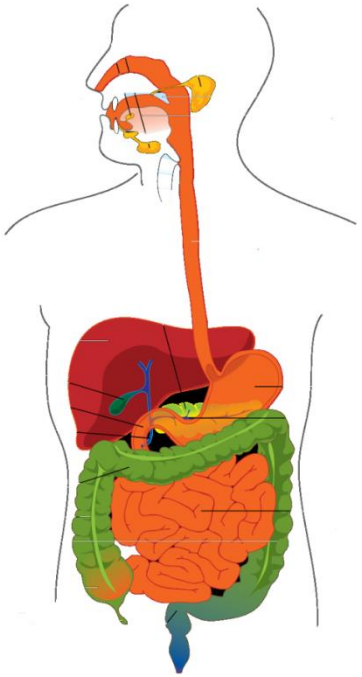
MUNI MED Ústav histologie a embryologie

MICROSCOPIC ANATOMY AND DEVELOPMENT OF GIT I



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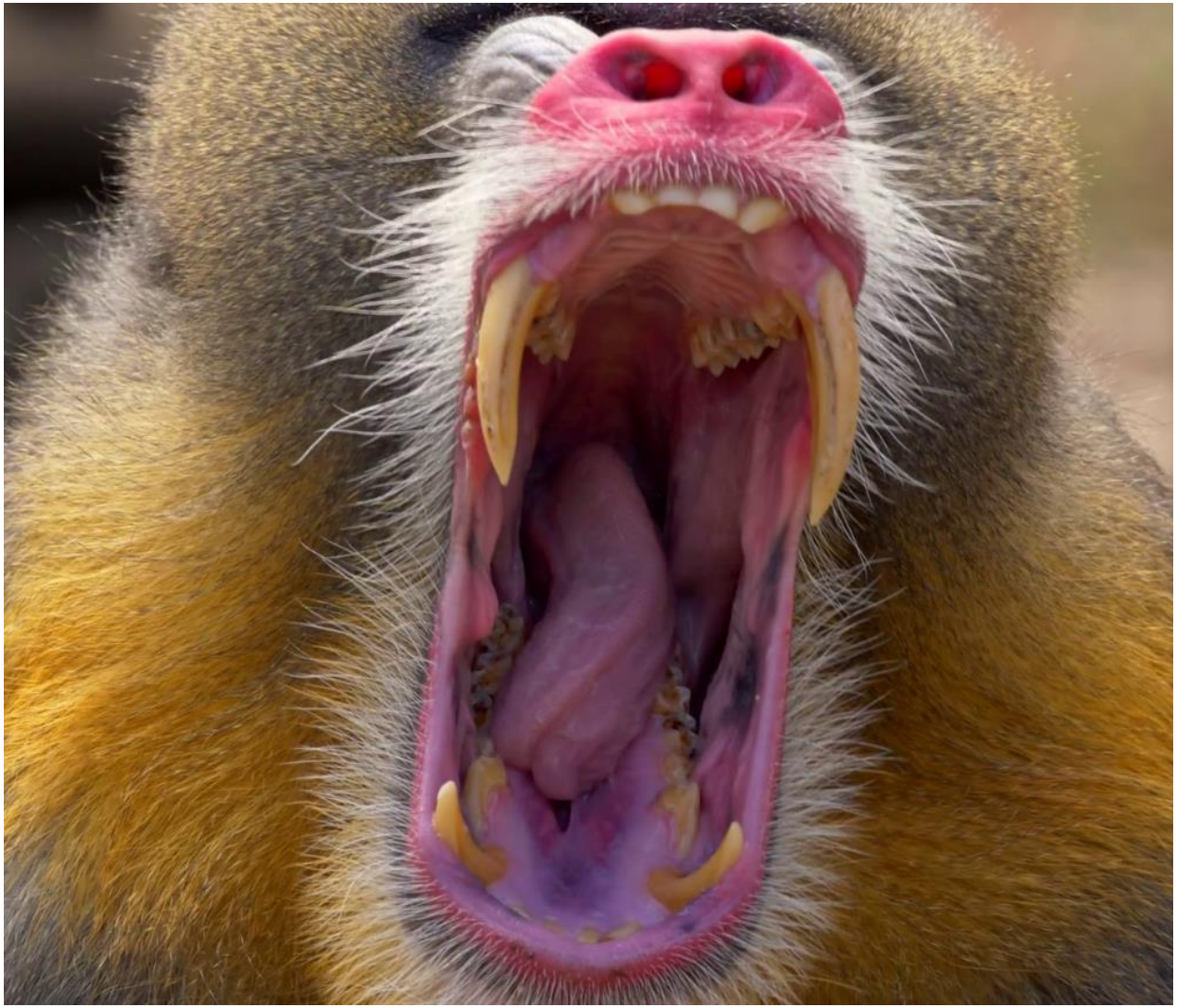
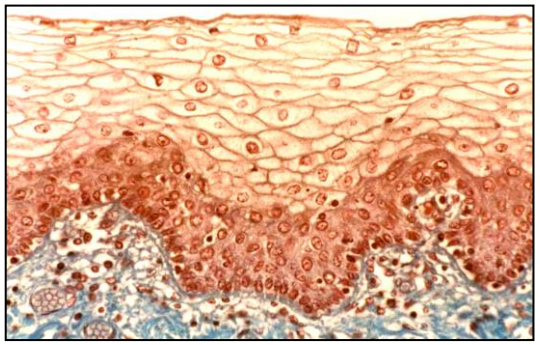
ORAL CAVITY



- Upper and lower lip
- Vestibulum oris
- Soft and hard palate
- Tooth and gingiva
- Tongue

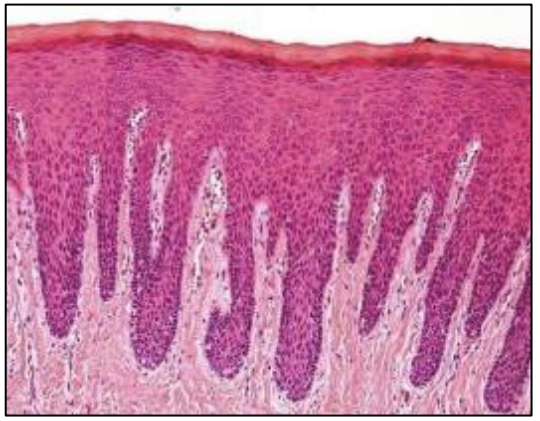
ORAL MUCOSA

- ***lamina epithelialis mucosae***
  stratified squamous epithelium
- ***lamina propria mucosae***
  loose collagen C.T.

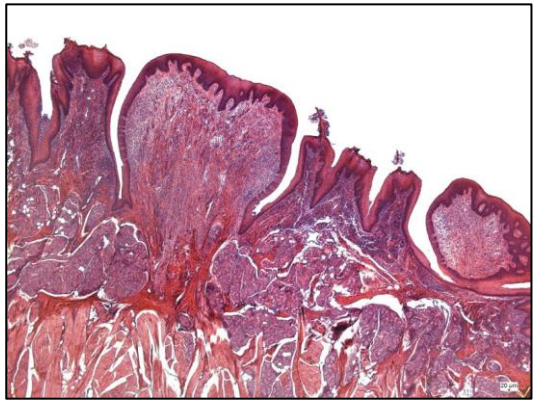


Types of oral mucosa

- **lining mucosa**
- mucosal and submucosal C.T.

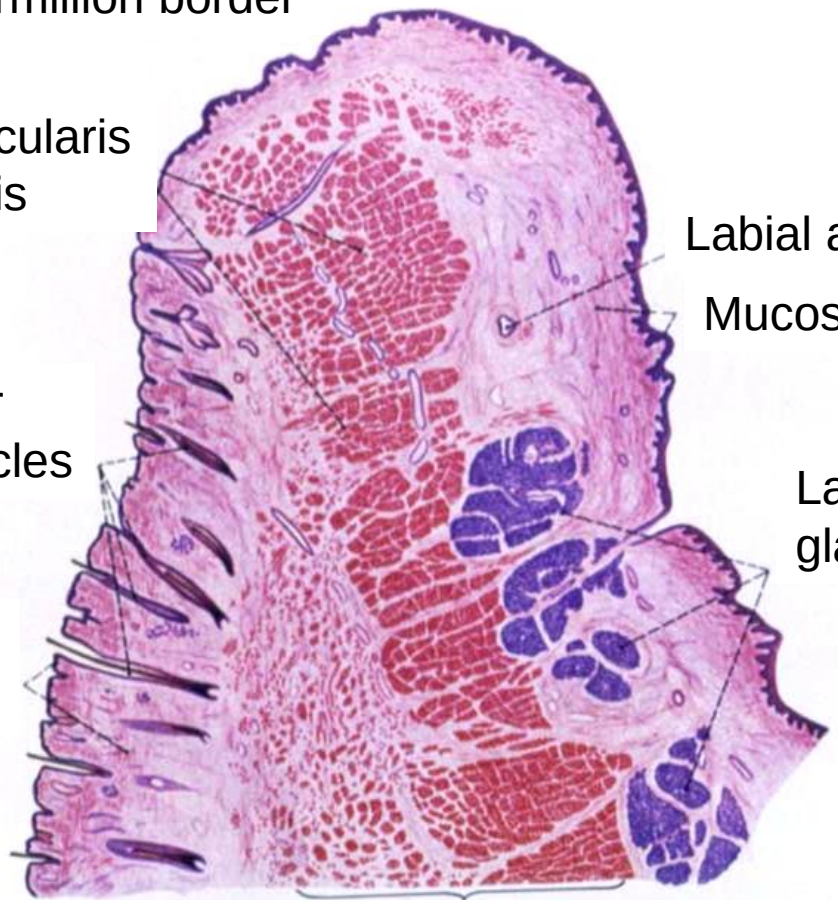


- **masticatory mucosa**
- parakeratinized epithelium
- directly on periost (mucoperiosteum)
- no submucosa



- **specialized mucosa**
- dorsum linguae – papillae

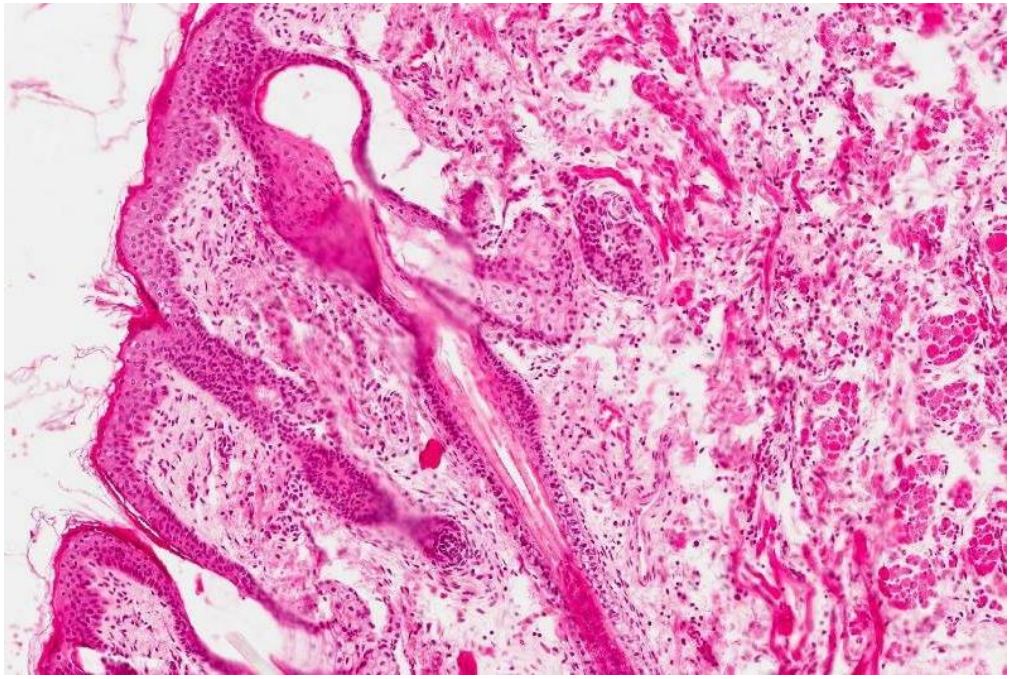
LIP


Vermillion border
M. orbicularis oris
Labial artery
Mucosa
Hair follicles
Labial glands
Labial skin
M. orbicularis oris


Dorsal
Ventral

LIP

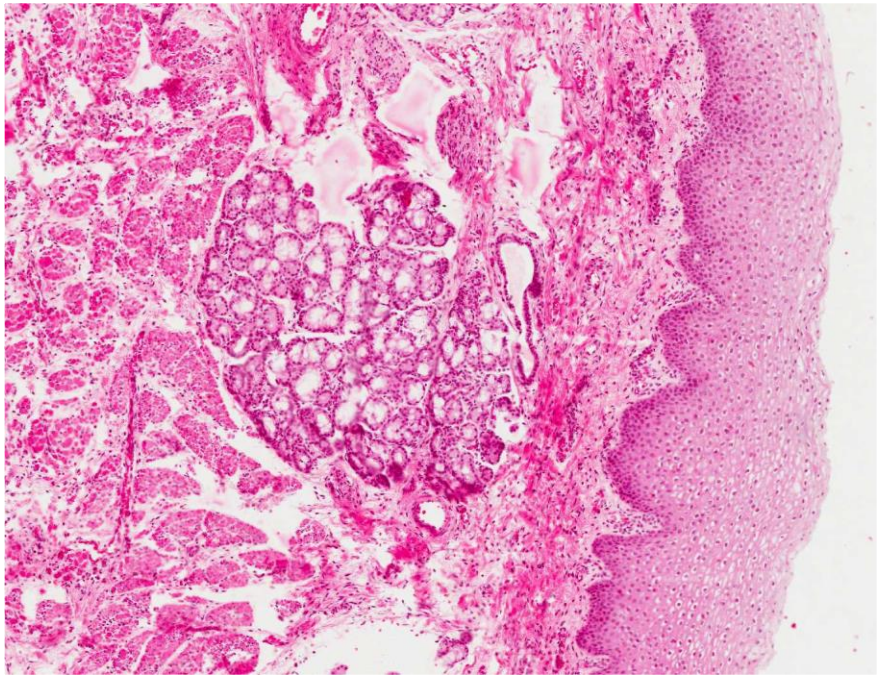
Skin side (ventral)



Epidermis
- Keratinized stratified squamous epithelium

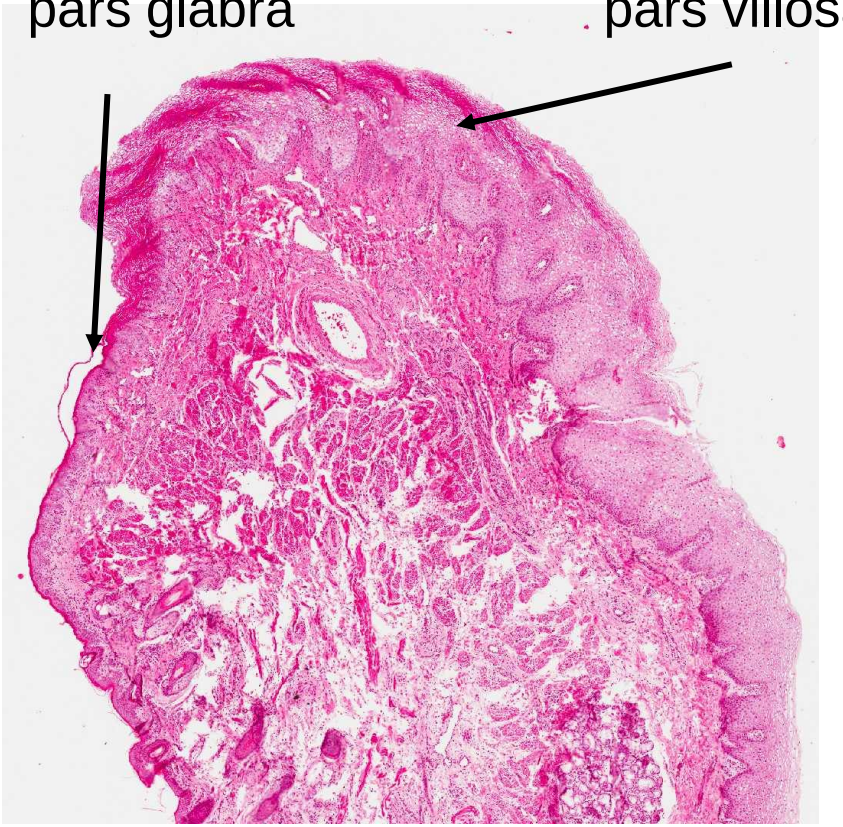
Dermis
- Loose collagen C.T.
- Hair follicles
- Sebaceous glands
- Sweat glands

Oral side (dorsal)



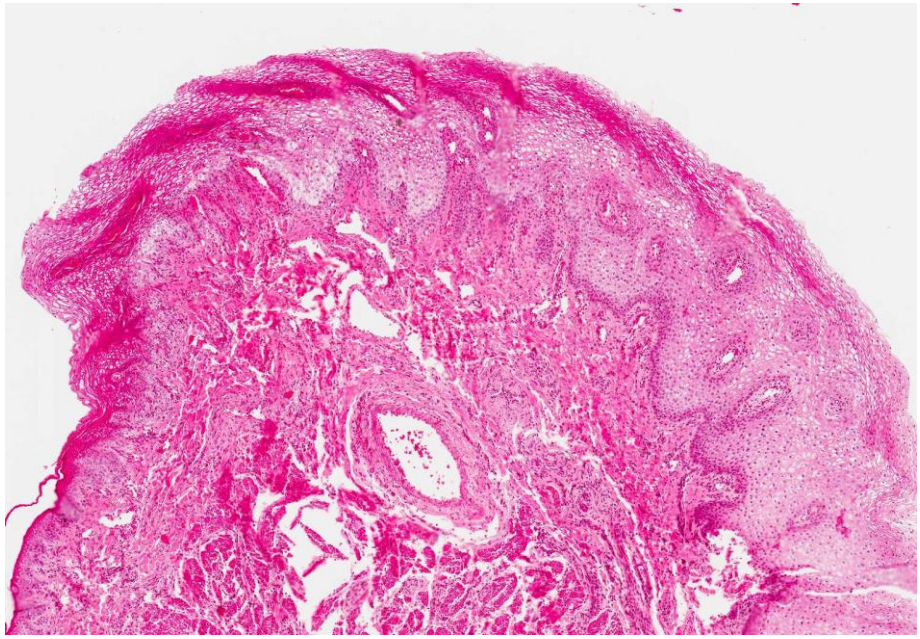
Oral mucosa
- Stratified squamous epithelium
- Loose collagen C.T.
- Small salivary labial mixed glands

LIP



newborns

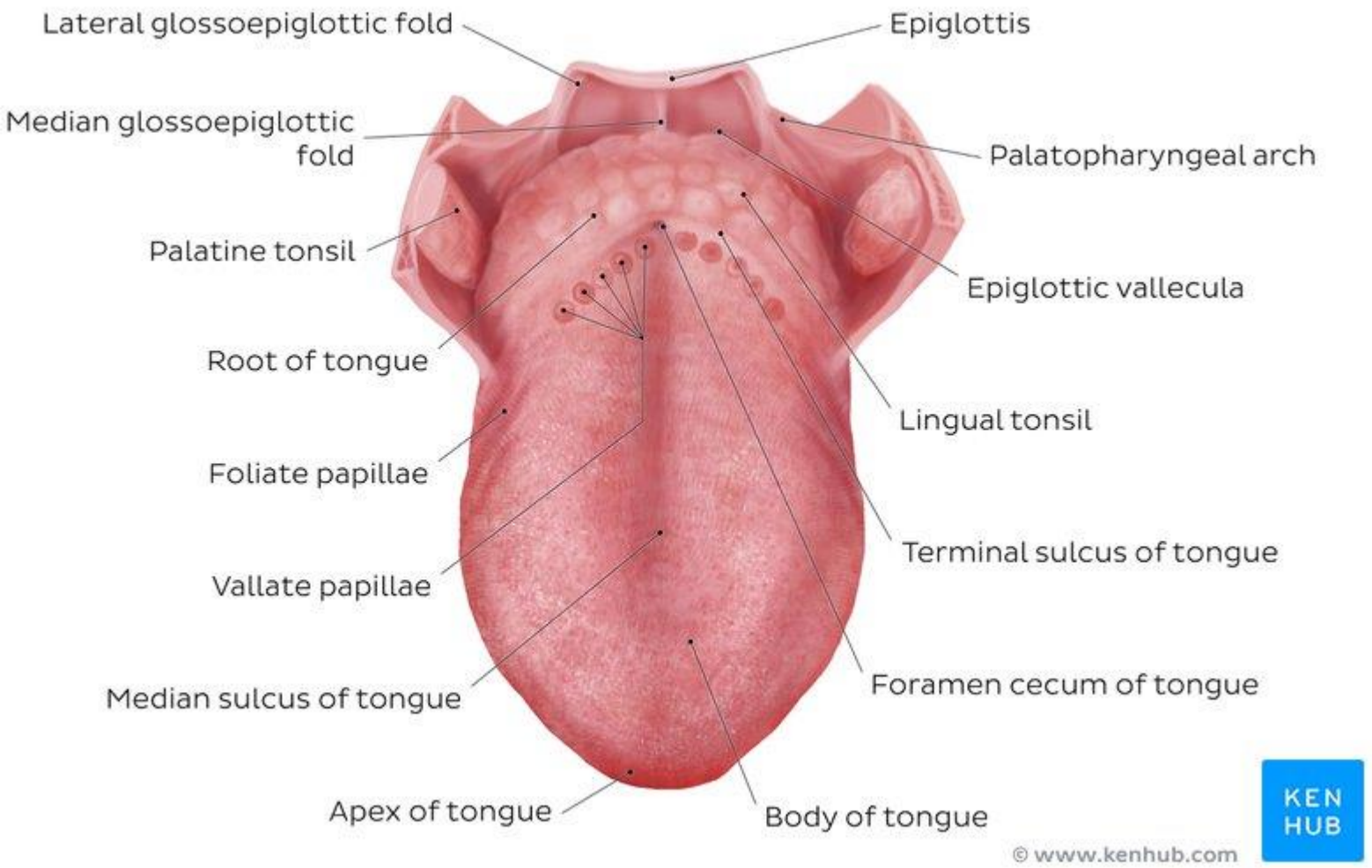
torus labialis



<u>Vermillion border</u>

- Eleidin protein
- salivary glands hair follicles, sweat glands absent
- high c.t. papillae, capillaries
- nerve endings, Meissner’s corpuscles

TONGUE


Lateral glossoepiglottic fold
Epiglottis
Median glossoepiglottic fold
Palatopharyngeal arch
Palatine tonsil
Epiglottic vallecula
Root of tongue
Lingual tonsil
Foliate papillae
Terminal sulcus of tongue
Vallate papillae
Median sulcus of tongue
Foramen cecum of tongue
Apex of tongue
Body of tongue
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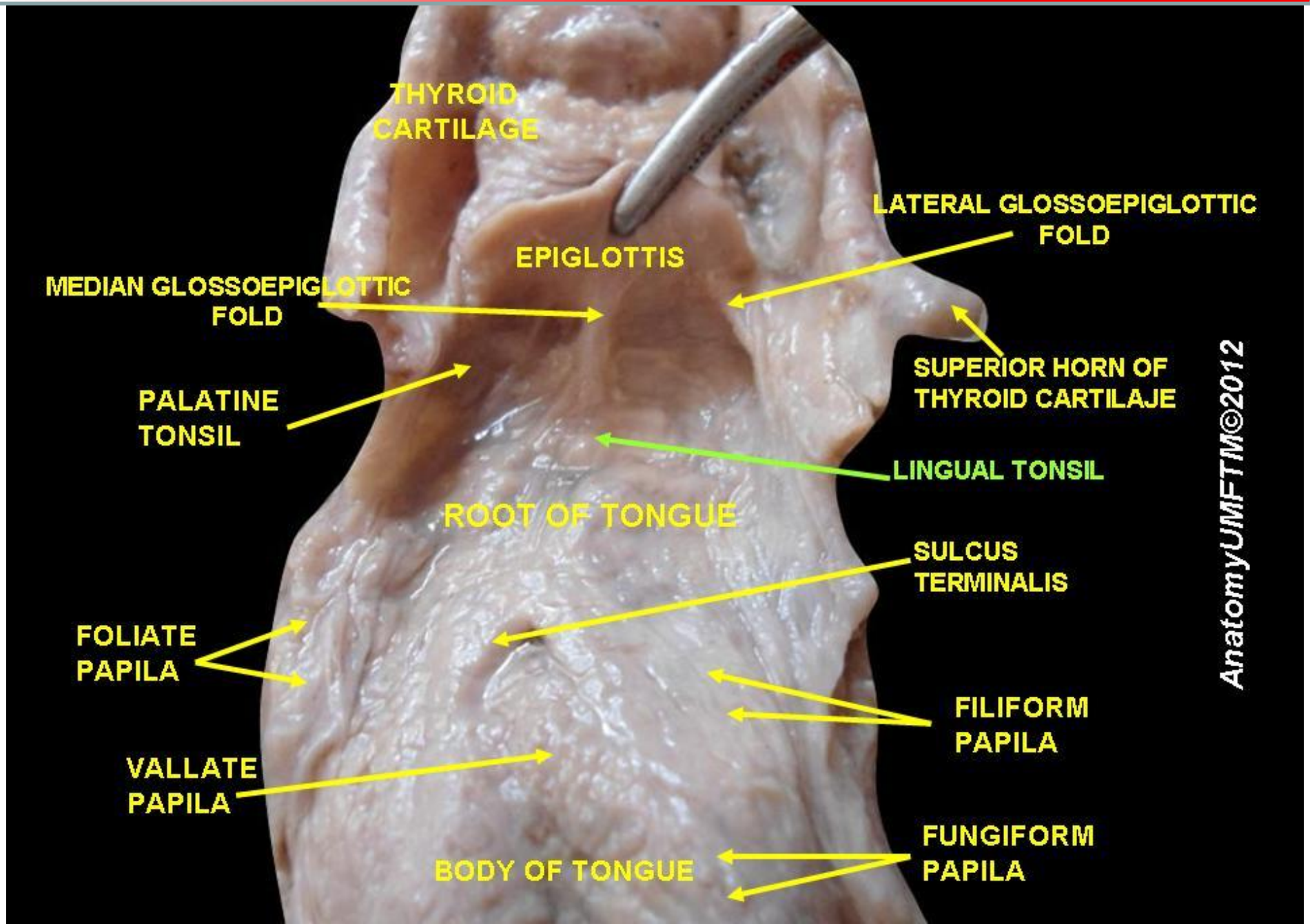
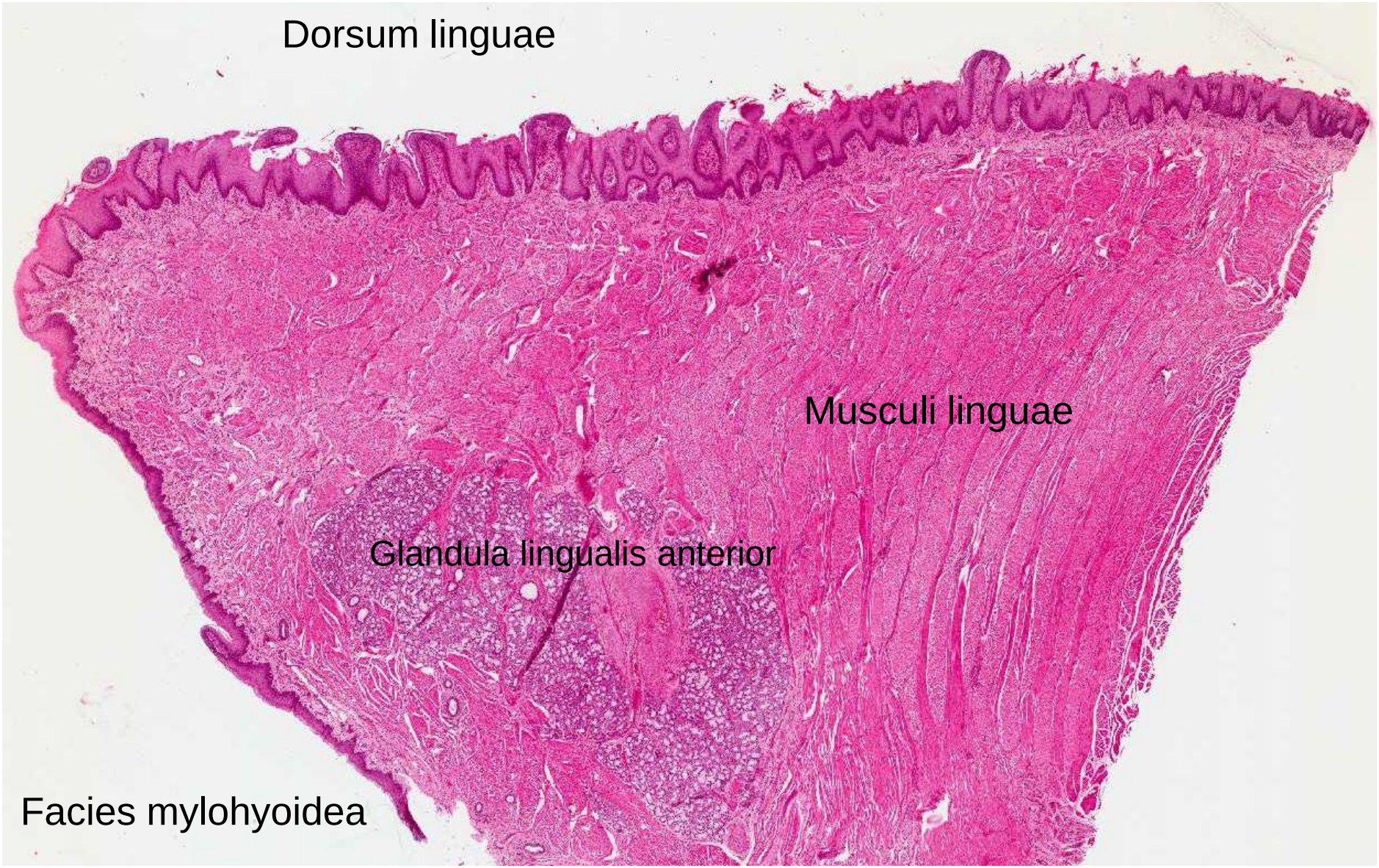
TONGUE

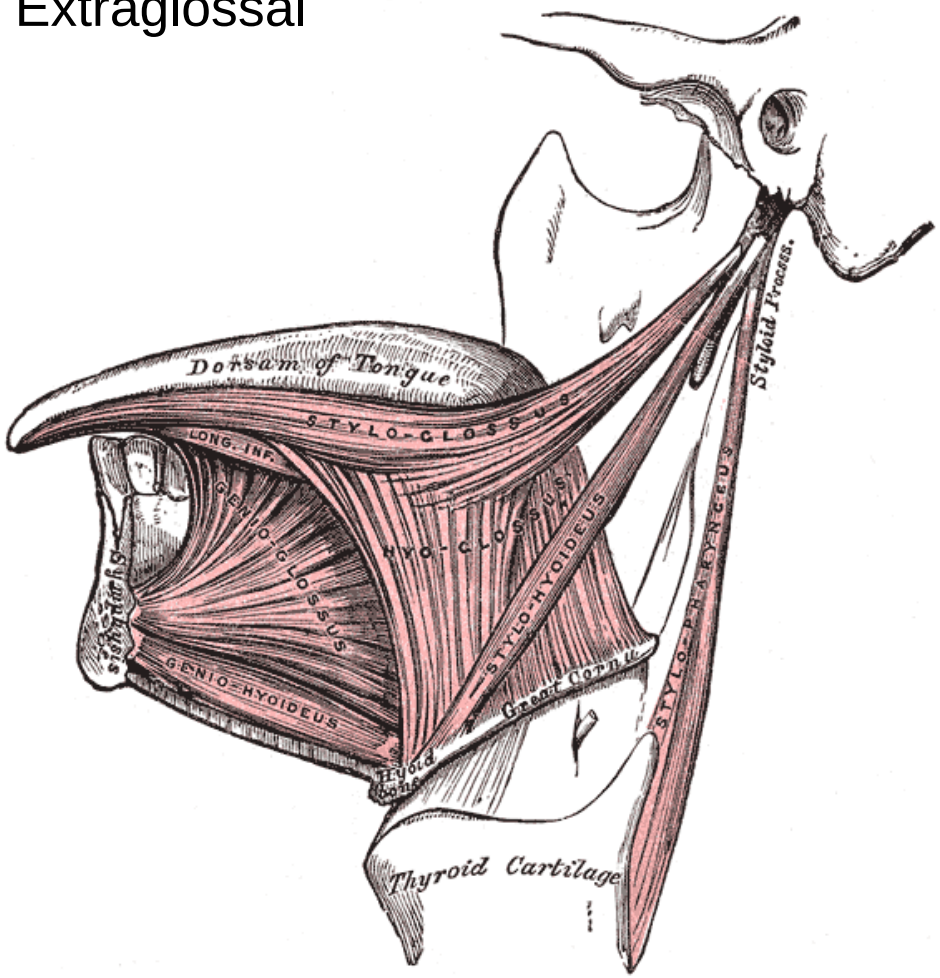

THYROID CARTILAGE
LATERAL GLOSSOEPIGLOTTIC FOLD
EPIGLOTTIS
MEDIAN GLOSSOEPIGLOTTIC FOLD
SUPERIOR HORN OF THYROID CARTILAJE
PALATINE TONSIL
LINGUAL TONSIL
ROOT OF TONGUE
SULCUS TERMINALIS
FOLIATE PAPILA
FILIFORM PAPILA
VALLATE PAPILA
FUNGIFORM PAPILA
BODY OF TONGUE
AnatomyUMFTM©2012

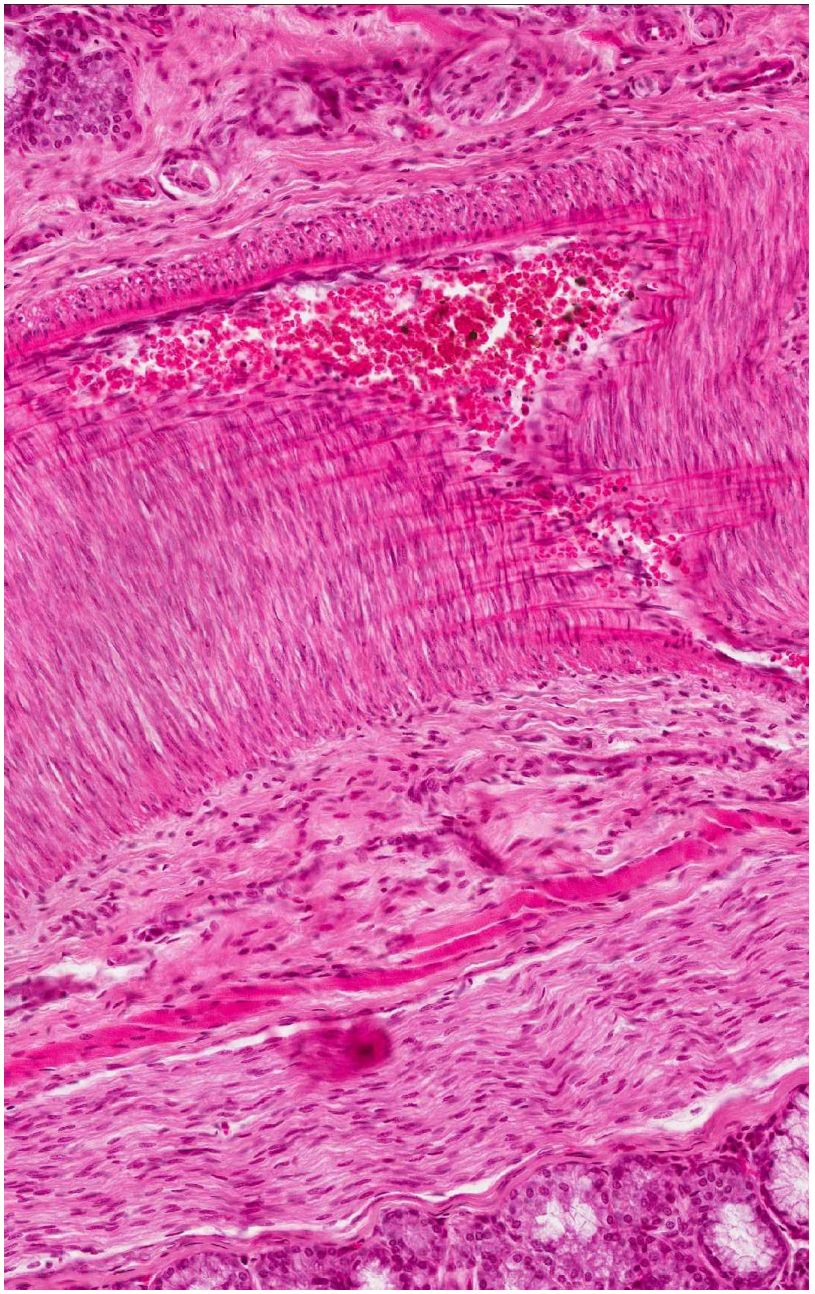
TONGUE – APEX LINGUAE



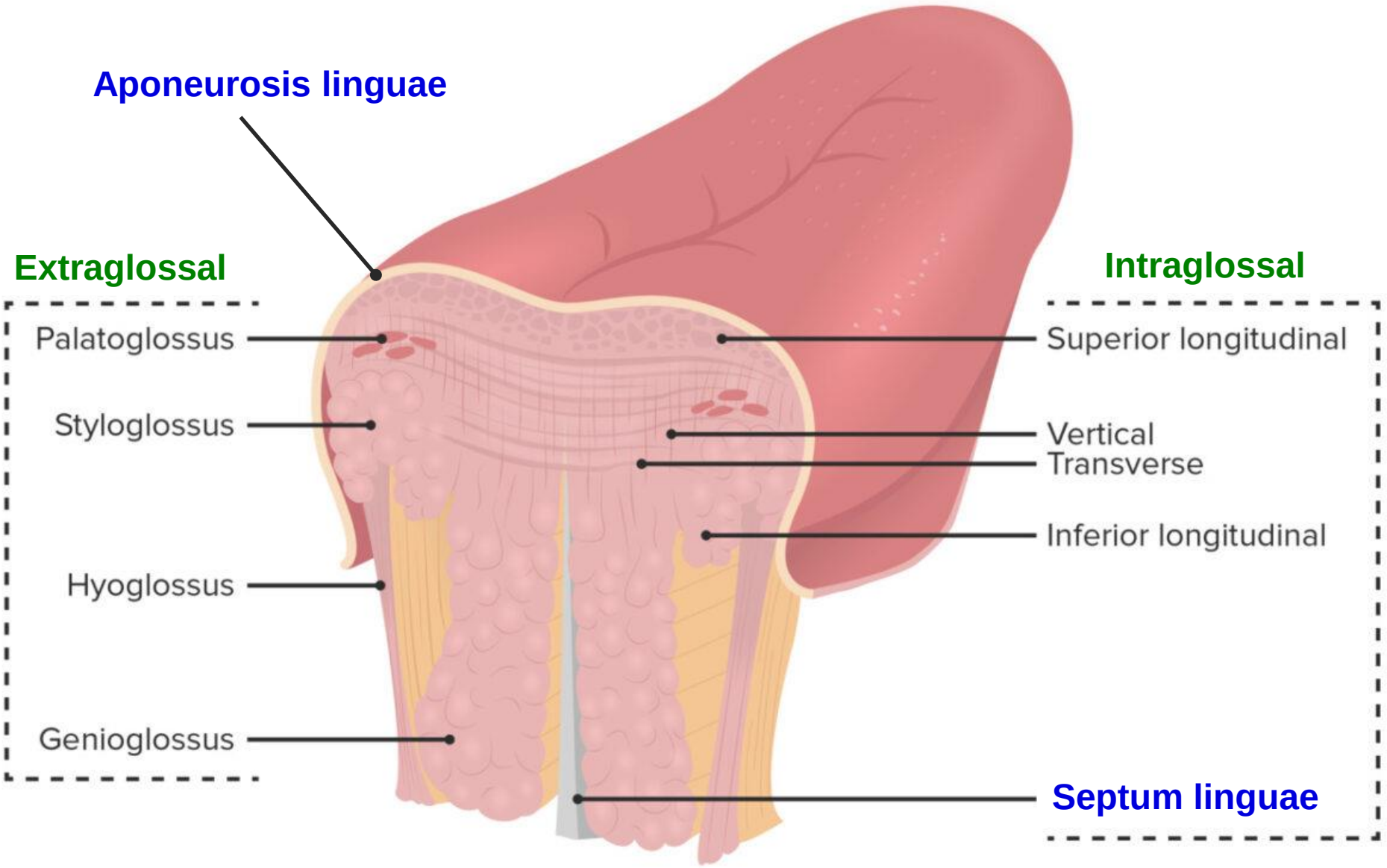
TONGUE – MUSCLES

- Intraglossal
- Extraglossal

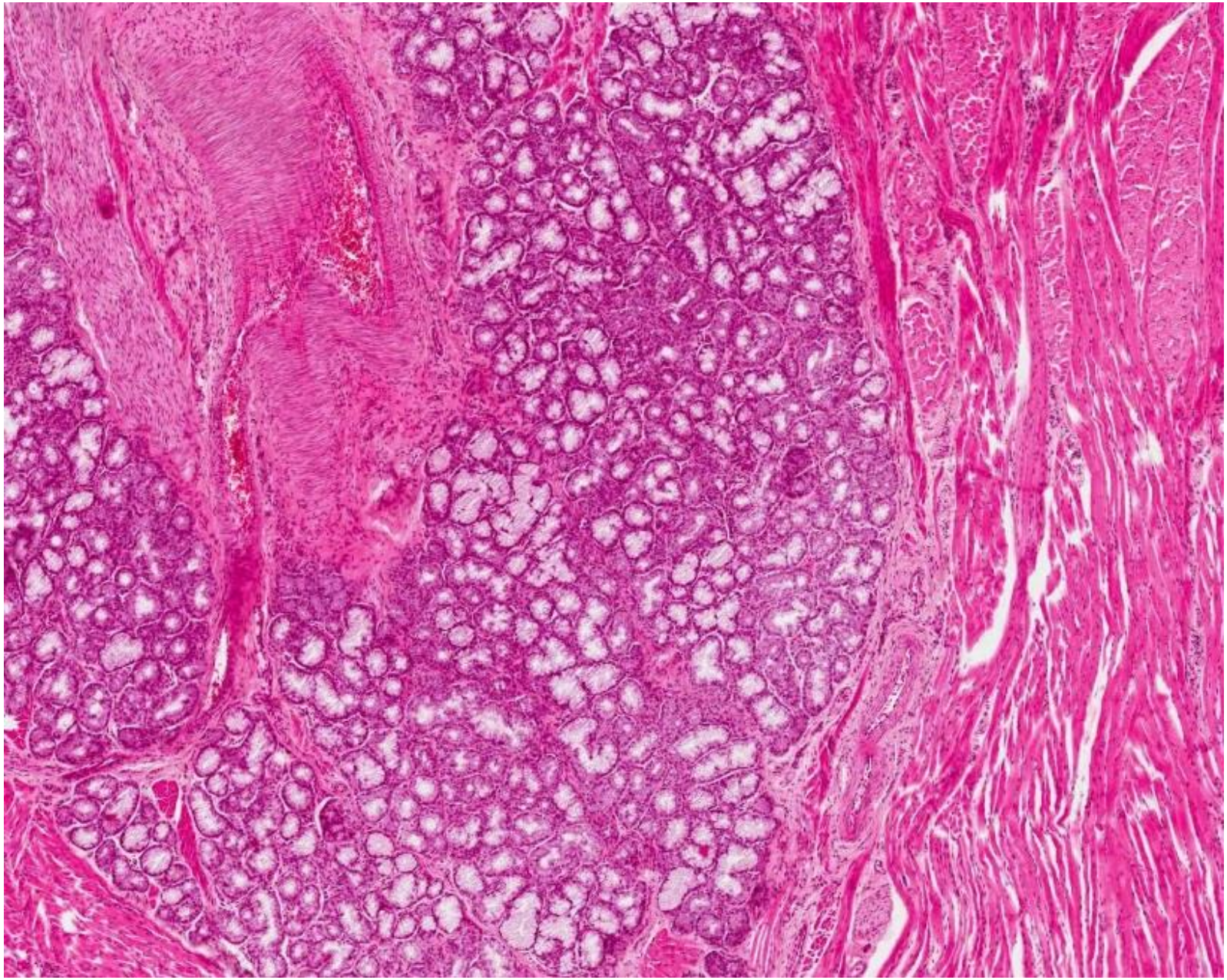




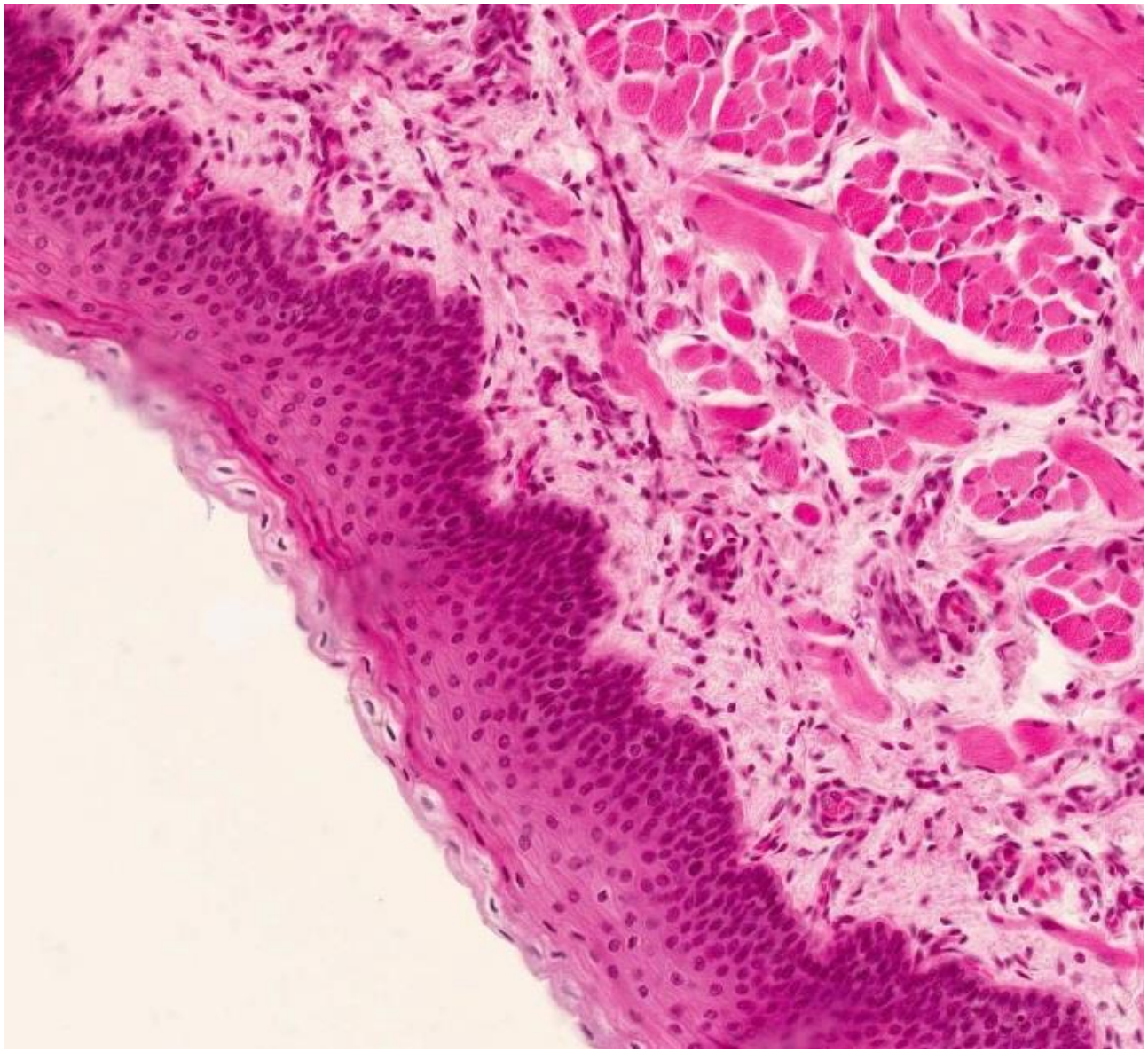
TONGUE – MUSCLES



TONGUE – GLL. LINGUALES ANTERIORES (BLANDINI)

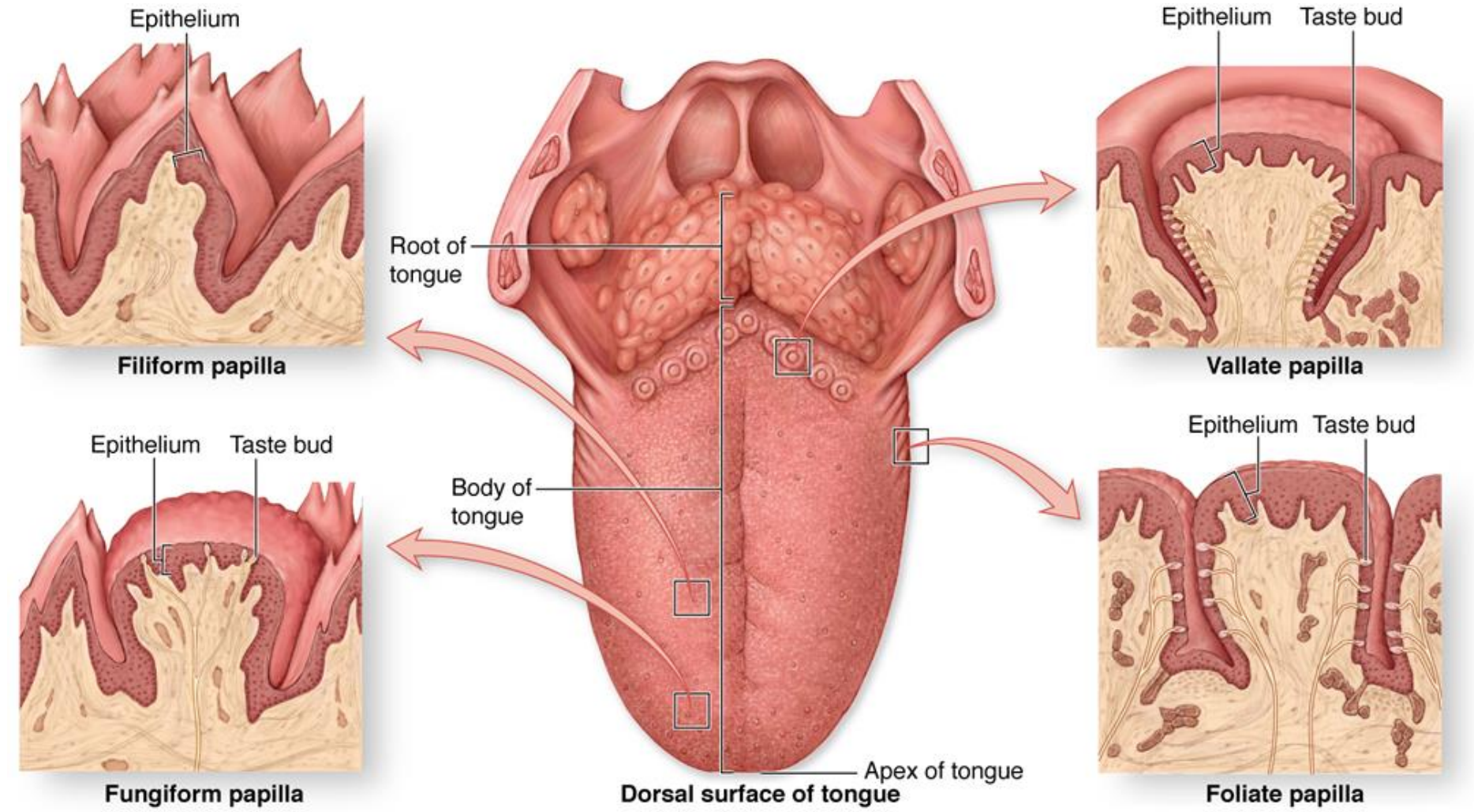


TONGUE – FACIES MYLOHYOIDEA

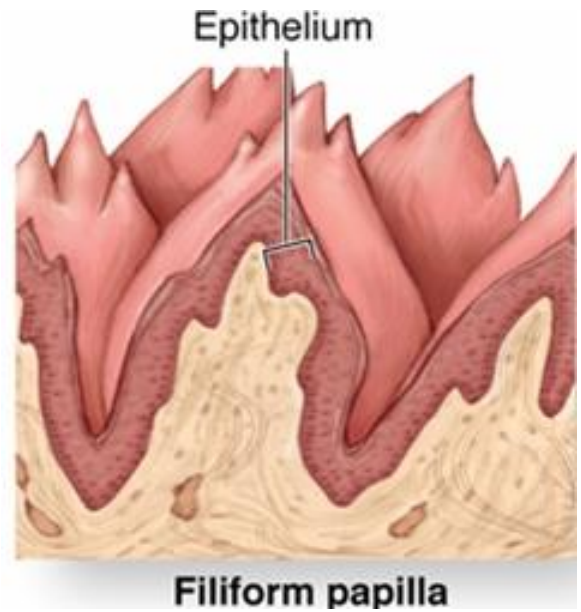


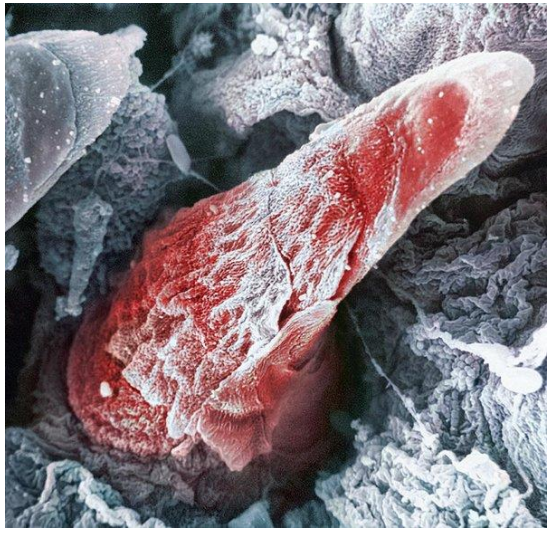
TONGUE – DORSUM LINGUAE

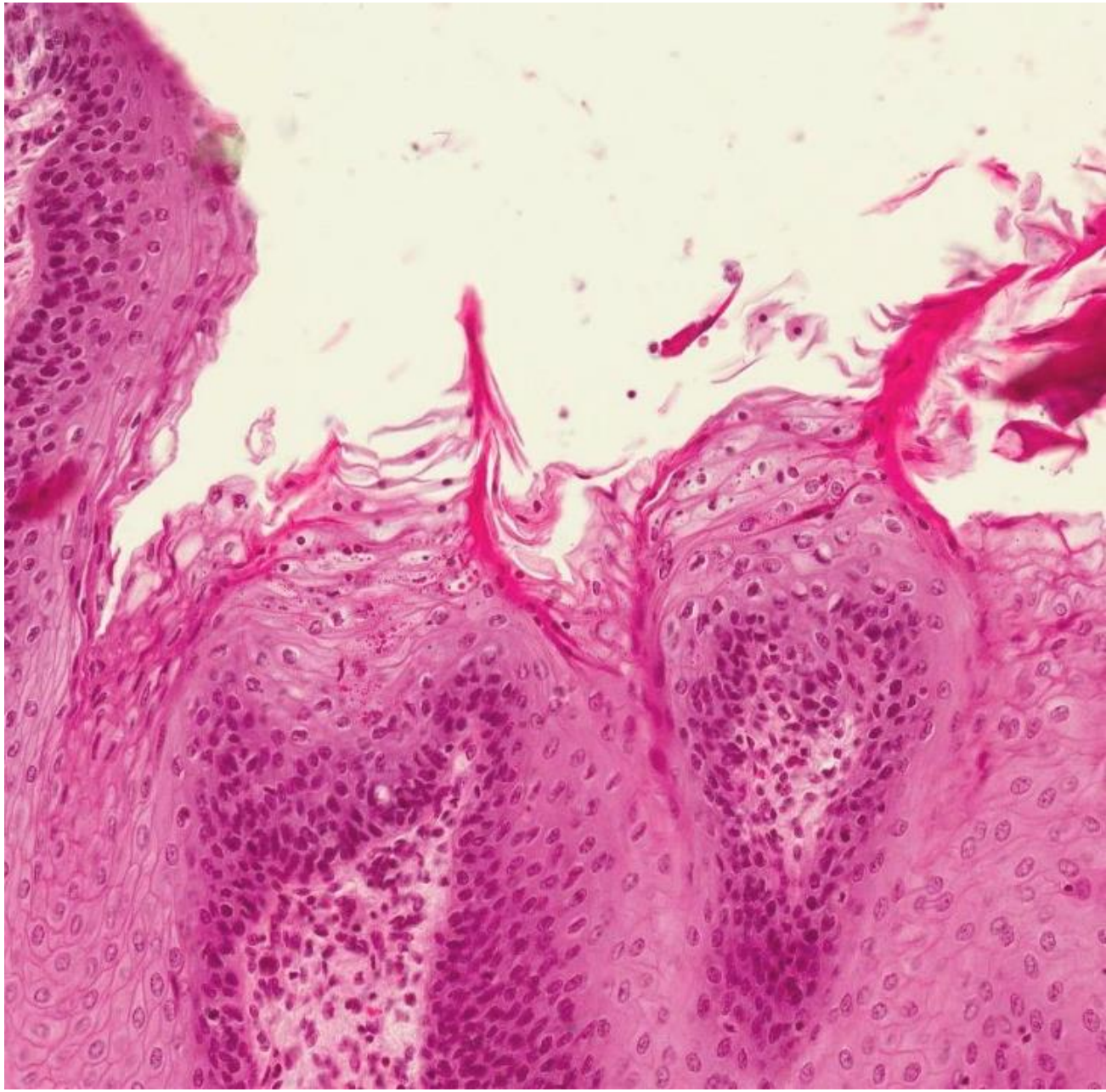
- specialized mucosal structures - **papillae**
- submucosal C.T. is absent



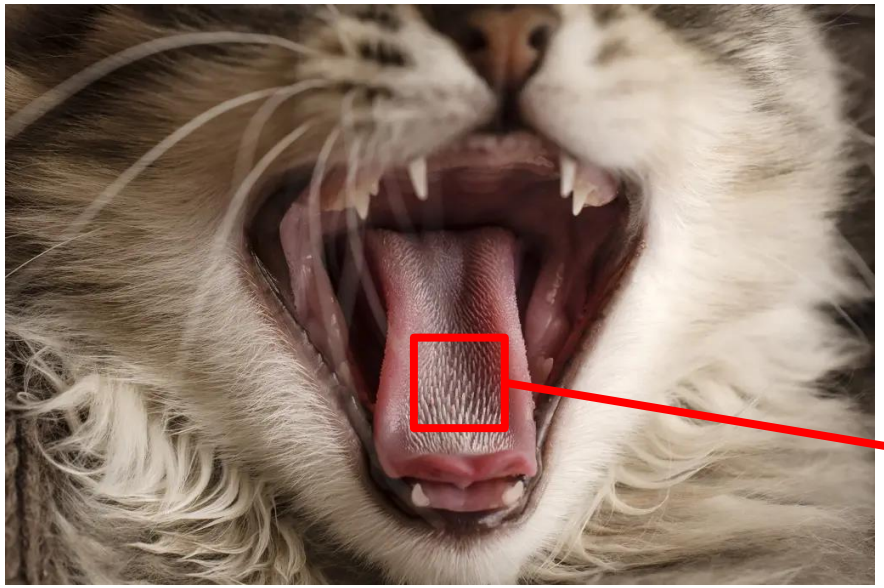
TONGUE – FILLIFORM PAPILLAE

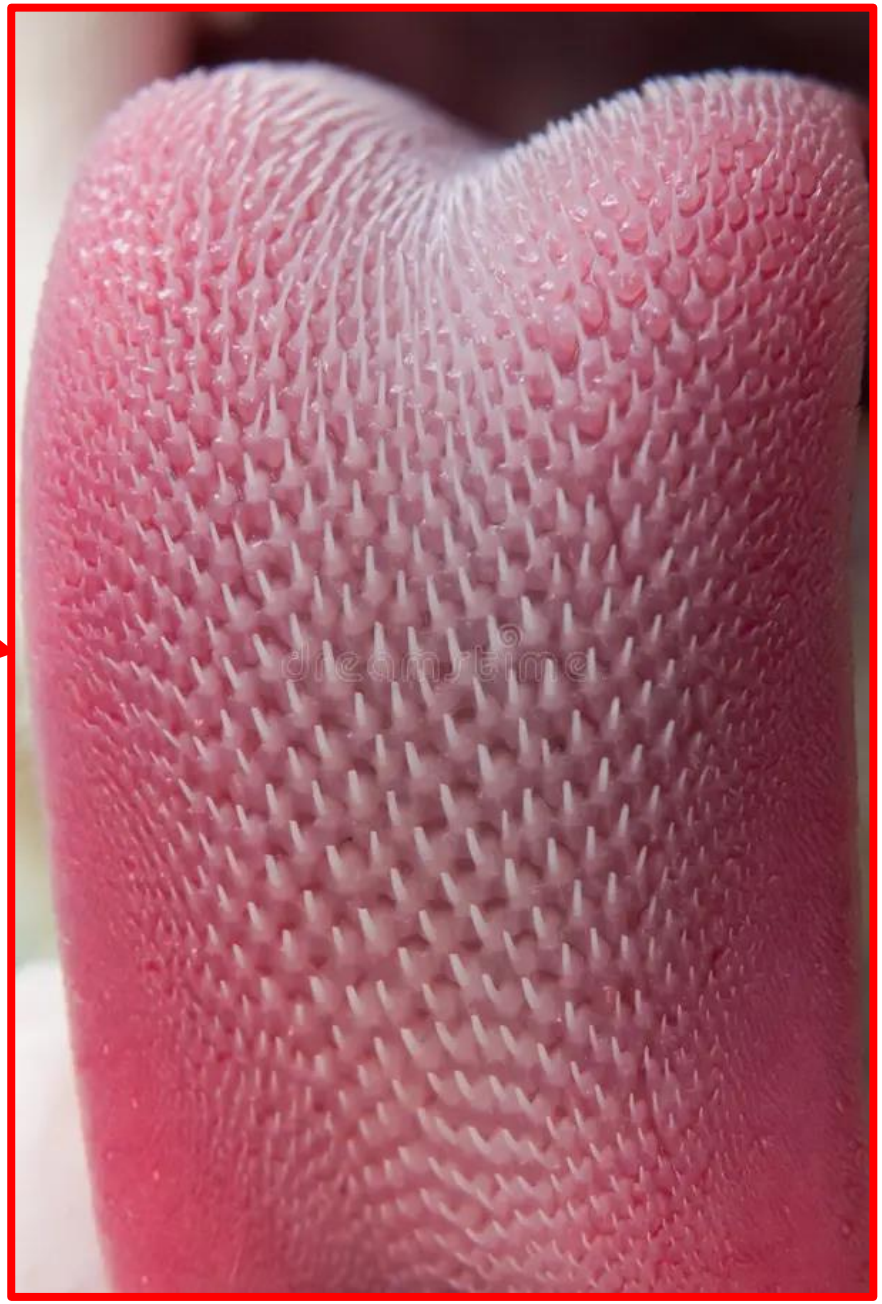




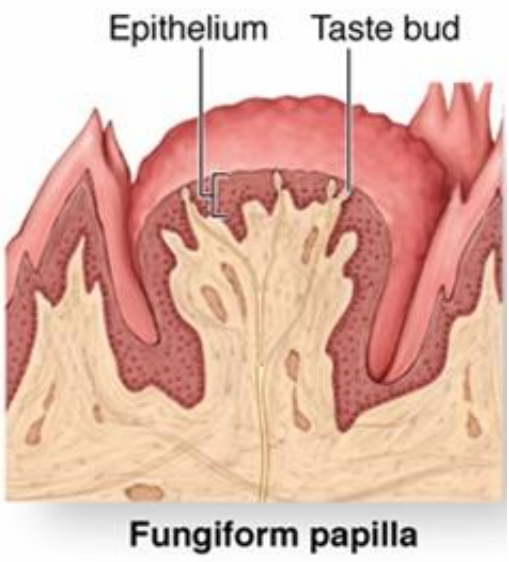


TONGUE – FILLIFORM PAPILLAE

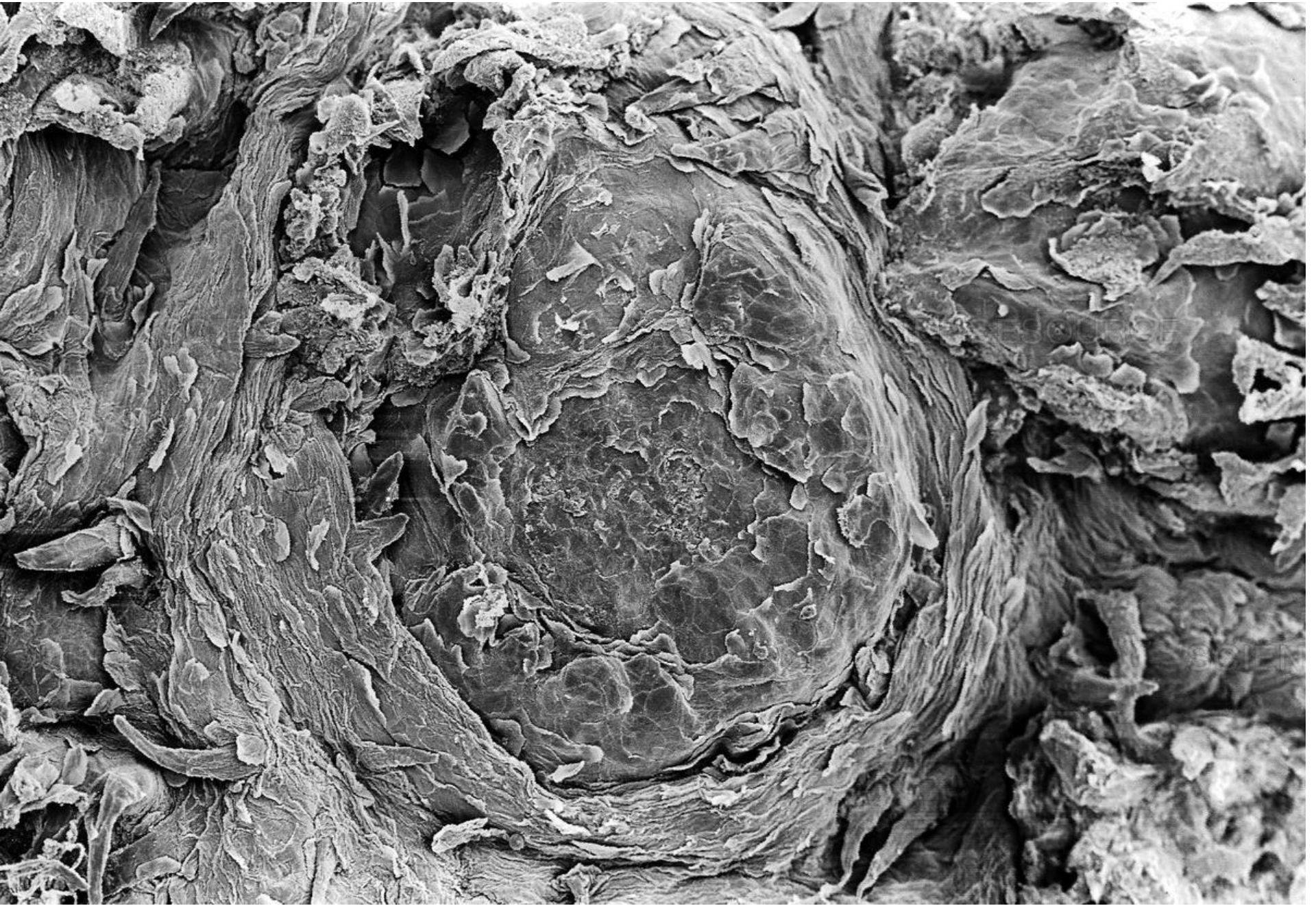




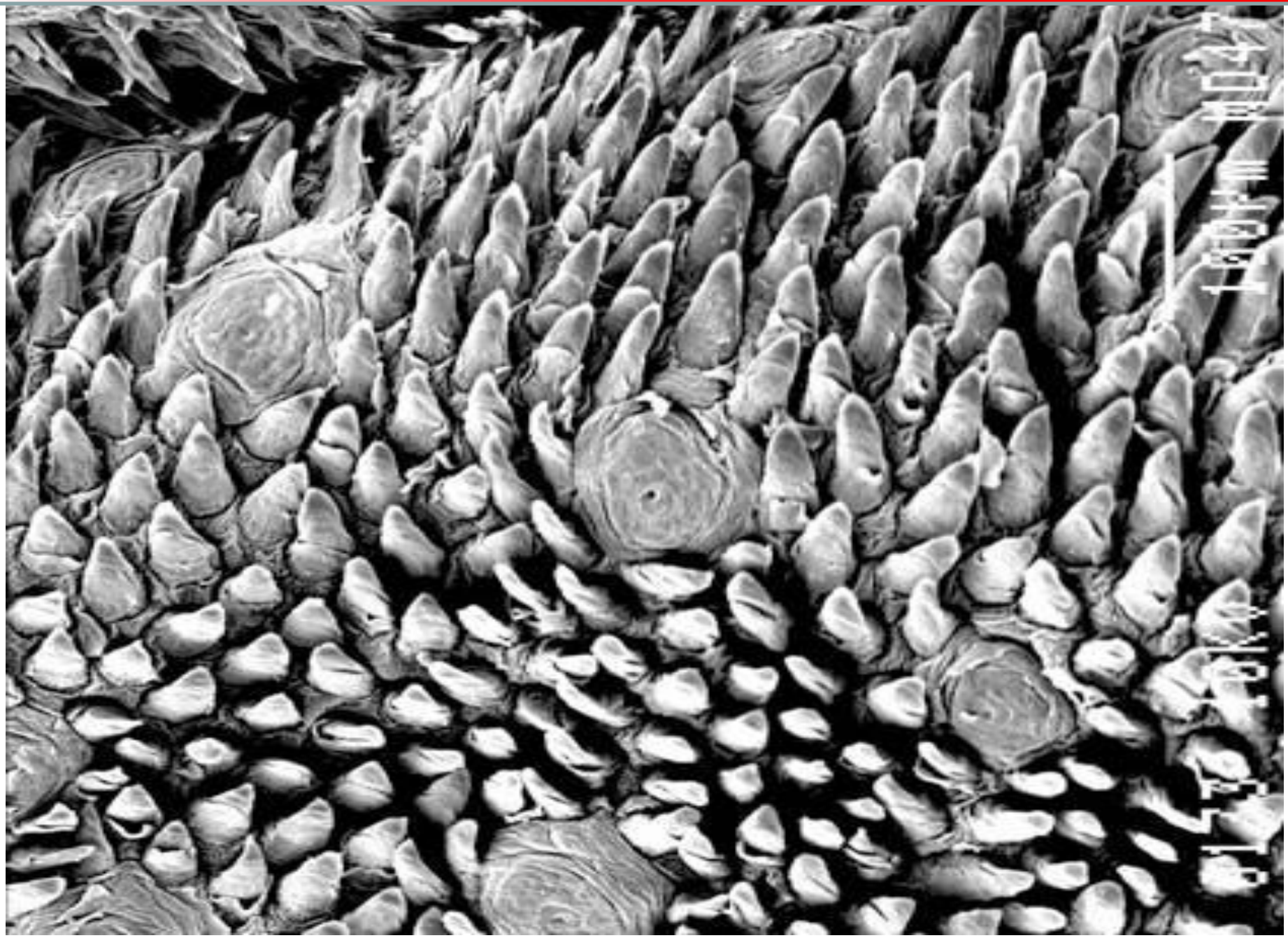
TONGUE – FUNGIFORM PAPILLAE



TONGUE – FUNGIFORM PAPILLAE

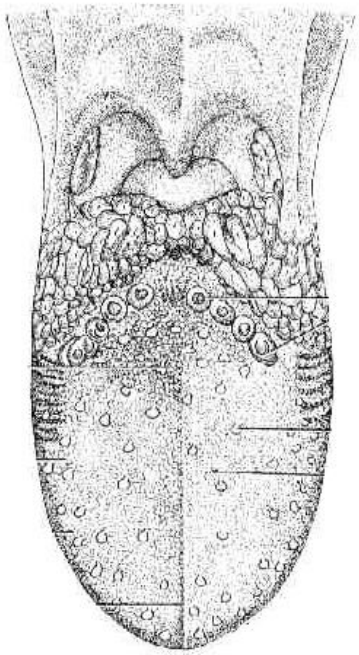


TONGUE – FILLIFORM AND FUNGIFORM PAPILLAE

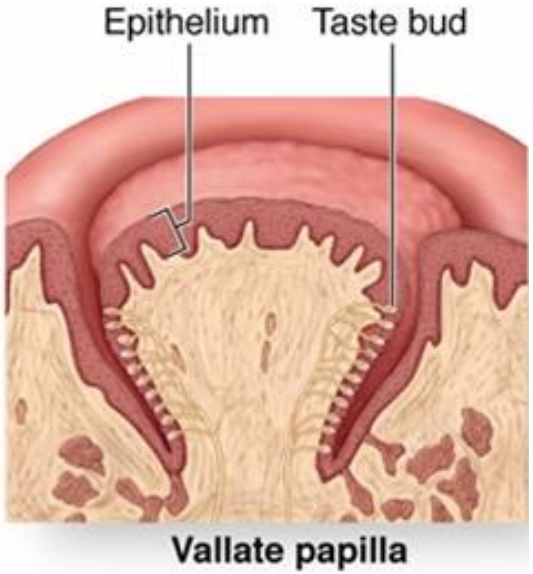


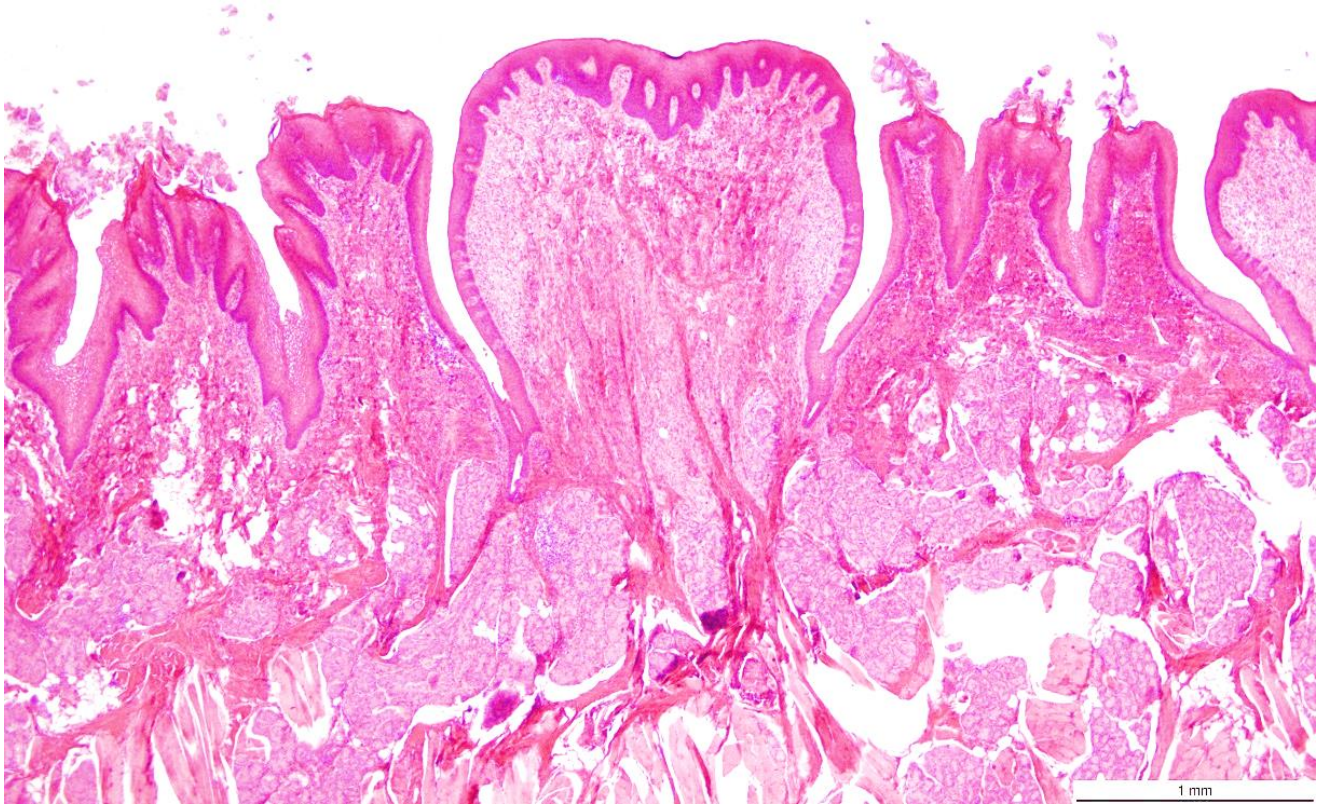
TONGUE – FOLIATE PAPILLAE

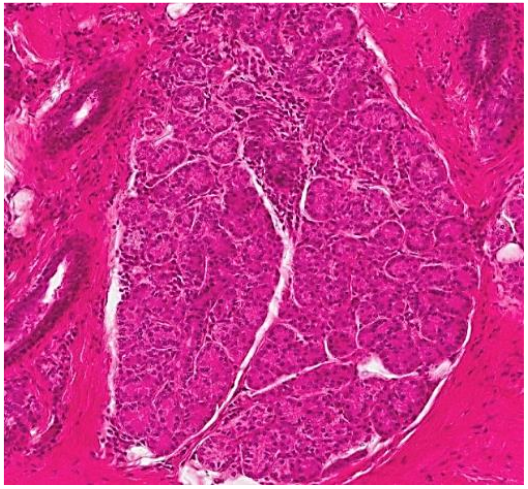
Foliate papilla



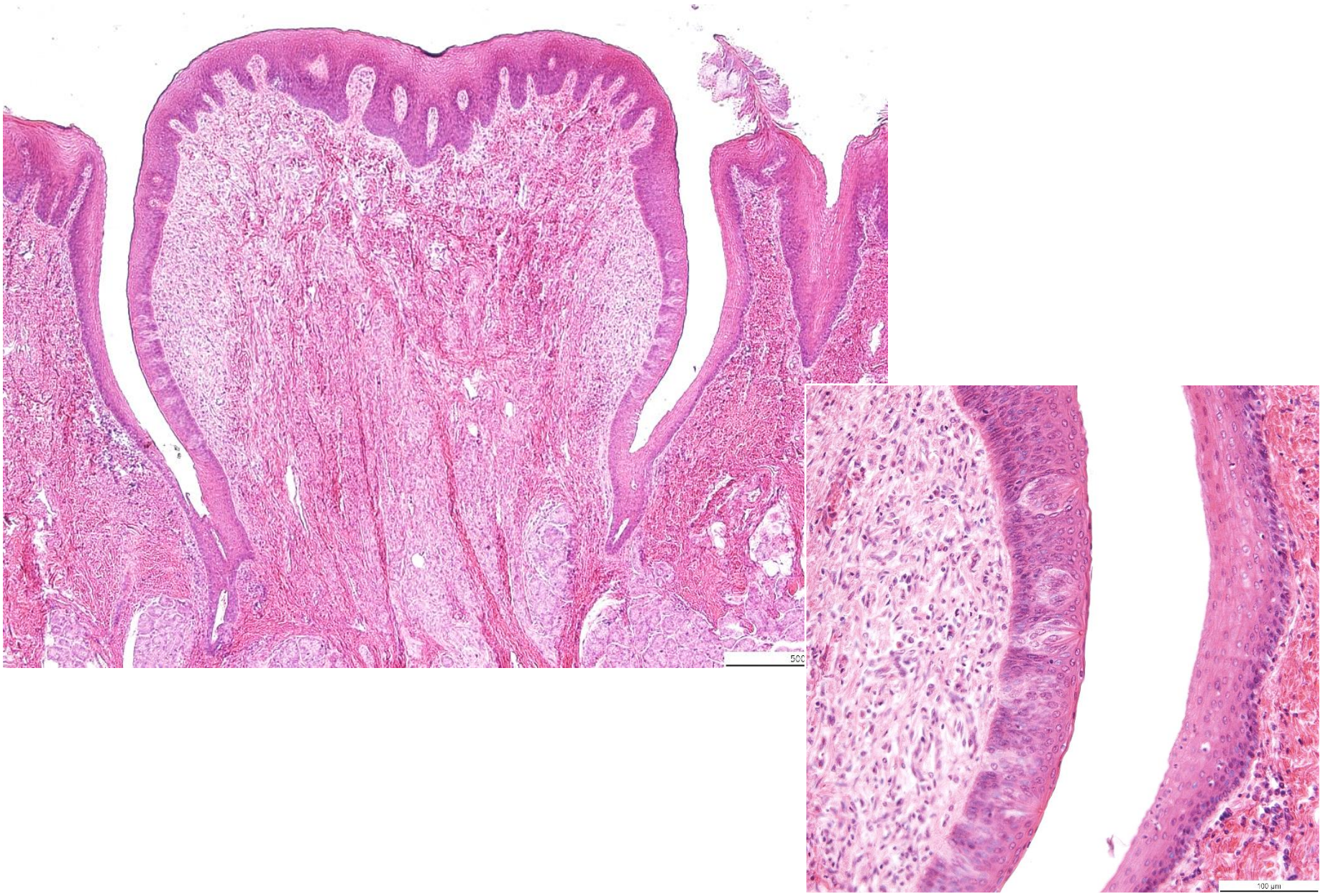
TONGUE – VALLATE PAPILLAE



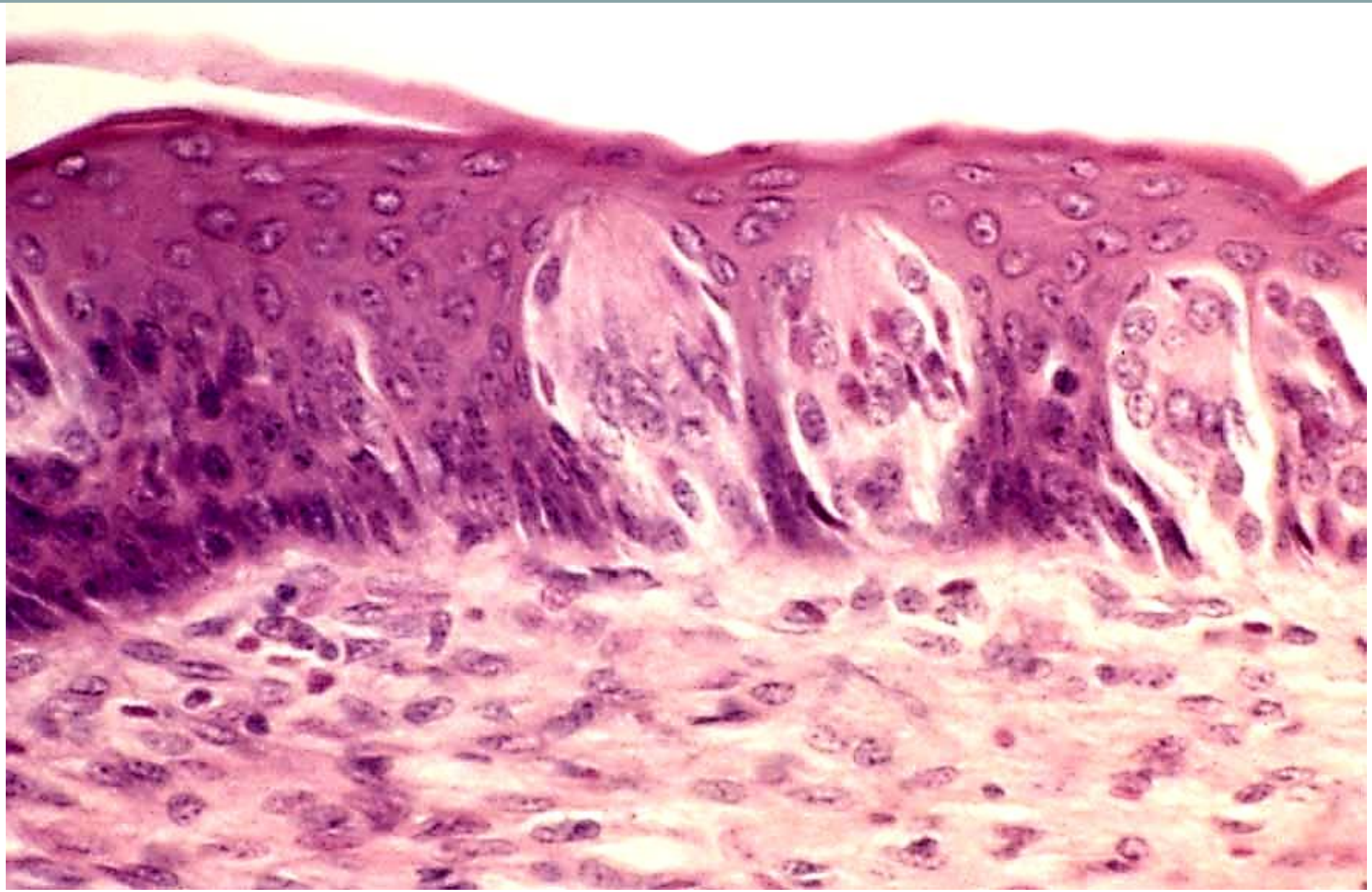




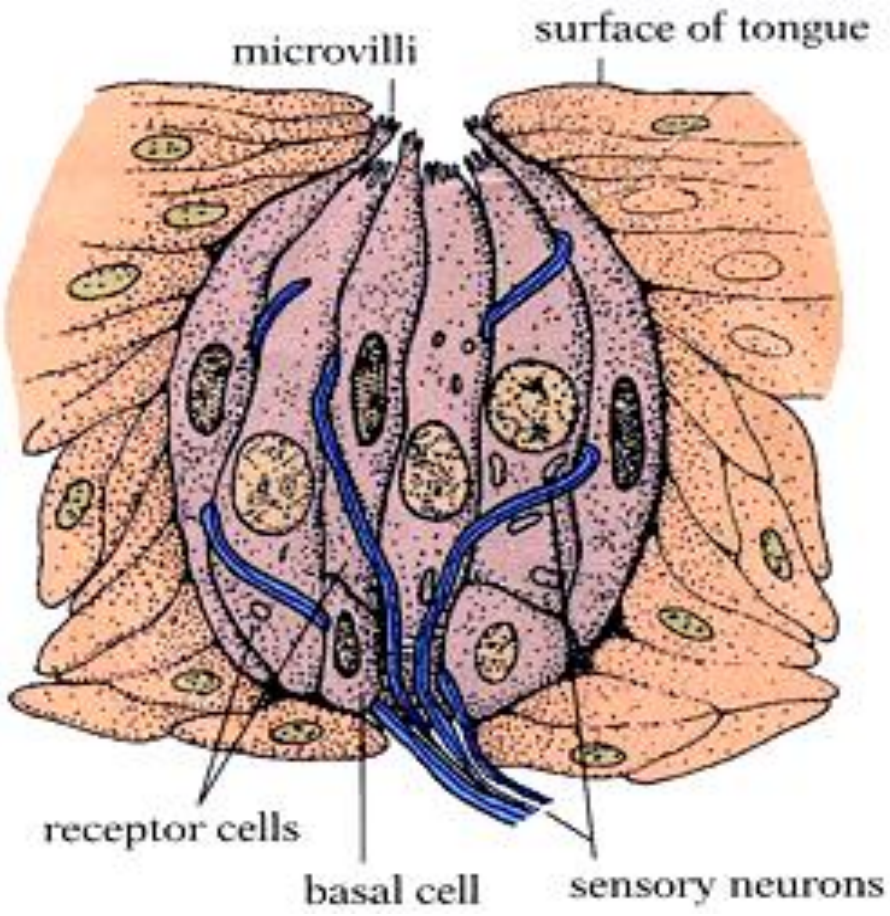
TONGUE – VALLATE PAPILLAE



TONGUE – TASTE BUDS

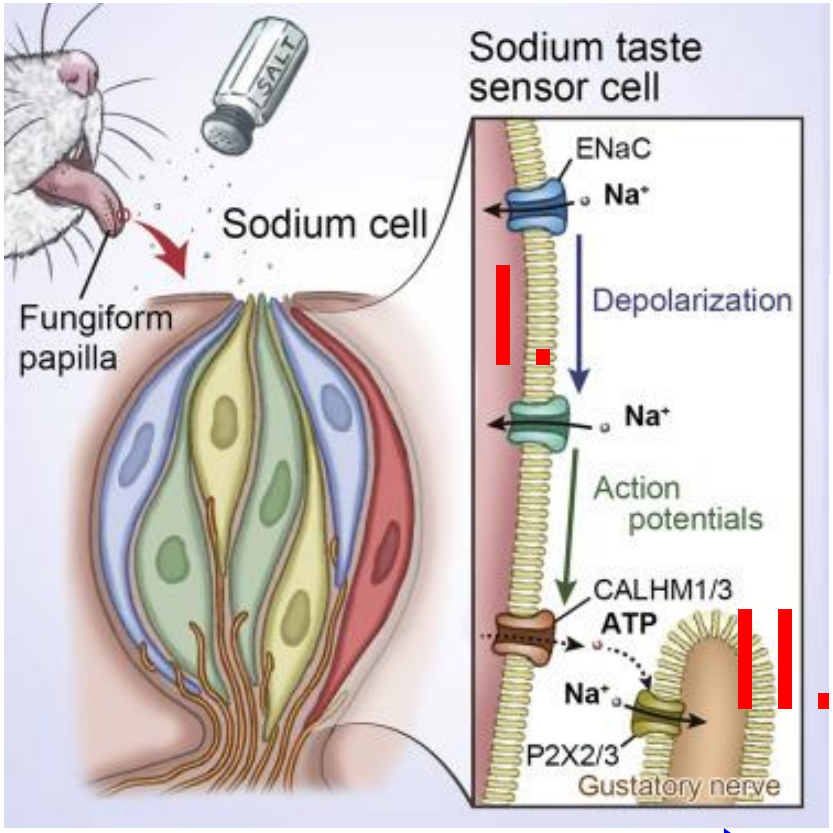


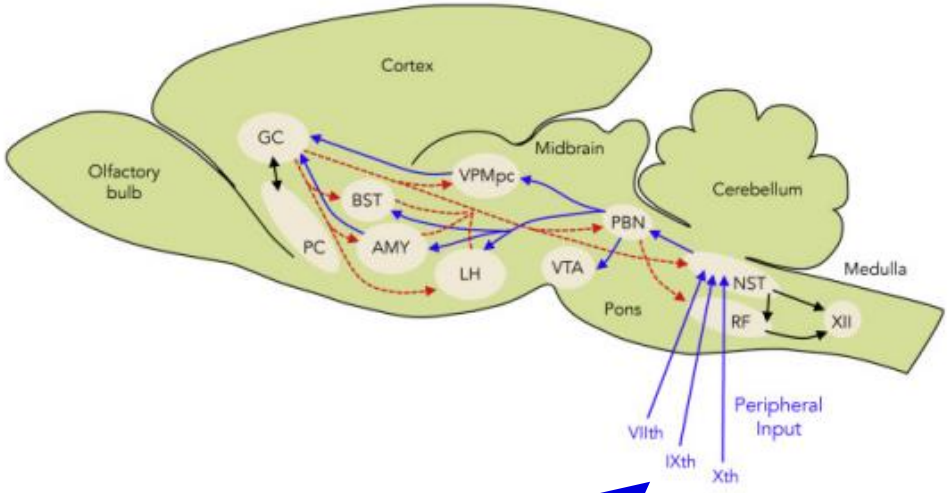
TONGUE – TASTE BUD



- Intraepithelial
- porus gustatorius
- 2000-8000 in oral cavity
- 60-80 cells
- 70-80 μm × 30-40 μm
- microvilli on sensory cells
- nerve fibers

TONGUE – TASTE BUD



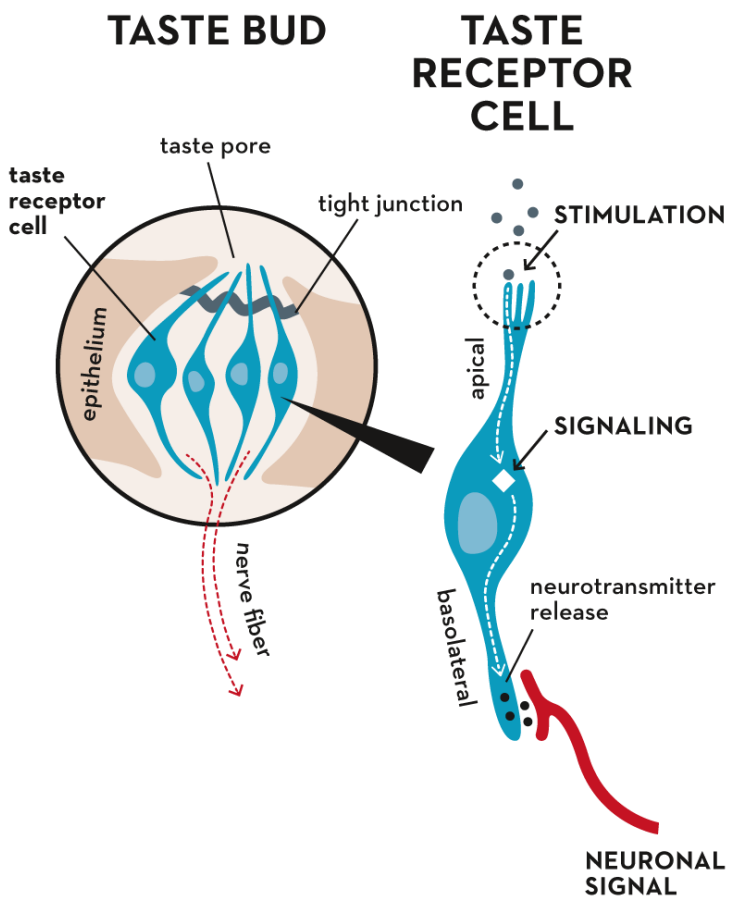


- secondary sensory epithelium

- n. vagus
- n. facialis
- n. glossopharyngeus

doi.org/10.1016/j.neuron.2020.03.006

TONGUE – TASTE BUD

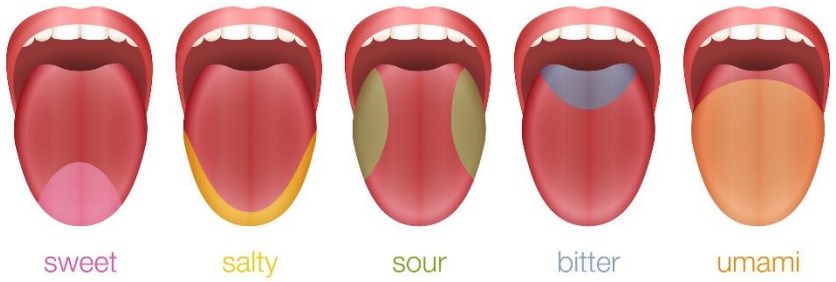


- bitter
- sweet
- umami (glutamate)
- G-protein-coupled receptors

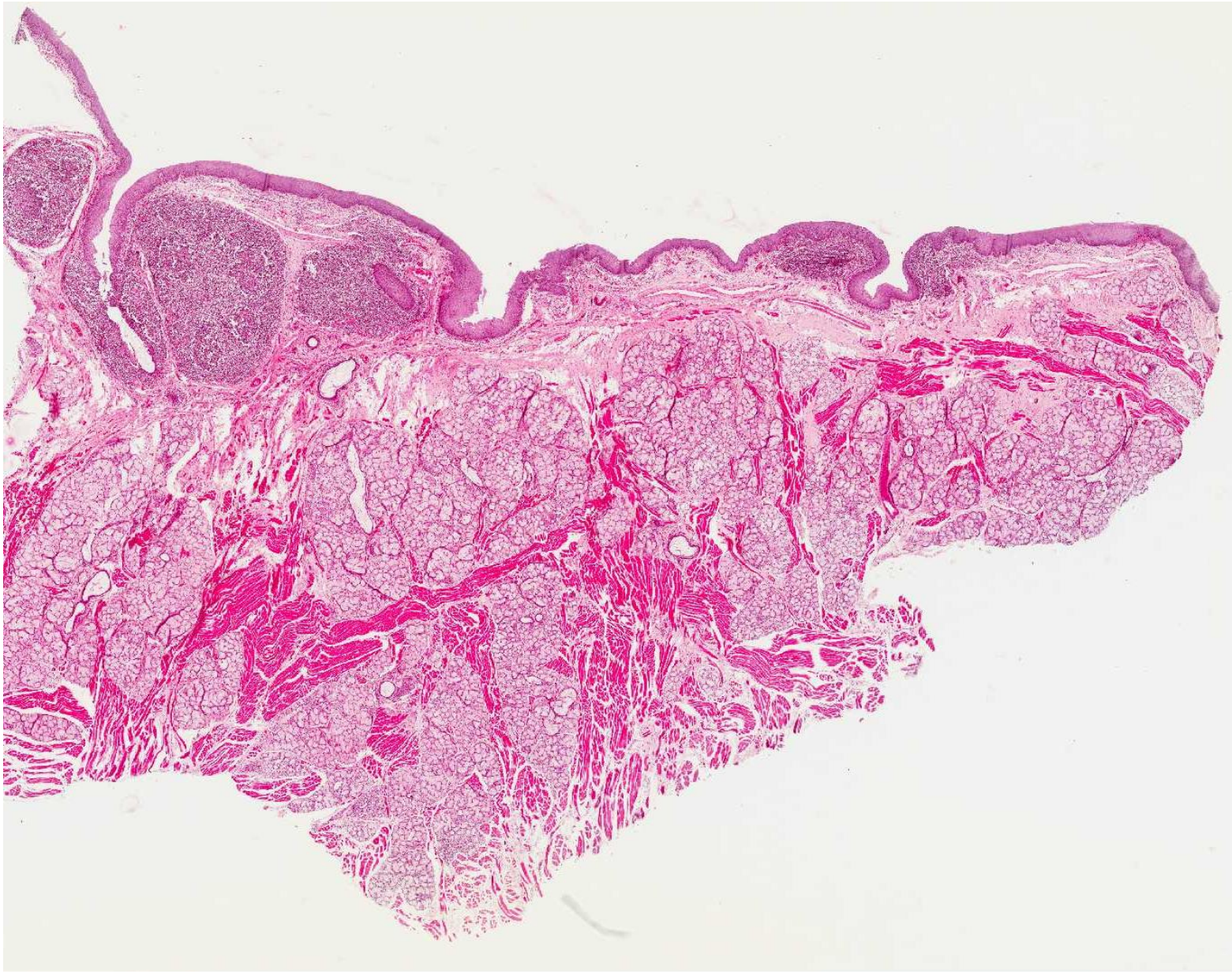
- salt
- acid
- ion channels

- CD36
- fatty acid transporter

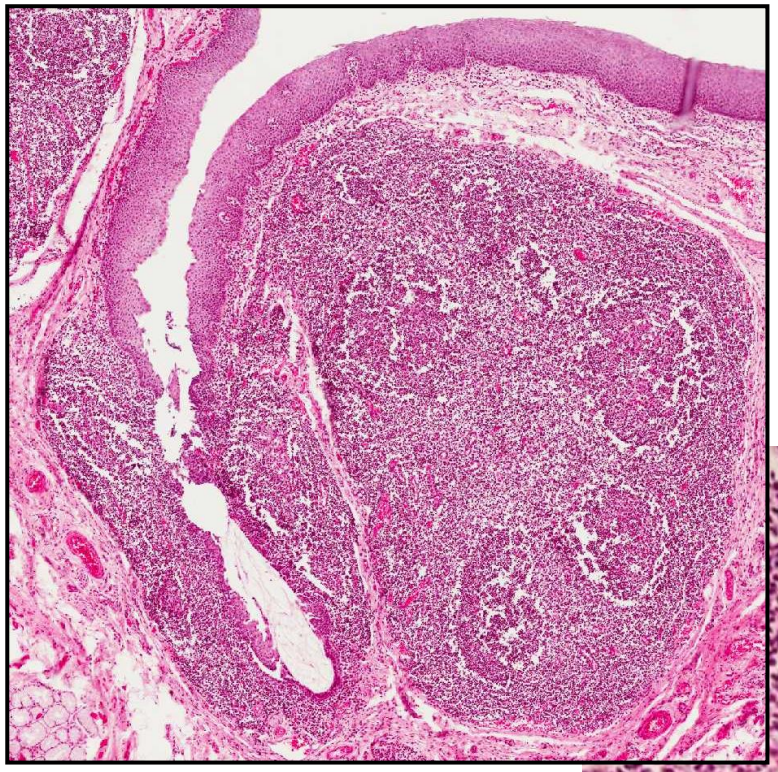
- in taste sensing olfactory epithelium is involved

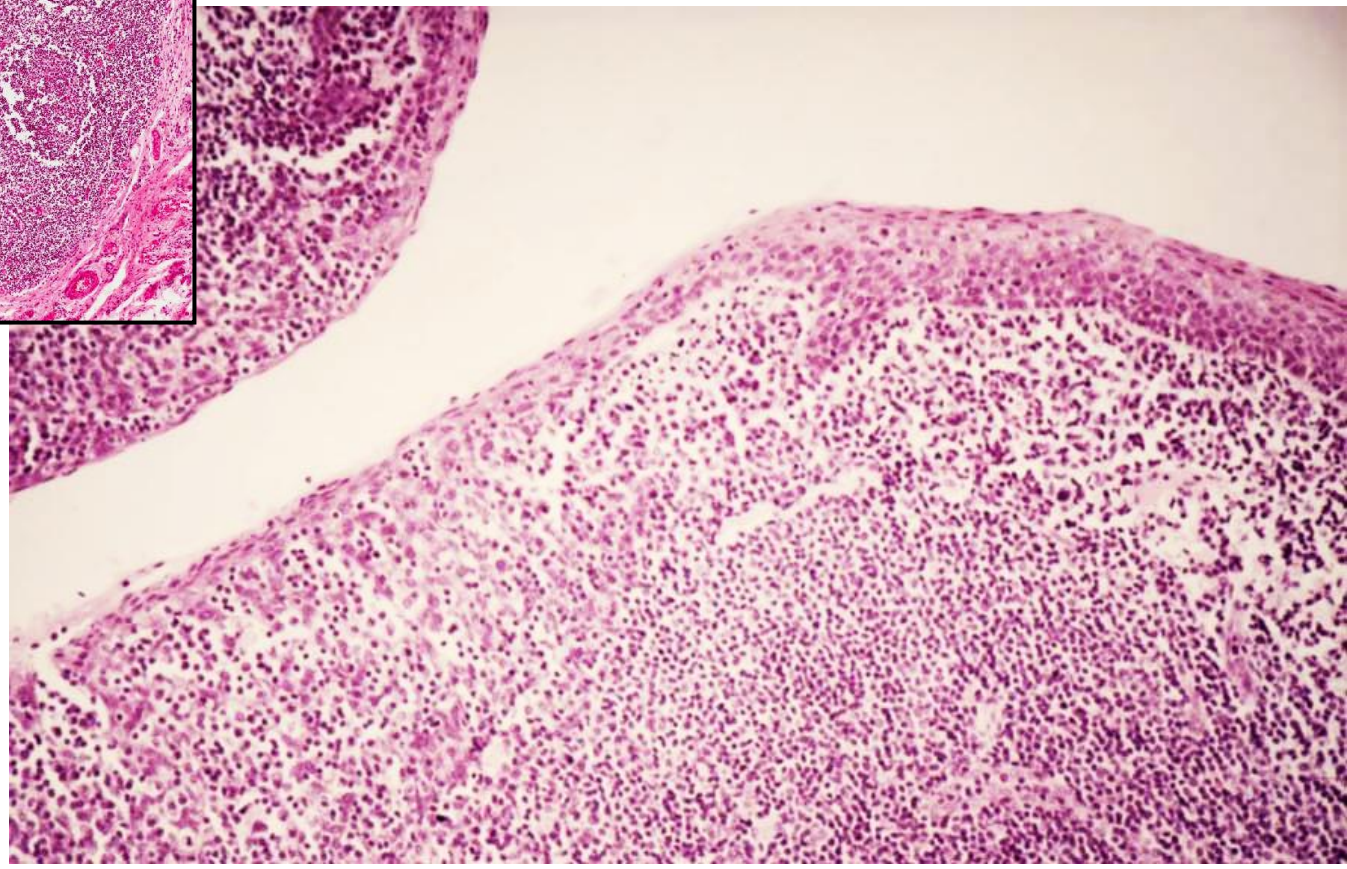


TONGUE – RADIX, TONSILLA LINGUALIS

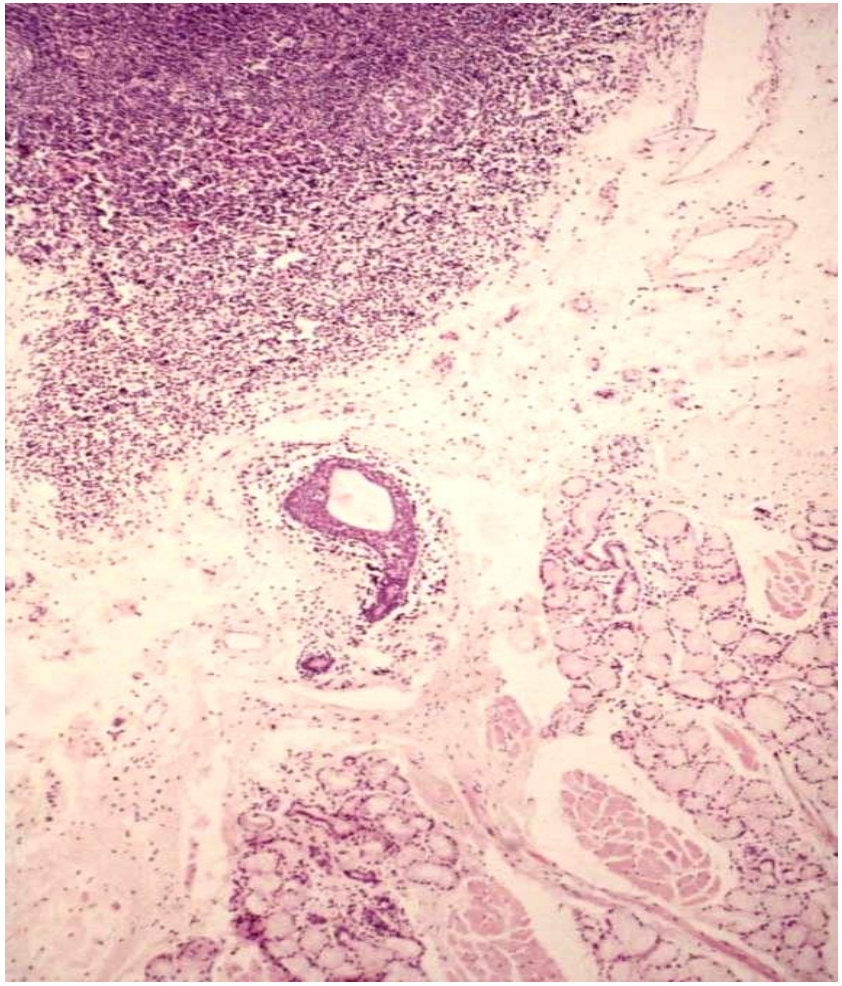


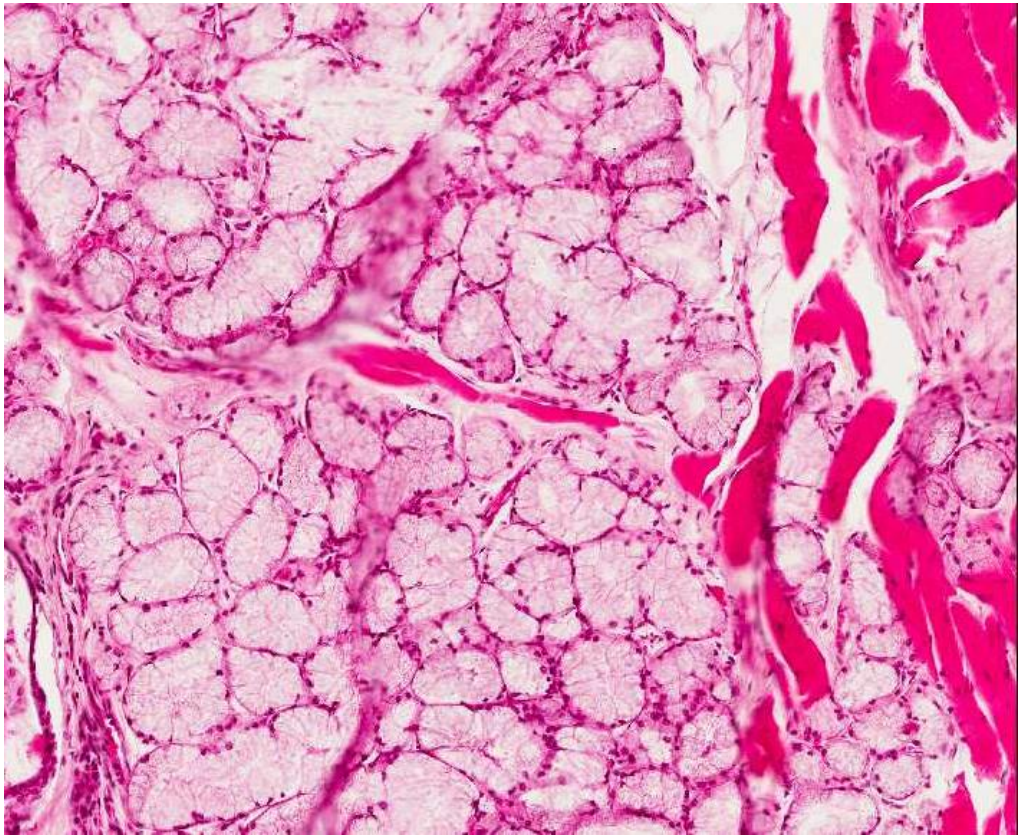
TONGUE – RADIX, TONSILLA LINGUALIS



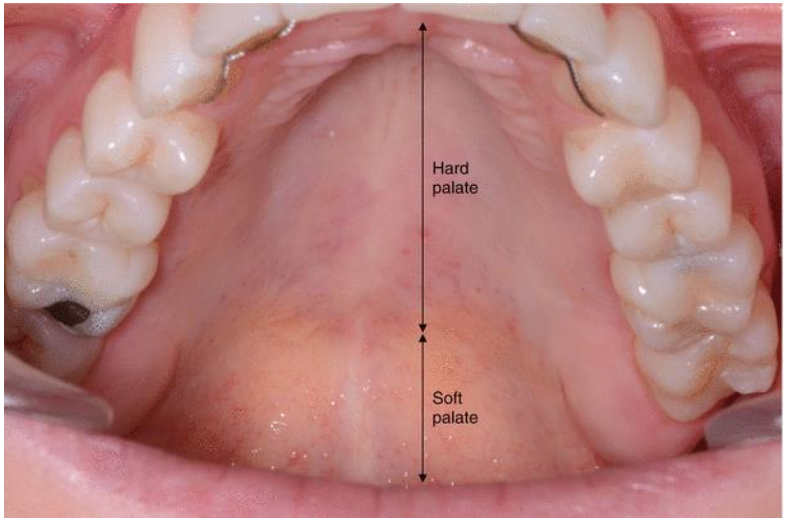


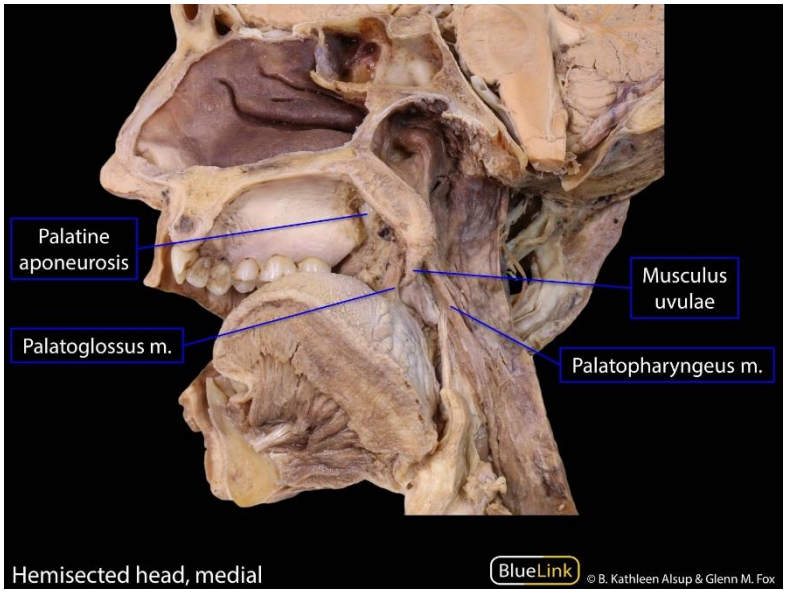
TONGUE – RADIX, TONSILLA LINGUALIS, WEBER'S GLANDS

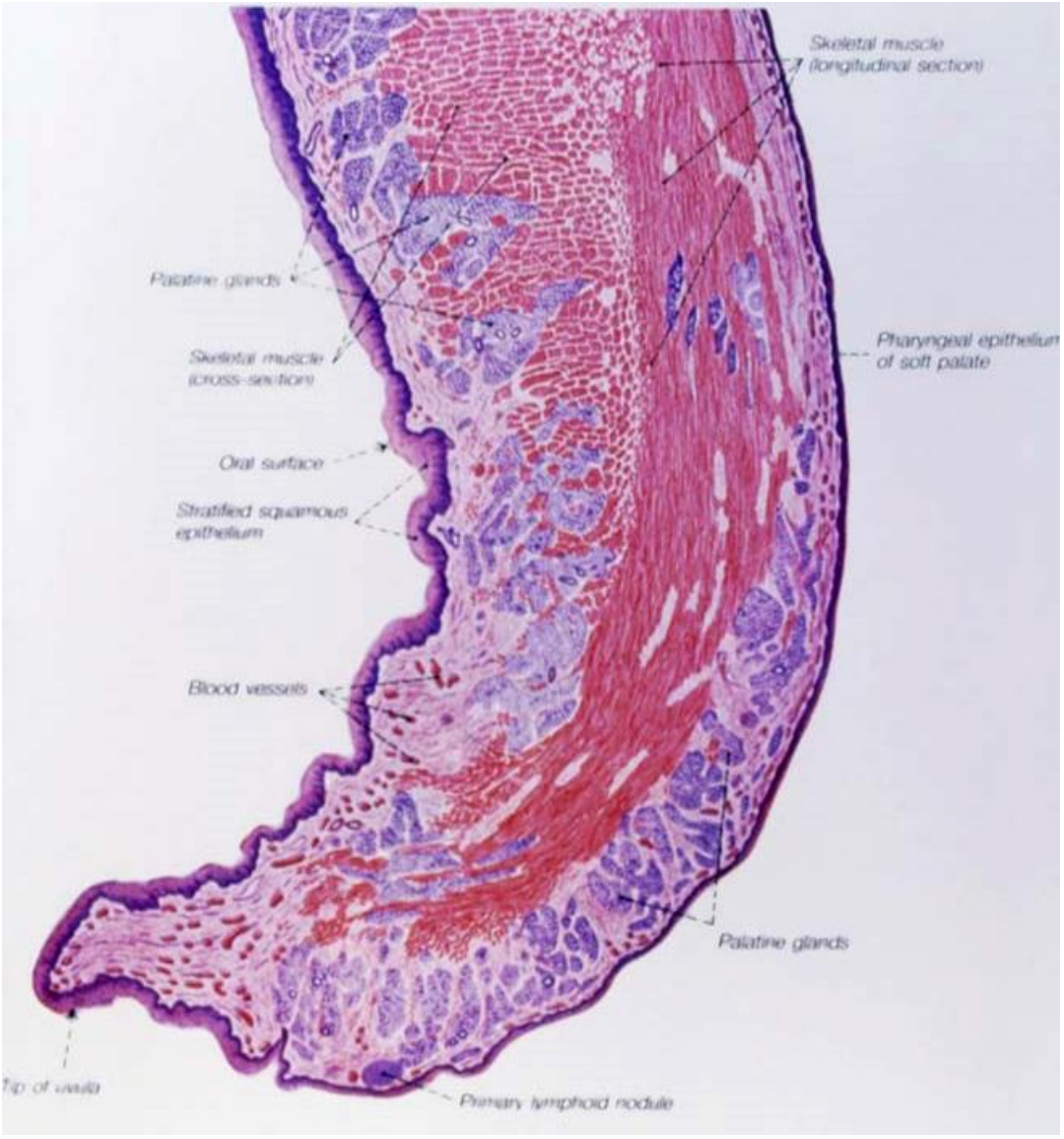




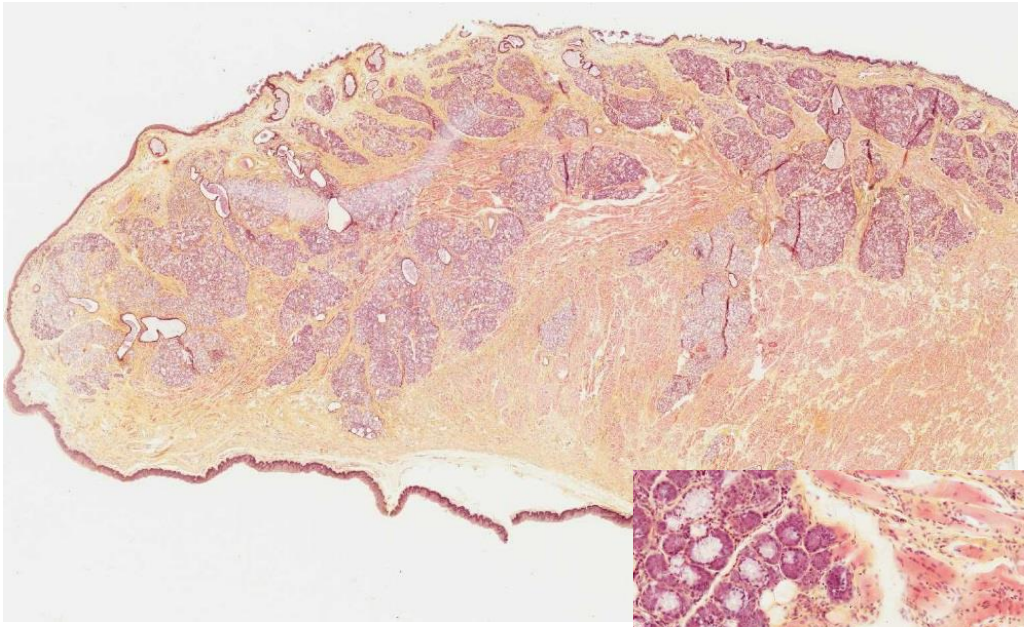
PALATE

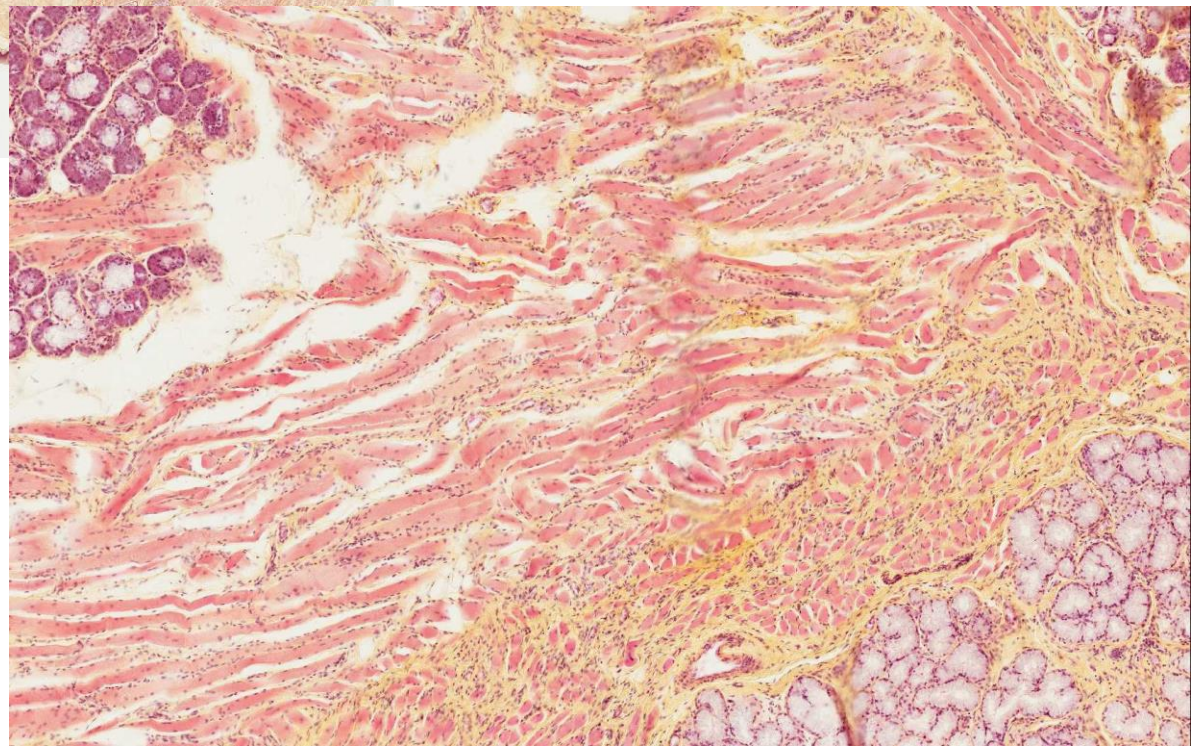

Hard palate
Soft palate


Palatine aponeurosis
Musculus uvulae
Palatoglossus m.
Palatopharyngeus m.
Hemisected head, medial
BlueLink
© B. Kathleen Alsup & Glenn M. Fox

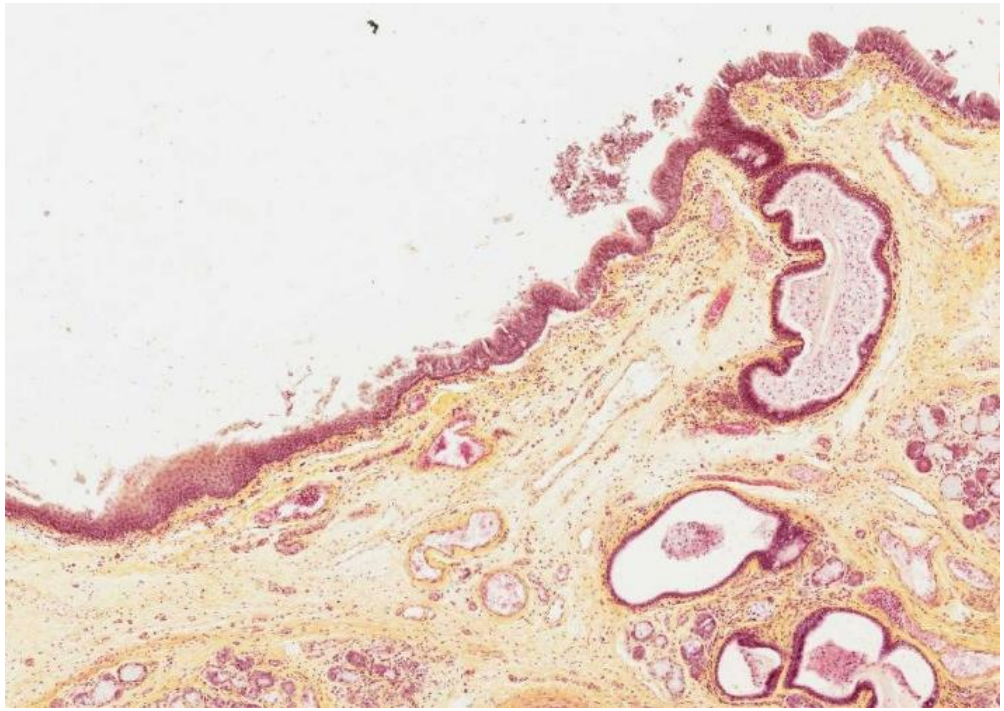

Skeletal muscle (longitudinal section)
Palatine glands
Skeletal muscle (cross-section)
Pharyngeal epithelium of soft palate
Oral surface
Stratified squamous epithelium
Blood vessels
Palatine glands
Primary lymphoid nodule

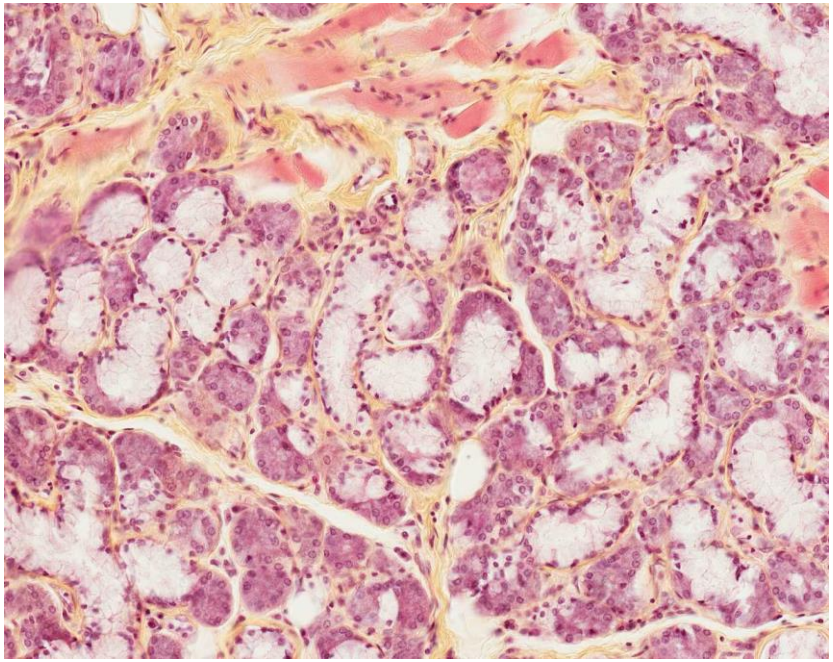
SOFT PALATE

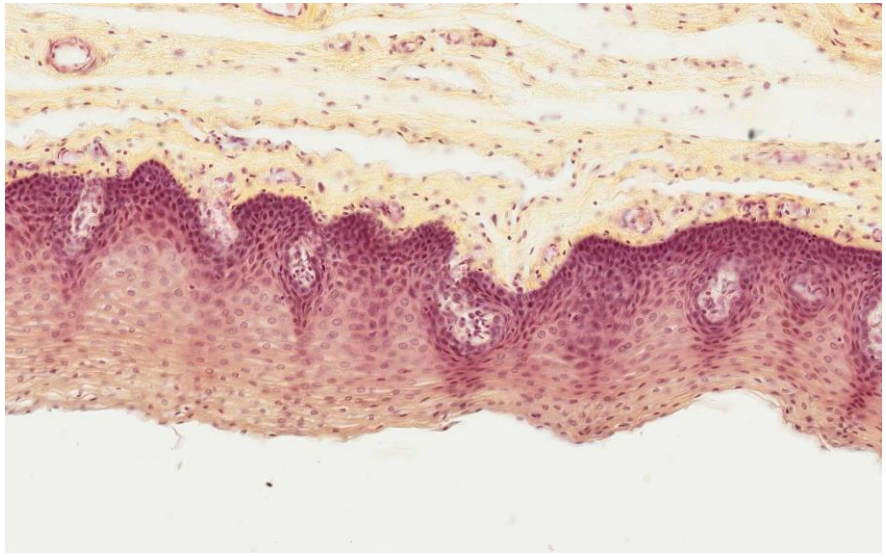


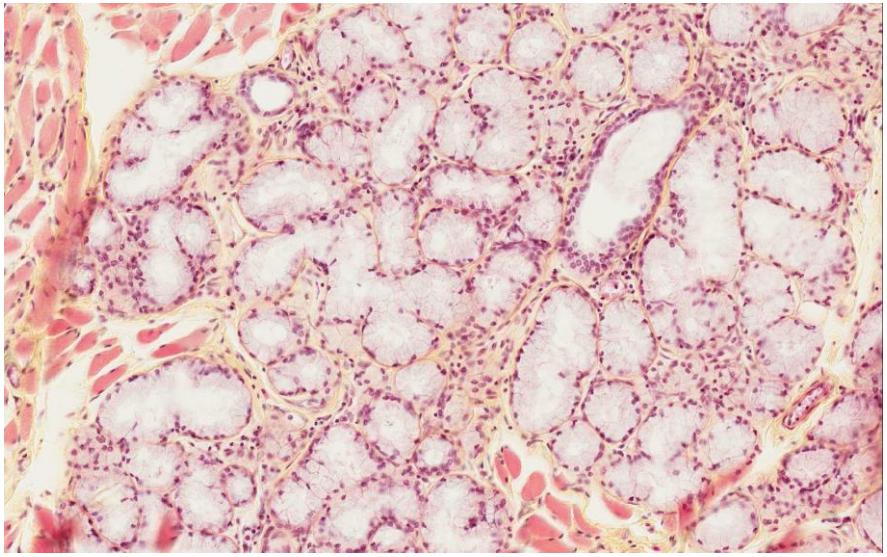


SOFT PALATE

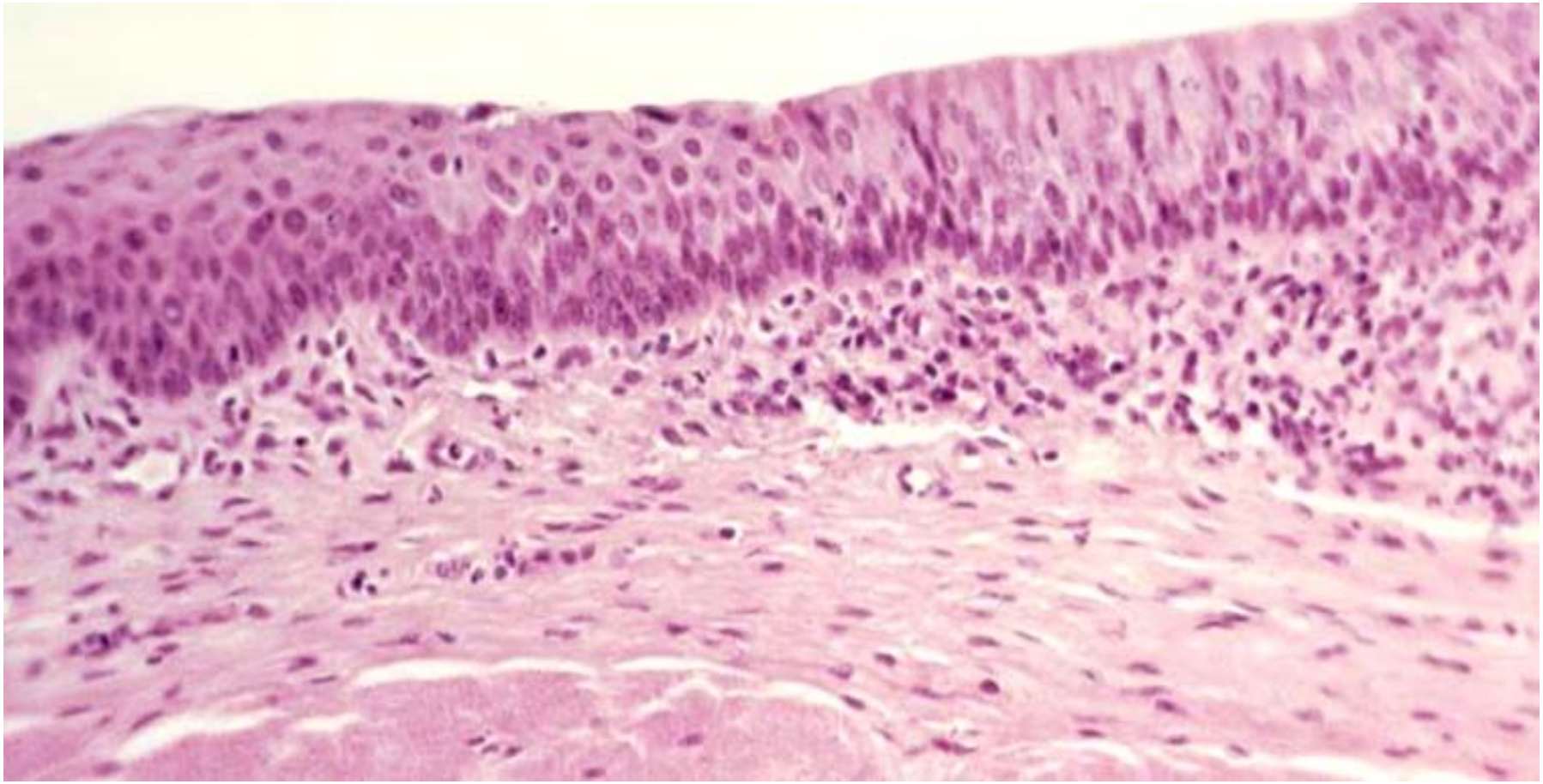




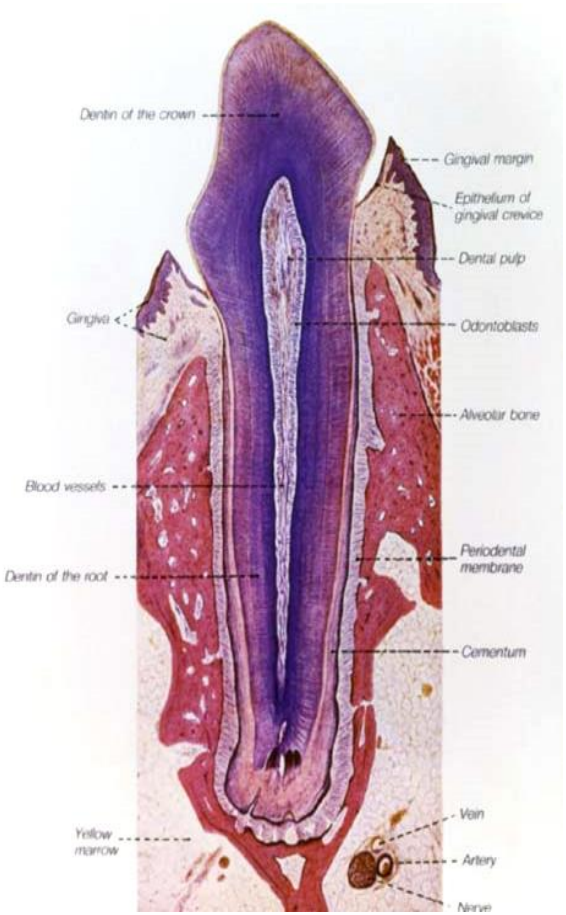




SOFT PALATE – EPITHELIAL CHANGE

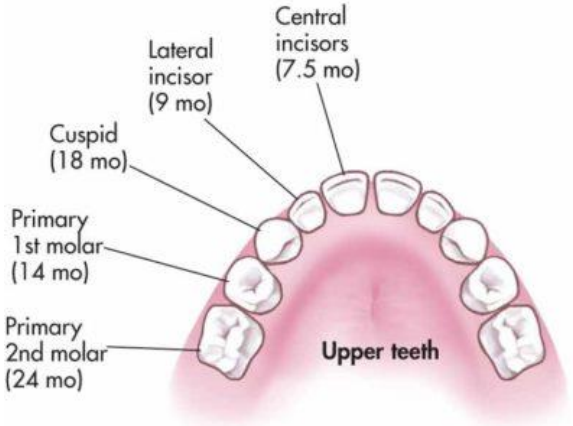


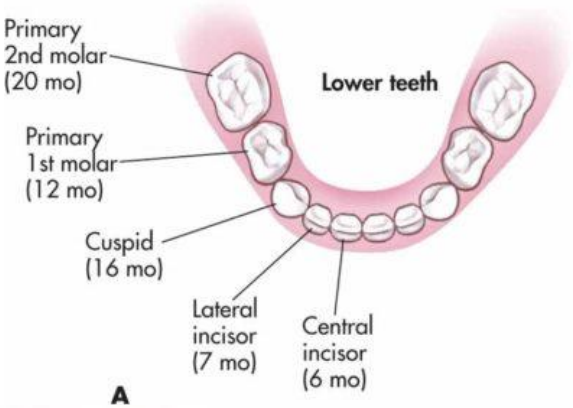
TOOTH



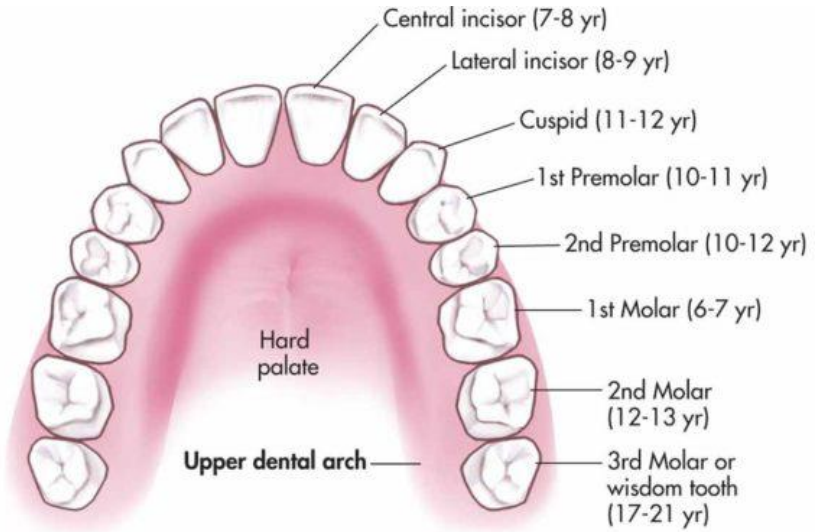
- Anatomical × clinical crown
- Neck (cementoenamel junction)
- Root

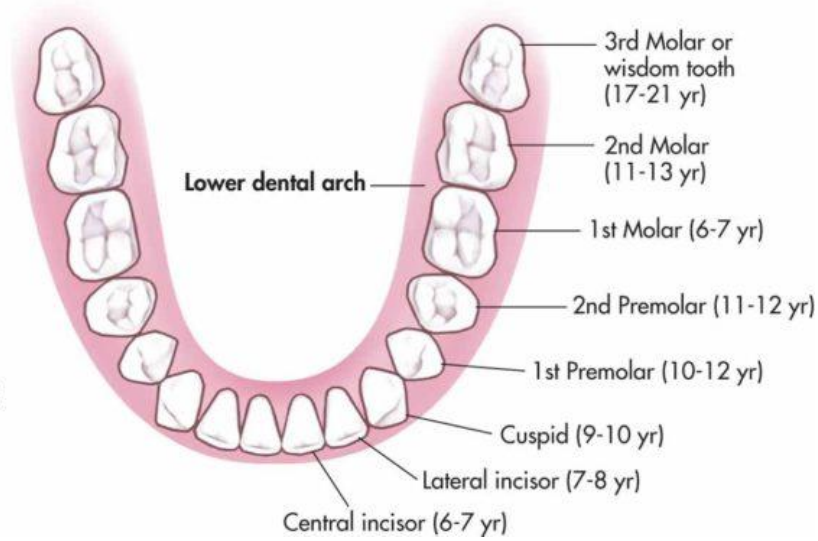
DECIDUAL AND PERMANENT TEETH





A





B

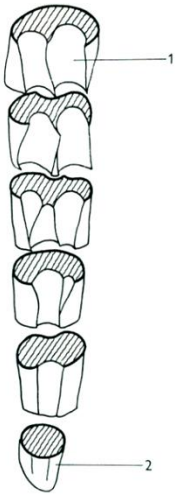
Vzorec mléčného chrupu:

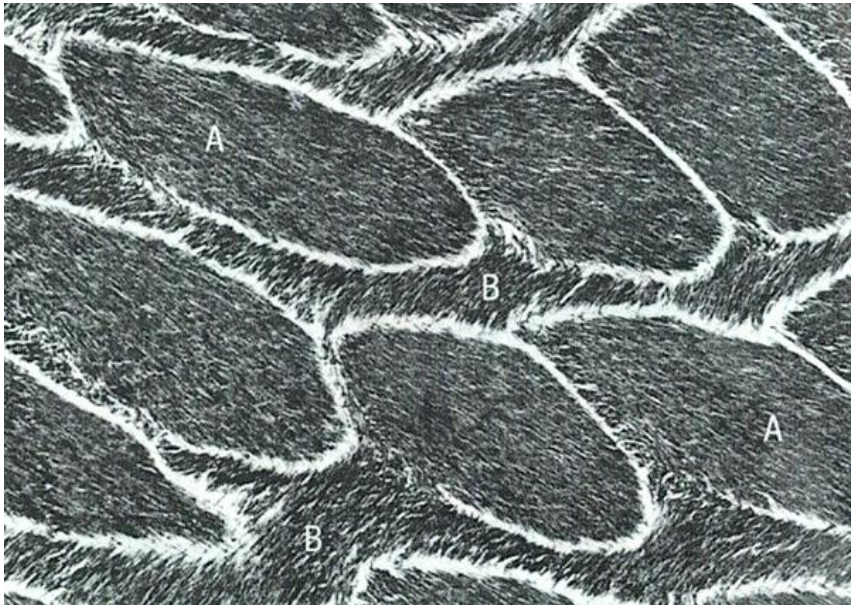
$m_2\ m_1\ c\ i_2\ i_1$	$i_1\ i_2\ c\ m_1\ m_2$
$m_2\ m_1\ c\ i_2\ i_1$	$i_1\ i_2\ c\ m_1\ m_2$

Vzorec definitivního chrupu:

$M_3\ M_2\ M_1\ P_2\ P_1\ C\ I_2\ I_1$	$I_1\ I_2\ C\ P_1\ P_2\ M_1\ M_2\ M_3$
$M_3\ M_2\ M_1\ P_2\ P_1\ C\ I_2\ I_1$	$I_1\ I_2\ C\ P_1\ P_2\ M_1\ M_2\ M_3$

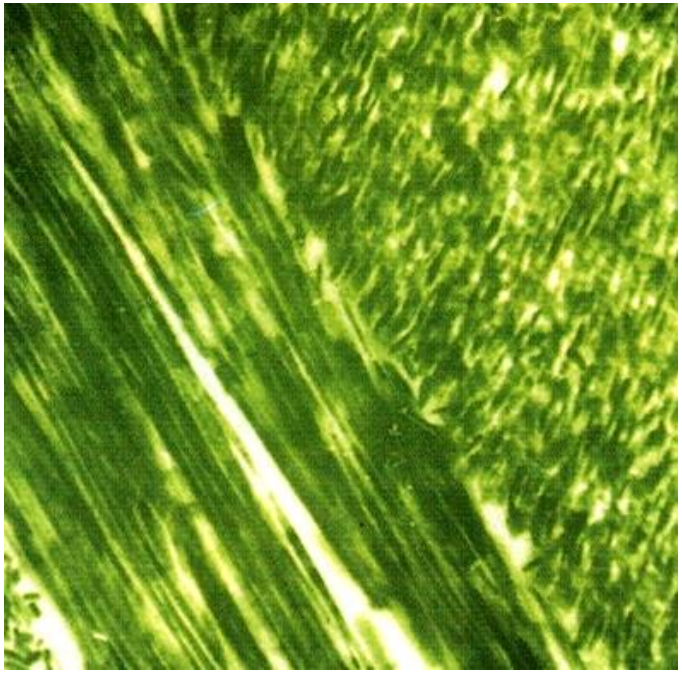
TOOTH – ENAMEL



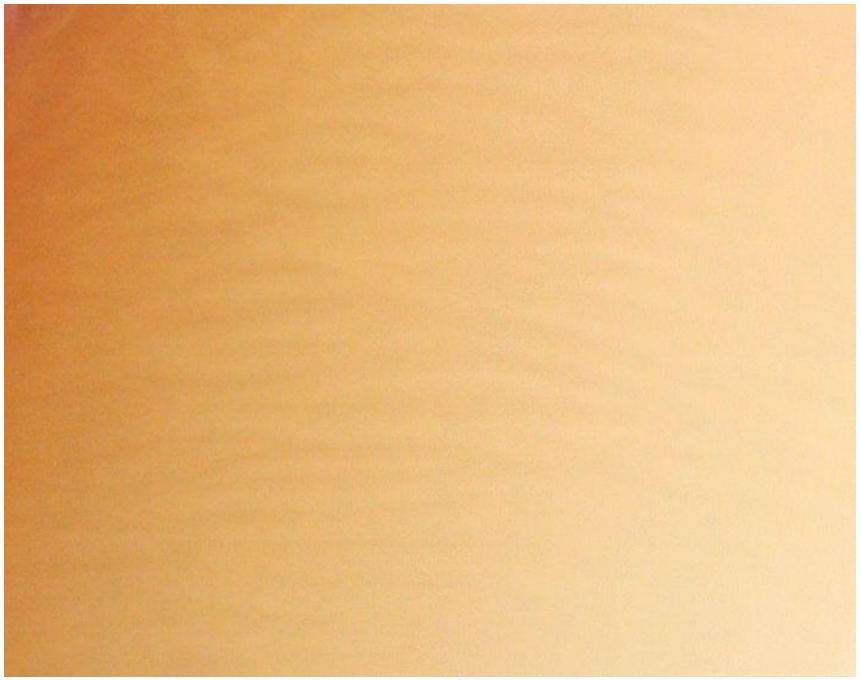


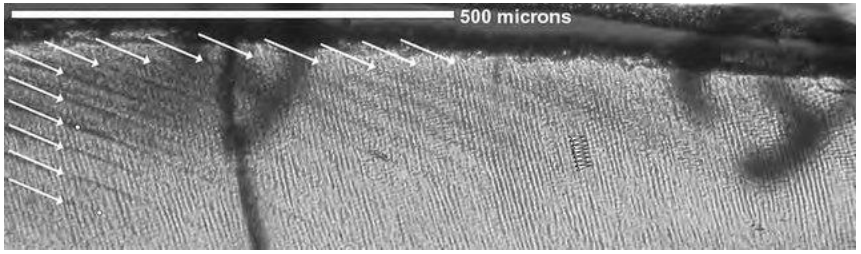
<u>Enamel</u>, 1-2 mm

- Covers the crown
- Made by ameloblasts, but after eruption acellular
- No regeneration
- 96% Ca-hydroxyapatite, enamel prisms
- Enamelins, amelogenins, ameloblastins
- Striae of *Retzius* (incremental growth lines)



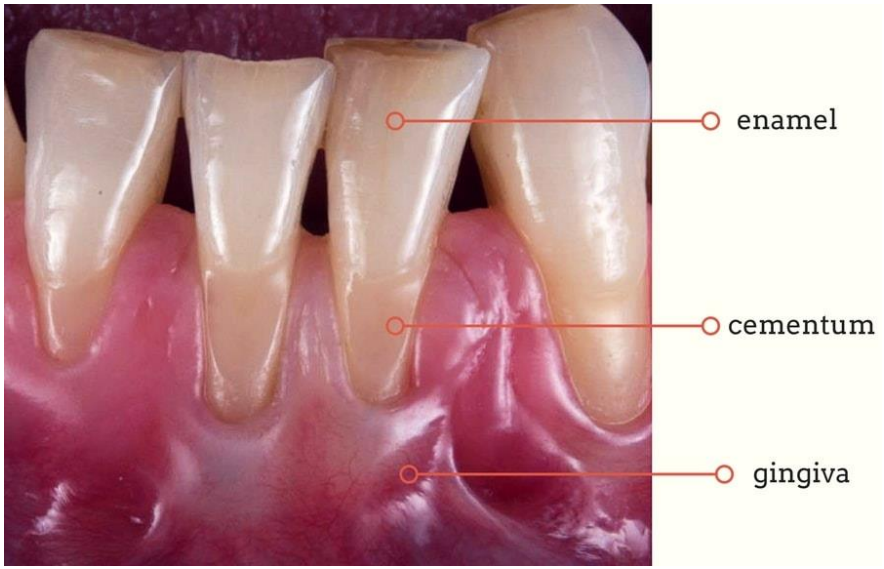
TOOTH – ENAMEL

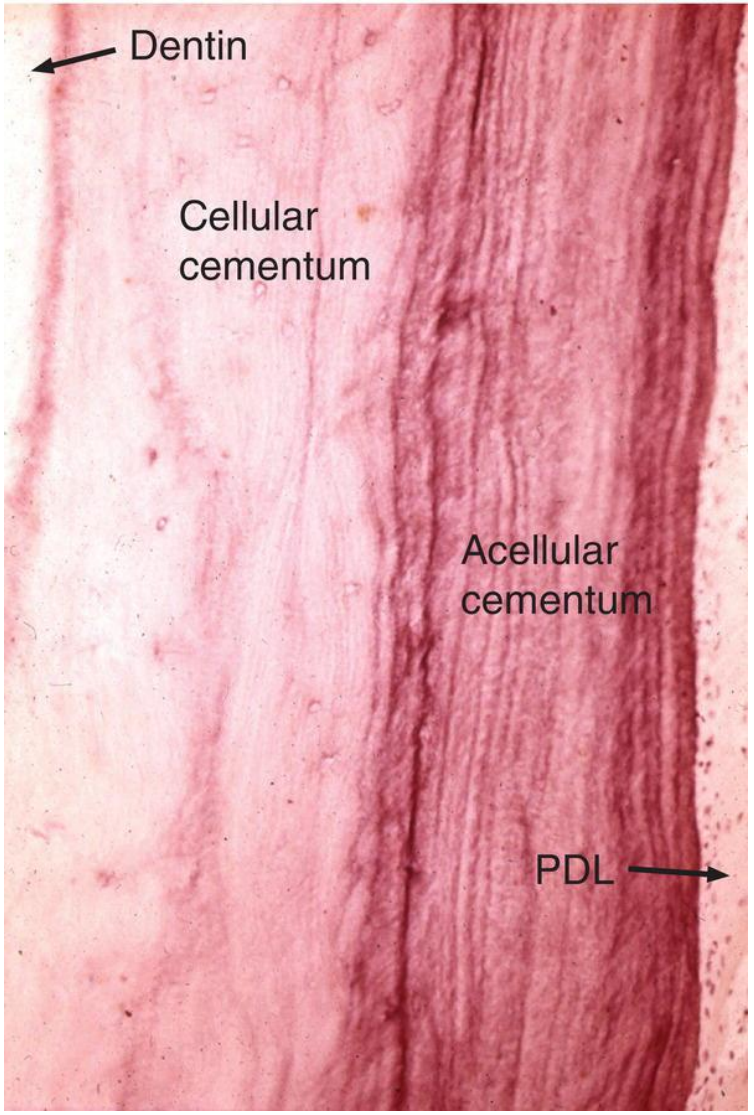




10.1007/978-1-4020-5845-5_11

TOOTH – CEMENTUM





<u>Cementum</u>, 100-500 µm

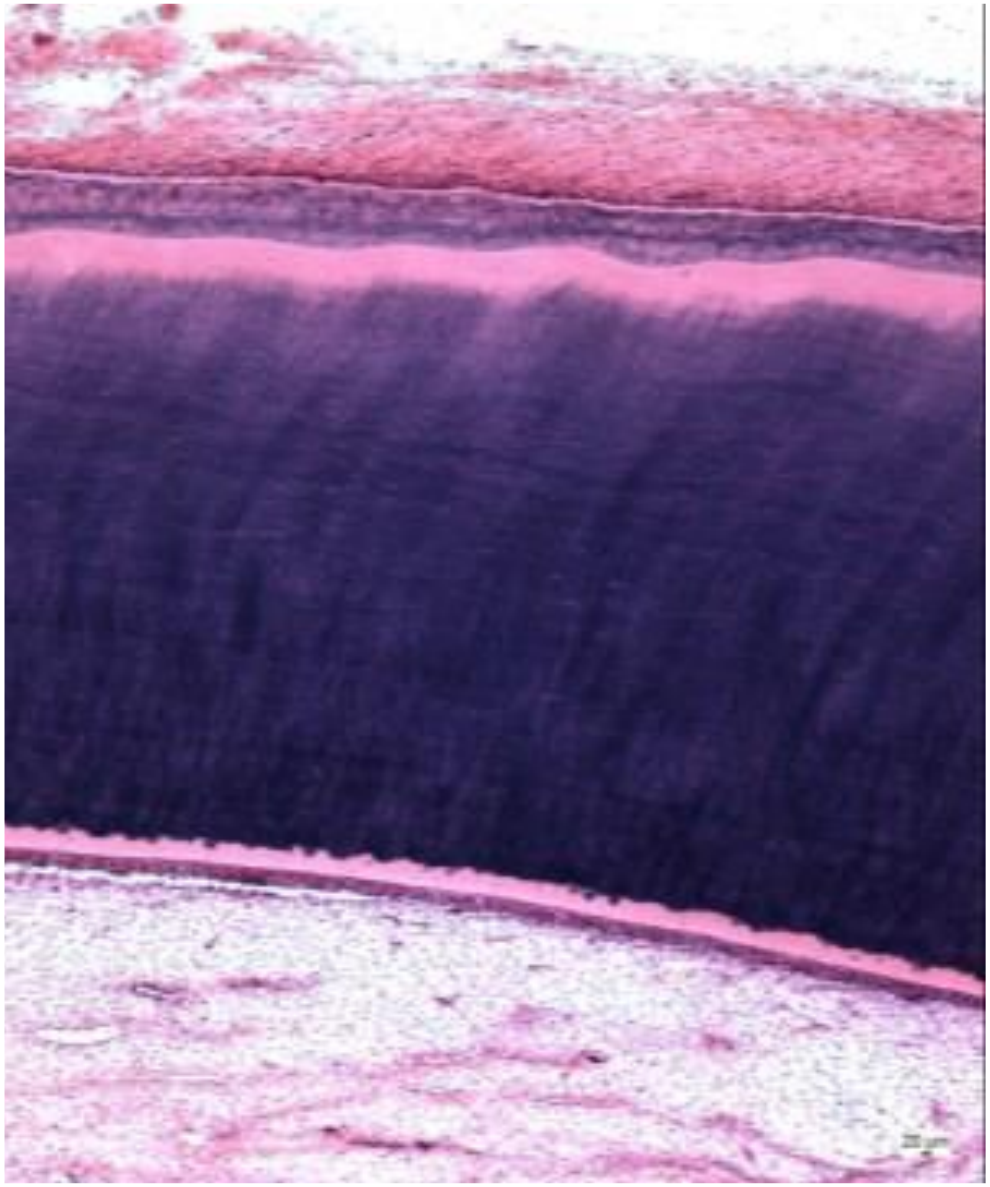
- Covers root and neck
- Cementoblasts/cementocytes
- Regenerates
- 50% Ca-hydroxyapatite
- Collagen I, III, XII, GAGs, proteoglycans
- Sharpey's fibers – fibrilal cementum
- Periodontal ligaments – tooth alveolus

TOOTH – CEMENTUM

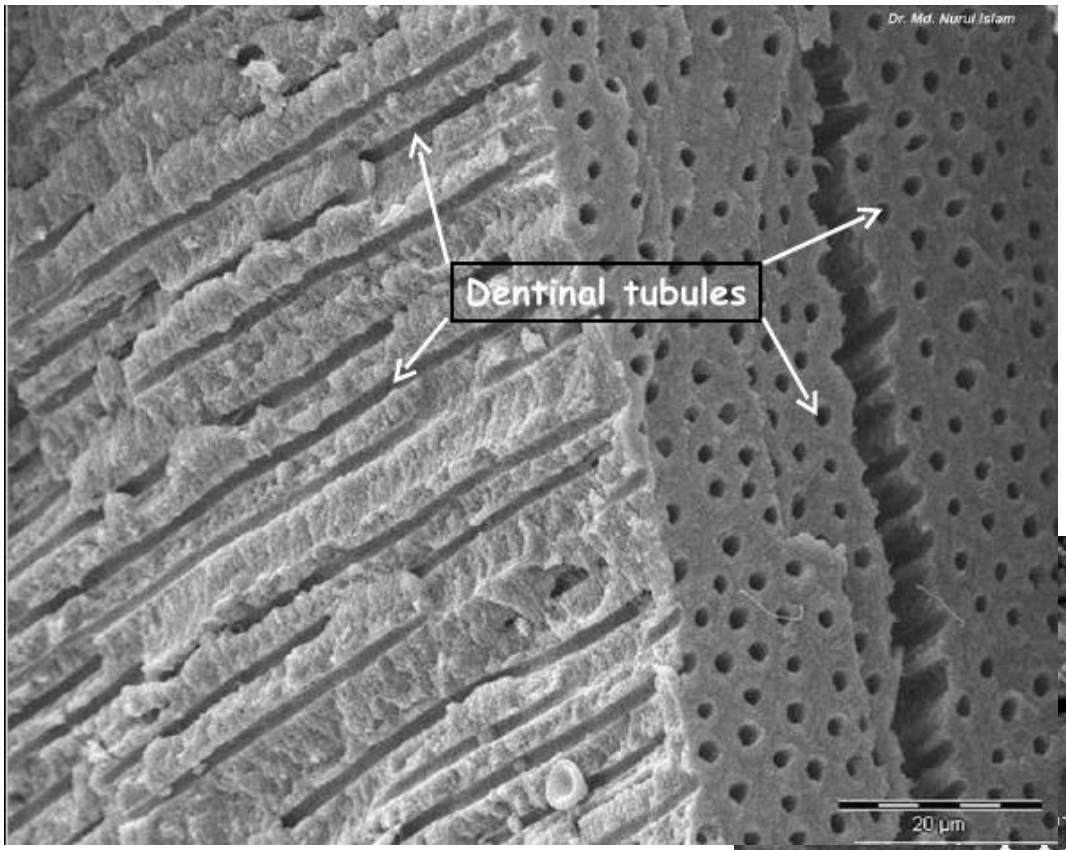
TOOTH – DENTIN

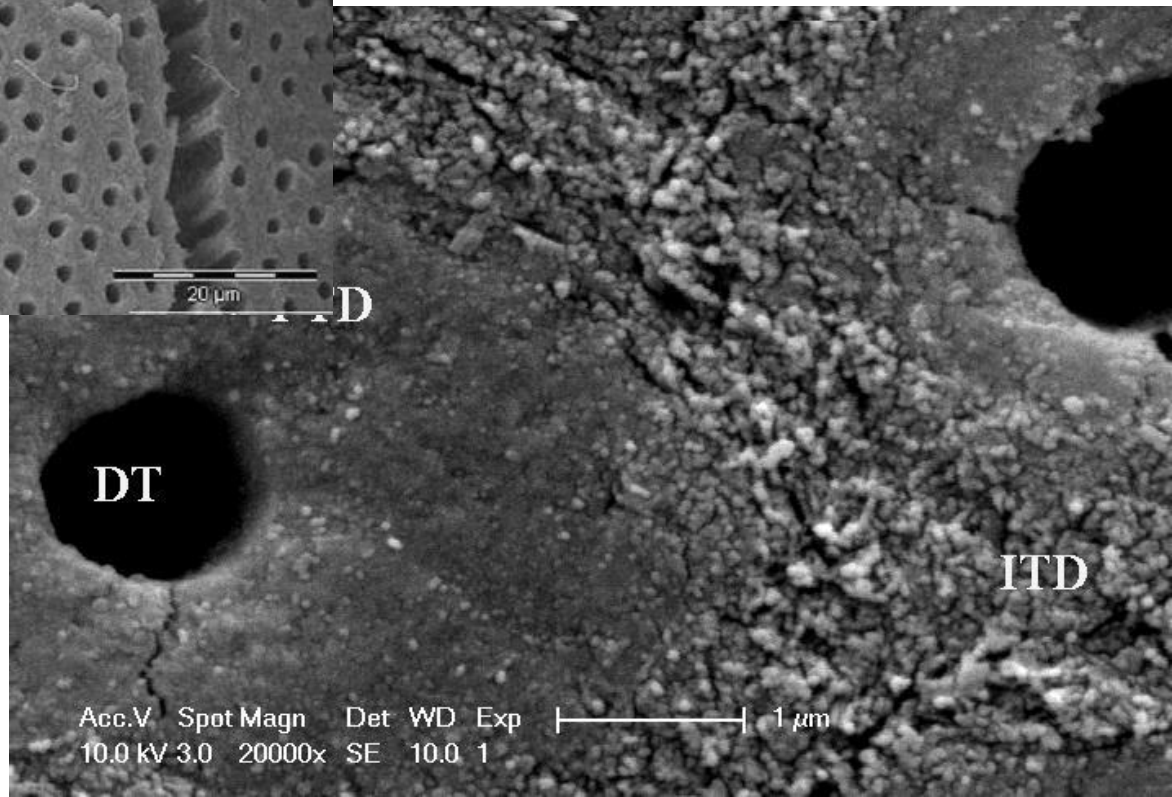
Dentin

- Odontoblasts
- Regenerates
- 70% Ca-hydroxyapatite
- Collagen I, glykoproteins, proteoglycans
- Odontoblast processes –Tomes' fibers
- Owen's lines
- Von Ebner's lines (incremental)
- Nerve fibers

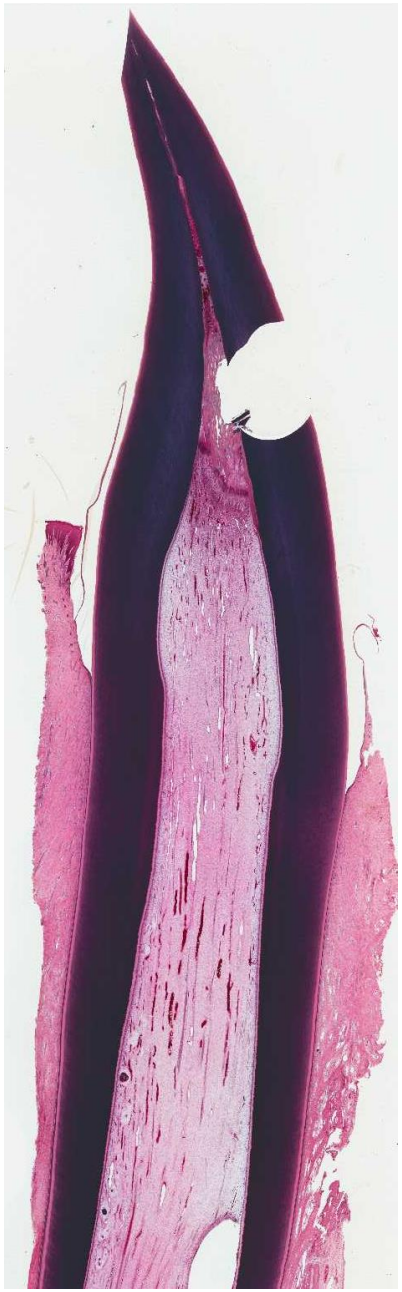


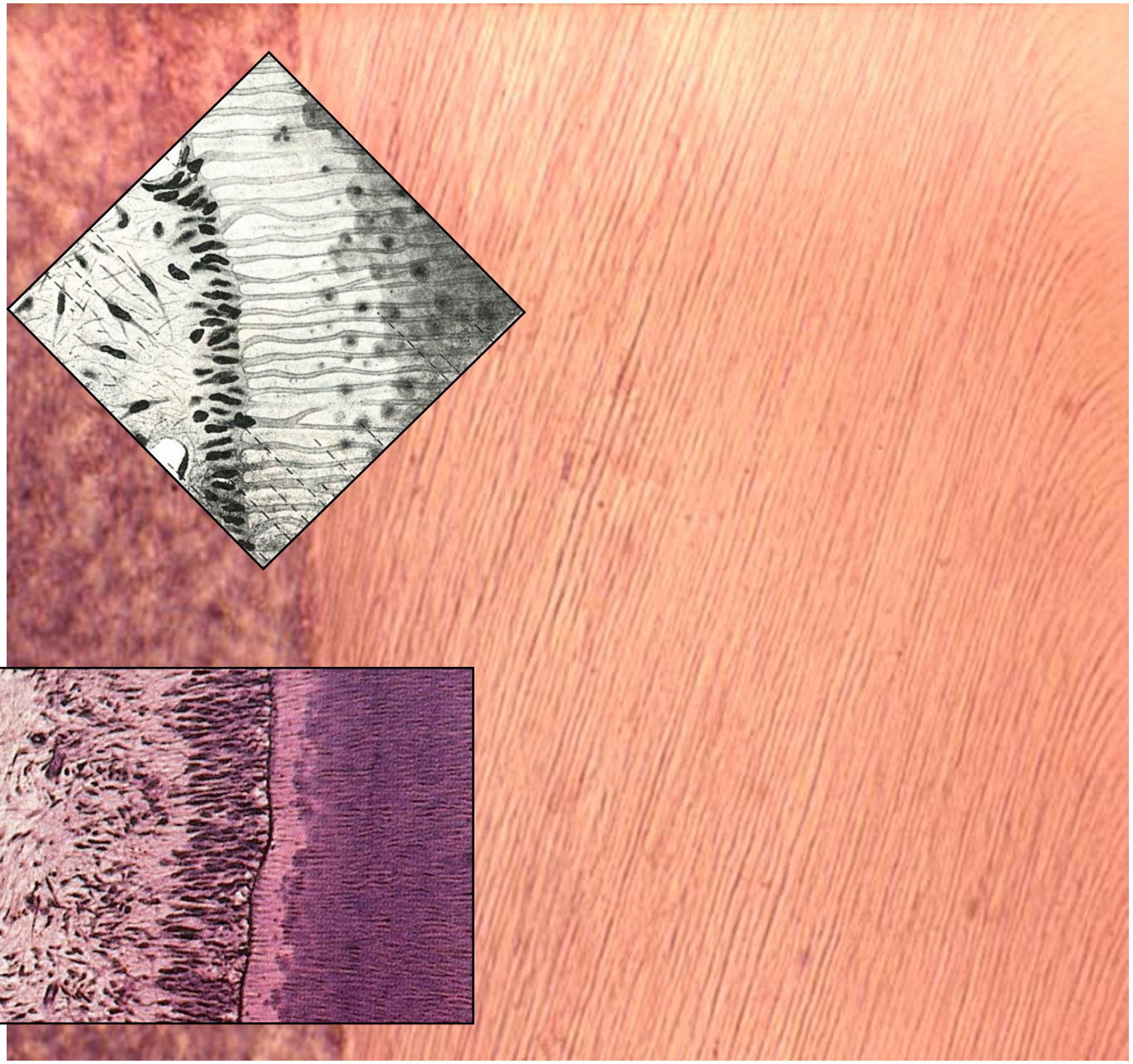
TOOTH – DENTIN





TOOTH – ODONTOBLASTS





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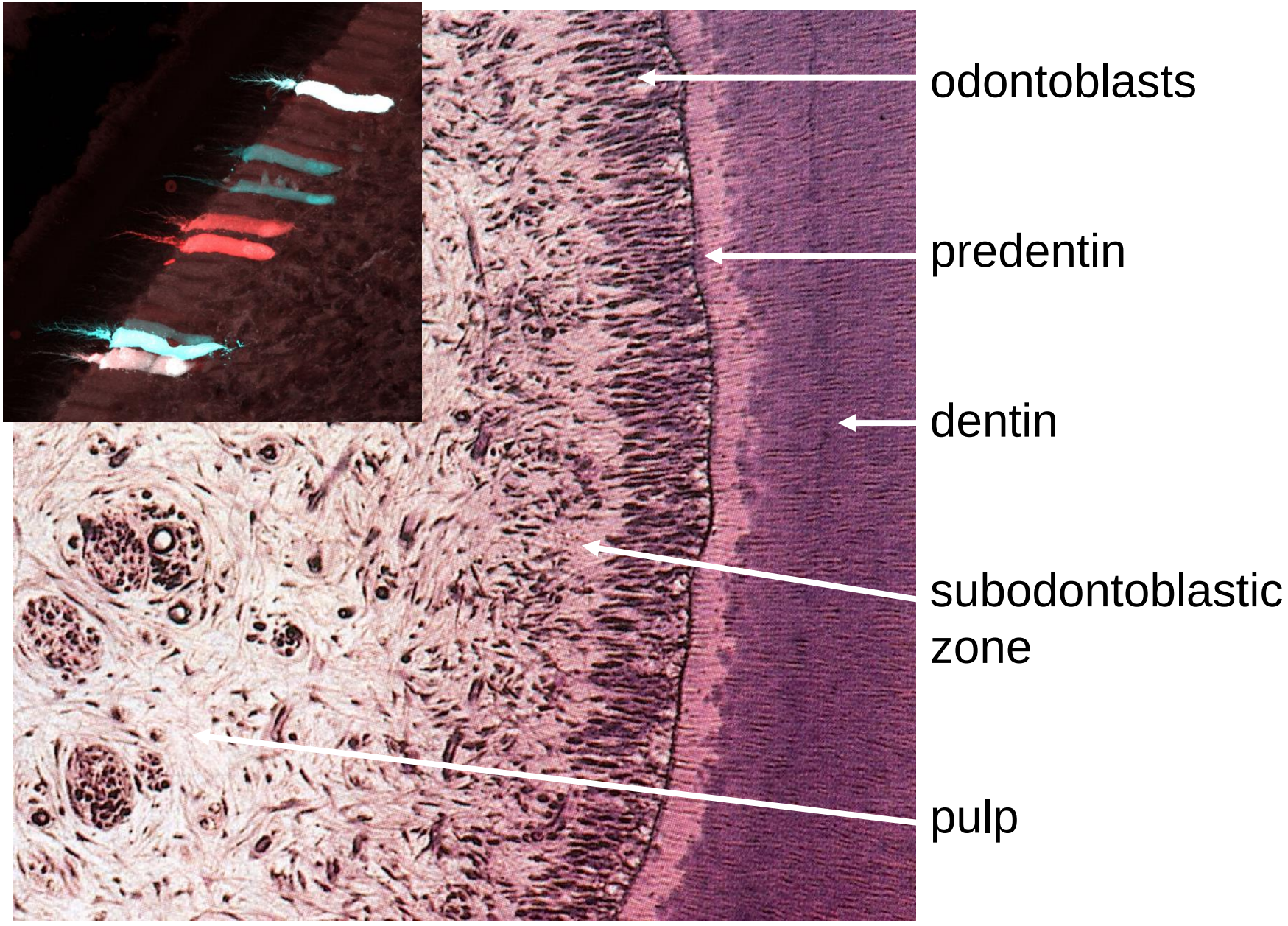
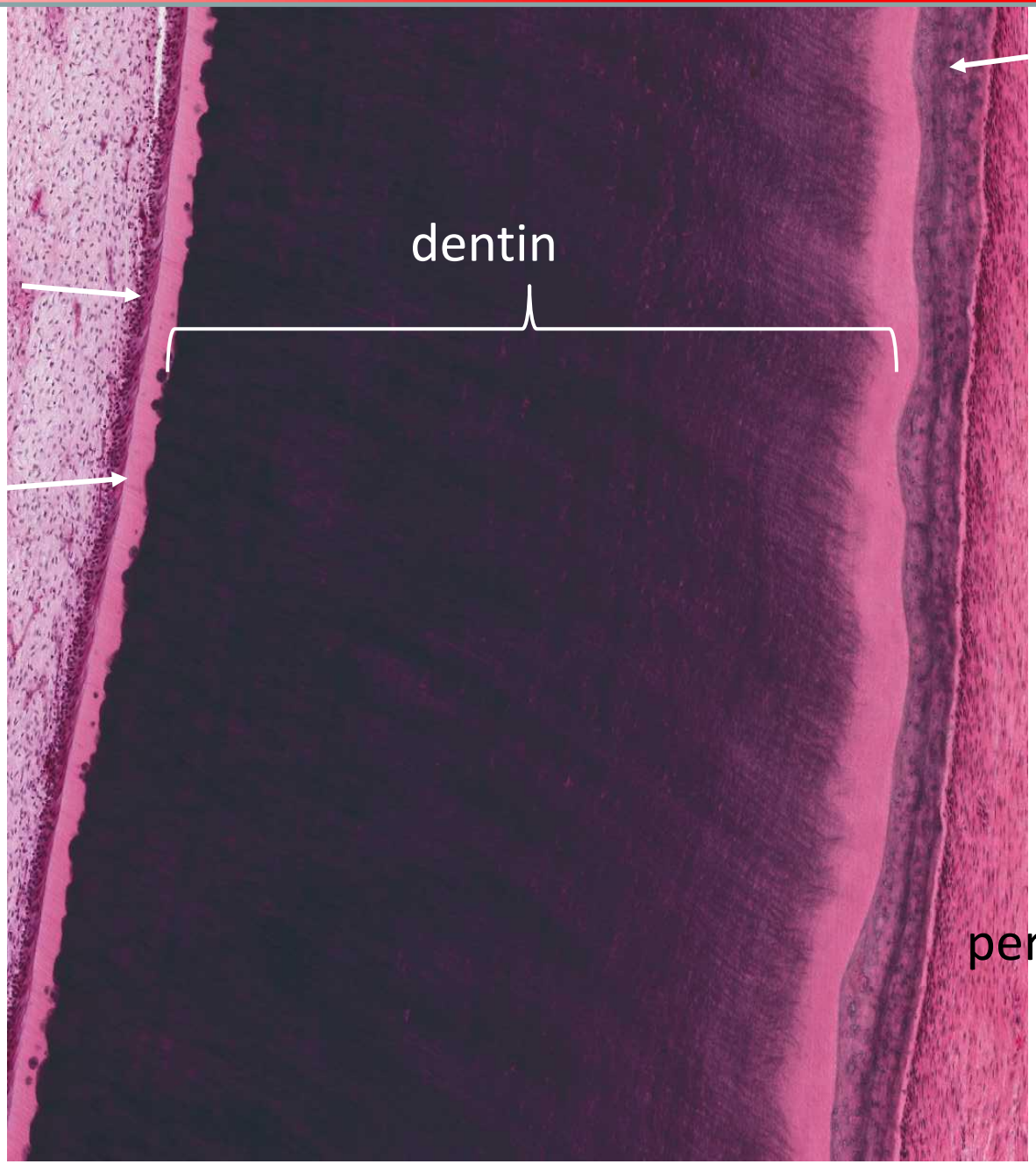
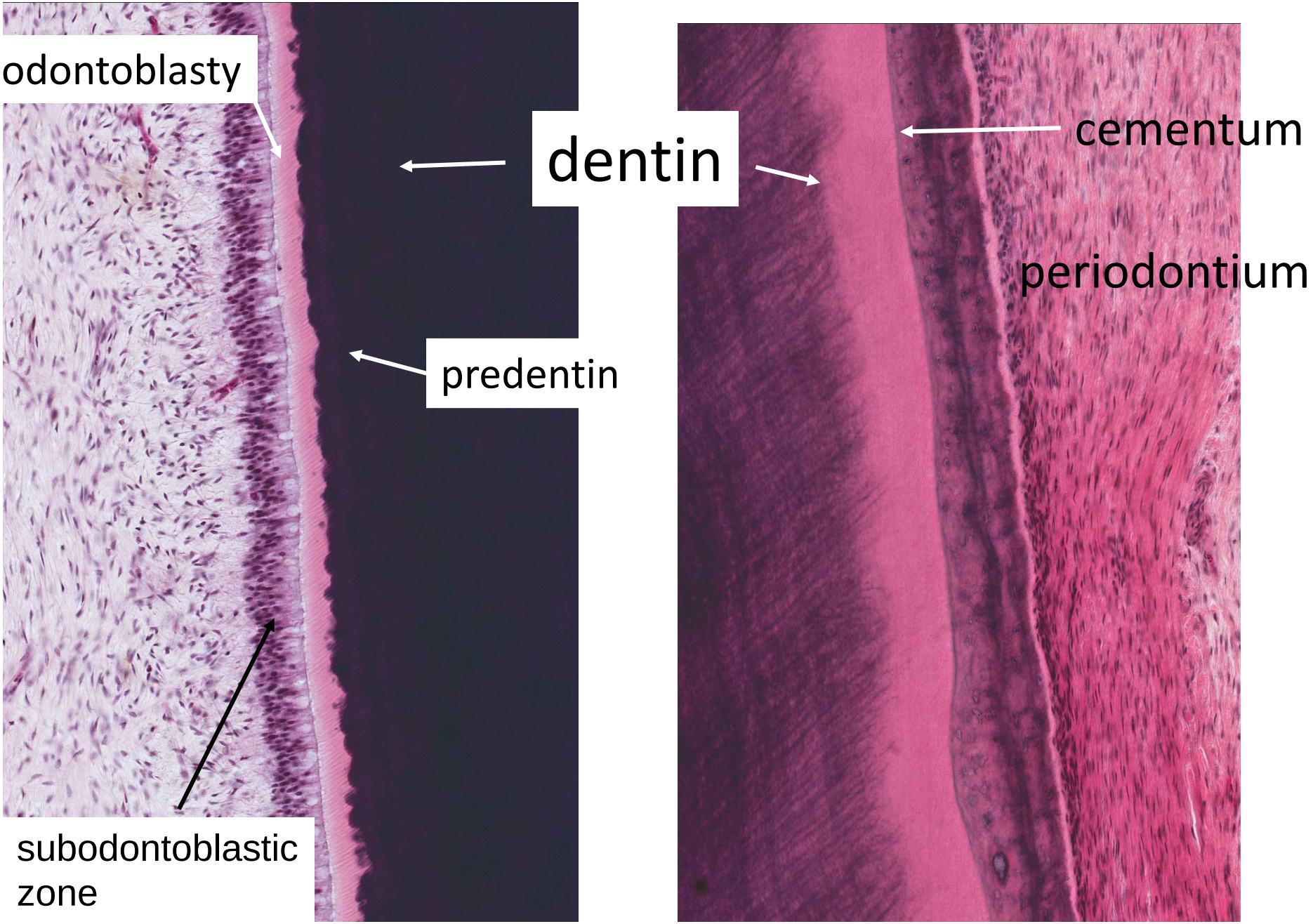


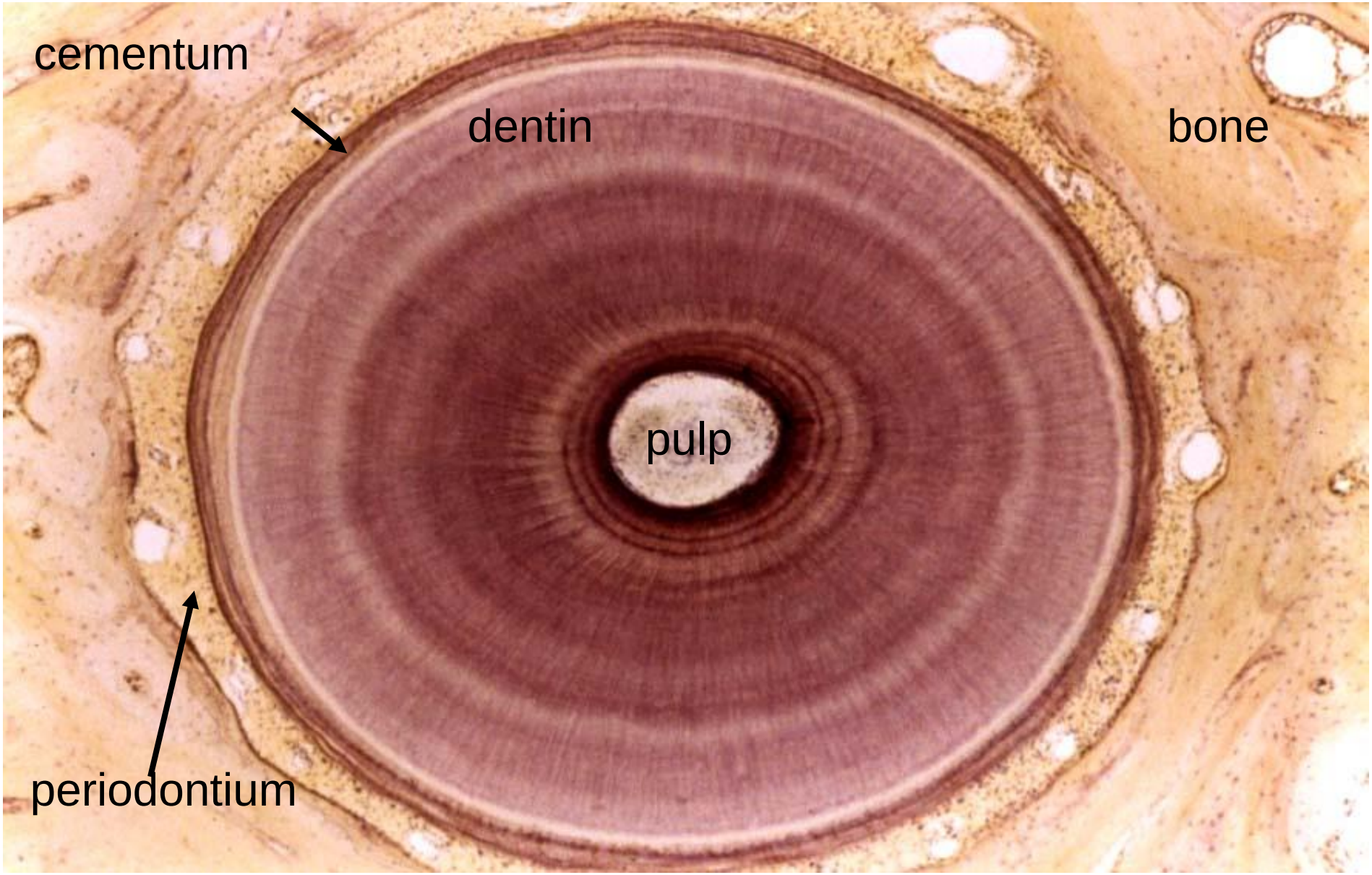
TOOTH – DENTIN



TOOTH

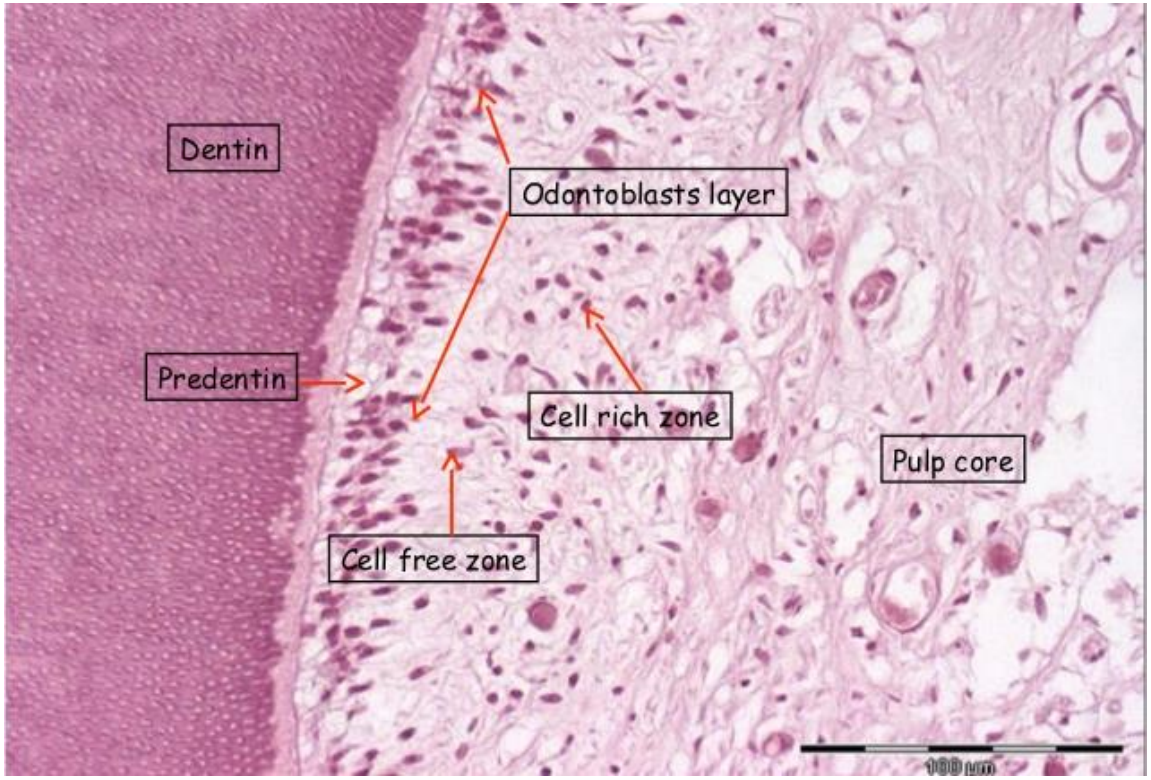

odontoblasty
dentin
predentin
subodontoblastic zone
cementum
periodontium

TOOTH



TOOTH – PULP

- soft connnective tissue similar to embryonic mesenchyme
- rich vascularisation and innervation
- crown pulp and rooth canal
- foramen apicale - periodontium
- odontoblasts
- nociceptive nerve plexus (plexus Raschkowi)



https://www.slideshare.net/hesham63/pulp-15597098

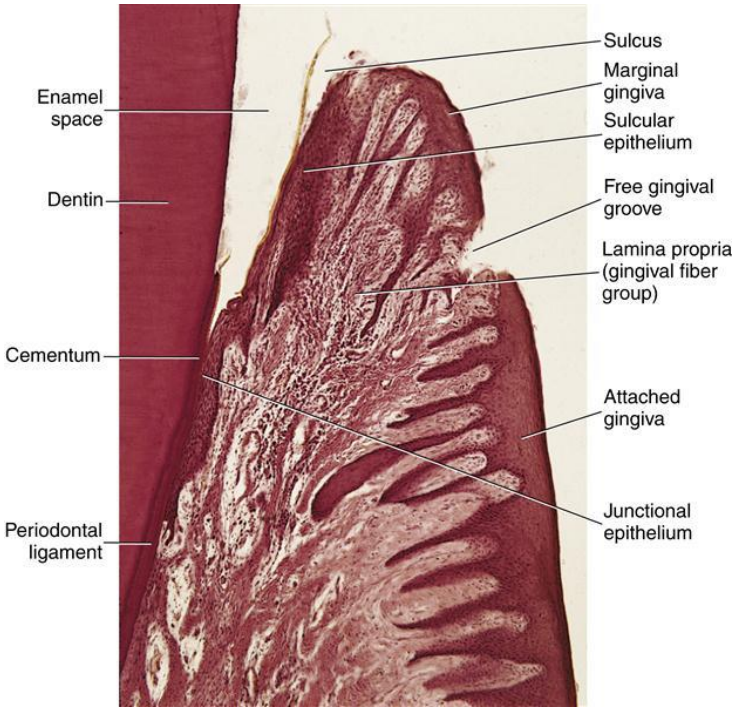
TOOTH – PERIODONTIUM AND GINGIVA

Gingiva

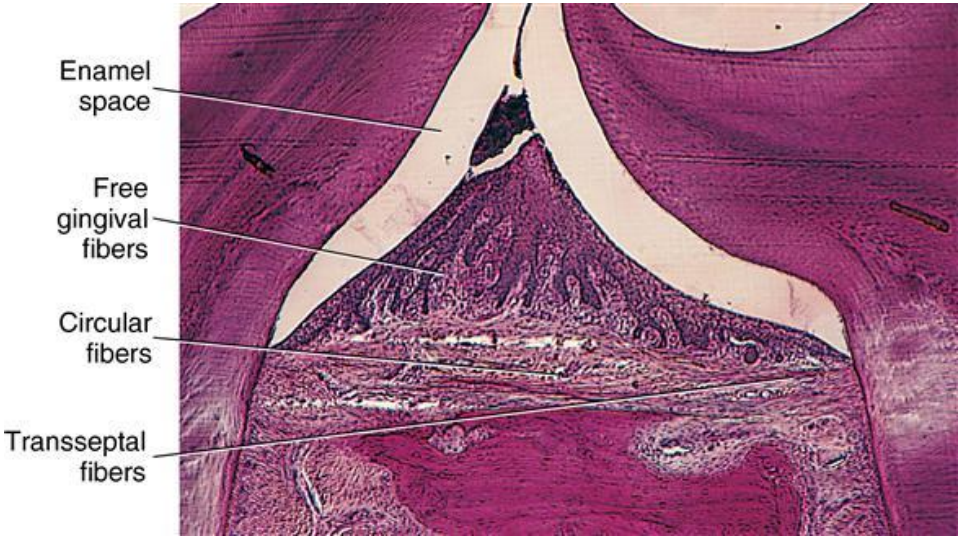
- free (marginal, g. libera)
- attached (g. affixa)
- paramarginal groove (outer gingival groove)
- sulcus gingivalis
- gingivodental junction of Gotlieb

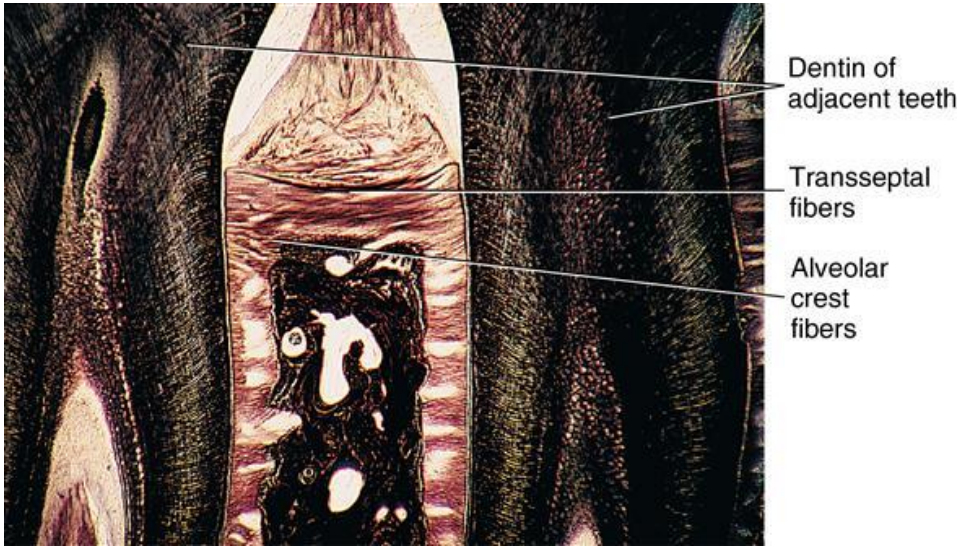
- stratified squamous epithelium
- lamina propria mucosae – dense collagen c.t.

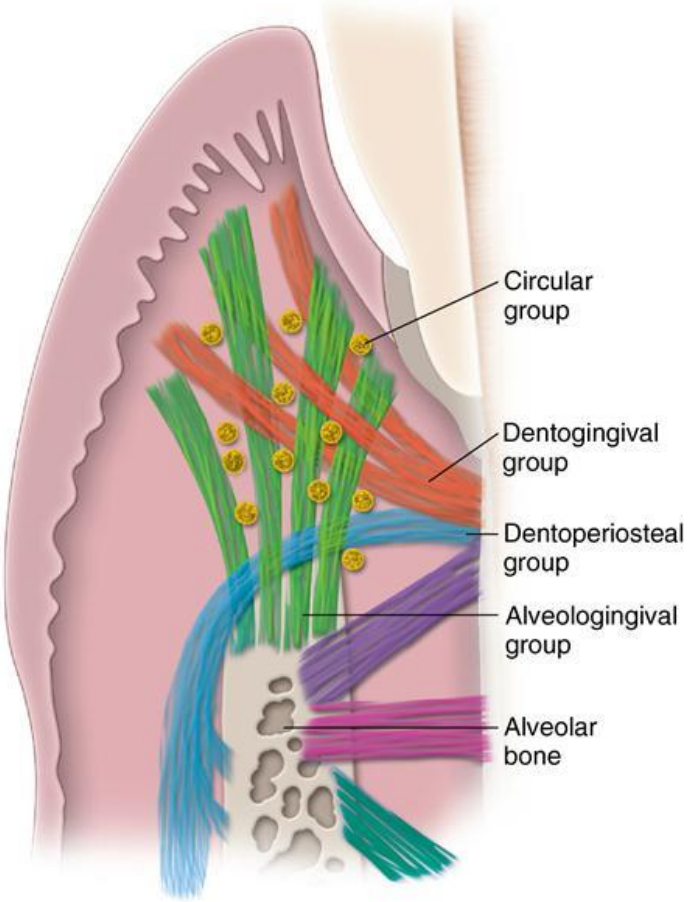
Obr. 8. Schéma gingivy. 1 — volná gingiva, 2 — připojená gingiva, 3 — alveolární sliznice, 4 — vestibulární sliznice



TOOTH – PERIODONTIUM AND GINGIVA

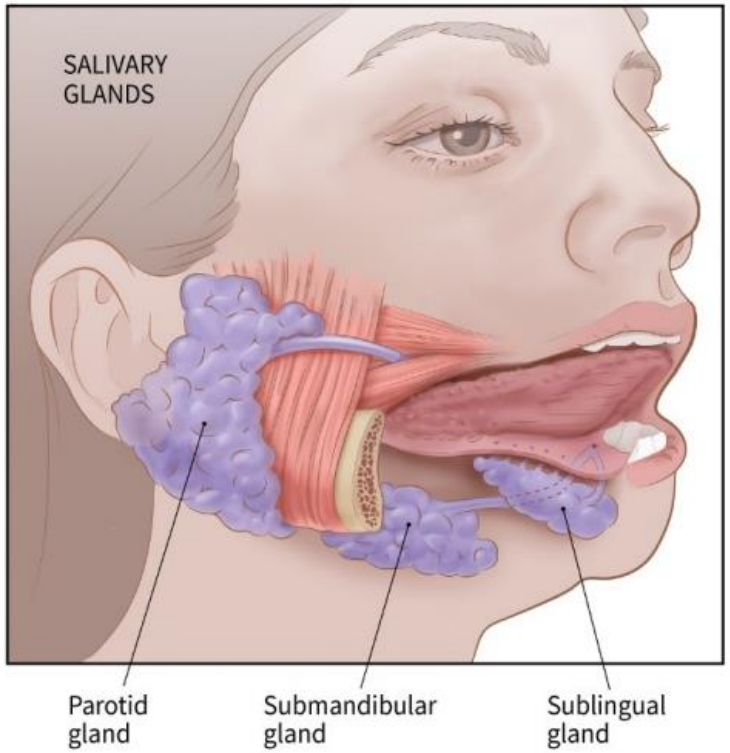






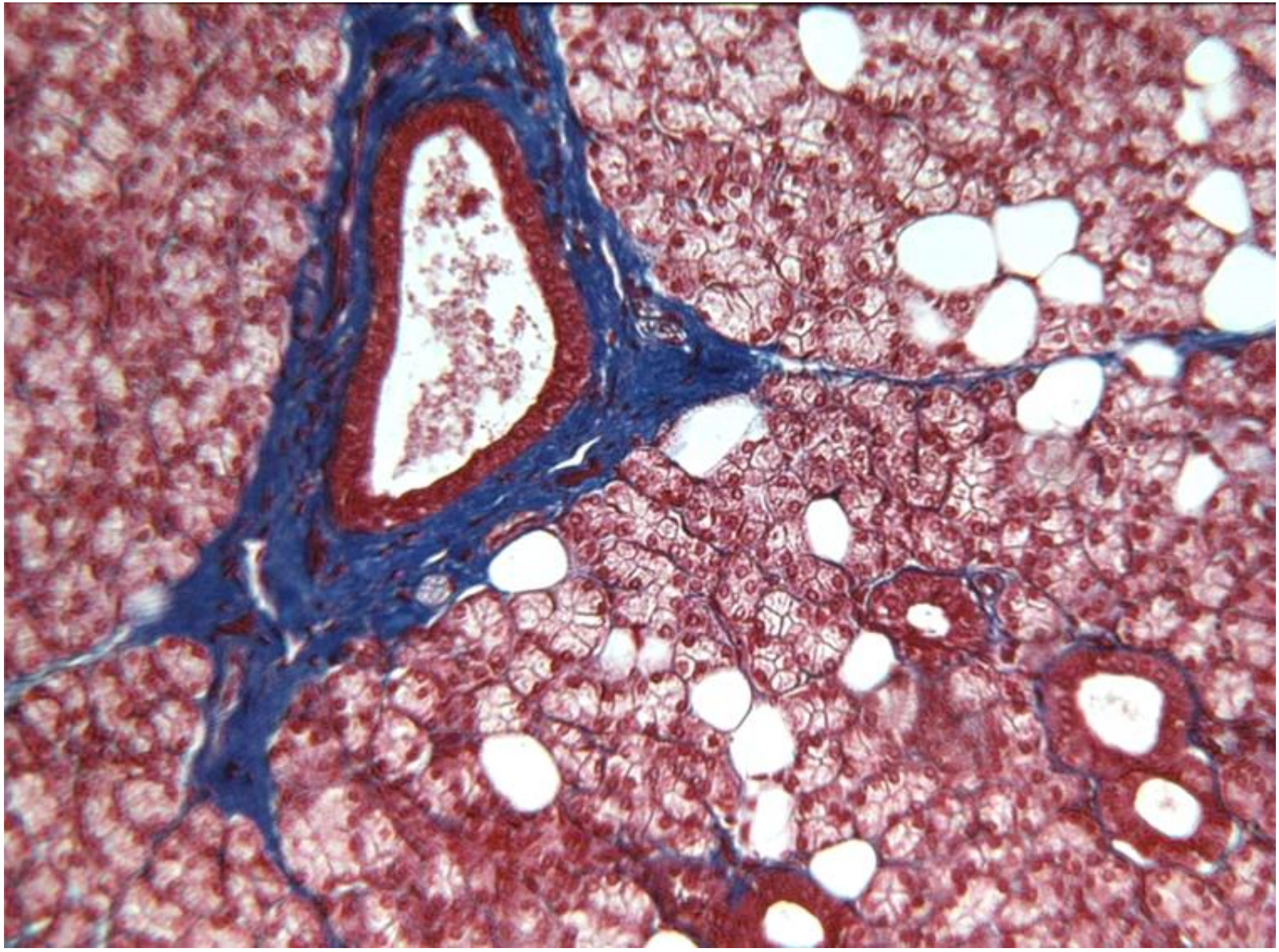
SALIVARY GLANDS

- small (gll. labiales, buccales, retromolares, palatinae, gll. lingualis anterior, gll. Ebneri, gll. Weberi)
- large (gl. parotis, gl. submandibularis, gl. sublingualis)

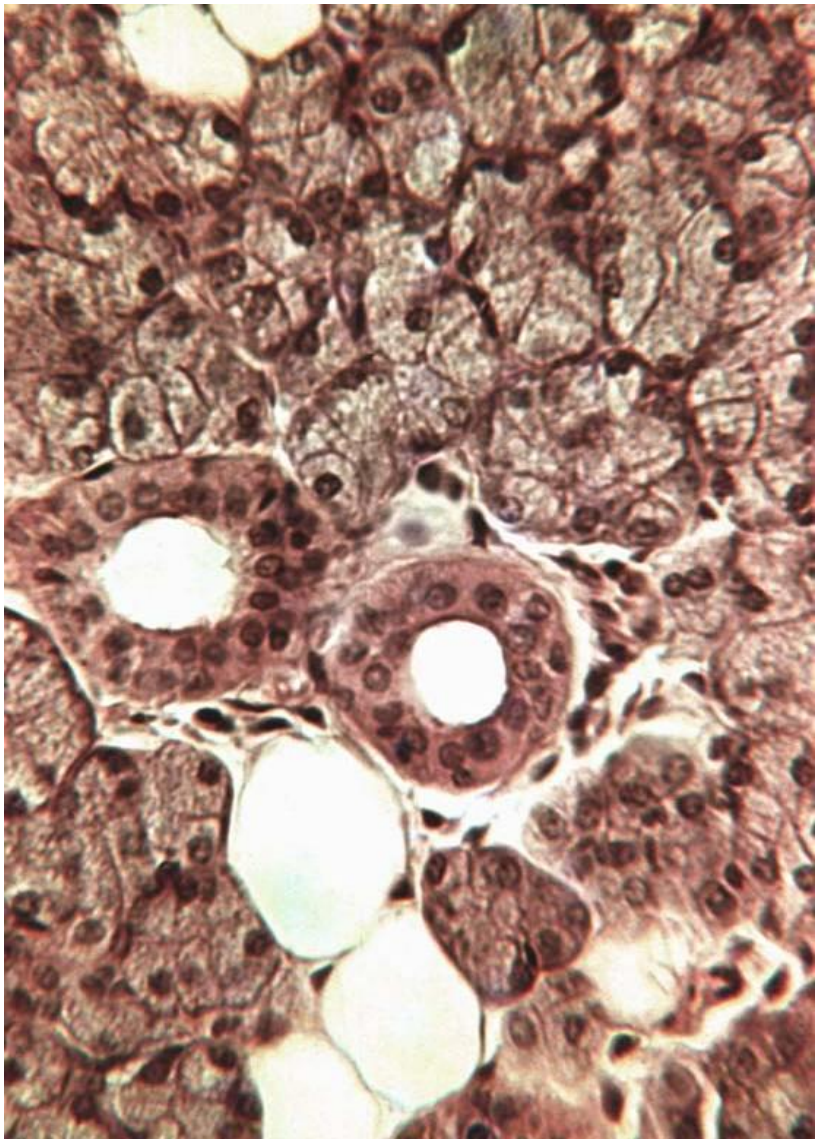


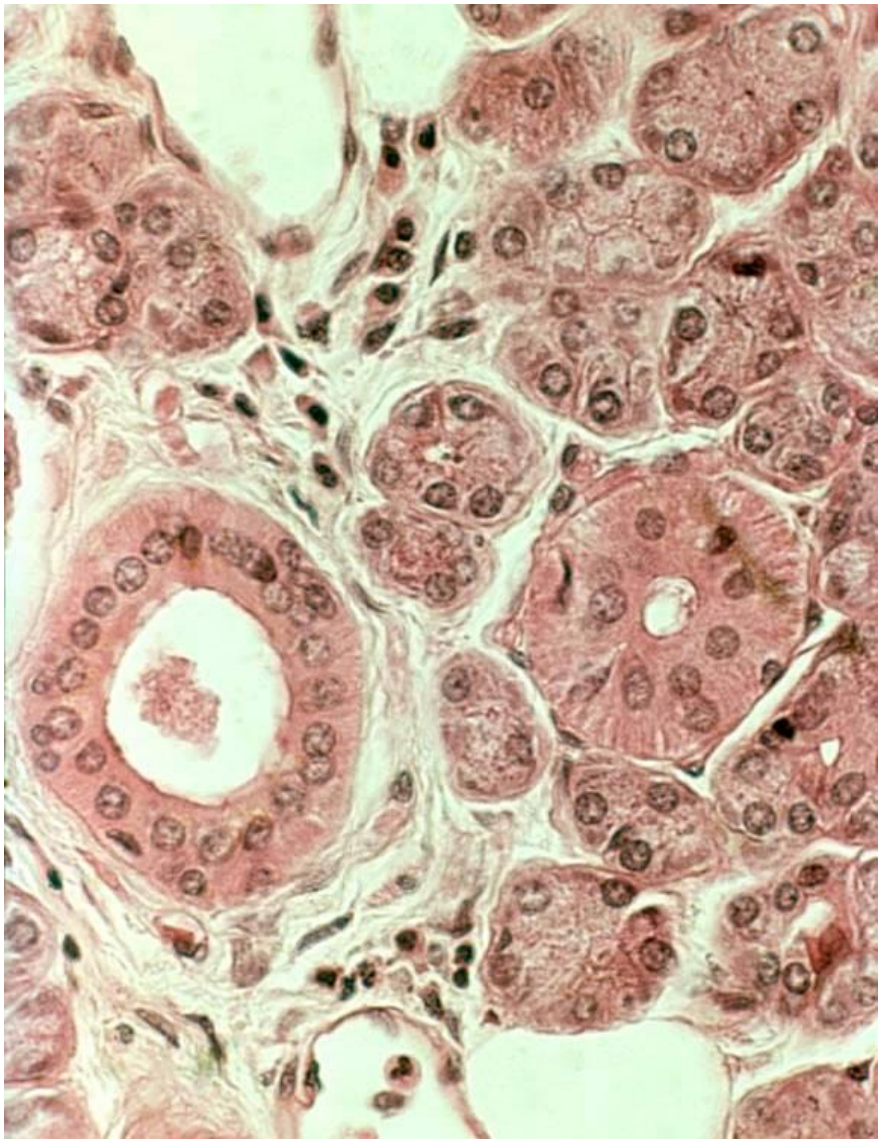
see GIT 3

SALIVARY GLANDS – GL. PAROTIS

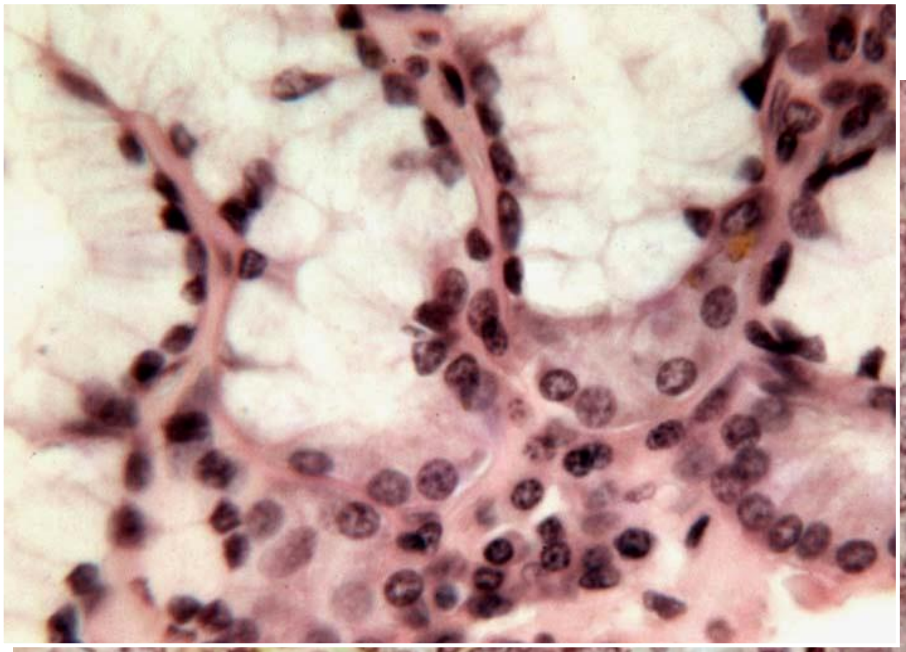


SALIVARY GLANDS – GL. PAROTIS

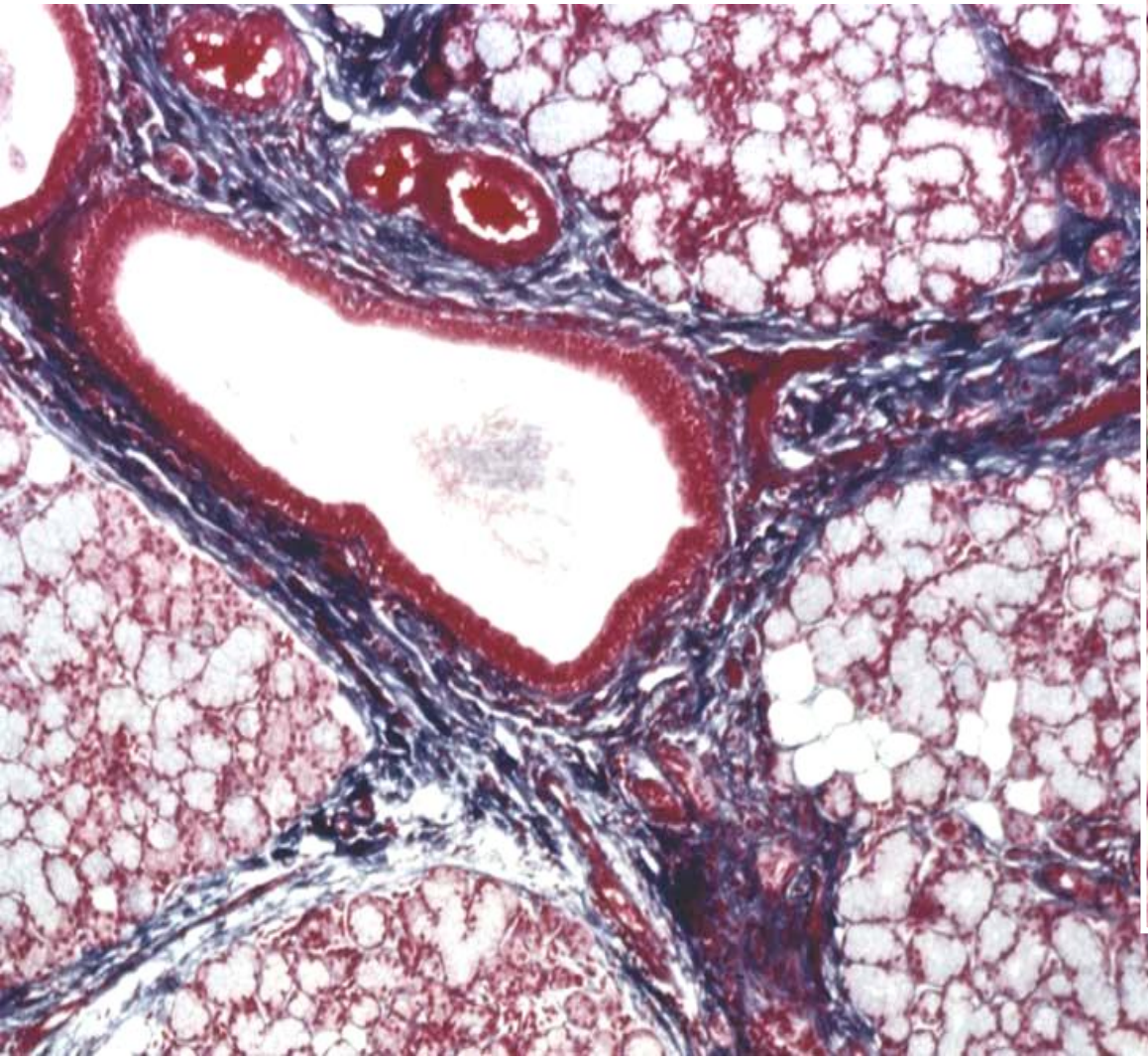


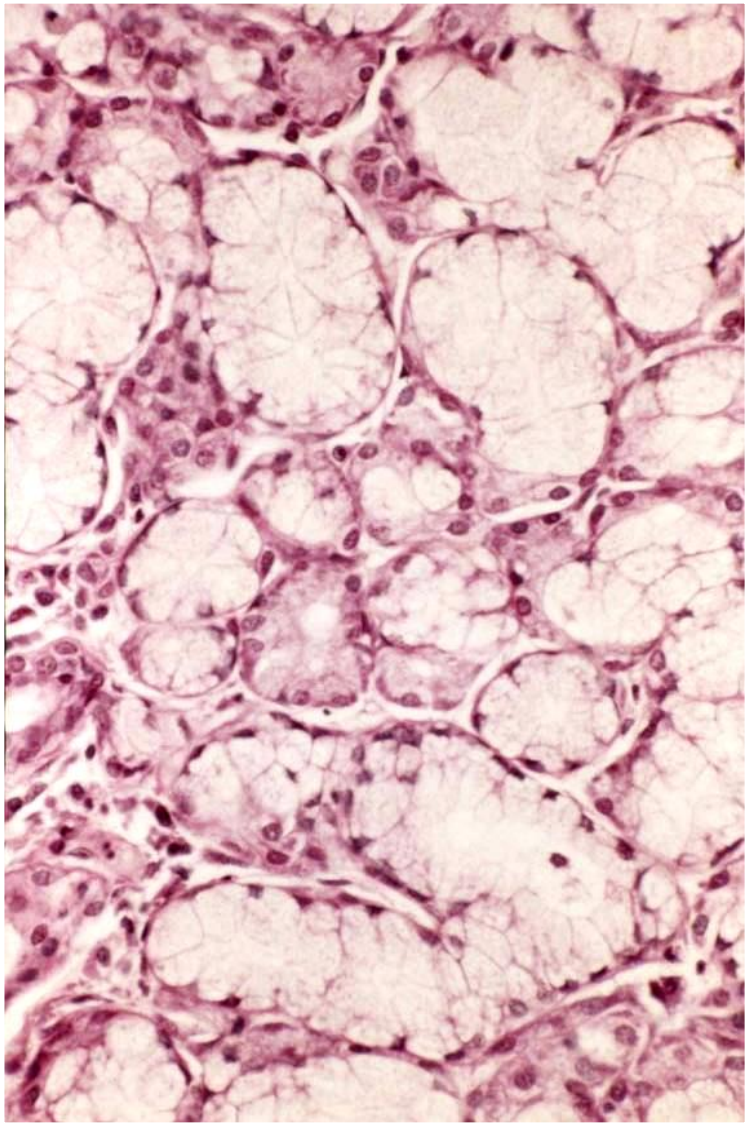


SALIVARY GLANDS – GL. SUBMANDIBULARIS

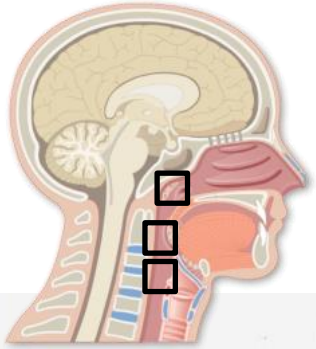


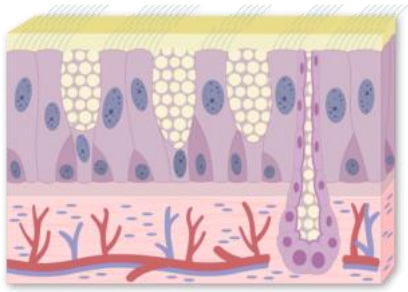
SALIVARY GLANDS – GL. SUBLINGUALIS





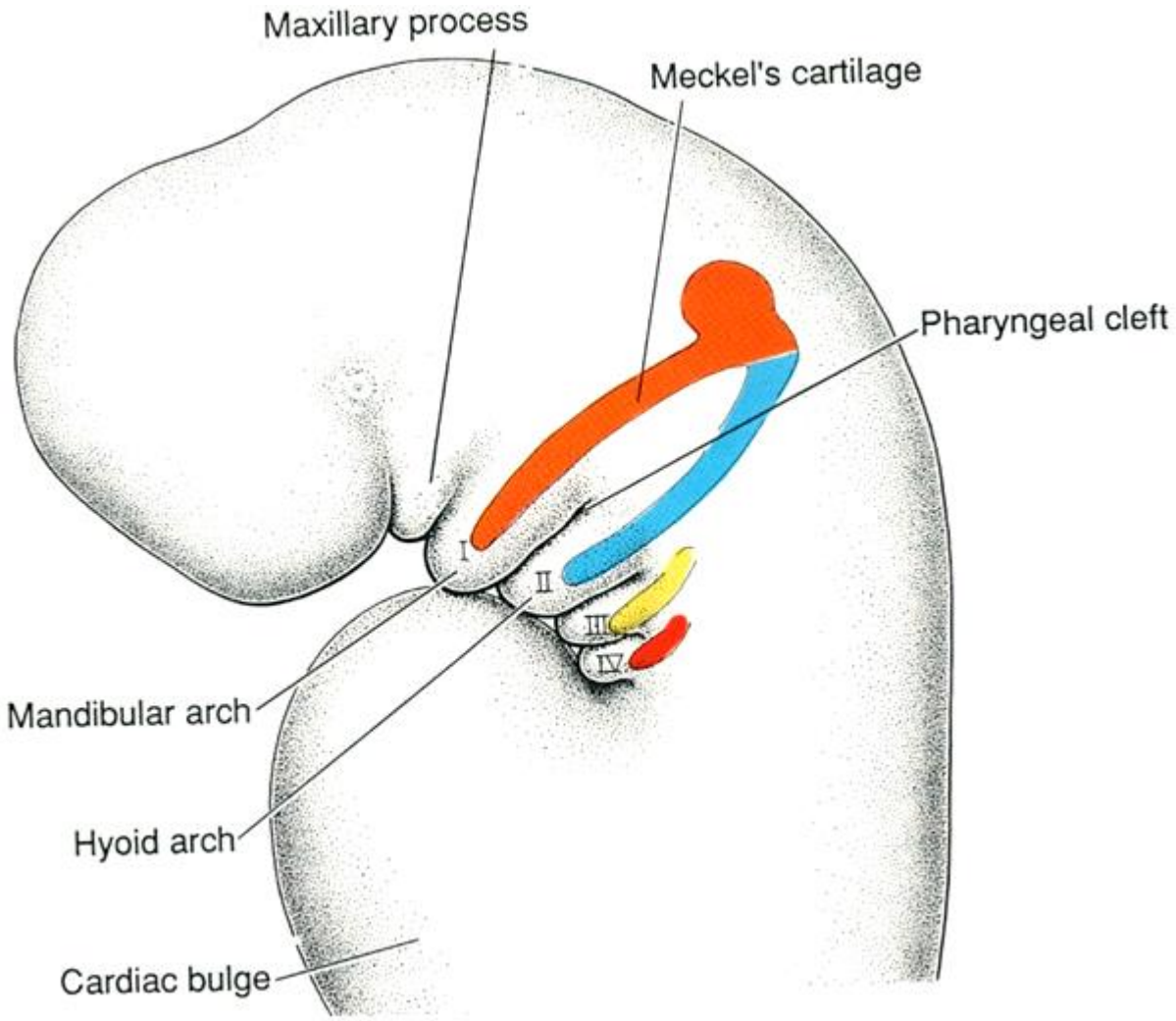
PHARYNX



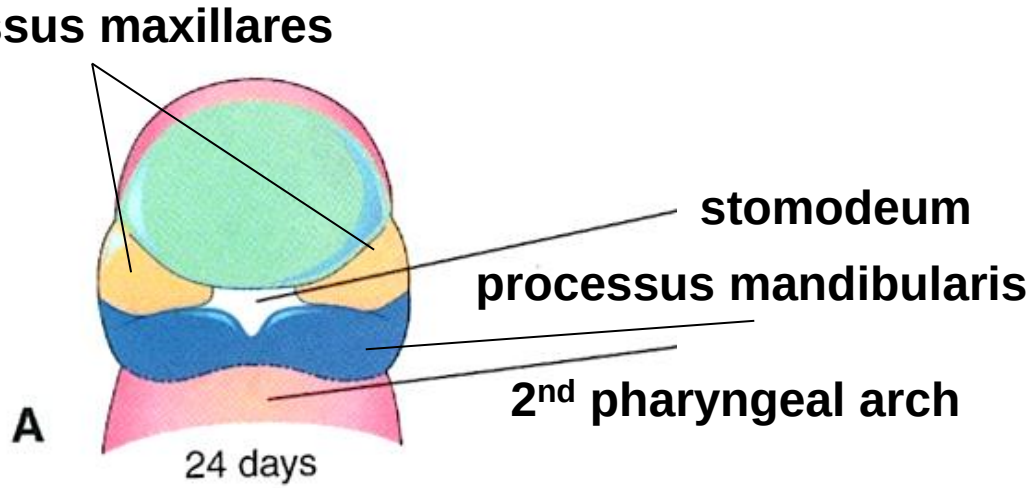


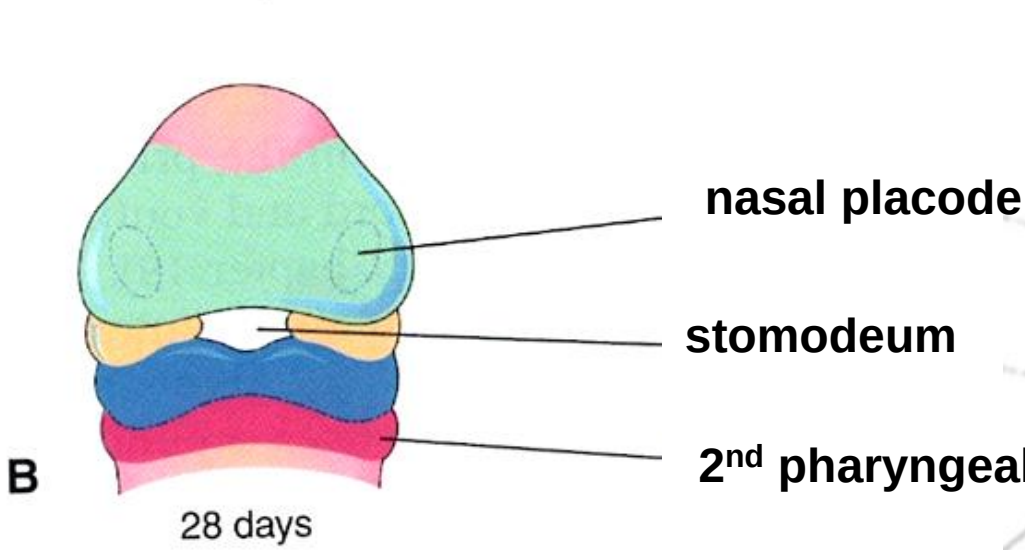
- nasopharynx
- oropharynx
- laryngopharynx

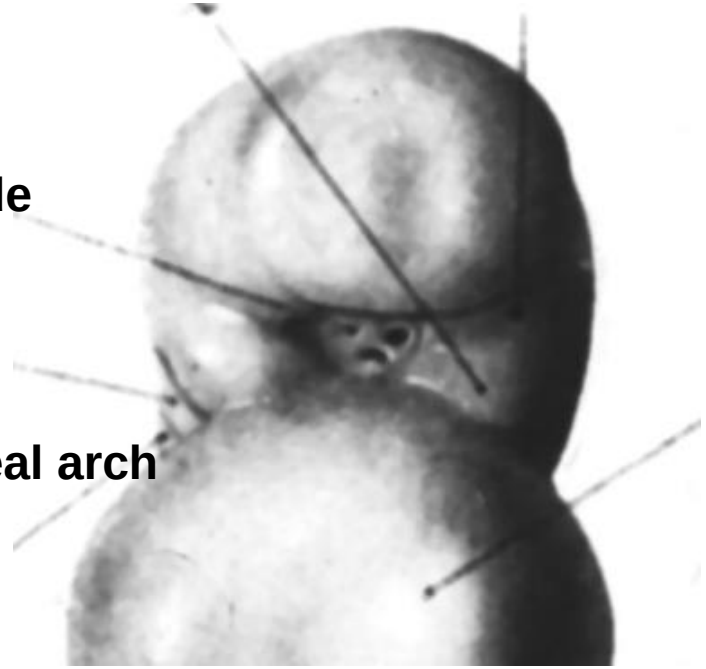
DEVELOPMENT OF FACE



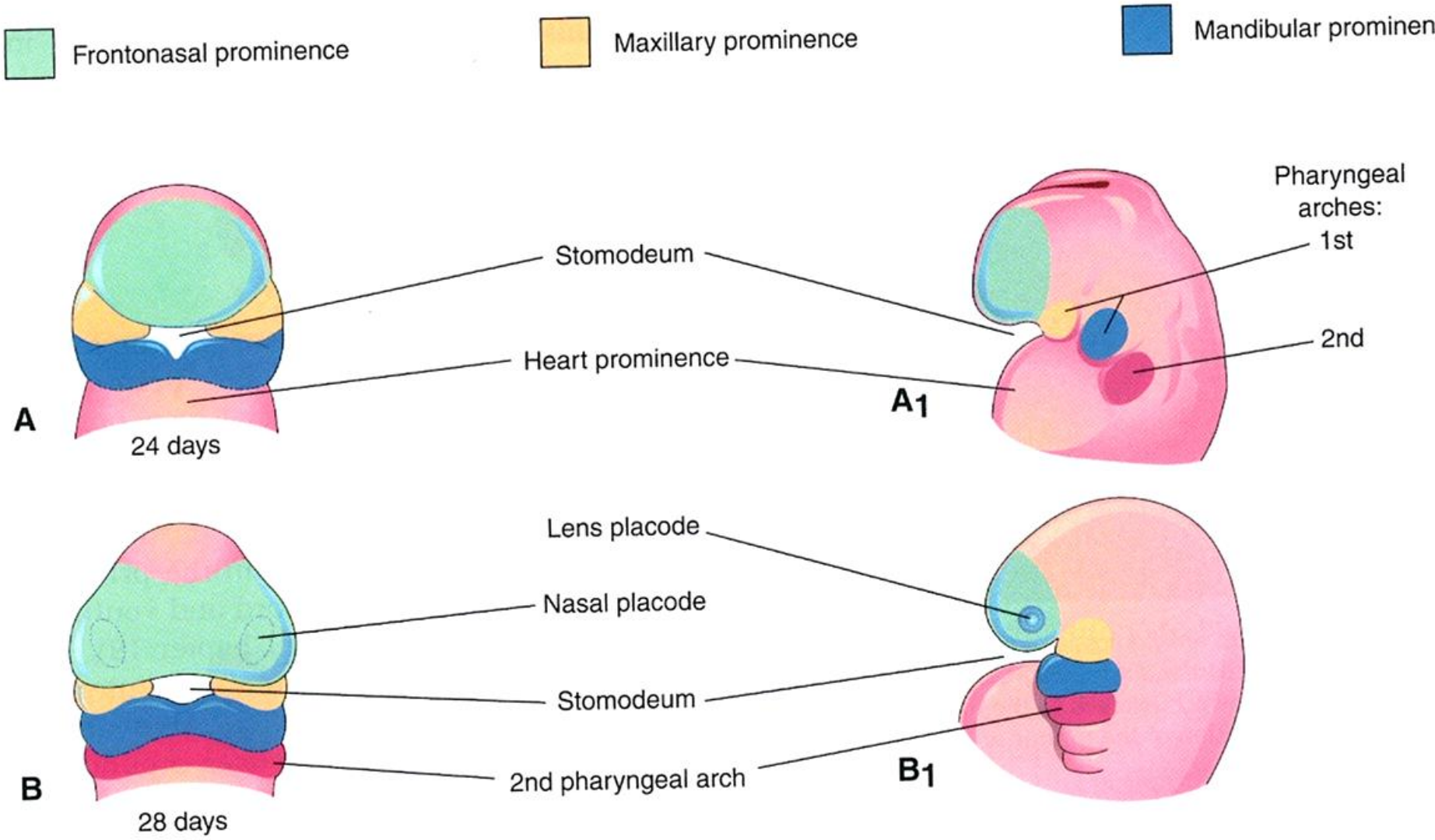
DEVELOPMENT OF FACE





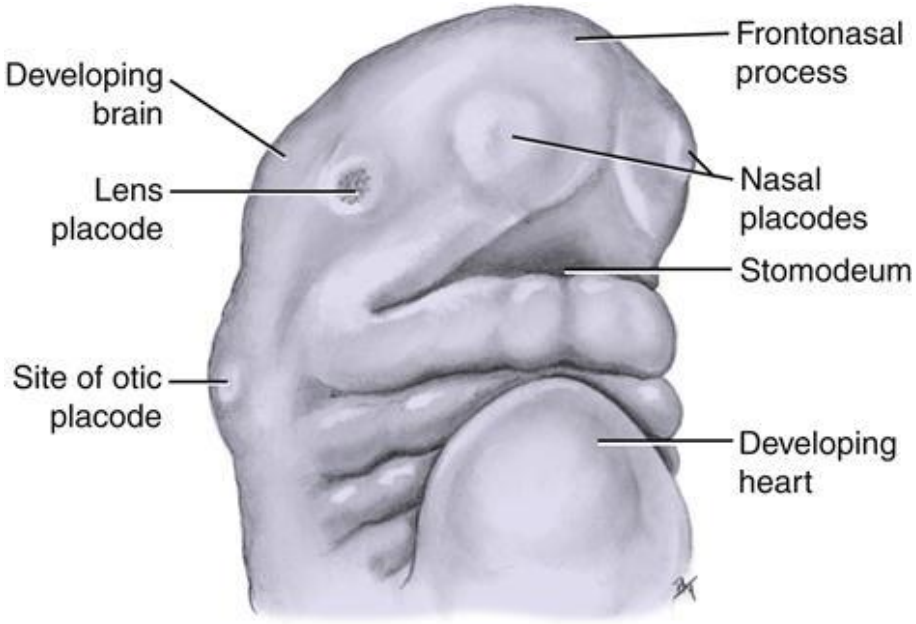


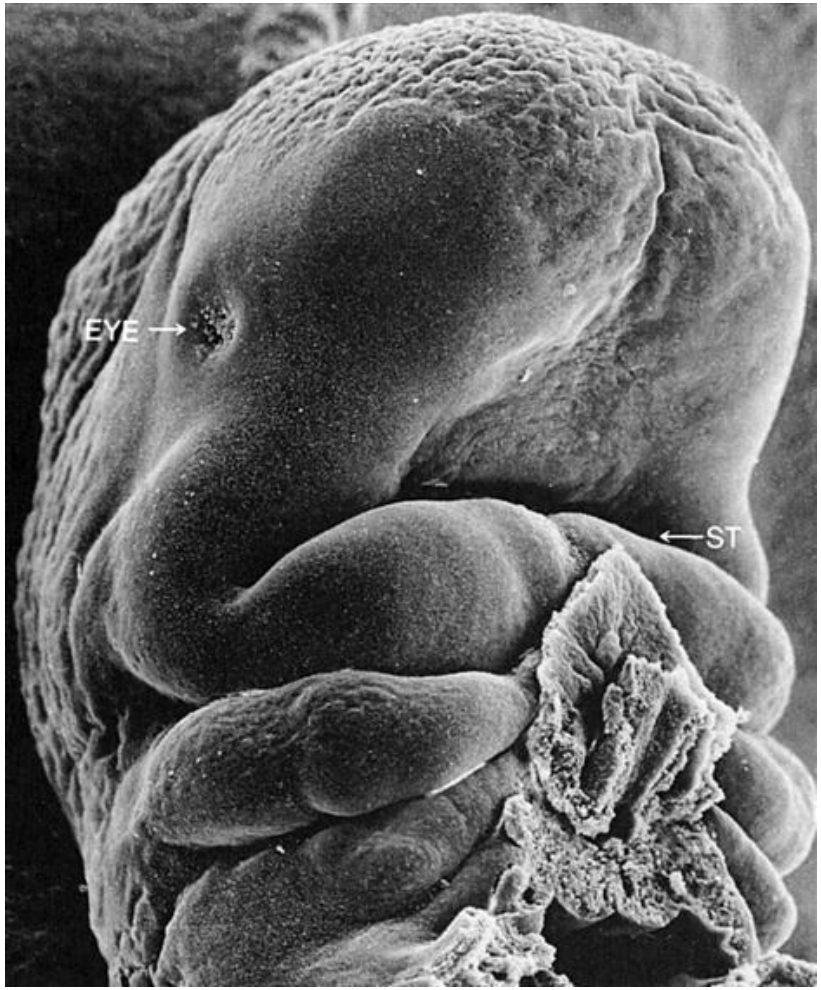
DEVELOPMENT OF FACE



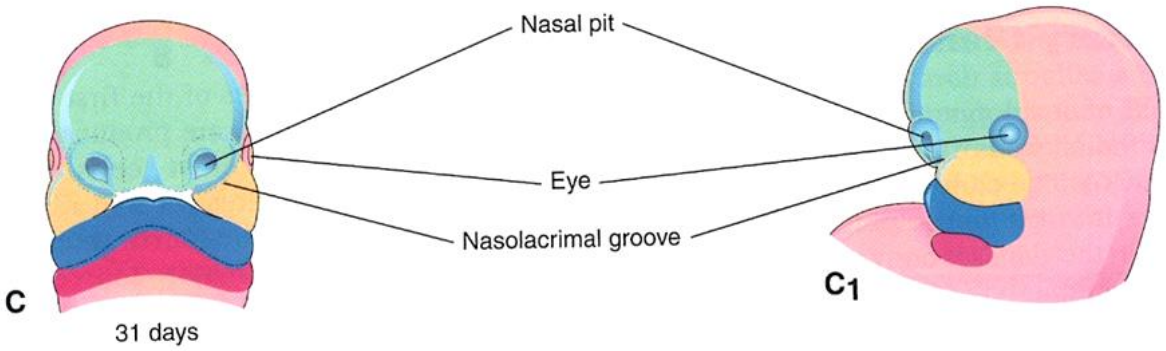
DEVELOPMENT OF FACE

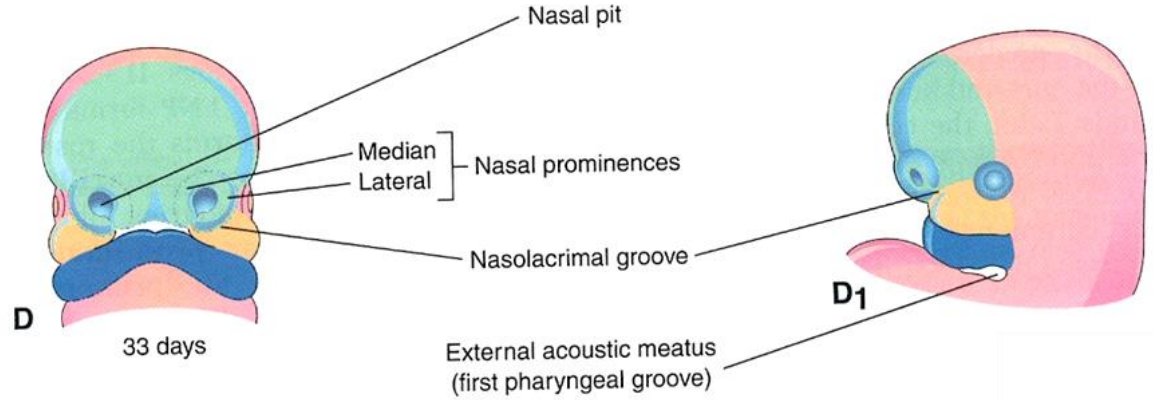
4th week

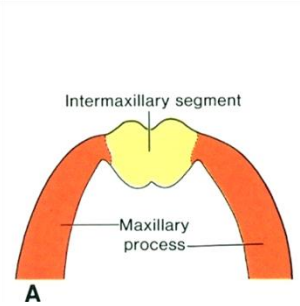


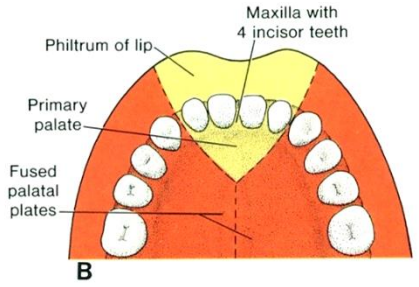


DEVELOPMENT OF FACE



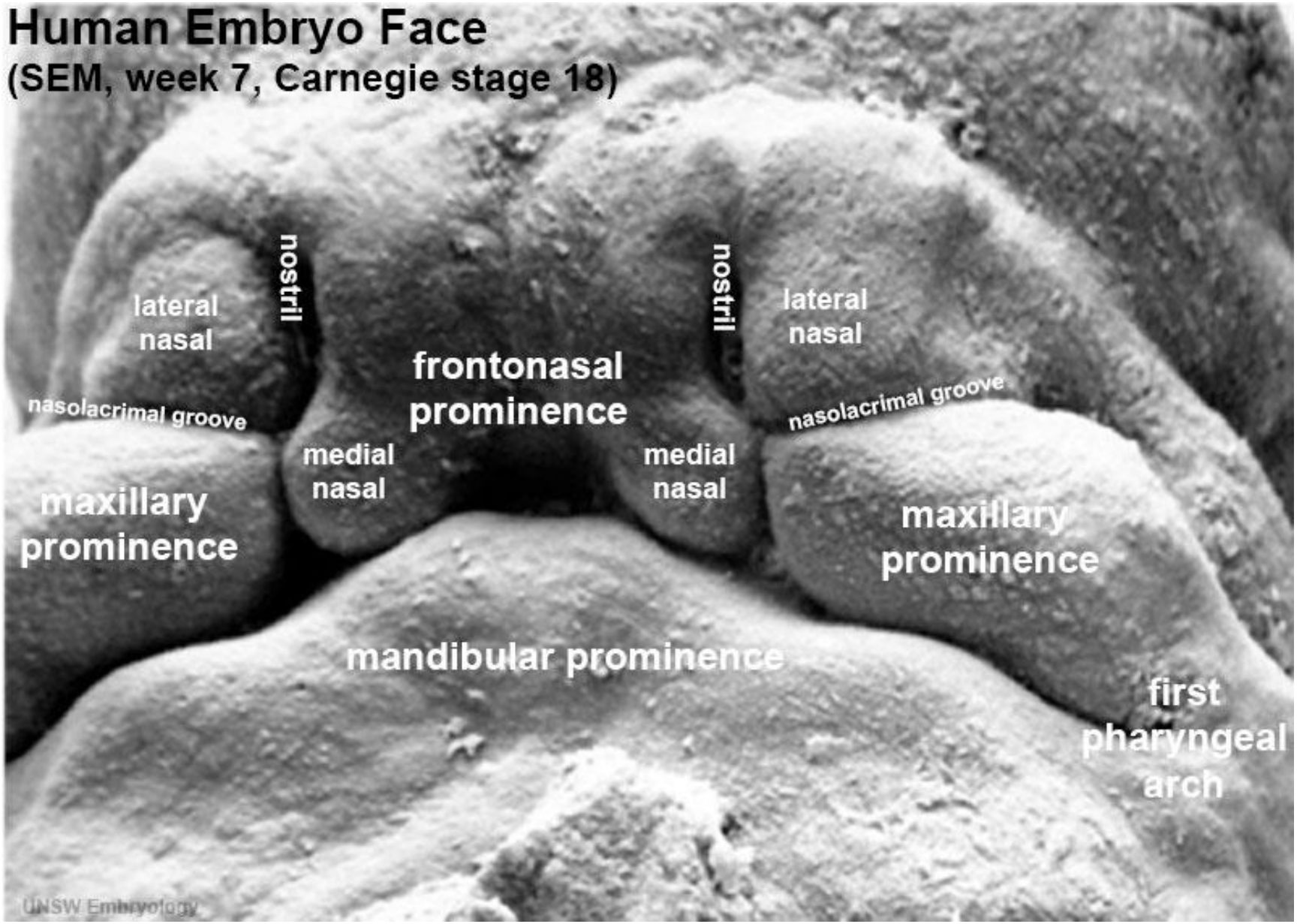




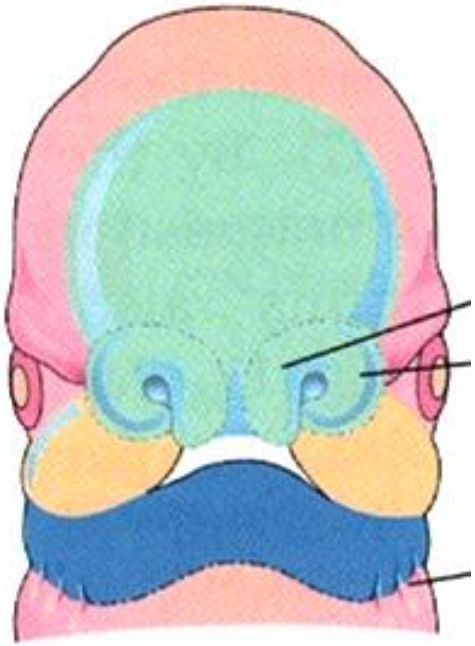


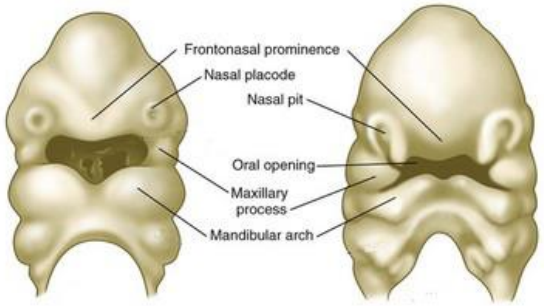
- nasal pits surrrounded by paired prominences – **medial and lateral nasal prominence**
- **area triangularis** (nose)
- **intermaxilary segment** (medial part of upper lip, part of upper jaw, primary palate)

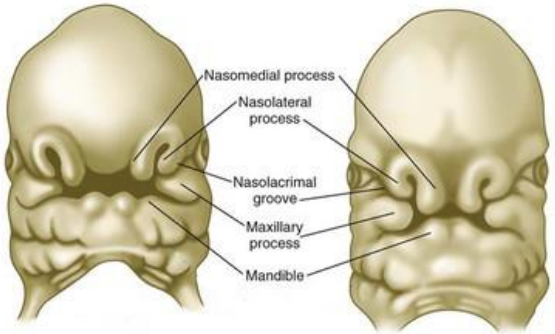
DEVELOPMENT OF FACE

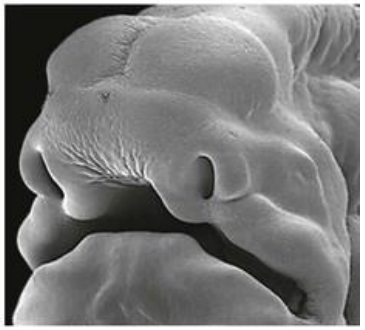


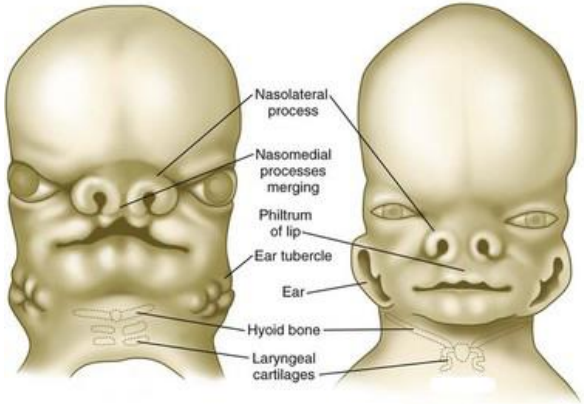
DEVELOPMENT OF FACE

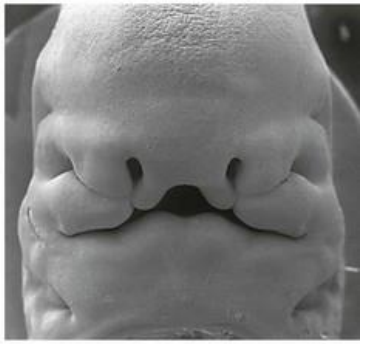












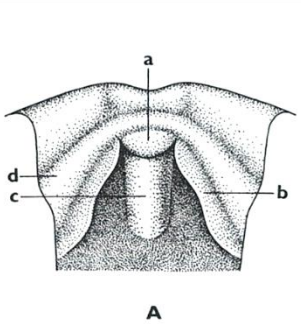
- maxillary prominences fuse with
1. intermaxillary segment
2. lateral nasal prominences
- sulcus nasolacrimalis

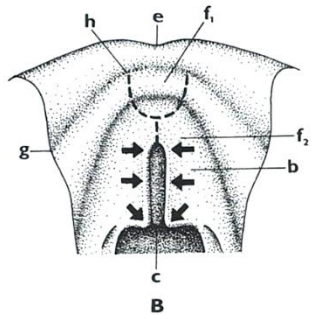
DEVELOPMENT OF FACE

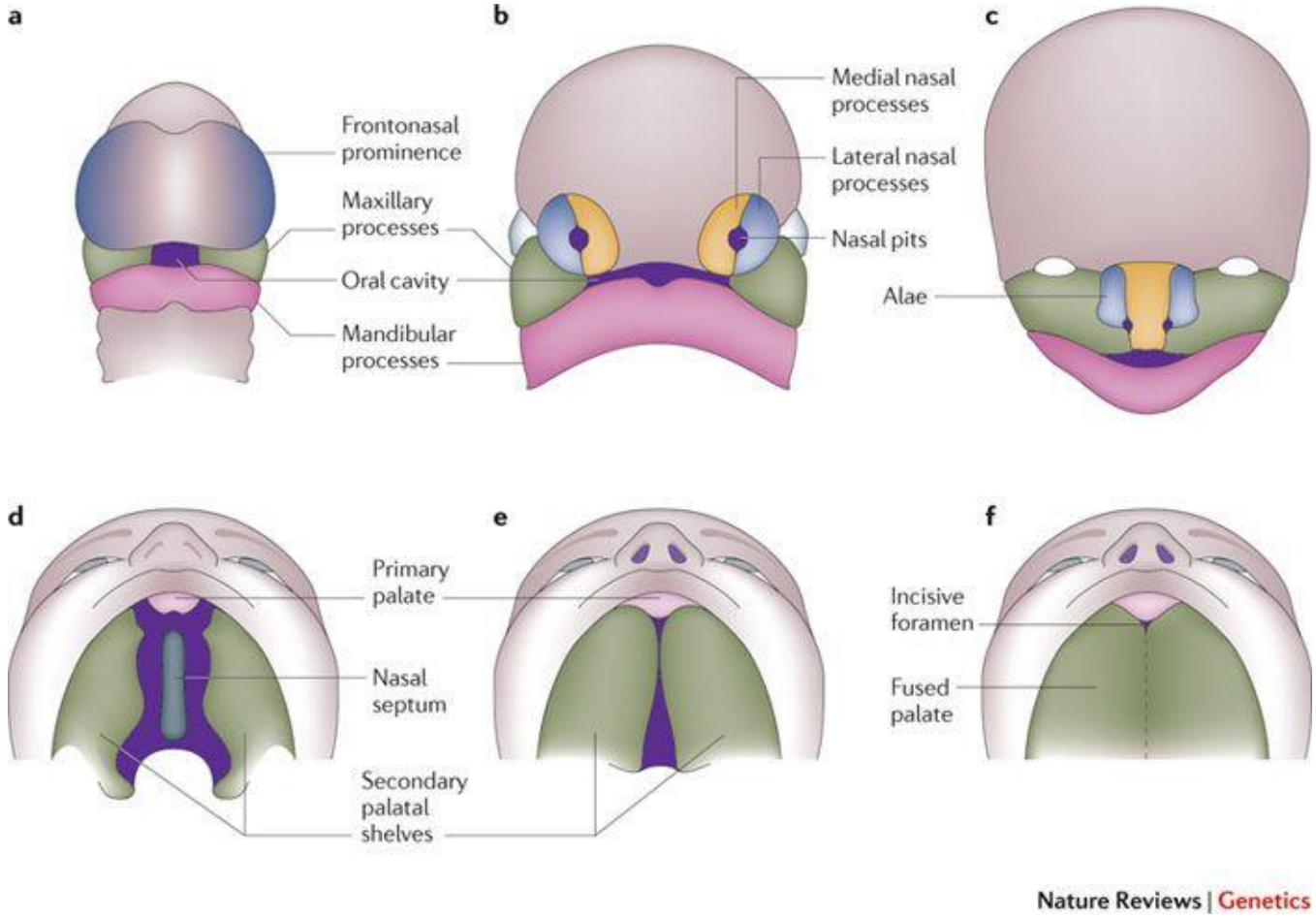
http://www.youtube.com/watch?v=4LQJIf0XLP0

DEVELOPMENT OF FACE - PALATE

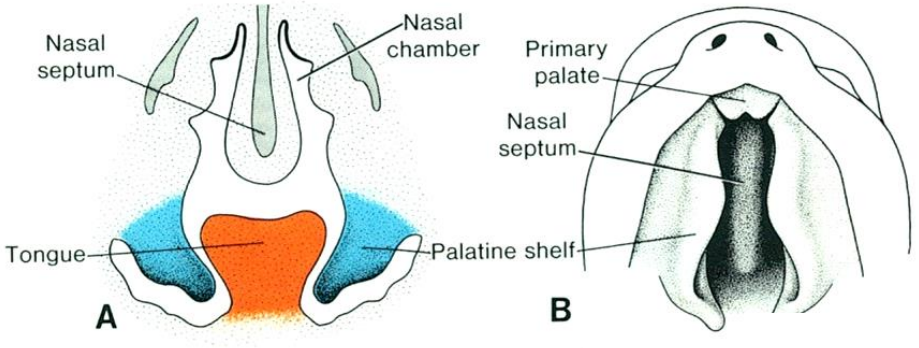
- **primary palate** (intermaxillary segment)
- **secondary palate** (lateral palate shelves

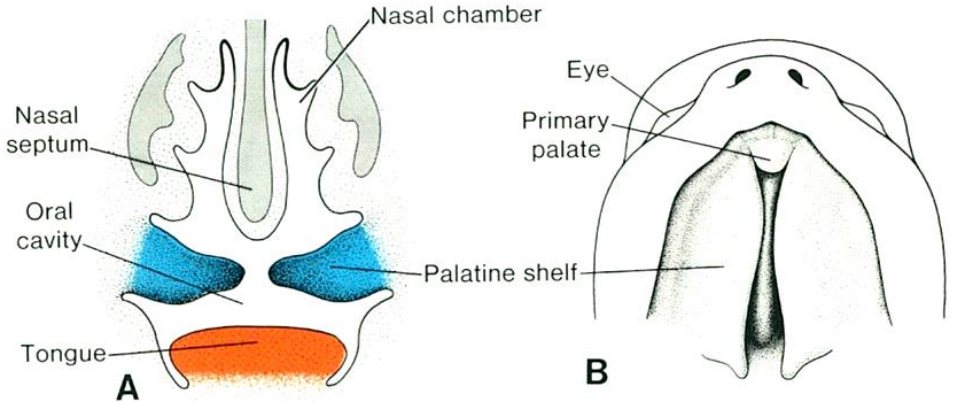


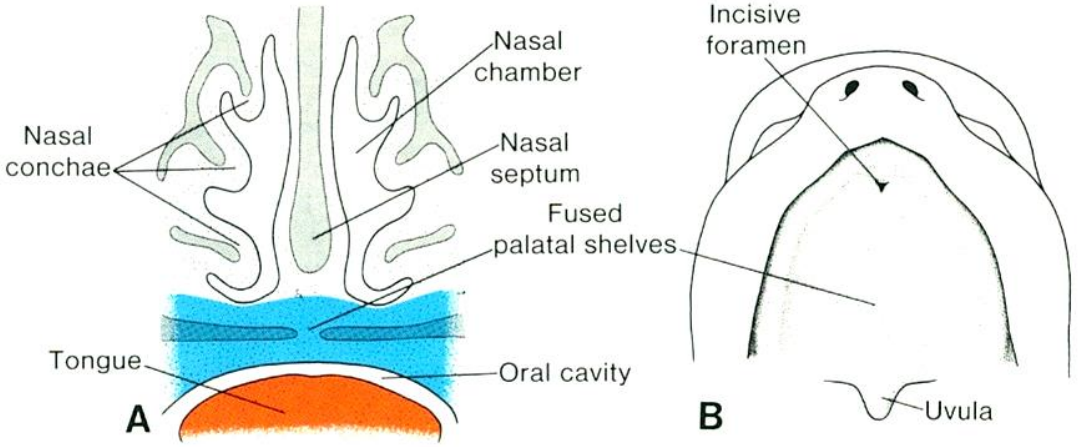




DEVELOPMENT OF FACE - PALATE

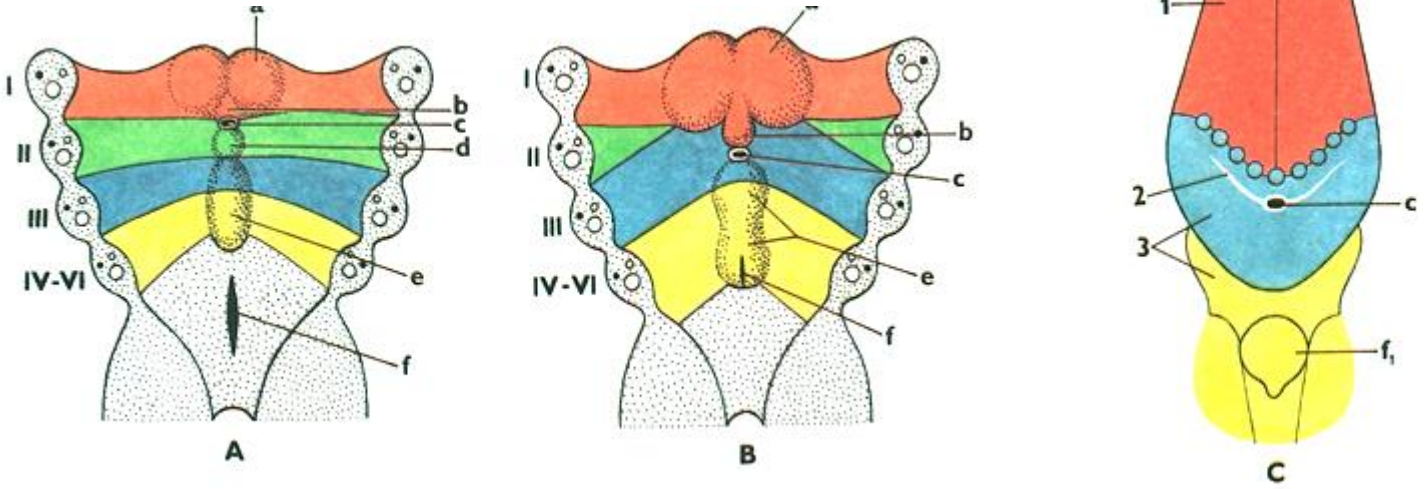






DEVELOPMENT OF TONGUE

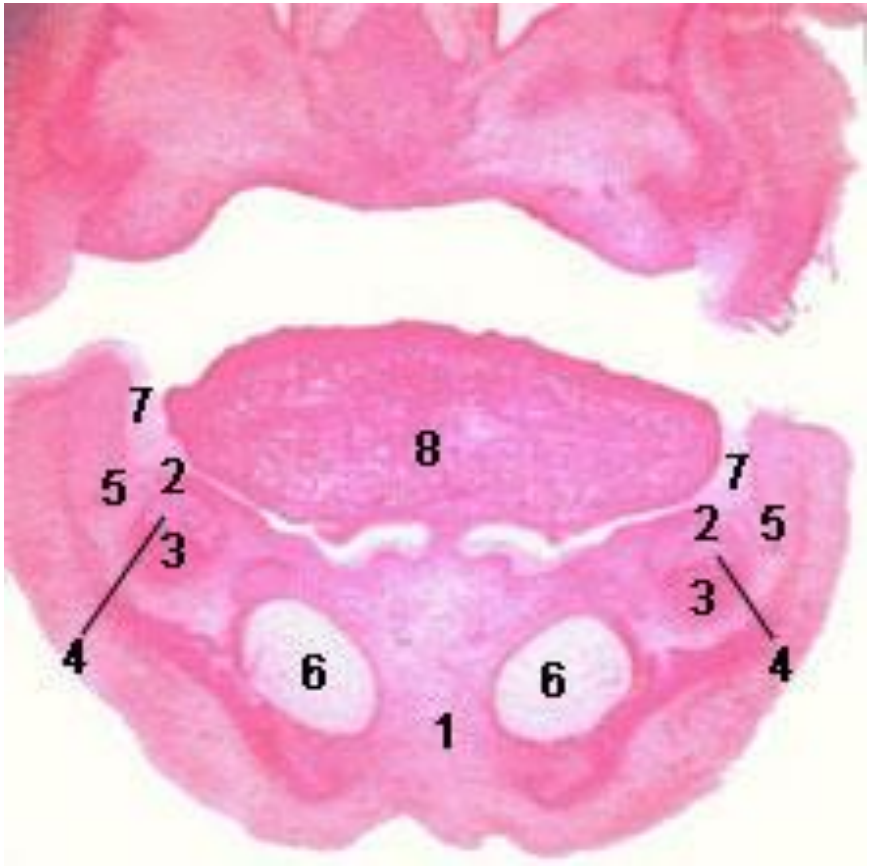
Pharyngeal arches:
I. tuberculum linguale laterale (dx. wt sin.) (paired) and tuberculum impar → **apex and corpus**
III and IV. copula and eminentia hypobranchialis → **radix**



DEVELOPMENT OF VESTIBULUM ORIS

Vestibular lamina

- Dental lamina
- Labiogingival lamina

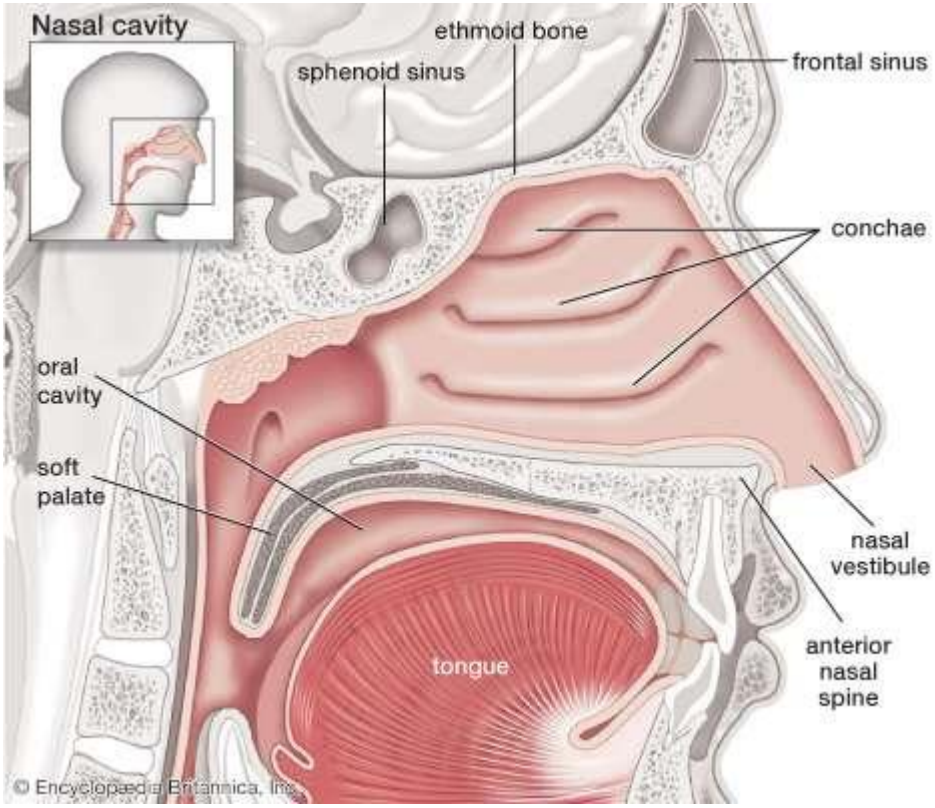


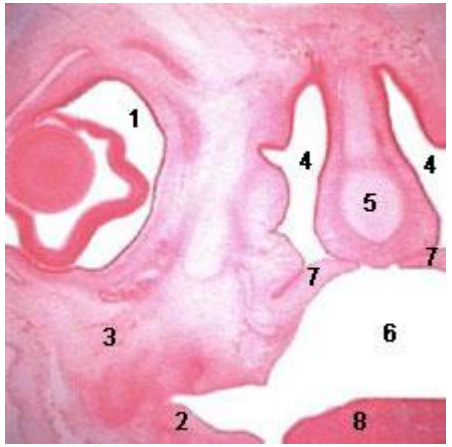
1. Mandible
2. Dental lamina
3. Dental papilla
4. Enamel organ
5. Labiogingival lamina
6. Meckel's cartilage
7. Oral epithelium
8. Tongue

http://www.chronolab.com/atlas/embryo/histo_head.htm

DEVELOPMENT OF VESTIBULUM NASI

- **Nasal canals** – primitive choans
- **Nasal septum** – from area triangularis – fusing with secondary palate

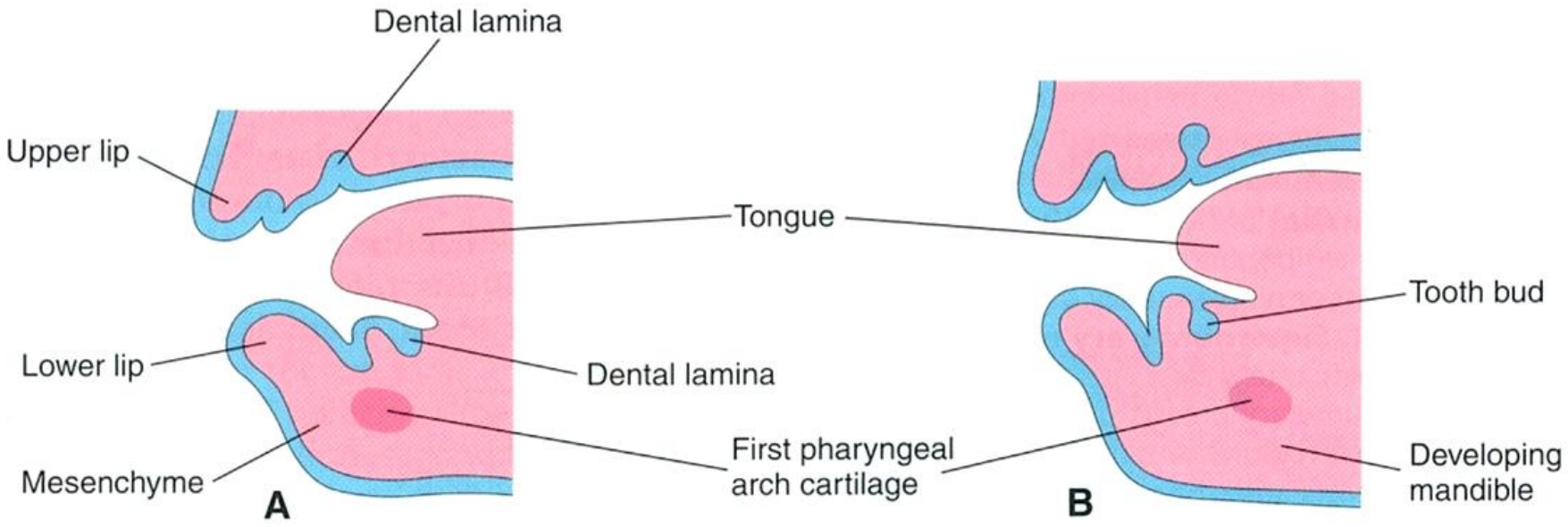




1. Eye
2. Mandibular bone
3. Maxillary bone
4. Nasal cavity
5. Nasal septum
6. Oral cavity
7. Palatine process
8. Tongue

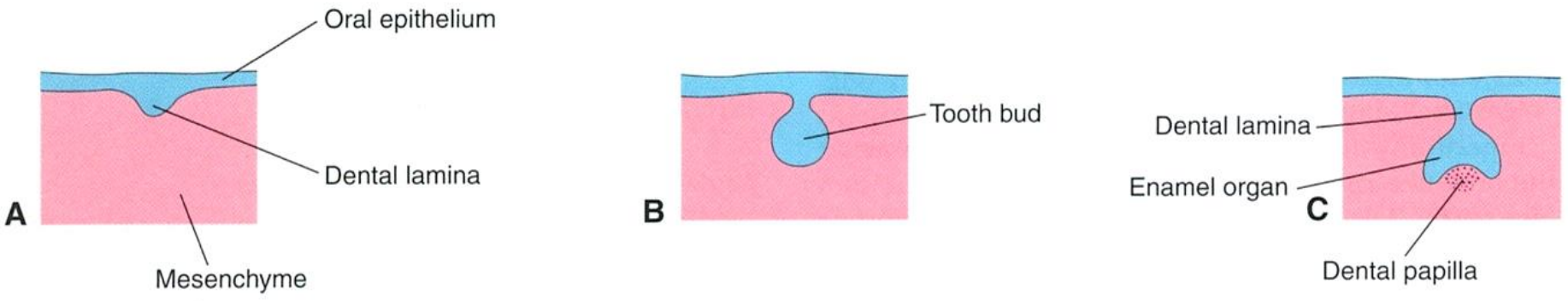
Interactions of ectoderm and mesenchyme

- primary dental lamina – teeth primordia



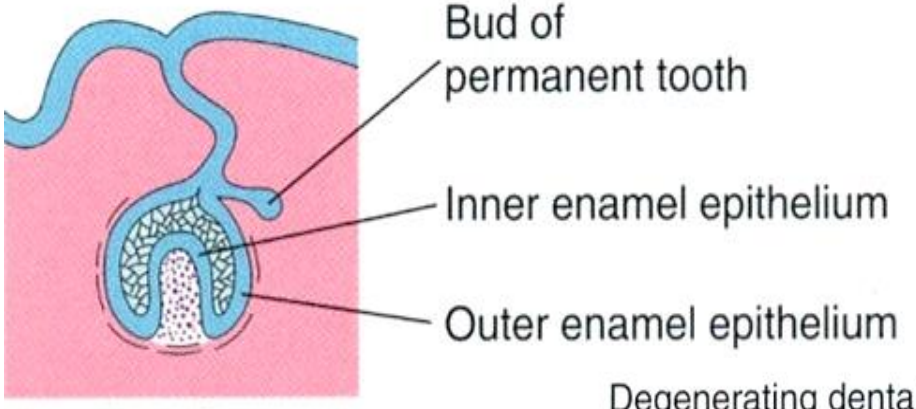
DEVELOPMENT OF TOOTH

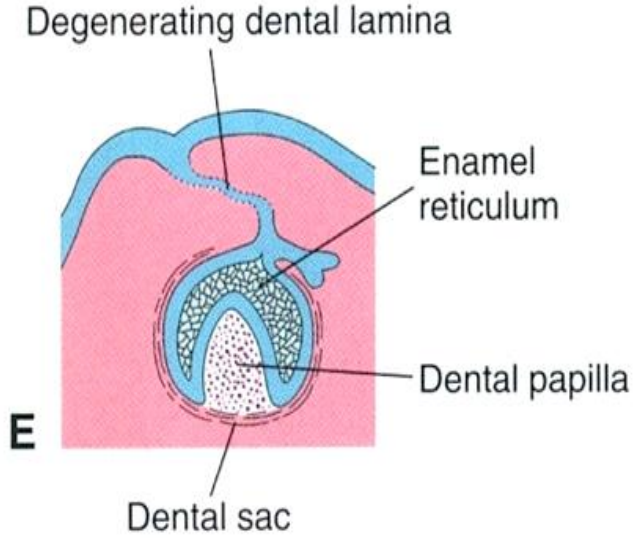
- Inititation stage
- tooth bud (primordium)
- cap stage
- bell stage (enamel organ, ectoderm), dental pulp (mesenchyme)

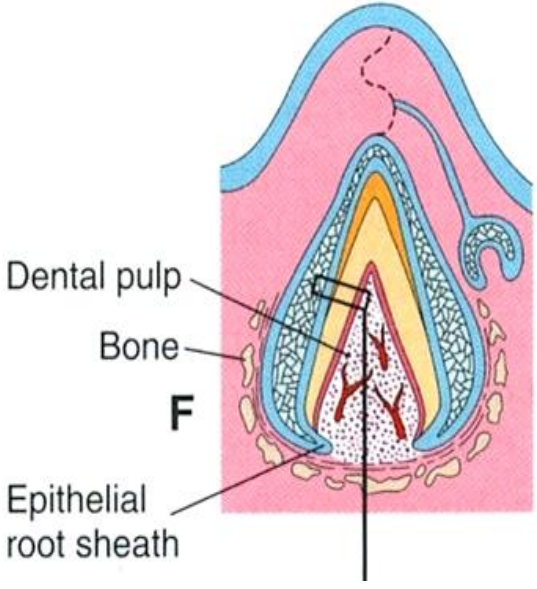


DEVELOPMENT OF TOOTH

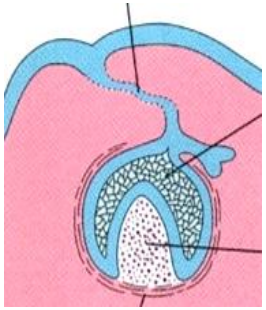
- bell stage – enamel, differentiation of odontoblasts from cells of dental pulp
- enamel prisms and dentin matrix
- dental sac

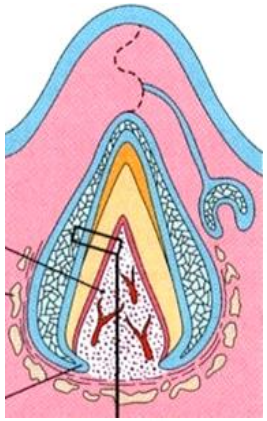




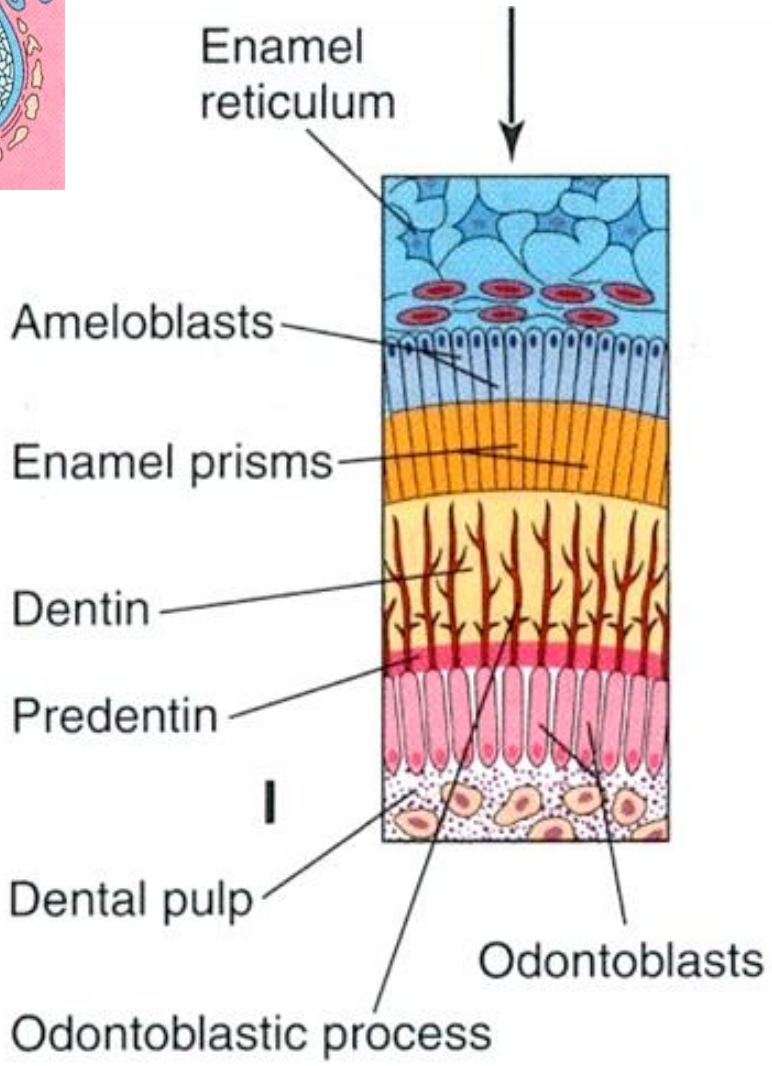


DEVELOPMENT OF TOOTH





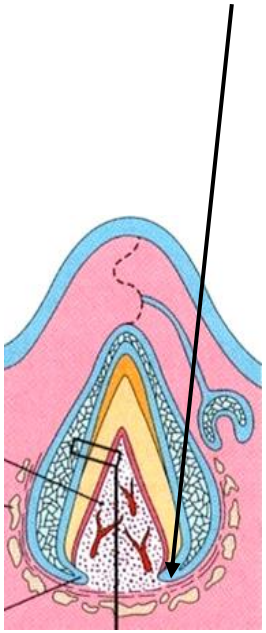
- enamel organ (inner and outer ambelobalsts, stratum intermedium stellate reticulum - pulp) – prisms
- odontoblast differentiation - dentin matrix, (processes of odontoblasts = Tomes fibers)

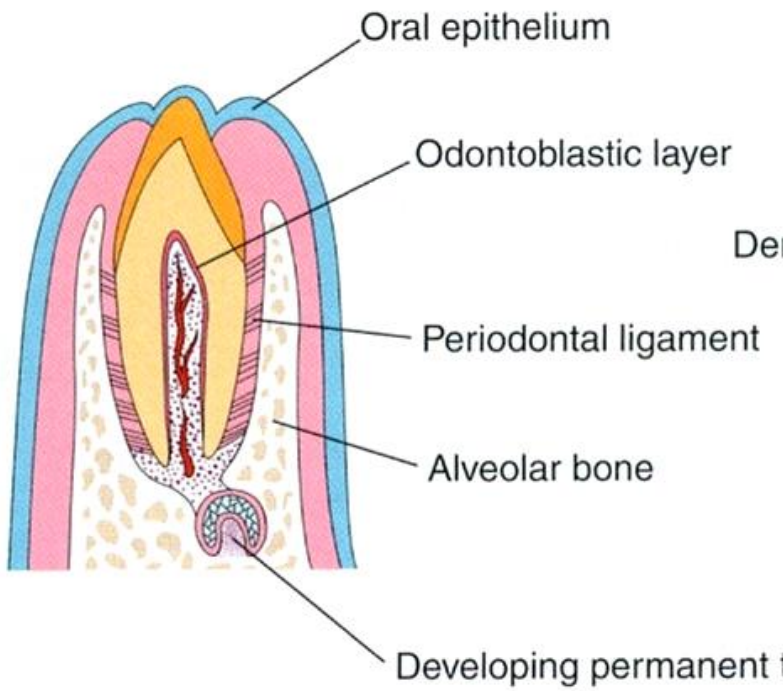


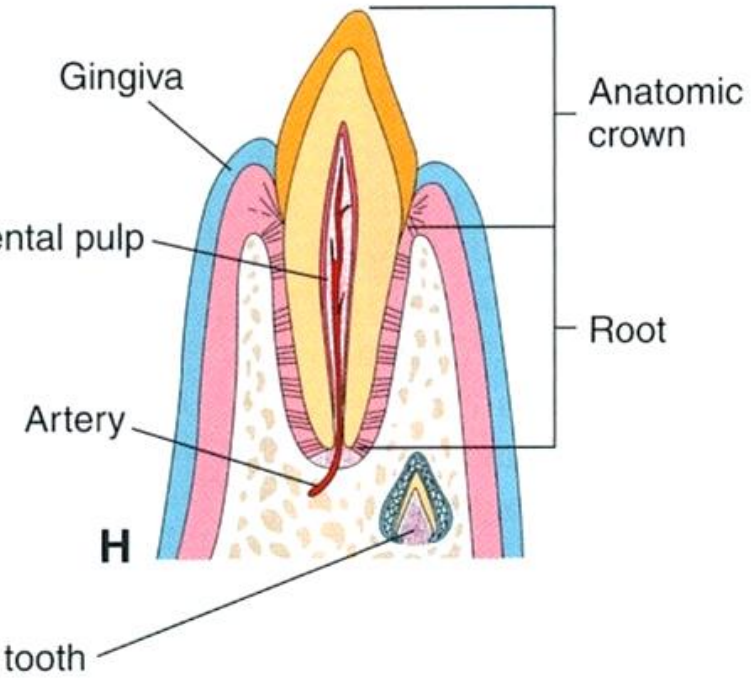
DEVELOPMENT OF TOOTH

root development – tooth eruption

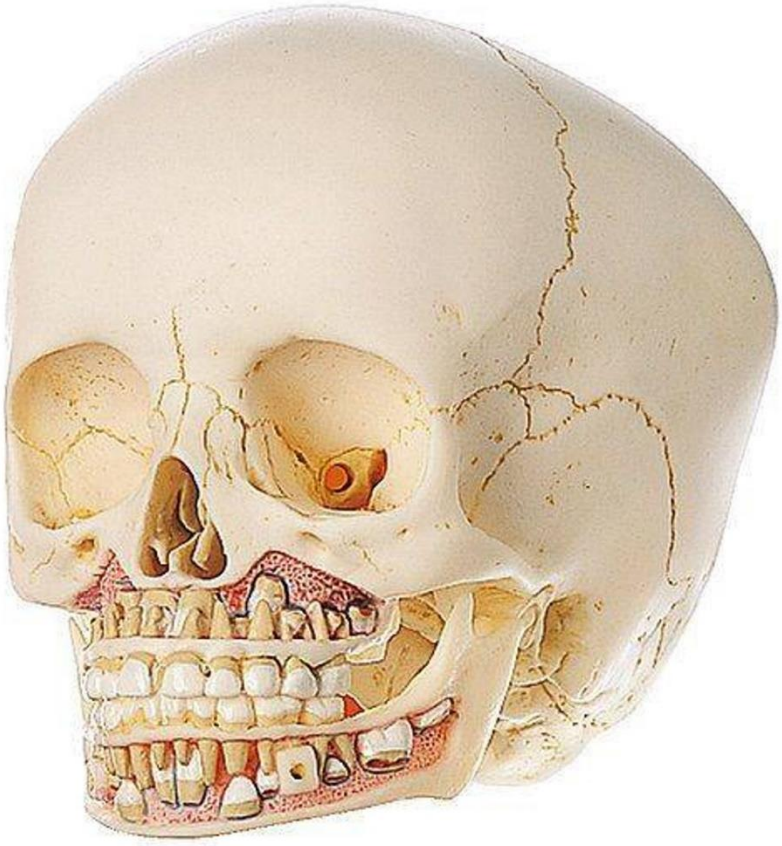
cervical loop → Hertwig epithelial root sheath

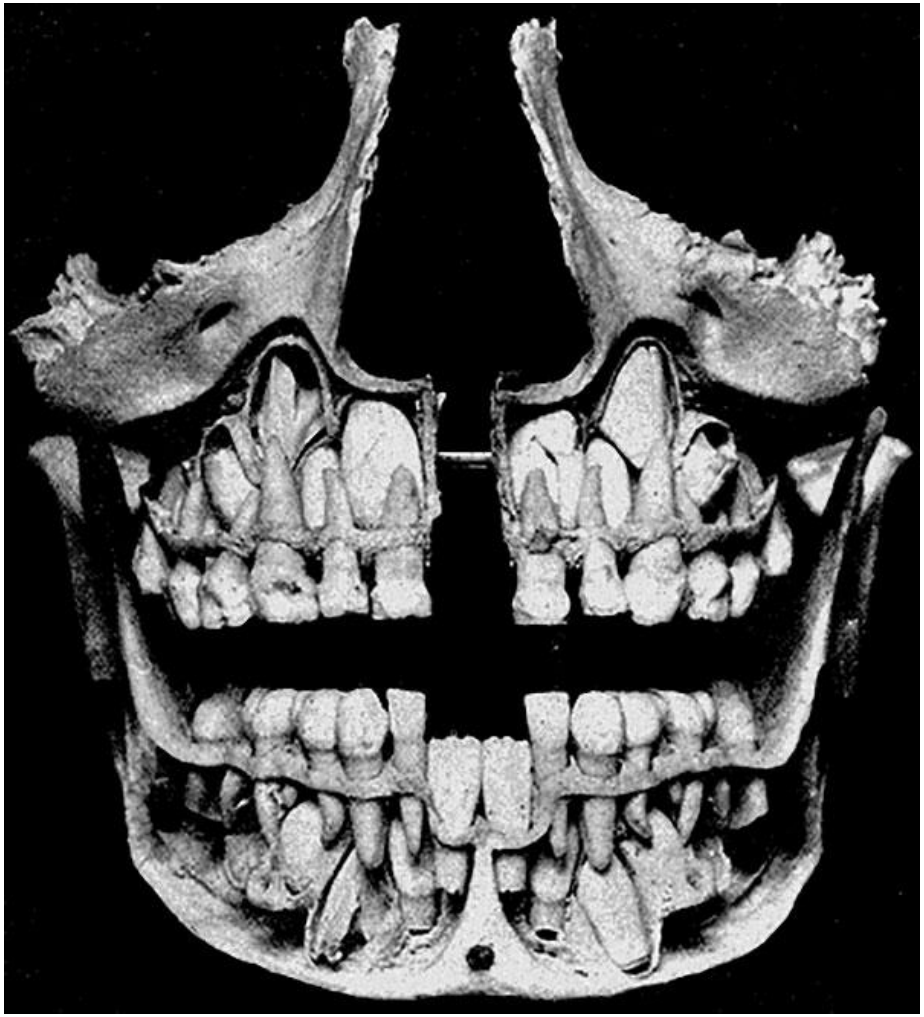




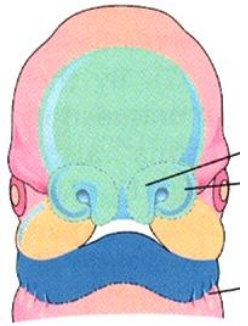


DEVELOPMENT OF TOOTH

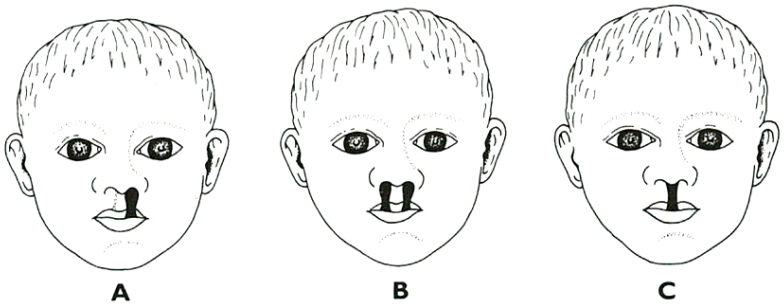




Soft tissue clefts



- upper lip (*cheiloschisis*) – lateral (uni, bi), medial
- lower lip – medial, always combined (jaw, tongue) – *gnathoschisis et cheiloschisis inf*.
- oblique cleft (*fissura orbitofacialis*)
- transferse cleft (*fissura transversa*)

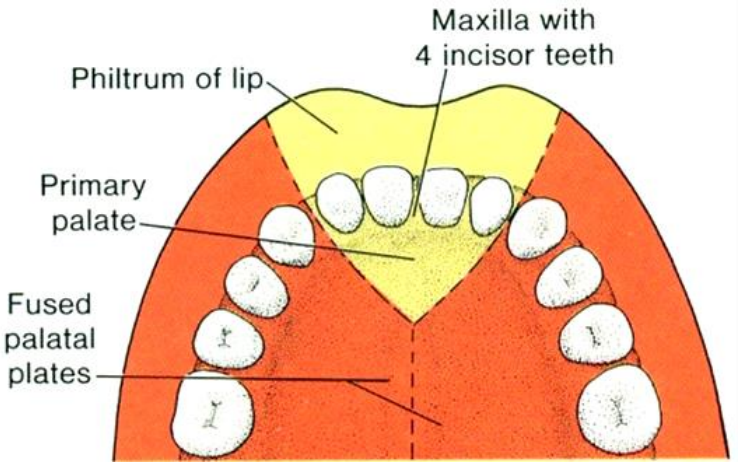


ABNORMALITIES OF FACE DEVELOPMENT - CLEFTS

Hard tissue clefts

- upper jaw
- between 2nd incisor and canine
- unilateral or bilateral
- always combined with palate cleft (cheilognathoschisis)

- palate (palatoschisis)
- primary (before foramen incisivum)
- secondary (behind foramen incisivum)
- combined: cheilognathopalatoschisis



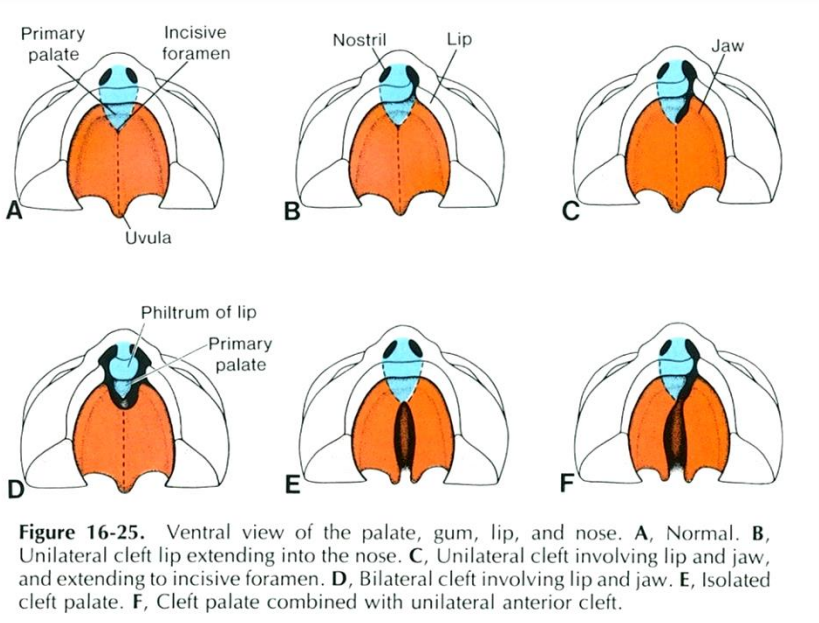


Figure 16-25. Ventral view of the palate, gum, lip, and nose. **A**, Normal. **B**, Unilateral cleft lip extending into the nose. **C**, Unilateral cleft involving lip and jaw, and extending to incisive foramen. **D**, Bilateral cleft involving lip and jaw. **E**, Isolated cleft palate. **F**, Cleft palate combined with unilateral anterior cleft.

ABNORMALITIES OF FACE DEVELOPMENT - CLEFTS

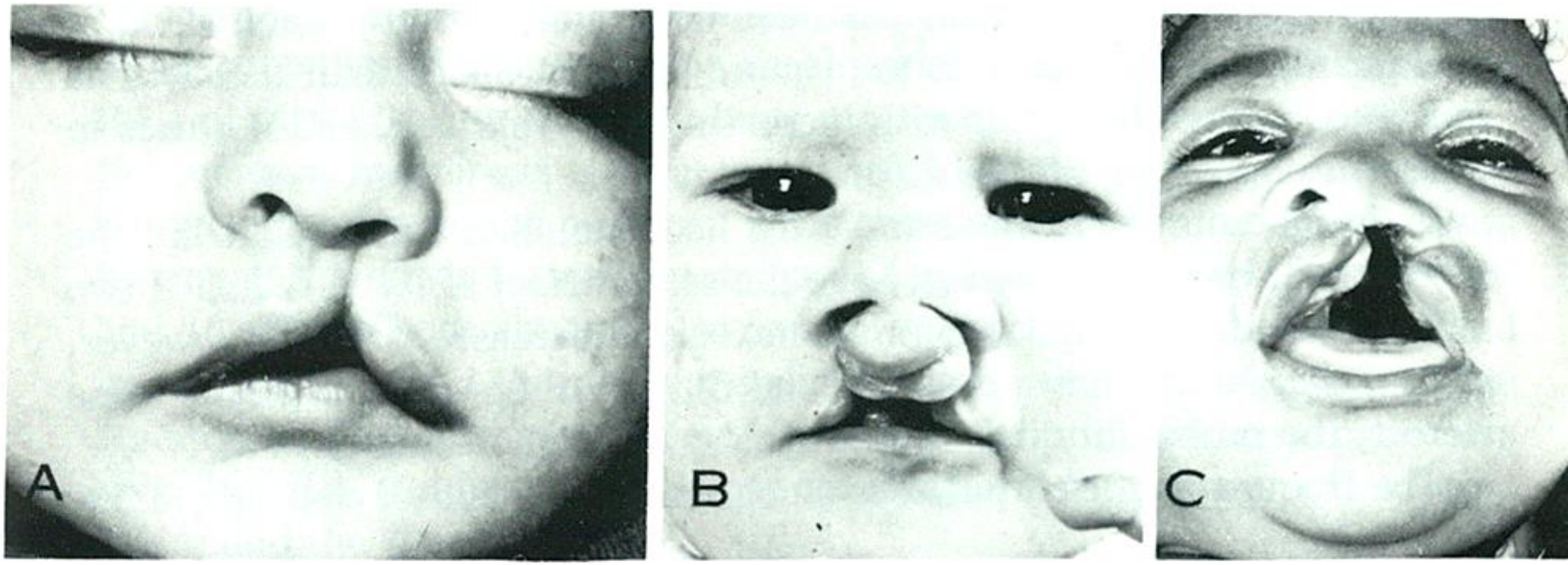
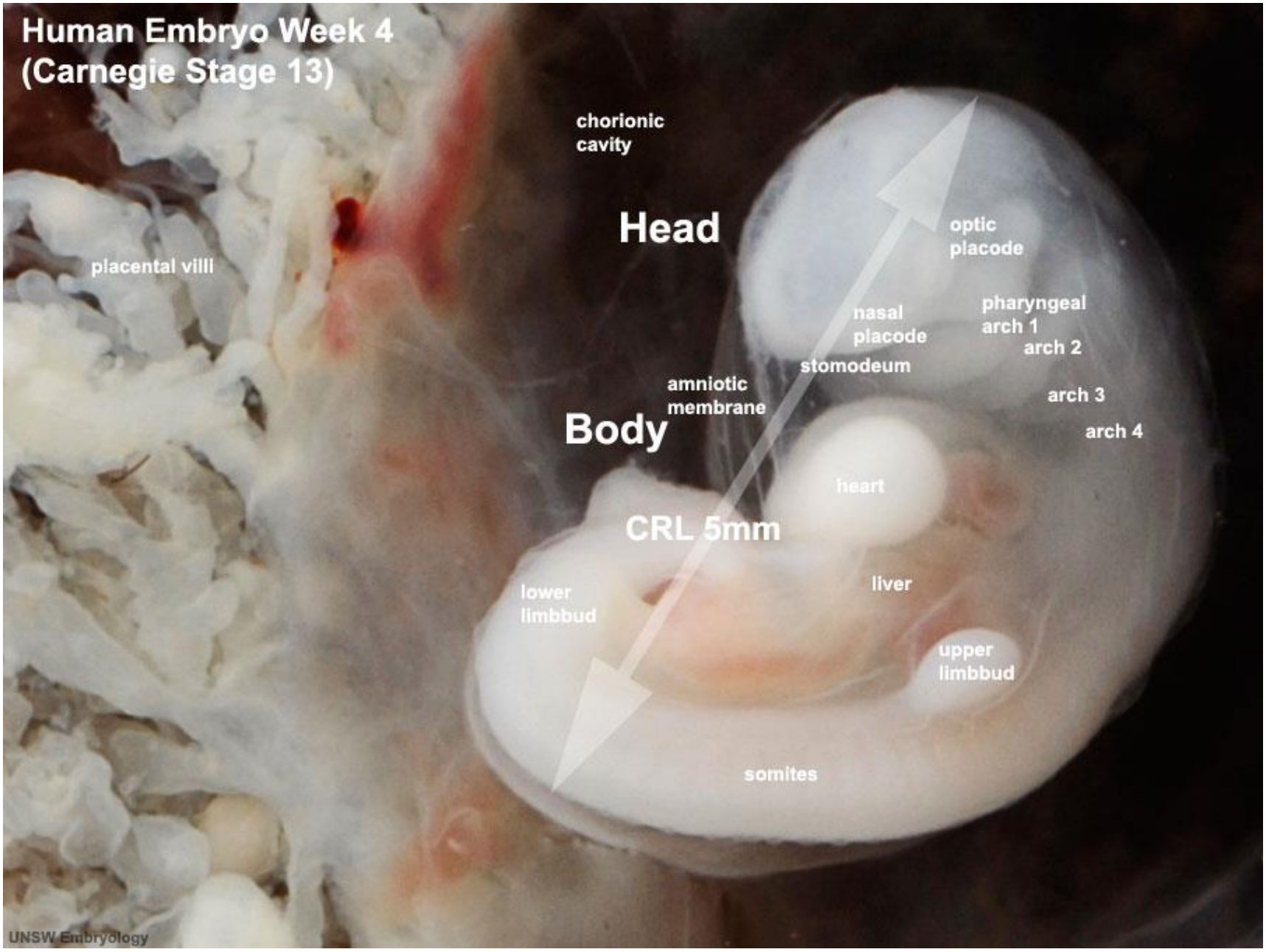


Figure 16-26. Photographs of incomplete cleft lip (**A**), bilateral cleft lip (**B**), and cleft lip, cleft jaw, and cleft palate (**C**). (Courtesy Dr. M. Edgerton, Department of Plastic Surgery, University of Virginia.)

http://www.youtube.com/watch?v=agmSH8_mLz0

PHARYNGEAL APPARATUS



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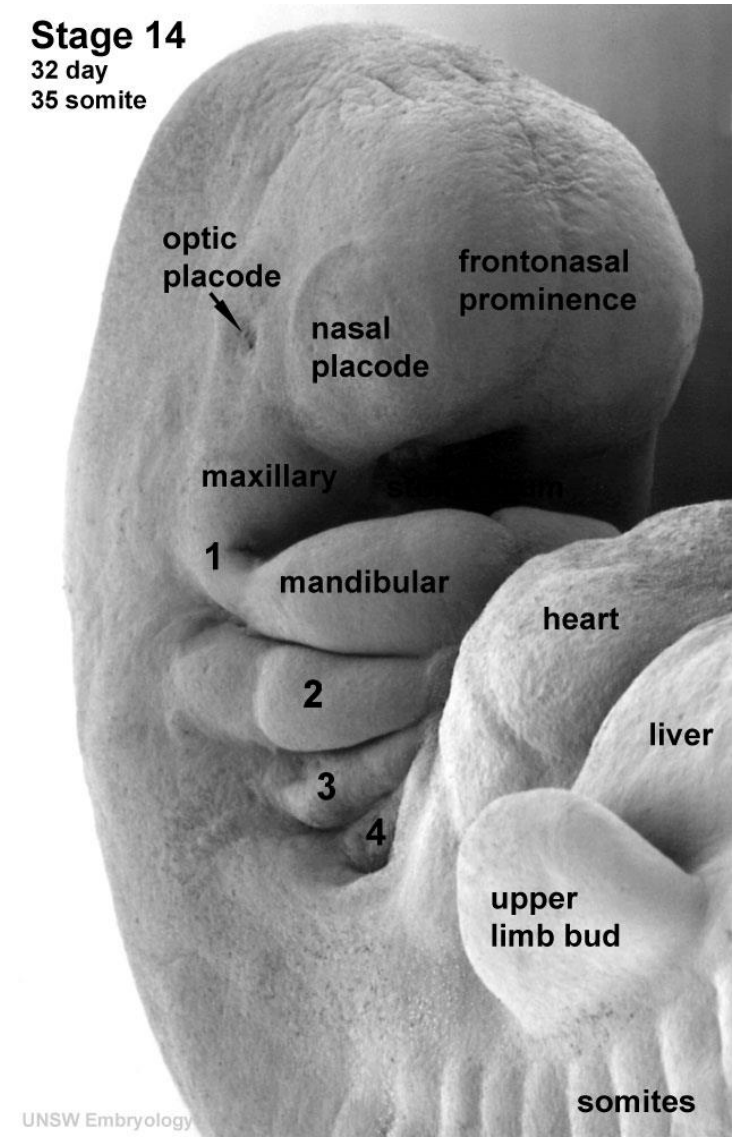

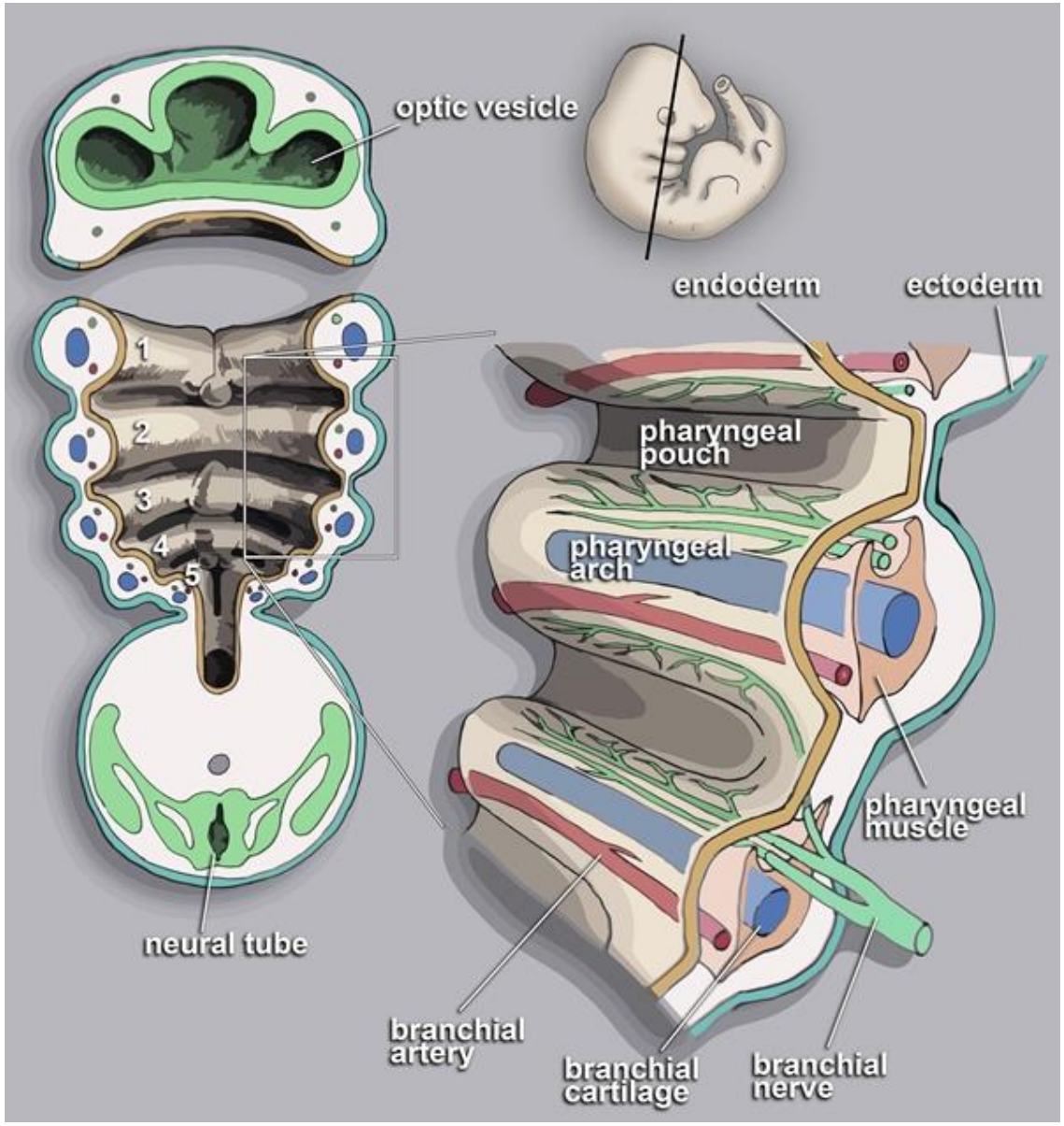

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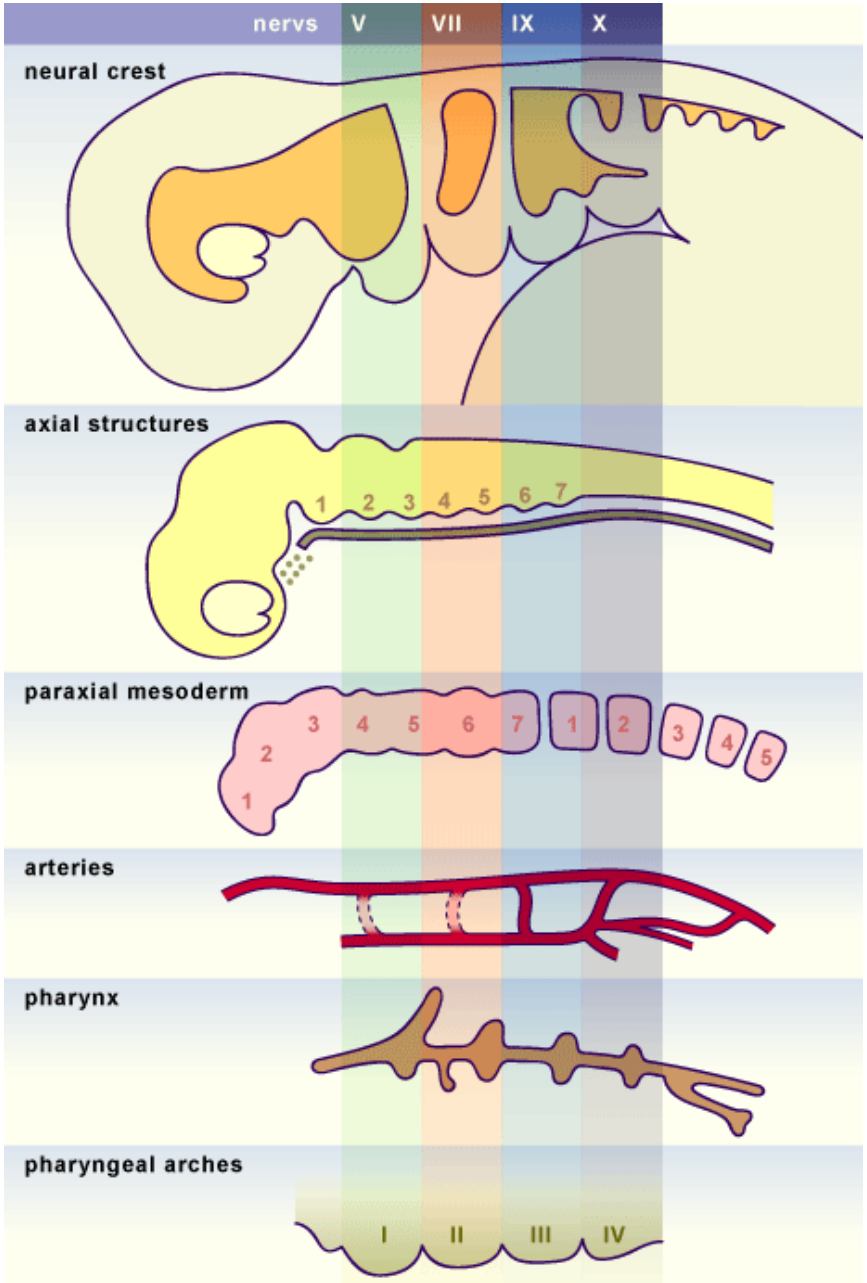

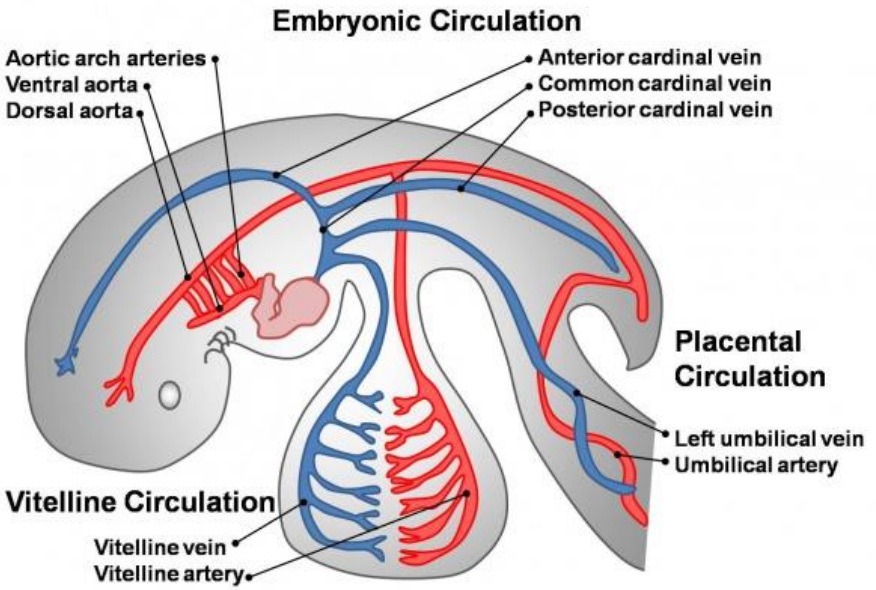

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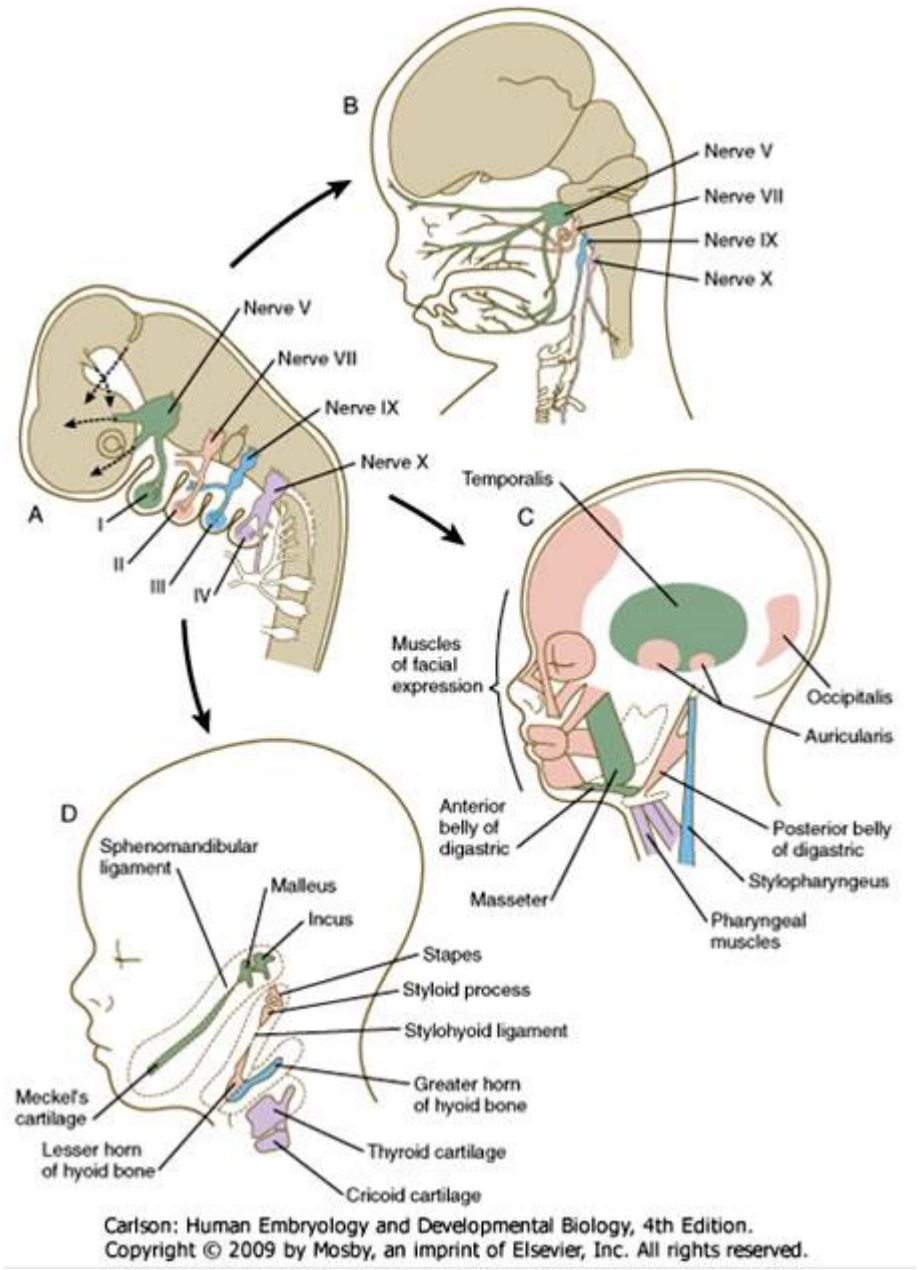
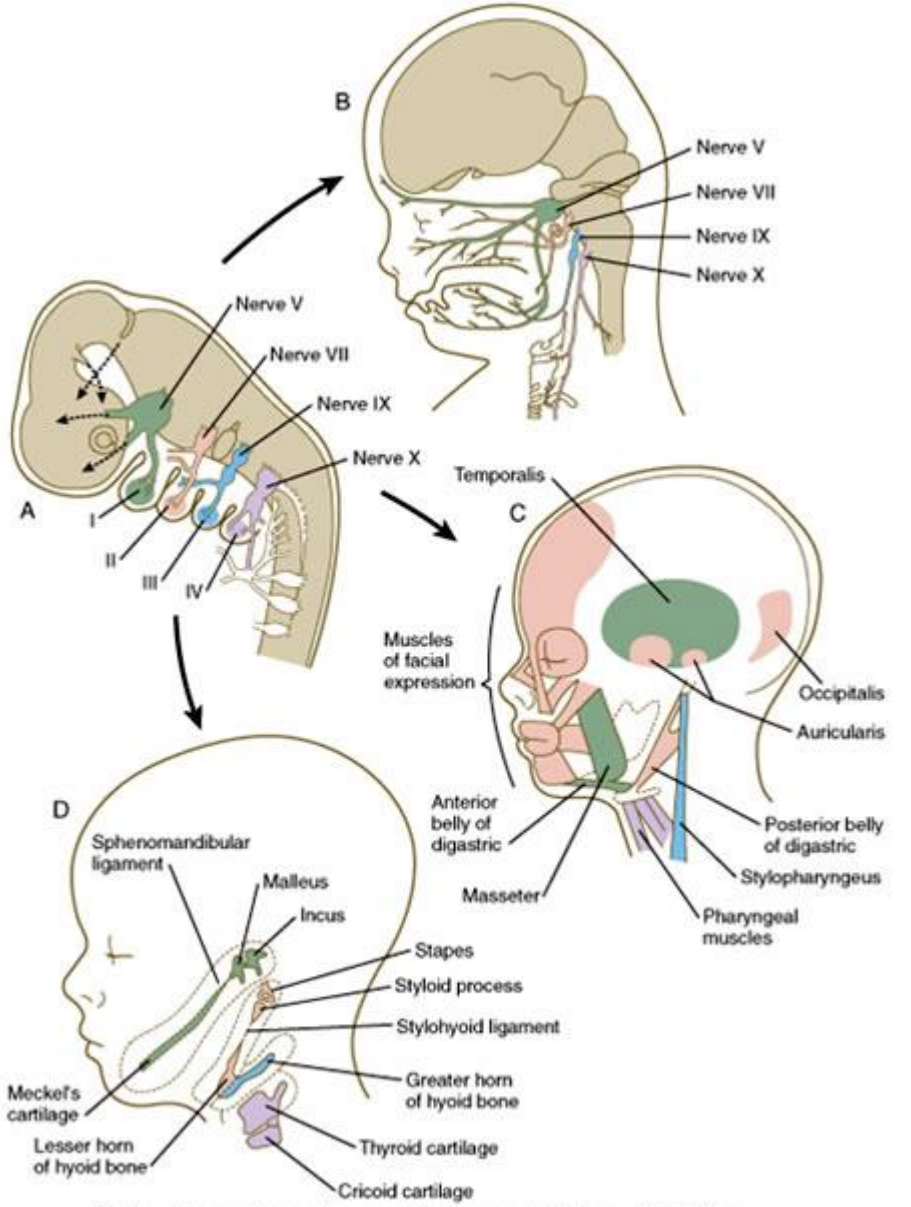


Derivatives

- Face including soft tissues
- Mimic and mastication muscles
- Tongue
- Outer and middle ear
- Hyoid bone
- Laryngeal cartilages
- Thymus
- Parathyroid glands
- Fossa tonsillaris ($\rightarrow$ t. palatina)
- Large arteries (for details see the lesson on cardiovascular systém development)

PHARYNGEAL APPARATUS



PHARYNGEAL APPARATUS

Derivative of ectodermal ridge	Pharyngeal arch	Aortic arch	Cranial nerve	Example of branchiomeric muscles	Skeletal derivatives	Derivative of endodermal pouch
1. external acoustic meatus	1 mandibular	a. maxillaris	V. trigeminus	mastica-tory	incus, maleus lig. sphenomandib. Meckel cartilage	middle ear cavity, tuba auditiva
2-4. disappear	2 hyoid	a. stapedia a. hyoidea	VII. facialis	mimic	stapes proc. styloideus, hyoid cartilage.	fossa tonsillaris
	3	a. carotis interna	IX. glosso-pharyngeus	m. stylopha-ryngeus	hyoid cartilage	thymus, parathyroid bodies (inf.)
	4	a. subclavia dx. a. arcus aortae	X. vagus	svaly faryngu a laryngu	laryngeal cartilages	parathyroid bodies (sup.)

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