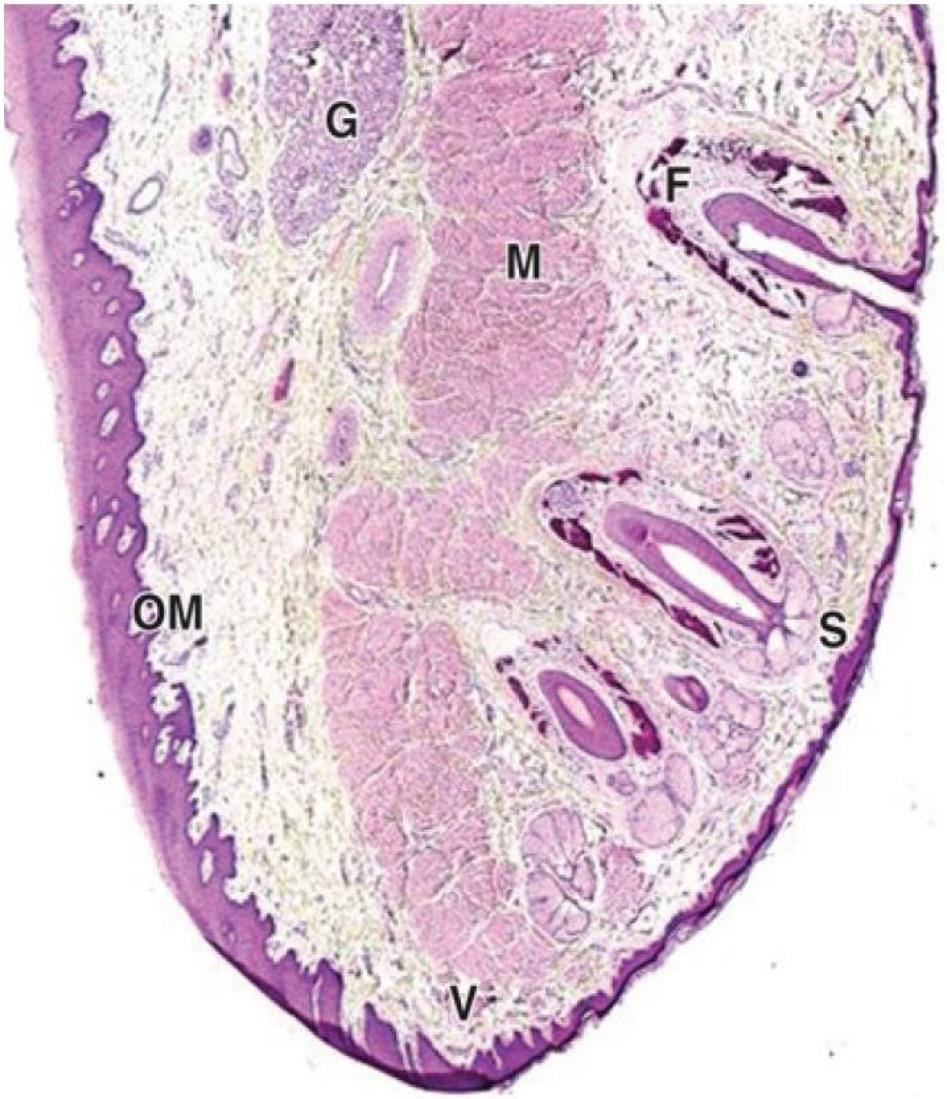
Oral cavity, teeth and salivary glands

2022/2023

Oral cavity - lip



Junqueira's Basic Histology, 15th

The internal mucous surface has lining mucosa with a thick, stratified squamous nonkeratinized epithelium and many minor labial salivary glands.

The red vermilion zone of each lip is covered by very thin stratified squamous keratinized epithelium and is transitional between the oral mucosa and skin. This region lacks salivary or sweat glands. The underlying connective tissue is very rich in both sensory innervation and capillaries, which impart the pink color to this region.

The outer surface has a structure of a thin skin (stratified squamous keratinized ep.) with sweat glands, and many hair follicles with sebaceous glands.

Low-magnification micrograph of a lip section showing one side covered by typical oral mucosa (**OM**), the opposite side covered by skin (**S**) containing hair follicles (**F**) and associated glands. Between the oral portion of the lips and normal skin is the vermilion zone (**V**). Internally, the lips contain much striated muscle (**M**) and many minor salivary glands (**G**).

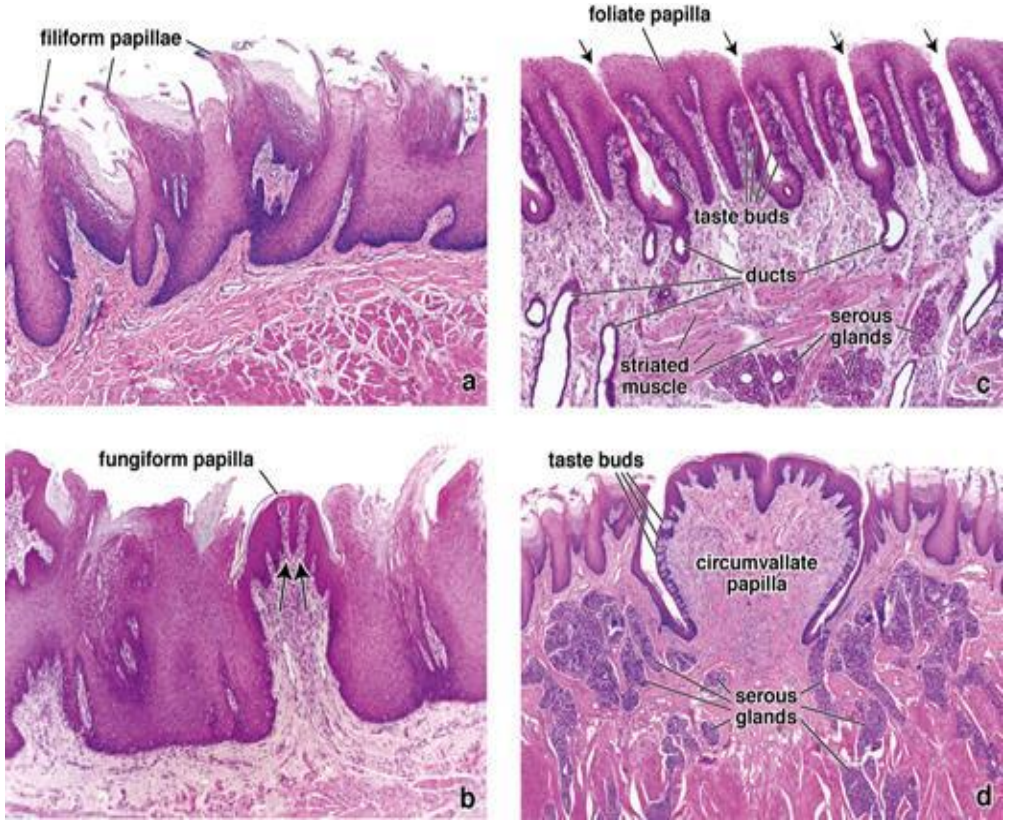
Tongue papillae

The oral part of the tongue is covered with small bumpy projections called papillae.

There are four types of papillae:

1. **filiform** (thread-shape),
2. **fungiform** (mushroom-shape),
3. **circumvallate** (ringed-circle),
4. **foliate.**

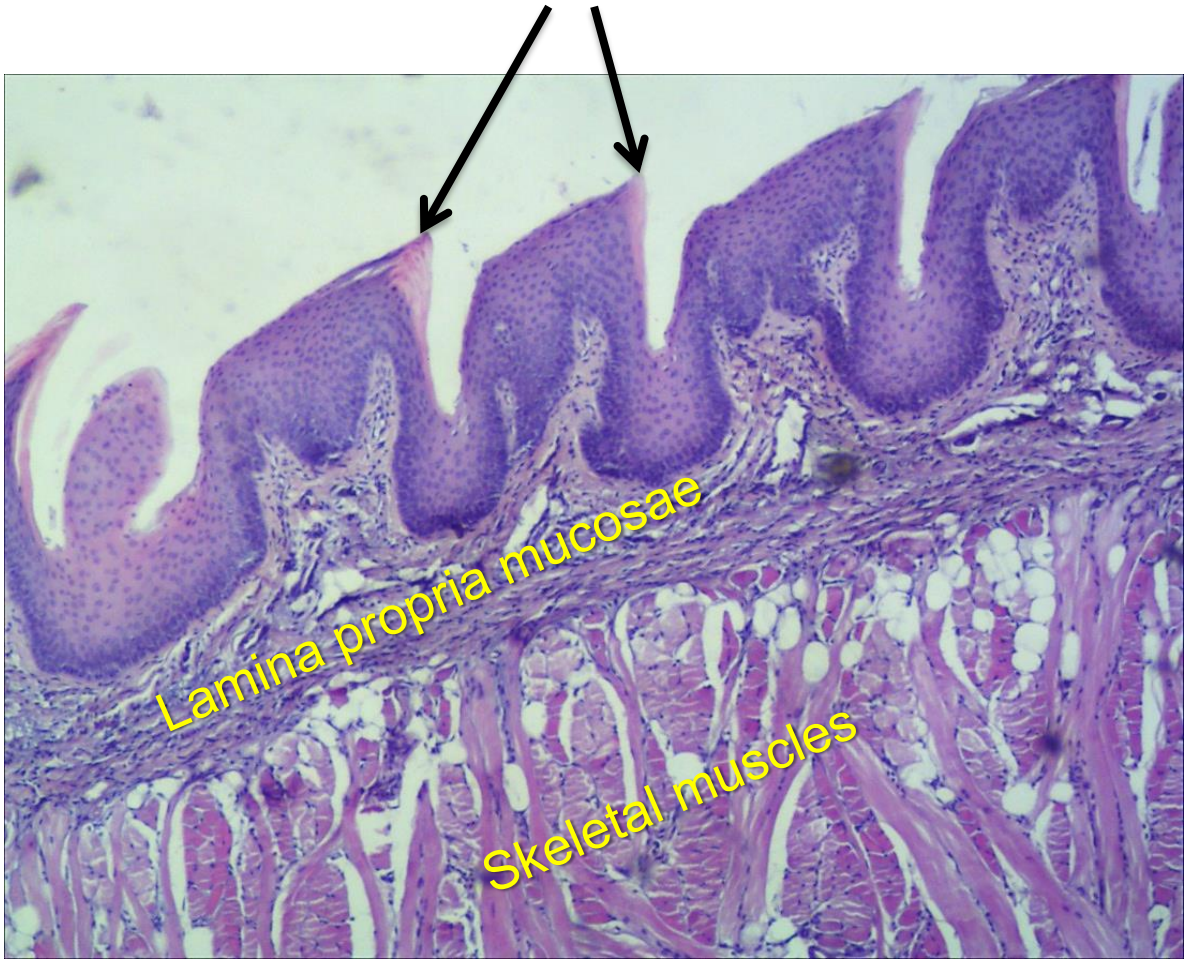
All papillae except the filiform have taste buds on their surface.



Histology: A Text and Atlas: With Correlated Cell and Molecular Biology, 8e
Wojciech Pawlina, Michael H. Ross

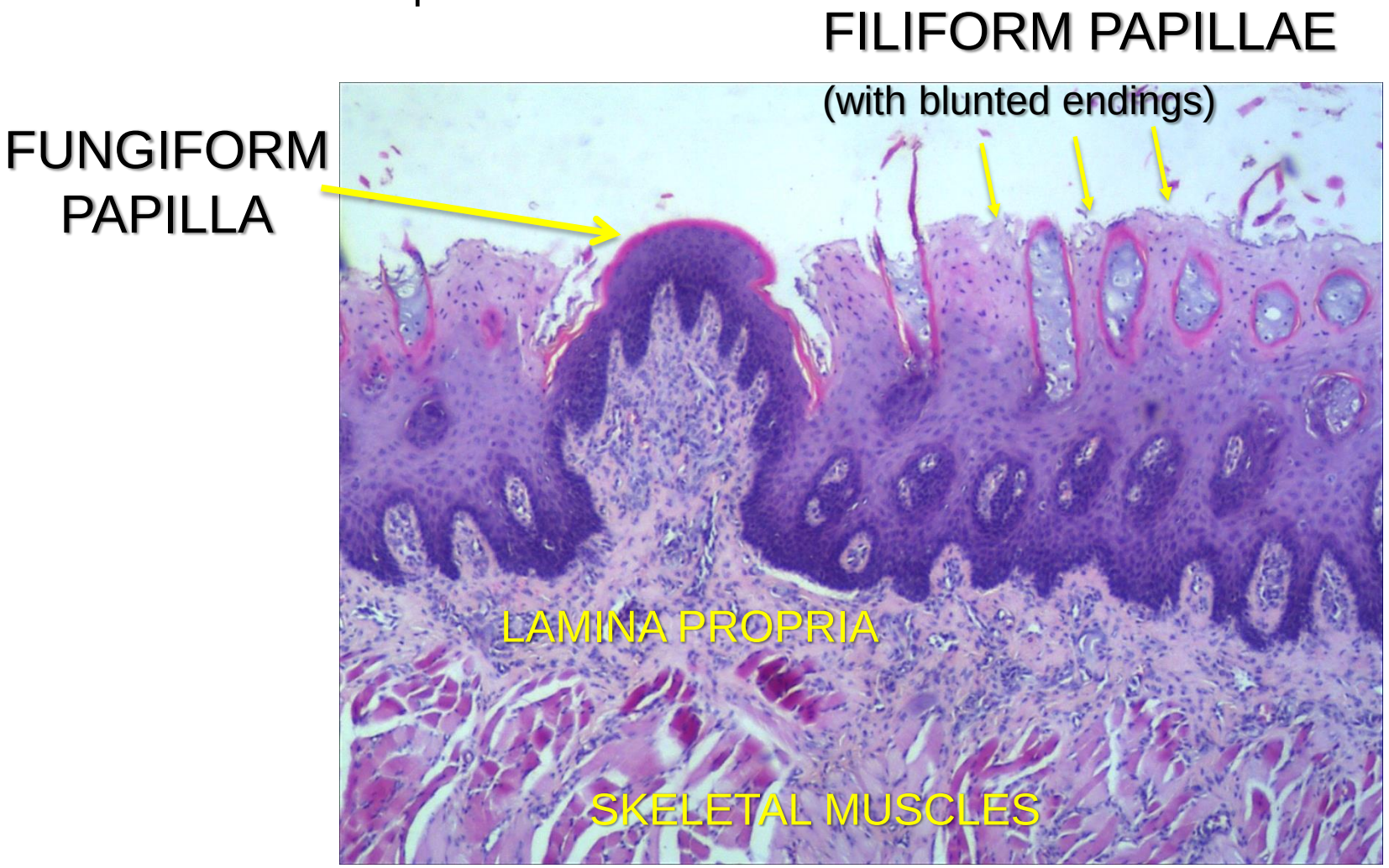
Filiform papillae

- are posteriorly bent conical projections of the epithelium,
- most numerous; do not possess taste buds,
- are covered by stratified squamous keratinized epithelium.



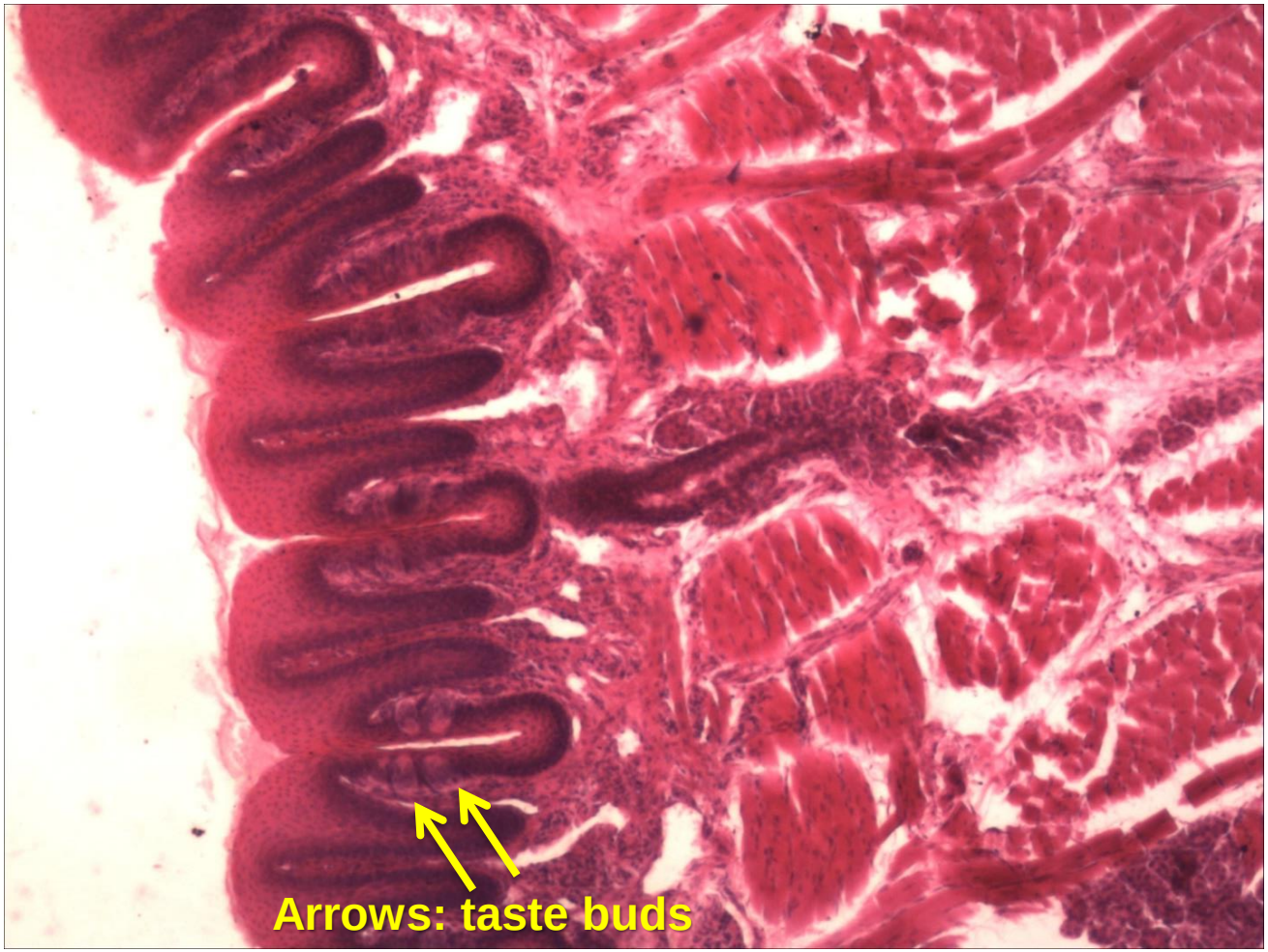
Fungiform papillae

- covered with stratified squamous nonkeratinized epithelium (in adults a thin, superficial layer may be keratinized),
- taste buds are present.



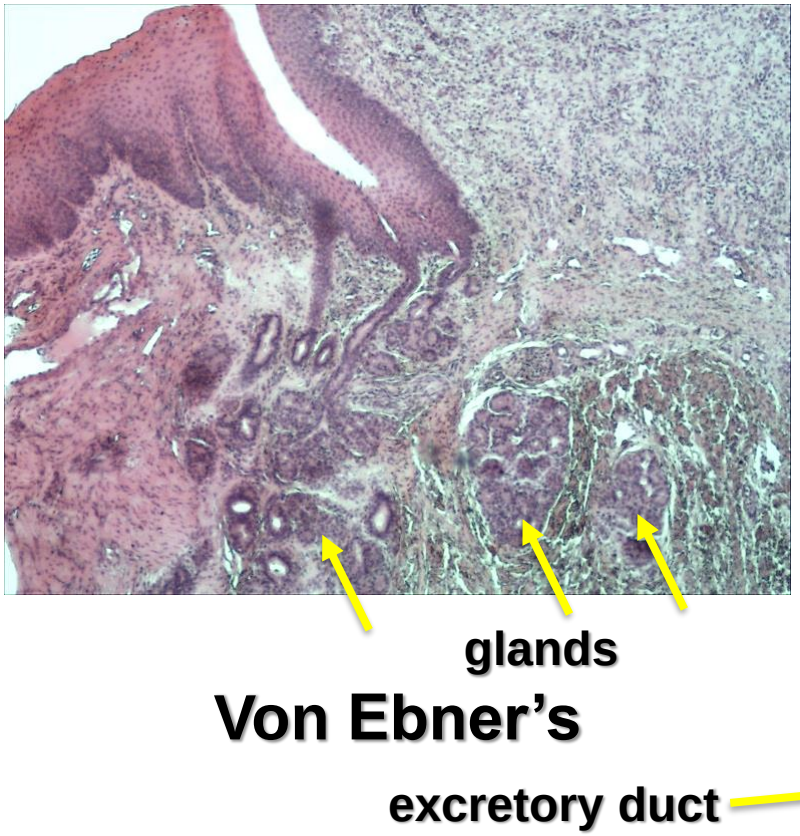
Foliate papillae

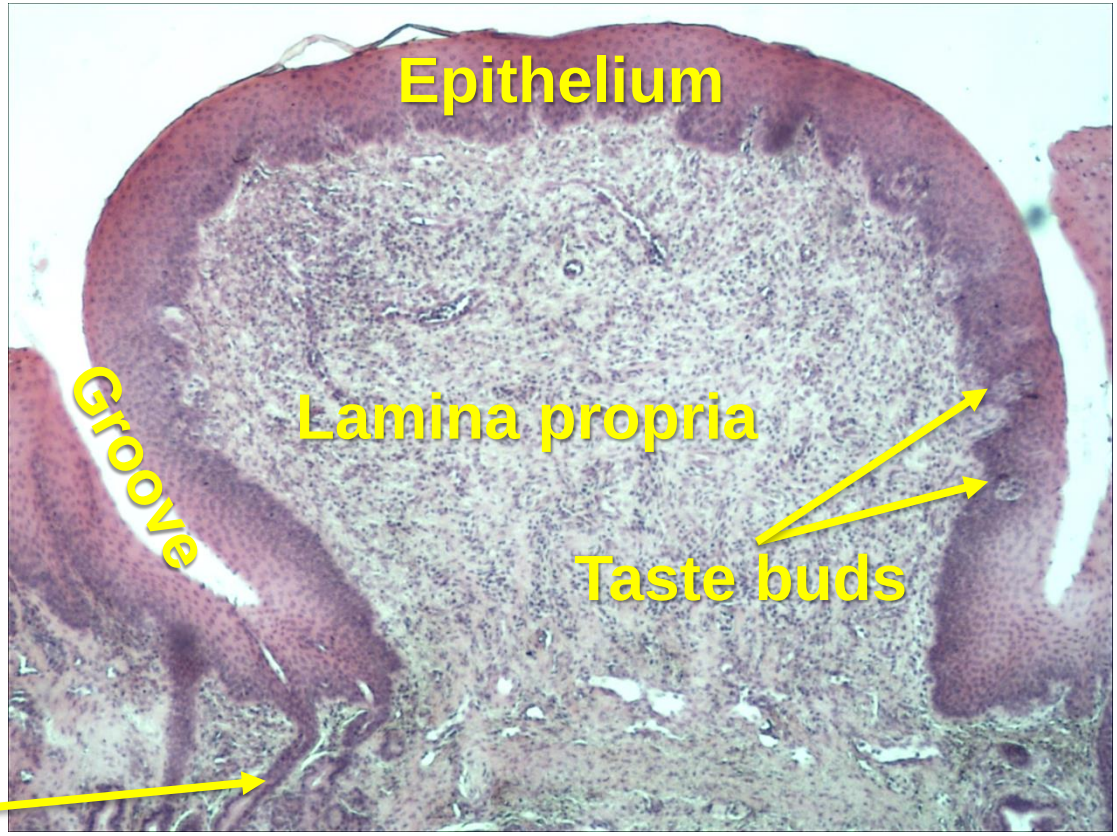
- covered with stratified squamous nonkeratinized epithelium (may have a thin keratinized layer); leaf-shaped,
- taste buds are present.



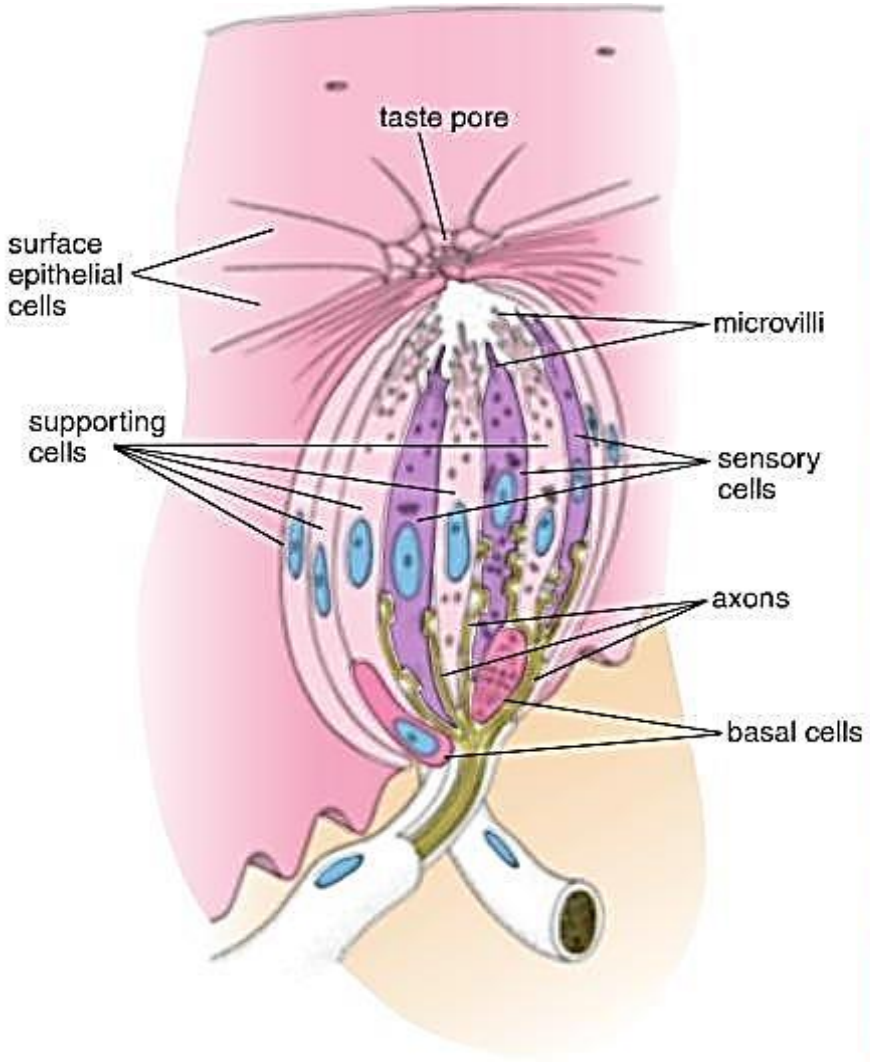
Circumvalate papillae

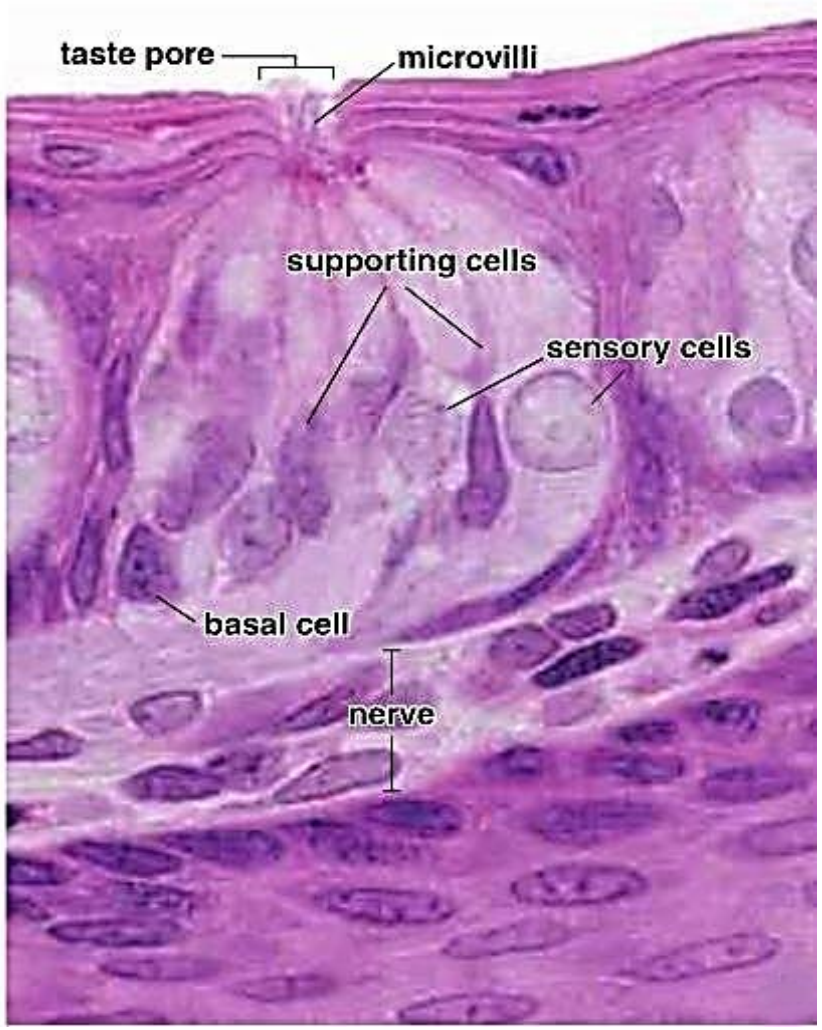
- biggest but less numerous,
- covered with stratified squamous nonkeratinized epithelium (may be partially keratinized),
- taste buds are present on the lateral walls,
- glands of von Ebner (minor salivary glands; serous).





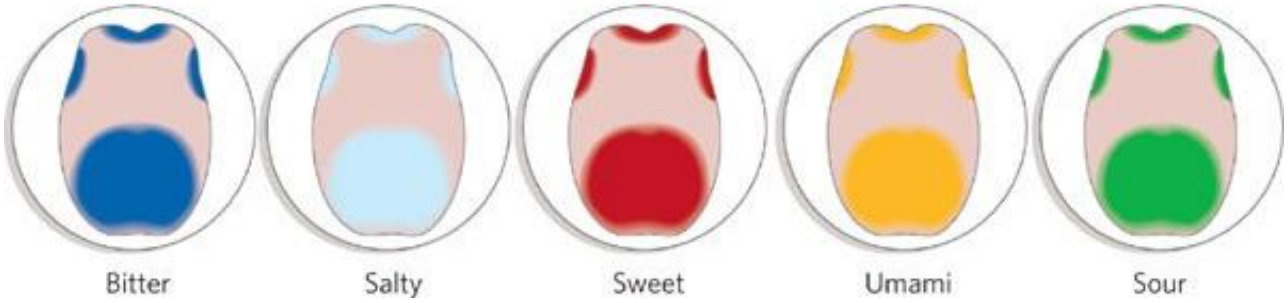
Taste buds: present on fungiform, foliate and circumvallate papillae





"Histology: A Text and Atlas", 6th Edition. Michael Ross, Wojciech Pawlina

Taste is a chemical sensation in which various chemicals elicit stimuli from neuroepithelial (sensory) cells of taste buds.

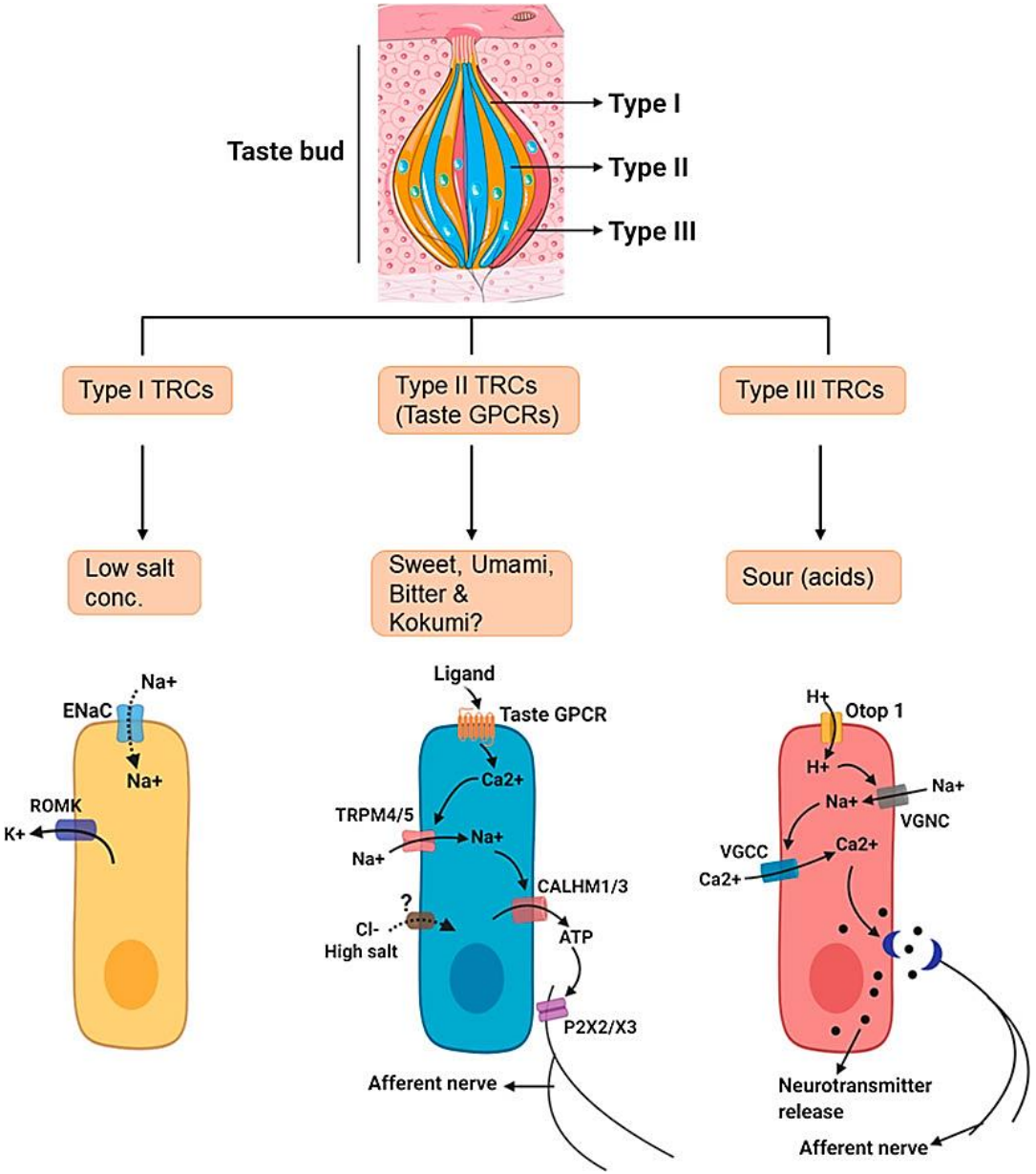


Taste buds detect at least five categories of tastants:

- sodium ions (**salty**);
- hydrogen ions from acids (**sour**);
- sugars and related compounds (**sweet**);
- alkaloids and certain toxins (**bitter**);
- amino acids such as glutamate and aspartate (**umami**; Jap. umami, savory).

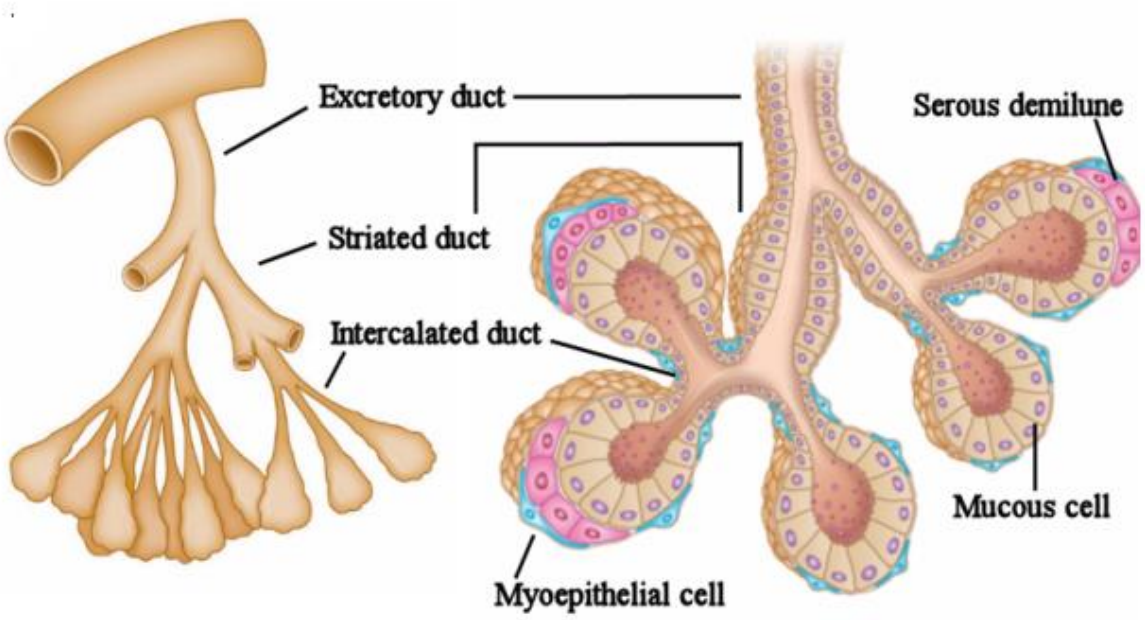
Salt and sour tastes are produced by **ion channels**, and the other three taste categories are mediated by **G-protein-coupled receptors**. Receptor binding of a ligand produces depolarization of the gustatory cells, stimulating the sensory nerve fibers that transmit information to the brain for processing.

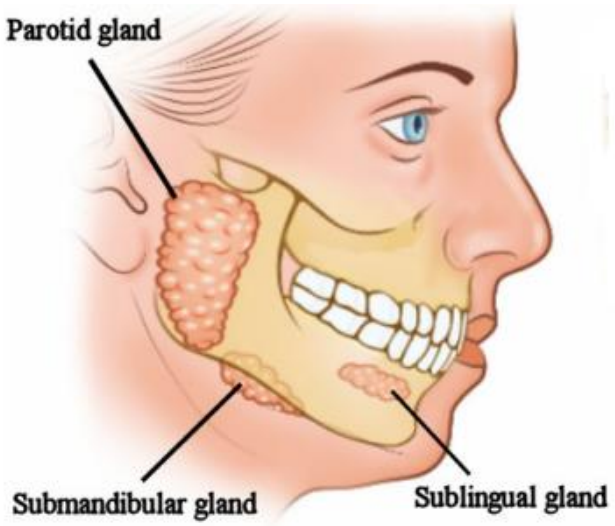
Schematic representation of **different types of taste receptor cells** (TRCs) in taste bud with their attributed taste modalities and signal transduction



Ahmad and Dalziel 2020

Salivary glands





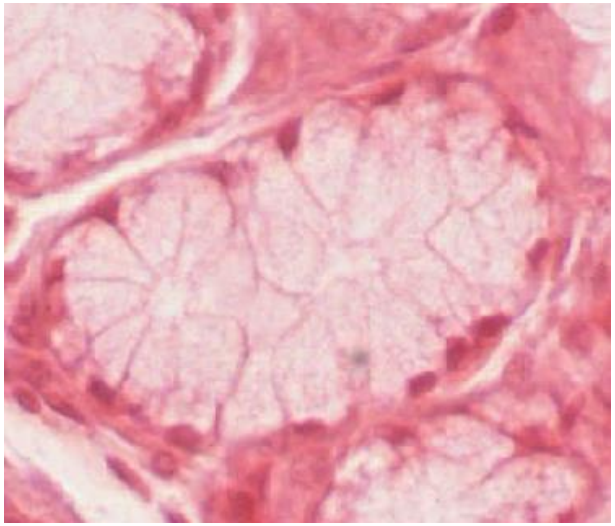
The submandibular and sublingual salivary glands are tubuloacinar structures composed of ductal cells, myoepithelial cells, and acinar cells. The duct system is divided into segments: excretory ducts, striated ducts, and intercalated ducts.

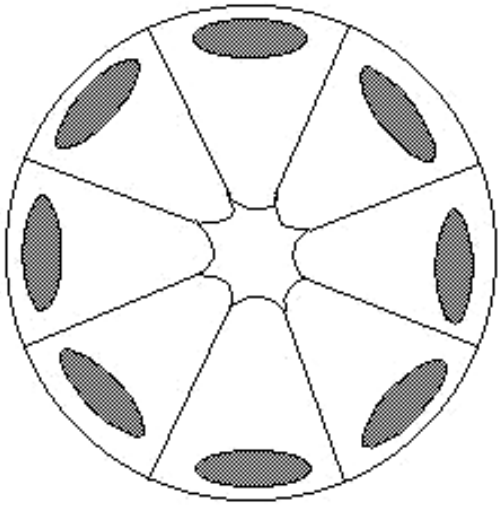
The parotid gland is composed exclusively acini made by serous cells.

The other two large salivary glands contain either serous or mucous cells, which are present **in various proportions** in the different glands.

Andreasen 2018

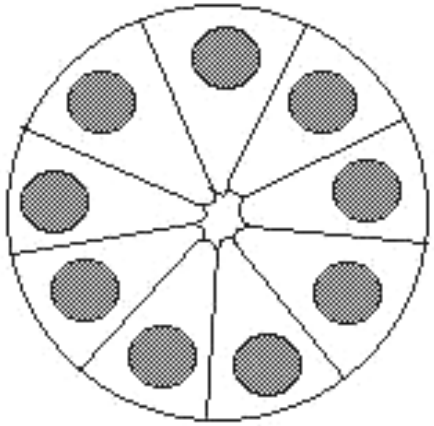
Salivary glands: serous acini and mucous tubules





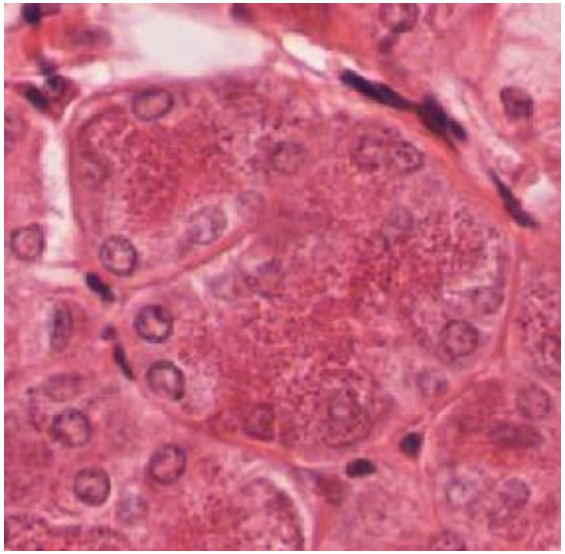
Mucous tubules of alivary gland:

1. Flattened nuclei in the basal half of the cells.
2. Axis of nuclei : parallel with base of cell.
3. Cytoplasm : faintly stained after conventional histological fix.
4. Lumen is larger, Golgi is well developed.



Serous acini of salivary GL:

1. spherical nuclei in the middle of cell
2. cytoplasm : strongly basophilic
3. rough endoplasmic reticulum is well developed.



Source: University of Michigan, Michigan Histology and Virtual Microscopy Learning Resources

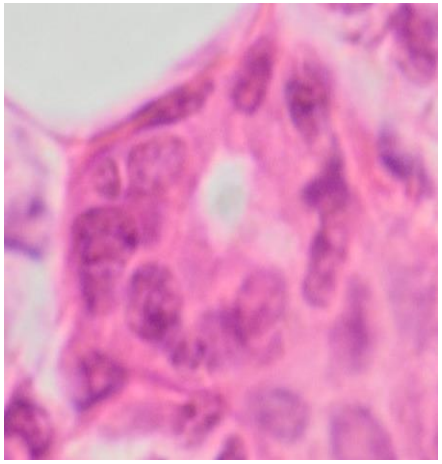
Salivary glands

Ducts

In the duct system, the lumens formed by the secretory cells empty into **intercalated ducts**, which in turn join to form **striated ducts**. These drain into interlobular ducts situated which merge to form interlobar ducts.

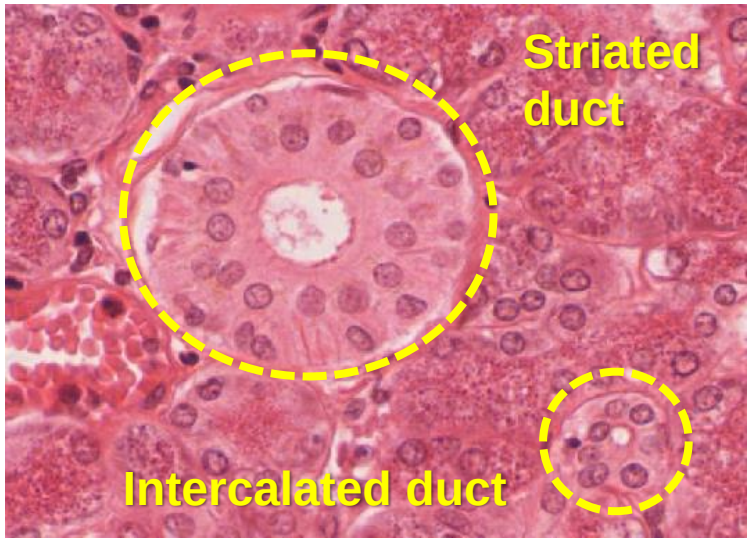
The short **intercalated ducts** are lined with low cuboidal epithelium.

The **striated ducts** consist of columnar cells with characteristics of ion-transporting cells: basal membrane invaginations with mitochondrial accumulations. The cell nuclei are localized in the upper half of the cell.



intercalated duct

striated duct

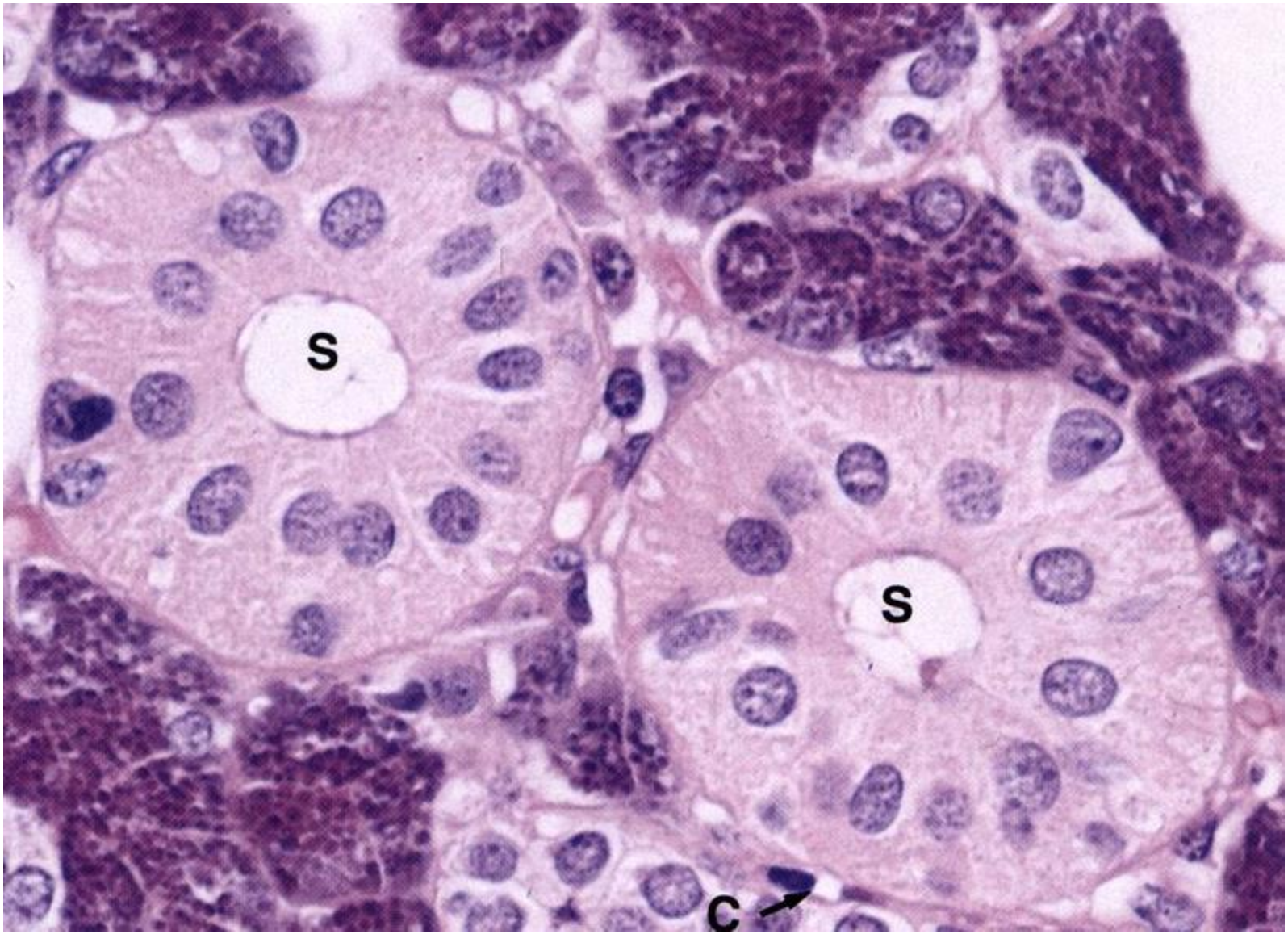


Source: University of Michigan, Michigan Histology and Virtual Microscopy Learning Resources

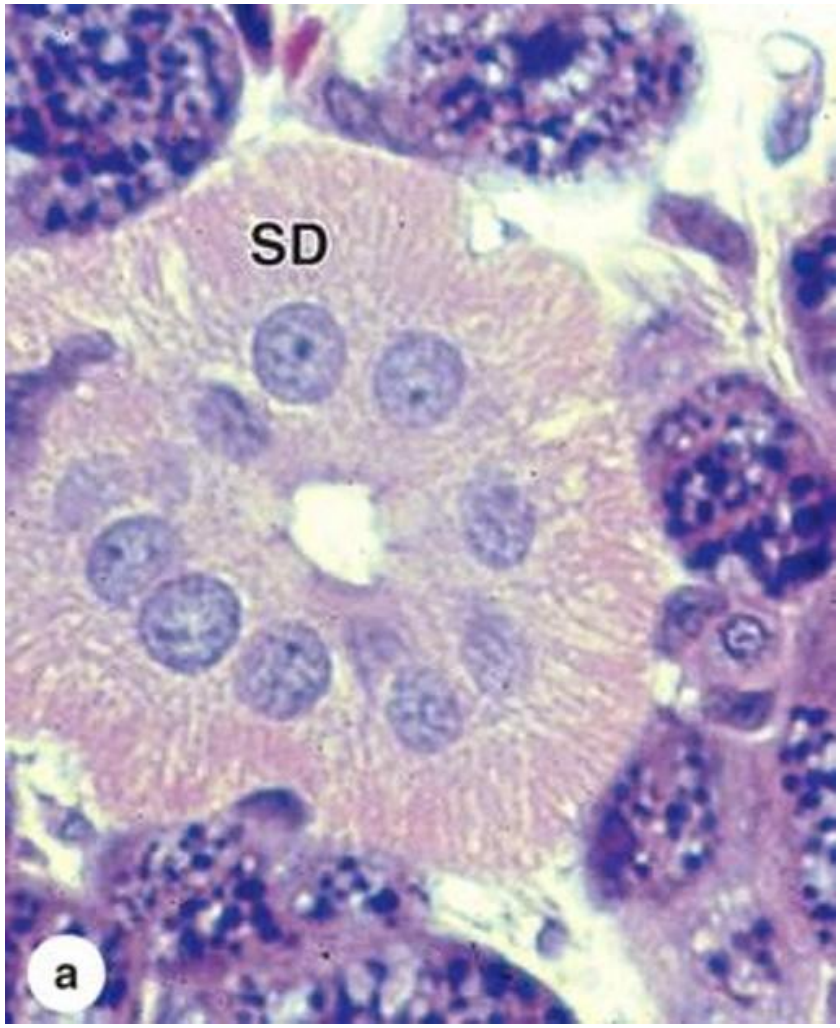
Junqueira's Basic Histology, 15th

Histology: A Text and Atlas: With Correlated Cell and Molecular Biology, 8e Wojciech Pawlina, Michael H. Ross

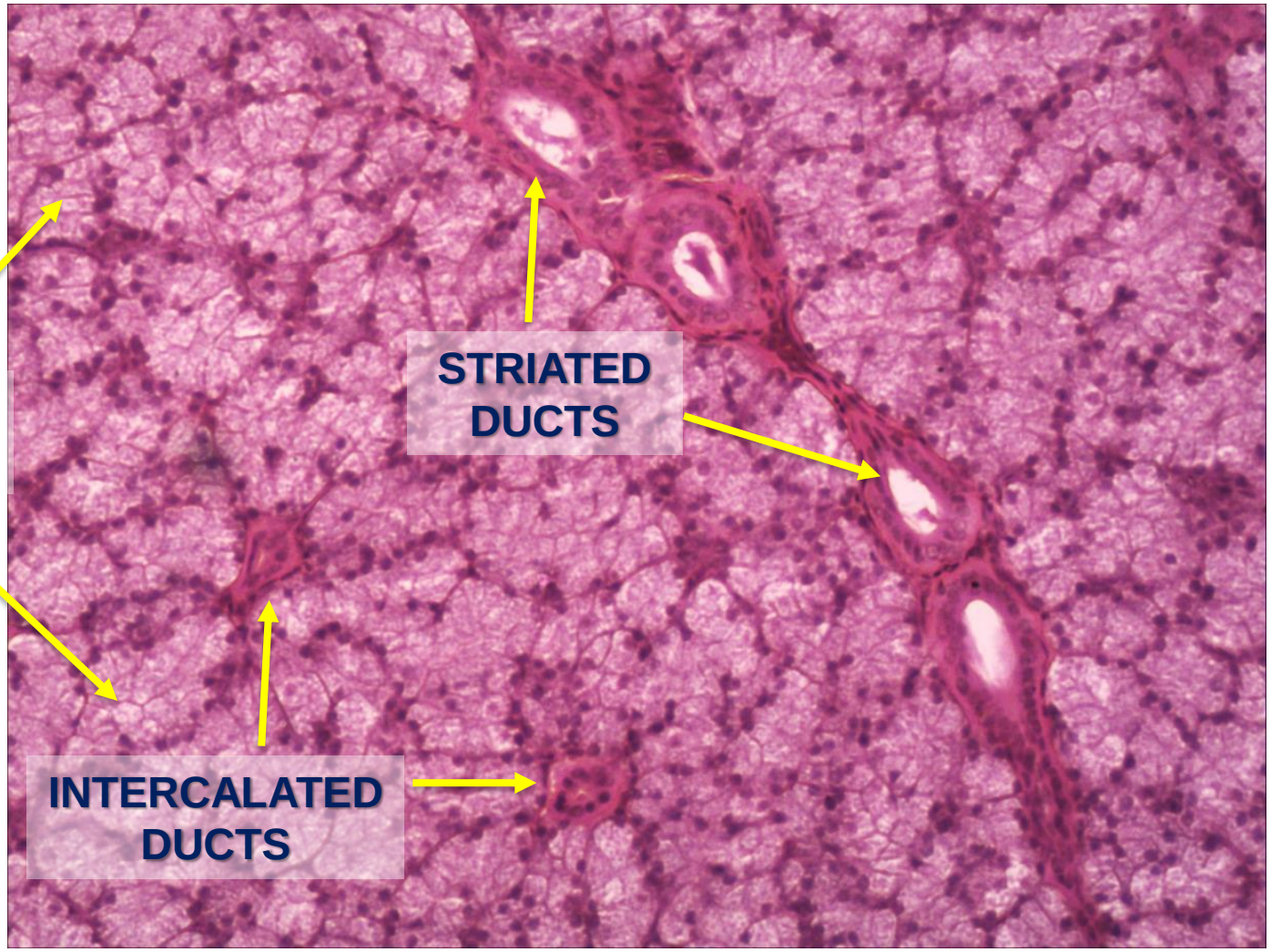
Striated ducts (S), in a submandibular gland



Wheather's Funct Histol 2004

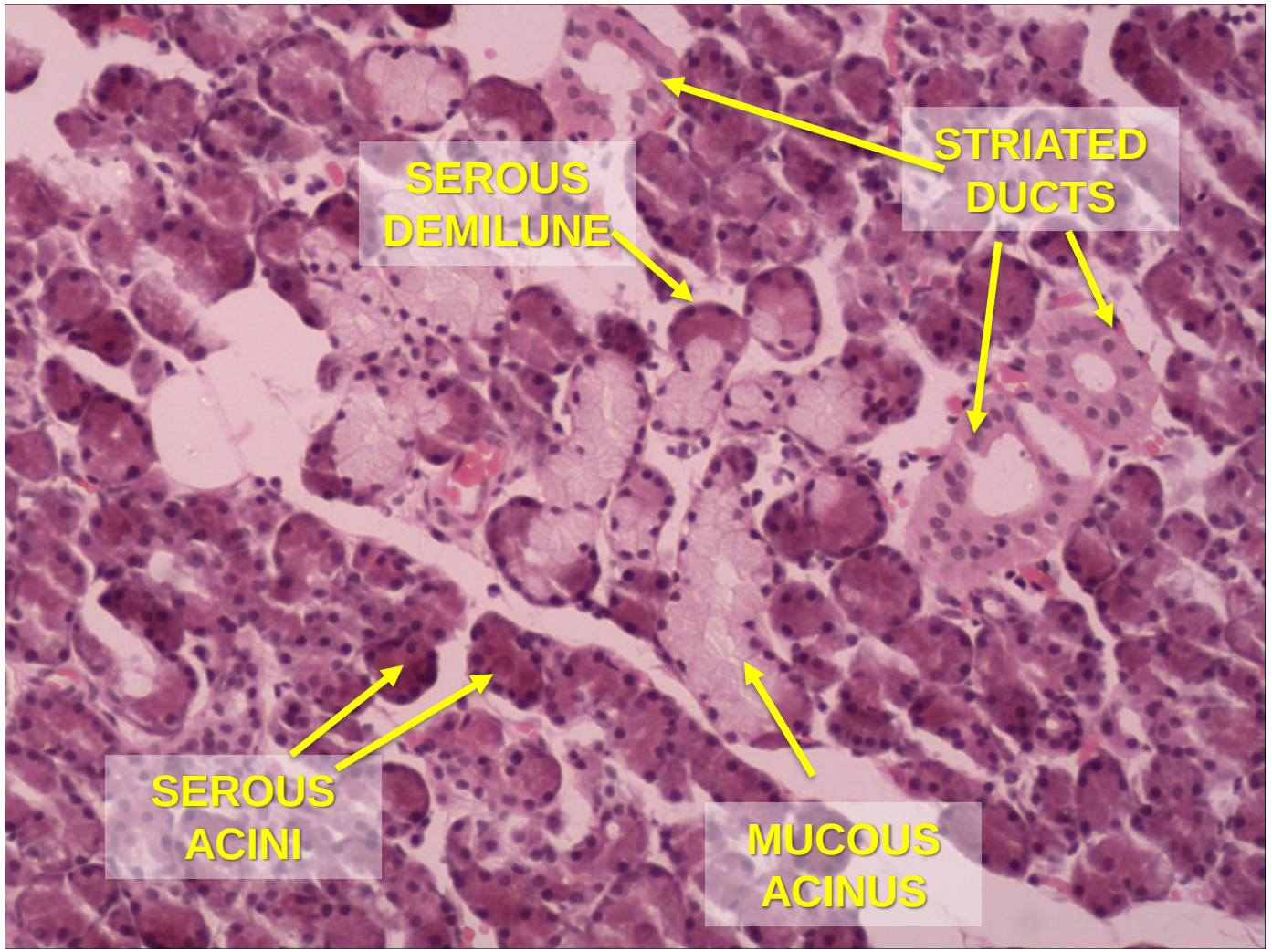

SD
a

Parotid salivary gland (serous glands)



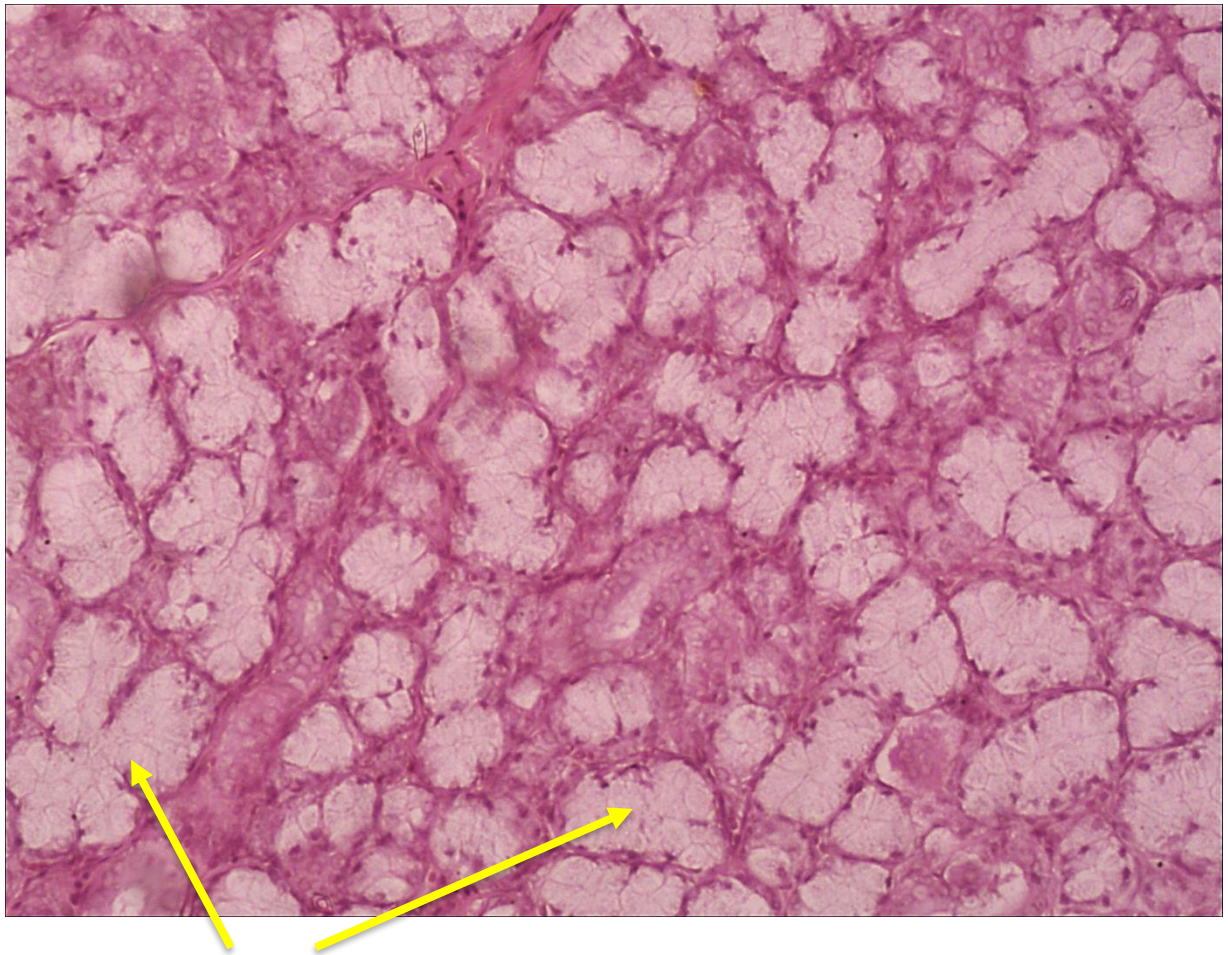
The **parotid gland** is formed by acini containing **exclusively serous-secreting cells** with a basal nucleus and an apical cytoplasm with **secretory granules**.

Submandibular gland (serous-mucous gland)



Submandibular glands are mixed **serous (90%) and mucous (10%)** tubuloacinar glands.

Sublingual salivary gland (moucous-serous gland)

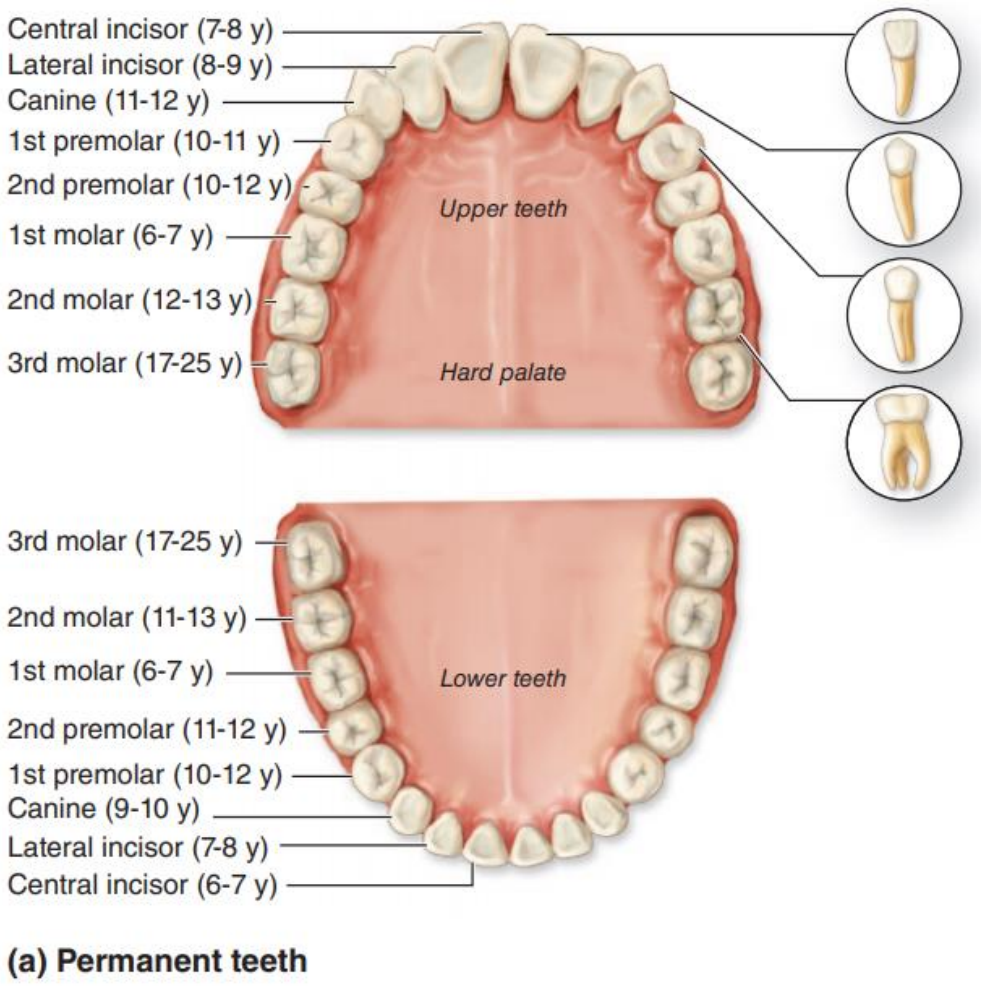


Sublingual glands are **mixed serous (30%) and mucous (60%)** tubuloacinar glands in which mucous-secreting cells predominate.

The i**ntercalated** and **striated ducts** are **poorly developed** in the sublingual gland.

Teeth

- In the adult human there are normally 32 **permanent teeth**, arranged in two bilaterally symmetric arches in the maxillary and mandibular bones.
- Each quadrant has eight teeth: two incisors, one canine, two premolars, and three permanent molars.
- Twenty of the permanent teeth are preceded by **primary teeth** (**deciduous or milk teeth**) that are shed; the others are permanent molars with no deciduous precursors.
- Each tooth has a **crown** exposed above the gingiva, a constricted **neck** at the gum, and one or more **roots** that fit firmly into bony sockets in the jaws called **dental alveoli**.

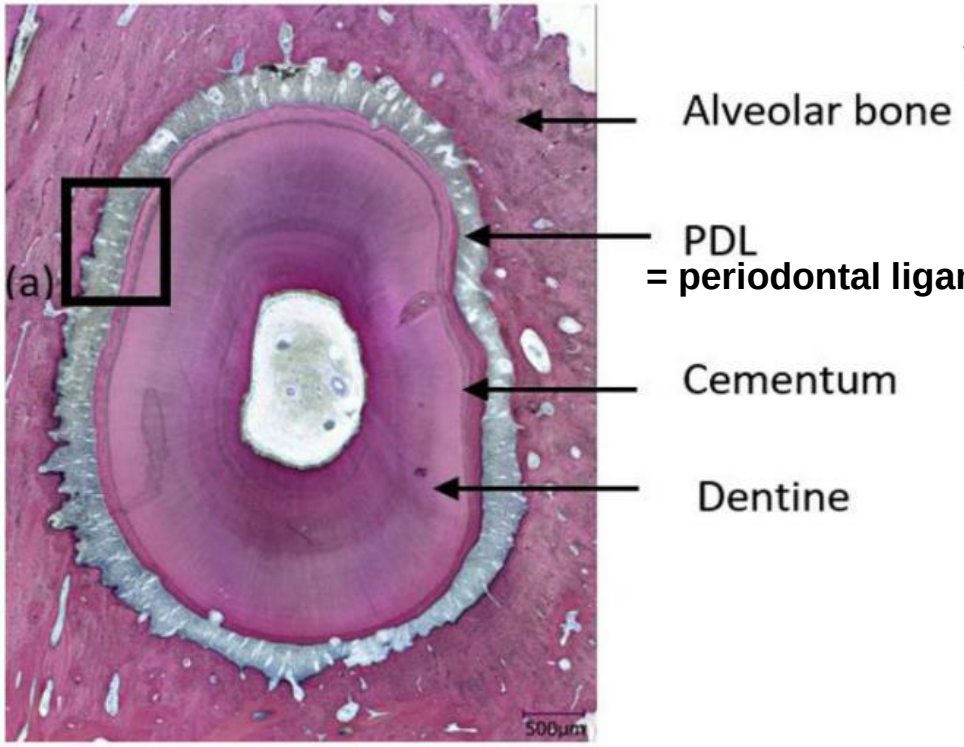


(a) Permanent teeth

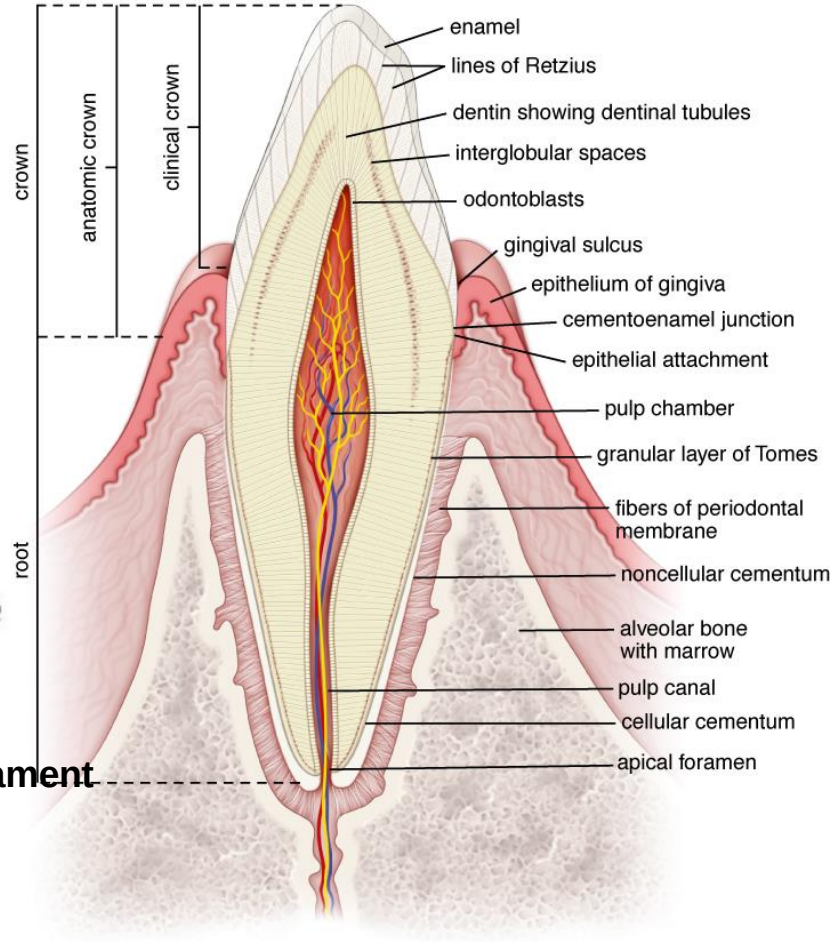
Junqueira's Basic Histology, 15th

Major tooth parts (an incisor) **and its supporting soft and hard tissues (periodontium)**

Cross-section of tooth's root



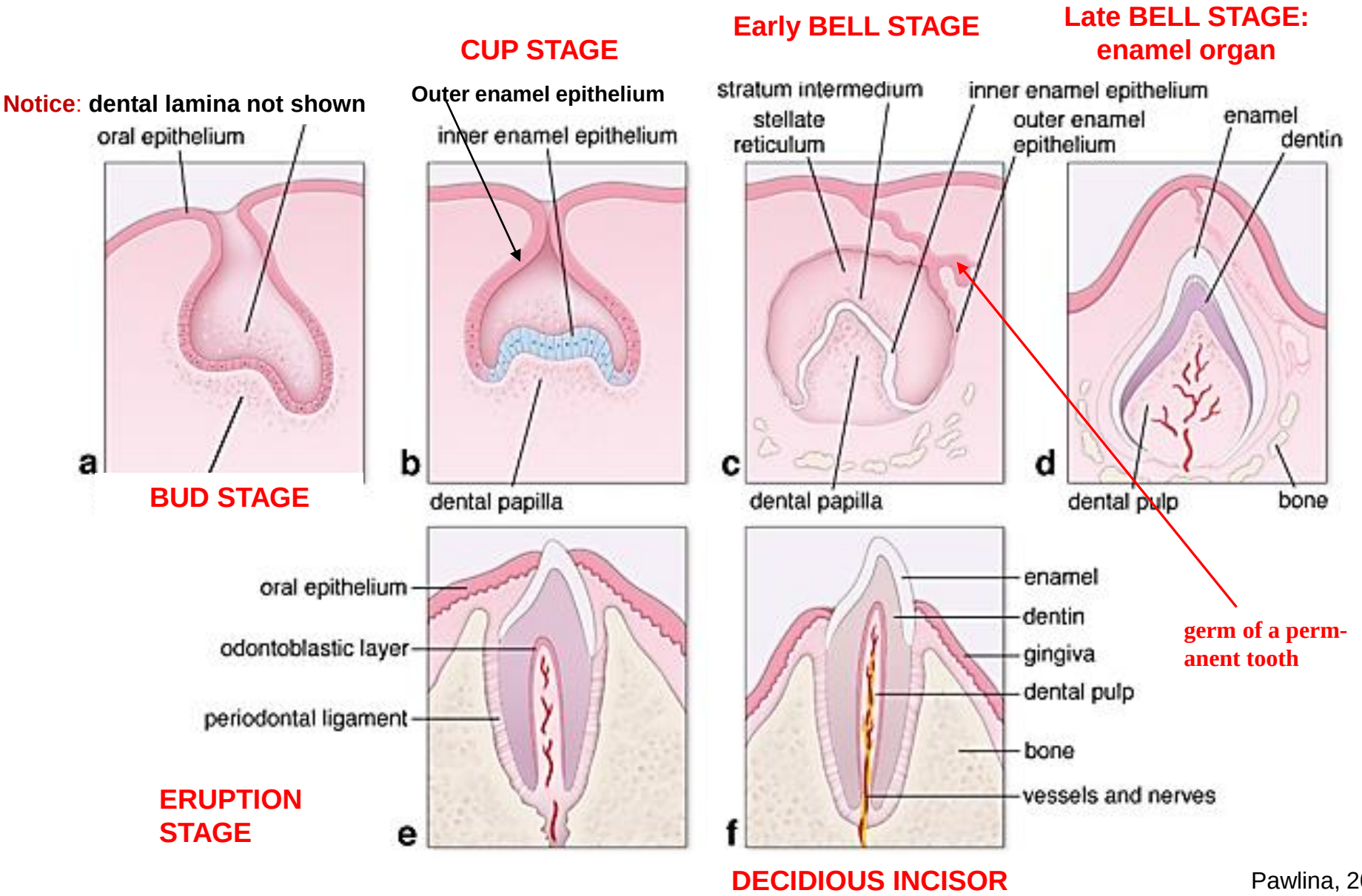
= periodontal ligament



Pawlina 2020

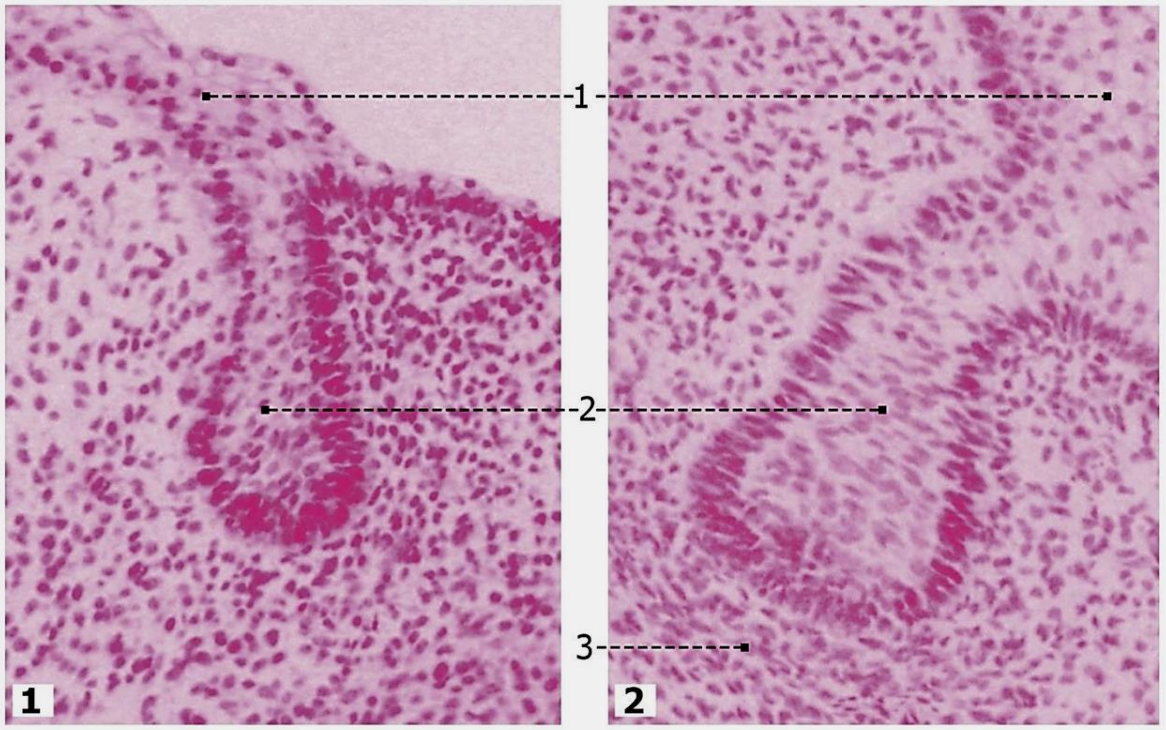
Wagner, D., El Hafci, H., Bensidhoum, M., Petite, H., Bolender, Y., Rémond, Y., & George, D. (2018). *Periodontal ligament histology for orthodontic bone remodeling: First quantification. Journal of Cellular Immunotherapy*

Morphological stages of tooth's germ development: bud stage - tooth eruption



Pawlina, 2020

Dental lamina

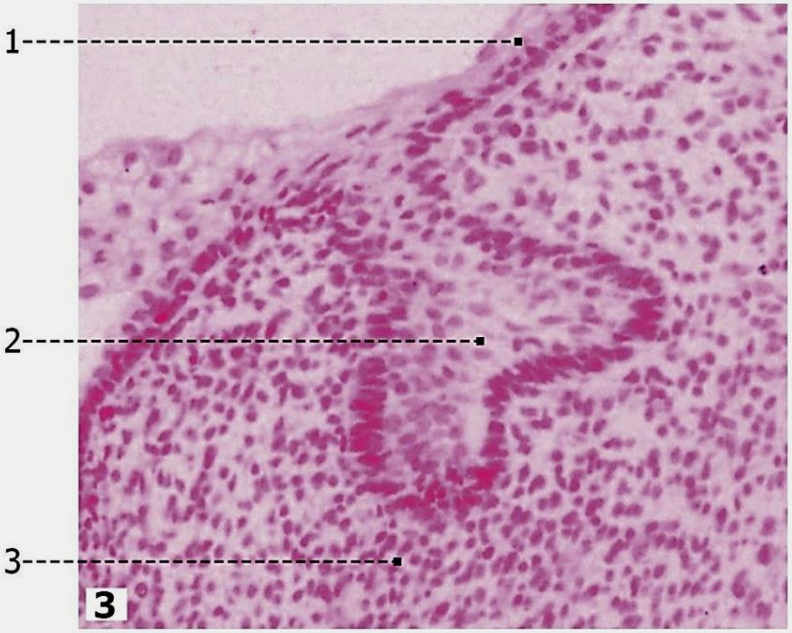


Bud stage

Oral epithelium

Ectoderm of dental lamina

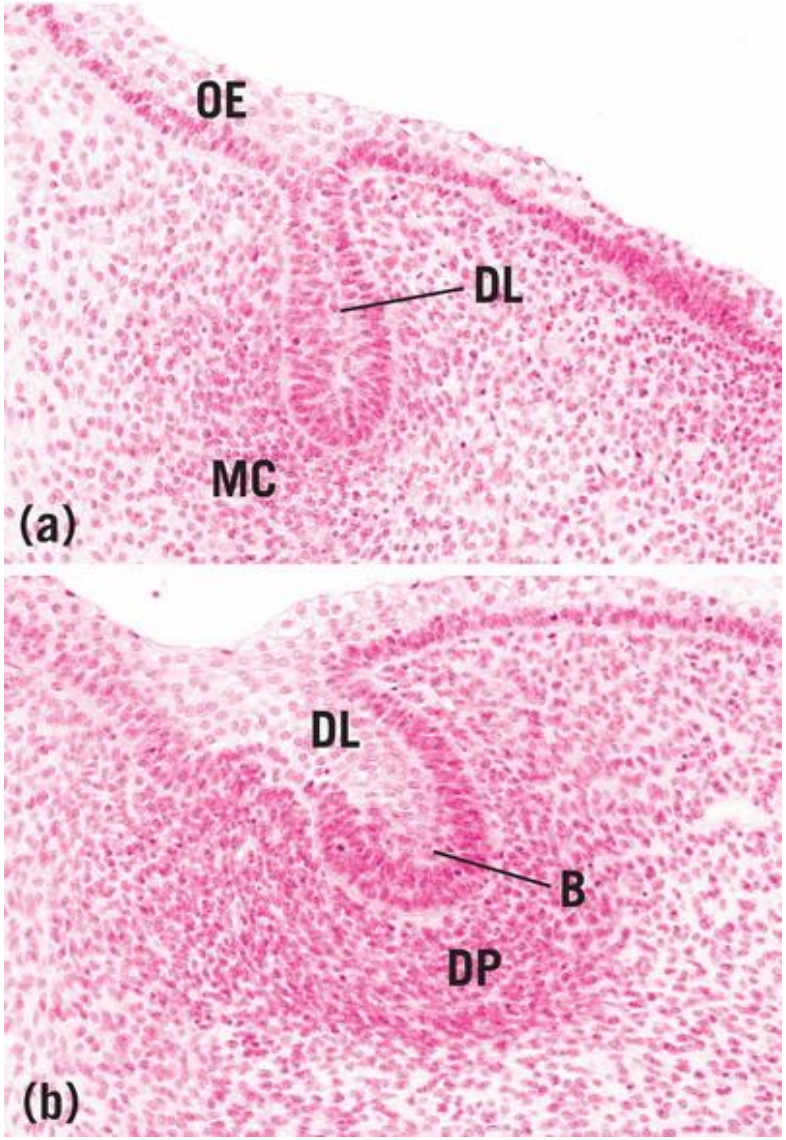
(Ecto)mesenchyme



Early cup stage

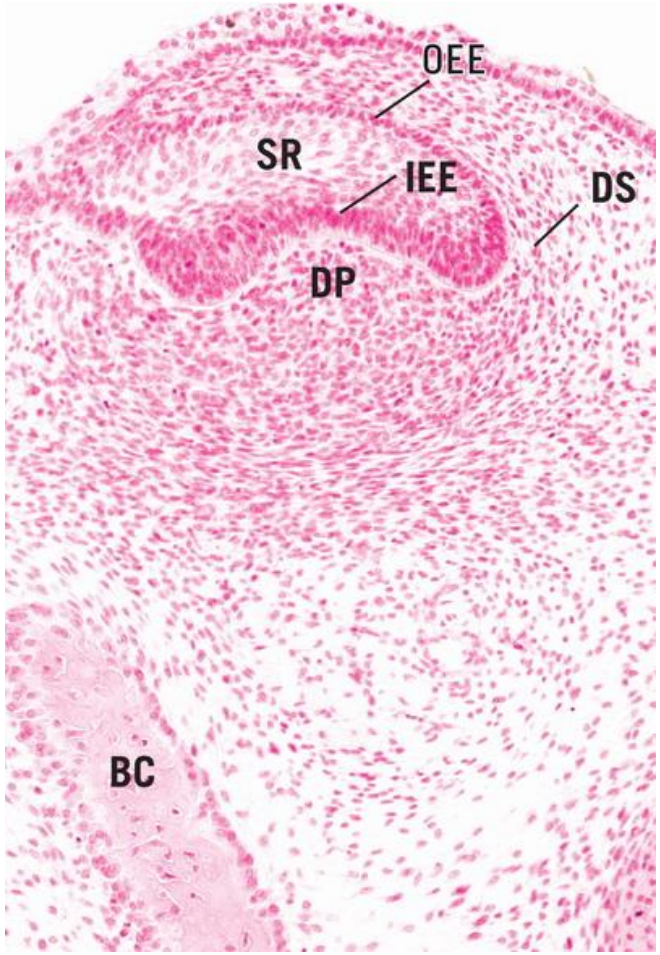
Kmiec, 2006

Dental lamina (DL) and bud (B) stages



Oe, oral epithelium; MC, condensed mesenchyme, DP, dental papilla

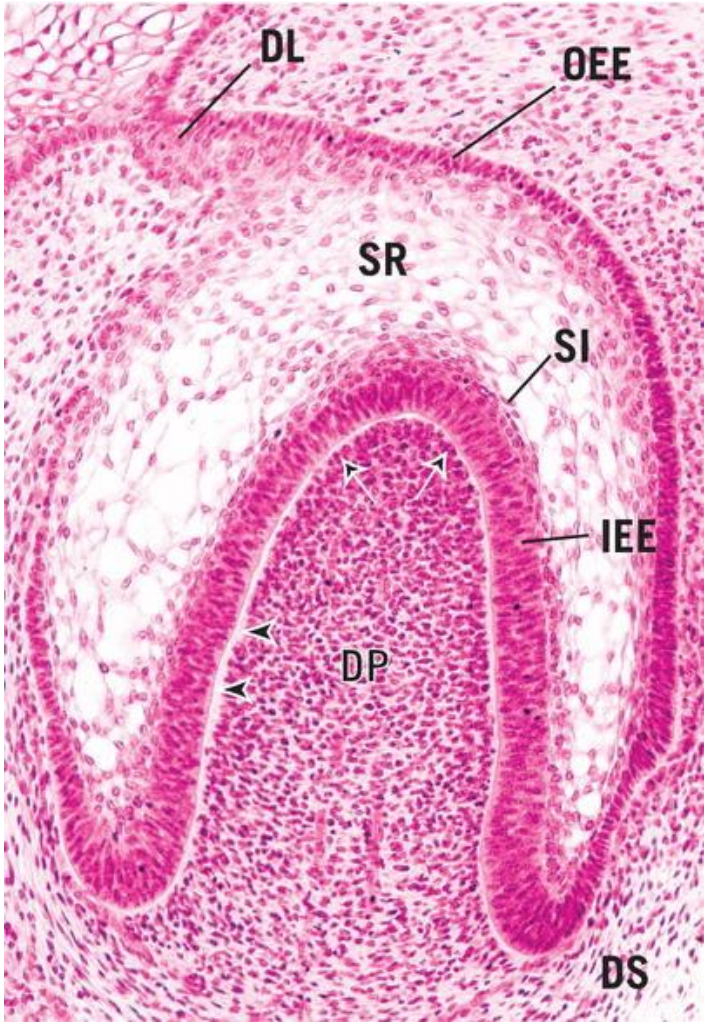
Cup stage



OEE and IEE, outer AND inner enamel epithelium; SR, stellate reticulum; DS, dental sac (follicle); BC, bone

Gartner, Txb. Histology, 4th ed.

Early bell stage (enamel organ)



Gartner, Txb. Histology, 4th ed.

DL, dental lamina; OEE and IEE, outer AND inner enamel epithelium; SR, stellate reticulum; SI, stratum intermedium; DP, dental papilla; DS., dental sac (follicle); BC, bone

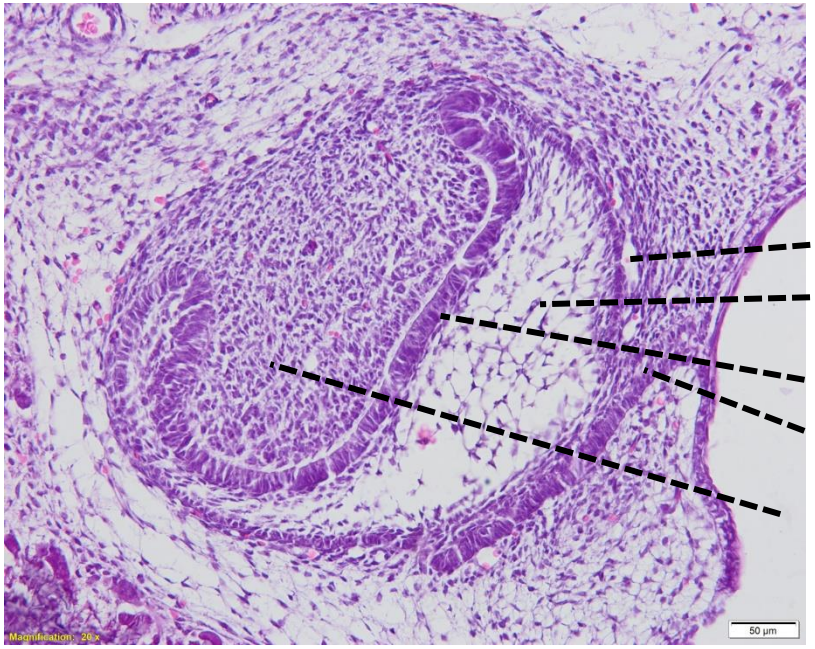
Enamel organ (bell stage) consists of a single layer of cuboidal cells forming the ***outer enamel epithelium***; the ***inner enamel epith***. has differentiated into columnar **pre-ameloblasts.**

The layer of cells adjacent to the inner enamel epith. has formed the ***stratum intermedium***, important for nourishing and supporting ameloblasts.

The remainder of the EO is occupied by the ***stellate reticulum***.

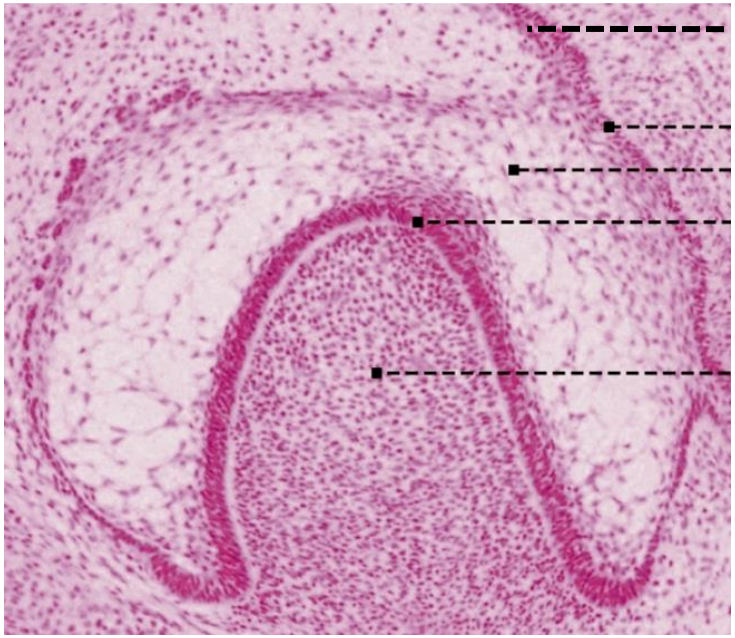
The layer of dental papilla cells adjacent to inner enamel epith. will differentiate into **odontoblasts**.

Bell stage – enamel organ (slide 38)



NO ROOT! ONLY CROWN at bell stage

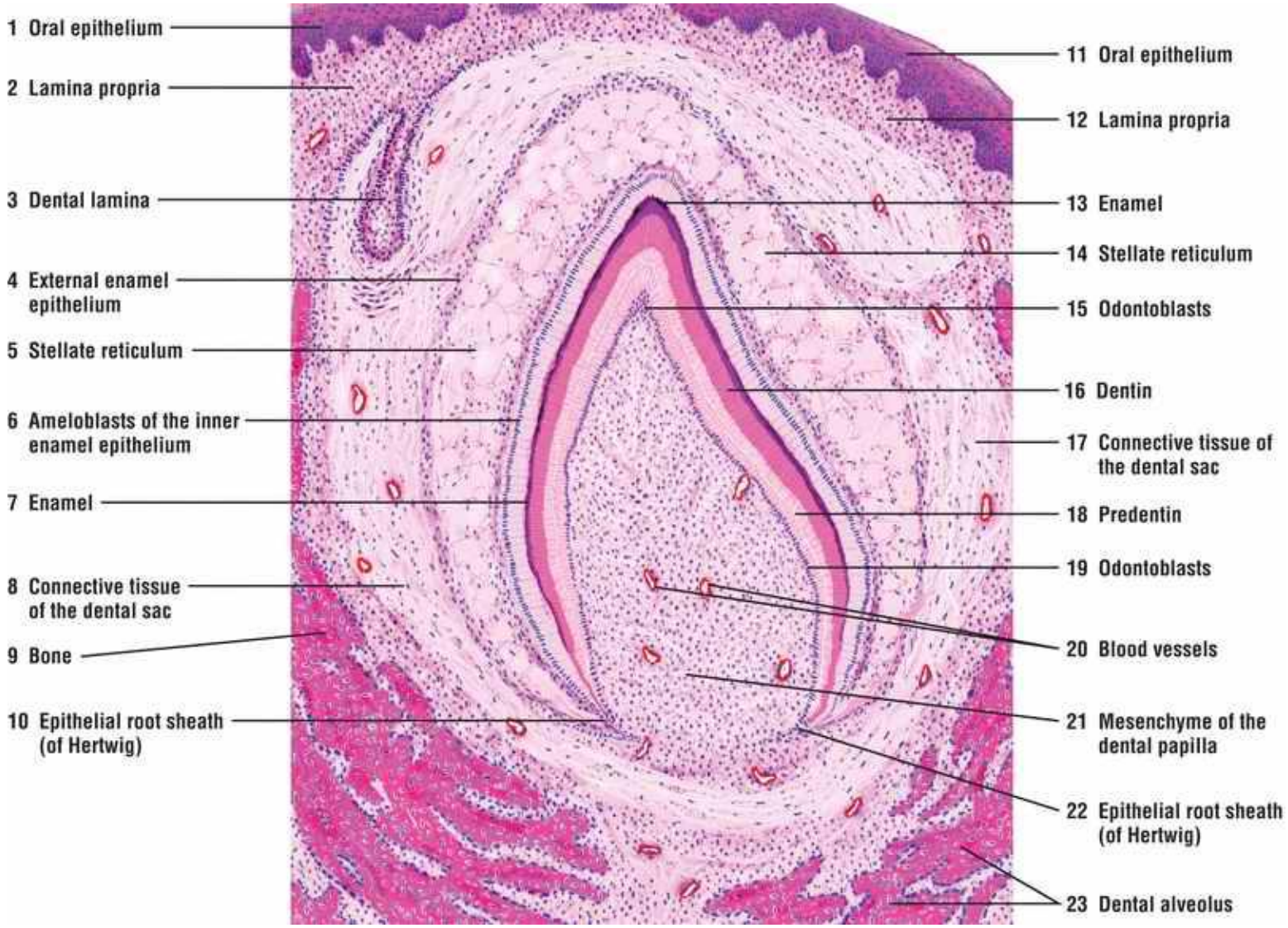
OUTER DENTAL EPITHELIUM
ENAMEL ORGAN PULP = STELLATE RETICULUM
INNER DENTAL EPITHELIUM
DENTAL LAMINA
DENTAL PAPILLA



DENTAL LAMINA
OUTER DENTAL EPITHELIUM
ENAMEL ORGAN PULP = STELLATE RETICULUM
INNER DENTAL EPITHELIUM
DENTAL PAPILLA

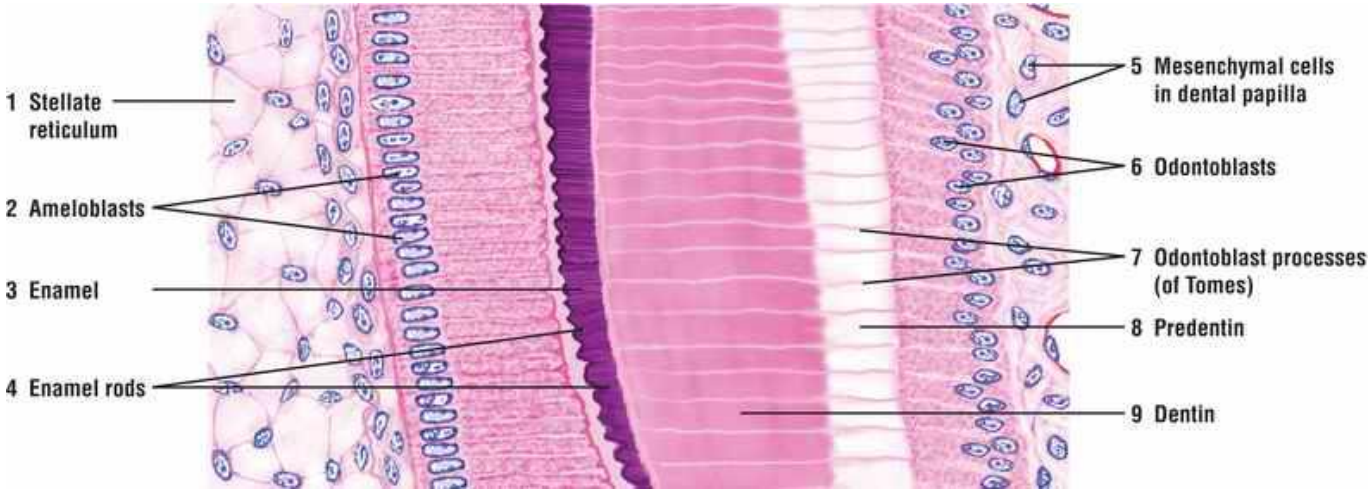
Gartner, Txb. Histology, 4th ed.

Developing enamel organ (bell stage): histogenesis (specific tooth's tissues) and morphogenesis (final formation of tooth's shape); actually, only the crown is formed at bell's stage, formation of root begin's before tooth's eruption

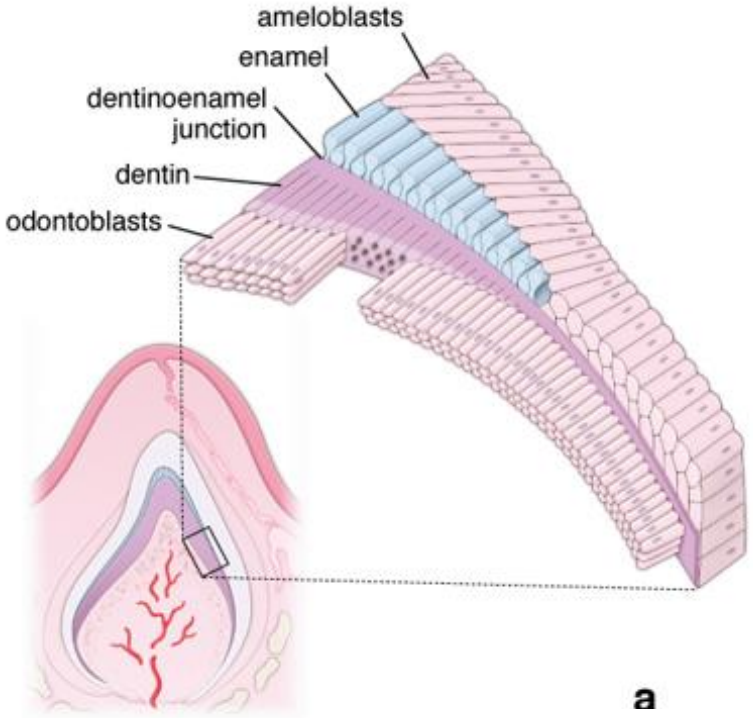


Gartner, Txb. Histology, 4th ed.

Dentoenamel junction in at bell stage



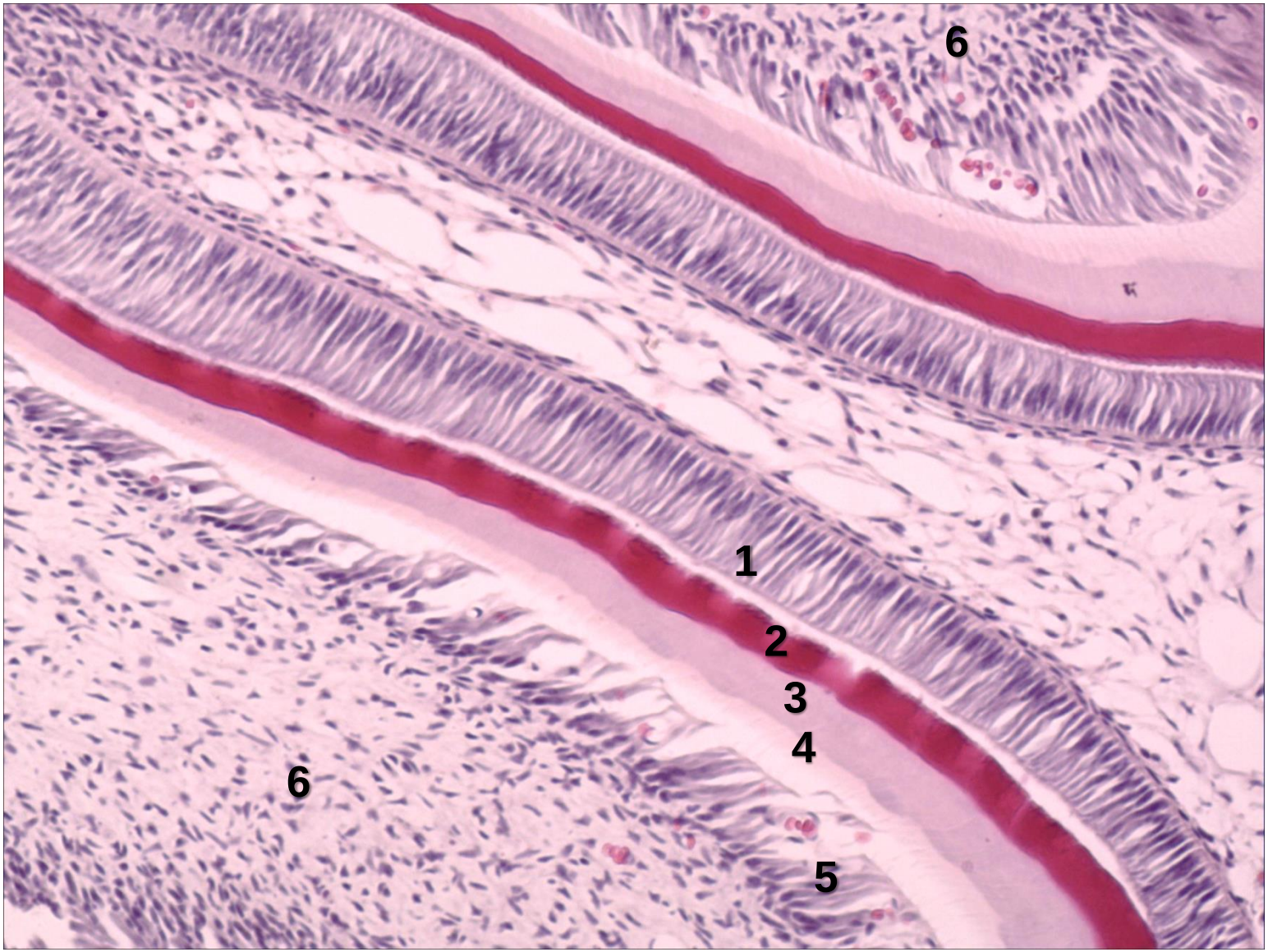
Cui, Atlas of Histology, 2011



In the **initial secretory stage, dentin is produced first by odontoblasts**. Enamel matrix is then deposited **directly on the surface** of the previously formed dentin by secretory-stage ameloblasts (a).
The secretory-stage ameloblasts continue to produce enamel matrix until the full thickness of the future enamel is achieved

Pawlina 2020

Neonate’s tooth



1 – ameloblasts 2 – enamel 3 – dentin
4 – predentin 5 – odontoblasts 6 – pulp

Neonate’s tooth