DIGESTIVE SYSTEM

Histology

Semester 2, Year 2 •

Dr . Amira Osman

Associate professor of Human histology & Cell Biology

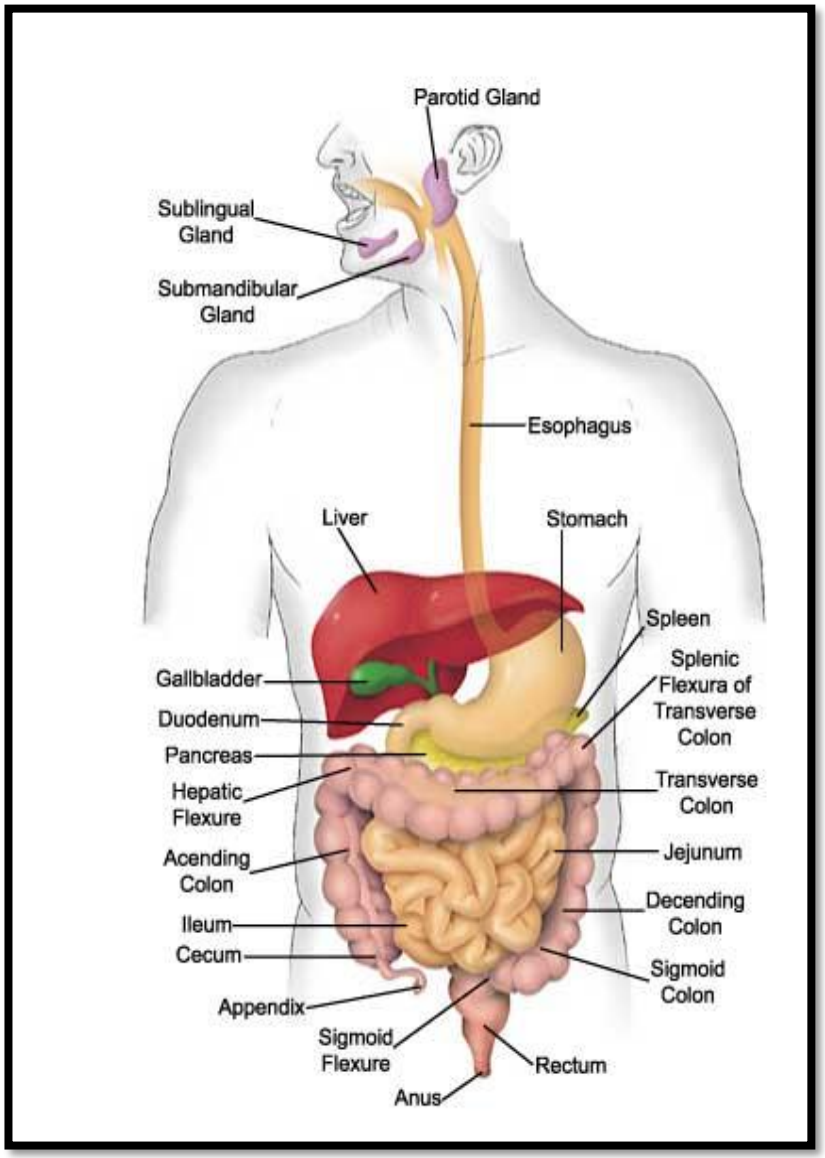
Digestive System Consists of:

(I) Digestive Tract:

- Oral cavity
- Oropharynx
- Oesophagus
- Stomach
- Small Intestine
- Large intestine
- Rectum & Anal canal

(II) Associated Glands:

- Salivary Glands
- Liver
- Pancreas



Functional Histology of the GIT

- **Passage of food** (mouth, oropharynx , oesophagus) (Protective epithelium)
- **Digestion** (stomach , intestine)
- **Absorption** (small intestine)
- **Elimination of residues & absorption of water** (large intestine , rectum & anal canal)

Oral Cavity

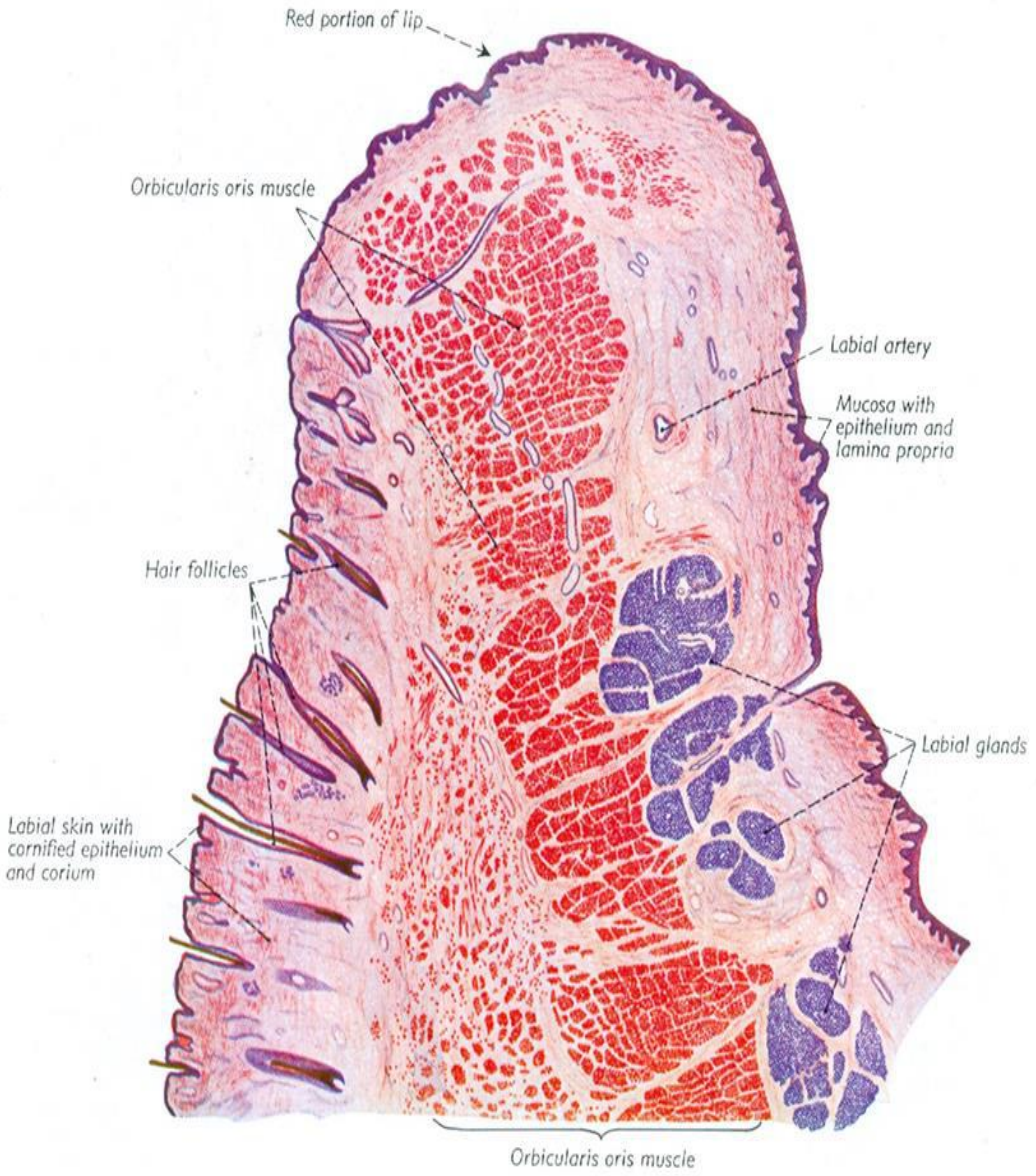
- **Lip**
- **Cheeks**
- **Tongue**
- **Pharynx -------Nasopharynx**
  ------- Oropharynx
  ------- Laryngeopharynx
- **Palate ---------Hard**
  ---------- Soft
- **Teeth & gums (gingiva)**

Functional structure:

- **Oral cavity** is lined by a mucous membrane : Non-keratinized stratified squamous epithelium on soft palate,inner part of lip cheeks,floor of mouth
- On the gums , hard palate & dorsal surface of tongue , it becomes keratinized

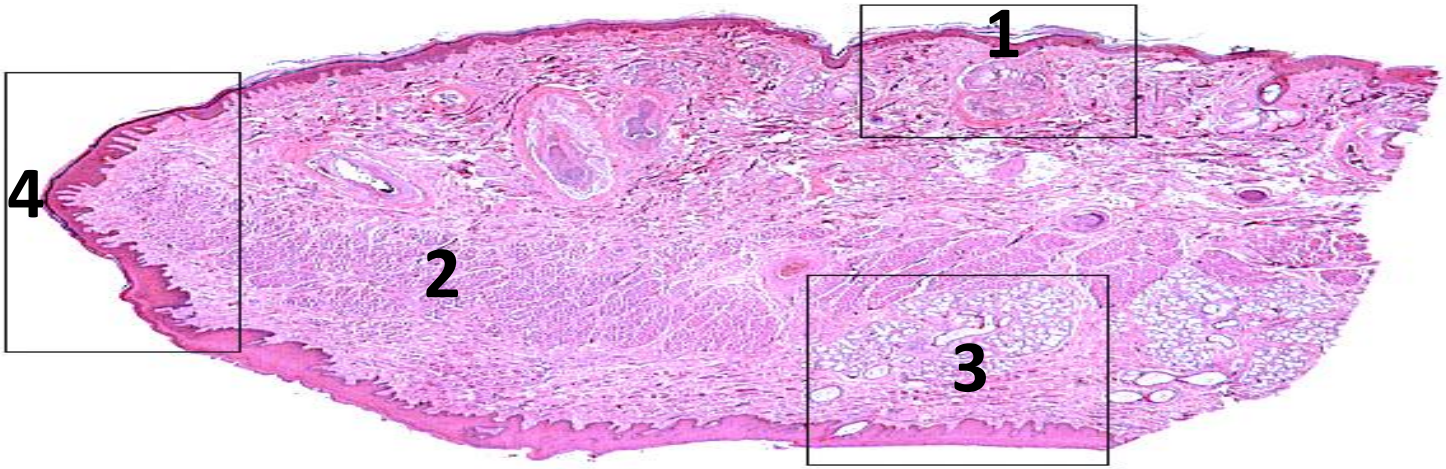
- **Lamina propria** : areolar C.T. contains minor salivary glands , blood & lymph capillaries
- **In vestibule** , on floor of mouth , soft palate , Its lamina propria is loose allowing considerable mobility .

The Lip


Red portion of lip
Orbicularis oris muscle
Labial artery
Mucosa with epithelium and lamina propria
Hair follicles
Labial glands
Labial skin with cornified epithelium and corium
Orbicularis oris muscle

The Lip

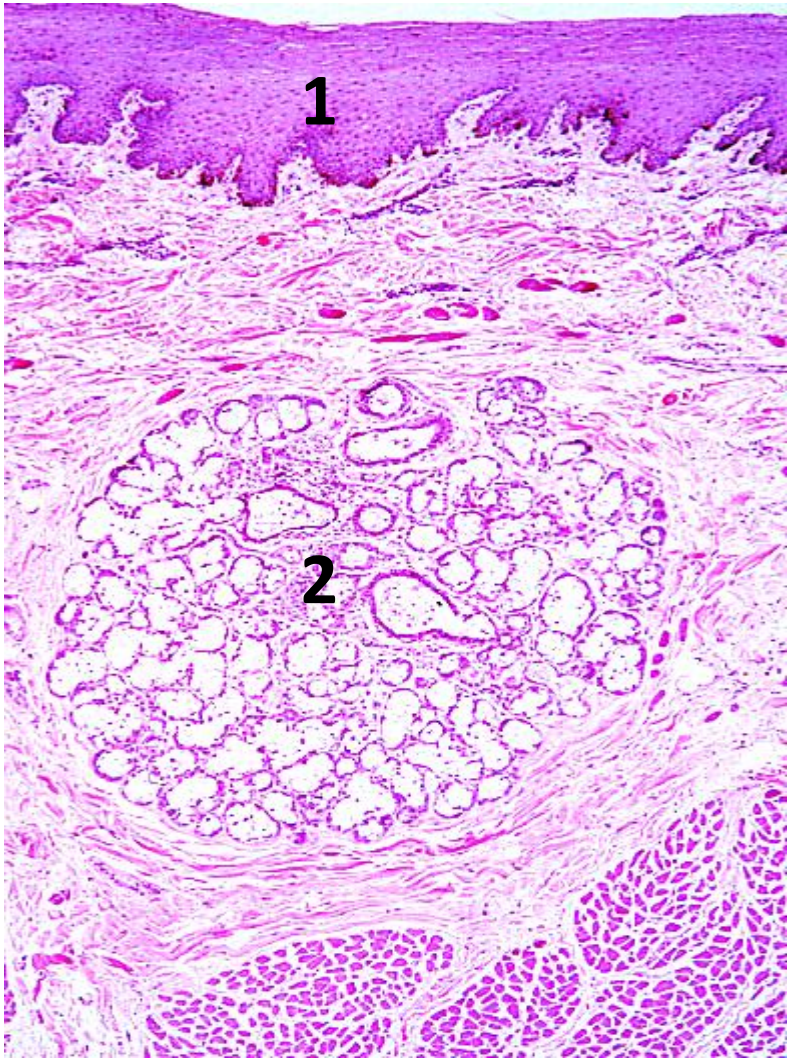
Outer surface	Middle layer	Inner surface	Lip (red) margin
Thin skin	Orbicularis oris	Mucous membrane	Modified skin



The Lip

- **Inner surface (mucous membrane)**

1. ***Epithelium***: thick, transparent, stratified squamous non-keratinized, contains many nerve endings.
2. ***Corium***: loose C.T. containing labial mucous glands.

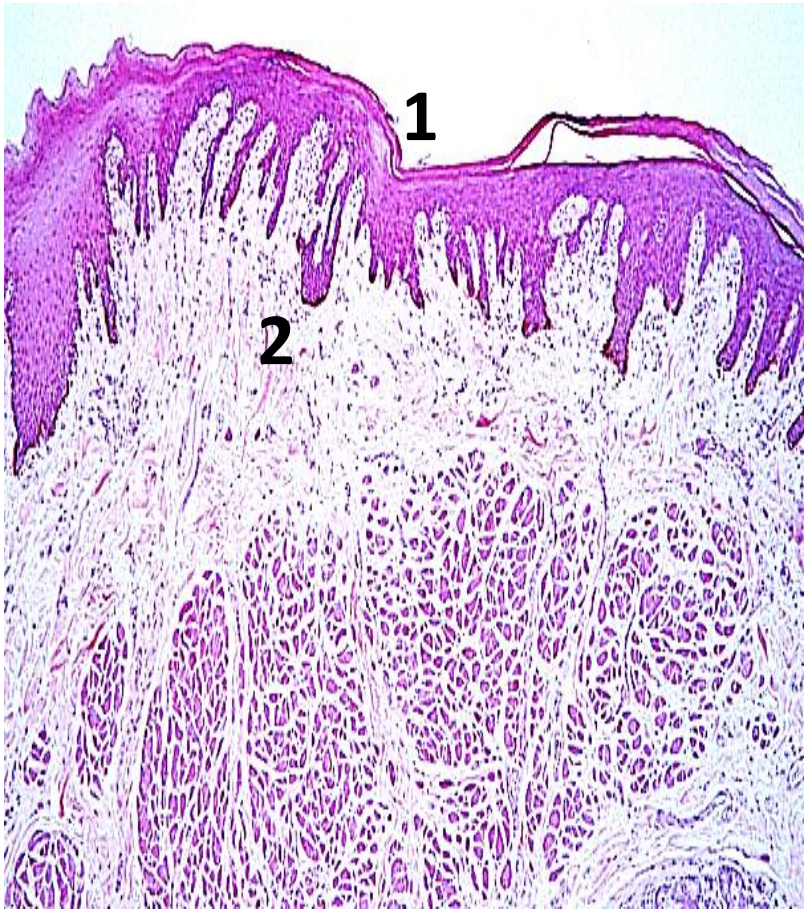


The Lip

- **Lip (red) margin** modified skin

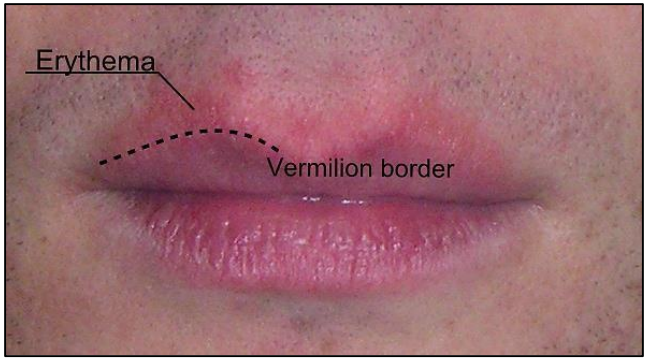
1. ***Epidermis***: transparent, thin, partially keratinized stratified squamous epithelium to reveal the underlying blood vessels in the dermis.
2. ***Dermis:***

- Highly vascular, so called red margin & highly sensitive.
- Absent hair follicles, sebaceous and sweat glands.



The lip margin (vermilion) represent the change in the epidermis from highly keratinized face skin to less Keratinized lip skin. richly supplied e free nerve endings. So it is *highly sensitive*.

(herpetic stomatitis : HSV type I)



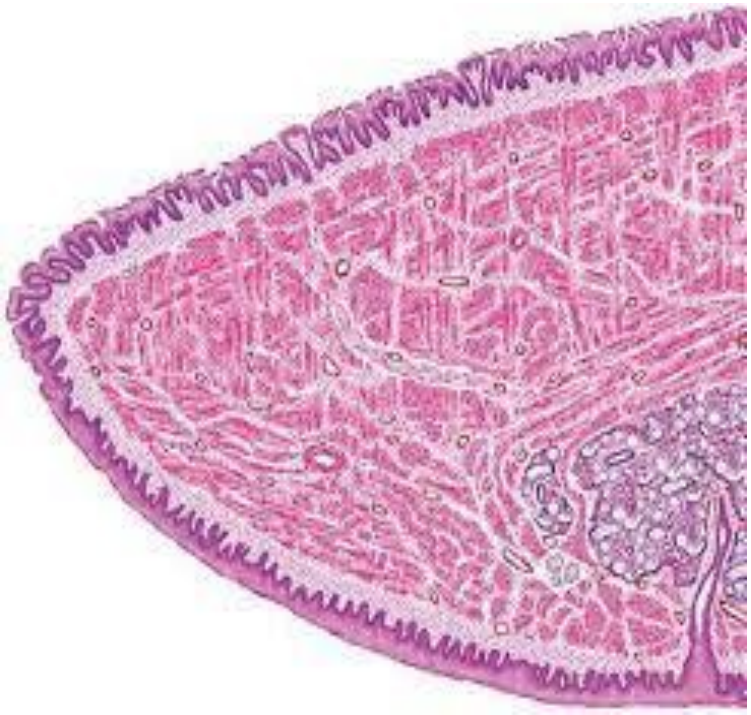
The Tongue

Skeletal muscle

Longitudinal

Transverse

Vertical



Mucous membrane

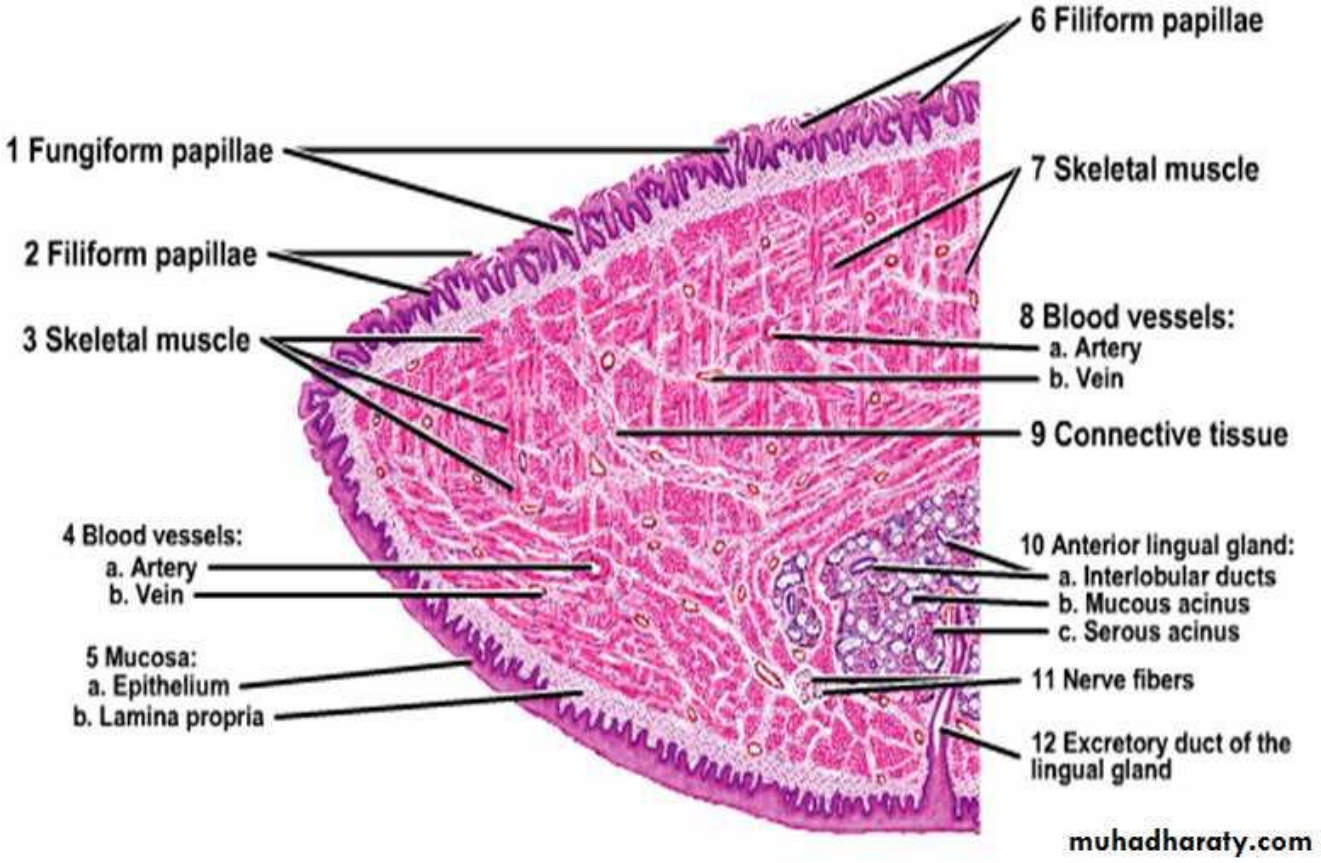
Epithelium stratified squamous epithelium

Corium: contains lingual glands & lingual tonsils

Dorsal surface

Ventral surface

Rough	Smooth
Lingual papillae **Present**	Absent
Epithelium **Mostly keratinized**	Non-keratinized


6 Filiform papillae
1 Fungiform papillae
7 Skeletal muscle
2 Filiform papillae
8 Blood vessels:
a. Artery
b. Vein
3 Skeletal muscle
9 Connective tissue
4 Blood vessels:
a. Artery
b. Vein
10 Anterior lingual gland:
a. Interlobular ducts
b. Mucous acinus
c. Serous acinus
5 Mucosa:
a. Epithelium
b. Lamina propria
11 Nerve fibers
12 Excretory duct of the lingual gland
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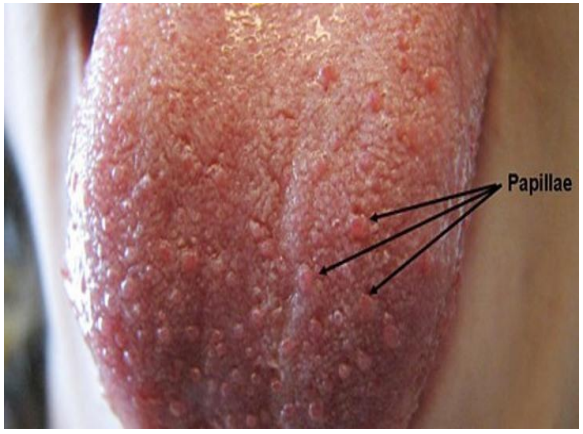
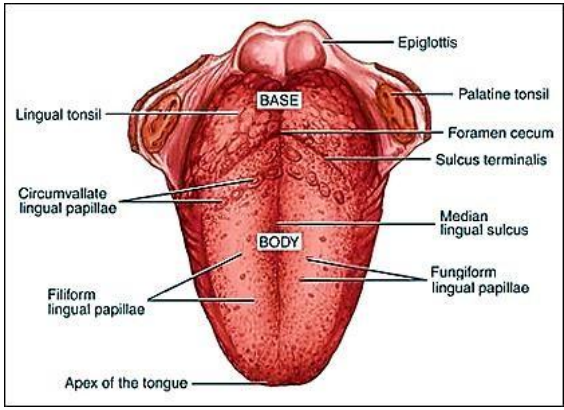

Papillae

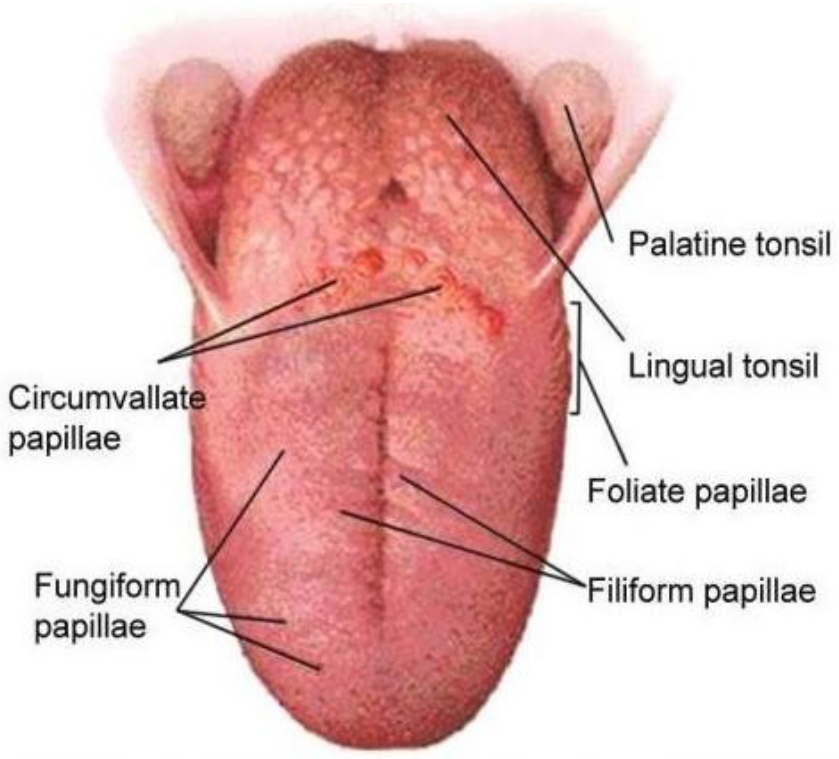

Epiglottis
Palatine tonsil
Lingual tonsil
BASE
Foramen cecum
Sulcus terminalis
Circumvallate lingual papillae
Median lingual sulcus
BODY
Fungiform lingual papillae
Filiform lingual papillae
Apex of the tongue

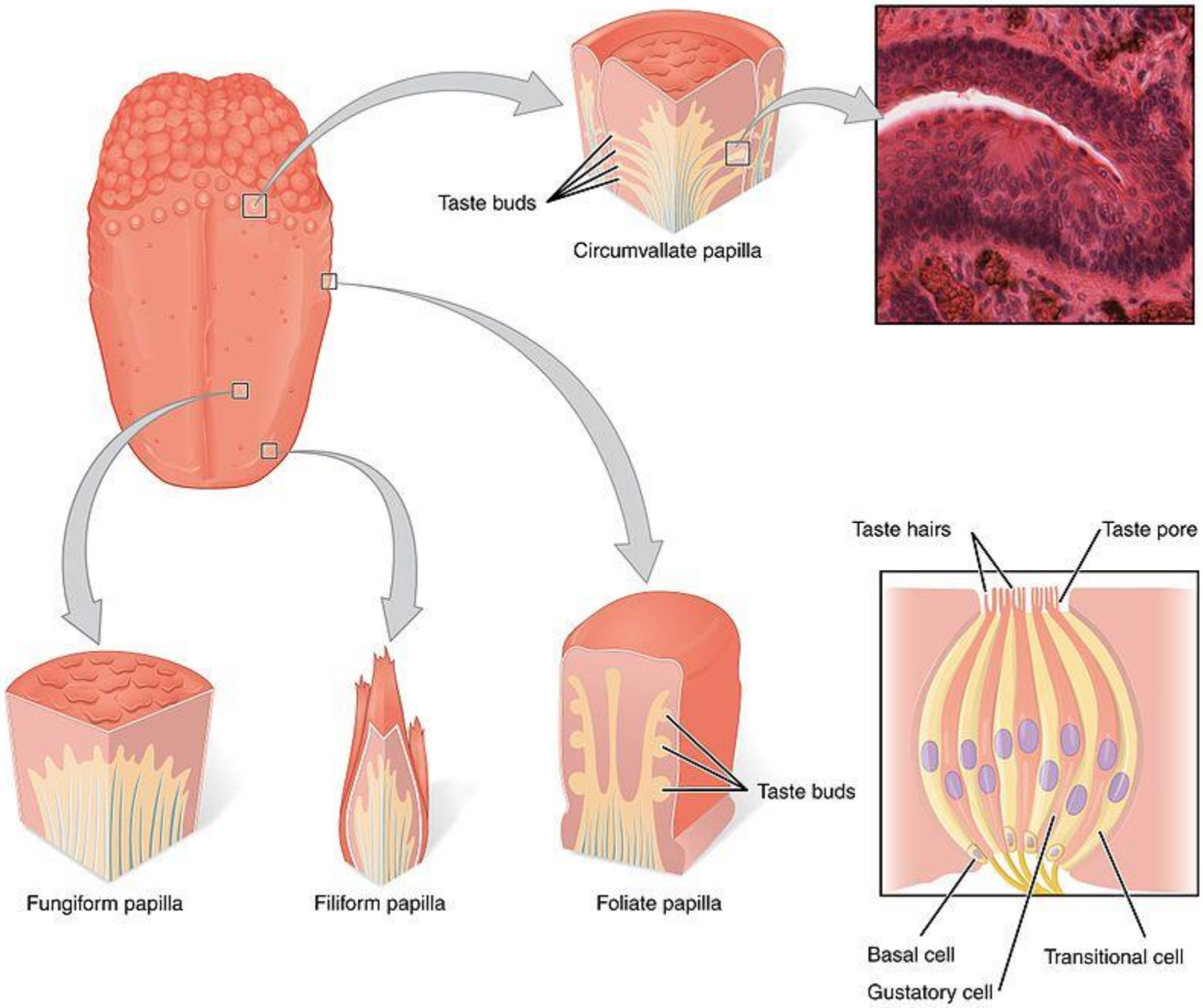
Lingual Papillae

- ***Definition***: Small numerous elevations of the mucous membrane covering the dorsal surface of the tongue.

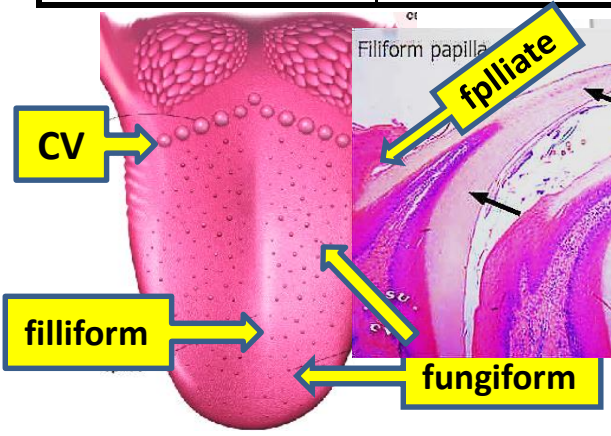
- ***Types:***

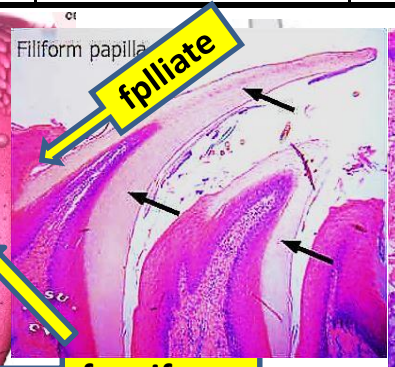
1. Filiform papillae
2. Fungiform papillae
3. Circumvallate papillae
4. Foliate papillae

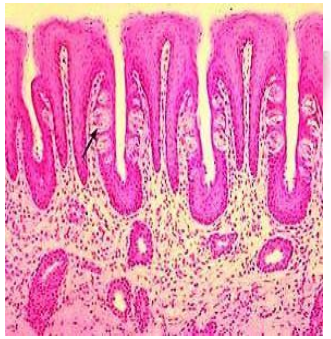


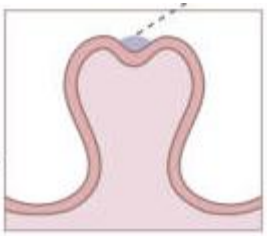
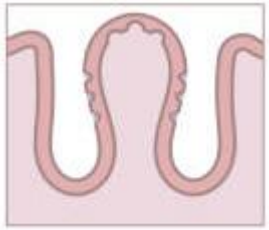

Taste buds
Circumvallate papilla
Fungiform papilla
Filiform papilla
Foliate papilla
Taste buds
Taste hairs
Taste pore
Basal cell
Gustatory cell
Transitional cell

	Filiform papillae	Fungiform papillae	Circumvallate papillae	Foliate papillae
Site:	Anterior 2/3	Sides & tip	Anterior to sulcus terminalis	Posterior part of lateral margin
Number:	Numerous	Less numerous	8 - 12	Poorly developed in human
Appearance:	Long conical	• Mushroom-like (narrow base & rounded top) • Red in colour	Large circular with wide top	Rectangular (parallel ridges)



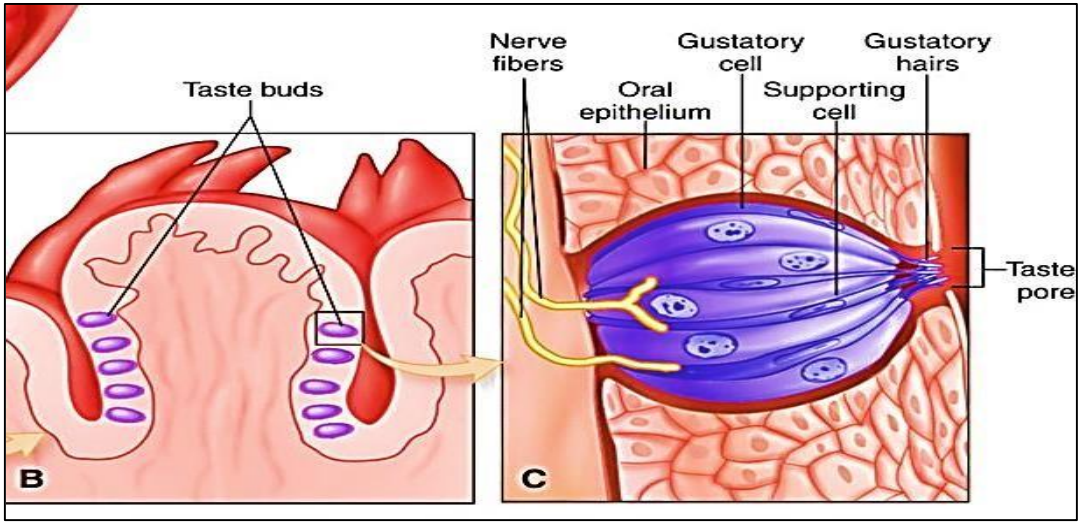


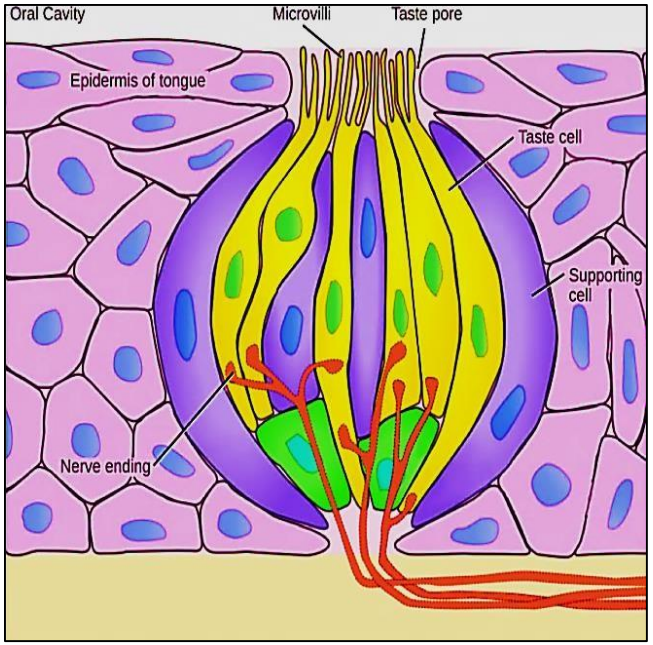


	Filiform papillae	Fungiform papillae	Circumvallate papillae	Foliate papillae
Structure:				
Epithelium	Keratinized	Non-keratinized	Keratinized top Non-keratinized sides	Keratinized top Non-keratinized sides
C.T. core		Many blood vessels (**red**)	Von-Ebner's glands	Serous glands
Grooves	**No** 	**No** 	Separate papillae & receive secretion of glands 	
Taste buds	**No**	**Top**	Sides	Sides
Function:	Suckling & chewing	Taste sensation	Taste sensation	Taste sensation

Taste buds (Neuroepithelium)

- Oval structures present on dorsal surface of tongue, in the lingual papillae (2000 – 8000)





- Each taste bud formed of **3 types of cells** & **taste pore** for passage of saliva:

1 **Sensory (taste, gustatory) cells: 50- 100 cells / bud**

2 **Supporting cells**

3- **Basal cells (stem cells)**

- Neuro-epithelial (taste, chemoreceptors) cells:

a. Tall columnar cells, central in position, 3 types I, II, III
b. Their apical surface terminate e fine filaments called gustatory hairlets which project into the gustatory pore
c. The base of the cells has vesicles that contain neurotransmitter & synapse with afferent nerve fibers

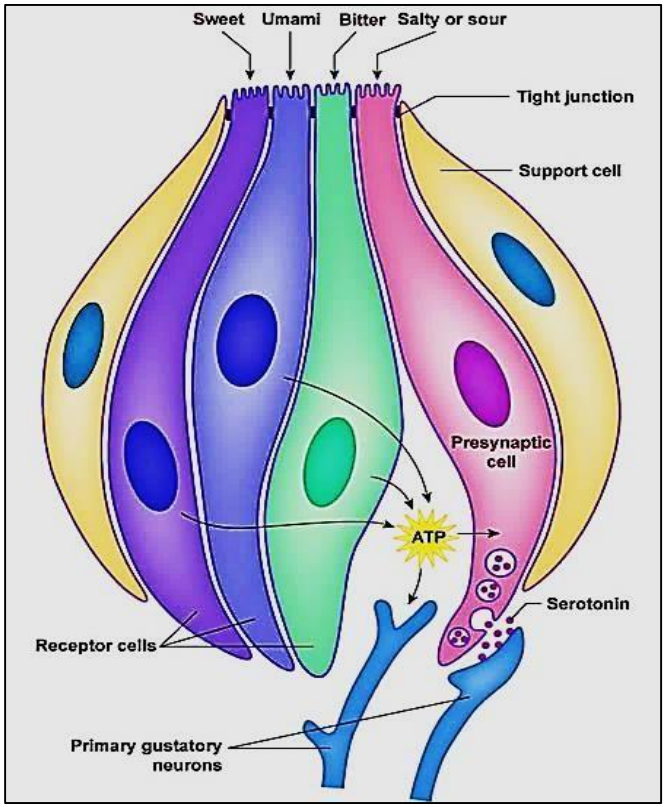
- The supporting cells

Tall columnar cells form the outer wall of the taste buds

- Basal cells:

found at the base of taste bud act as a stem cells for regeneration

The average life of a taste bud is 10 days



Palate

Hard Palate	Soft Palate
⮜Anterior 2 / 3	⮜Posterior 1 / 3
⮜Keratinized st. sq . epith & lamina propria	⮜Its oral surface is covered with Non-keratinized st .sq . Epith anterior . ⮜Its nasal surface is covered with Pseudo st . col. Ciliated epith posterior
⮜ Strongly bound to periostem of maxilla and palatine bones	⮜Movable i.e. contains skeletal muscles in centre with mucous glands

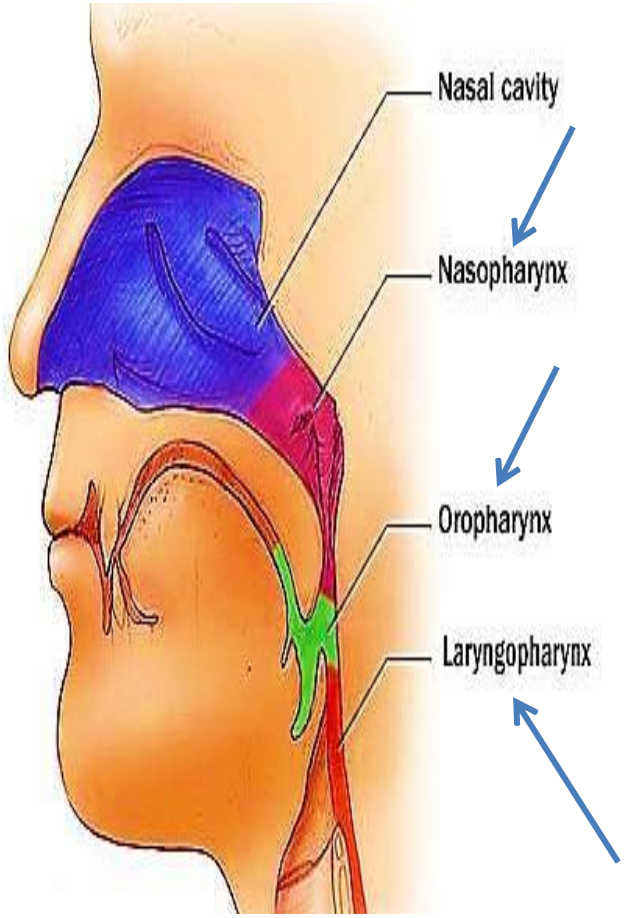
Pharynx:

- Divided into 3 parts:

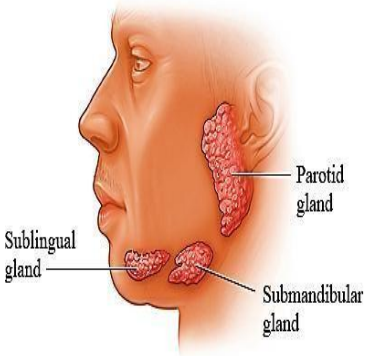
1 Nasopharynx: lined e pseudo- stratified columnar ciliated epith.

2 Oropharynx : lined e non- keratinized Stratified squamous epith.

3- Laryngo-pharynx: as oropharynx



Salivary Glands



Major

Compound branched tubulo-alveolar glands

- Parotid
- Submandibular
- Sublingual

Minor

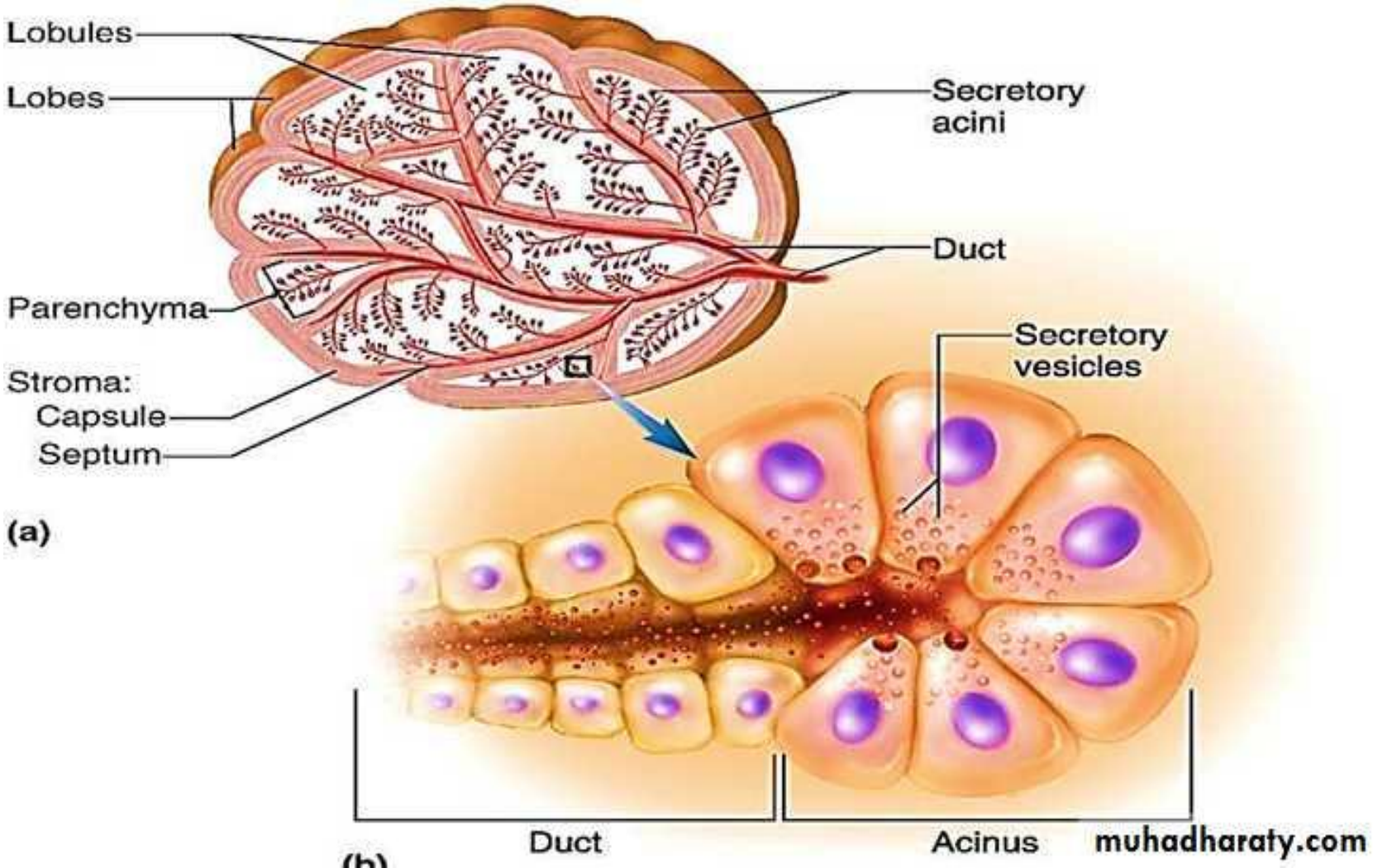
Simple branched tubulo-alveolar glands in mucous membrane of mouth cavity

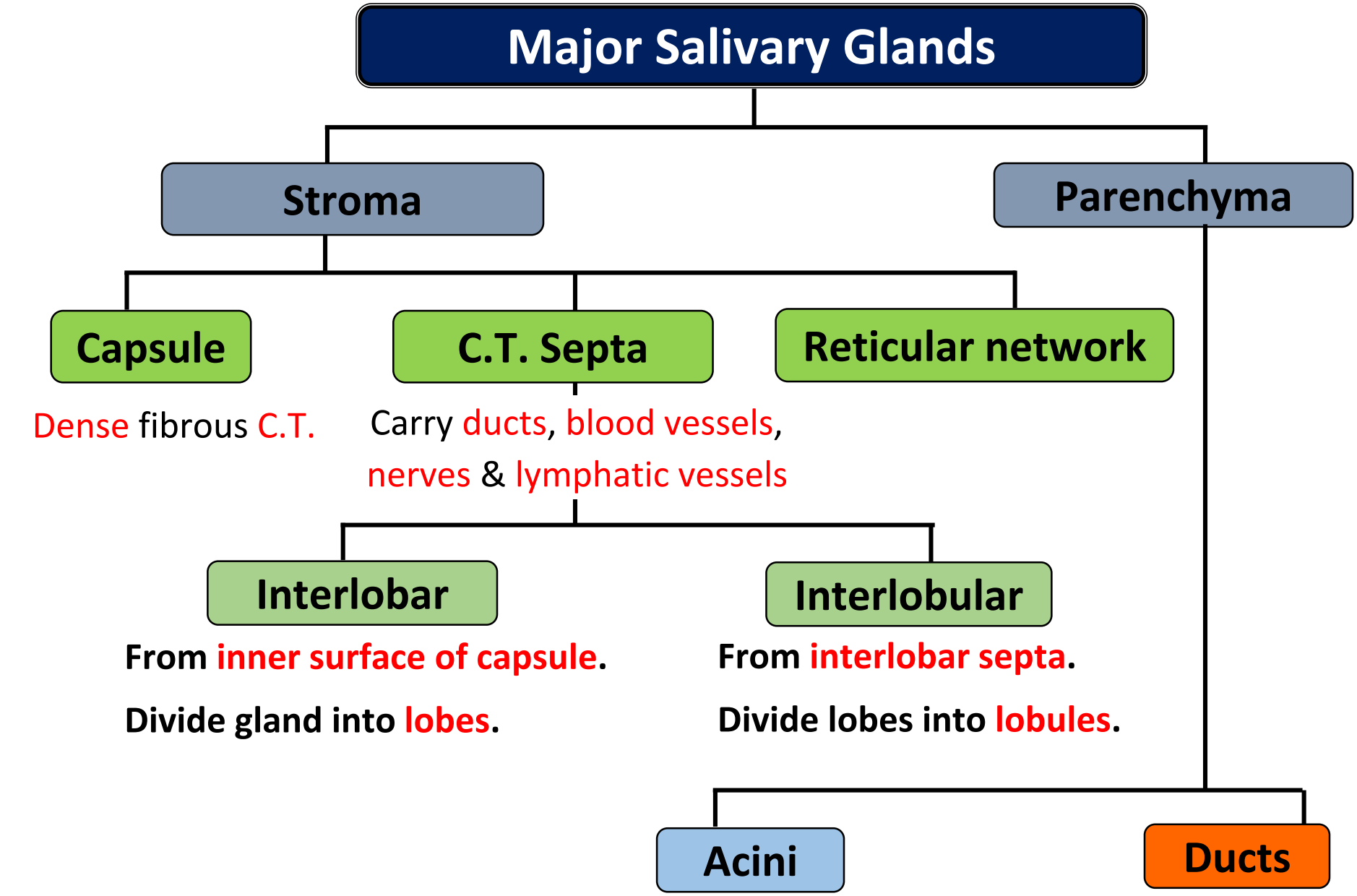
- Buccal
- Labial
- Lingual
- Palatine

Major Salivary Glands

- Exocrine glands, produce the saliva (90%) (pH 6.5 – 7.5)

  (99.5% :water & 0.5% : electrolytes, mucus, enzymes & Ab)



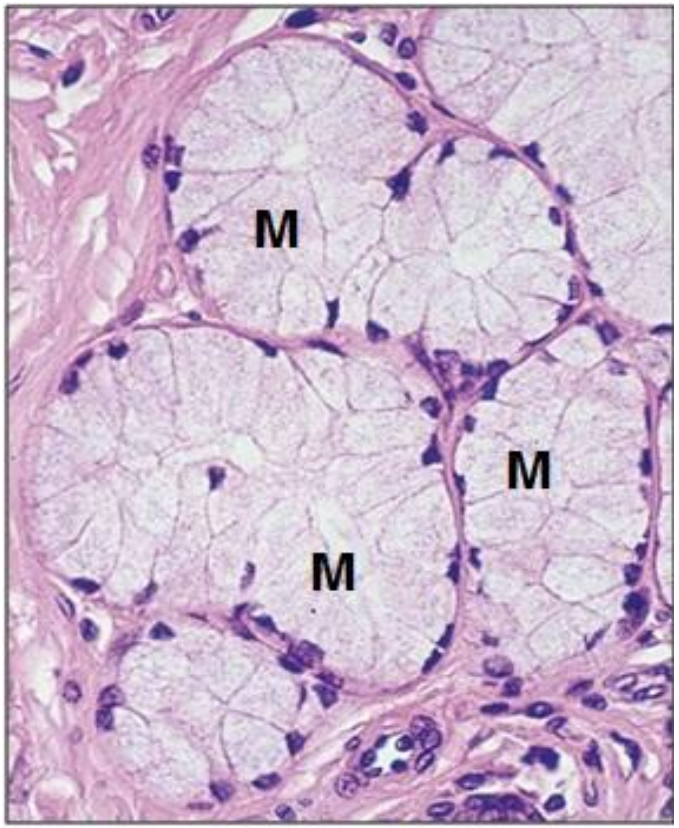

Major Salivary Glands
Stroma
Parenchyma
Capsule
C.T. Septa
Reticular network
Dense fibrous C.T.
Carry ducts, blood vessels, nerves & lymphatic vessels
Interlobar
Interlobular
From inner surface of capsule.
Divide gland into lobes.
From interlobar septa.
Divide lobes into lobules.
Acini
Ducts
Group of cells around central lumen with basket (myoepithelial) cells surrounding the acini to squeezes the secretions into ducts

	Mucous acinus	Mixed acinus	Serous acinus
• **Size** • Lumen • **Staining**	Larger Wider Light 		Smaller Narrower Dark 
• **LM of cells:** ✓ Shape ✓ Boundaries ✓ Nucleus ✓ Cytoplasm	Columnar Distinct Flat, basal Pale, foamy basophilic	mucous acinus capped by a group of serous cells	Pyramidal Indistinct Rounded, central Deep basophilic with apical acidophilic zymogen granules Basal basophilia

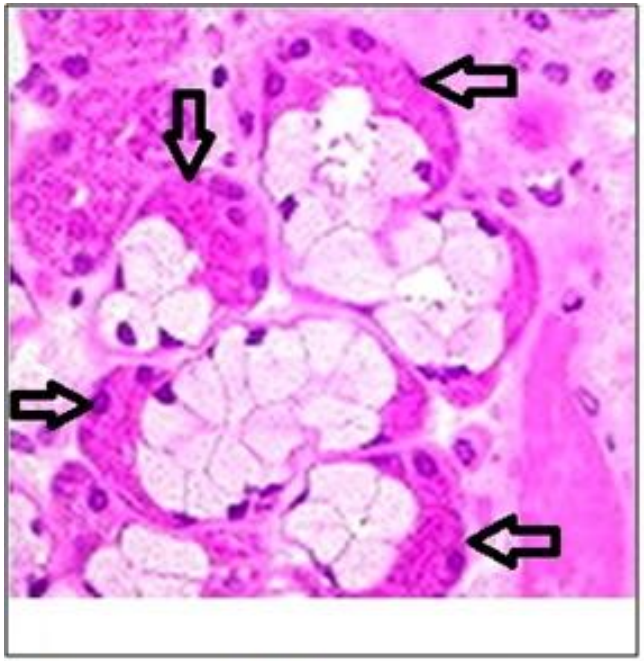
	Mucous acinus	Mixed acinus	Serous acinus
• **EM of cells:**	1. rER, Golgi apparatus 2. Mitochondria 3. Apical electron **lucent mucous** granules	mucous acinus capped by a group of serous cells	1. rER, Golgi apparatus 2. Mitochondria 3. Apical electron **dense secretory** granules

Types of Acini in Salivary Glands

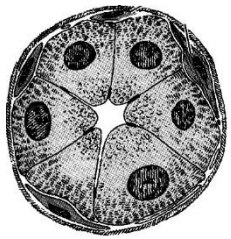
Serous Acinus

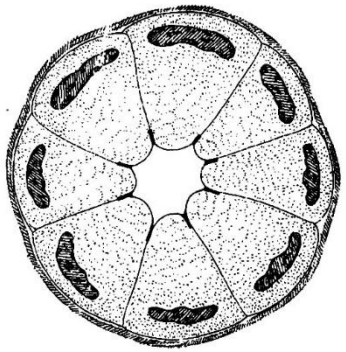


Mucous Acini

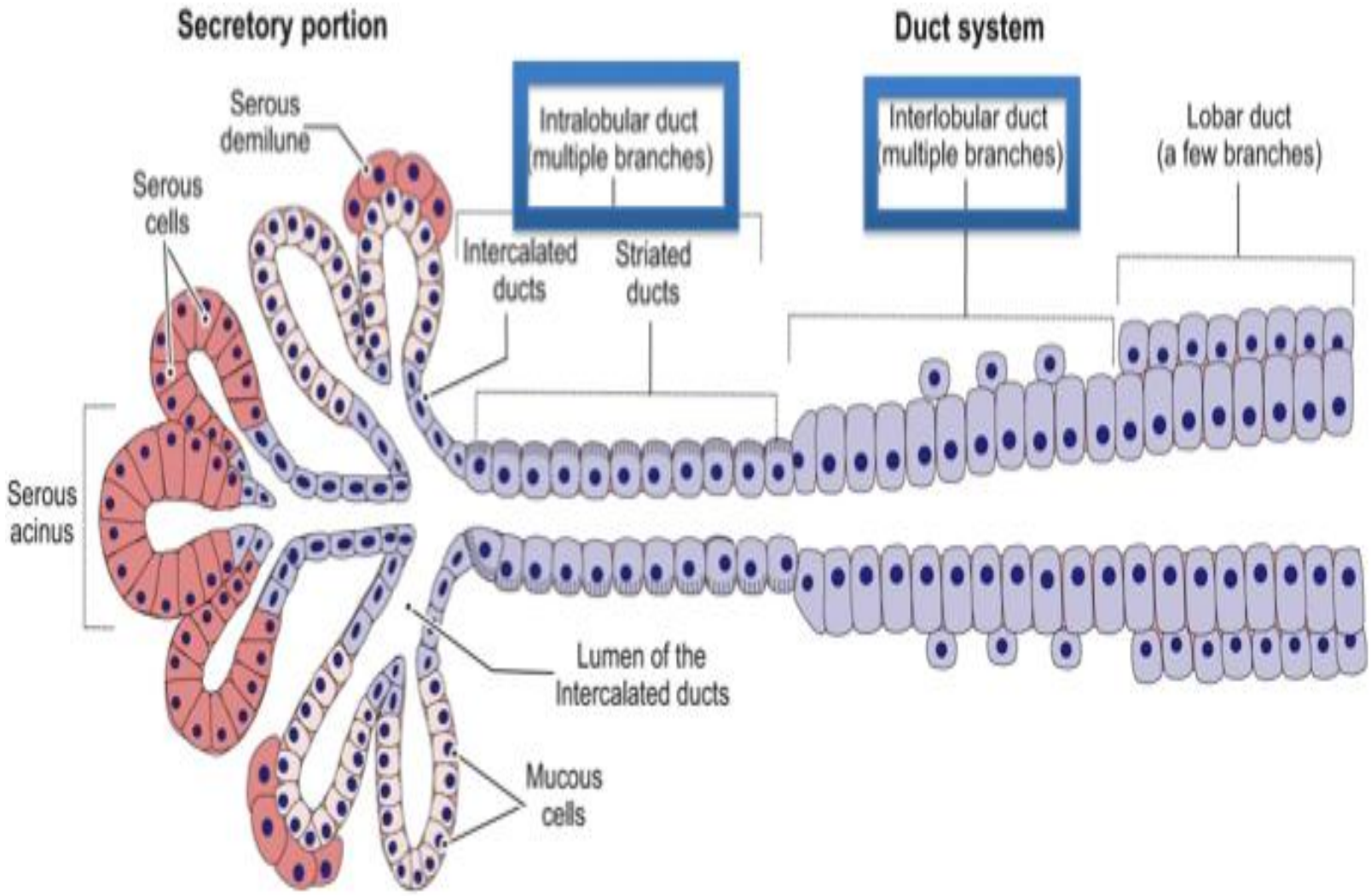


Mixed acini showing serous demilune





Ducts system



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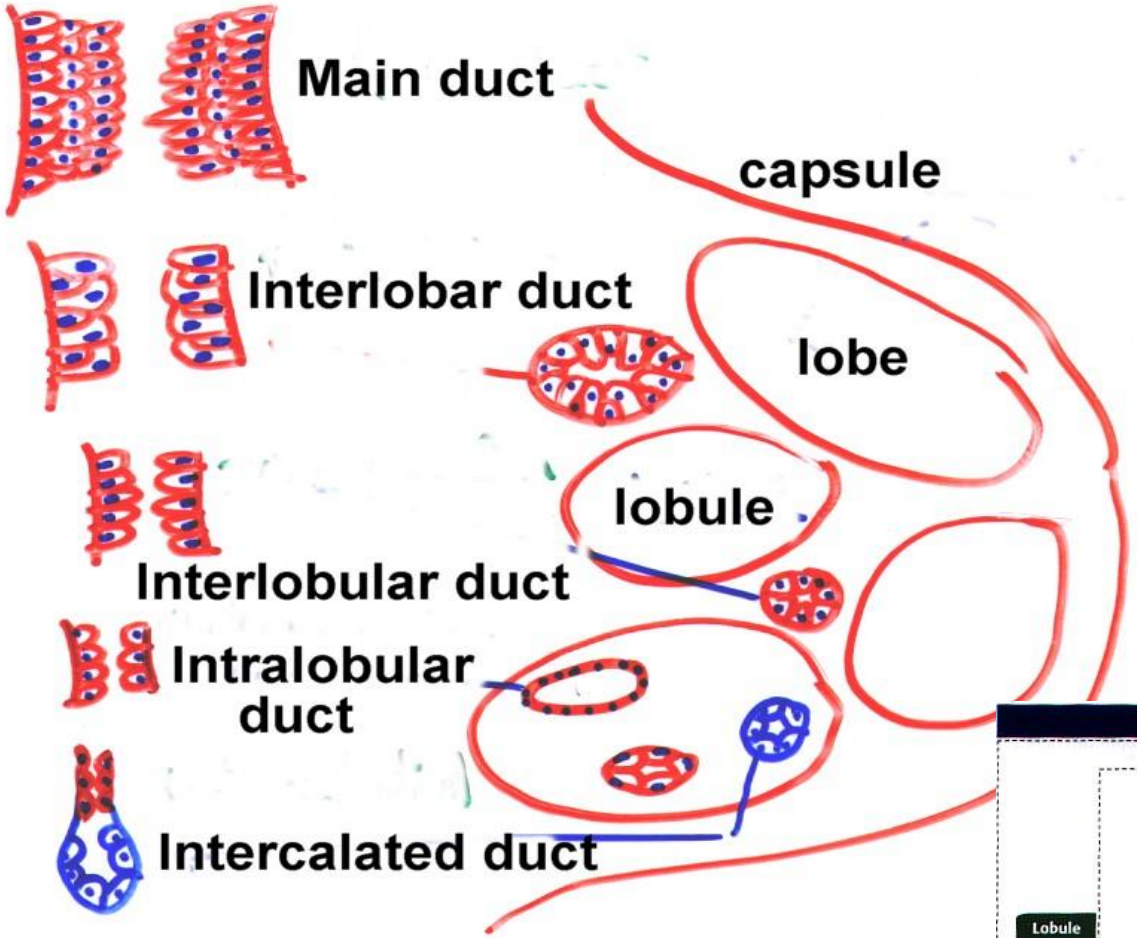
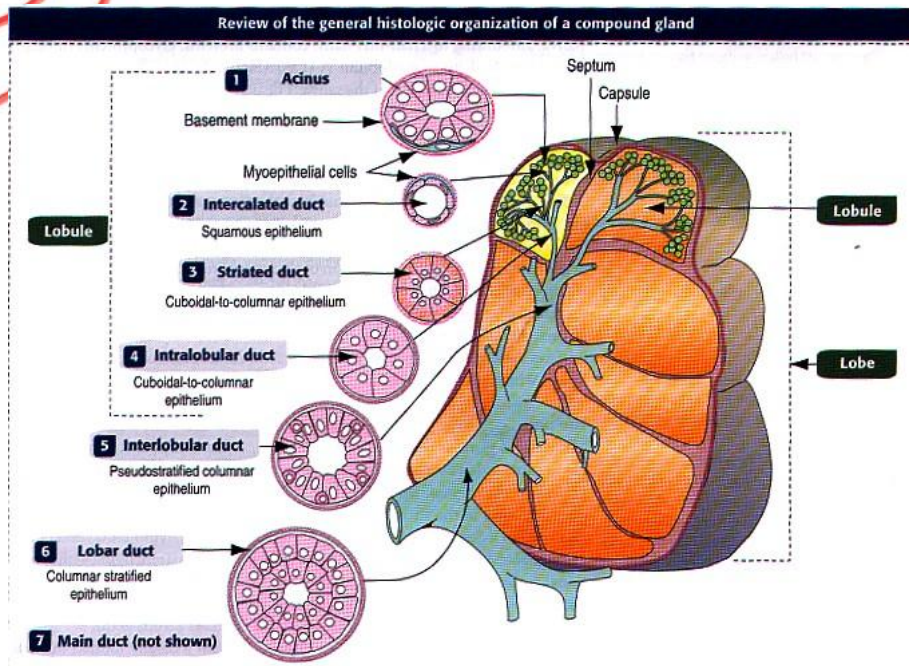
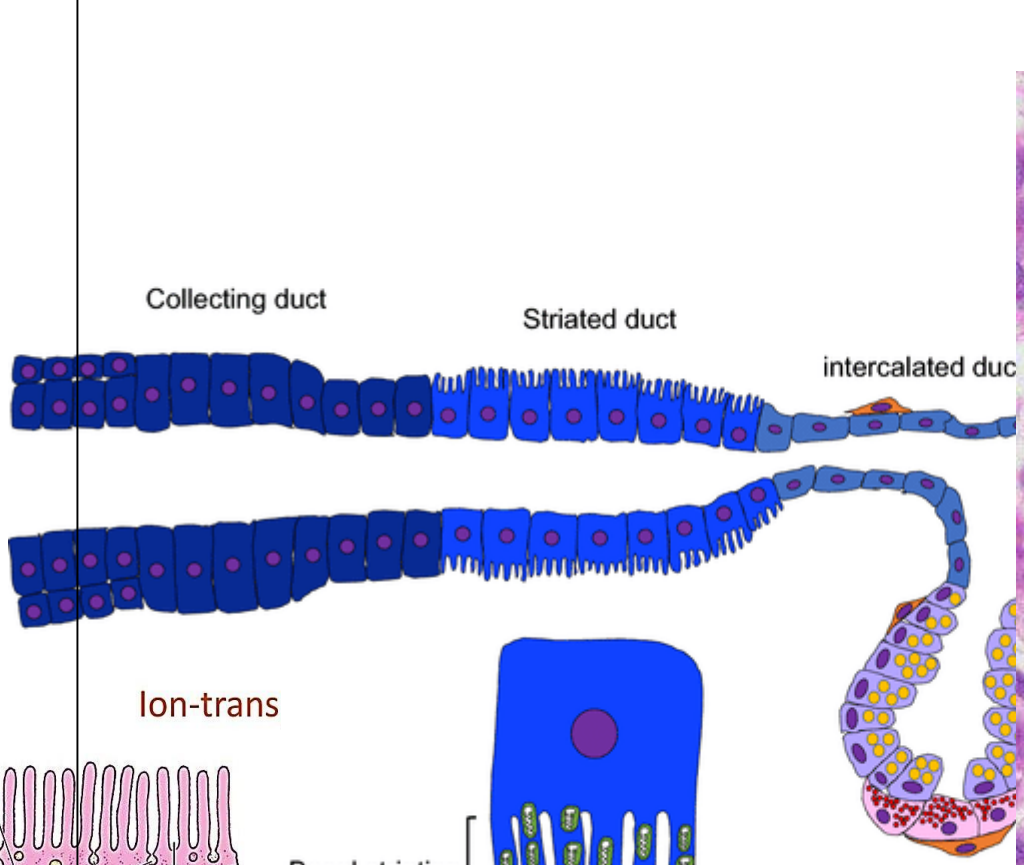

Main duct
capsule
Interlobar duct
lobe
lobule
Interlobular duct
Intralobular duct
Intercalated duct

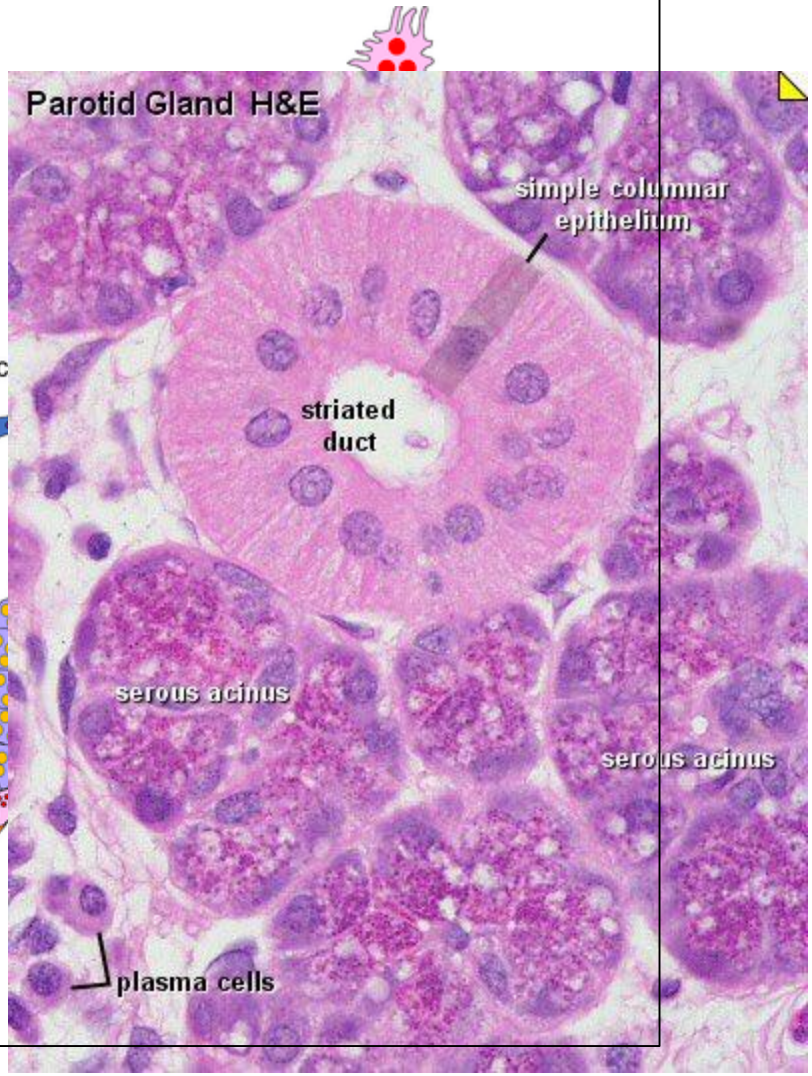

Review of the general histologic organization of a compound gland
1 Acinus
Basement membrane
Myoepithelial cells
2 Intercalated duct
Squamous epithelium
3 Striated duct
Cuboidal-to-columnar epithelium
4 Intralobular duct
Cuboidal-to-columnar epithelium
5 Interlobular duct
Pseudostratified columnar epithelium
6 Lobar duct
Columnar stratified epithelium
7 Main duct (not shown)
Septum
Capsule
Lobule
Lobule
Lobe

Ducts system

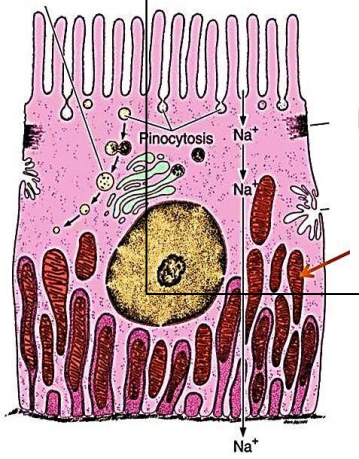
	Intercalated ducts	Intralobular ducts	Interlobular ducts	Interlobar ducts	Main duct
Start	lumen of acinus	Intercalated	Intralobular	Interlobular	Interlobar
End	Intralobular	Interlobular	Interlobar	Main duct	Mouth cavity
Lining	low cubical	Cubical	Columnar	Pseudostratified col. ↓ stratified columnar	St.col. ↓ St.squamous

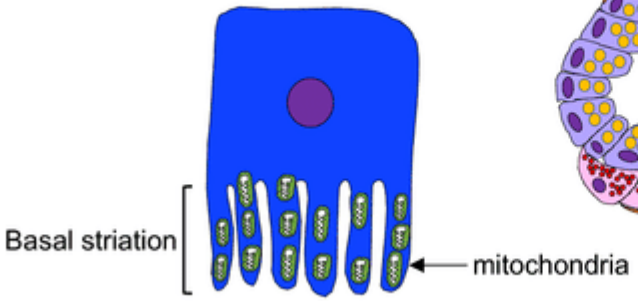
Intralobular (Striated) ducts





Ion-trans



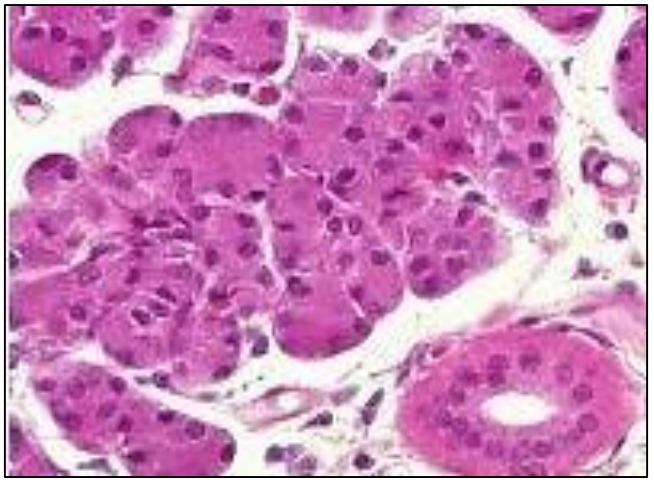


Intralobular (Striated) ducts

	L/M	E/M
Shape:	Cubical cells	
Nucleus:	central, rounded	
Cytoplasm:	granular acidophilic	mitochondria
Apical border:	brush border	microvilli
Lateral border:	indistinct	interdigitations
Basal border:	striation	infoldings with mitochondria in between

Function: absorb Na+ from saliva & secrete K+ into it (ion transport) → hypotonic saliva.

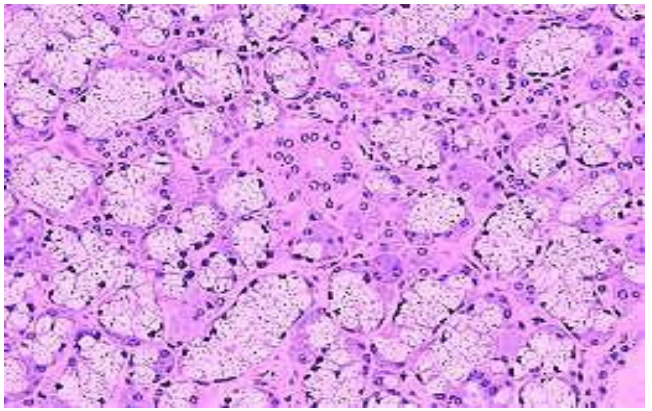
- **Parotid gland: (100%)**
- Acini: are **pure serous** Opens by parotid duct



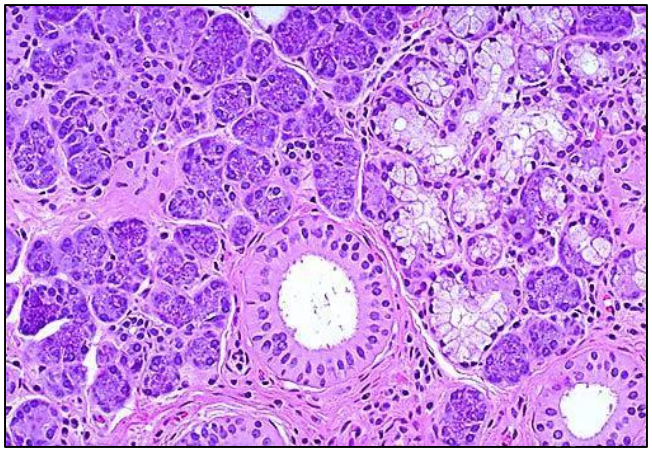
- **Sublingual gland: (95% + 5%)**

The smallest & the only unecapsulated

- Acini : **mainly mucous** cells capped with serous demilunes **(mixed)**
- Opens by 10-12 mini ducts

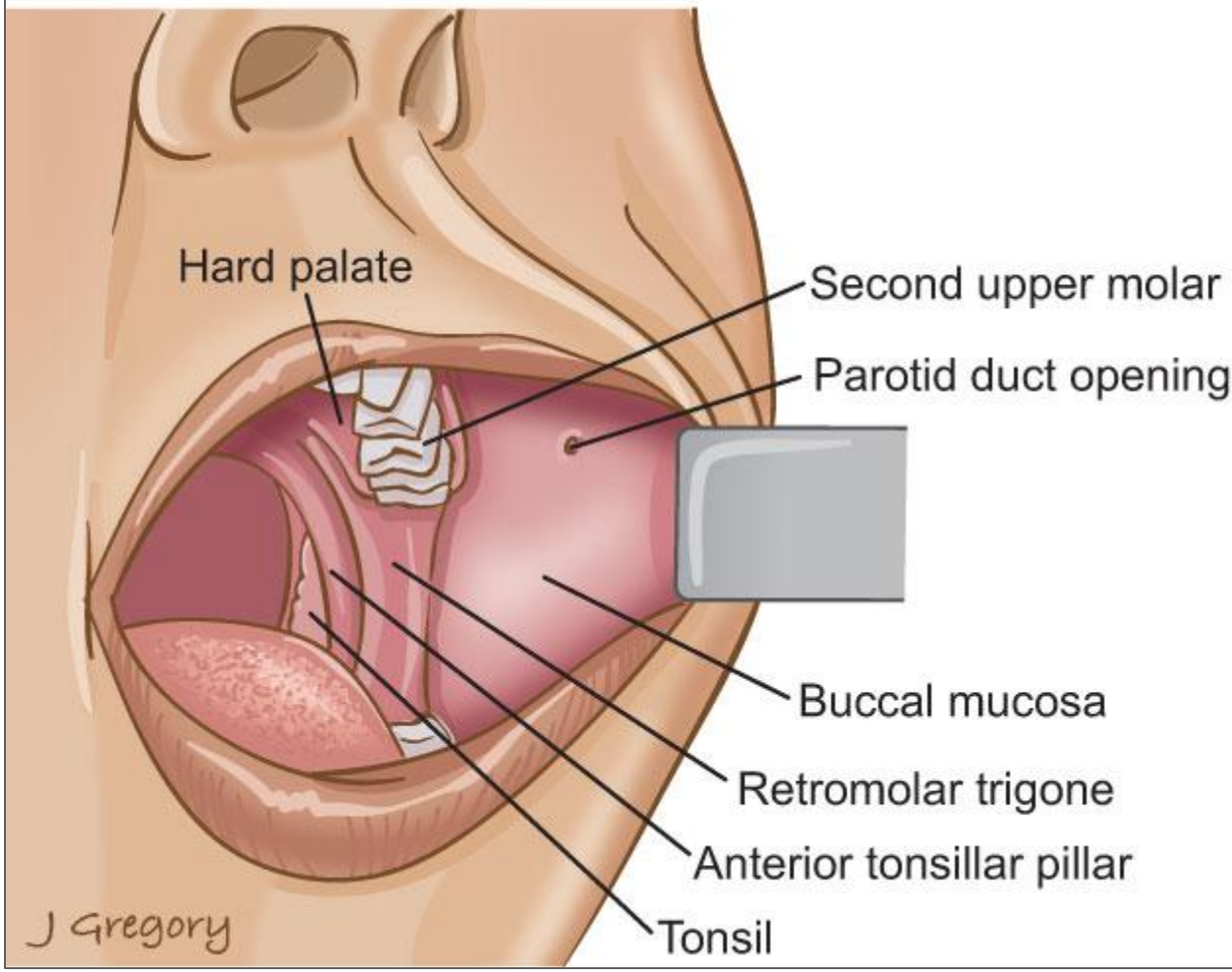


- **Submandibular gland: (80% + 20%)**
- Acini: **mixed serous** & **mucous acini**
- Opens by Wharton's duct



Main Parotid duct (Stenson's duct)

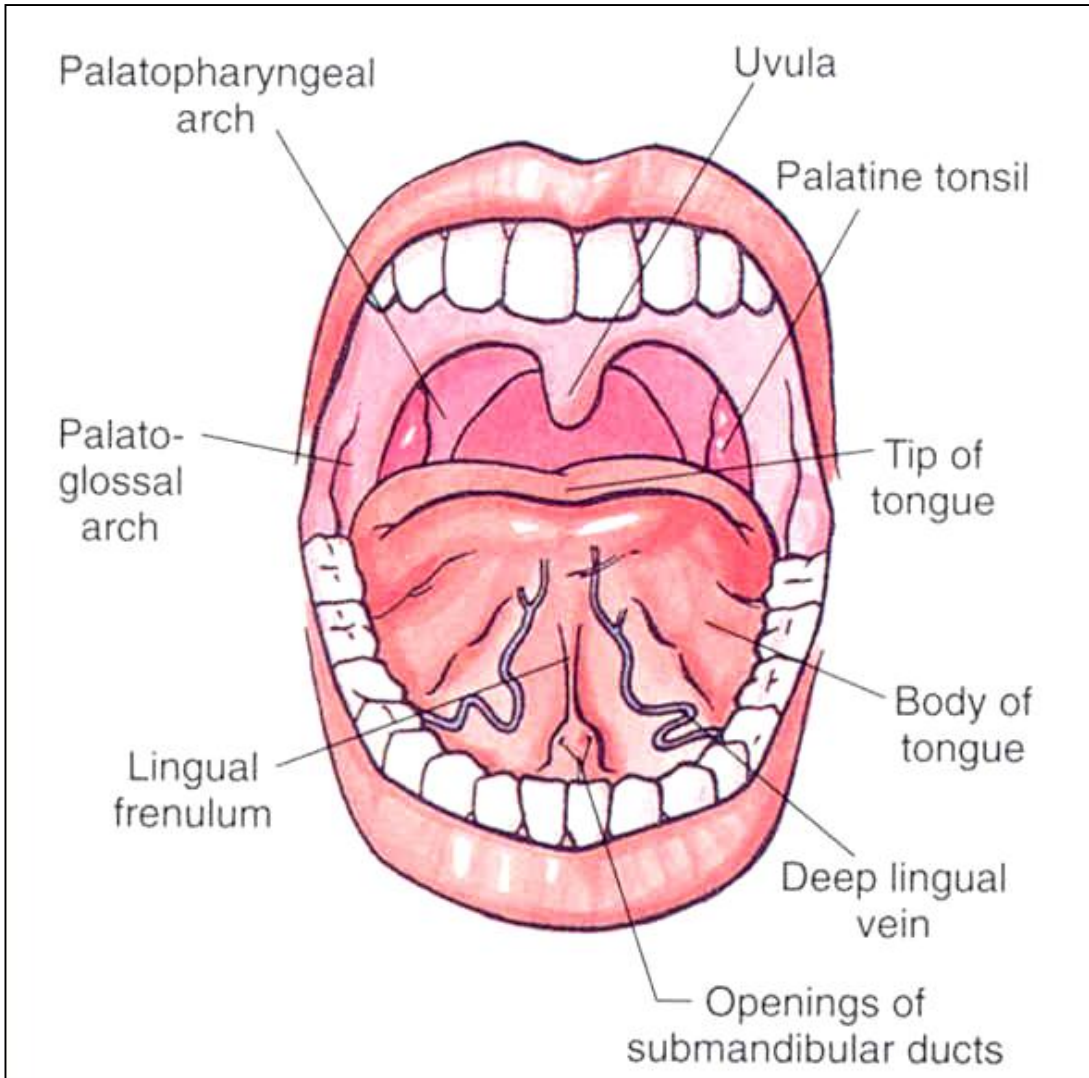
Stenson's duct, leaves the gland and pierces through fat and muscle to open into the mouth opposite the second upper molar



	Parotid gland	Submandibular	Sublingual gland
Capsule:	-Thick	- Thick capsule	- Thin capsule
Septa:	-Thick, rich in fat	-Thick septa, less fat	- few septa
Parenchyma	**Purely Serous**	**Mixed [Seromucous]**	**Mixed [Mucoserous]**
Acini		**Predominant serous (90%)** + 10% Mucous acini & Mixed	**Predominant mucous** + mixed acini. **NO** purely serous acini.
Ducts	**Prominent intralobular ducts**	**Present**	**Fewer**
Main duct	opens opposite upper 2nd molar tooth	Open posterior to the lower incisor teeth	Open by numerous ducts posterior to ducts of submandibular gl.
	Secrete 25% of saliva	**70%**	**5%**

Main duct of submandibular gland (Wharton´s duct)

(Wharton´s duct) opens on the floor of the mouth at the sides of tongue frenulum




Thank
you!