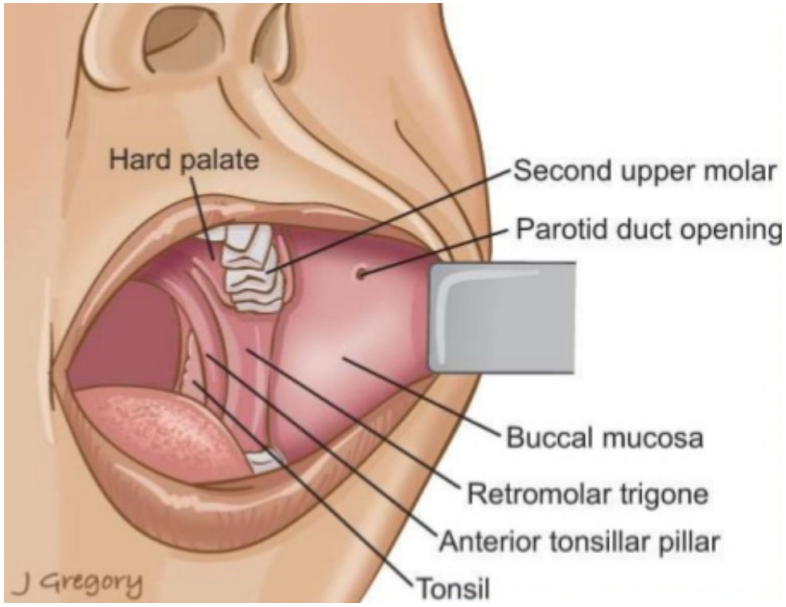


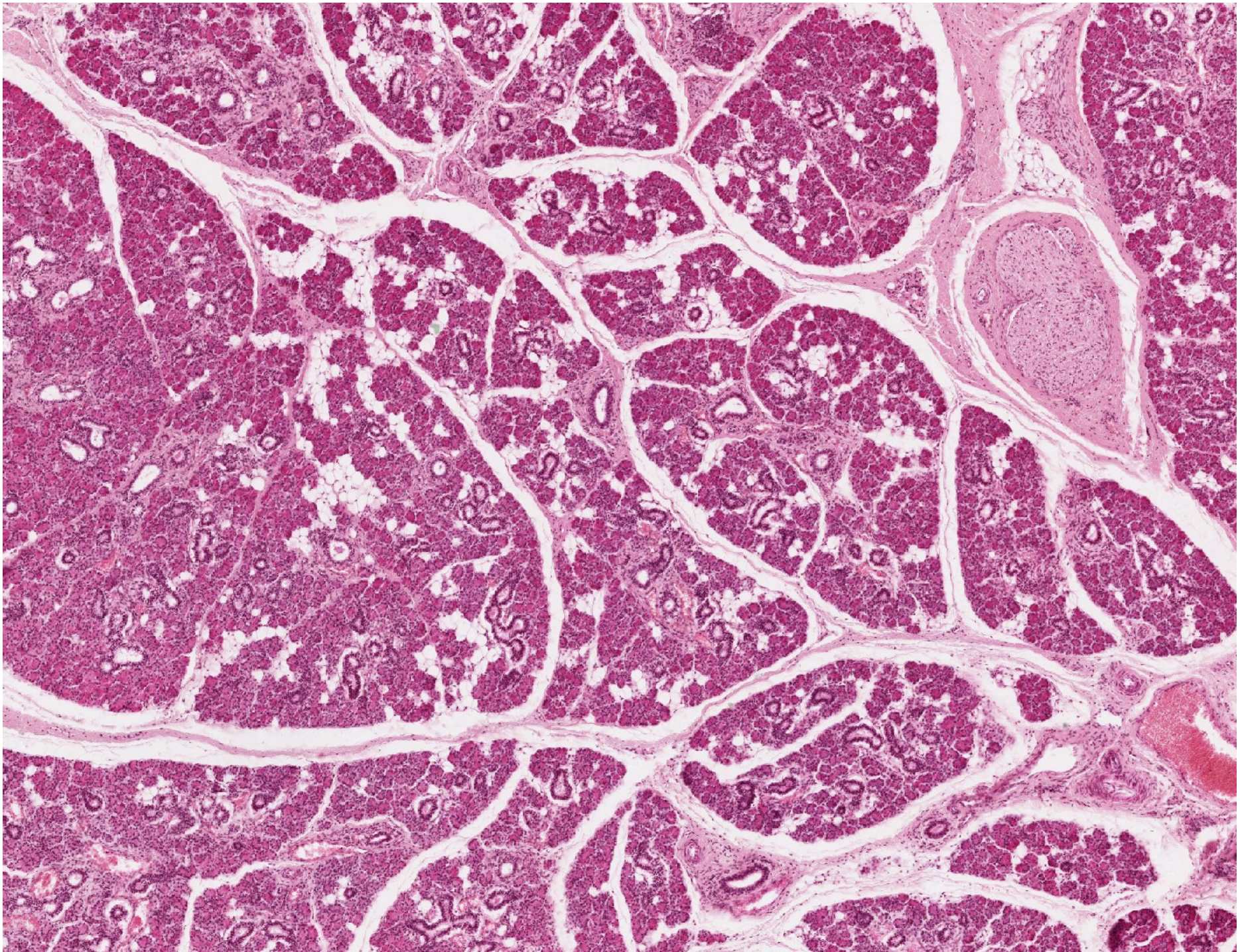
To help treat this problem obstructive stones can be removed from the parotid salivary duct. A miniature endoscope is introduced through the duct to locate the stone or stones in a procedure called sialendoscopy.

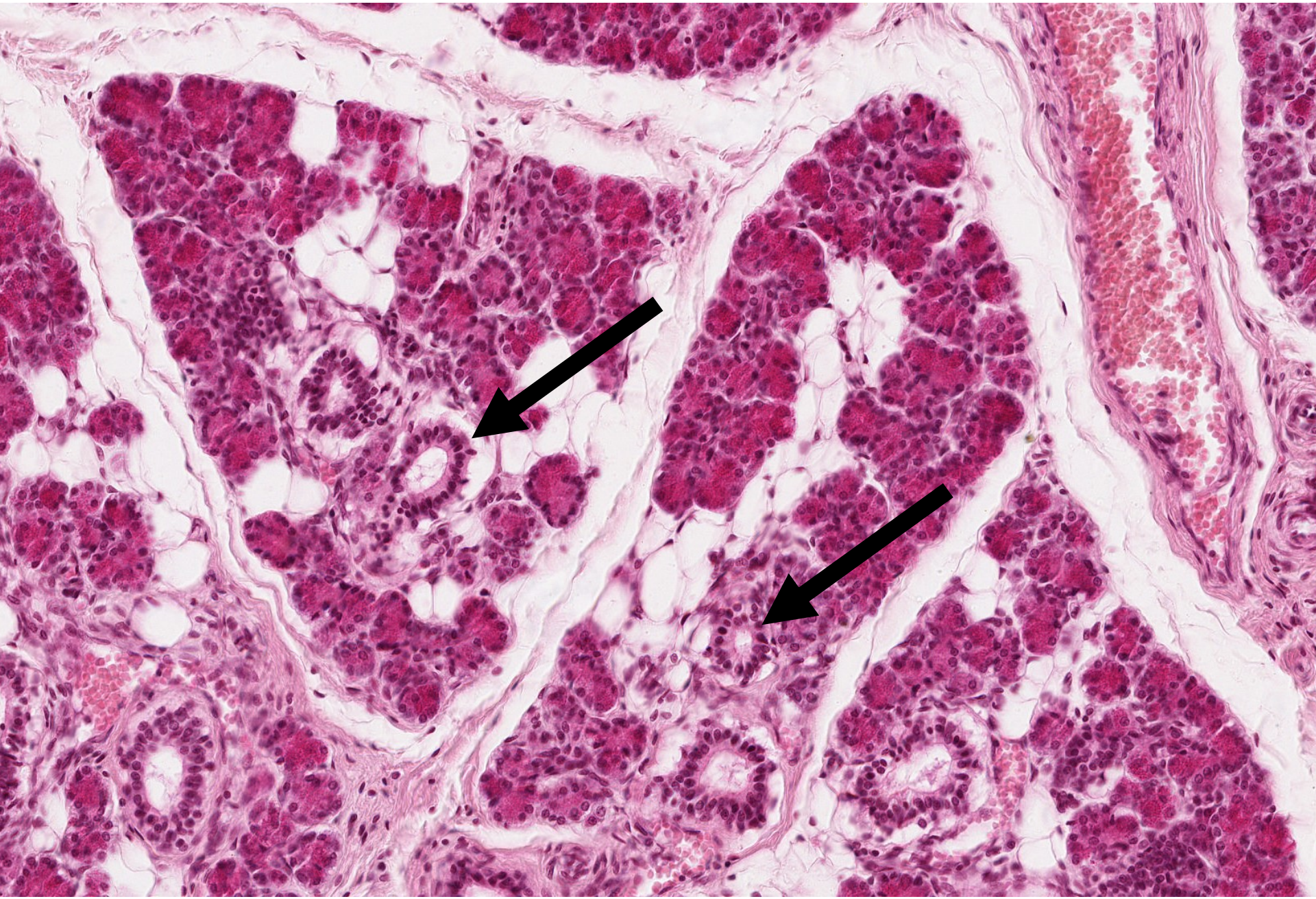
Glandula parotis

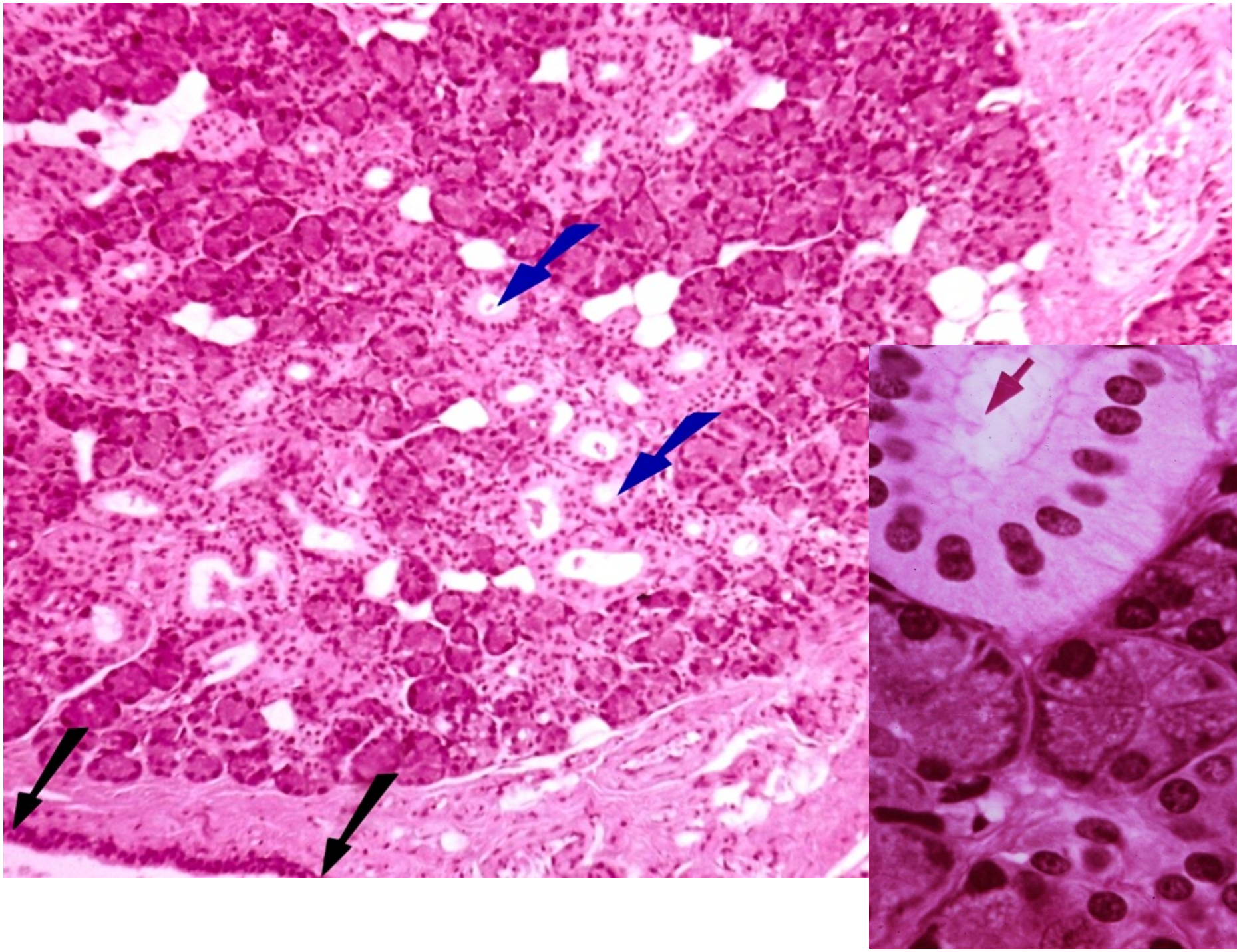
- **SEROUS gland**
- 14 - 28 g
- capsule, septs and lobules
- Serous acini, ducts: **long** intercalated ducts, **numerous** of striated ducts
- **ductus parotideus (Stenoni)** - 2. upper molar (Steno/Stensen, Niels)
- adipocytes

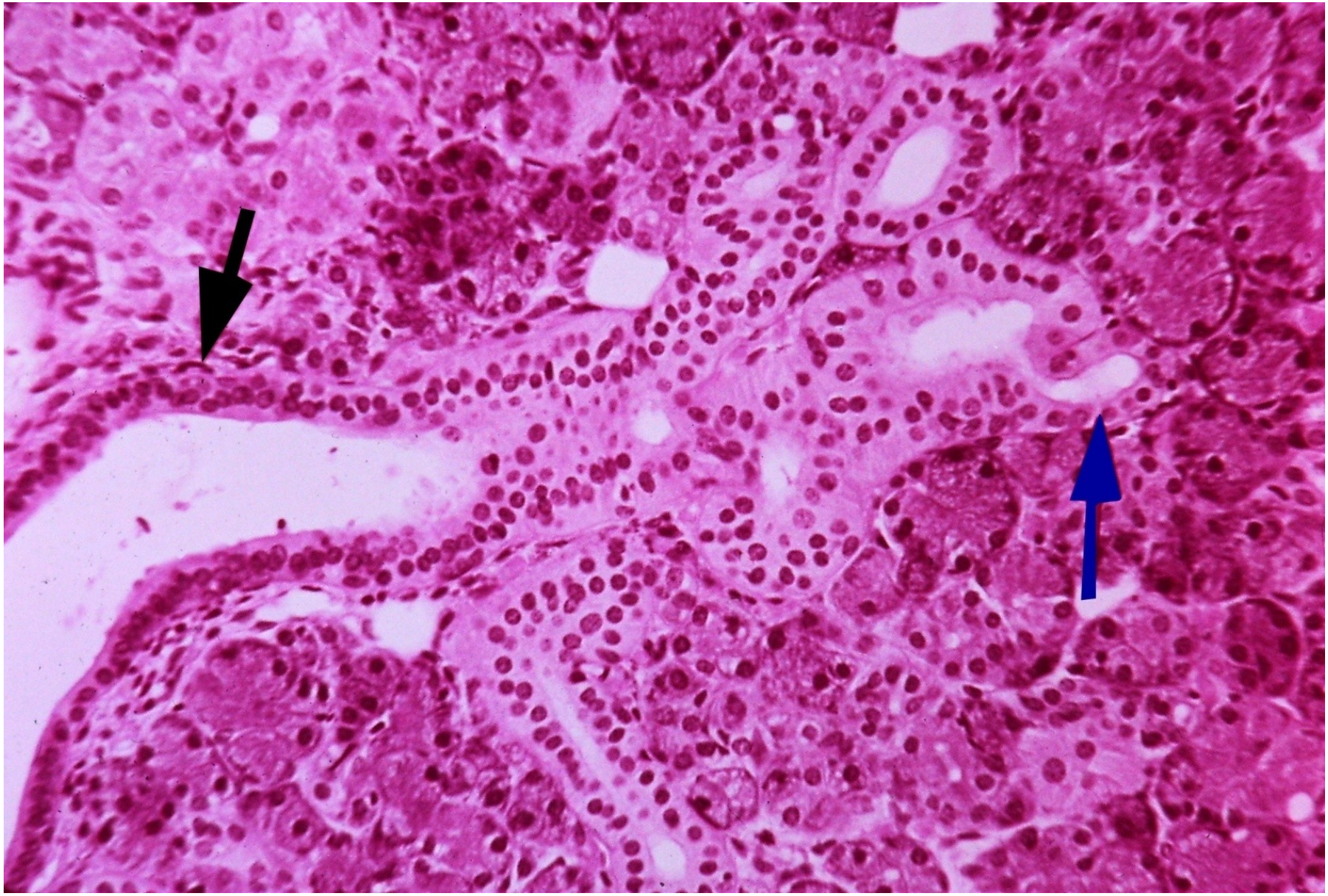


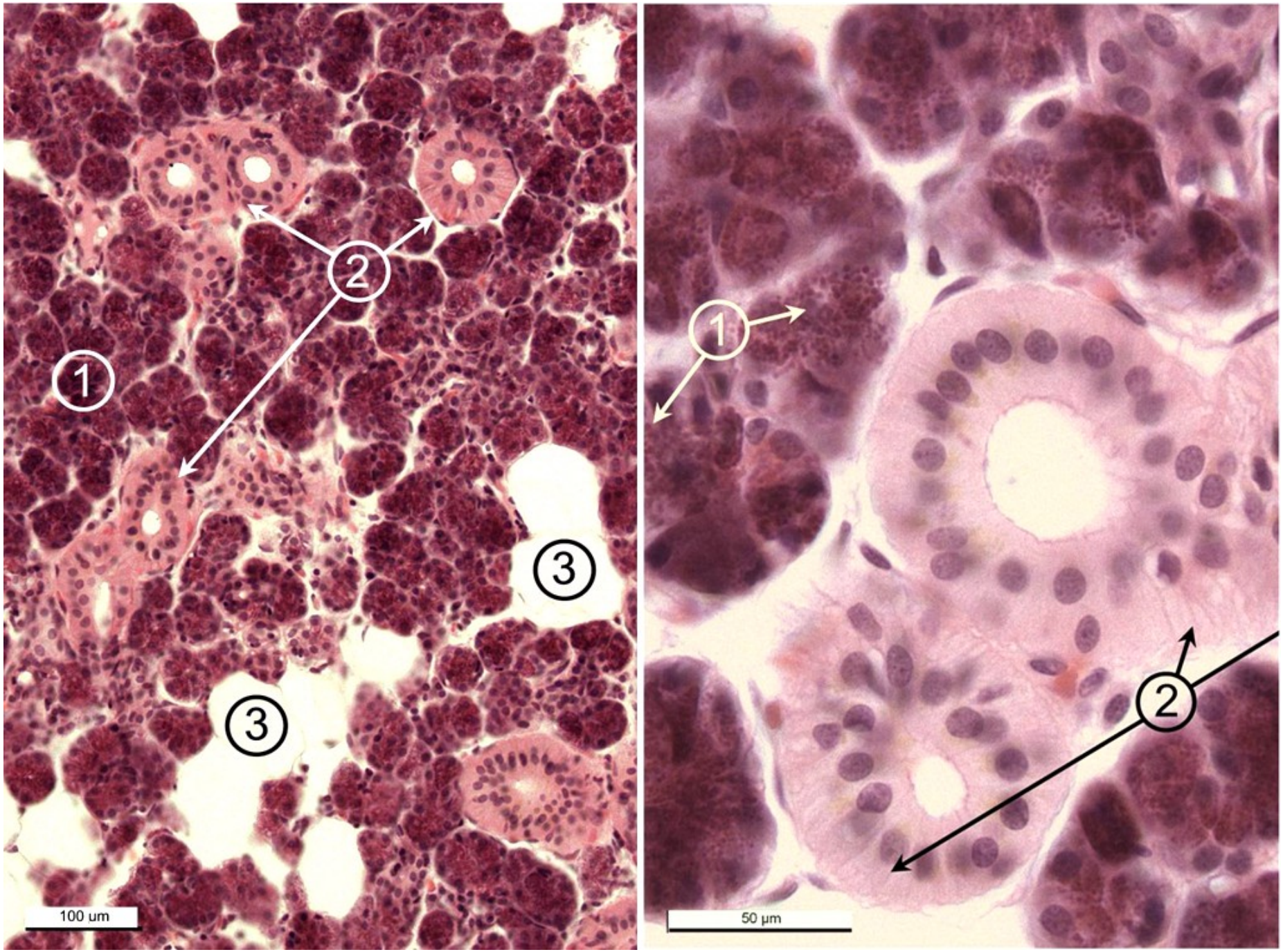








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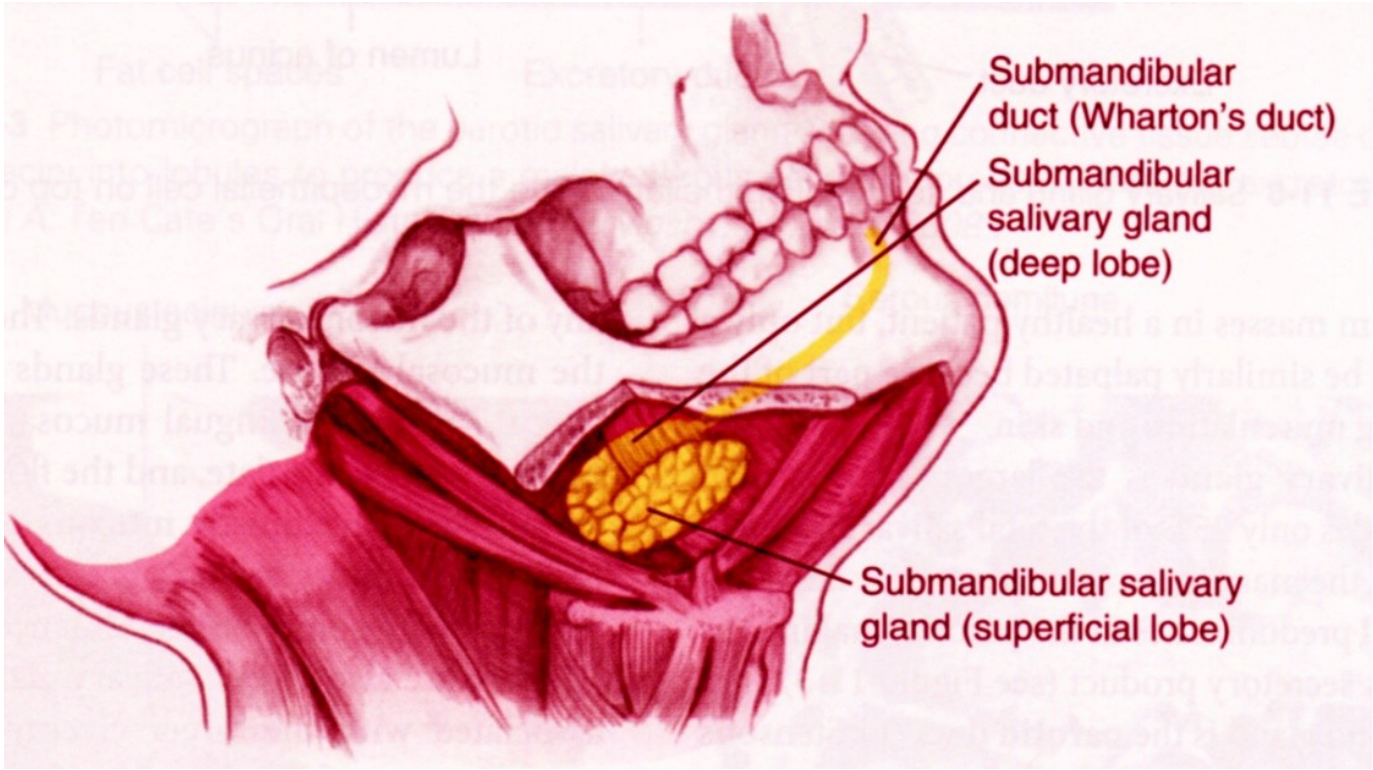
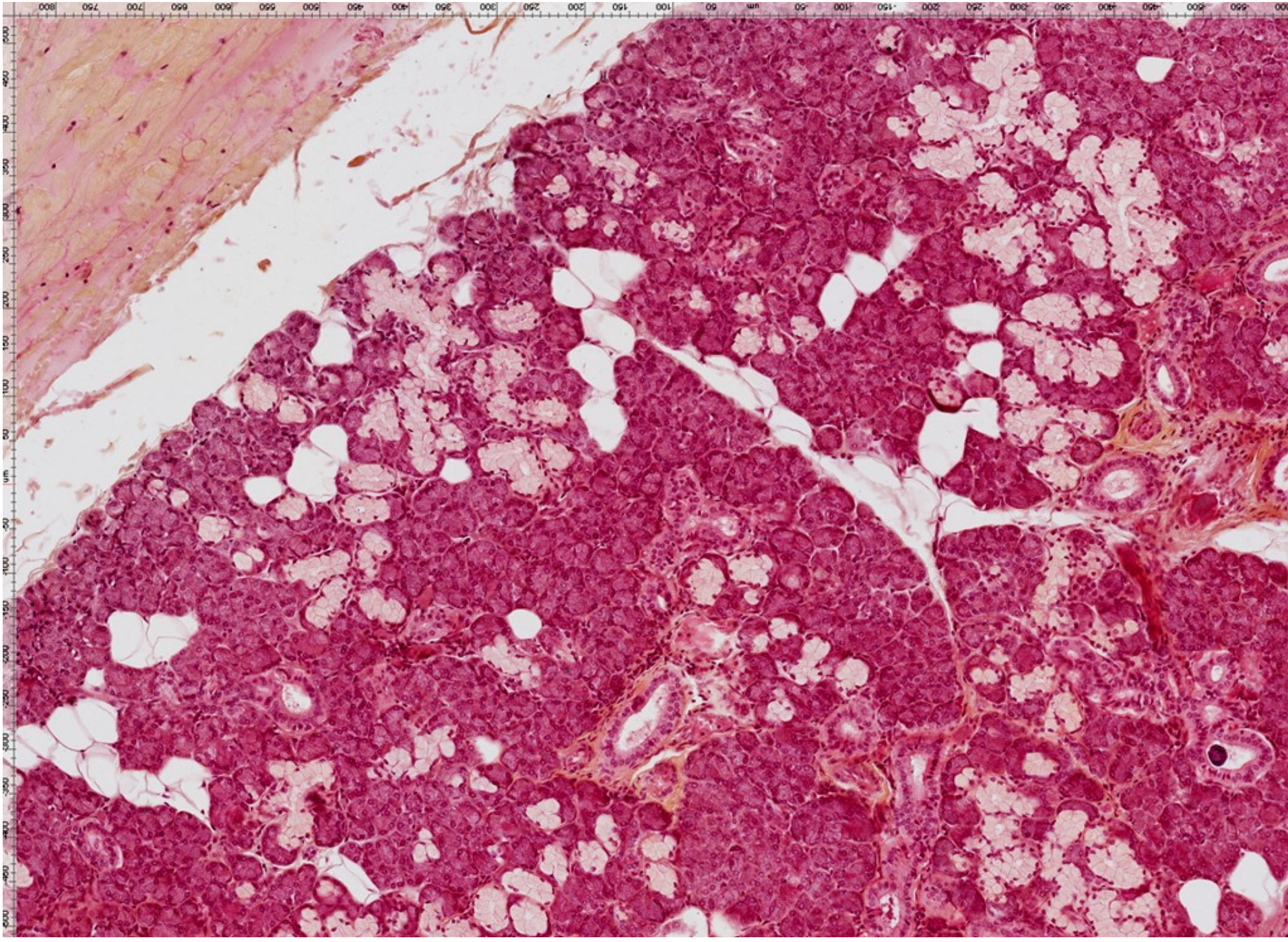
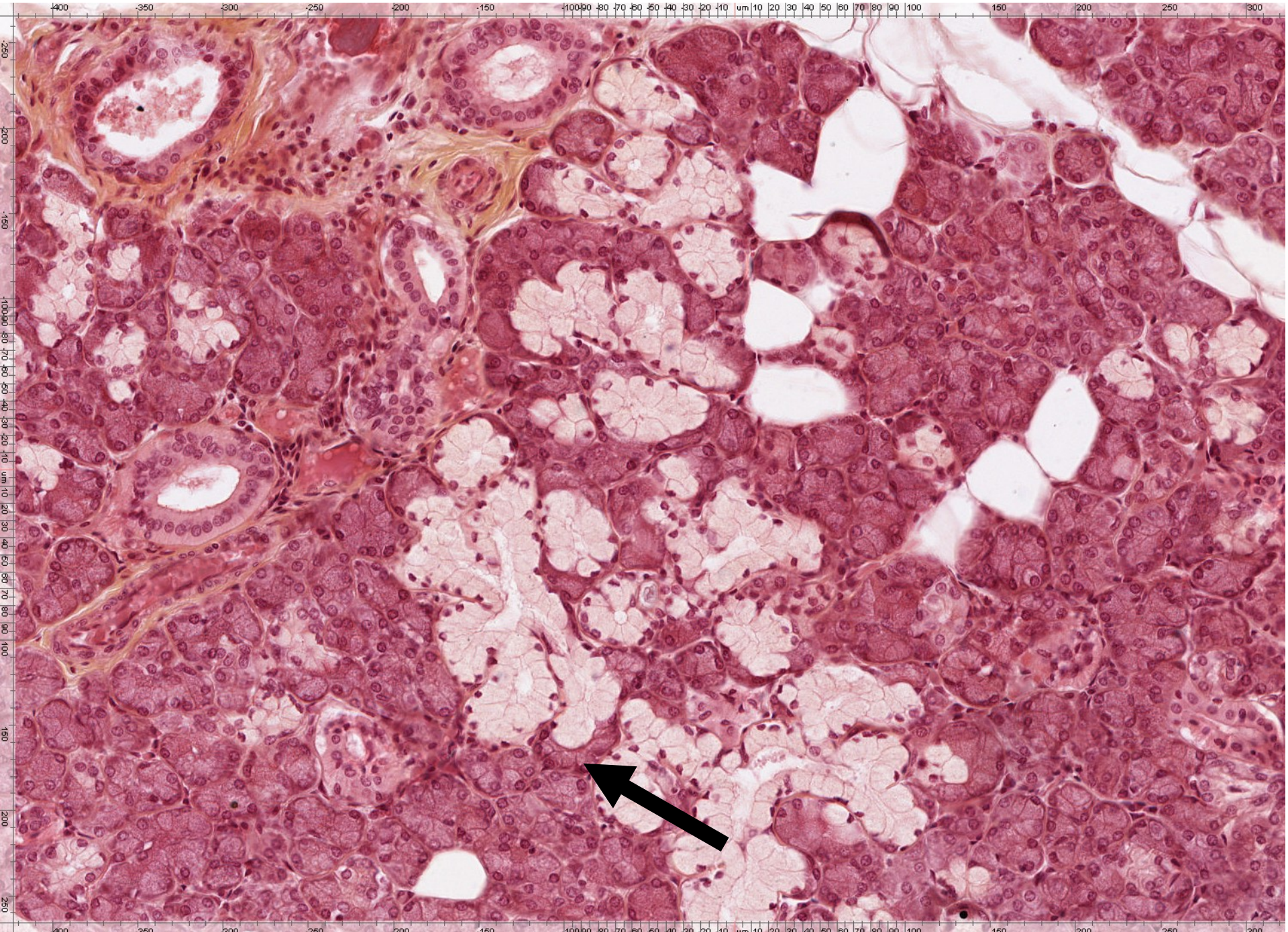
50 µm

Glandula submandibularis

- **MIXED** tuboalveolar gland, predominantly **SEROUS**
- 10-15 g
- serous acini **-** 80 %, rest are mucinous tubules with **Gianuzzi demilunes**
- intercalated and striated ducts
- **ductus submandibularis (Whartoni) - frenulum linguae**





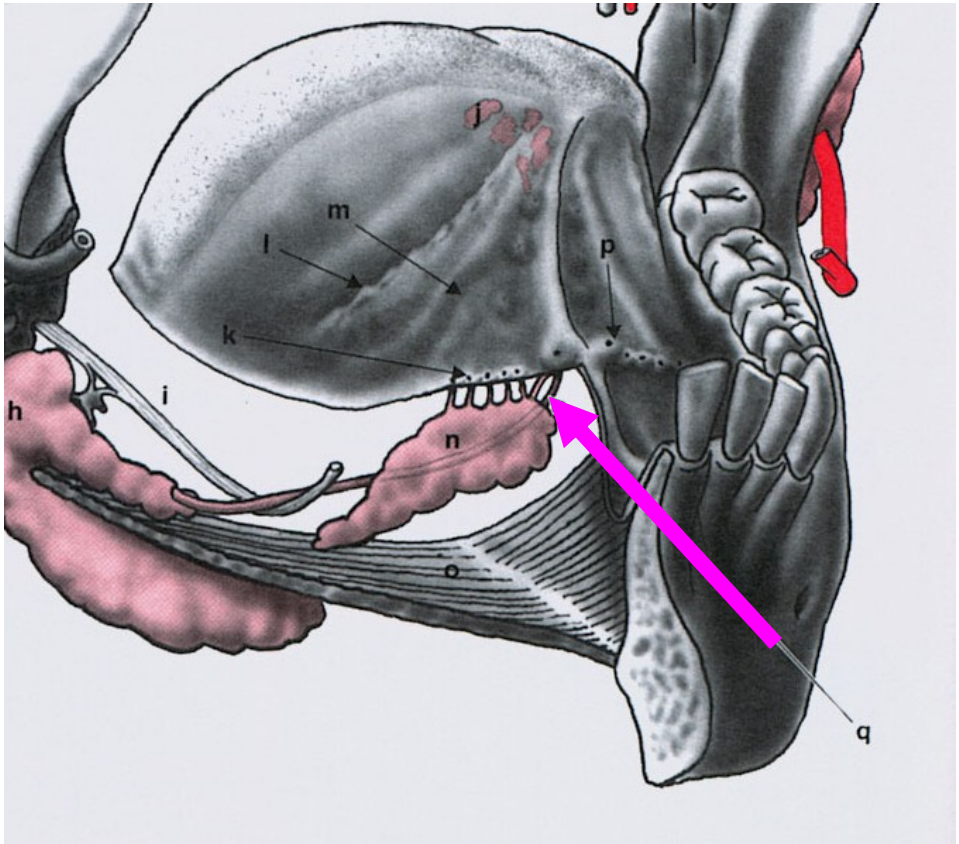


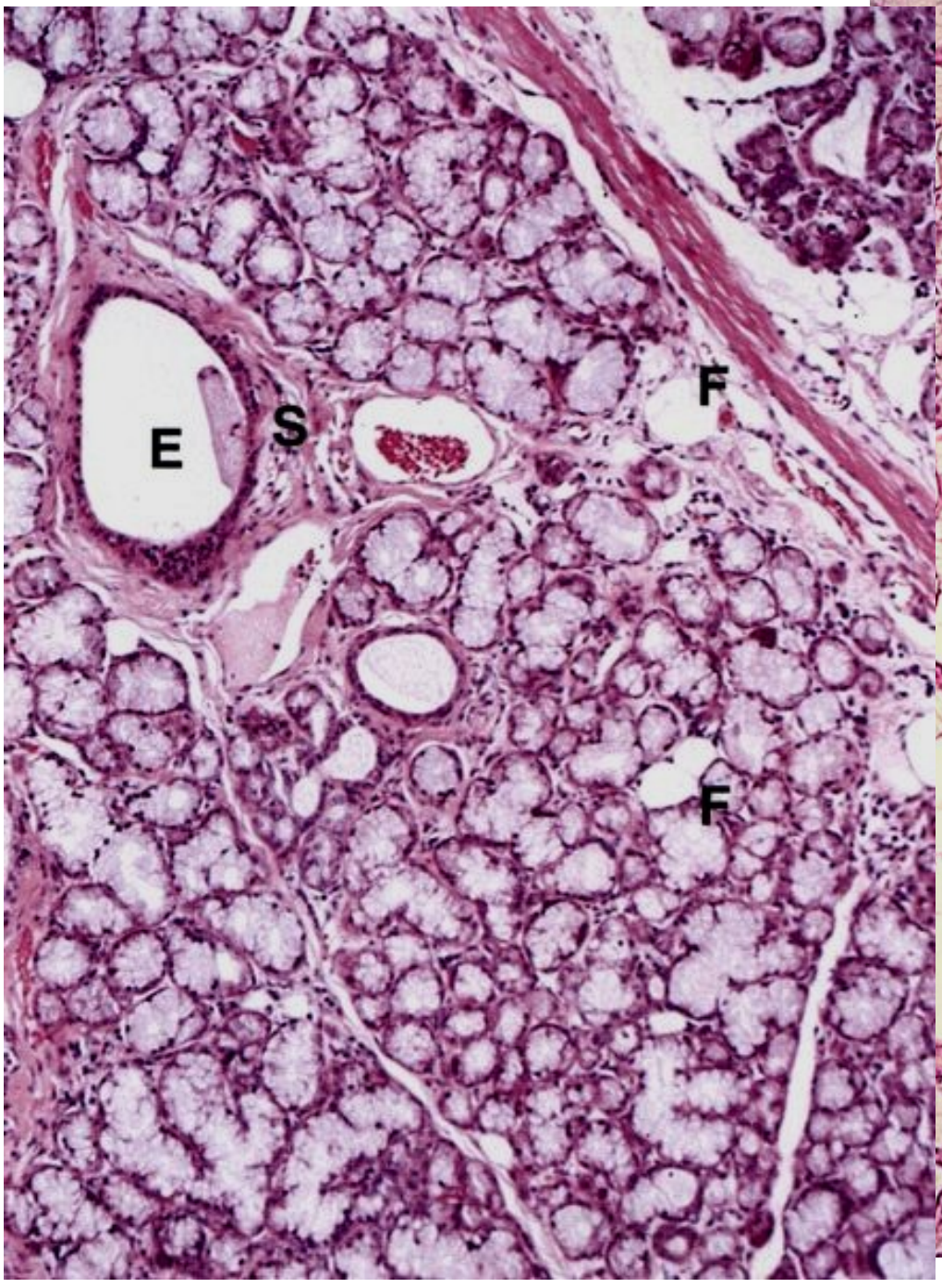
Glandula sublingualis

- **MIXED** tuboalveolar gland, predominantly **MUCOUS**
- 2g
- located on the floor of the mouth on mylohyoid muscle near the midline
- Mucinous tubules, **serous acini are rare**, instead of them: **Gianuzzi demilunes**
- Intercalated ducts are missing, striated ducta are present, but are reduced in number and short

- **ductus sublingualis major** (Bartholini)
- **ductus sublinguales minores** (Rivini)

along the crest of the plica sublingualis

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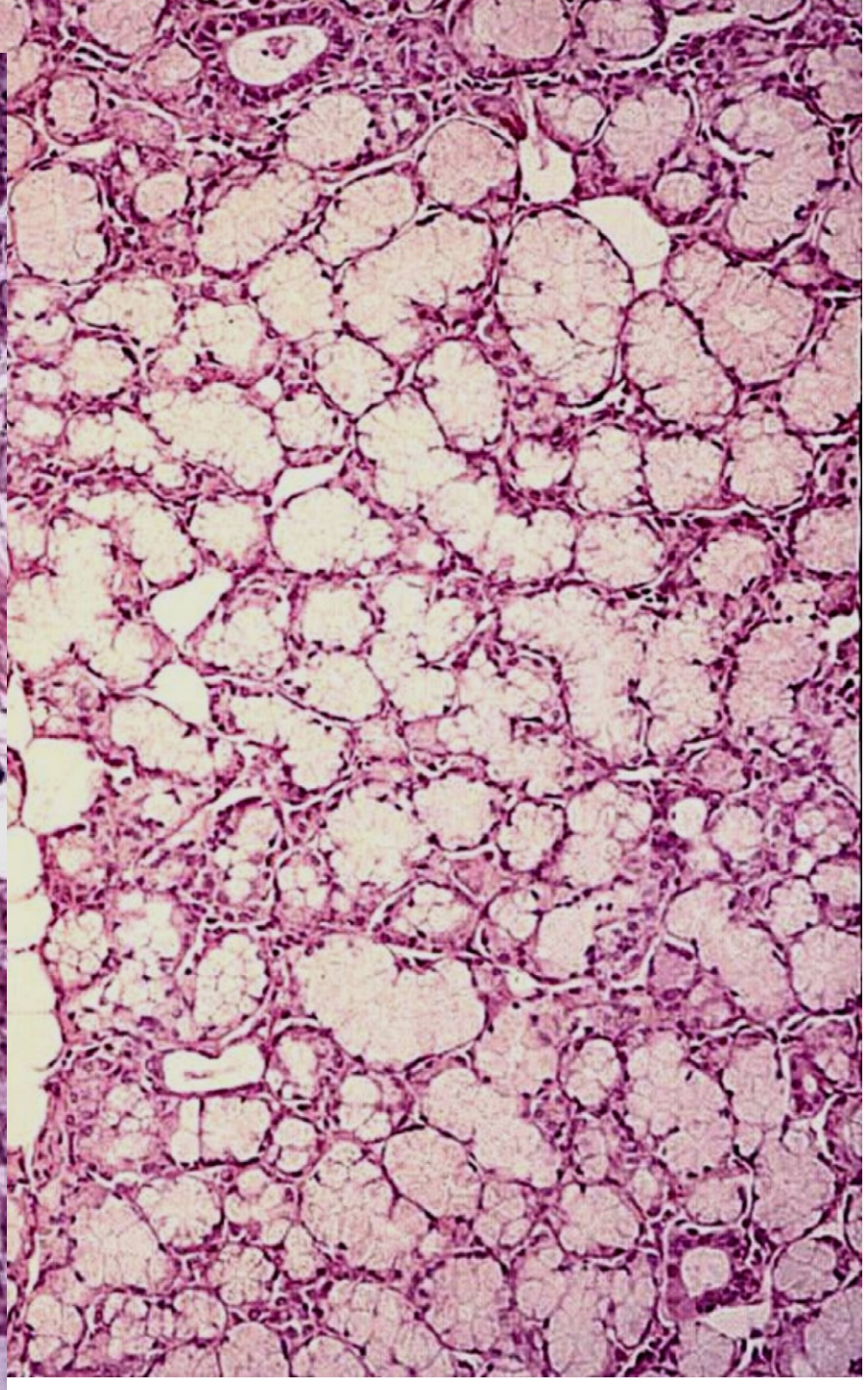
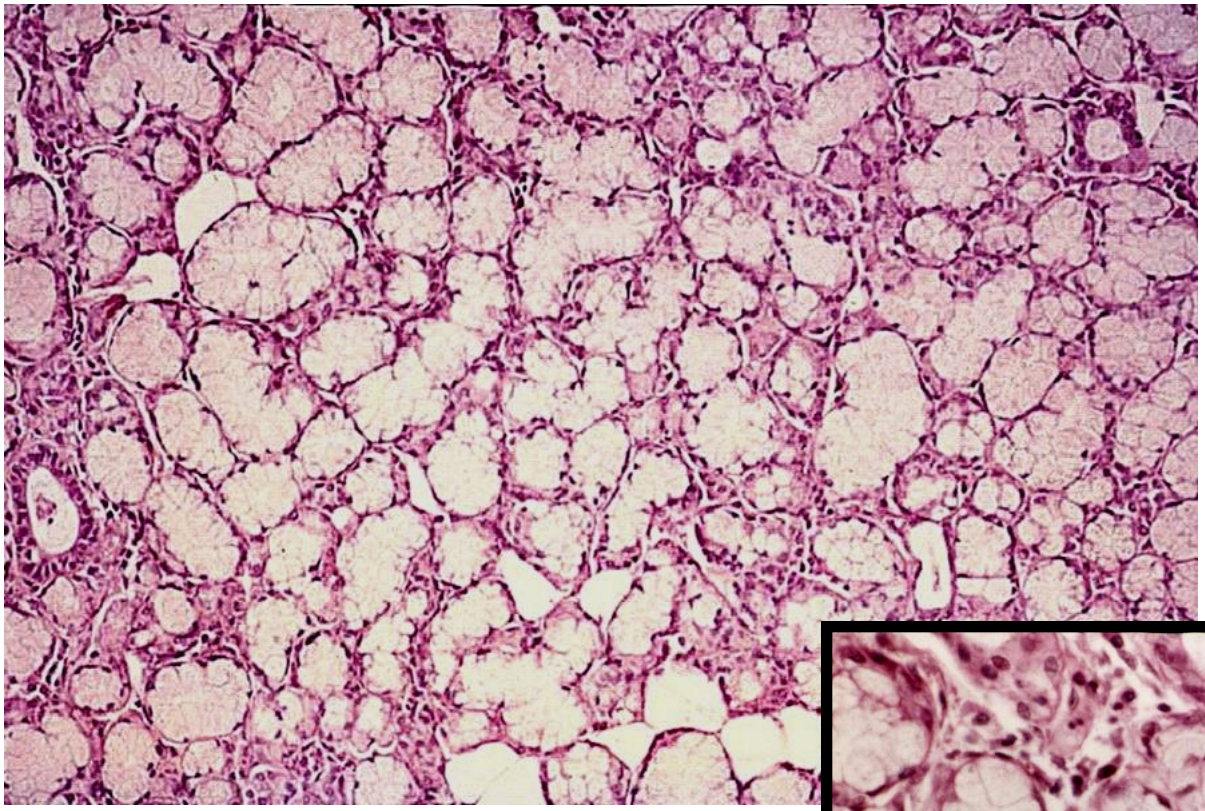
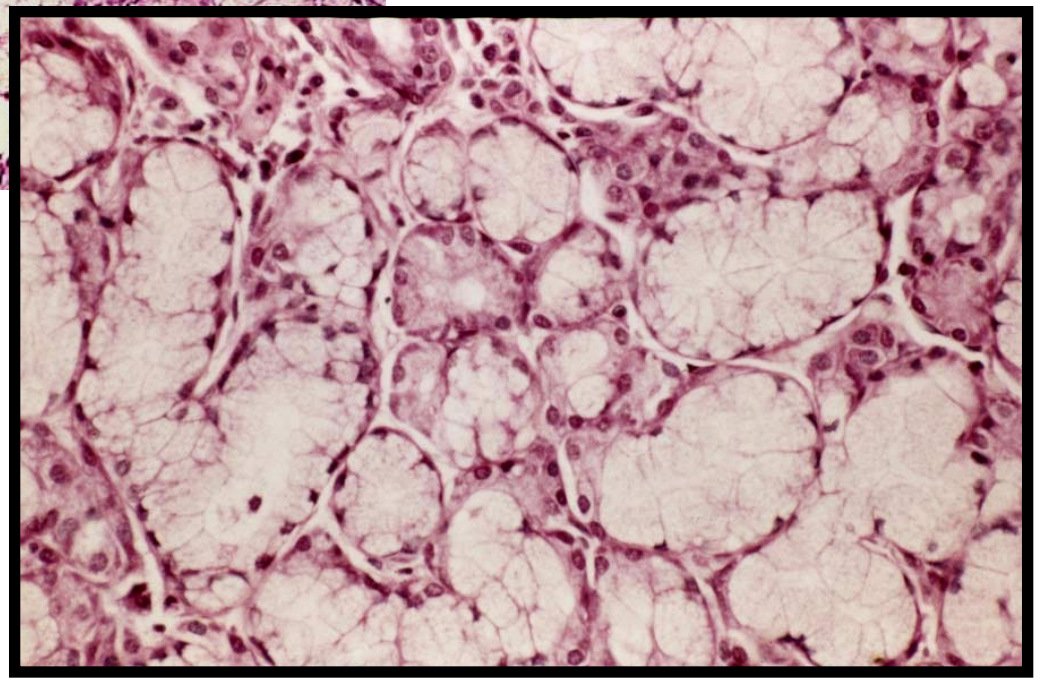
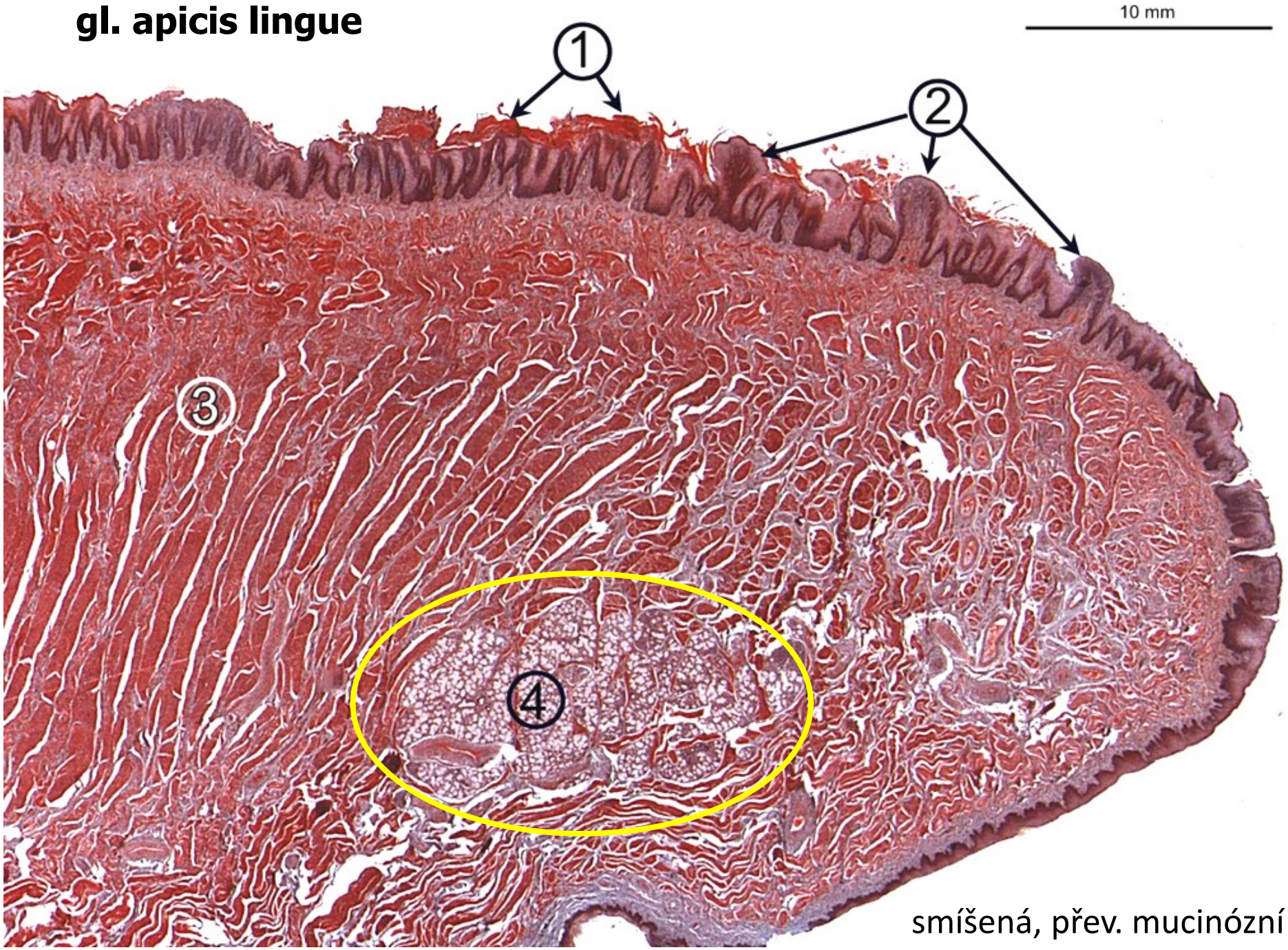


gl. sublingualis

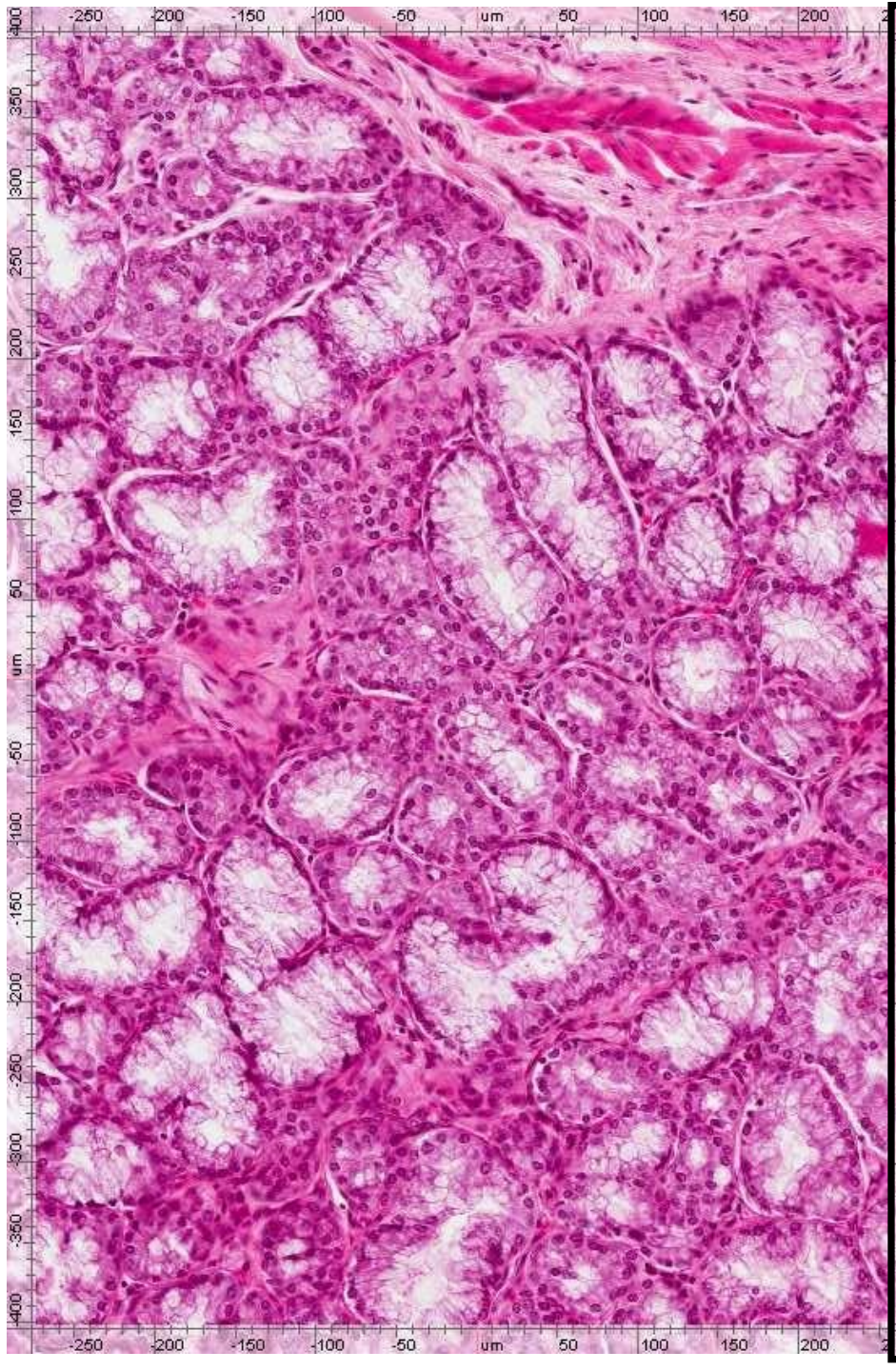
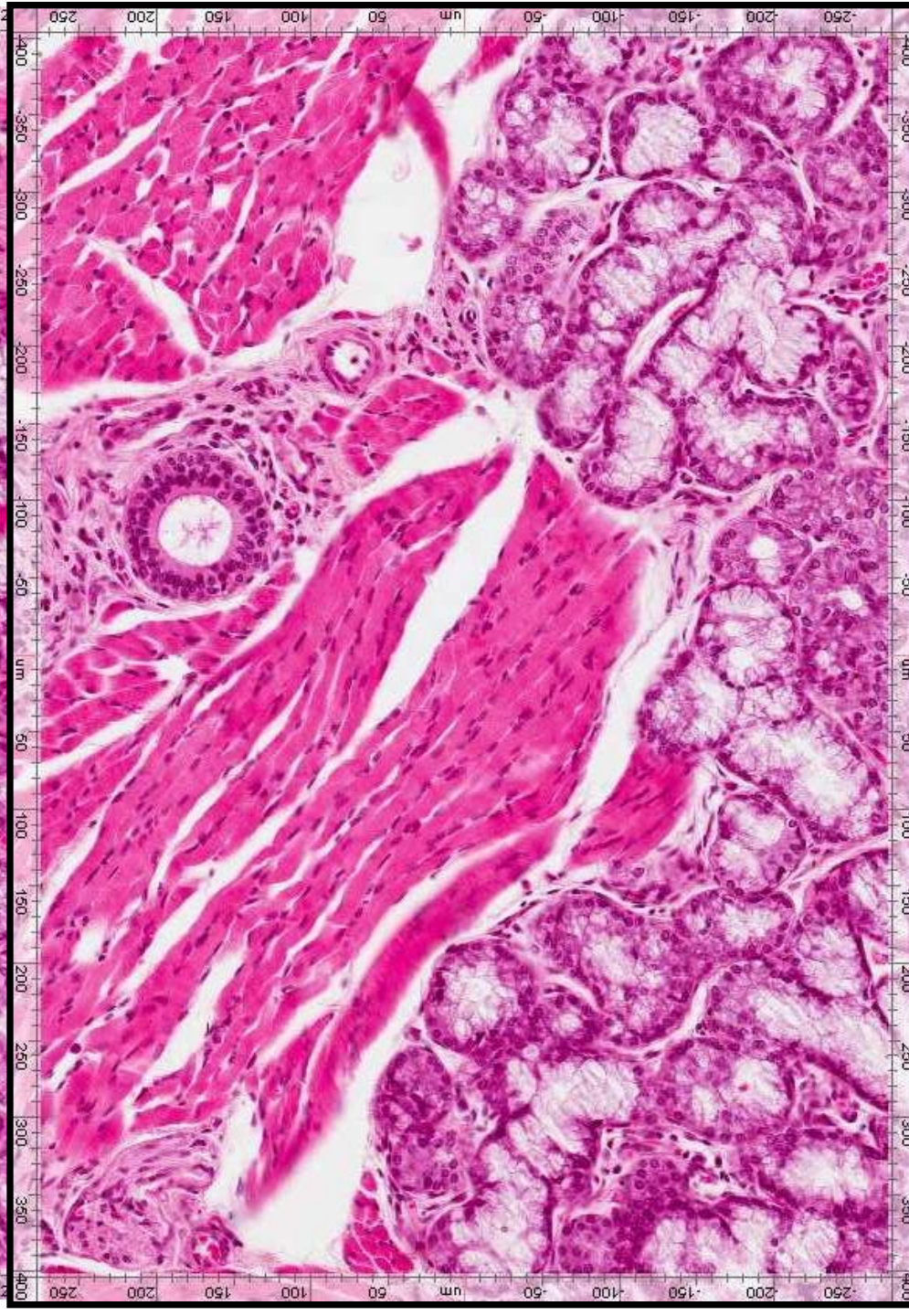




gl. apicis lingue



smíšená, přev. mucinózní

Location		Name	Type	Size
Lips		gll. labiales sup. et inf.	mixed, pred. mucinous	minor
Cheeks		gll. buccales	mixed, pred. mucinous	minor
		gll. molares (retromolares)	mixed, pred. mucinous	minor
		GL. PAROTIS	serous	**MAJOR**
Palate	**hard**	gll. palatinae (glandular zone)	mucinous	minor
	soft	gll. palatinae	mucinous	minor
Tongue	**Apex**	gl. apicis lingue (Blandini-Nuhni)	mixed, pred. mucinous	**minor/ major**
	Terminal sulcus	gll. Ebner‘s (gll. papillae vallatae)	serous	minor
	Base	gll. Weber‘s (gll. linguales post.)	mucinous	minor
Floor of the mouth		**GL. SUBMANDIBULARIS**	mixed, pred. serous	**MAJOR**
		GL. SUBLINGUALIS	mixed, pred. mucinous	**MAJOR**

Samples

gl. parotis **8**

gl. submandibularis **9**

gl. sublingualis **10**

gl. apicis linguae 2

Lokalizace		Název	Typ	Velikost
Rty		gll. labiales sup. et inf.	smíšené, přev. mucinózní	malé
Tváře		gll. buccales	smíšené, přev. mucinózní	malé
		gll. molares (retromolares)	smíšené, přev. mucinózní	malé
		GL. PAROTIS	serózní	**VELKÁ**
Patro	**tvrdé**	gll. Palatinae (žlázová zóna)	mucinózní	malé
	měkké	gll. palatinae	mucinózní	malé
Jazyk		gl. apicis lingue (Blandini-Nuhni)	smíšená, přev. mucinózní	**malá/ velká**
		žlázky Ebnerovy (gll. papillae vallatae)	serózní	malé
		žlázky Weberovy (gll. linguales post.)	mucinózní	malé
Dno dutiny ústní		**GL. SUBMANDIBULARIS**	smíšená, přev. serózní	**VELKÁ**
		GL. SUBLINGUALIS	smíšená, přev. mucinózní	**VELKÁ**

Comparison of the hard tooth tissues (and lamellar bone)

	Enamel	**Dentin**	**Cementum**	**Lamellar bone**
Colour	White (to light blue)	Ivory	Brown-yellow	Brown-yellow
Inorganic (%) **Organic (%)** **H_20 (%)**	96 (86) 1 (2) 3 (11)	70 (45) 20 (30) 10 (25)	61 (33) 27 (31) 12 (36)	45 (23) 30 (37) 25 (40)
Collagen fibres	NO	YES (perpendicular to the dentinal tubules)	YES (in all directions)	YES (same direction in lamellas)
Cells	**Ameloblasts** (missing in adults)	**Odontoblasts** (on the pulpal side of dentin)	**Cementoblasts** (cementocytes)	**Osteoblasts** osteocytes
Blood vessels	NO	NO	NO	YES (in Haversian canals)
Nerves	NO	YES (on entry of dentinal tubules)	NO	YES (in Haversian canals)

Procedures used to study the microscopic structure of teeth

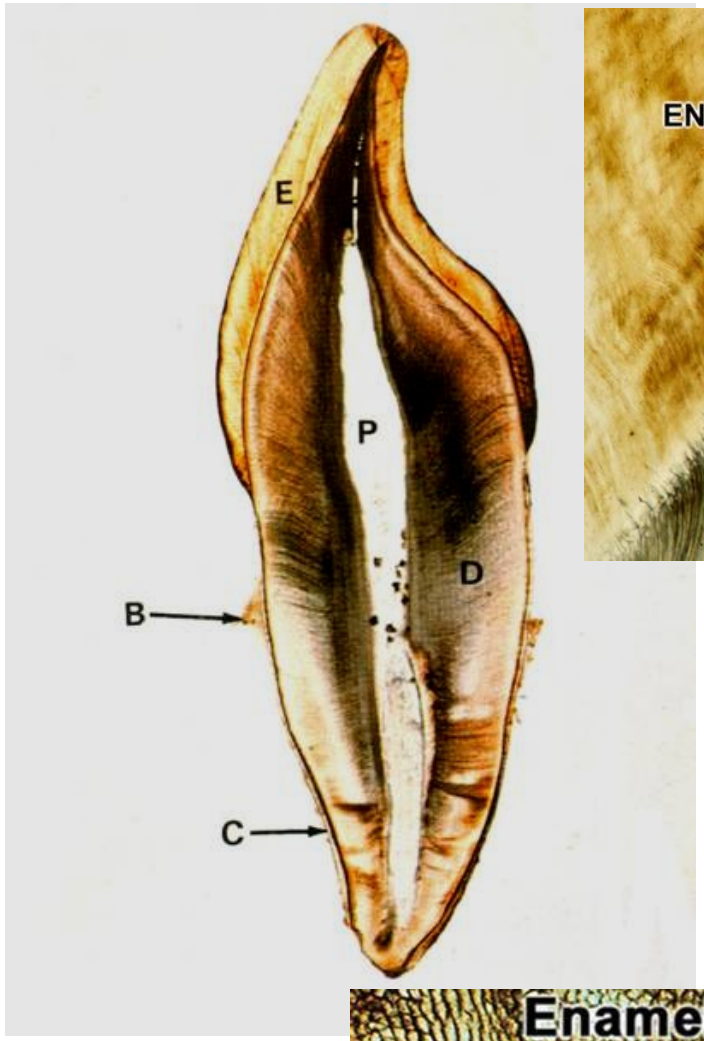
2 basic methods of hard tissue processing are used in **light microscopy**:

1. **Ground sections**
2. **Decalcified samples (and staining)**

1. Ground sections

50 - 70 µm discs made by grinding

(saw, carborundum wheel, fine grinders, abrasive powders and pastes during grinding, the disc must be water-cooled, the finished cut is sealed in a Canadian balm,
which heats up when mounted above the flame - so all the cavities and channels are preserved in the cut-out The preparation of the cut-out requires g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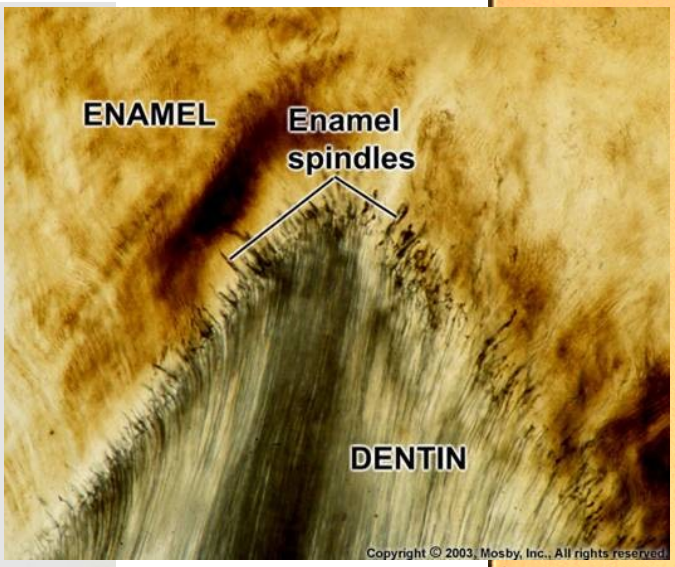
ENAMEL
Enamel spindles
DENTIN
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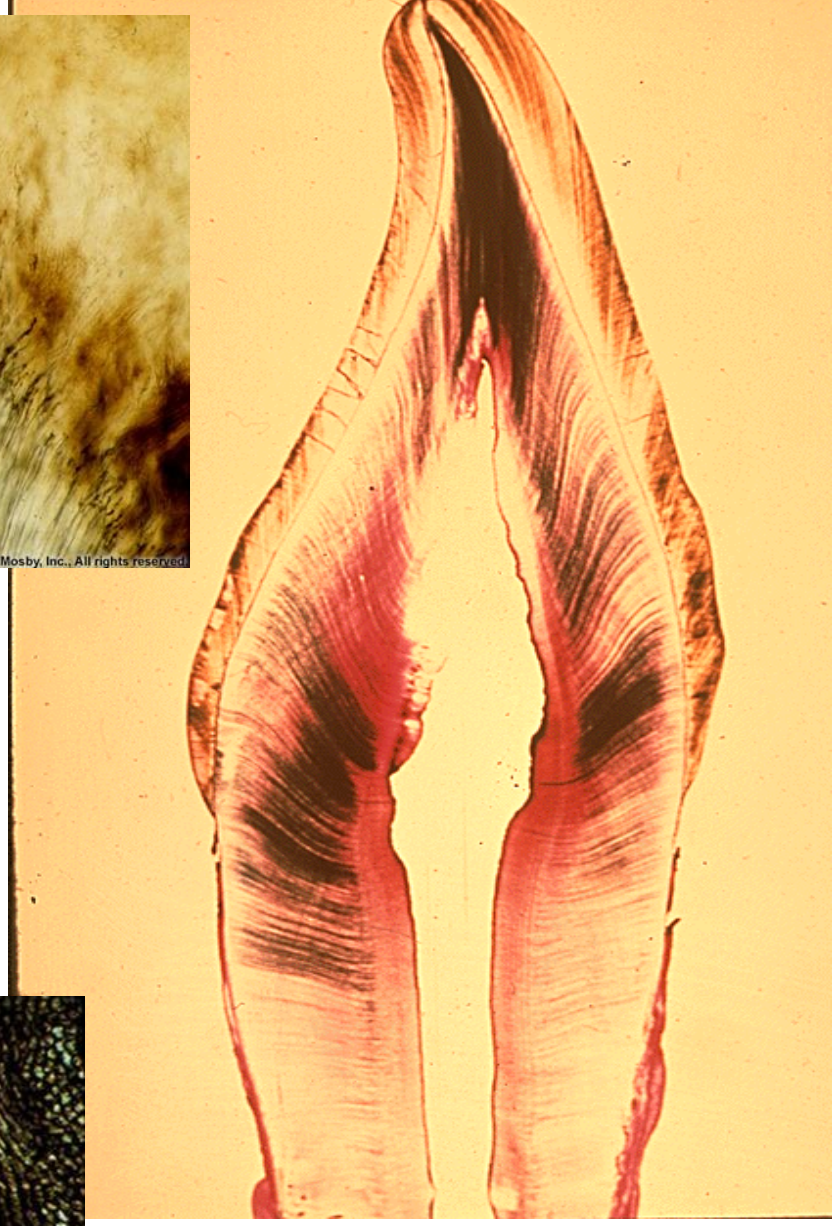

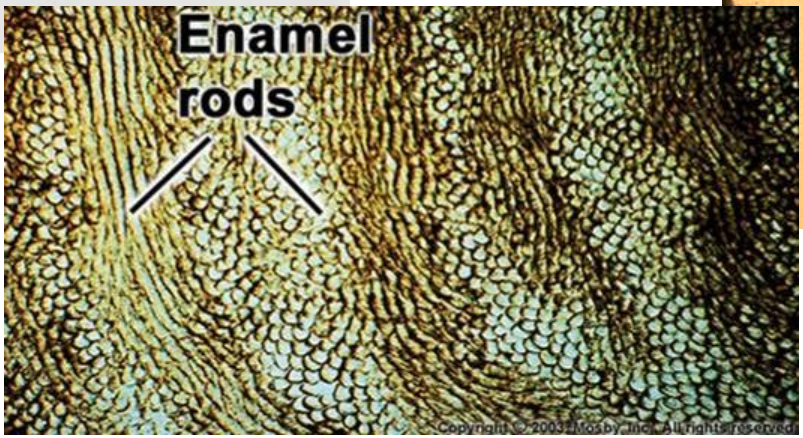
Enamel rods
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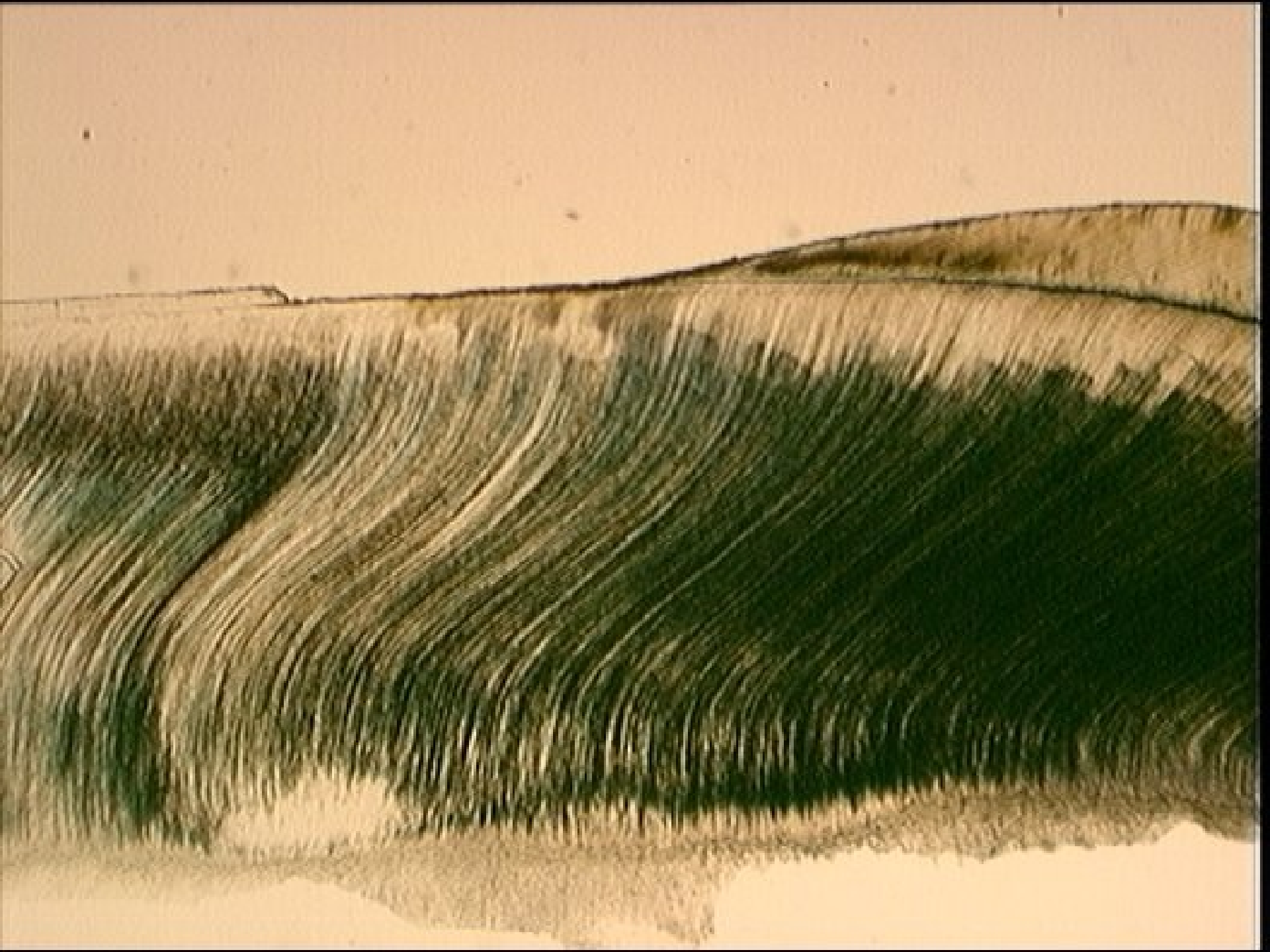


2. Stained sections of decalcified tooth

Long preparation: decalcification of the tooth, embedding, staining

Decalcification: dacalcification agents convert insoluble calcium salts (phosphate and carbonate) to water-soluble salts. The time required for descaling depends on the size of the object and the type of decalcifying fluid: **from several days to weeks and months**

Decalcification agents:

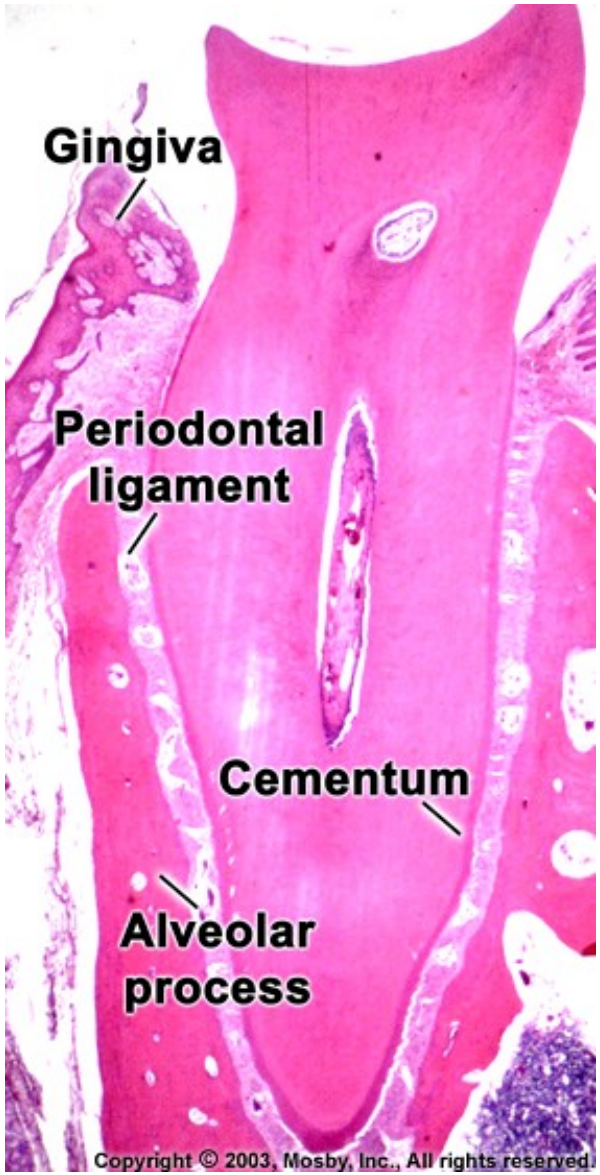
- **Acids** (e.g. 5% nitric acid, 5% trichloroacetic acid and 22-23% formic acid) - **1 week**
- **Chelating agents –** EDTA: **4 weeks - 3 months**

  preserves well the structure of the tissue and enable the staining

Embedding – paraffin, resins

Sectioning – cryotome, microtome (decalcified); staining

Stained slice of dacalcified tooth



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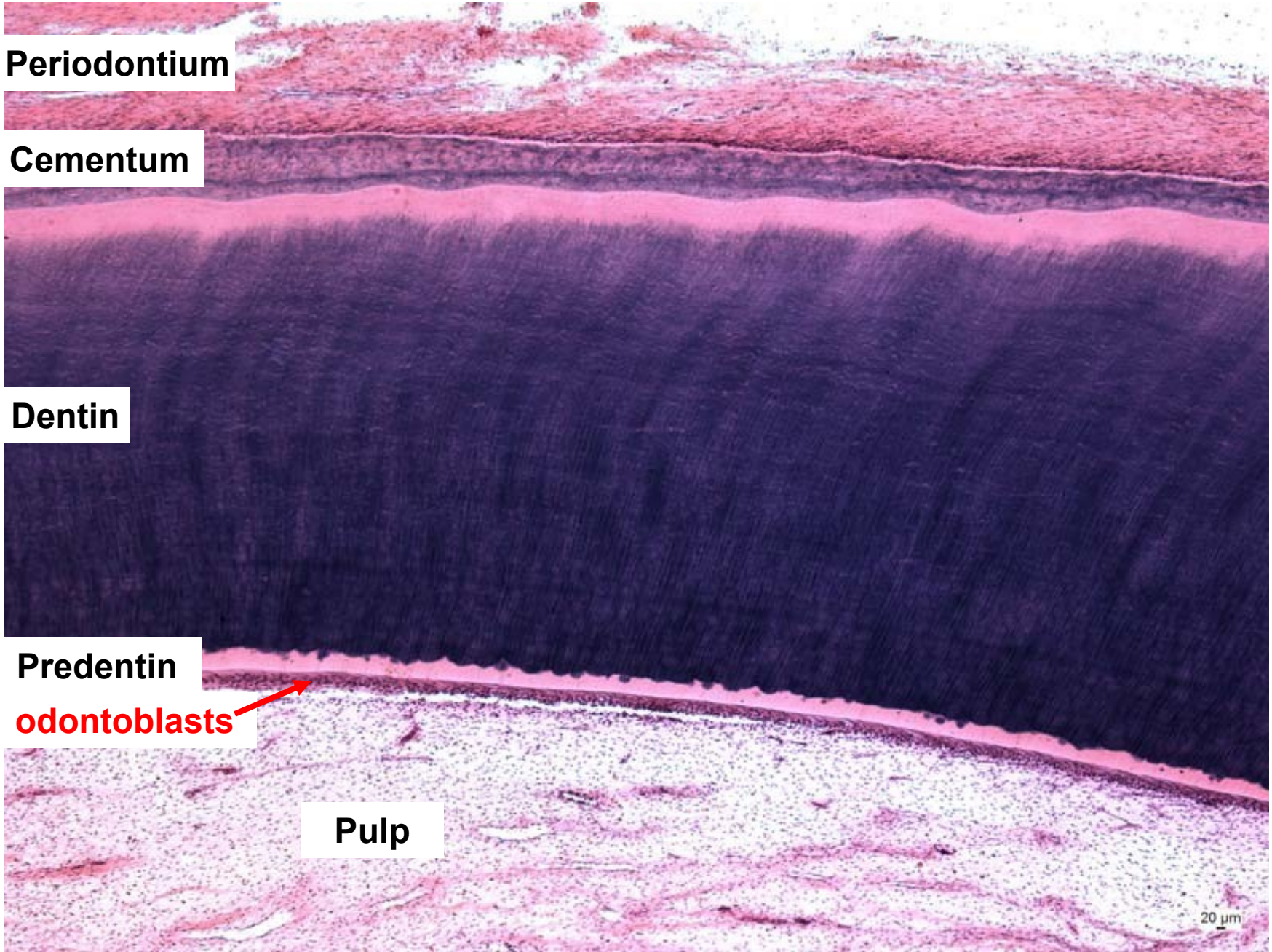
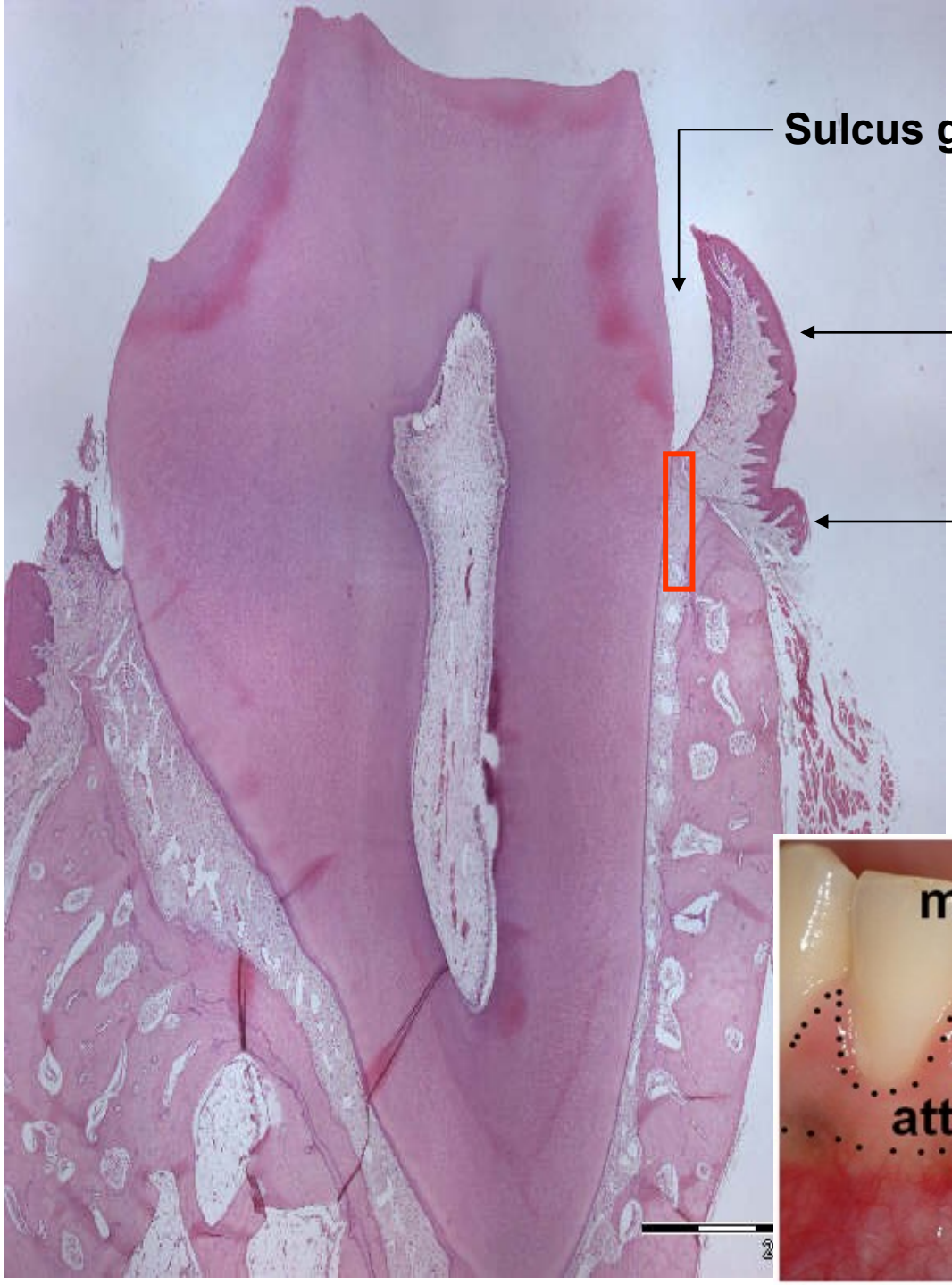
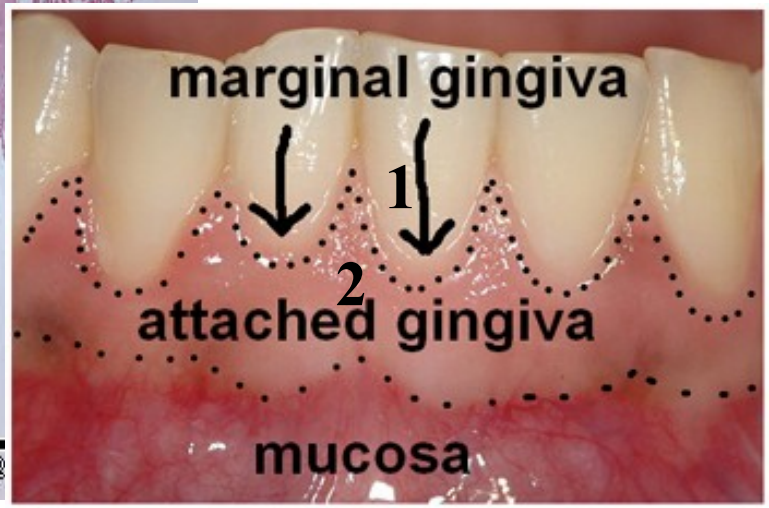
Soft tissues are not preserved on ground sections

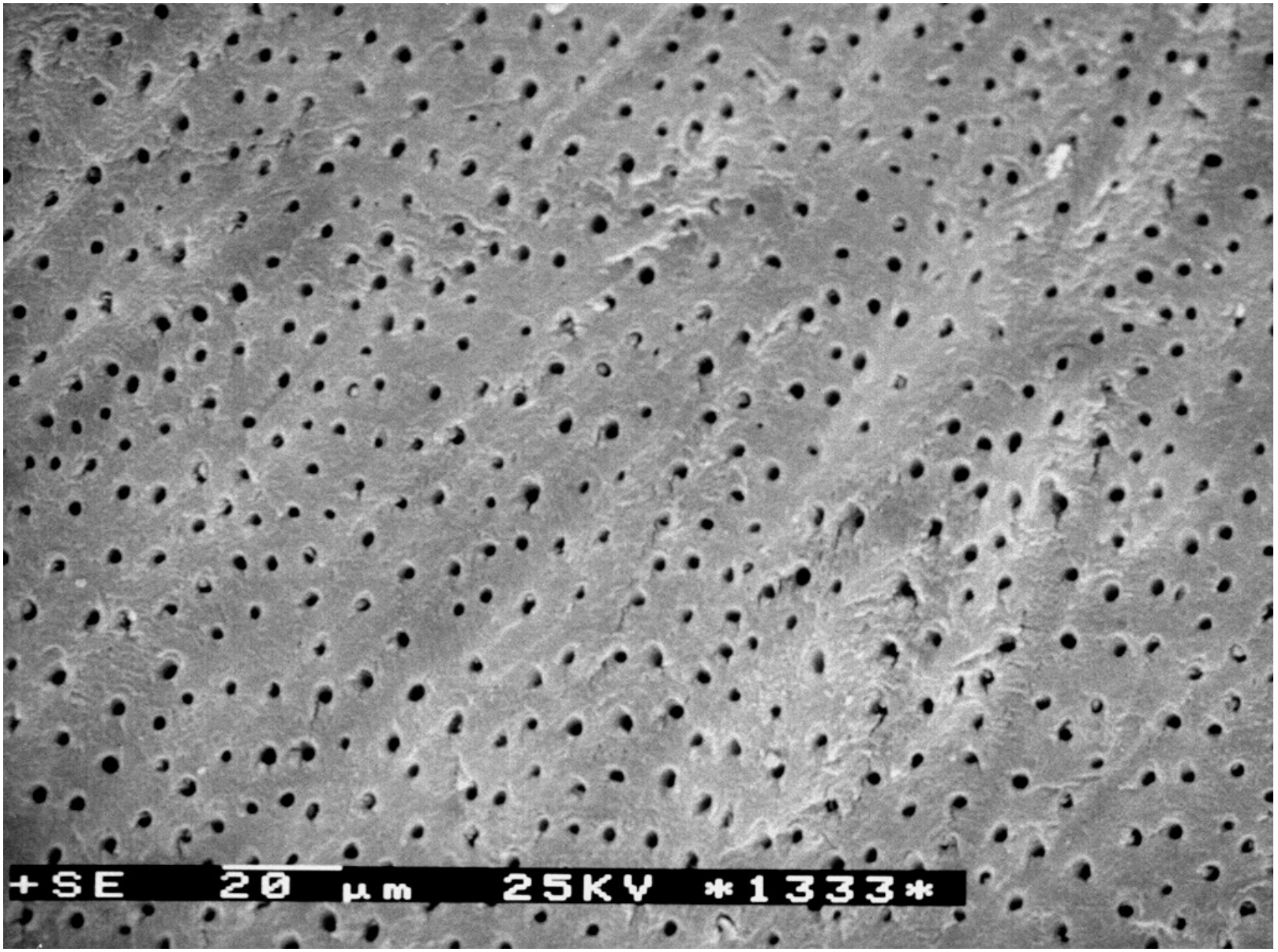
Enamel is missing on decalcified teeth

Tooth - root

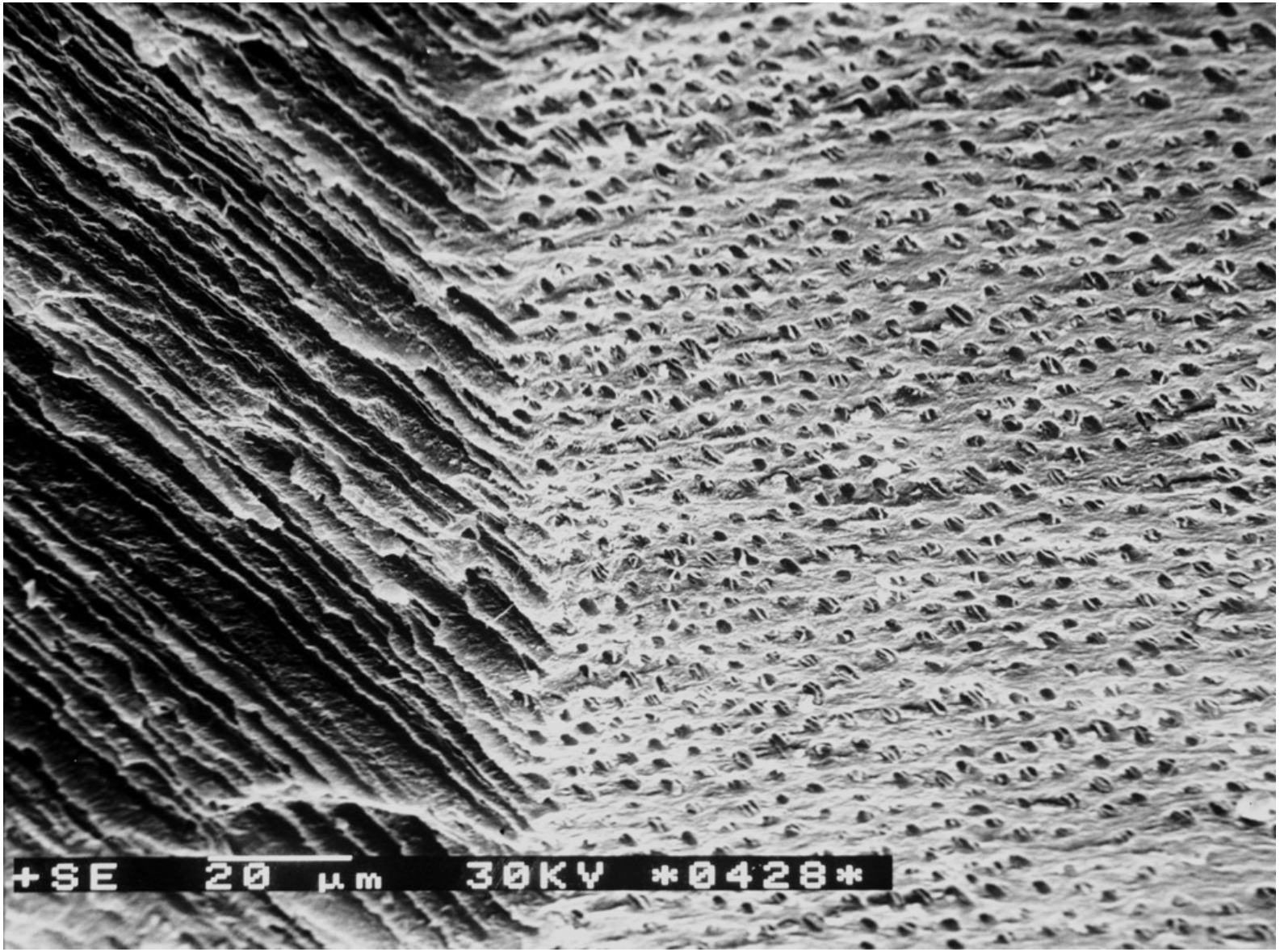

Periodontium
Cementum
Dentin
Predentin
odontoblasts
Pulp
20 µm


Sulcus gingivalis
Gingiva libera (1)
Gingiva affixa (2)


marginal gingiva
1
2
attached gingiva
mucosa



Dentin, SEM, 1 500x



Dentin, SEM, 1 500x