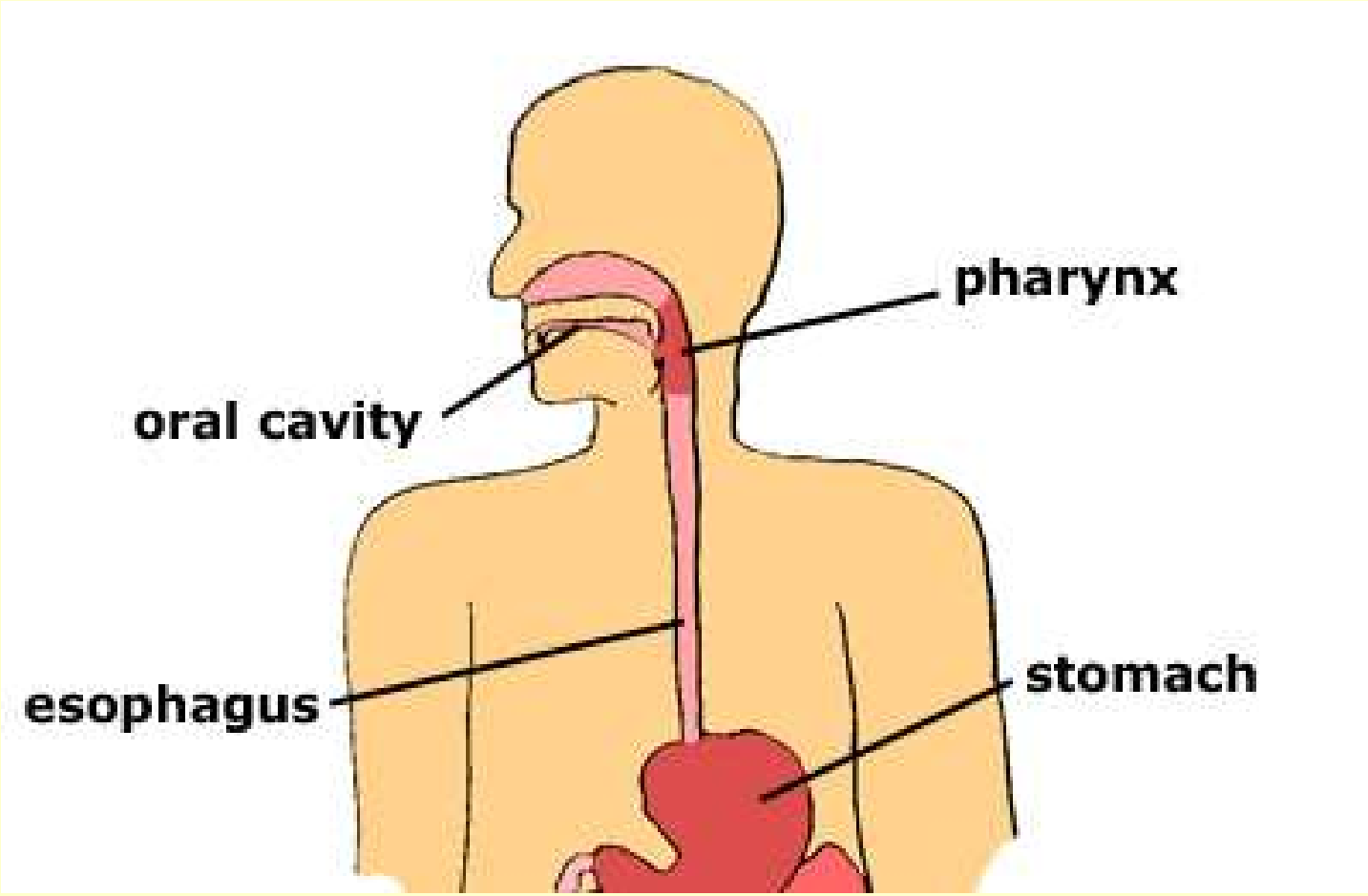
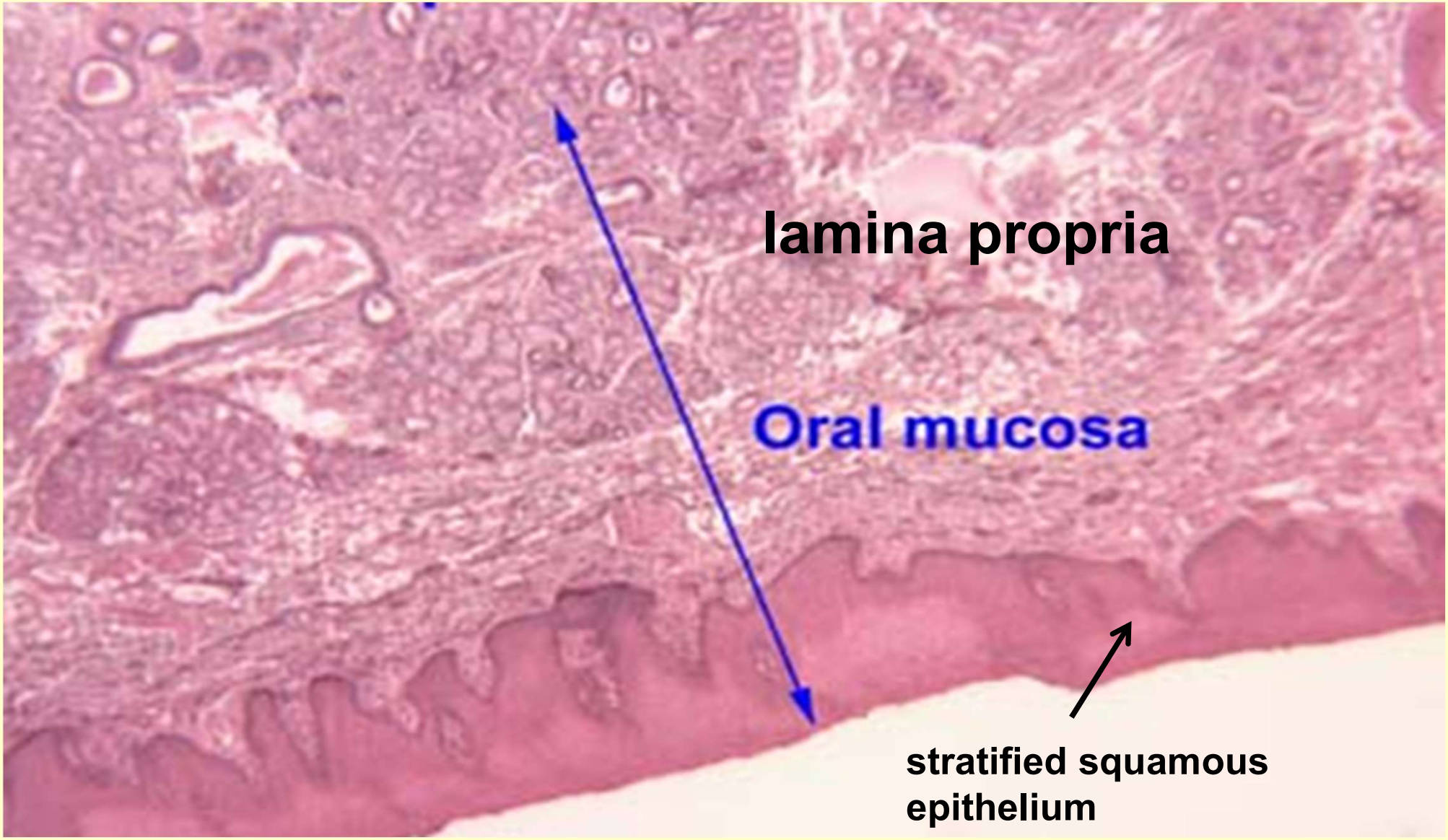
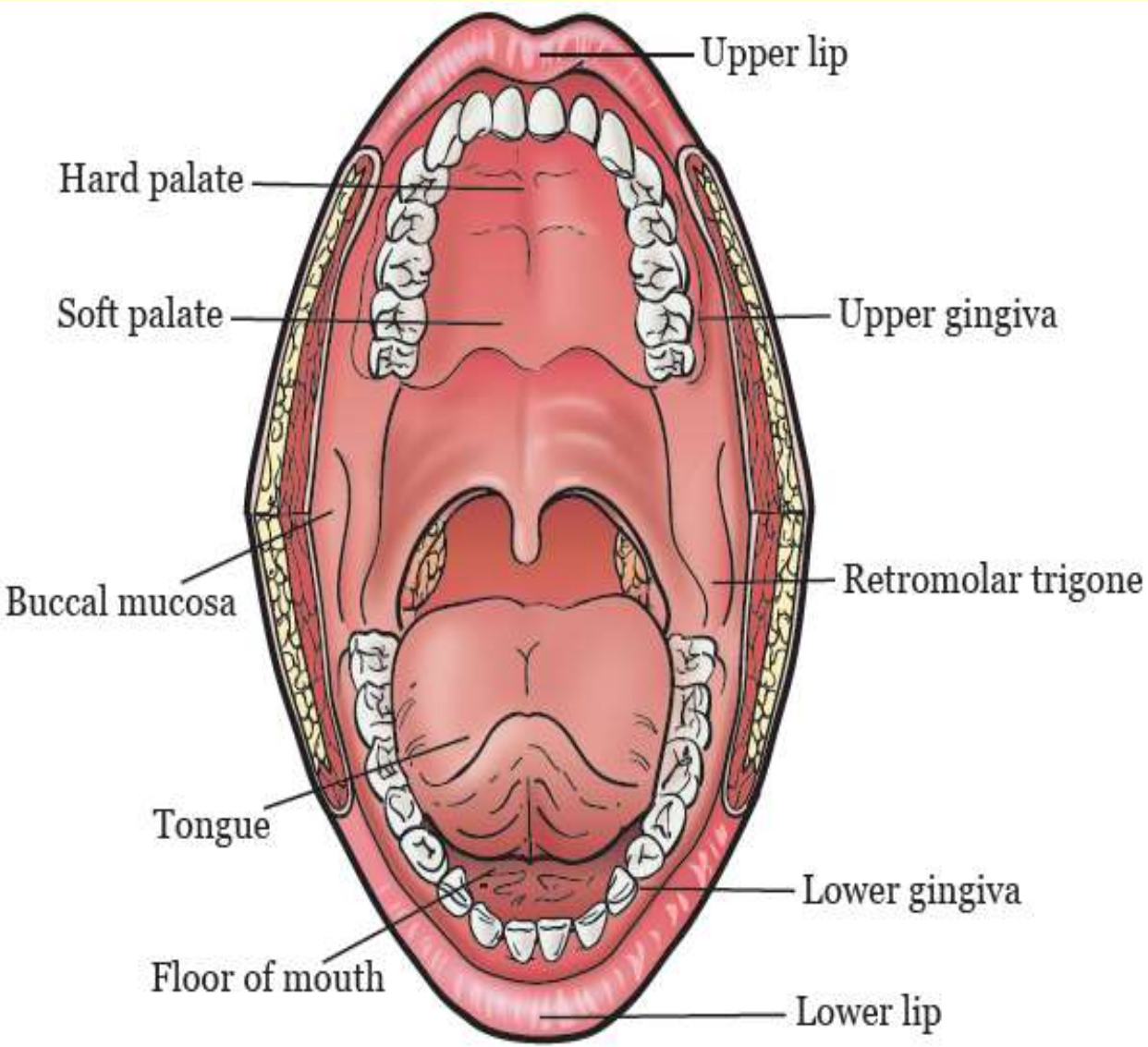
Digestive system - part 1
oral cavity, esophagus



The oral cavity - **oral mucosa**

- epithelium and connective tissue (lamina propria)





masticatory mucosa

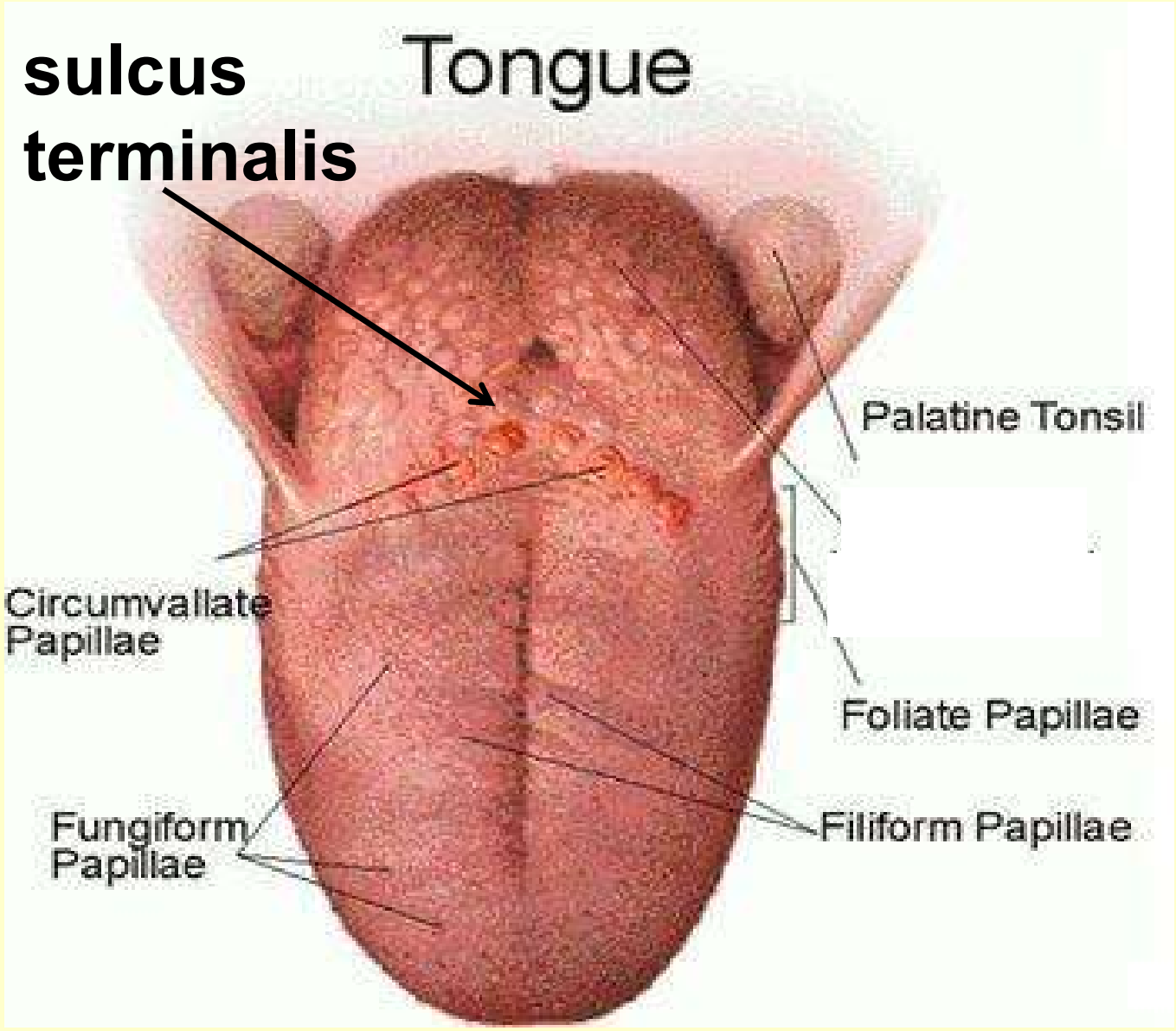
- gingiva, hard palate
- **keratinized stratified squamous epithelium -** dense irregular connective tissue.

lining mucosa – on remaining parts

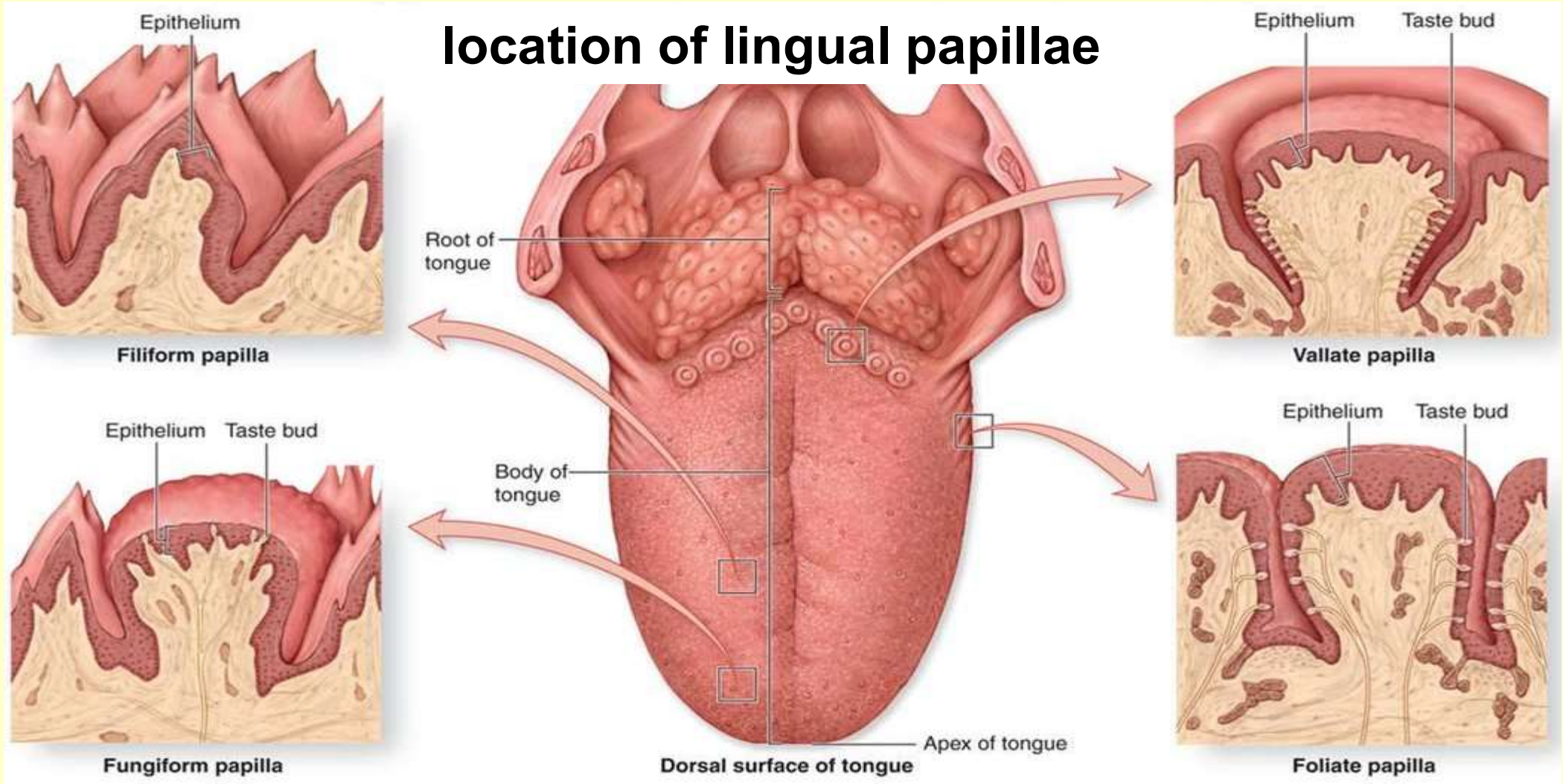
- **nonkeratinized stratified squamous epithelium,** looser type of dense irregular connective tissue

Lingual papillae

- anterior to the sulcus terminalis - dorsal and lateral aspect of the tongue



- **Filiform**
- **Fungiform**
- **Foliate**
- **Vallate (circumvallate)**

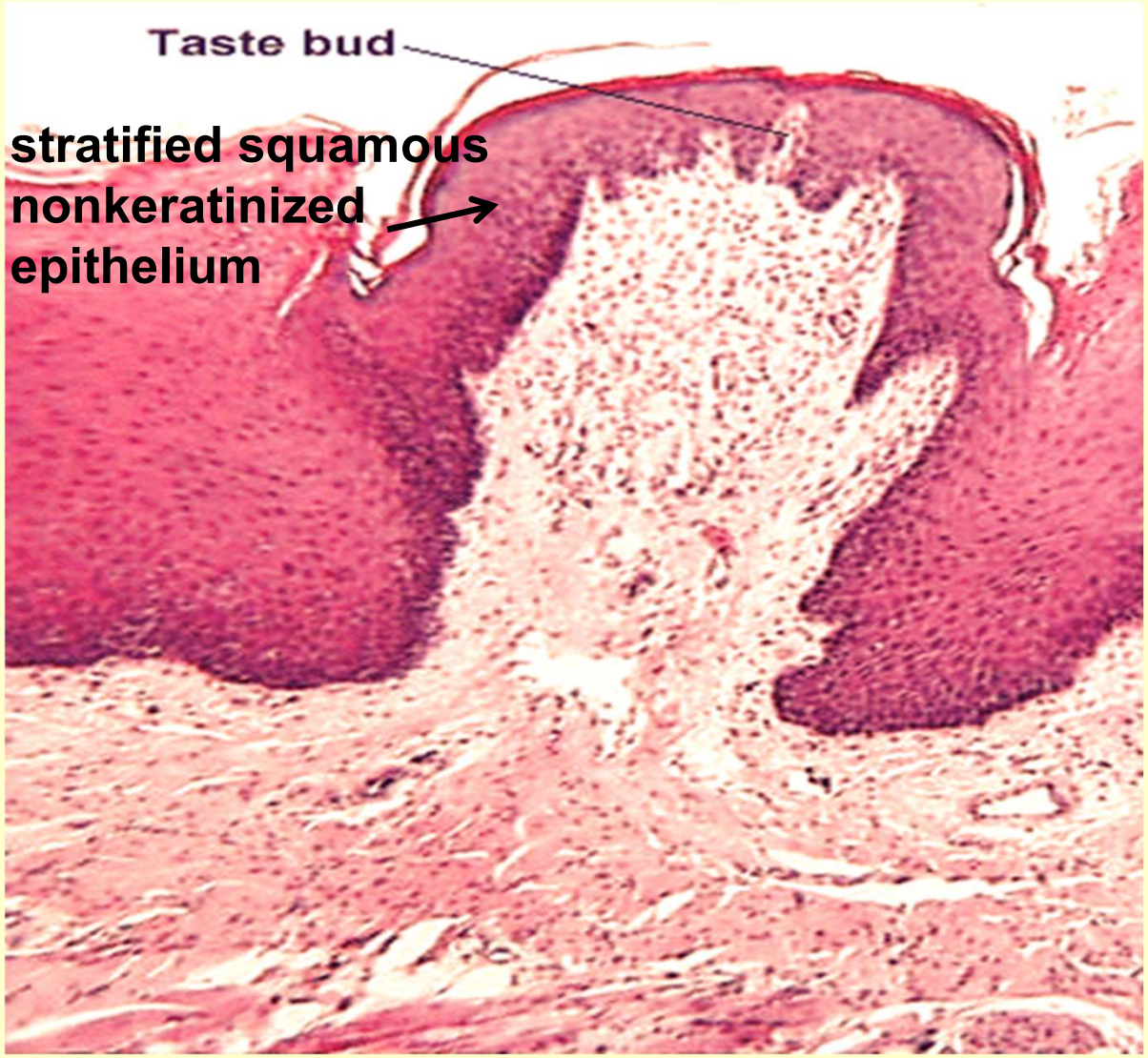


Filiform papillae - on the whole surface
Fungiform papillae – between filiform, mainly at the tip
Foliate papillae - on the lateral surfaces
Vallate papillae - in front of the sulcus terminalis, two rows meet in the midline.

Filiform papillae

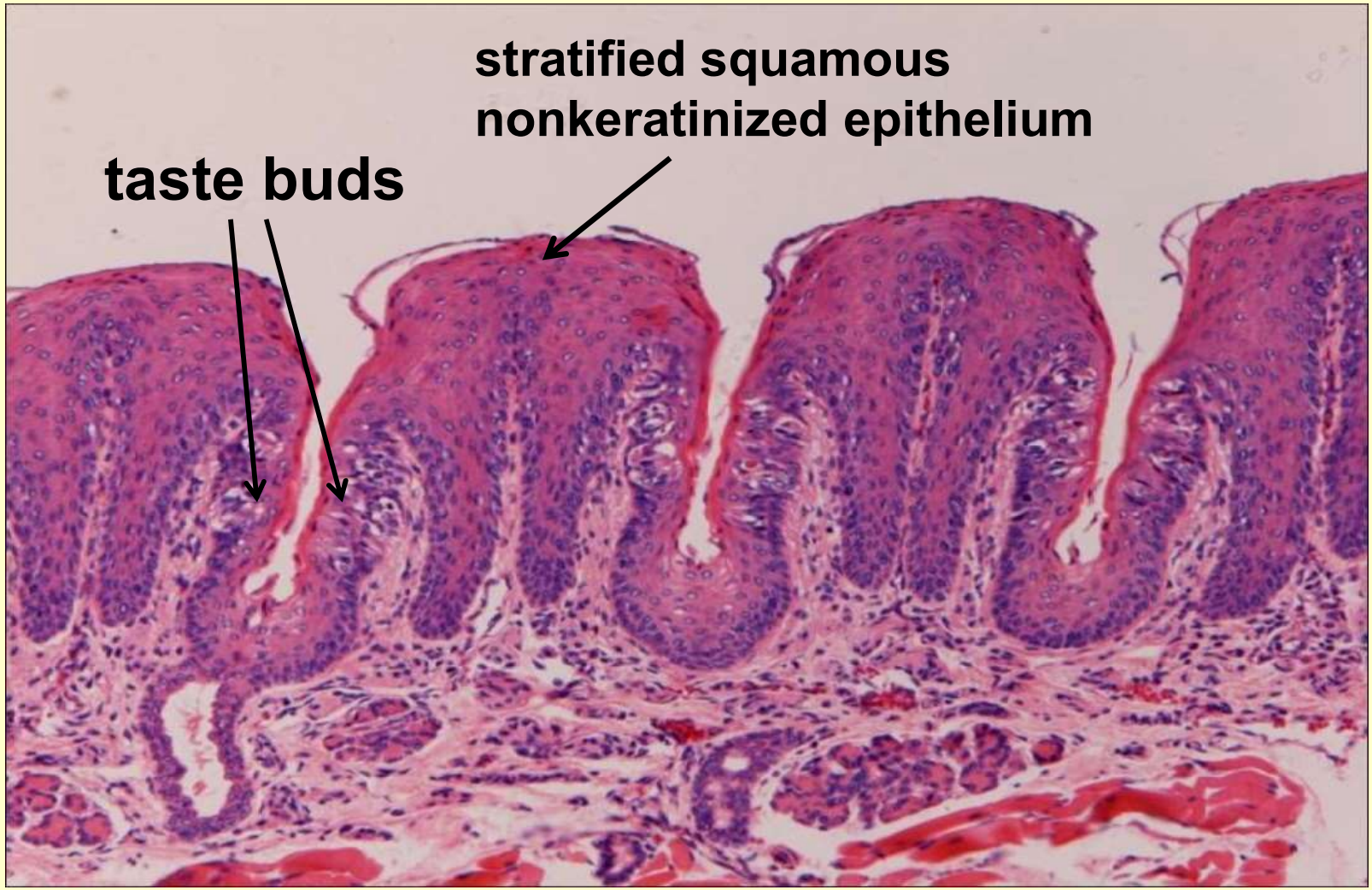
- thin - velvety appearance of the dorsal surface
- **stratified squamous keratinized epithelium**
- help to scrape food off a surface.
- **Filiform papillae do not have taste buds.**

Fungiform papillae



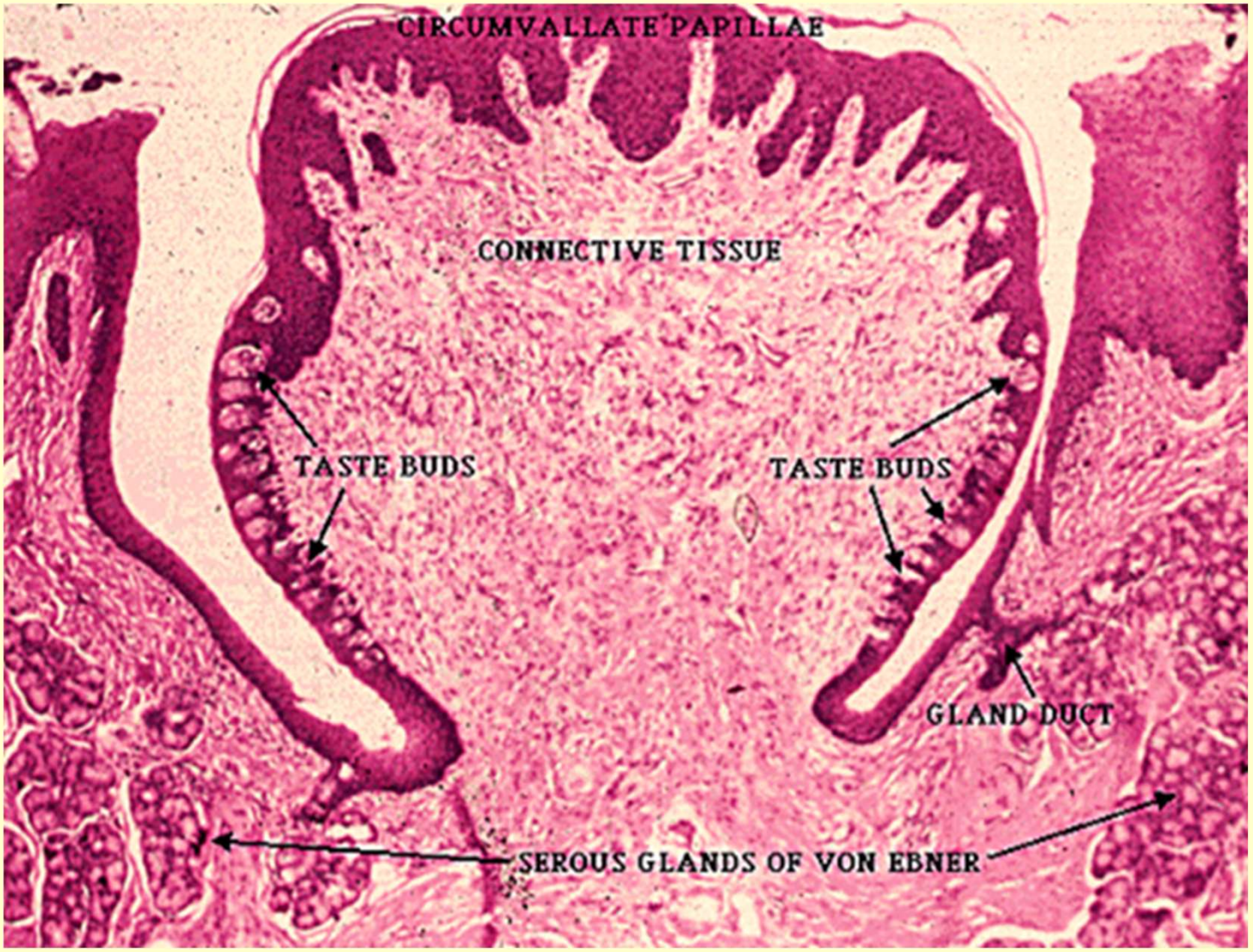
- resemble a mushrooms.
- **stratified squamous nonkeratinized epithelium**.
- **Fungiform papillae have taste buds on the dorsal aspect of their cap**.

Foliate papillae



- stratified squamous nonkeratinized epithelium
- have functional taste buds (lateral surface)

Vallate (circumvallate) papillae

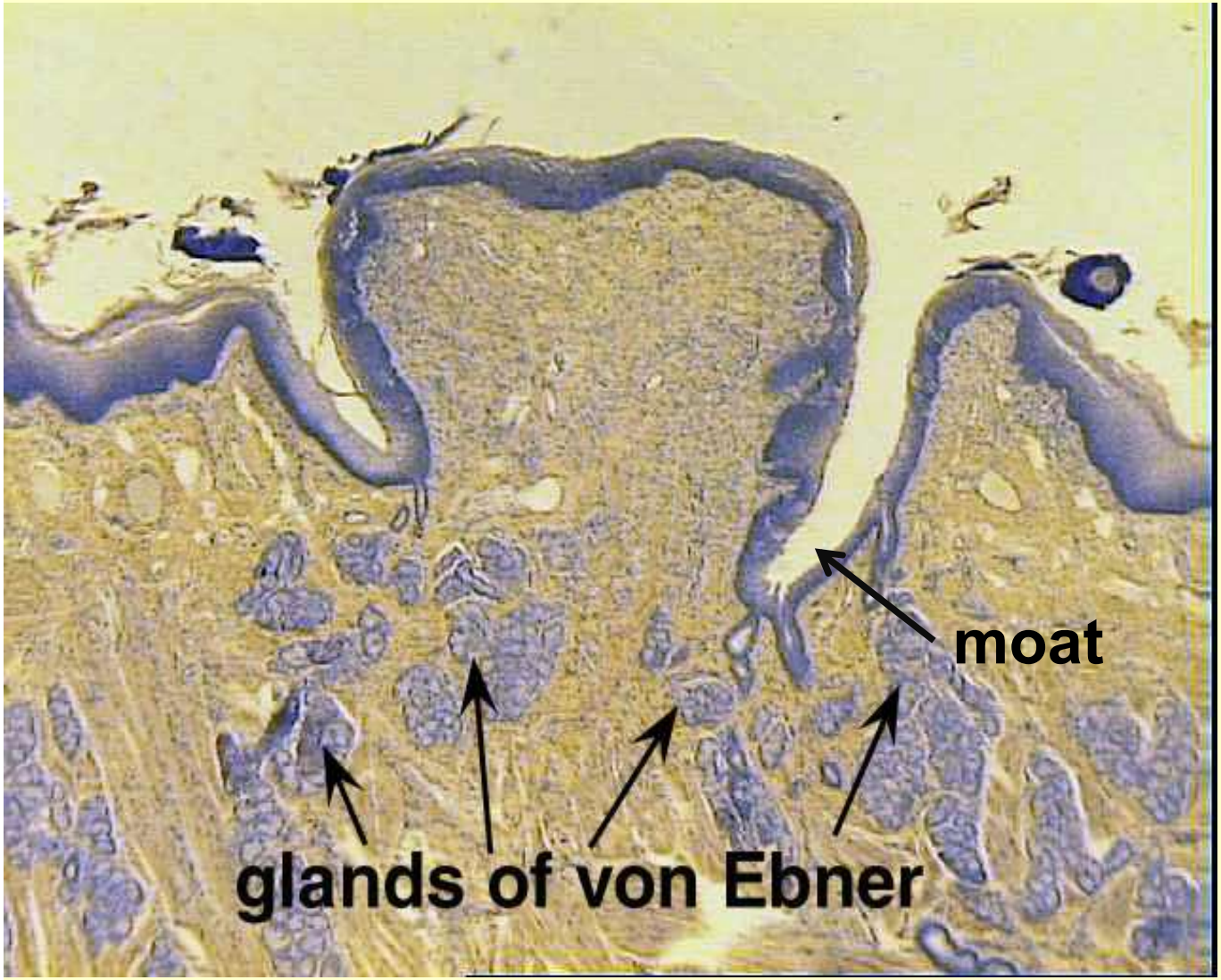


- submerged into the surface of the tongue
- surrounded by an epithelially lined groove, whose base is pierced by ducts of **glands of von Ebner**

Taste buds in the epithelial lining of the groove

glands of von Ebner (minor salivary glands)

- around **vallate, fungiform** and **foliate papillae**
- **serous secretion** - flushes material from the moat - taste buds can respond rapidly to changing tastes

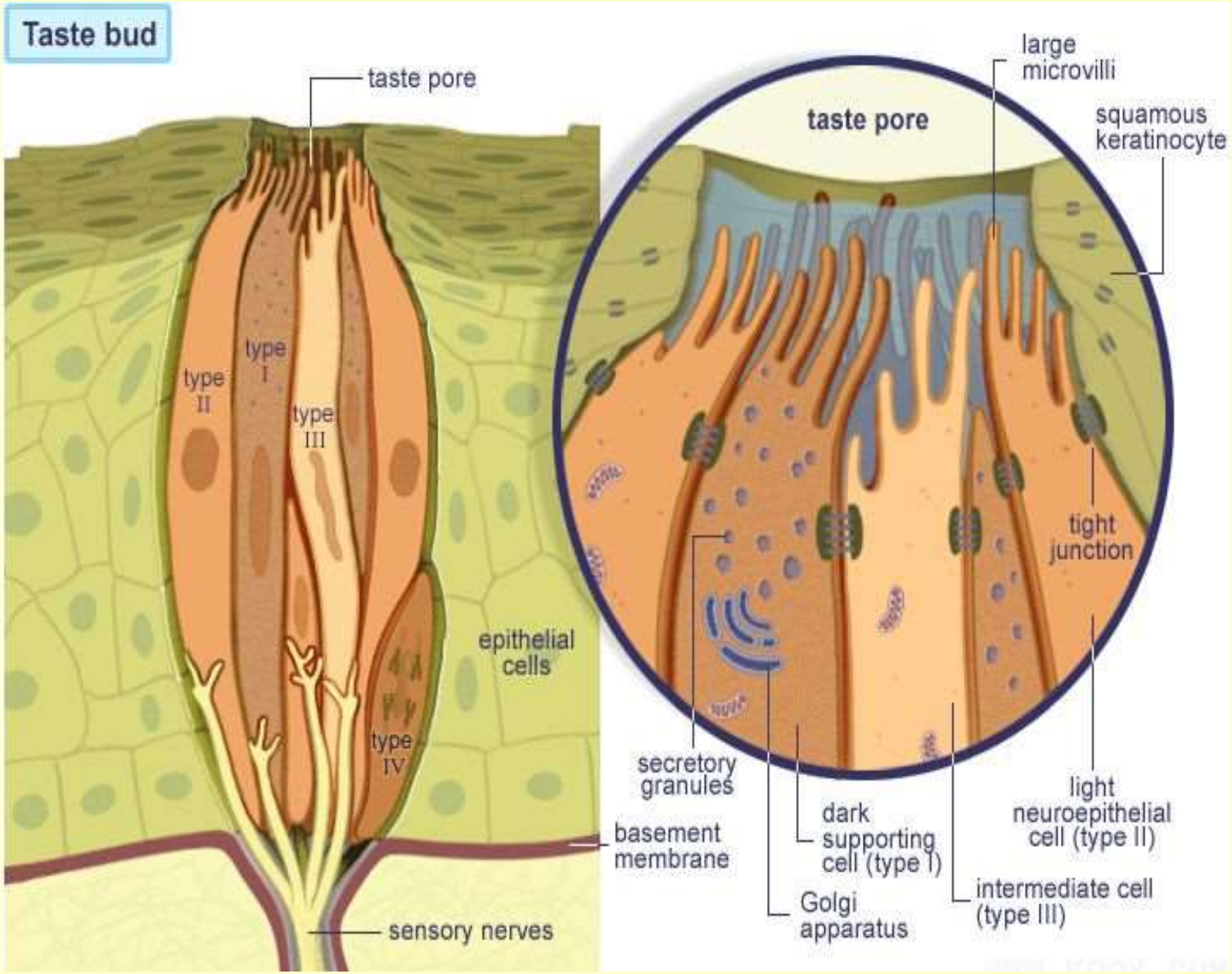


sensing different tastes

- **Taste Buds - ovoid, lightly stained bodies** (distinctly paler than the epithelium)

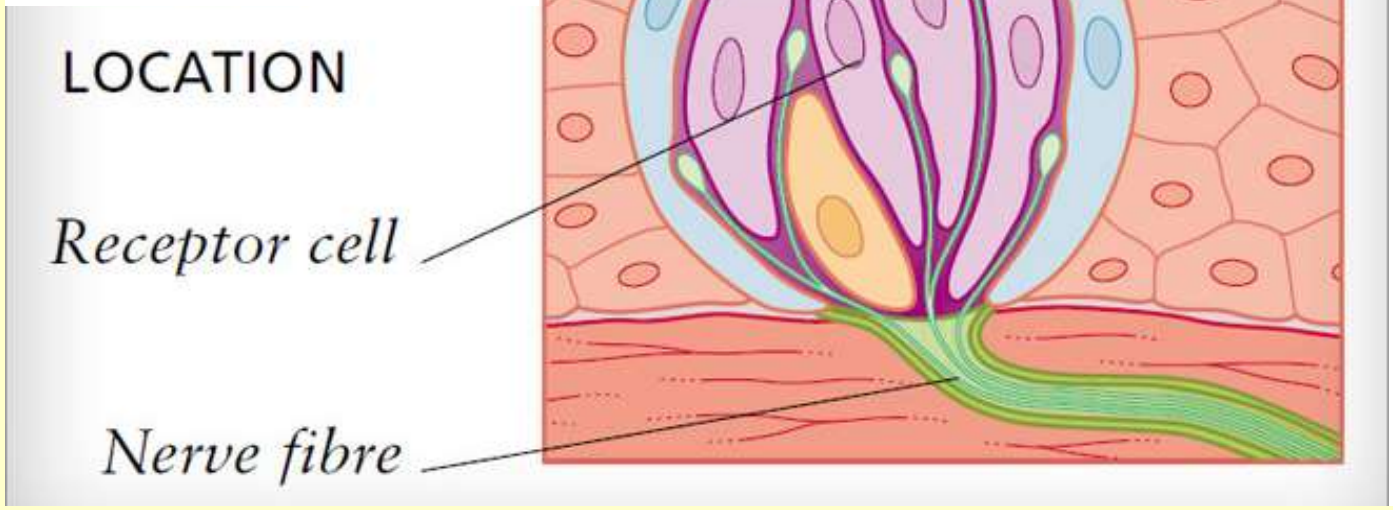
Taste Buds

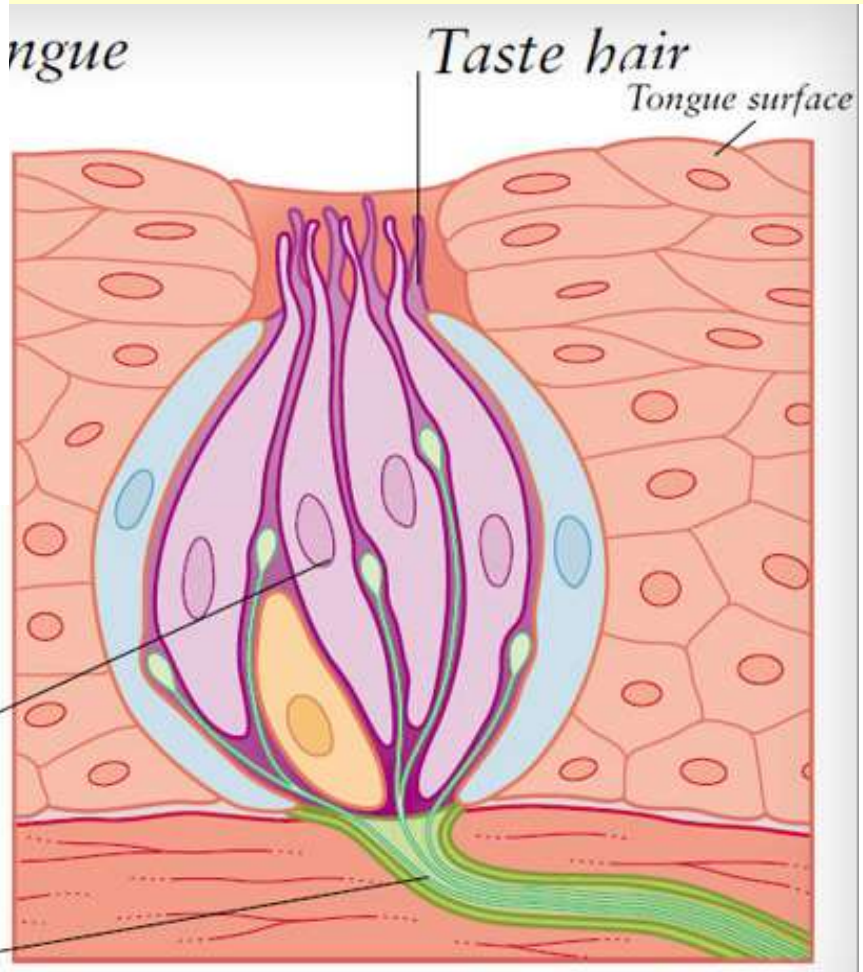
- spindle-shaped cells
- an opening in epithelium
  - the **taste pore**

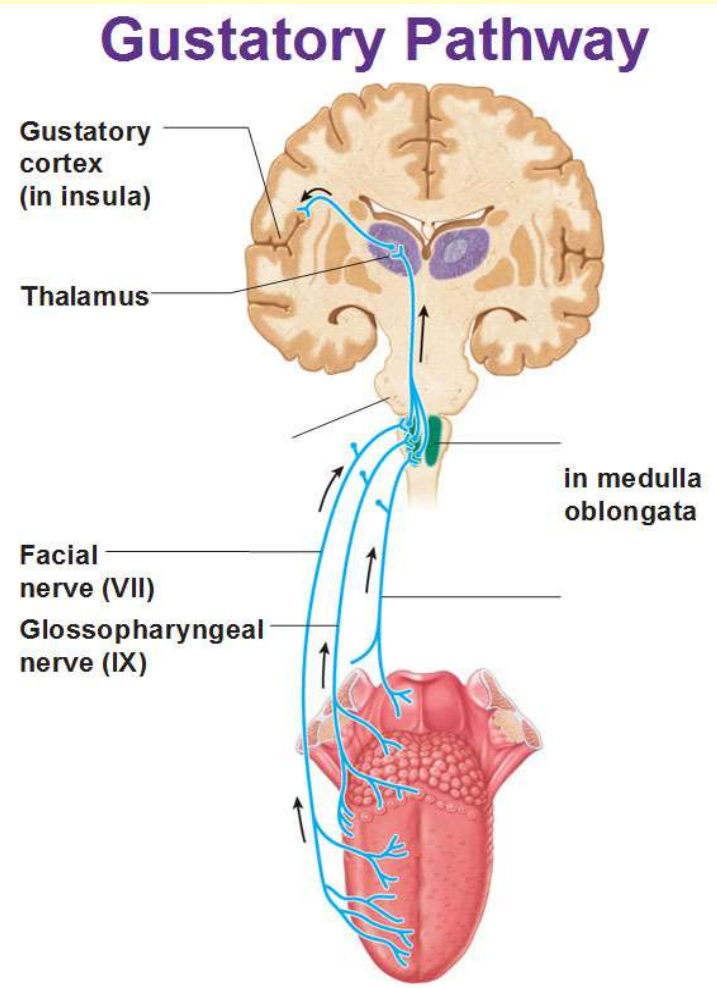


Basal cells – stem cells
Supporting cells
Gustatory (taste) cells - detection of taste.

receptor cell – long **microvilli (taste hair)** - receptors



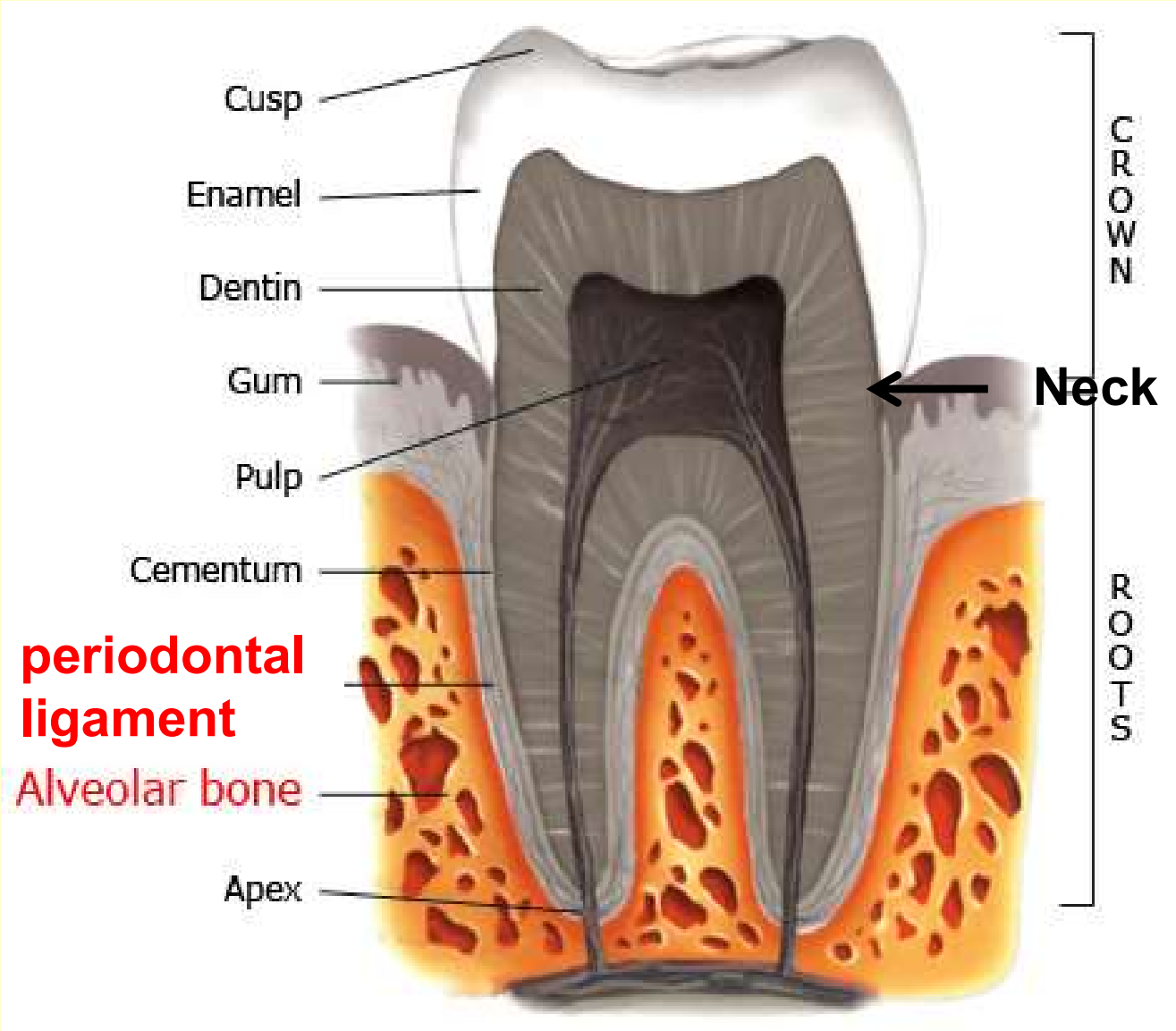




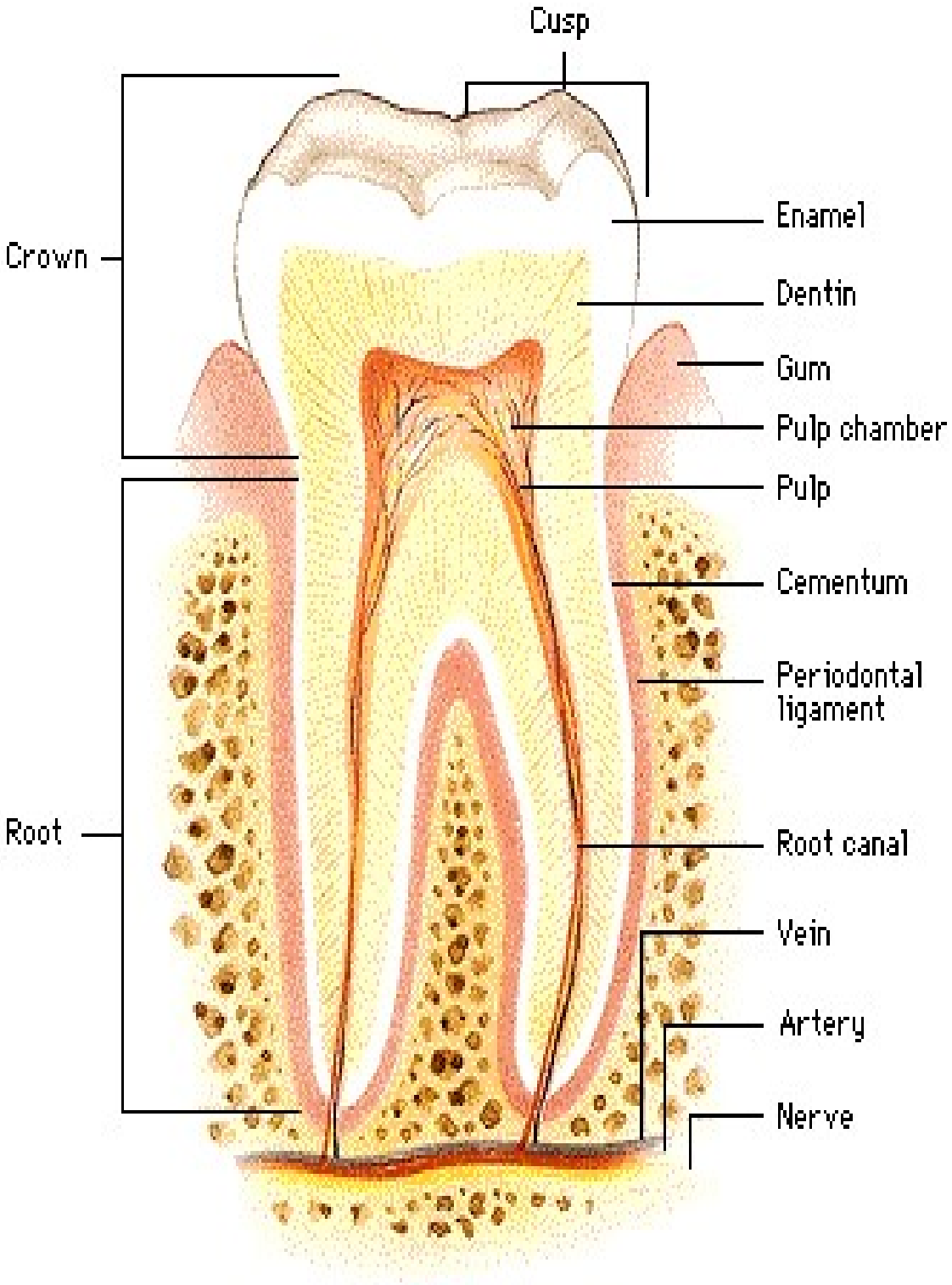
- molecules from food (dissolved in saliva) + ion channels and receptors (microvilli of taste cells) = action potential of taste cells
- nerve fibers form synapses with receptor cells
- signal transmitted to the brain (gustatory cortex)

Tooth

- suspended in bony socket, **alveolus,** by a dense, irregular collagenous connective tissue, the **periodontal ligament.**



Crown - visible in the oral cavity
Root - within the alveolus
Neck - between the crown and the root



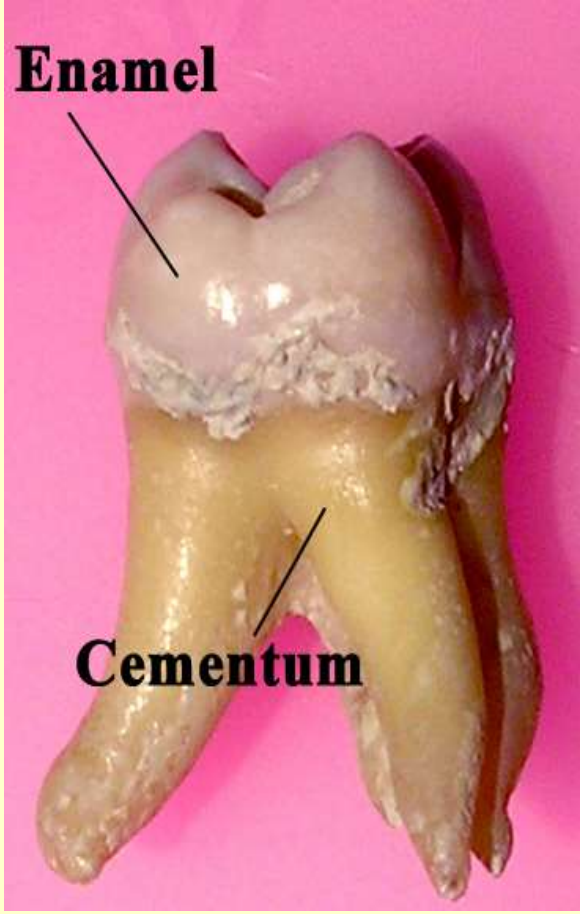
The mineralized structures:

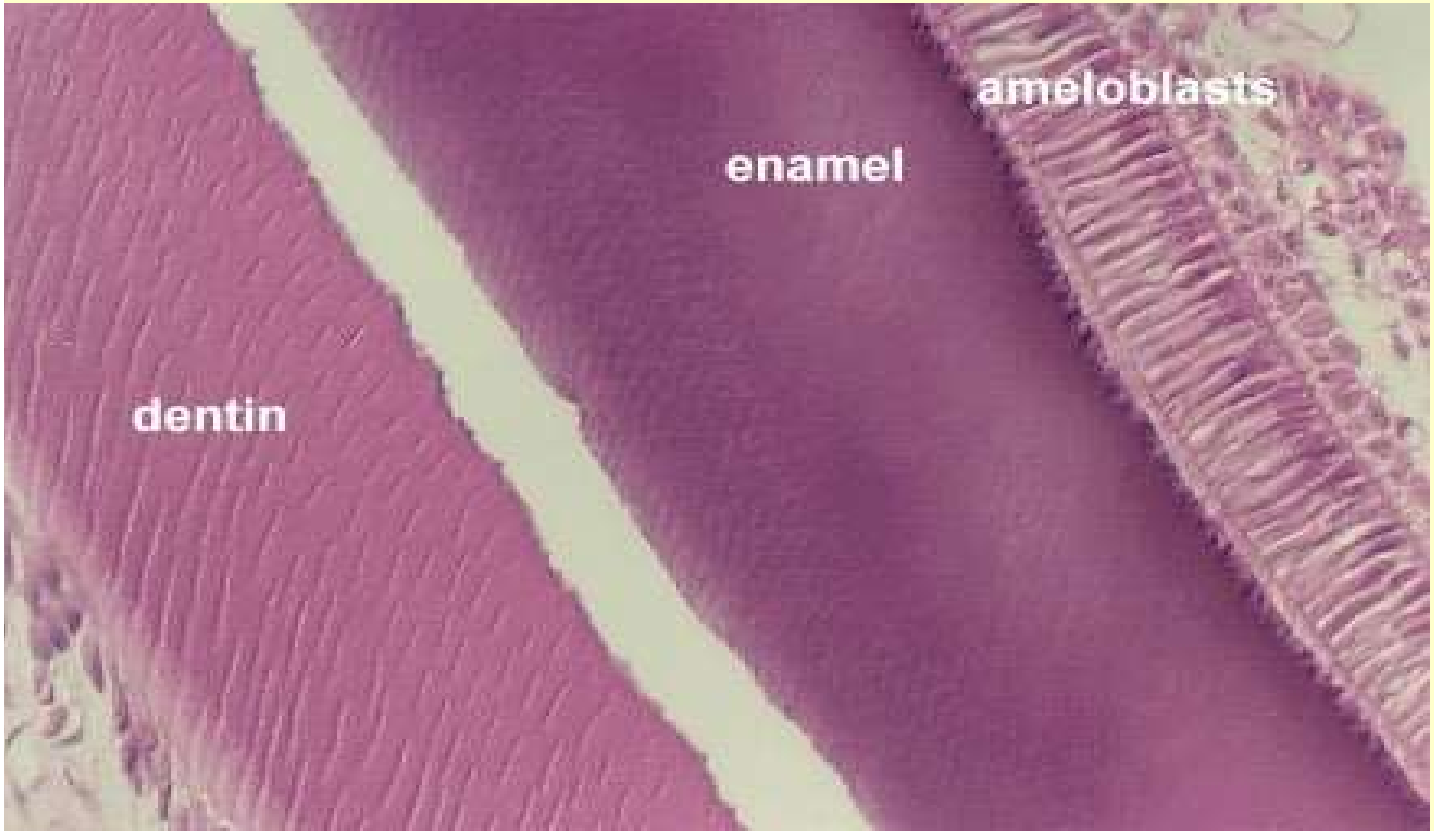
- **enamel**
- **dentin** - surrounds the **pulp chamber** and **root canal**
- **cementum**

Dentin - covered on the crown by **enamel** and on the root by **cementum**

ENAMEL - the hardest substance in the human body

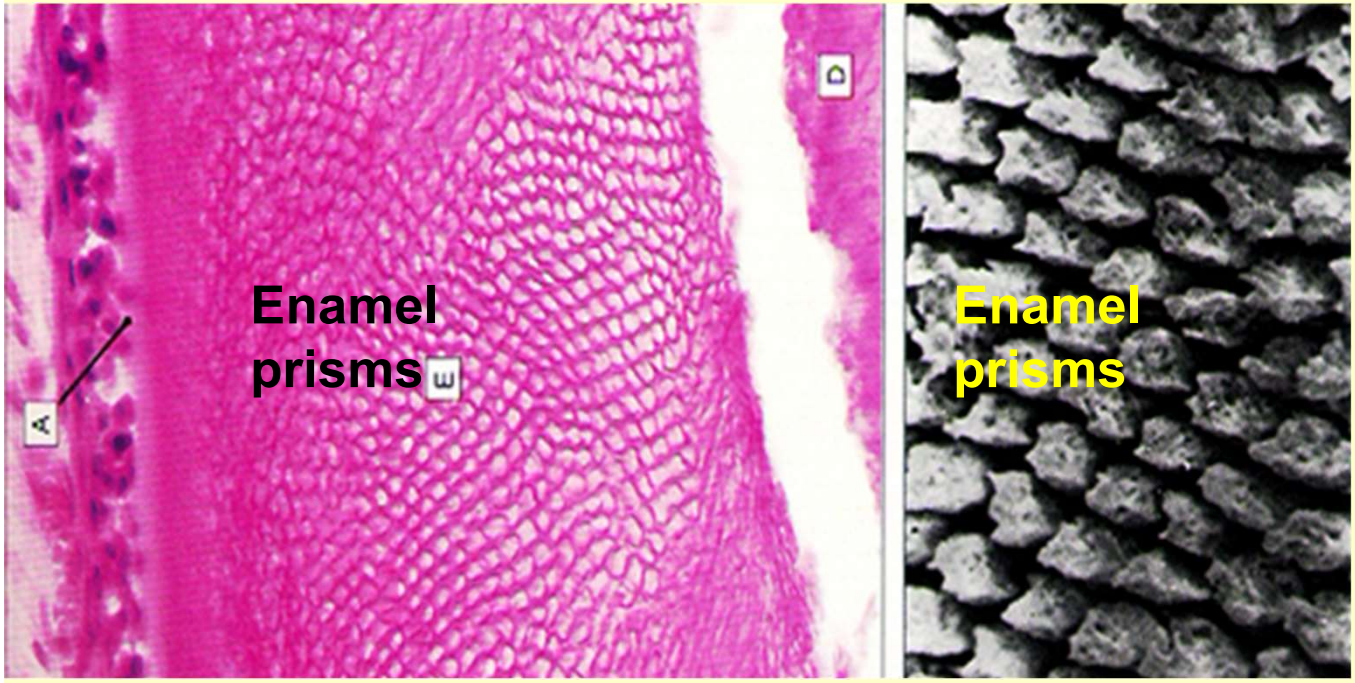
- the highest percentage of minerals - 96% (**hydroxyapatite**), **water** and **organic material (enamelins, tuftelins, amelogenins)**
- produced by **ameloblasts**

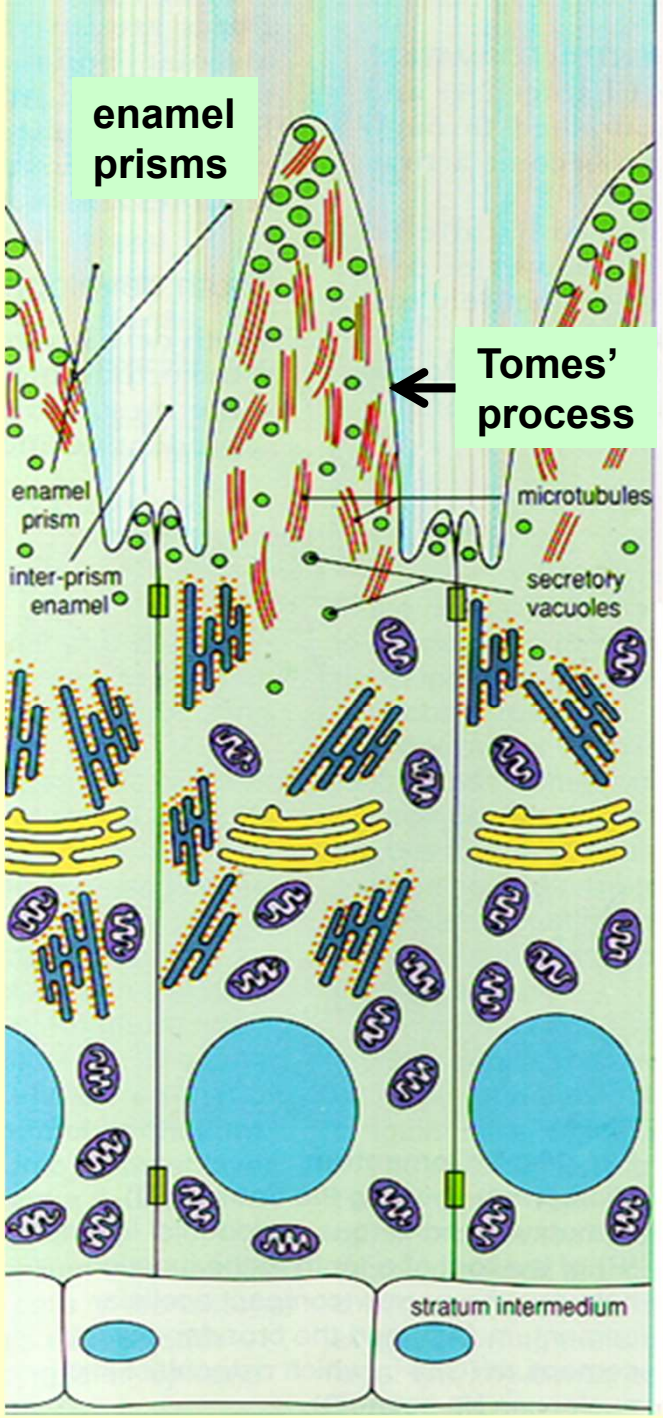




Ameloblasts - columnar cells

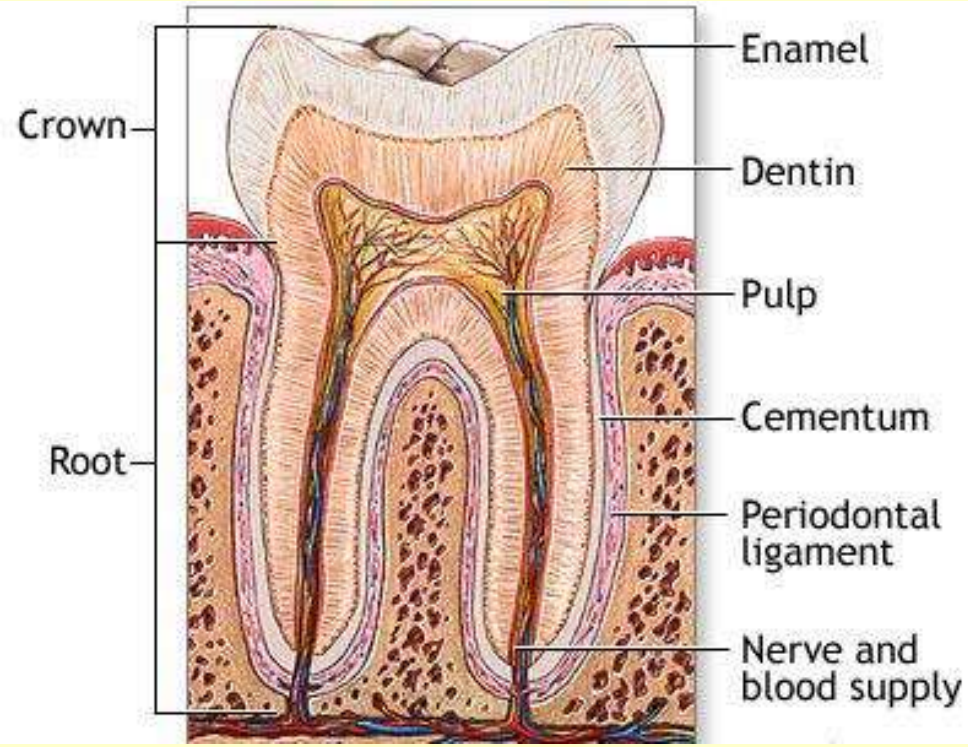
- present only during tooth development - deposit tooth enamel
- secrete proteins: **enamelin** and **amelogenin** - later mineralize to form **enamel (enamel prisms)**
- the secretory end of the ameloblast - **Tomes' process**

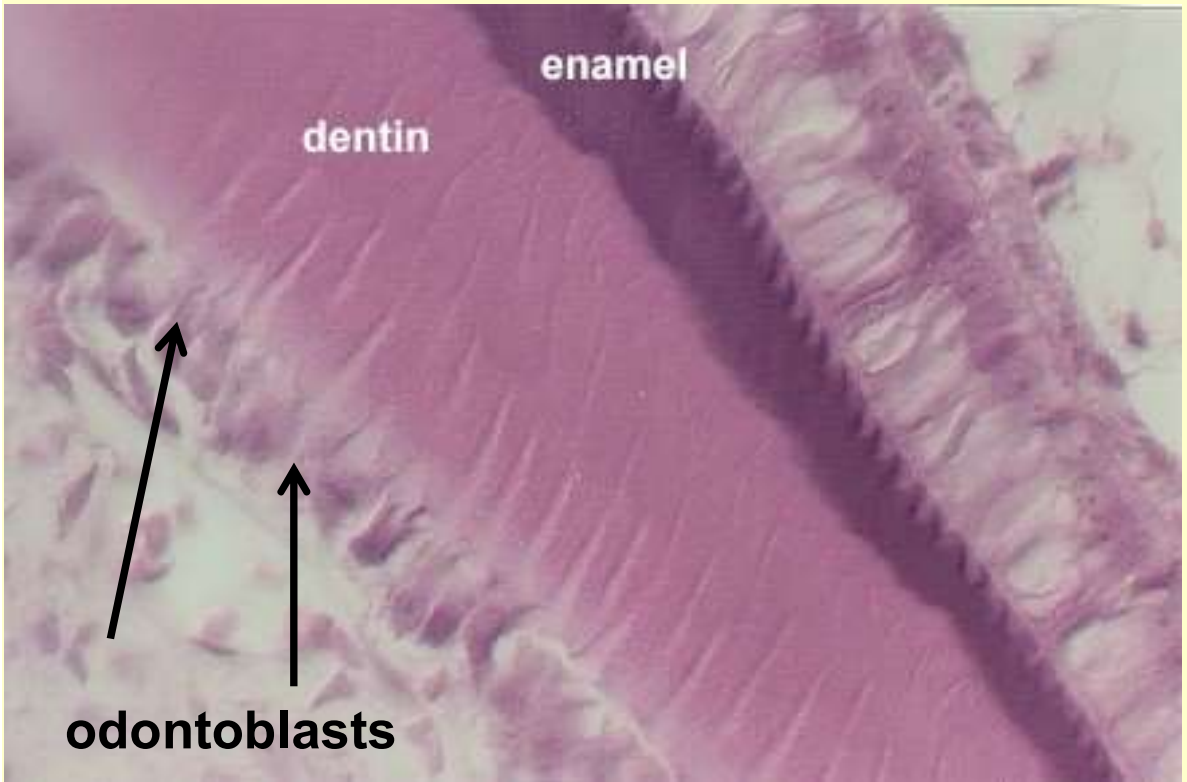




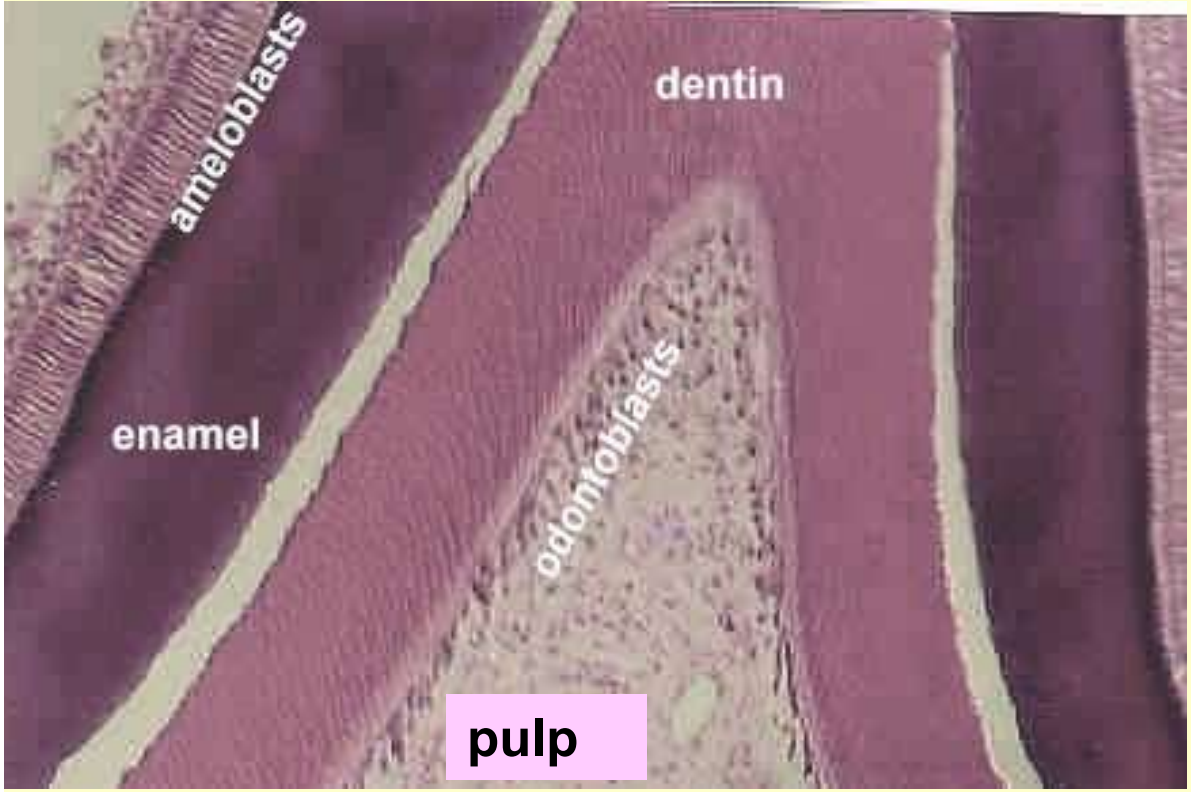
Dentin

- covered by enamel on the crown and cementum on the root and surrounds the entire pulp.
- the second hardest tissue of the body



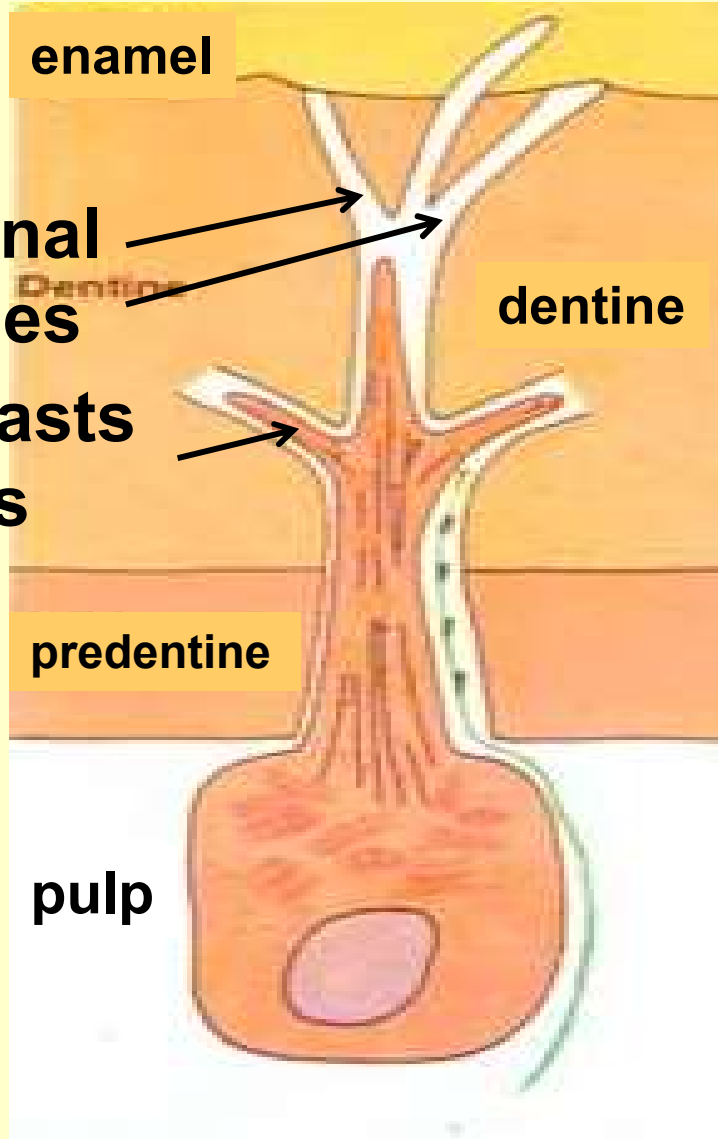


- 70% - **hydroxyapatite**, 20% - organic material (mainly **type I collagen and proteoglycans**) and 10% - **water**
- produced by **odontoblasts**



Odontoblasts

- at the periphery of the pulp

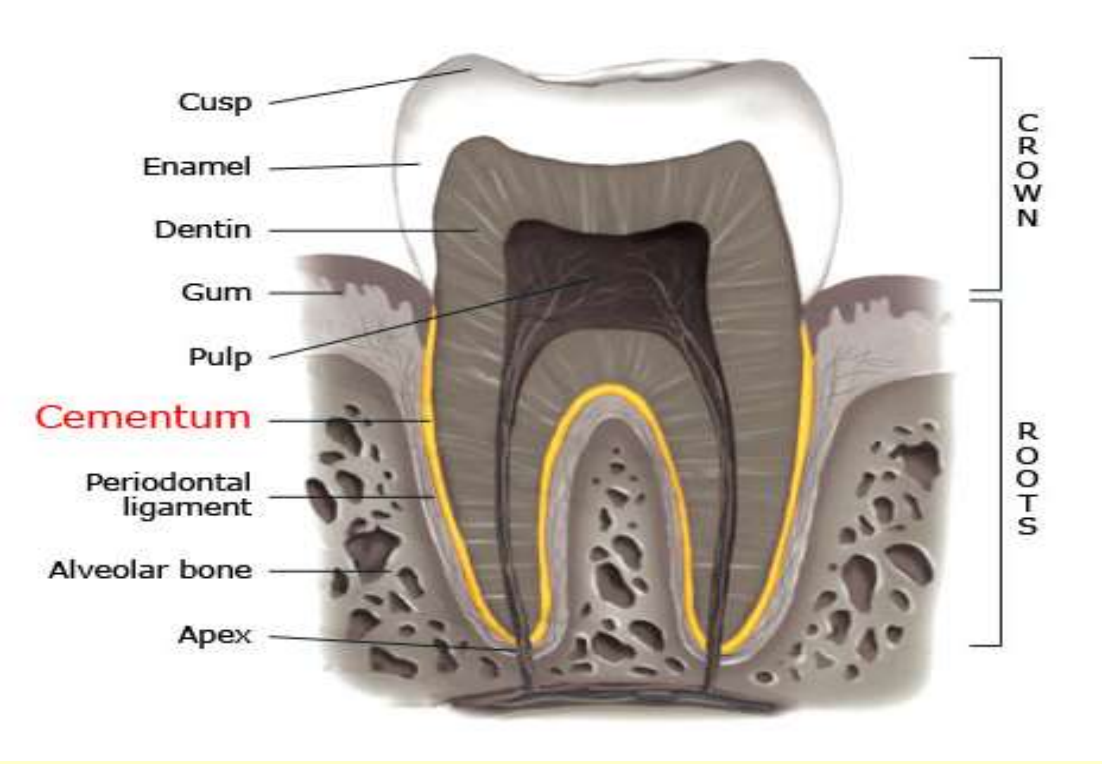


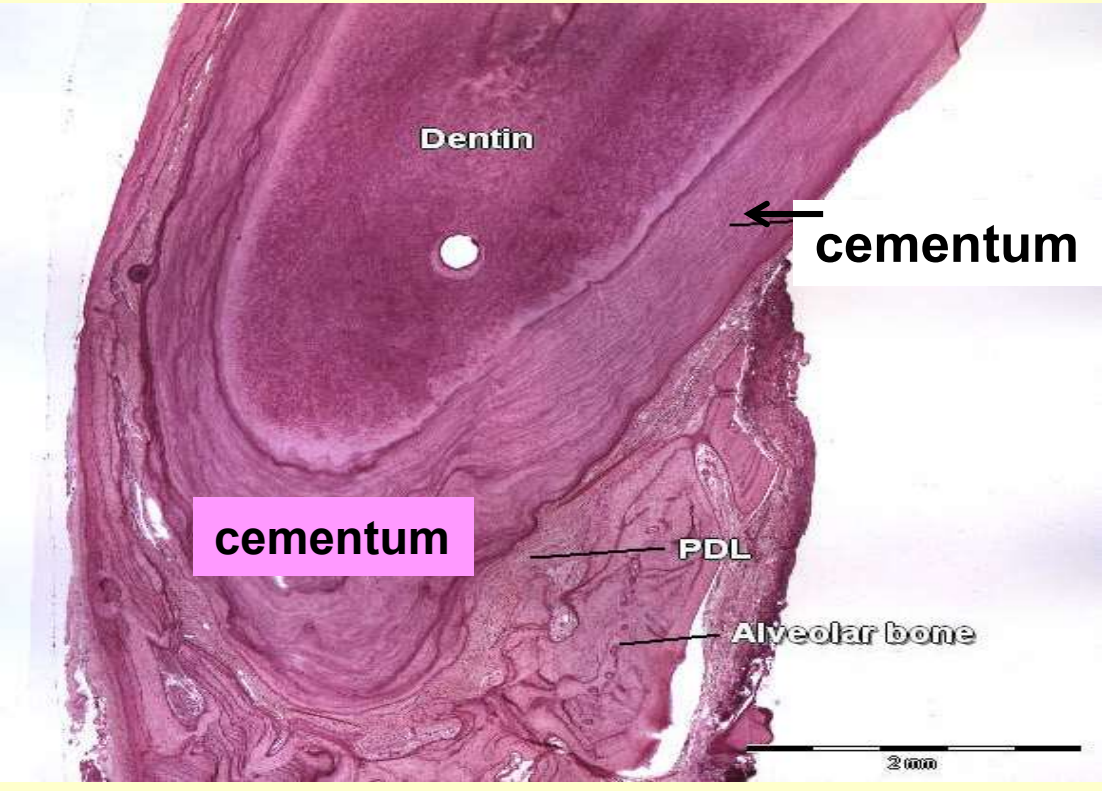
odontoblasts processes - Tomes' fibers - in dentinal tubules

Matrix deposited by odontoblasts is at first non-mineralised (**predentine**).

cementum

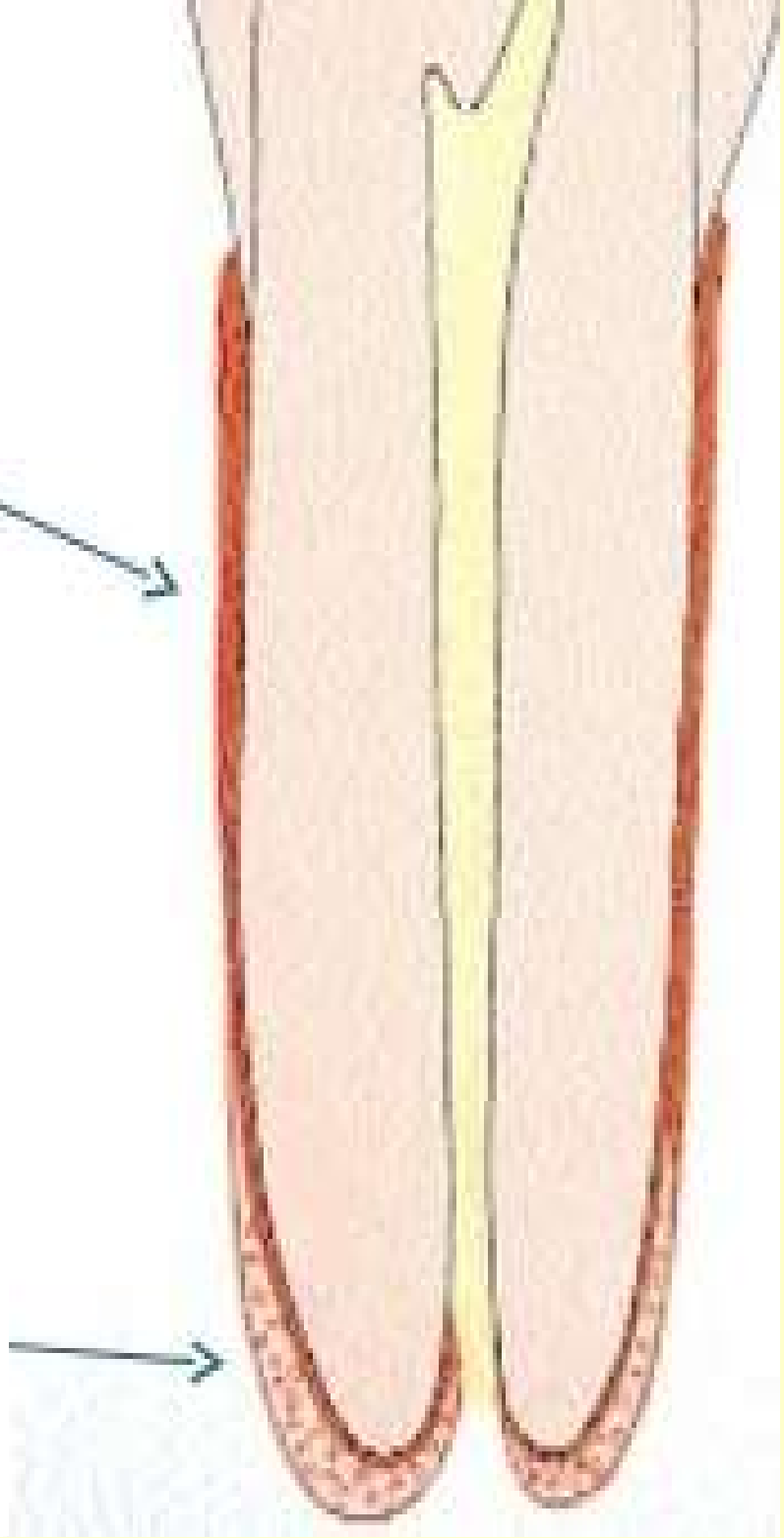
- covers the **root**
- slightly softer than dentin
- 45% to 50% inorganic material (**hydroxylapatite**), 50% to 55% organic matter (**type I collagen and proteoglycans**) and water.
- secreted by **cementoblasts**





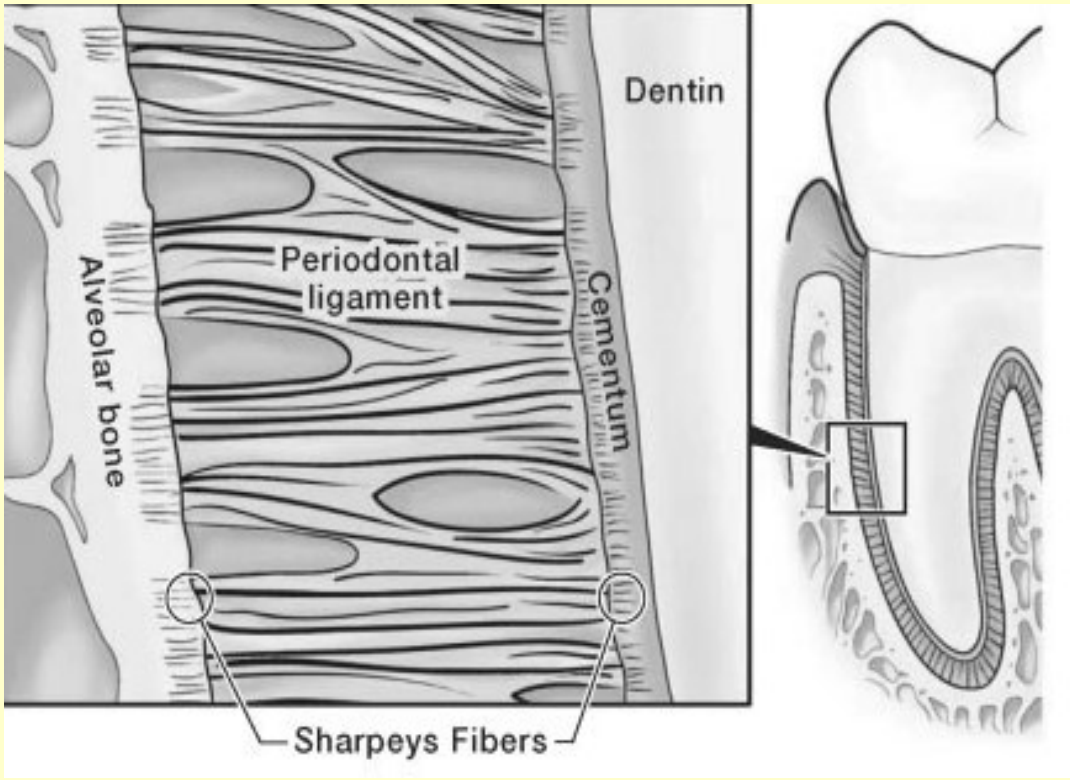
Acellular cementum - calcified extracellular matrix (without cementocytes) - produced before eruption of tooth

Cellular (secondary) cementum - formed after tooth eruption - cementocytes (in lacunae) - similar to osteocytes - produced throughout life to compensate physiological damage of the teeth



Sharpey's fibers

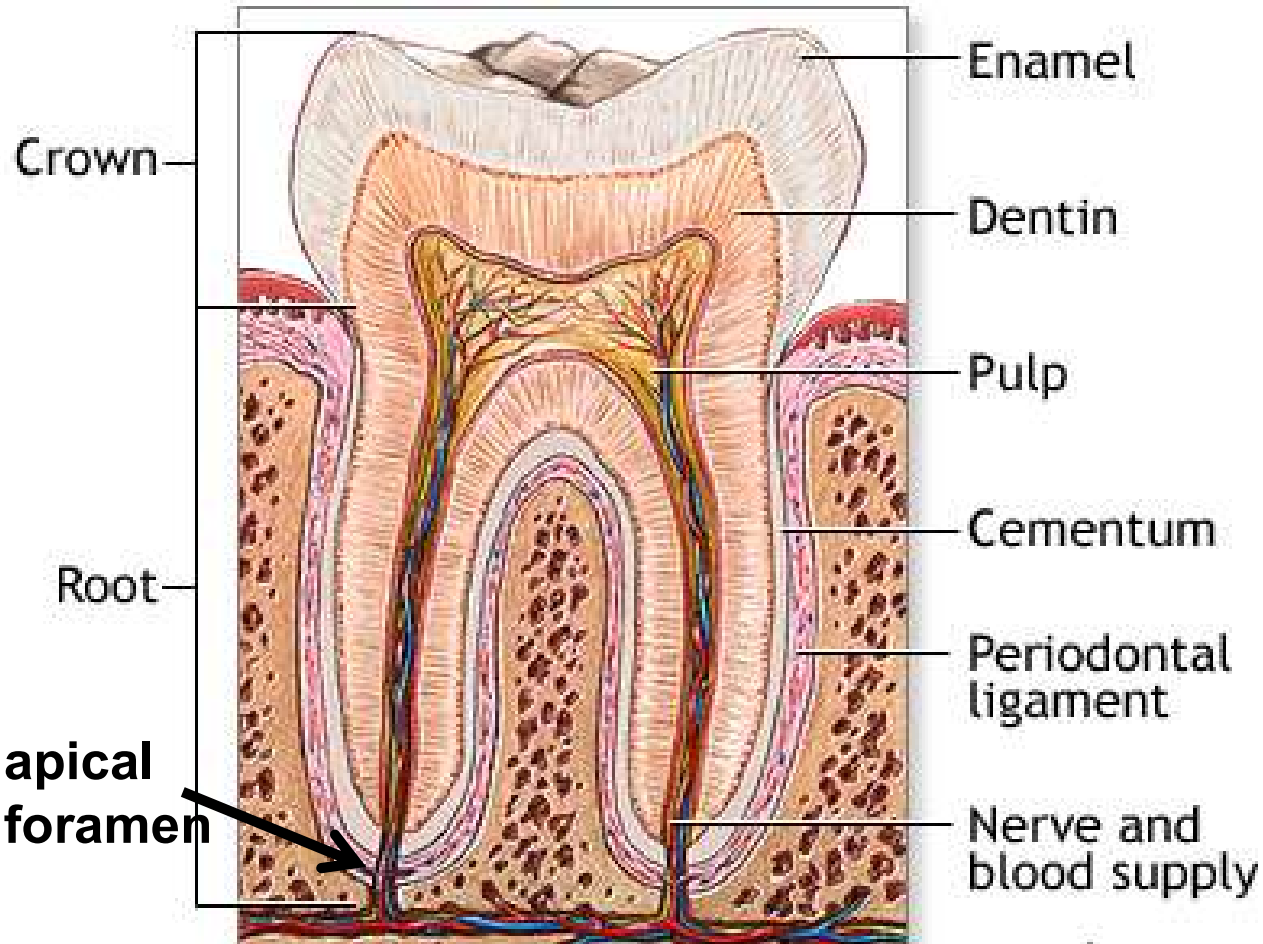
- collagen type I fibers of the periodontal ligament
- insert into the cementum and into the periosteum of the alveolar bone.

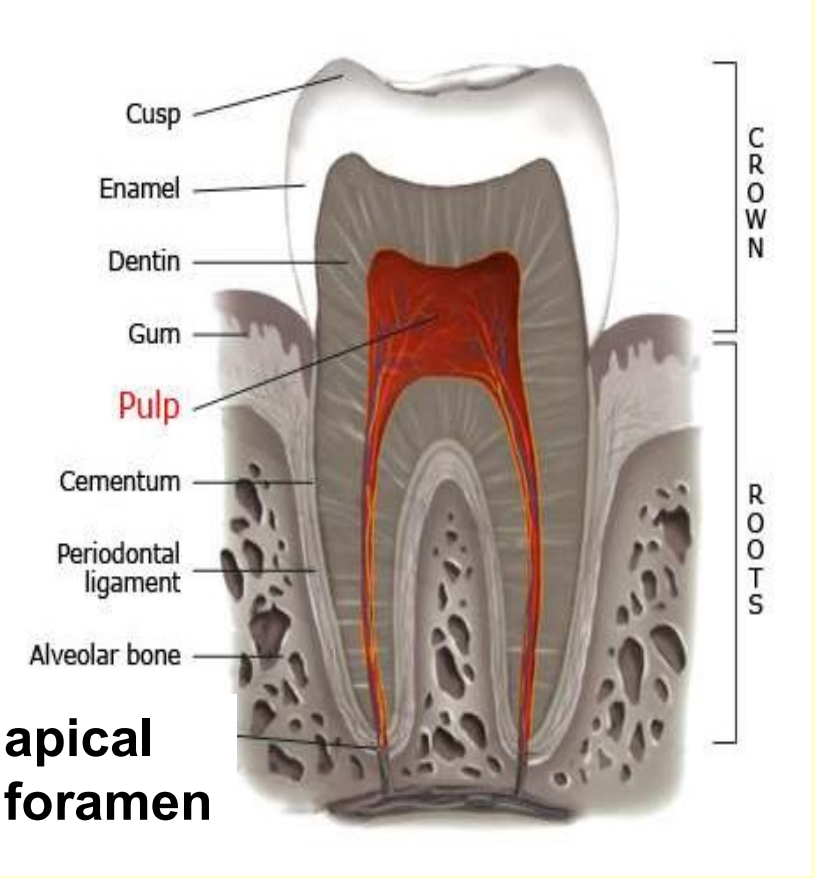


- maintain the tooth in the alveolus

pulp

- in **the pulp chamber and root canal**
- **loose, gelatinous connective tissue** (stem cells).
- extensive vascular and nerve

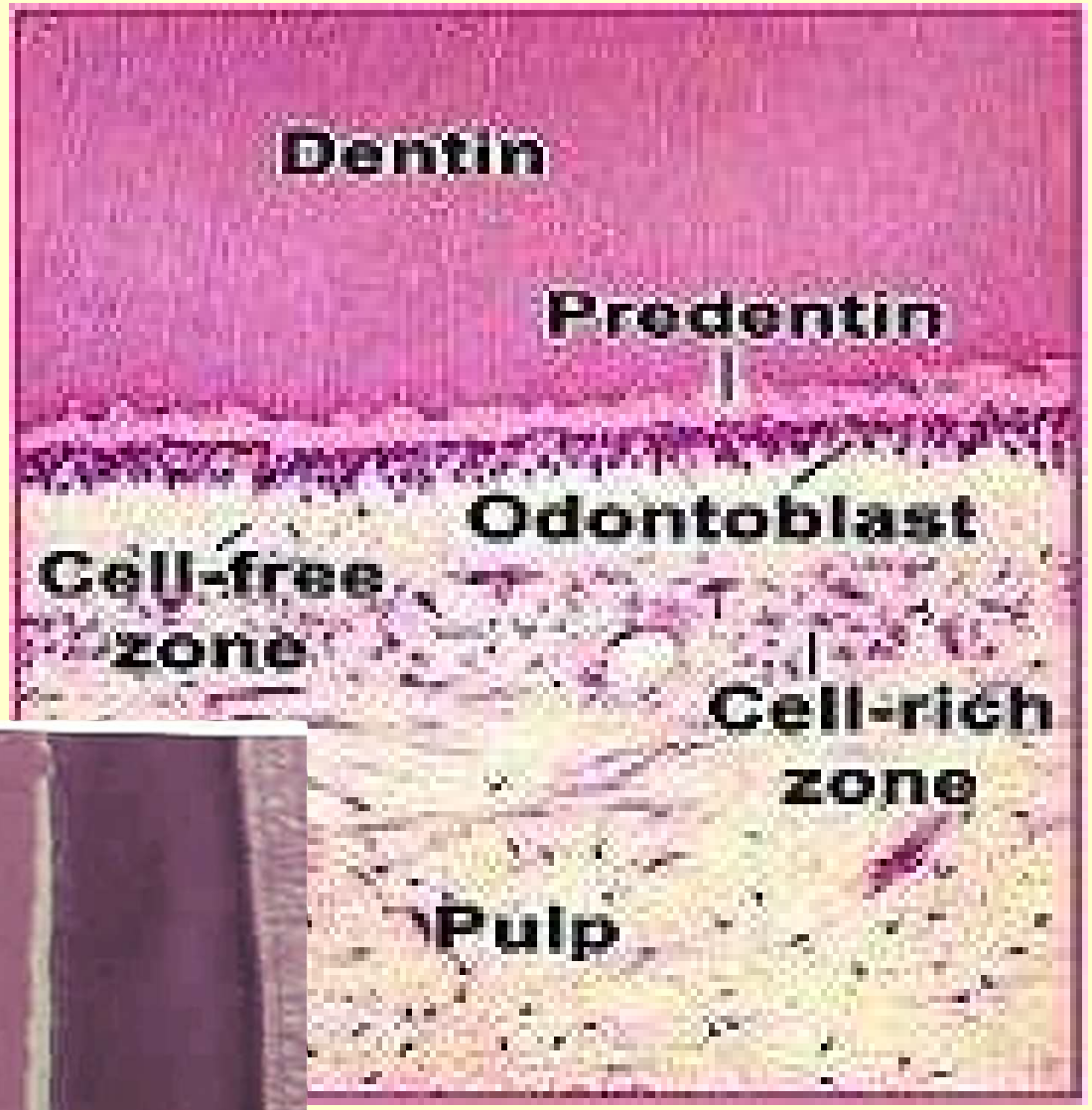


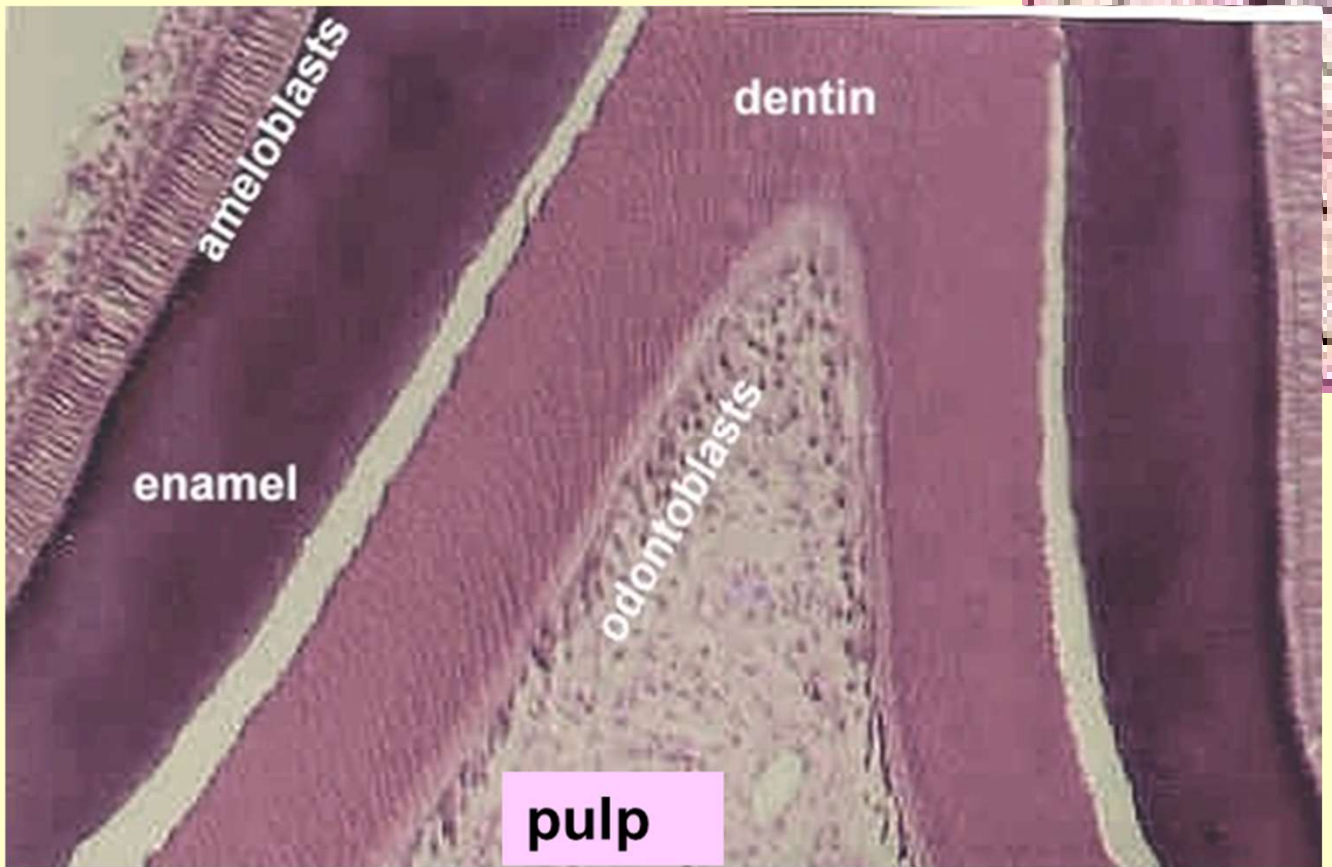


Nerves and blood vessels enter and leave the pulp through **apical foramen**

Pulp

- odontoblastic zone
- cell-free zone
- cell-rich zone
- core of the pulp



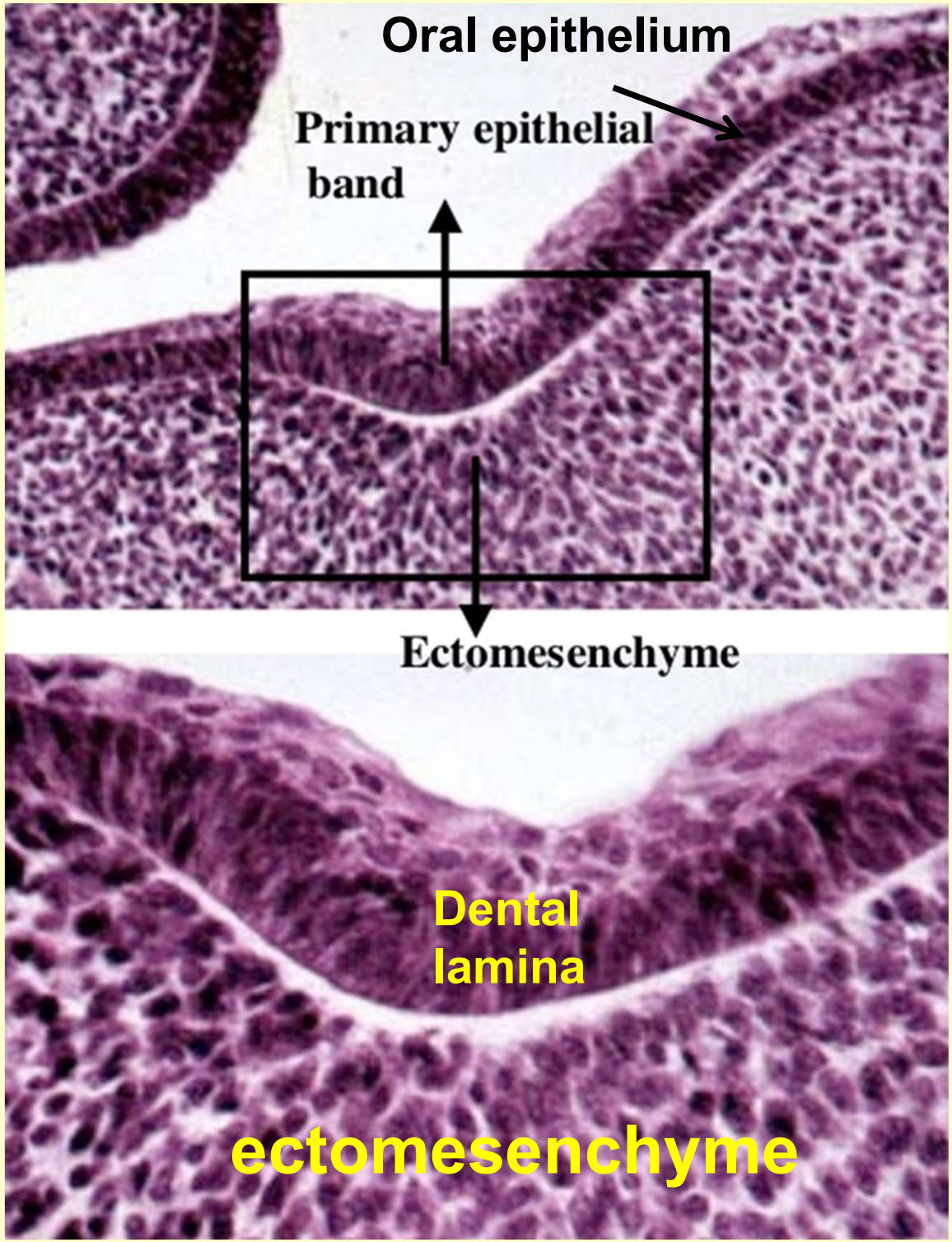


Odontogenesis - teeth development

- the complex process by which teeth are formed from embryonic cells, grow, and erupt into the mouth.

Odontogenesis

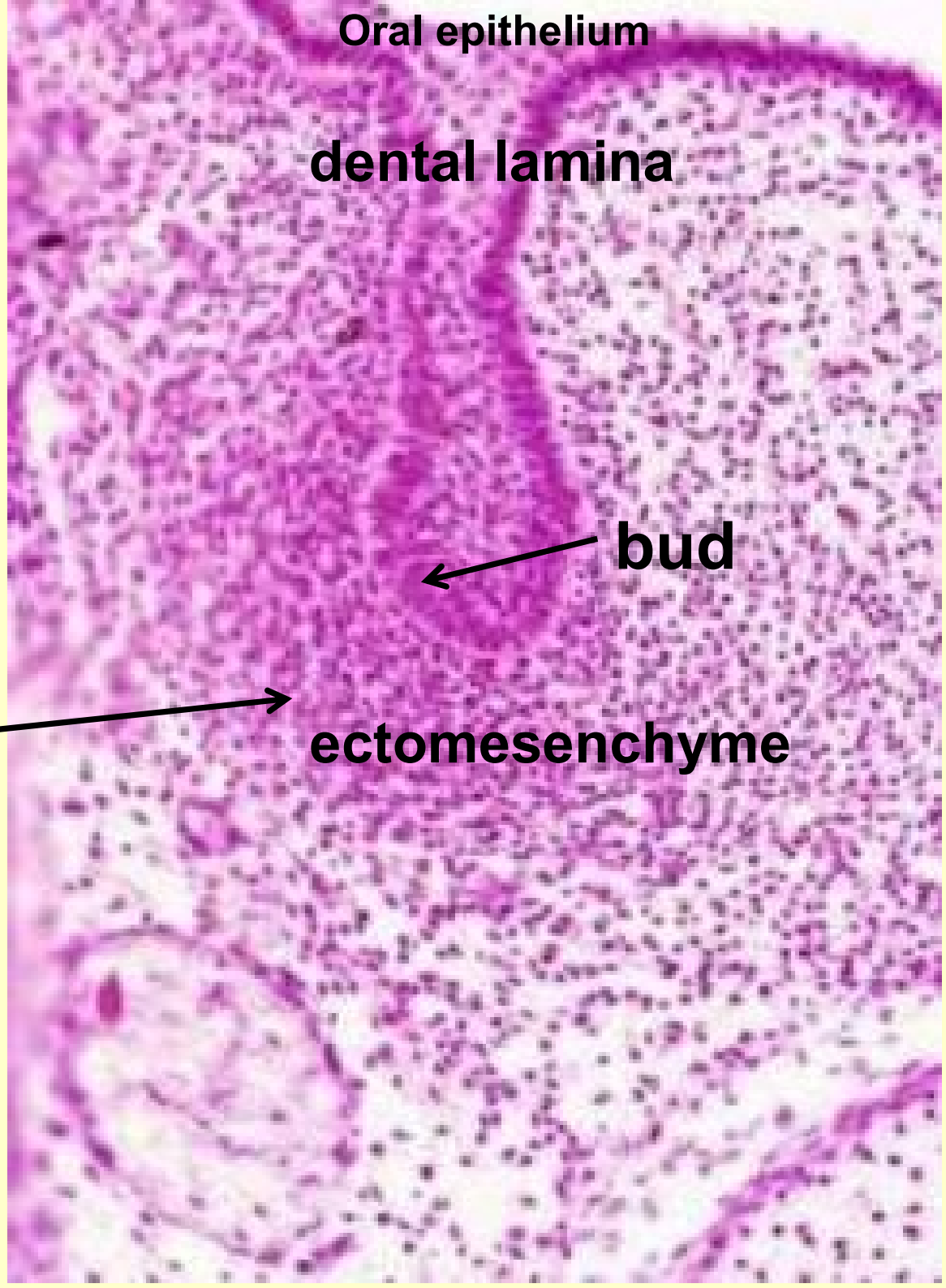
- **dental lamina** (proliferation of the ectodermally derived **oral epithelium** cells)
- **dental lamina** - surrounded by **neural-crest** cells derived **ectomesenchyme**



Bud stage

- epithelial cells of dental lamina proliferate into the ectomesenchyme – form **bud**

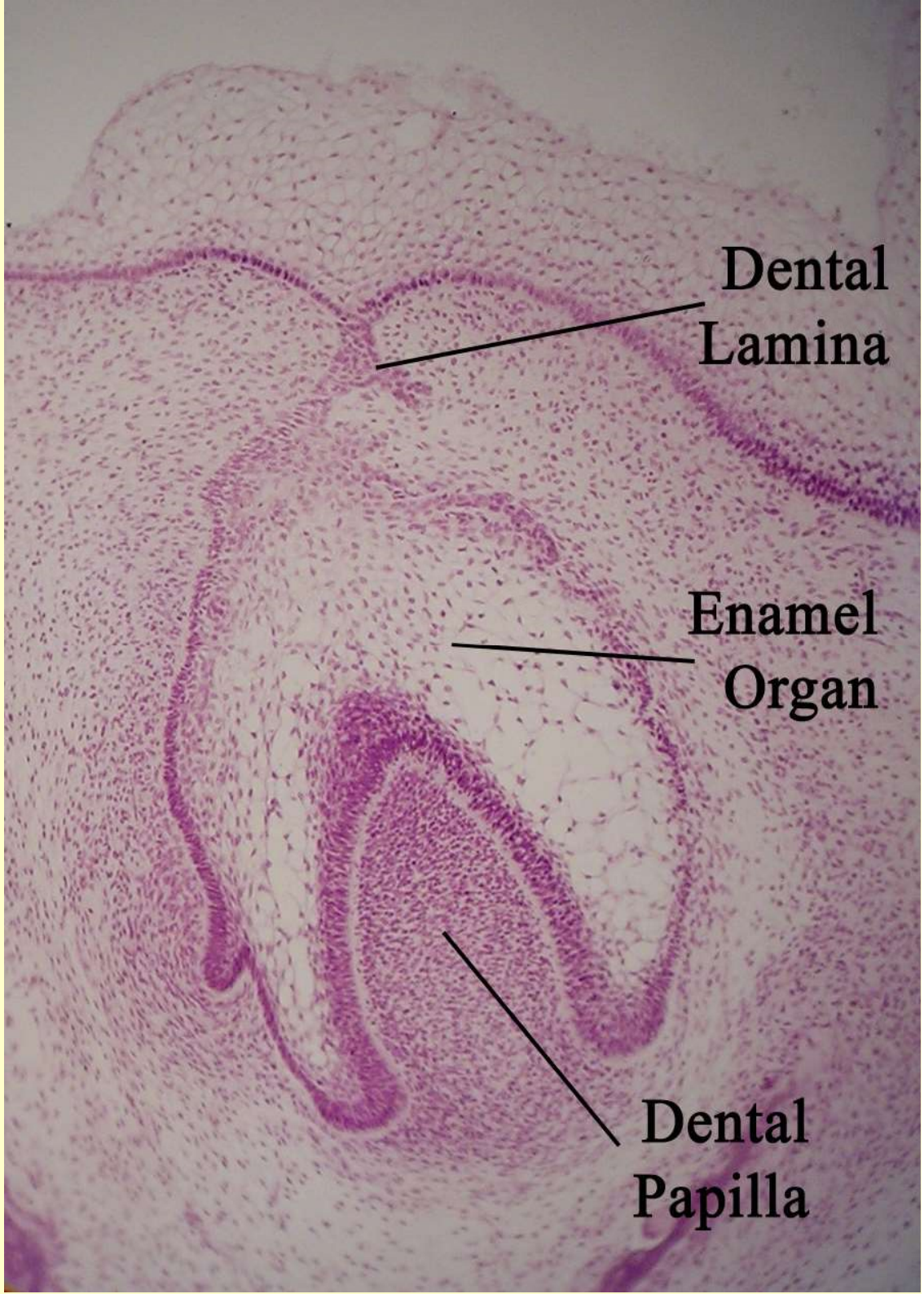
Presumptive **dental papilla** (a condensation of ectomesenchymal cells)



Cap stage

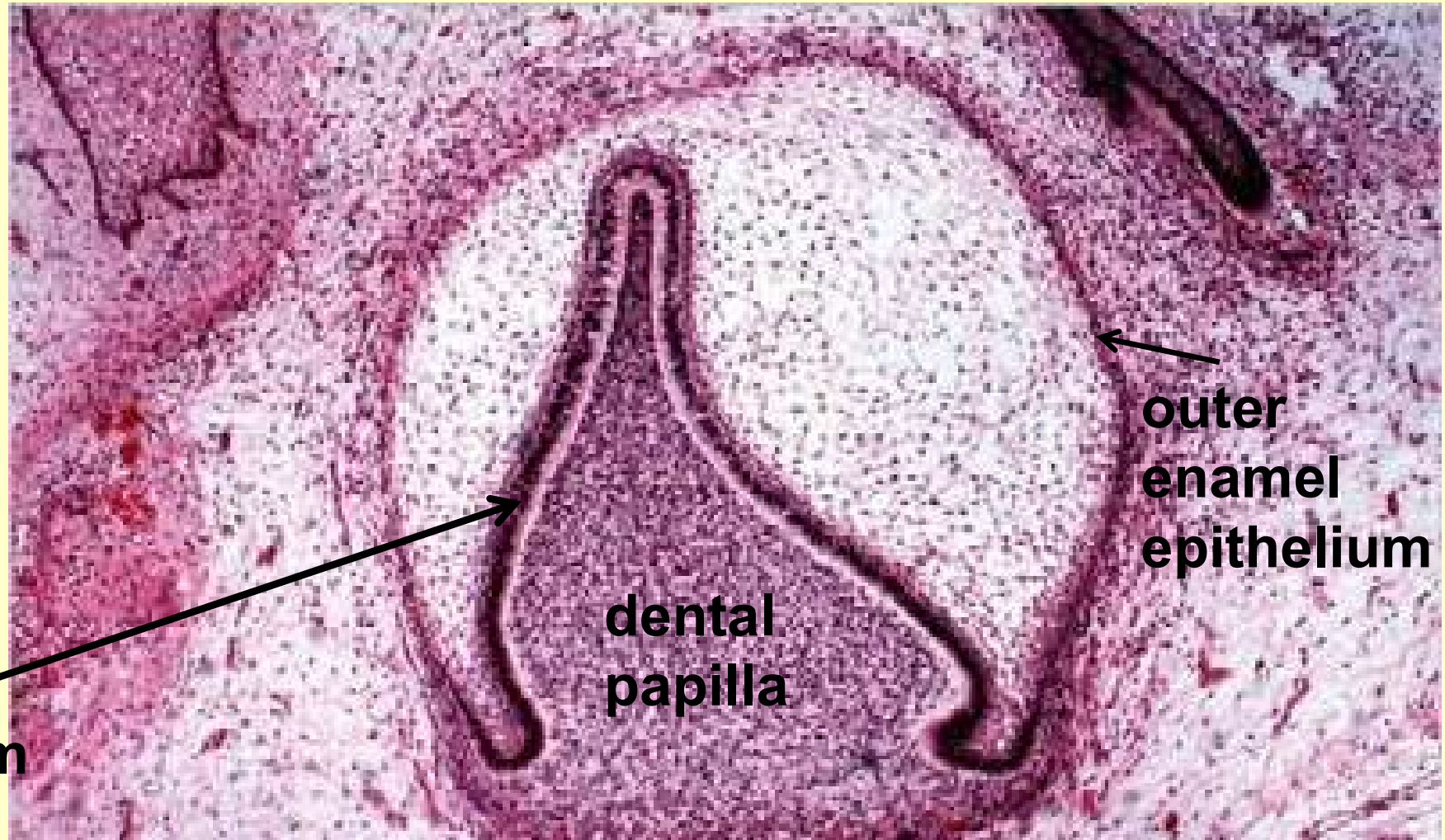
- formation of **enamel organ** and **dental papilla**

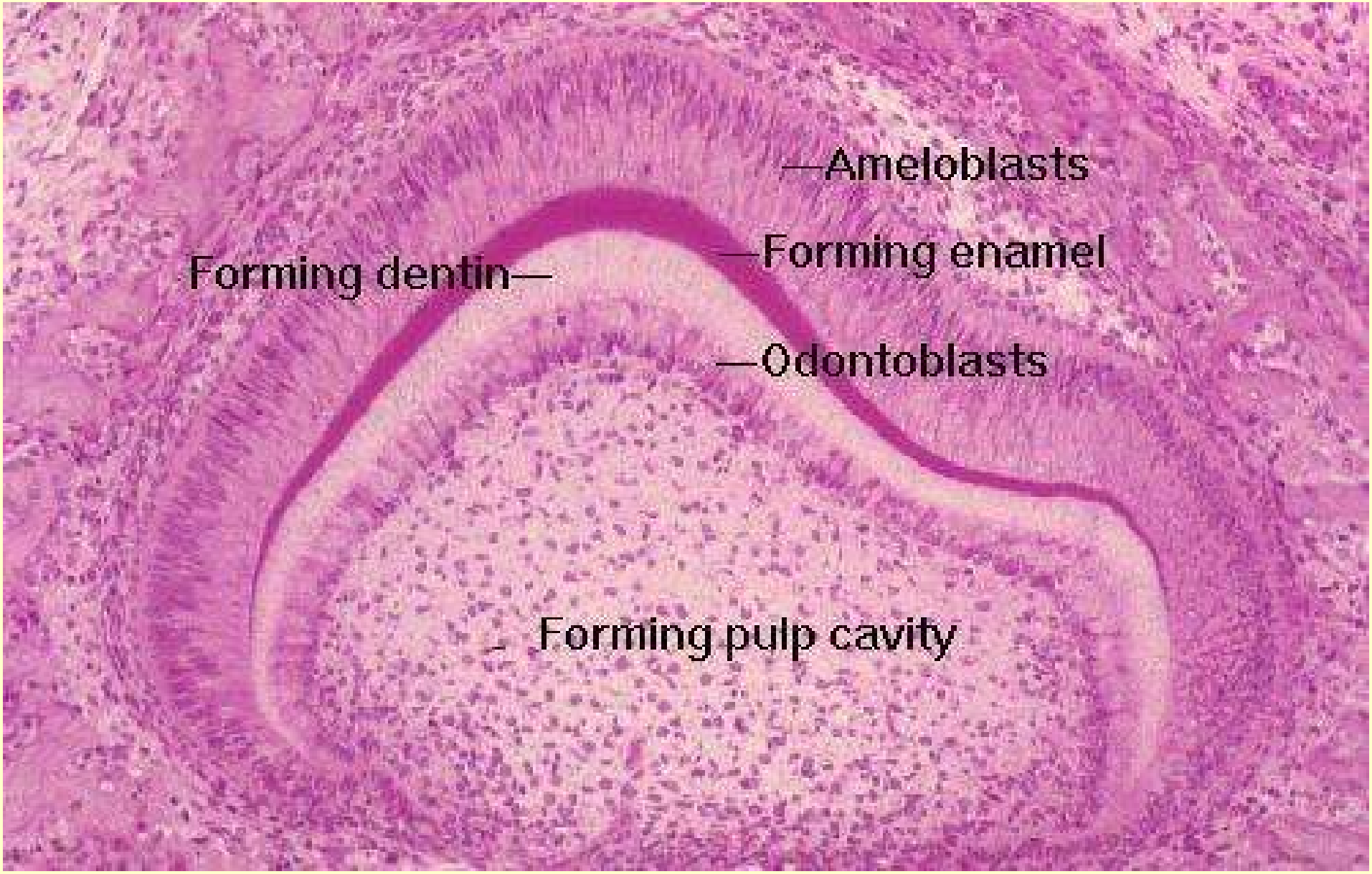
- **the enamel organ - enamel,**
- **the dental papilla - dentin and pulp**



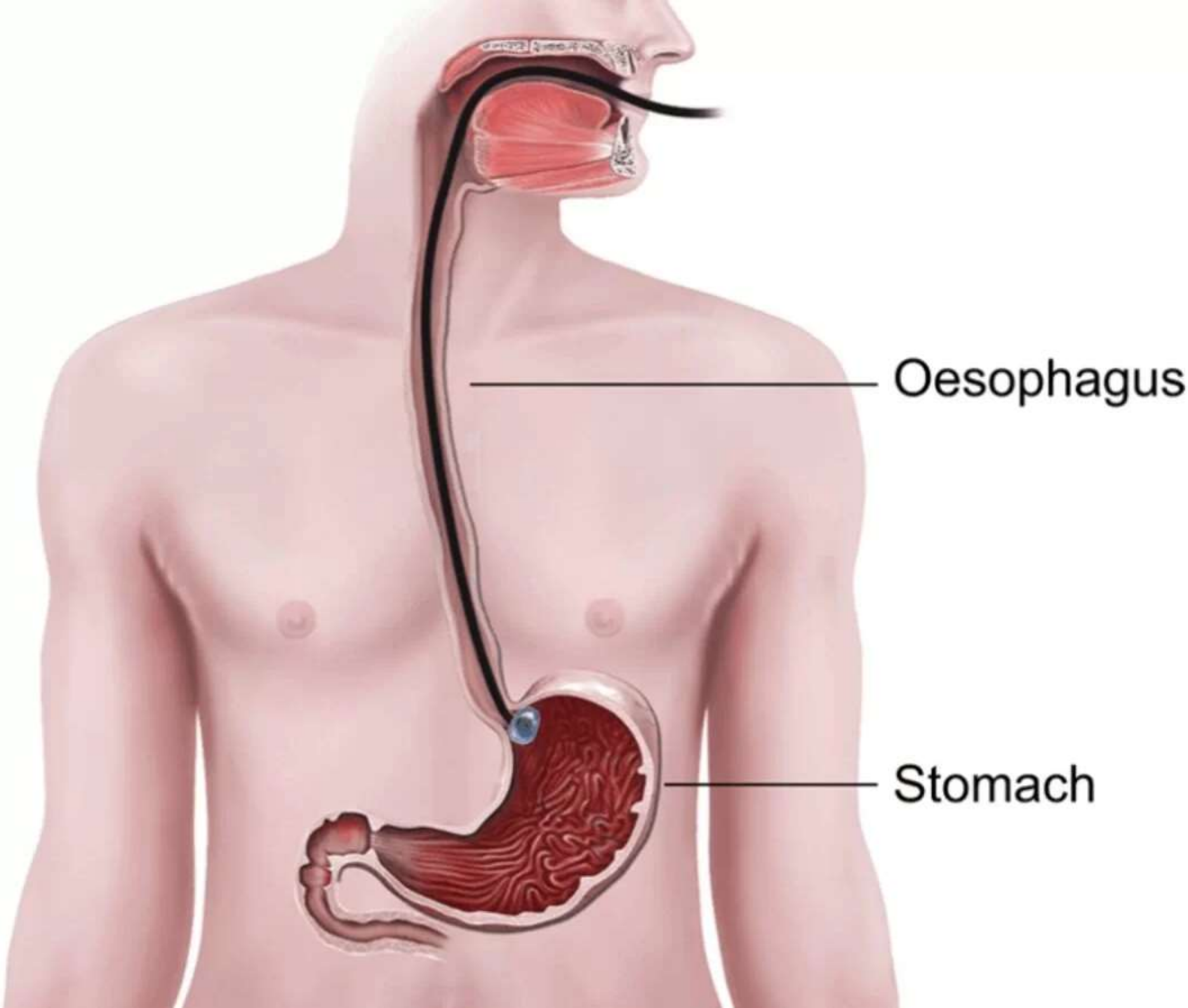
Bell stage

- **Inner enamel epithelium - ameloblasts,**
- the most peripheral cells of **dental papilla - odontoblasts**



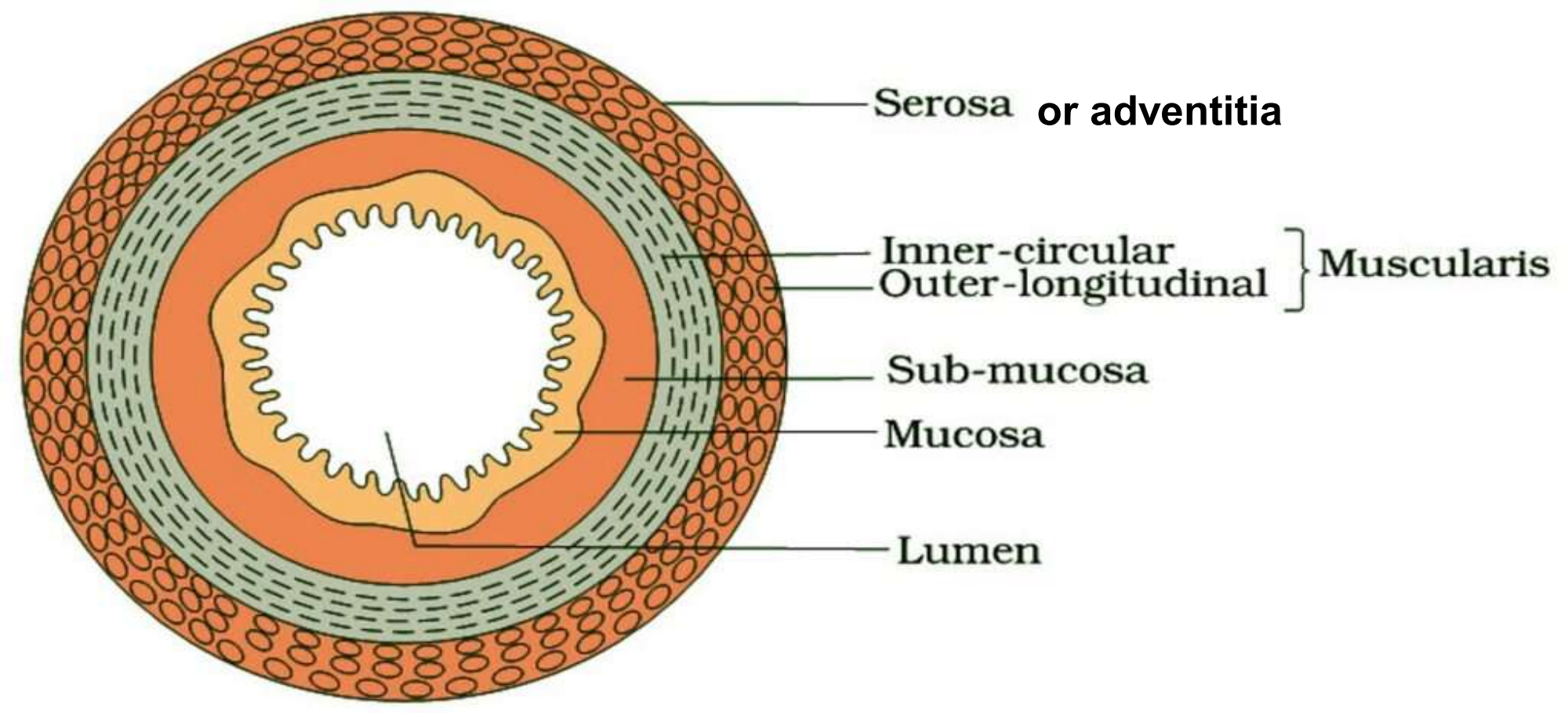


inner enamel epithelium – ameloblasts - enamel
outer cells of the dental papilla – odontoblasts- dentin


Oesophagus
Stomach

The wall of alimentary canal

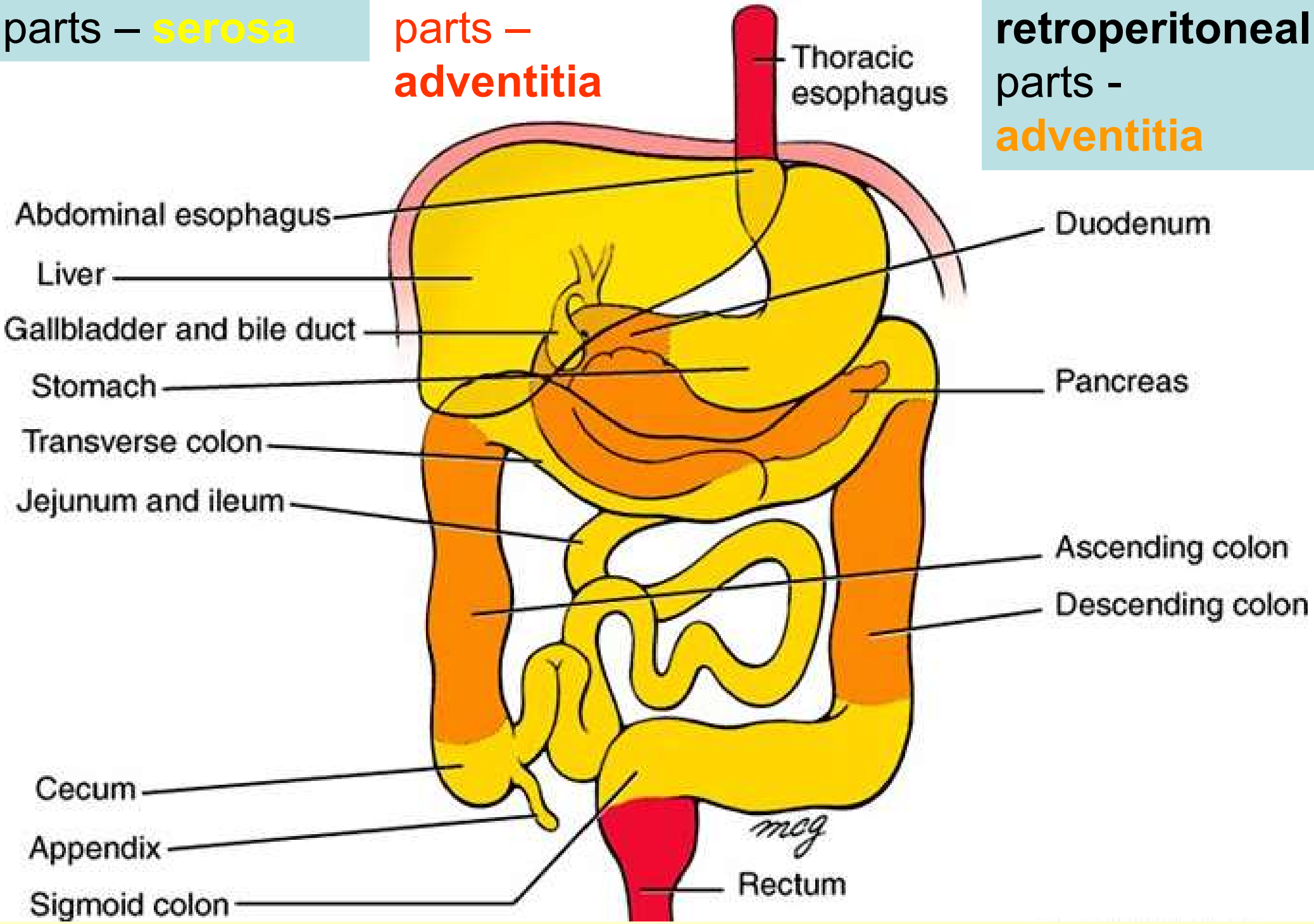
- **mucosa**
- **submucosa**
- **muscularis externa**
- **serosa** (simple squamous epithelium – **mesothelium**, connective tissue) or **adventitia** (connective tissue)



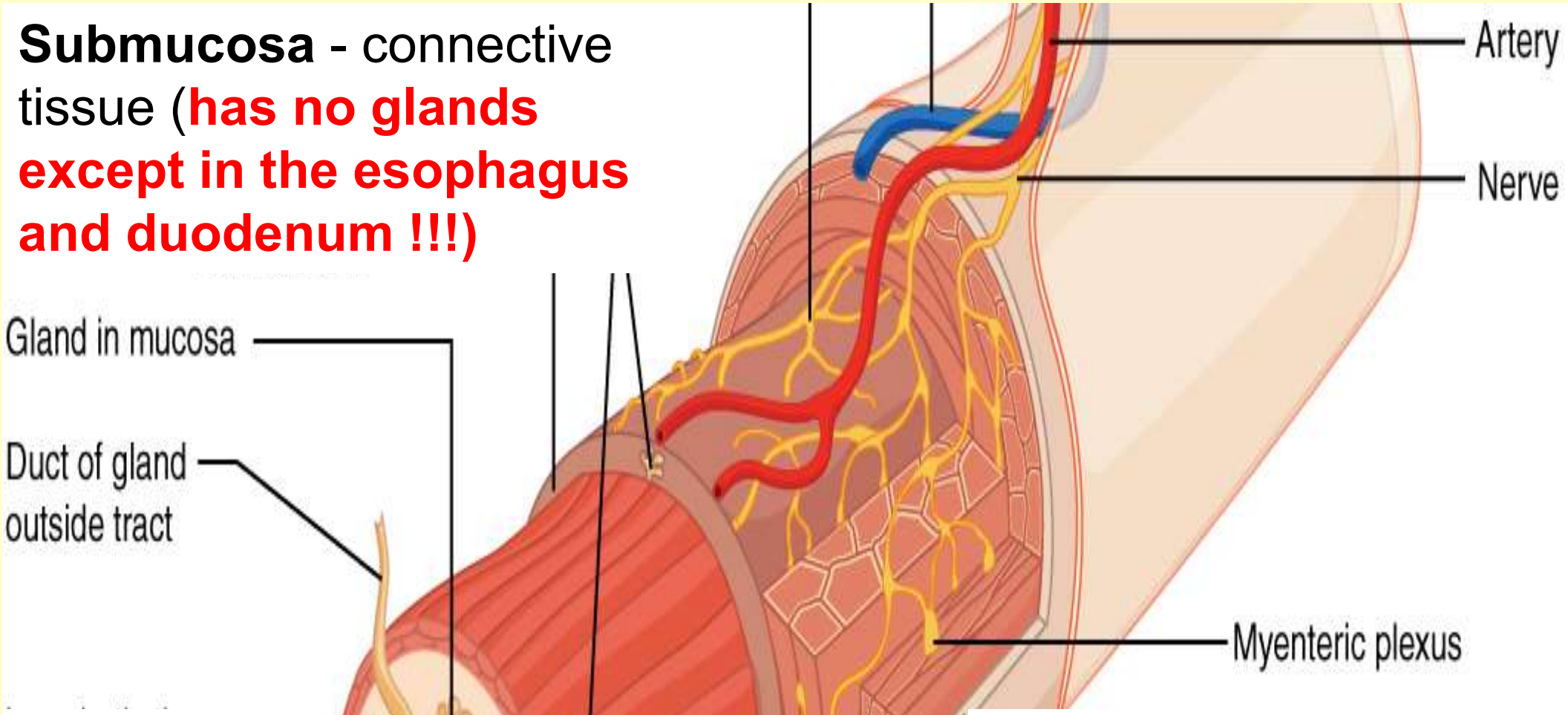
intraperitoneal parts – **serosa**

retroperitoneal parts – **adventitia**

Secondarily retroperitoneal parts - **adventitia**



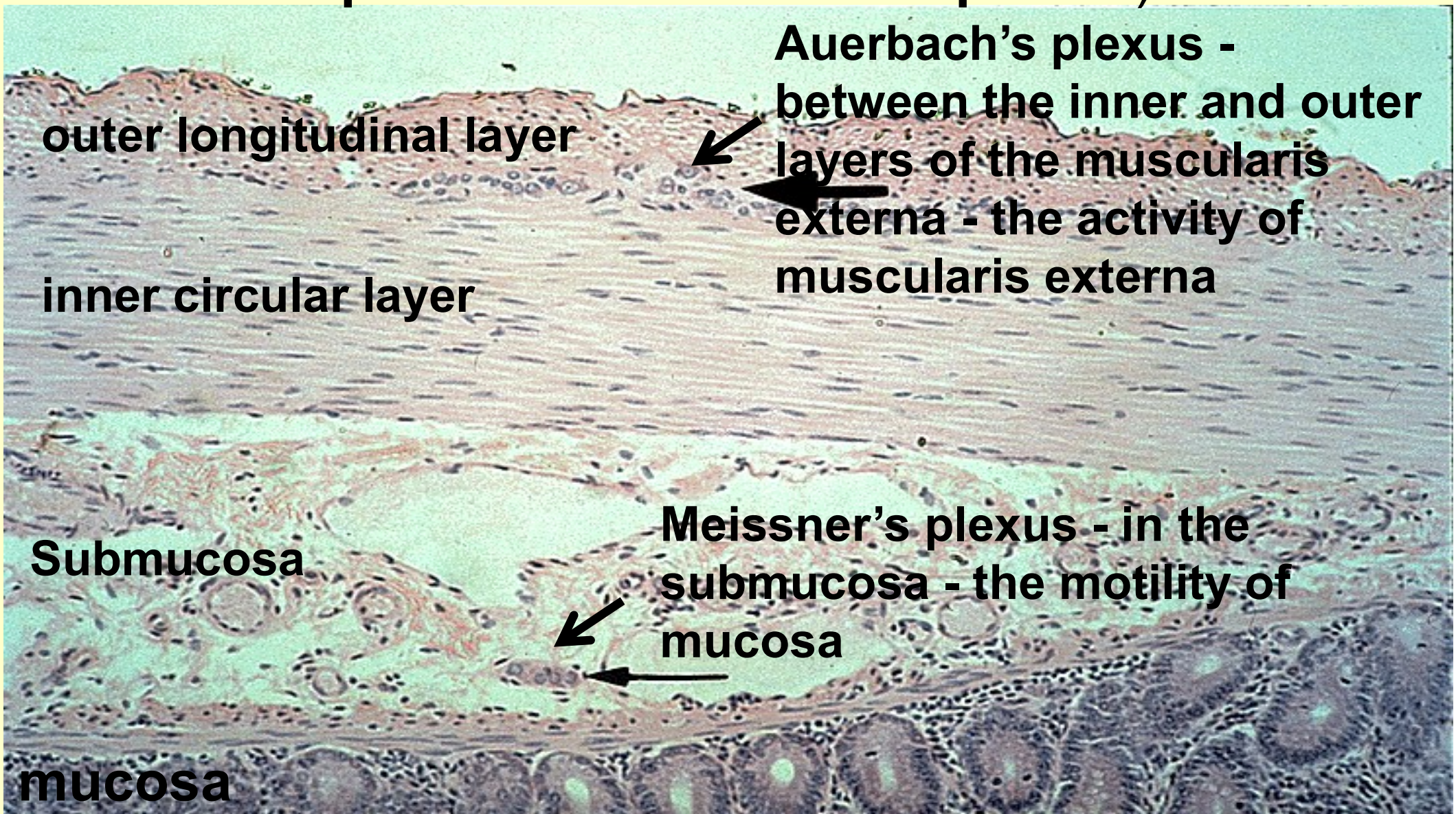
Submucosa - connective tissue (**has no glands except in the esophagus and duodenum !!!)**



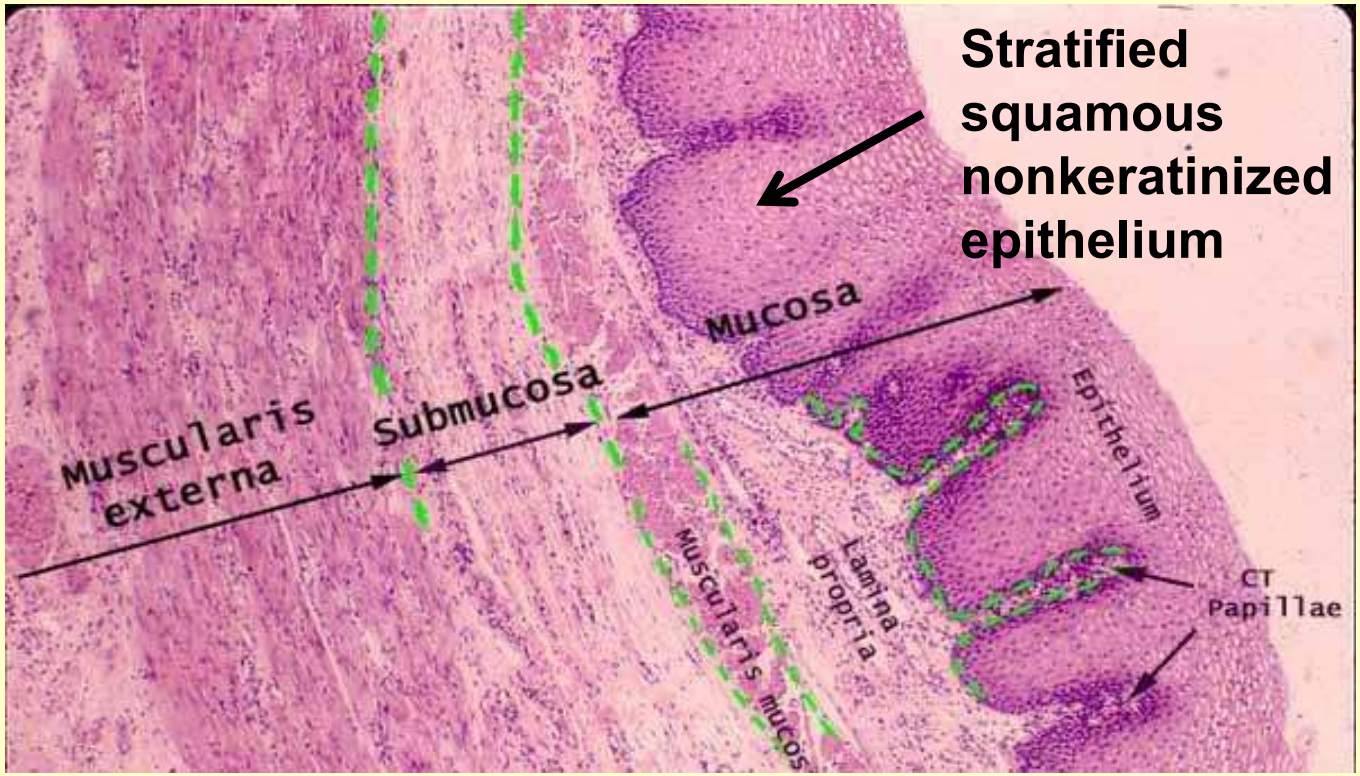
Mucosa - epithelium, lamina propria (**glands**), **muscularis mucosae**

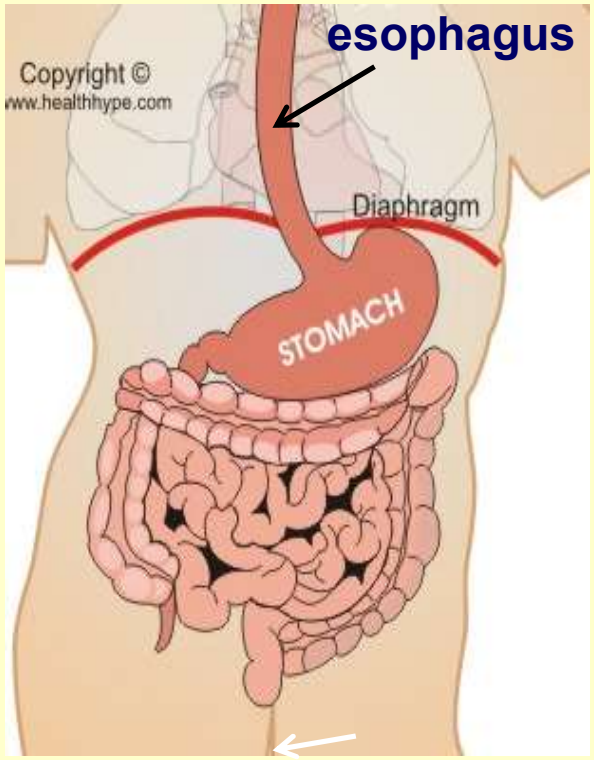
Muscularis externa – inner circular layer and outer longitudinal layer of **smooth muscle - peristaltic activity -** in **esophagus – skeletal muscle**

Enteric nervous system (autonomic) - ENS - control all digestive processes: motility, secretion, absorption (neurons of the ENS - collected into two ganglia: **Auerbach's plexus** and **Meissner's plexus**)

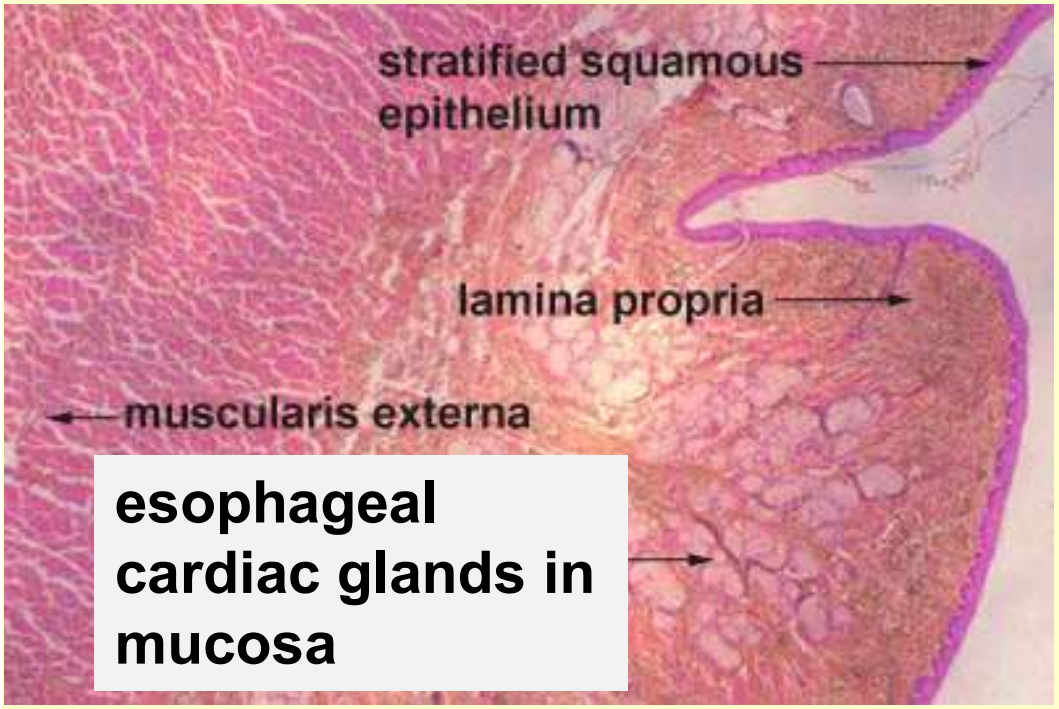


Esophagus - conveys the masticated food (bolus) from oral cavity to the stomach

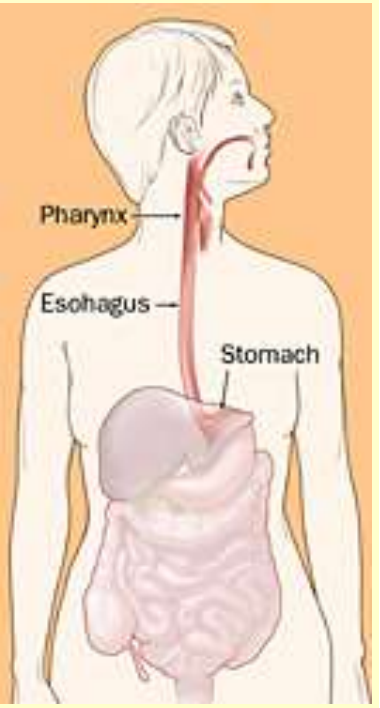


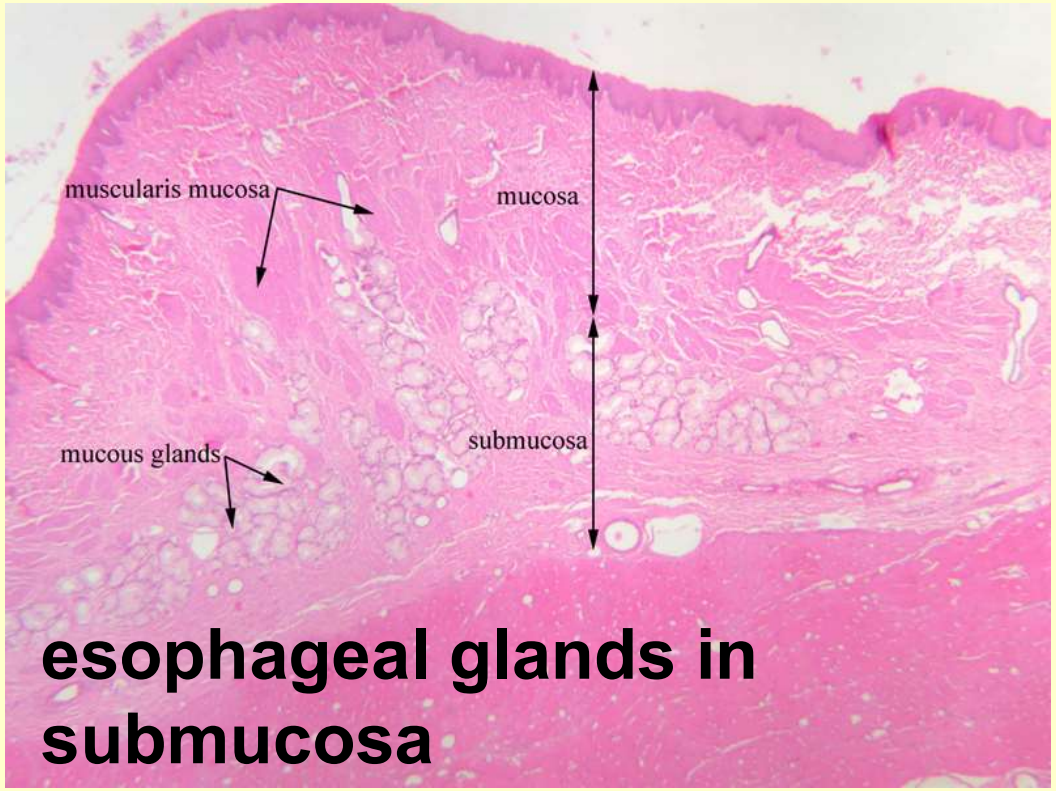


- **Mucosa** (Stratified squamous nonkeratinized epithelium, lamina propria, muscularis mucosae)
- **Submucosa**
- **Muscularis externa**
- Part of the esophagus in the peritoneal cavity **- serosa**, the rest by **adventitia**.



Lamina propria – near the stomach - **esophageal cardiac glands** - mucus.

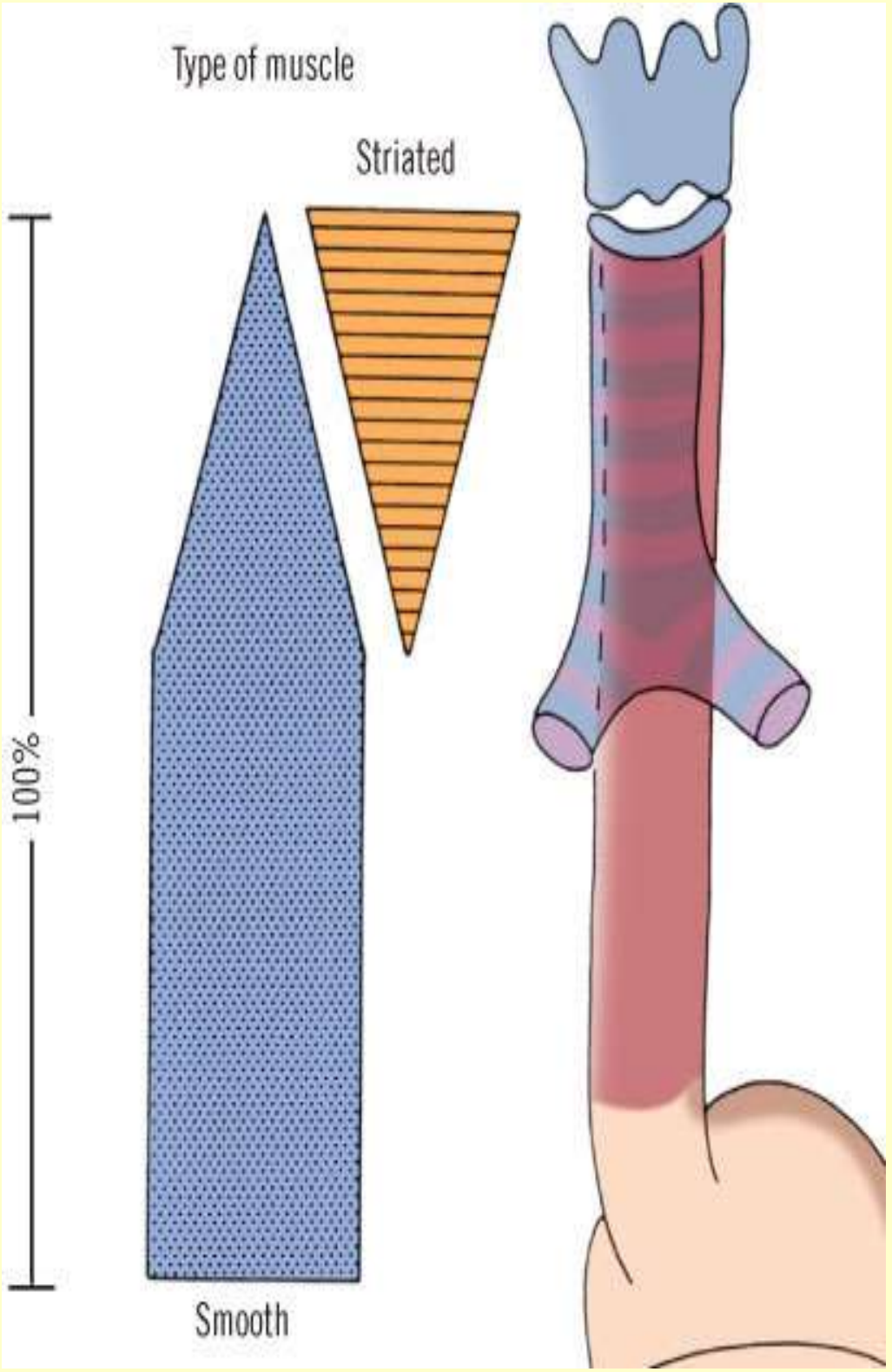




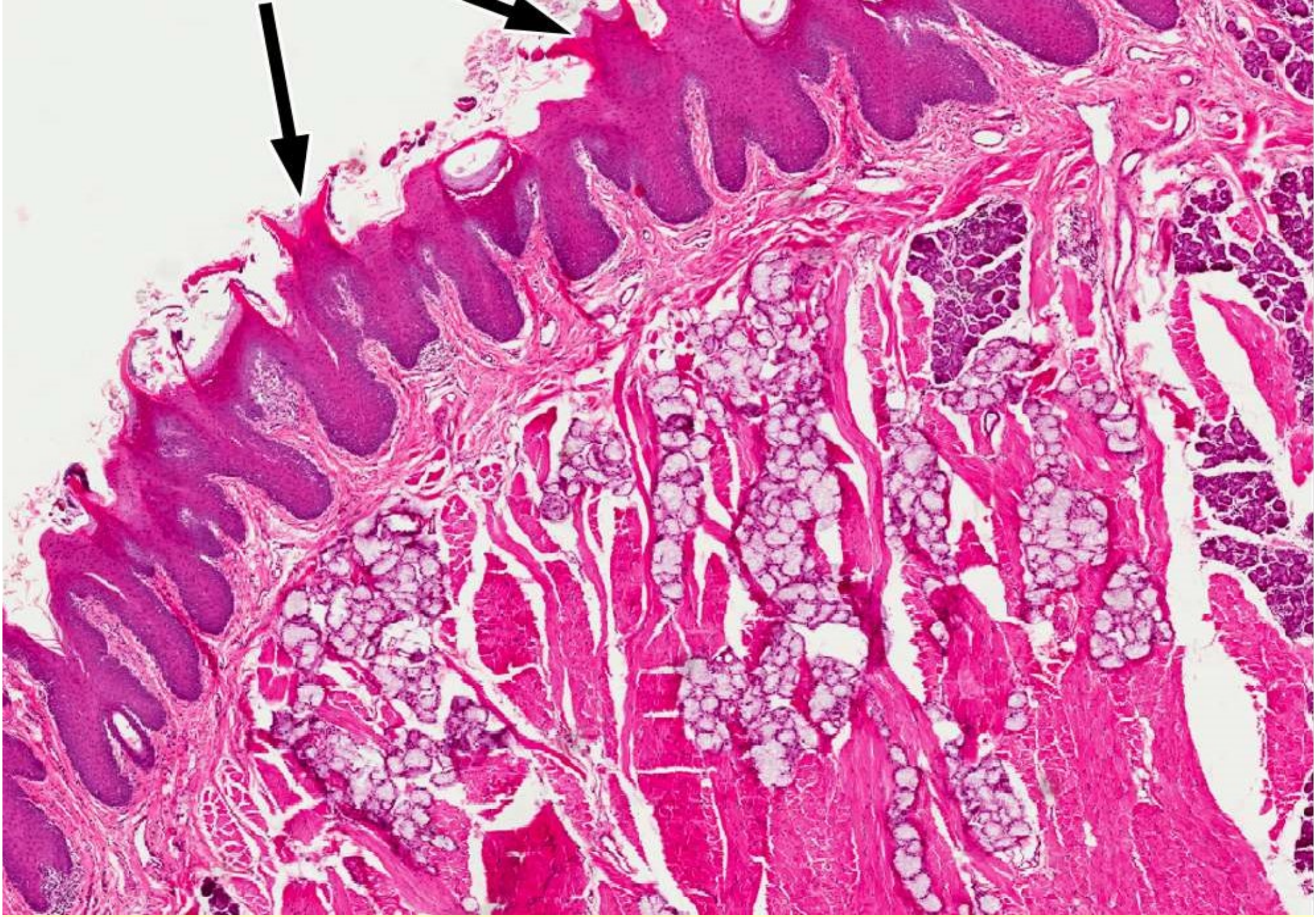
Submucosa – main esophageal glands - mucus and serous cells (**only esophagus and duodenum glands in submucosa).**

The muscularis externa of the esophagus

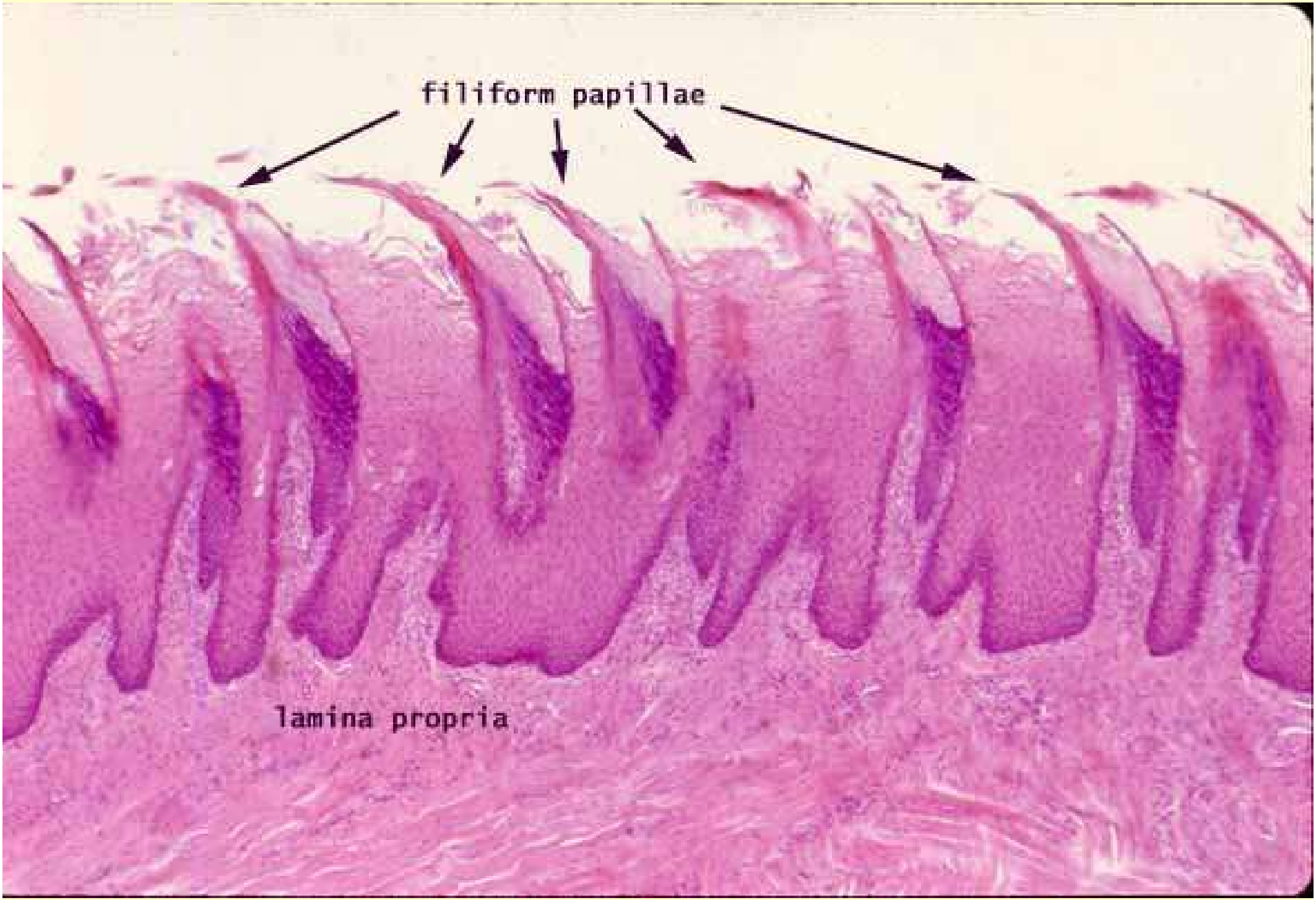
- the **upper third of the esophagus - skeletal muscle (swallowing)**
- the **middle third -** both **skeletal and smooth muscle,**
- the **lowest third -** only **smooth muscle (**inner circular and outer longitudinal)



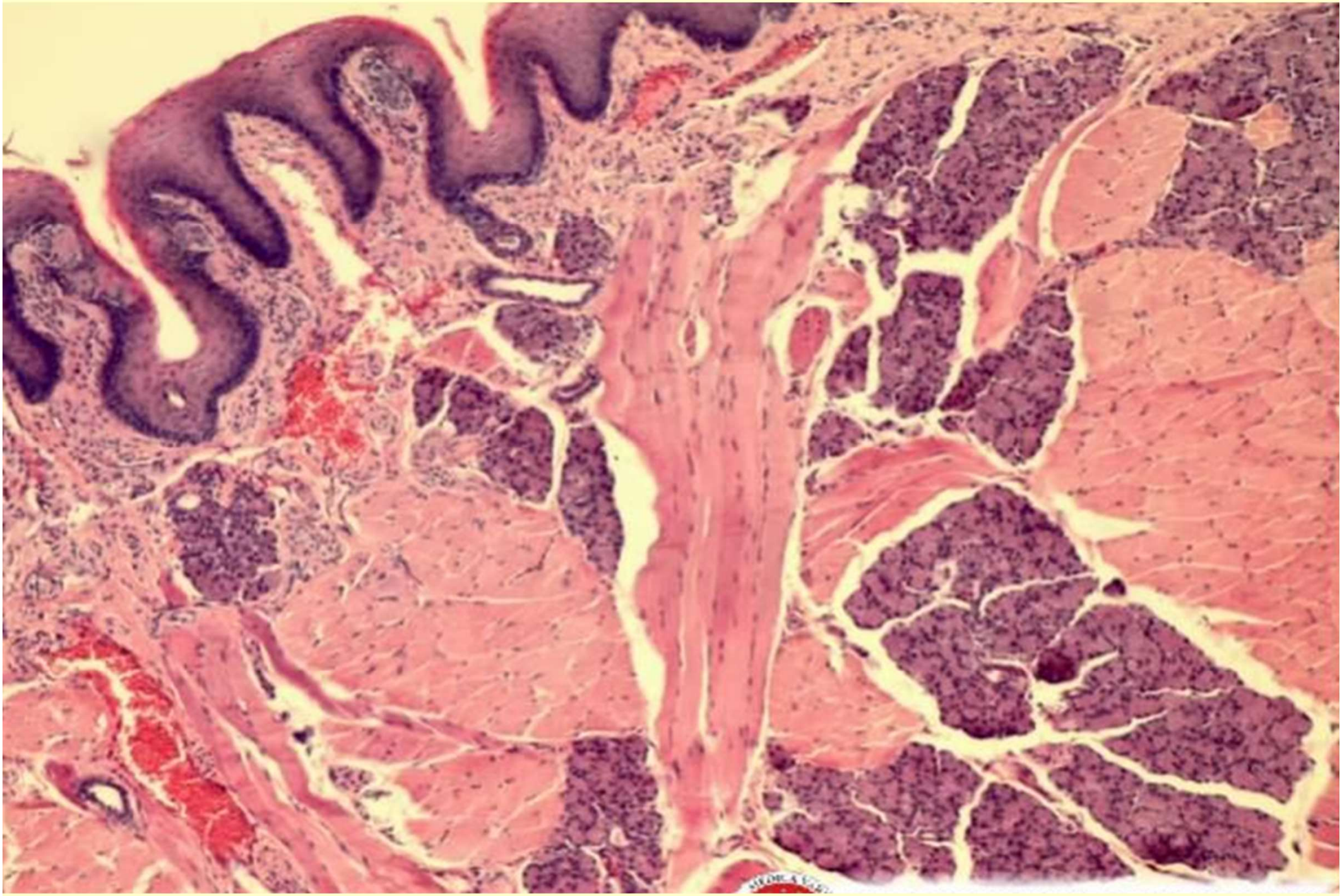
SLIDES FOR TODAY



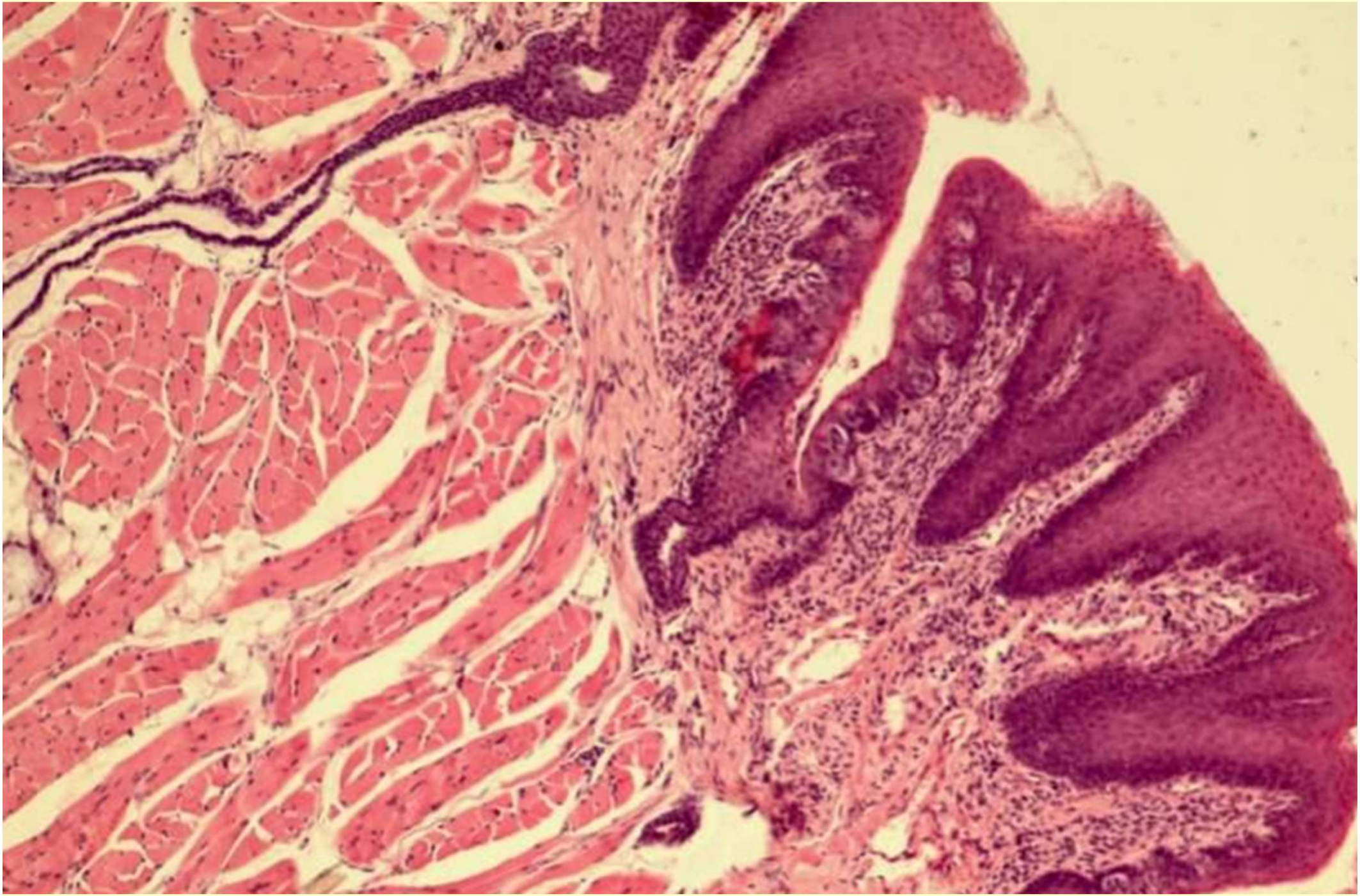
filiform papillae – tongue (no. 41),



filiform papillae – tongue (no. 41),

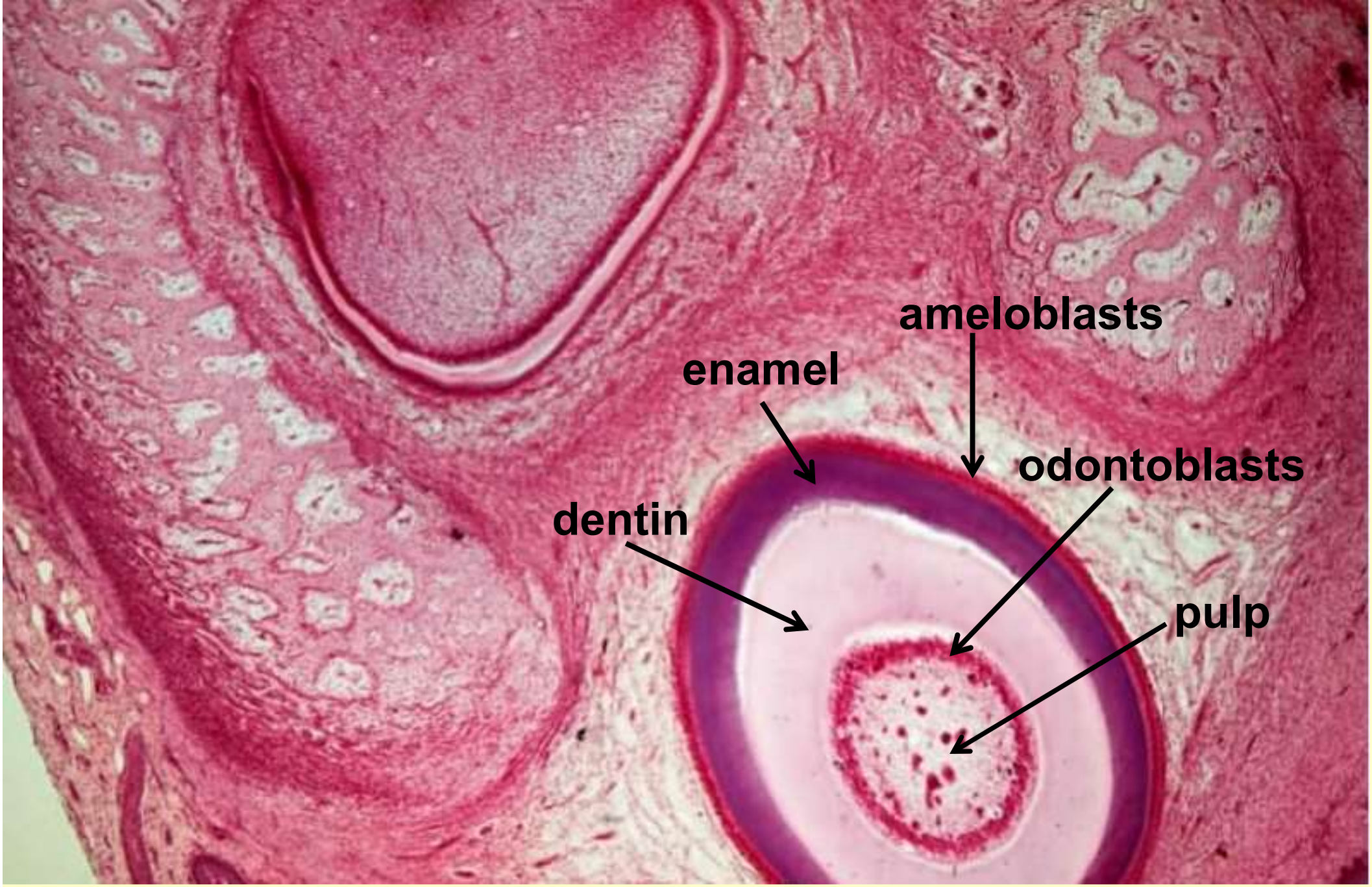


circumvallatae papillae – tongue (no. 42)

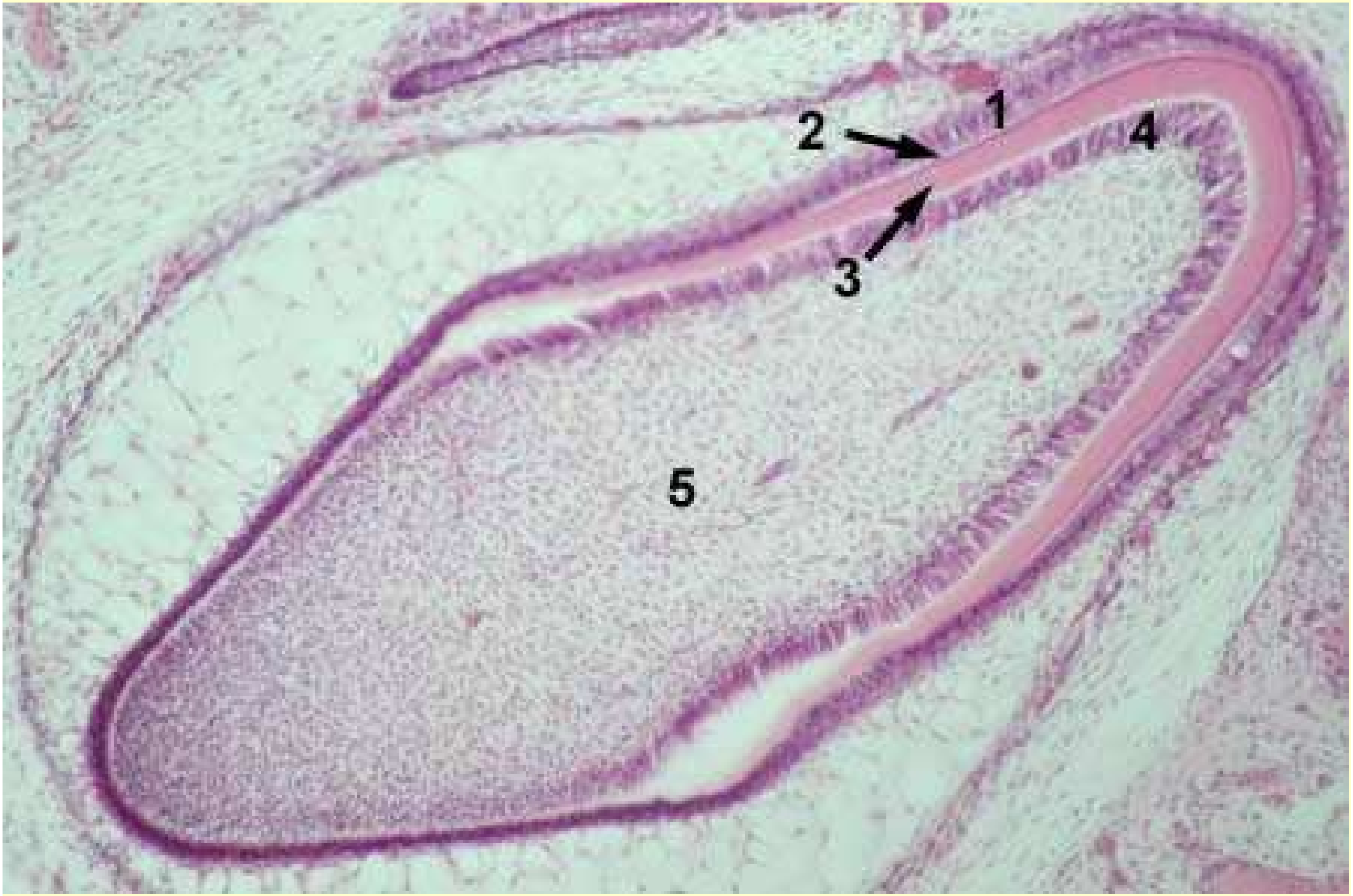


circumvallatae papillae – tongue (no. 42)

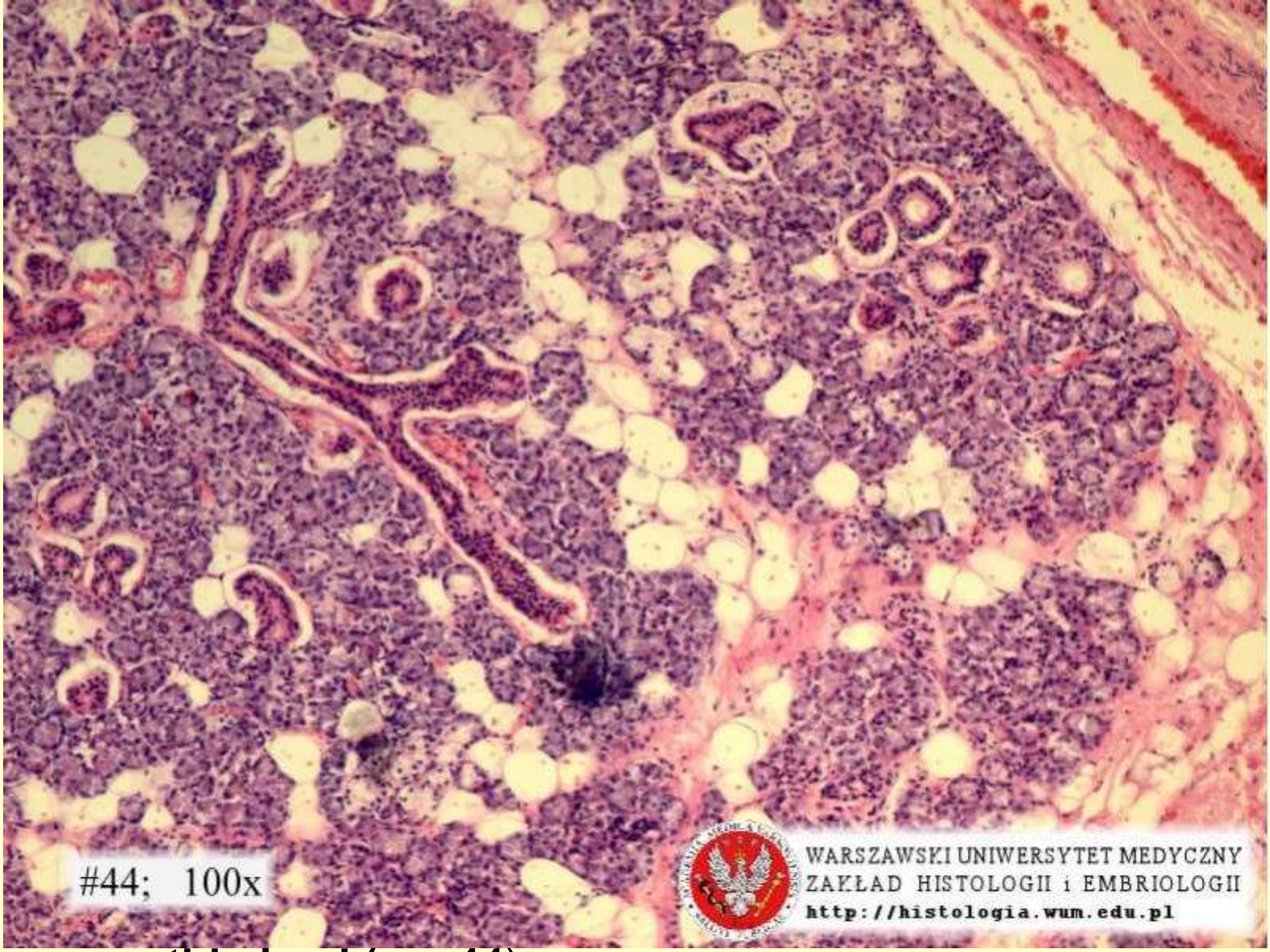
tooth germ (no. 103)



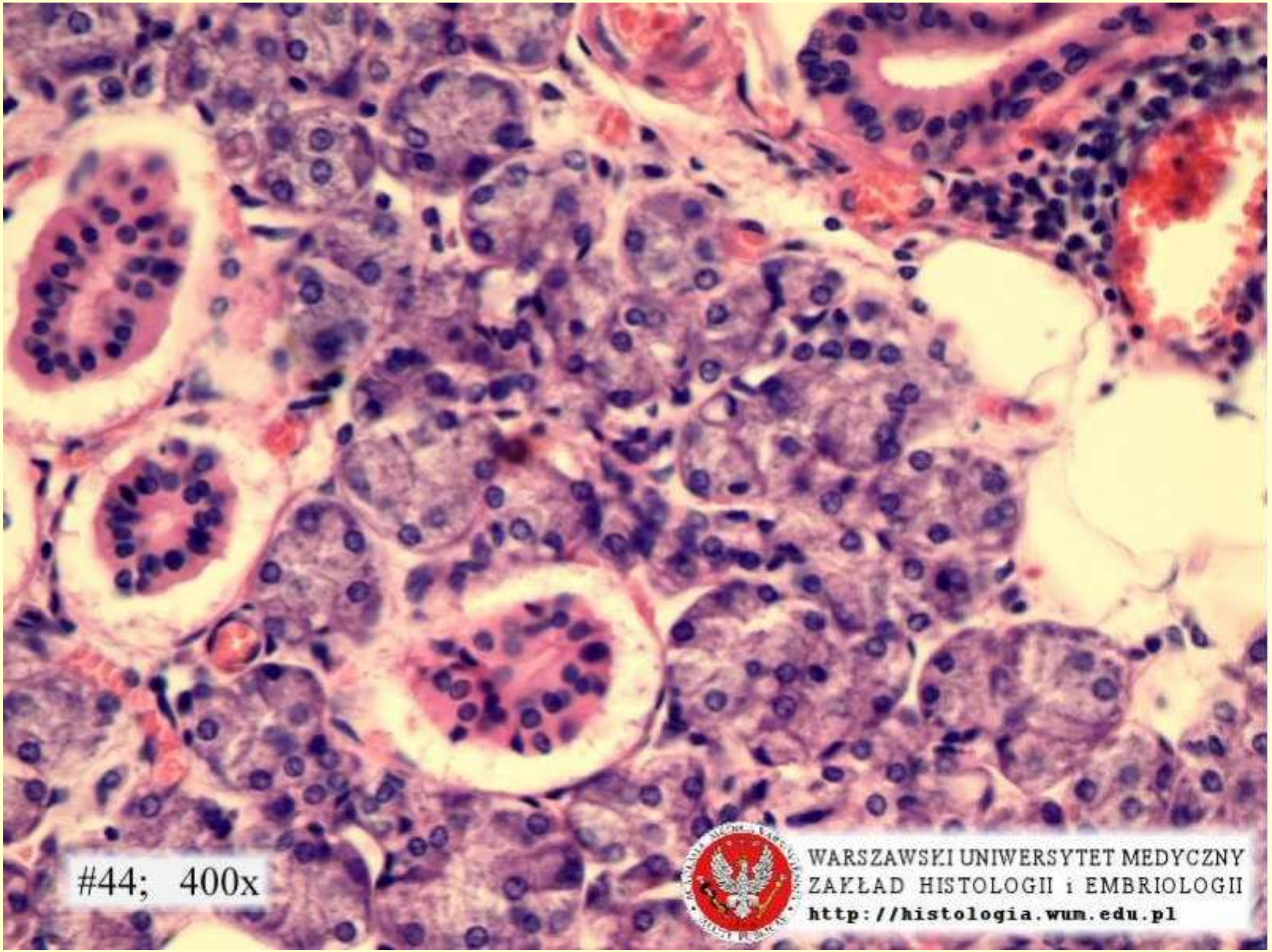
Tooth development



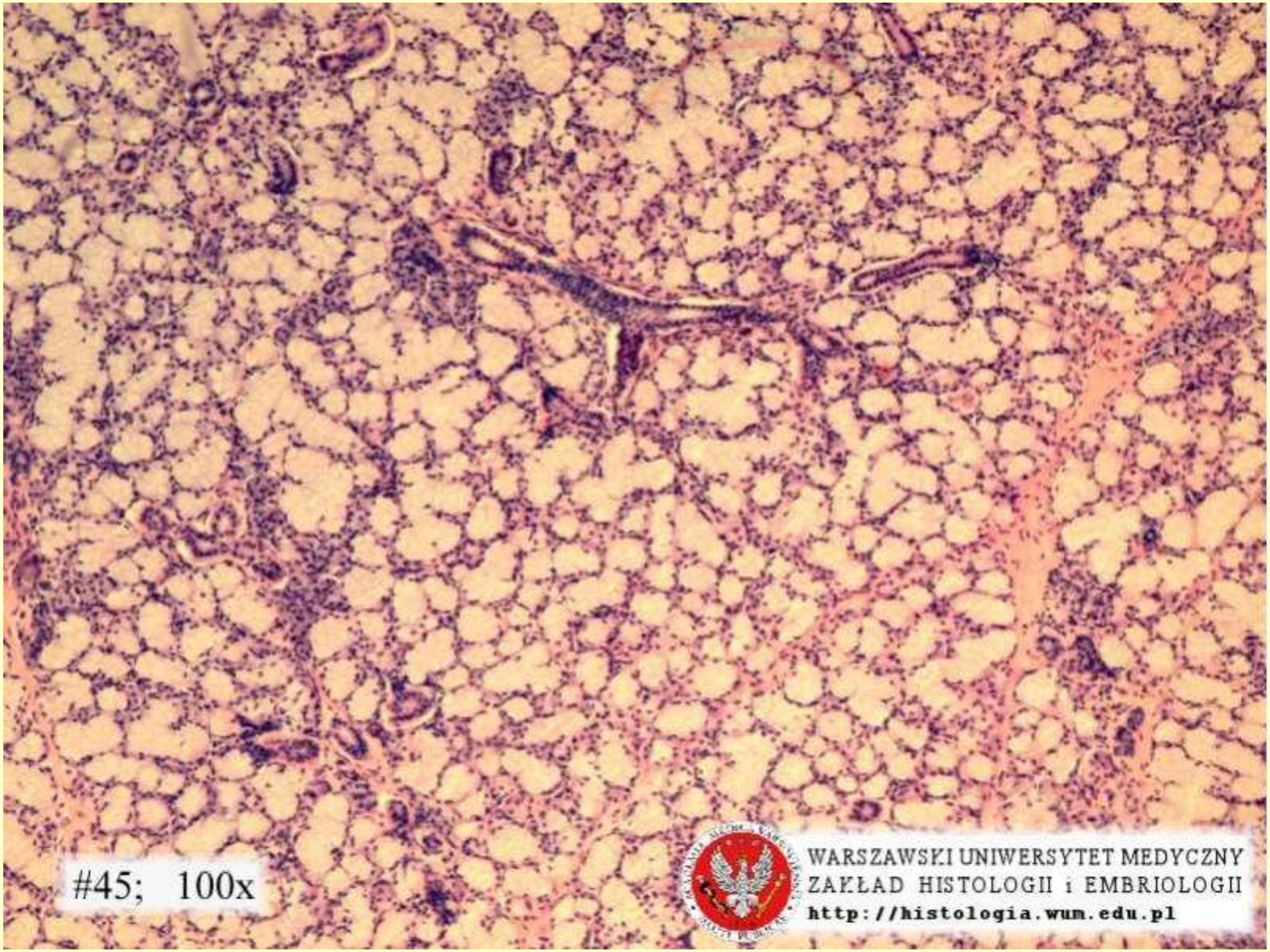
tooth germ (no. 103),



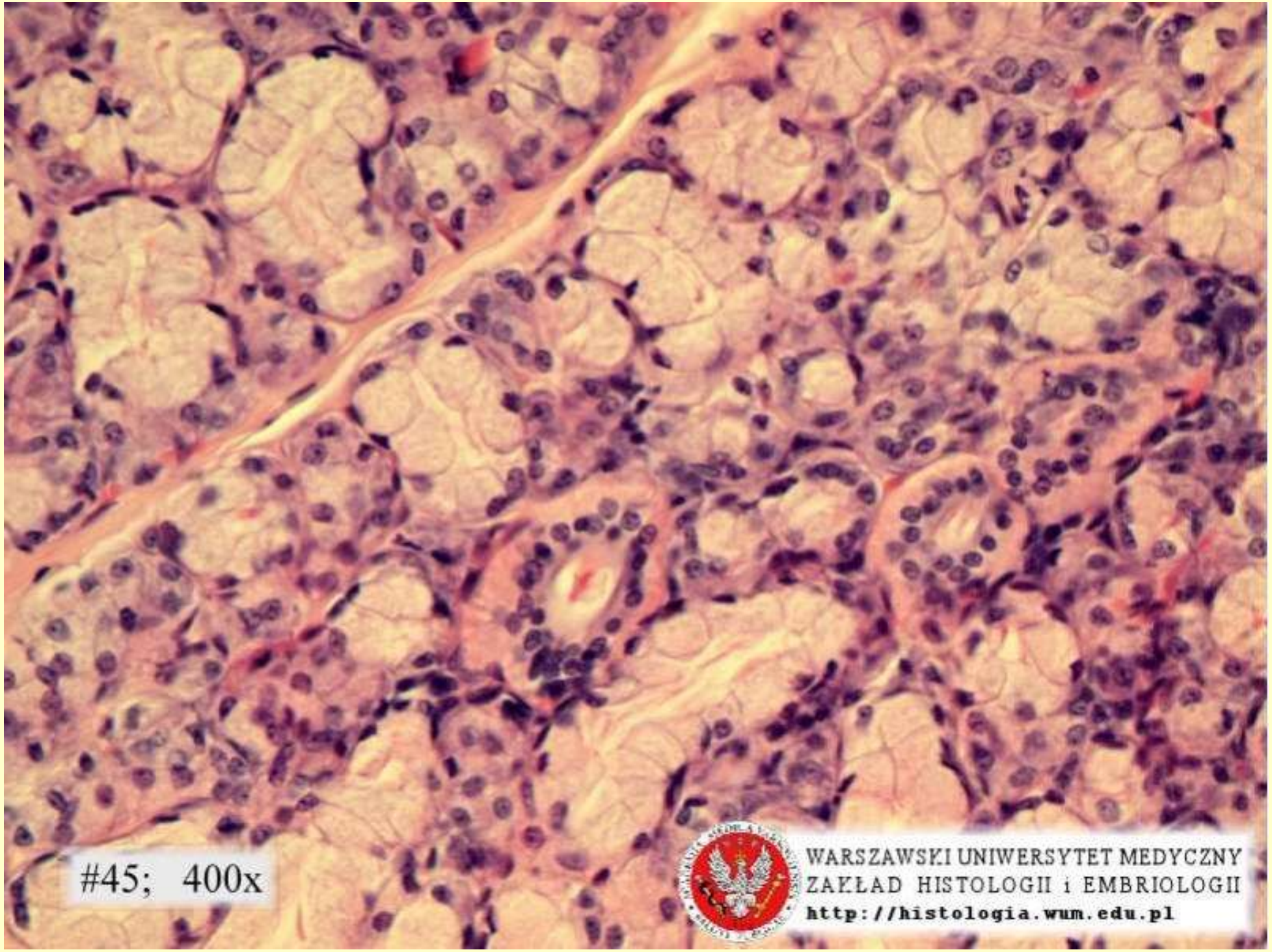
parotid gland (no. 44)



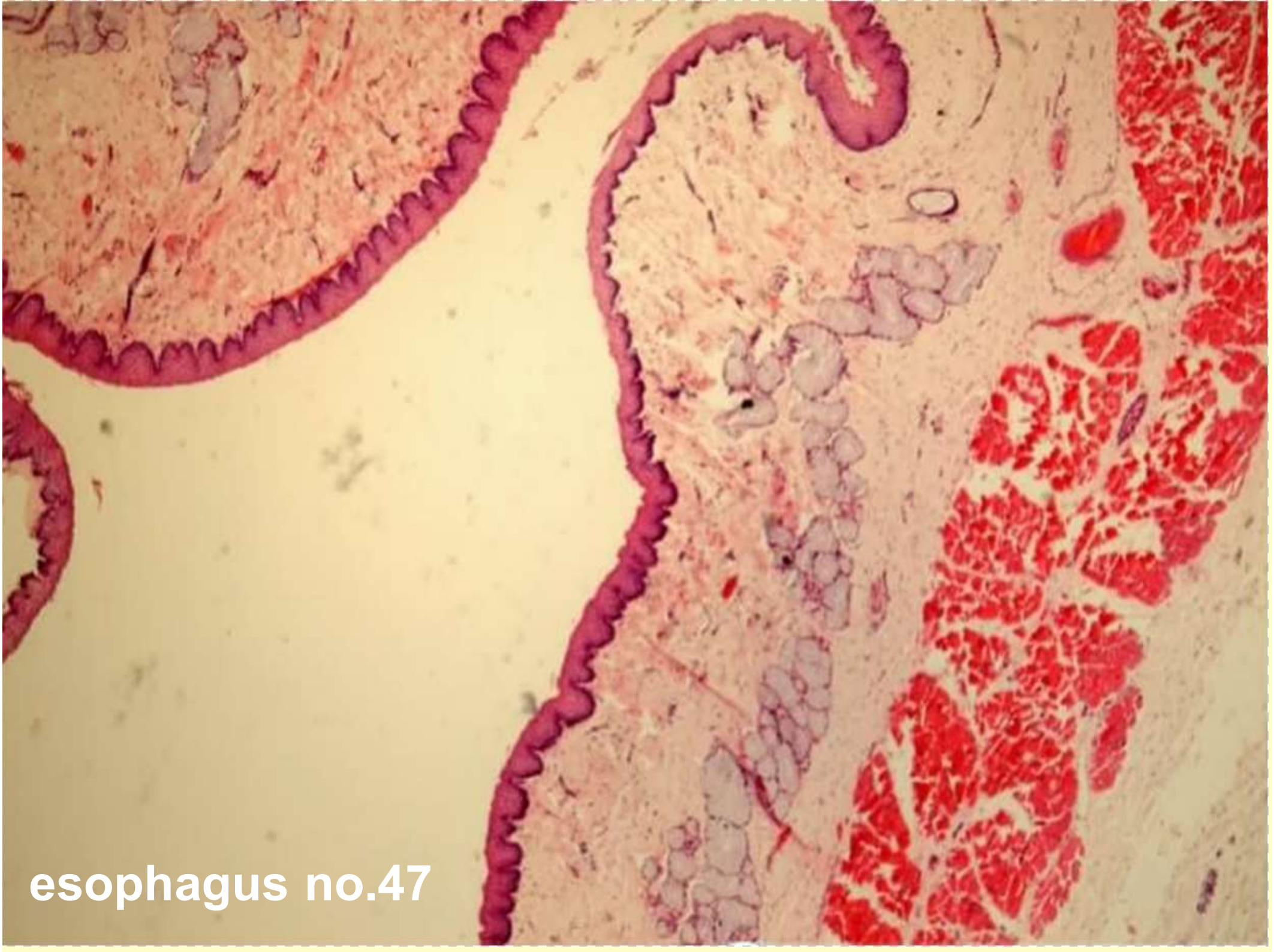
parotid gland (no. 44)



sublingual gland (no. 45)

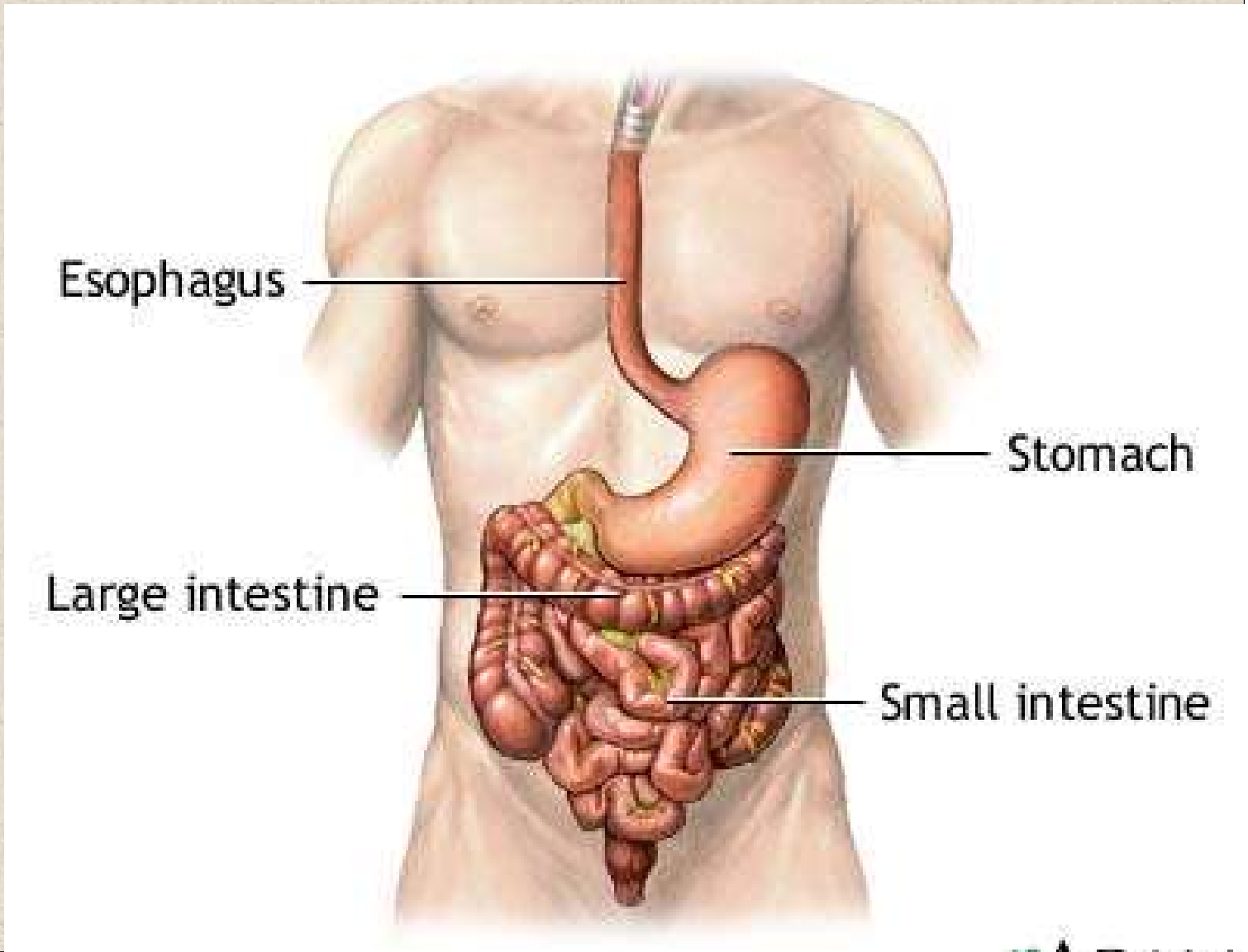


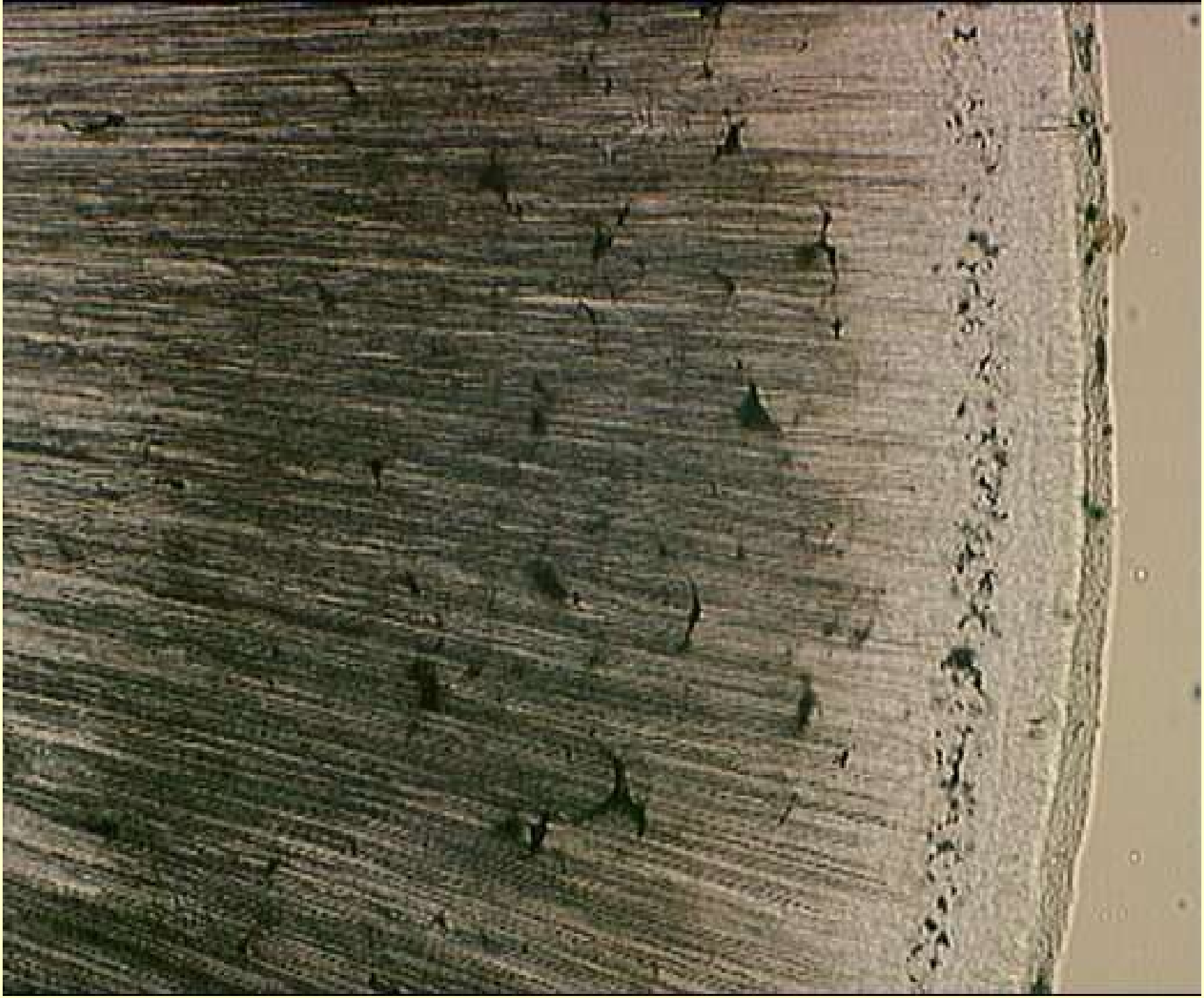
sublingual gland (no. 45)


esophagus no.47

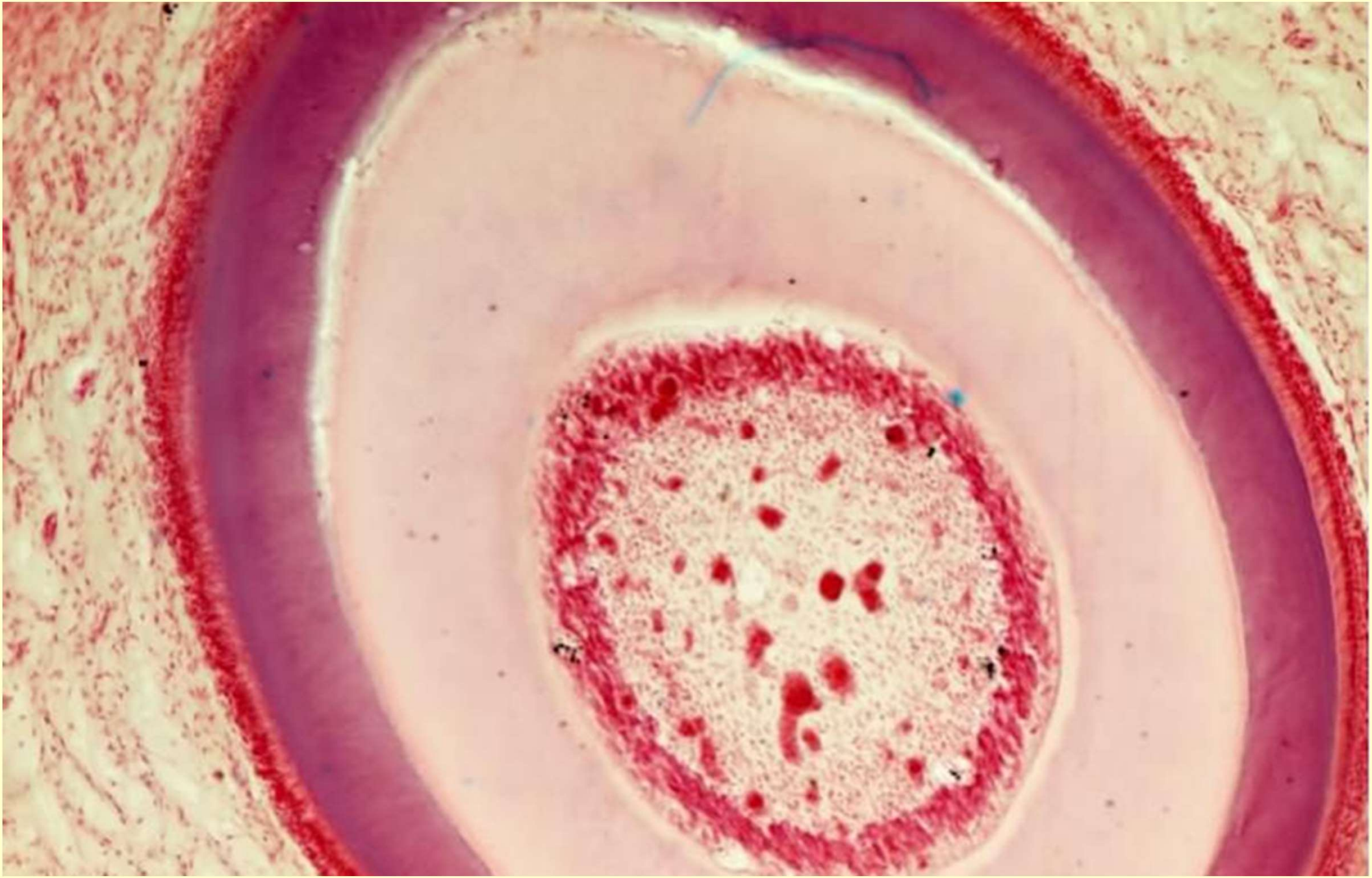

Esophagus no.47

Next class – Alimentary canal

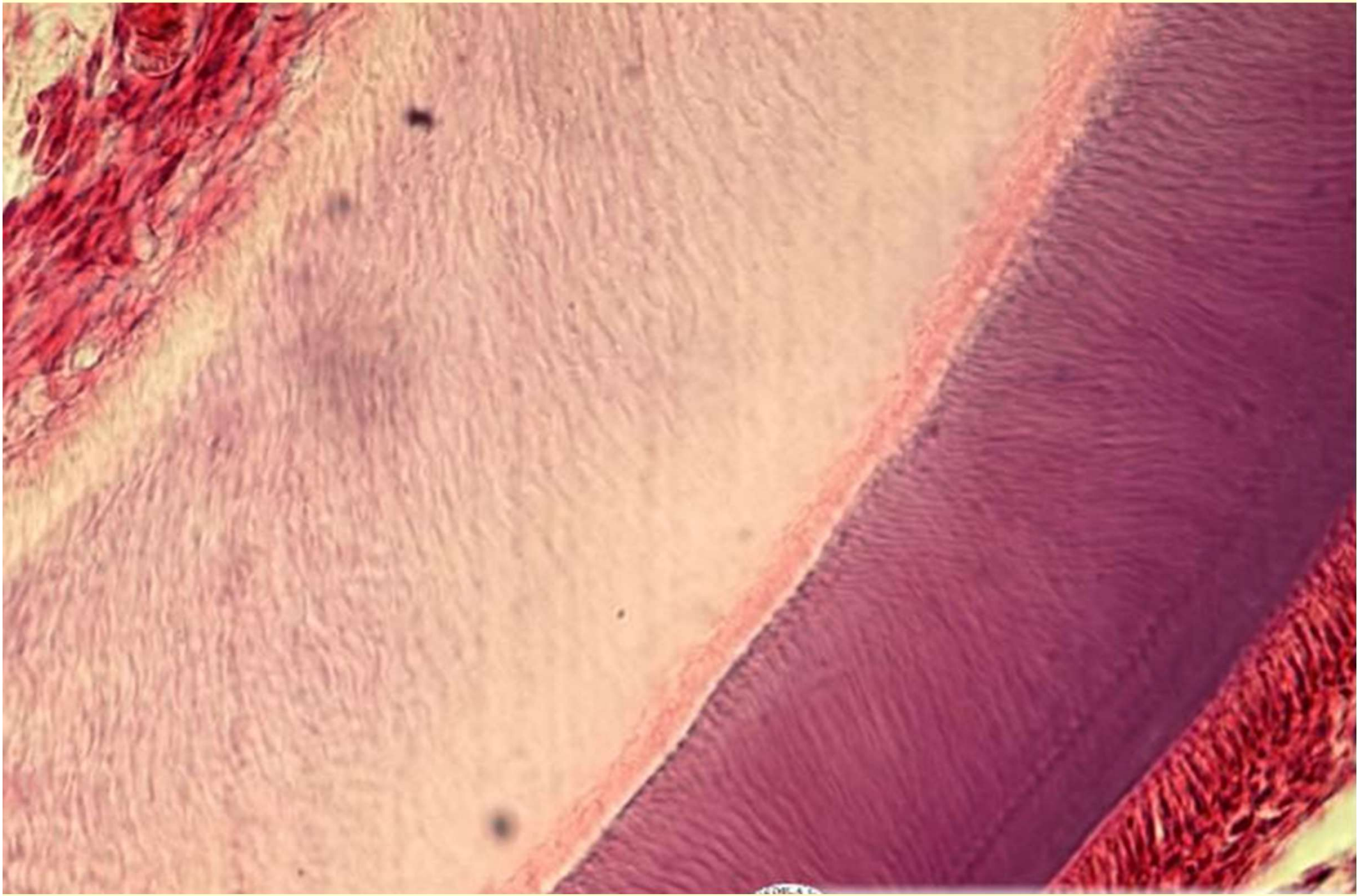




dentine, ground section (no. 100),



tooth germ (no. 103),



tooth germ (no. 103)