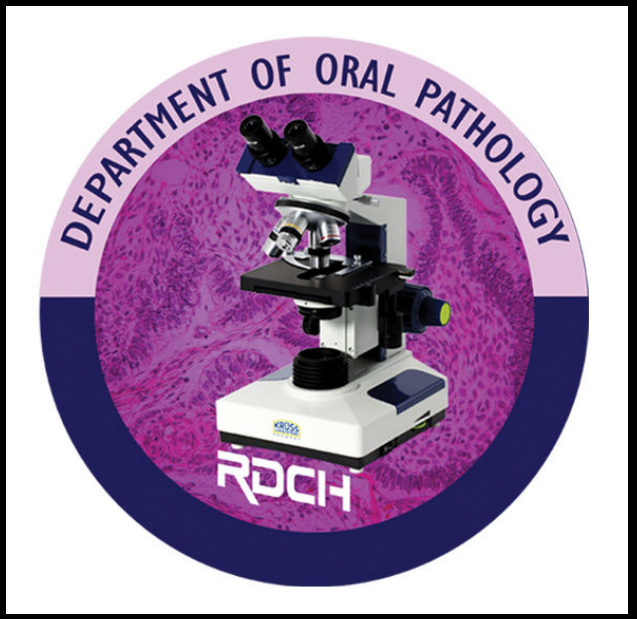


Oral mucous membrane

DEFINITION

Term mucous membrane is used to describe the moist lining of the gastrointestinal tract, nasal passage and other body cavities that communicate with the exterior.

In the oral cavity this lining is called

ORAL MUCOUS MEMBRANE

OR

ORAL MUCOSA

- At the lips it is continuous with the skin. At the pharynx it is continuous with the mucosa lining the rest of the gastrointestinal tract
- Thus the ***oral mucous membrane*** is situated anatomically between skin and gastrointestinal tract.

FUNCTIONS OF ORAL MUCOSA

A. **Protection**
- Separates and protects the deeper tissues.
- Mechanical forces such as compression, stretching, shearing and surface abrasion (from hard particles in the diet).
- Major barrier from microorganisms causing infection, toxins & various antigens.

B. **Sensation**
- Touch, pain, pressure & temperature
- Taste-anterior 2/3rd of dorsum of tongue

C. **Lubrication**

- Major secretion of oral mucosa is saliva secreted by salivary gland which maintains mucosa moist,& also helps in speech, mastication, swallowing & in perception of taste.

D. **Thermal Regulation**

-Heat is dissipated through the oral mucosa by panting (in some animals such as dog) which maintains body temperature.

CLASSIFICATON

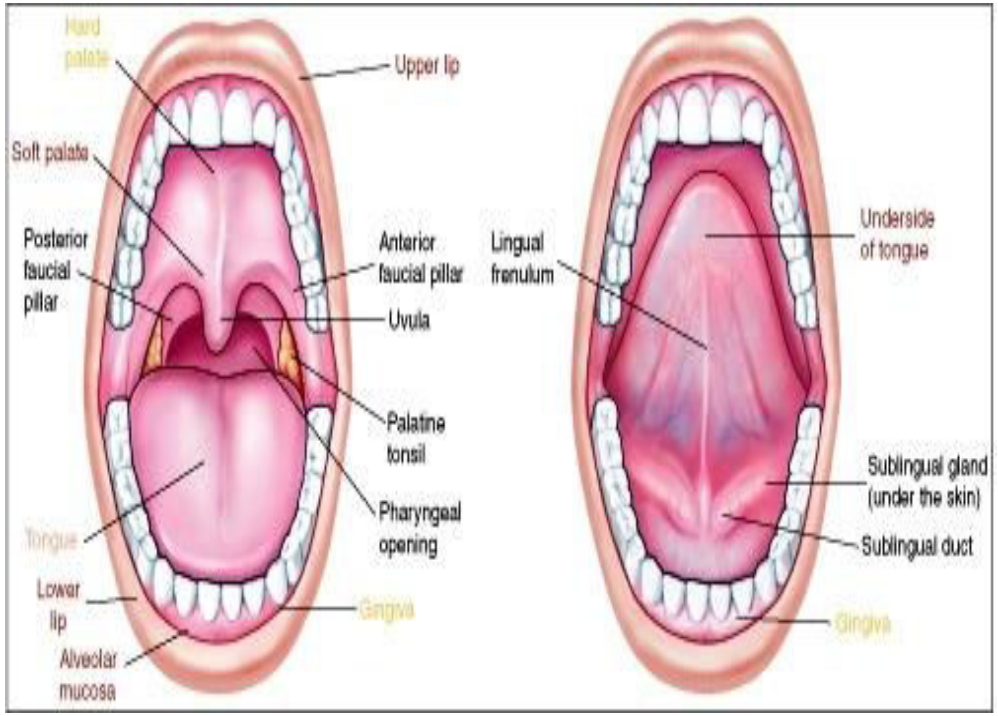
A . <u>Based on Functional criteria</u>

1. Masticatory mucosa
   - Gingiva
   - Hard Palate
2. Lining or reflecting mucosa
   - Lip, cheek
   - Soft palate
   - Vestibular fornix
   - Alveolar mucosa
   - Floor of mouth

3.Specialised or sensory mucosa

- Dorsum of tongue
- Taste buds

.



B . <u>Based on Keratinization</u>

1. Keratinized Areas

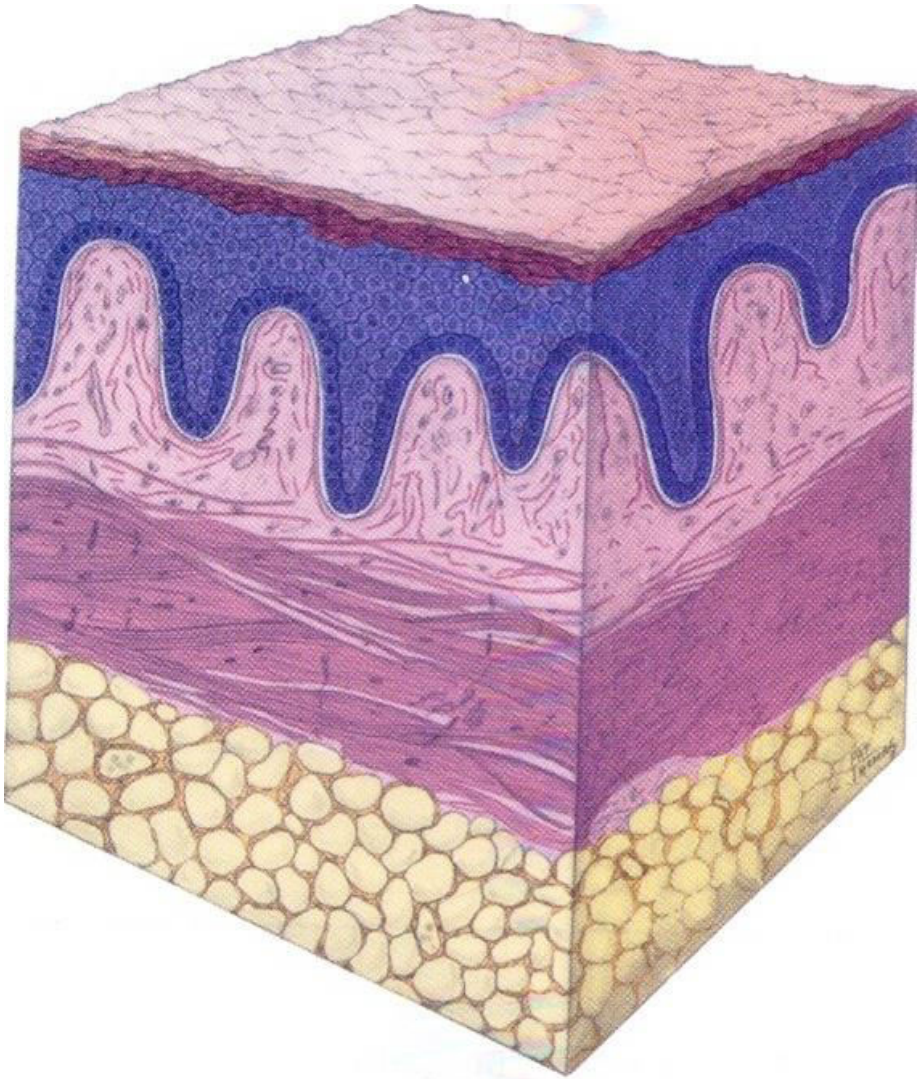
   - Masticatory mucosa

   - Vermillion border of lip

2. Non-Keratinized Areas

   - Lining or reflecting mucosa

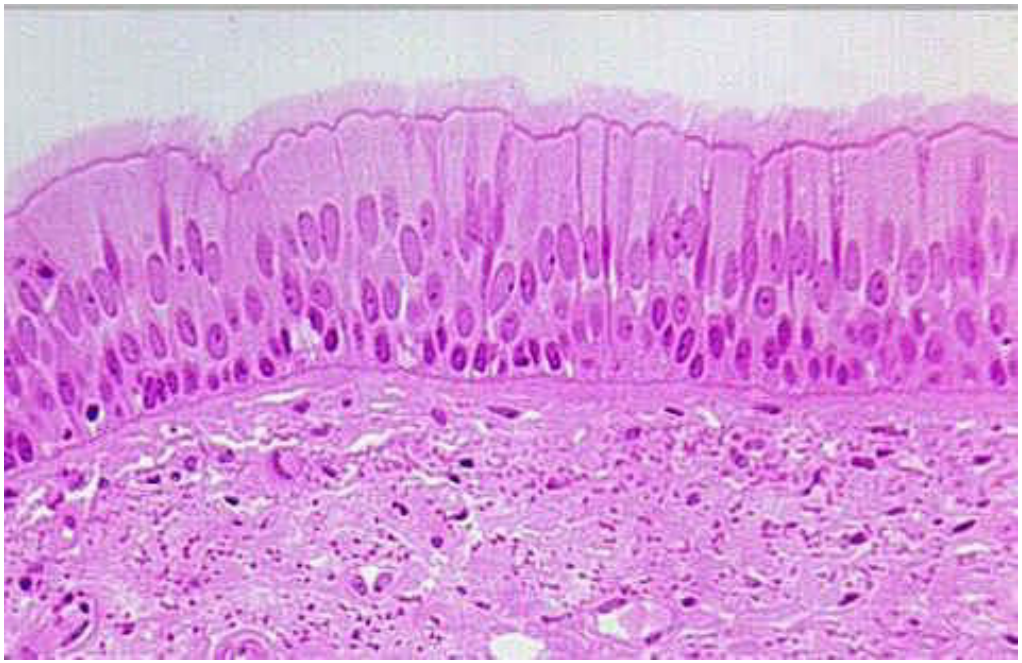
The comparable part of skin is termed as **epidermis** and **dermis** or corium.



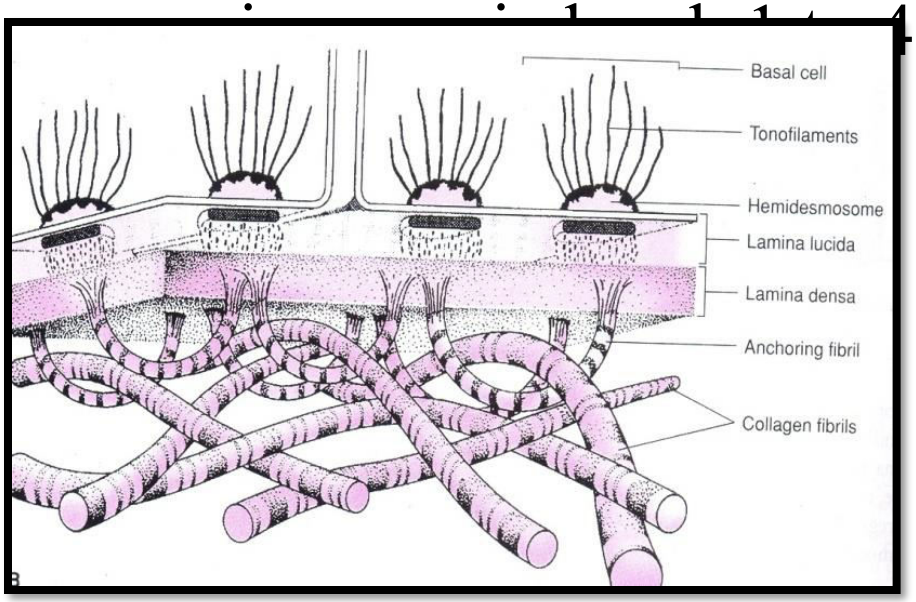
- The interface between epithelium and connective tissue is usually irregular and upward projections of connective called **connective tissue papillae**, interdigitate with epithelial ridges or pegs called the **rete ridges or pegs.**

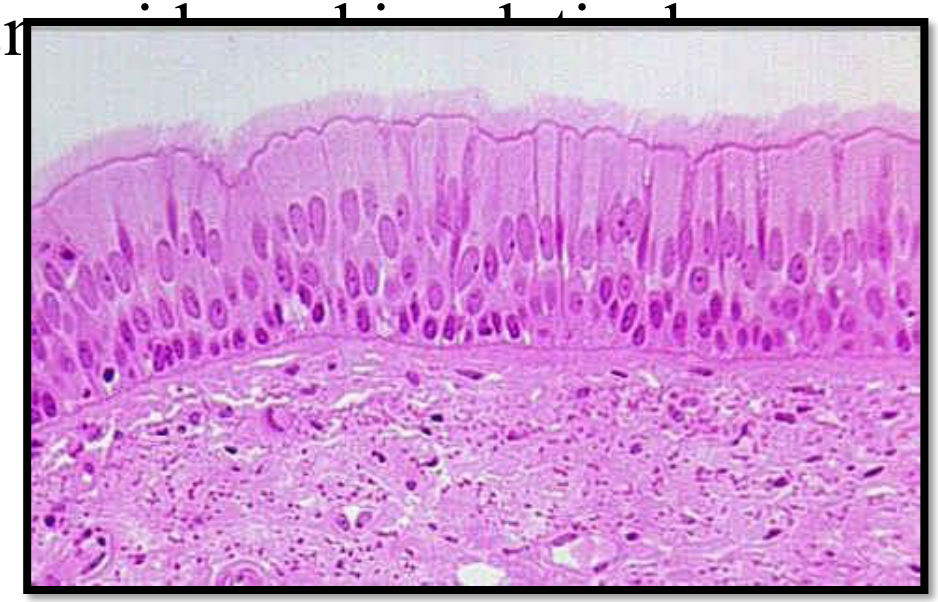
BASAL LAMINA OR BASEMENT MEMBRANE

- **Basement membrane** is present at the interface of epithelium and connective tissue,which appears as structure less layer



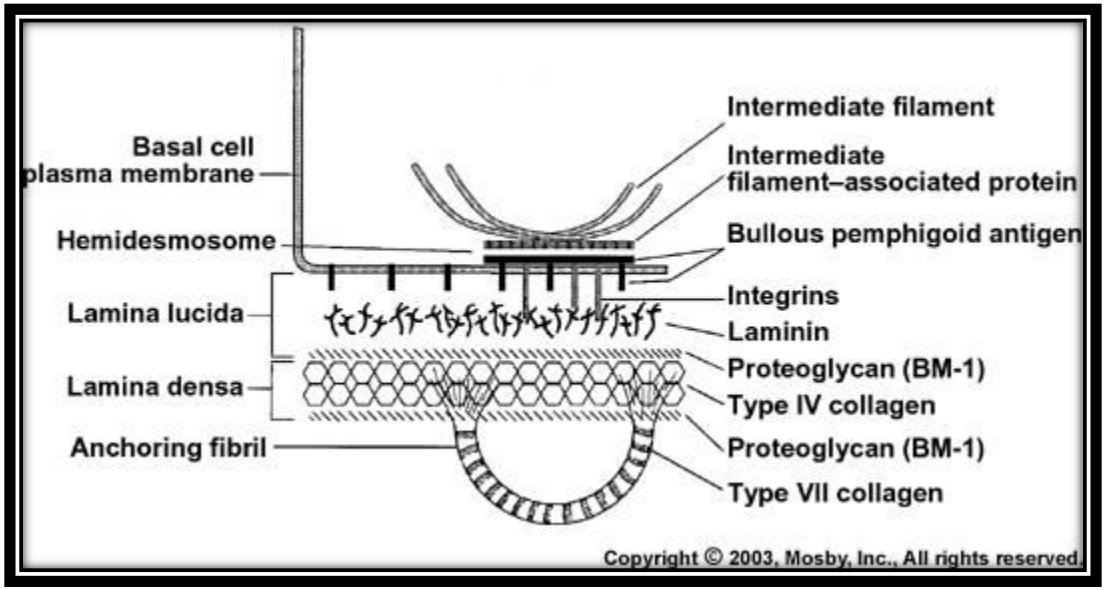
- The **Basal lamina** is evident at electron microscope level.
- The **Basement Membrane** is evident at the light





BASAL LAMINA

- Consist of a layer of finely granular or filamentous material about **50 nm** thick called **LAMINA DENSA**, runs parallel to the basal cell membrane
- Lamina densa separated from the basal cell membrane by an apparently clear zone **45 nm** wide called the **LAMINA LUCIDA.**


Basal cell plasma membrane
Hemidesmosome
Lamina lucida
Lamina densa
Anchoring fibril
Intermediate filament
Intermediate filament–associated protein
Bullous pemphigoid antigen
Integrins
Laminin
Proteoglycan (BM-1)
Type IV collagen
Proteoglycan (BM-1)
Type VII collagen
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- The layer represents the **SUBMUCOSA** in the oral cavity and determine the flexibility of oral mucosa to underlying structure.

- The minor salivary glands are situated in the submucosa of the oral mucosa.

- Associated with the lamina densa are striated fibrils called anchoring fibrils (type VII collagen) which form the loop through which run the collagen fibrils of the connective tissue.

- Each end of the loop enter the lamina densa and fans out to form a spray of finer filament.

- Network of anchoring fibrils provides interlocking between larger collagen fibers of connective tissue and the lamina densa.

- The lamina densa contains type IV collagen arranged in “chicken wire” configuration.

ORAL EPITHELIUM

- The oral epithelium is a **stratified squamous epithelium** consisting of cells tightly attached to each other and arranged in a number of distinct layers or strata.

- The oral epithelium may be **keratinized, parakeratinized or nonkeratinized**, depending on location.

- A common feature of all epithelial cells is **keratin intermediate filaments (tonofilaments or cytokeratins)** as a component of their cytoplasm.

- The cells of epithelium consists of two functional population

1. Progenitor population (divide & provide new cells)
2. Maturing population (differentiation or maturation to form a protective surface layer)

- The cells arises by division in the basal or parabasal layers of the epithelium and undergoes maturation as they move to the surface.

- Maturation in the oral cavity follows two main patterns.
  - **Keratinization**
  - **Nonkeratinization**

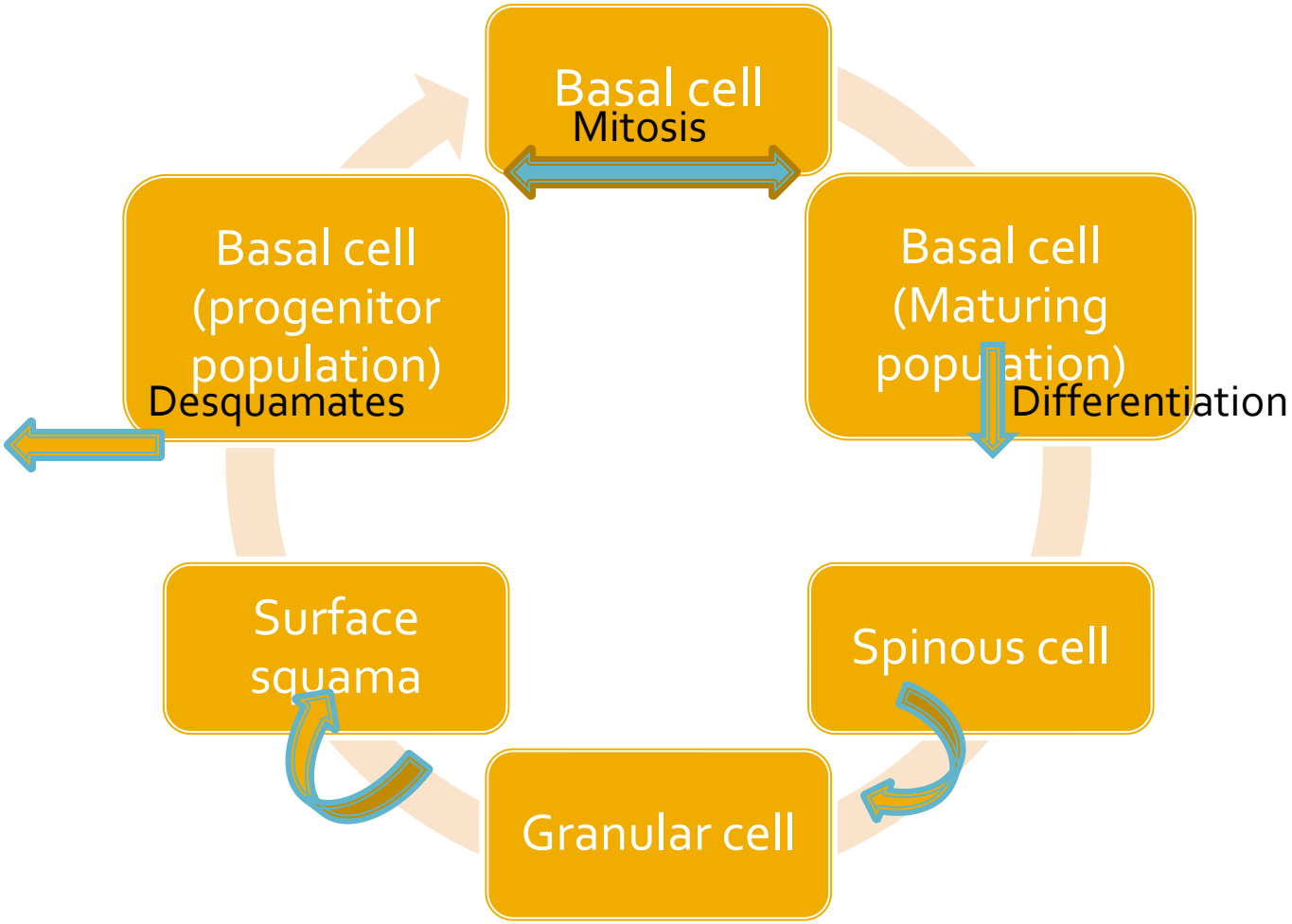
KERATINIZED EPITHELIUM

- The epithelial surface of the masticatory mucosa is inflexible, tough, resistant to abrasion and tightly bound to lamina propria.

- The mucosal surface result from the formation of a surface layer of keratin and the process of maturation is called **keratinization or cornification.**

- The time taken for a cell to divide & pass through the entire epithelium is termed as **Turnover time /Turnover rate**

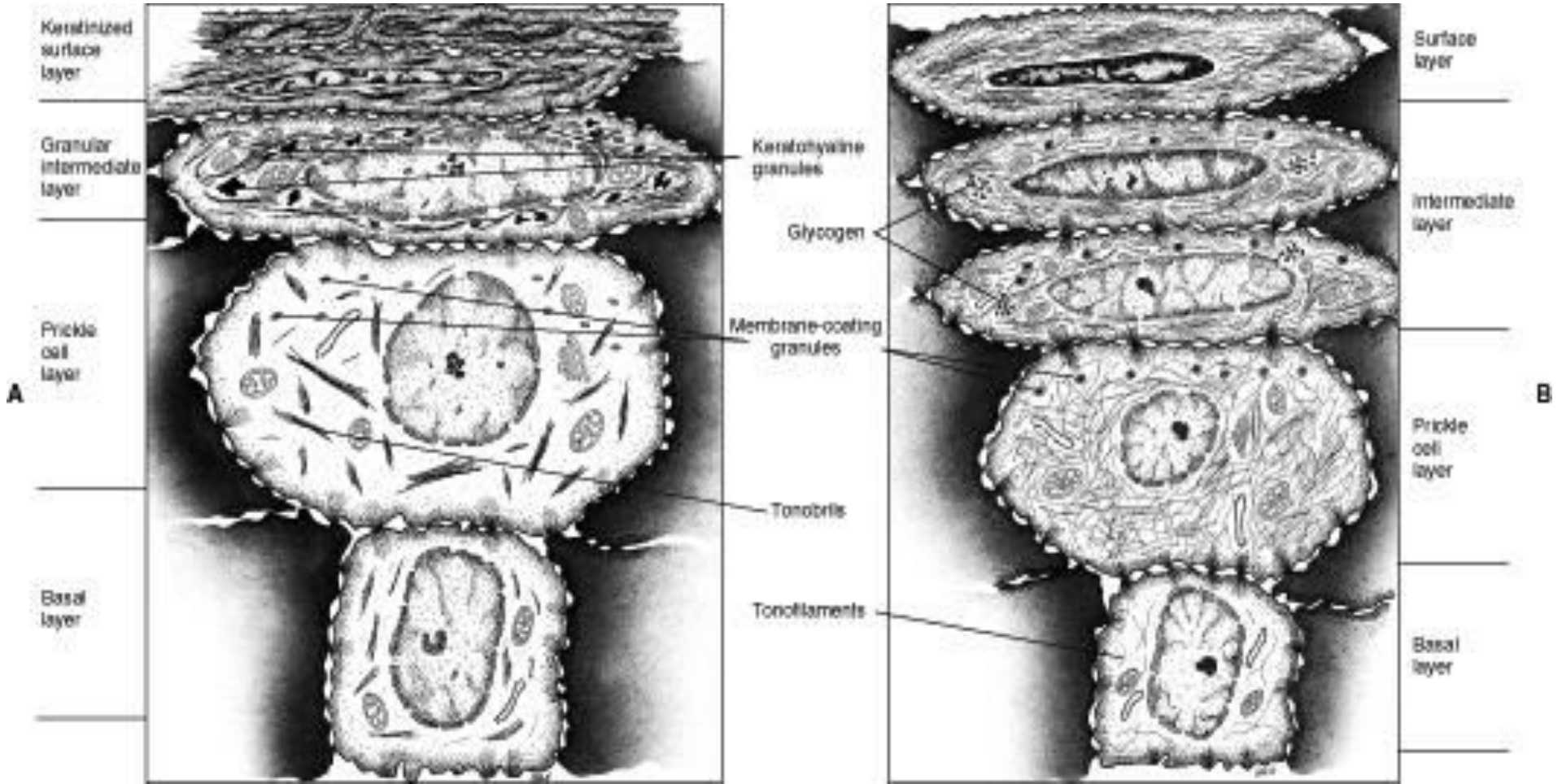
- There are four layers of keratinized epithelium.
  1. Basal (Stratum basale)
  2. Spinous (Stratum spinosum)
  3. Granular (Stratum granulosum)
  4. Cornified (Stratum corneum)

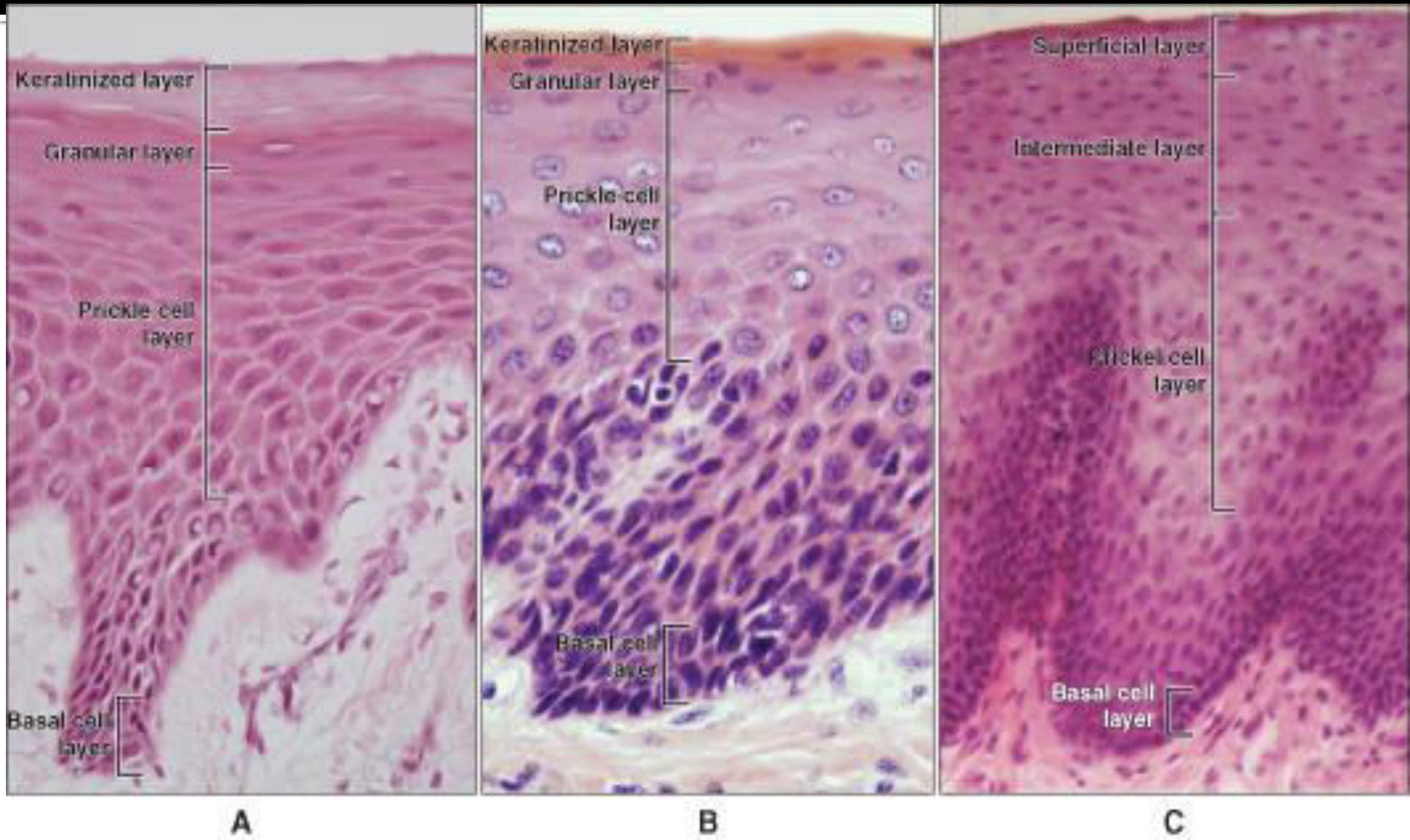

Basal cell
Mitosis
Basal cell (Maturing population)
Differentiation
Spinous cell
Granular cell
Surface squama
Desquamates
Basal cell (progenitor population)

NON-KERATINIZED EPITHELIUM

- They do not produce cornified surface layer.

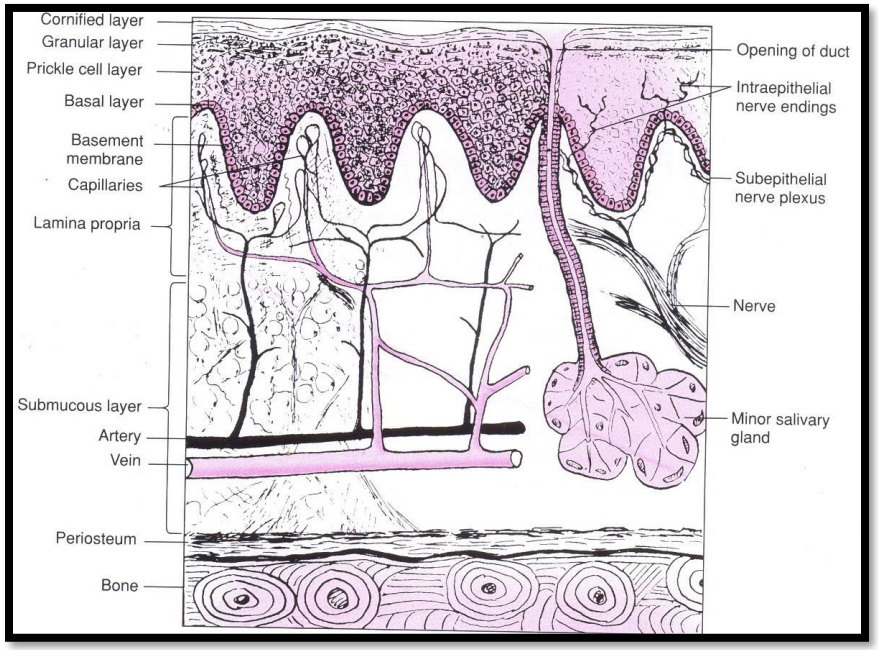
- There are four layers of non- keratinized epithelium.
  1. Basal (Stratum basale)
  2. Prickle cell
  3. Intermediate (Stratum intermedium)
  4. Superficial (Stratum superficiale)


Keratinized surface layer
Granular intermediate layer
Prickle cell layer
Basal layer
A
Keratohyaline granules
Glycogen
Membrane-coating granules
Tonofibrils
Tonofilaments
Surface layer
Intermediate layer
Prickle cell layer
Basal layer
B


Keratinized layer
Granular layer
Prickle cell layer
Basal cell layer
A
Keratinized layer
Granular layer
Prickle cell layer
Basal cell layer
B
Superficial layer
Intermediate layer
Prickle cell layer
Basal cell layer
C

LAMINA PROPRIA

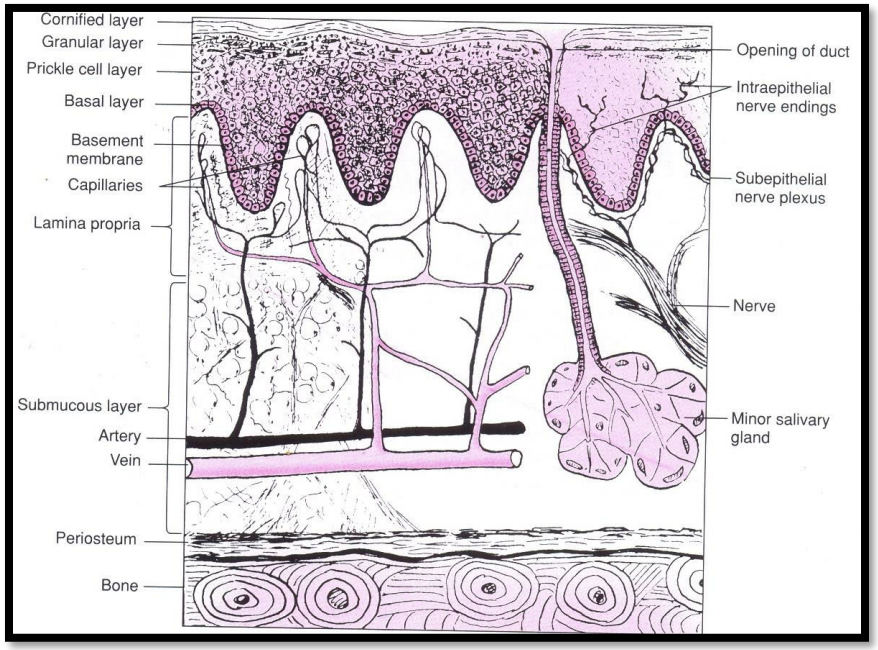
- The connective tissue supporting the oral epithelium is termed LAMINA PROPRIA.
- It can be divided into two layers.
  - **Superficial papillary layer**
  - **Deeper reticular layer**



- In papillary layer, collagen fibers are thin and loosely arranged and many capillary loops are present.
- In reticular layer, collagen fibers are arranged in thick bundles and lie parallel to surface plane.
- The lamina propria may be attached to the periosteum of the alveolar bone.

SUBMUCOSA

- The submucosa consists of connective tissue of varying thickness and density. It attaches the mucous membrane to the underlying structures.



- Glands, blood vessels, nerves, lymph vessels and adipose tissue are present in this layer.

- It is in the submucosa that larger arteries divide into smaller branches which then enter the lamina propria.

SUBDIVISIONS OF ORAL MUCOSA

For descriptive purposes, the oral mucosa can be divided into following areas :

1. Keratinized Areas
   - Masticatory mucosa (gingiva and hard palate)
   - Vermillion border of lip
2. Non-Keratinized Areas
   - Lining or reflecting mucosa
3. Specialised or sensory mucosa

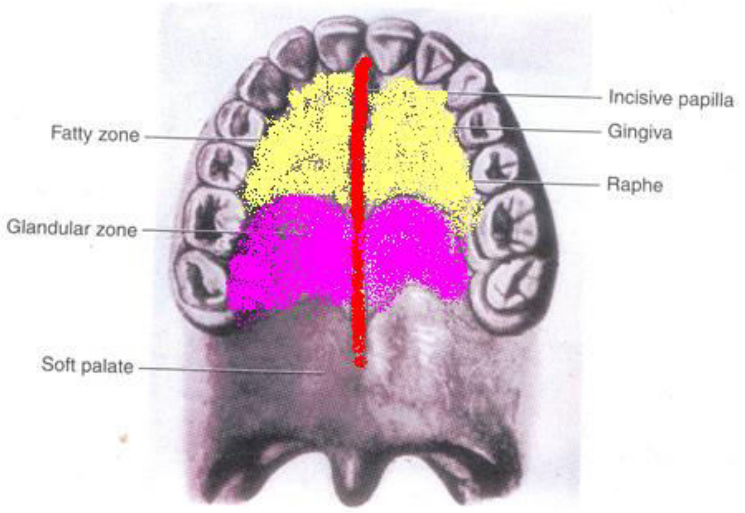
KERATINIZED AREAS

MUCOSA

two regions, anterior hard palate and
late.

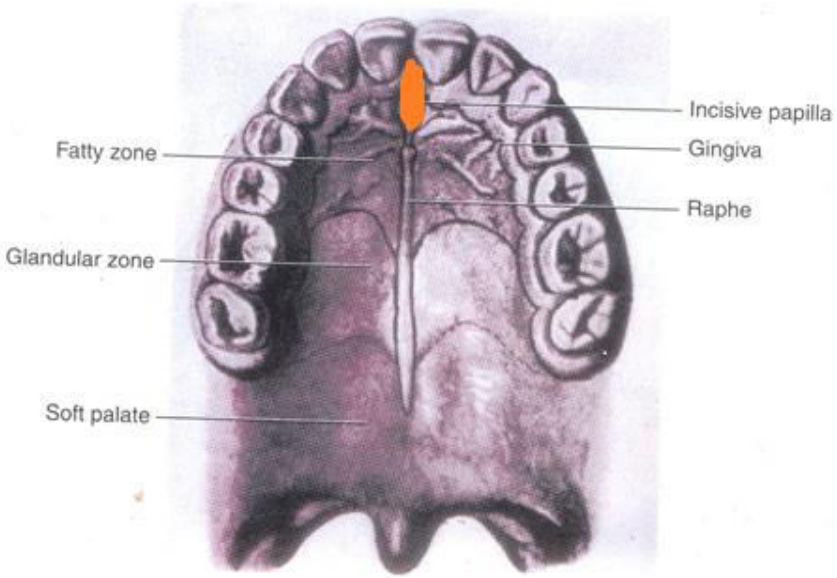
- Both are distinguished from one another by color and palpation.
- The hard palate is light pink while soft palate is red.
- The hard palate is firm and less movable than soft palate because the mucous membrane of hard palate is tightly fixed to underlying periosteum.

- The hard palate is further divided into three regions –
  1. The raphe
  2. The fatty zone
  3. The glandular zone



Incisive papilla

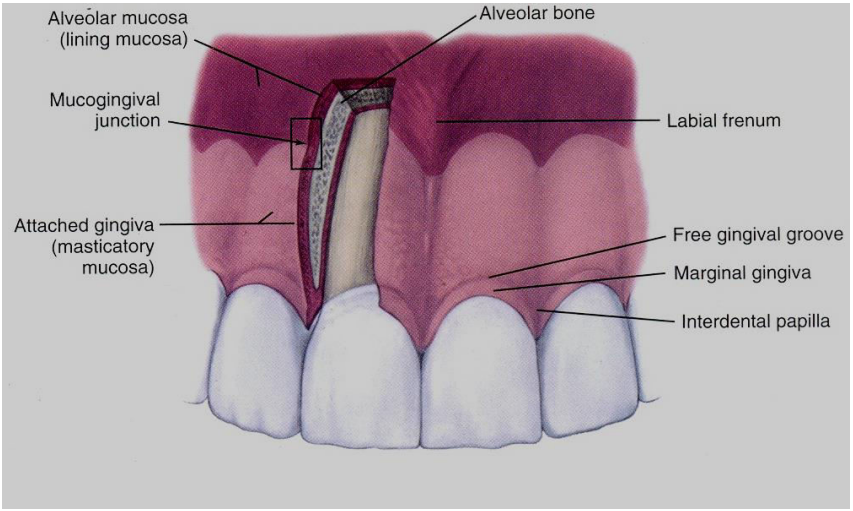
- The oral incisive papilla is formed of dense connective tissue.
- It contains the oral part of the vestigial Nasopalatine ducts.



Palatine rugae (Transverse palatine ridges)

- Irregular and often asymmetric in humans are ridges of mucous membrane extending laterally from the incisive papilla and the anterior part of the raphe
- Made up of dense connective tissue layer with the interwoven fibers.

GINGIVA



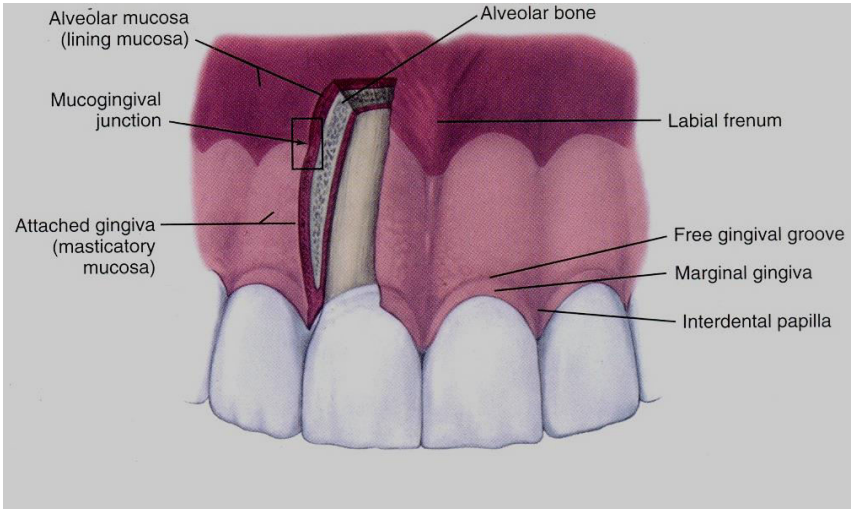
- The gingiva is that portion of the oral mucosa that surrounds and is attached to the teeth and the alveolar bone.
- The gingiva extends from the dentogingival junction to the alveolar mucosa.

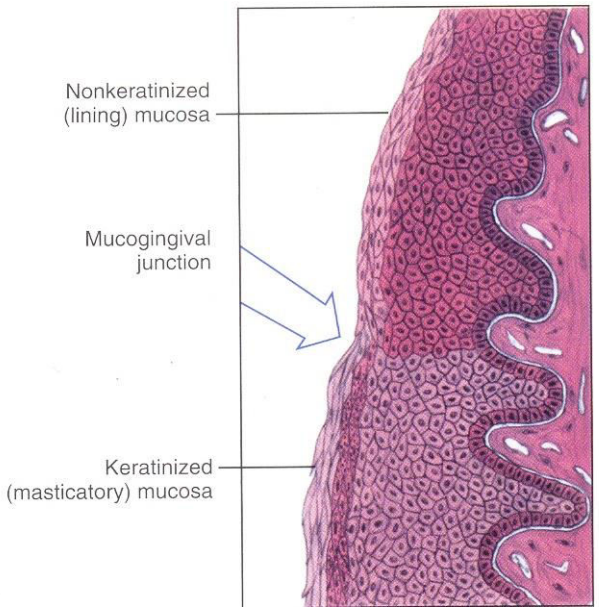
- Gingiva can be divided into

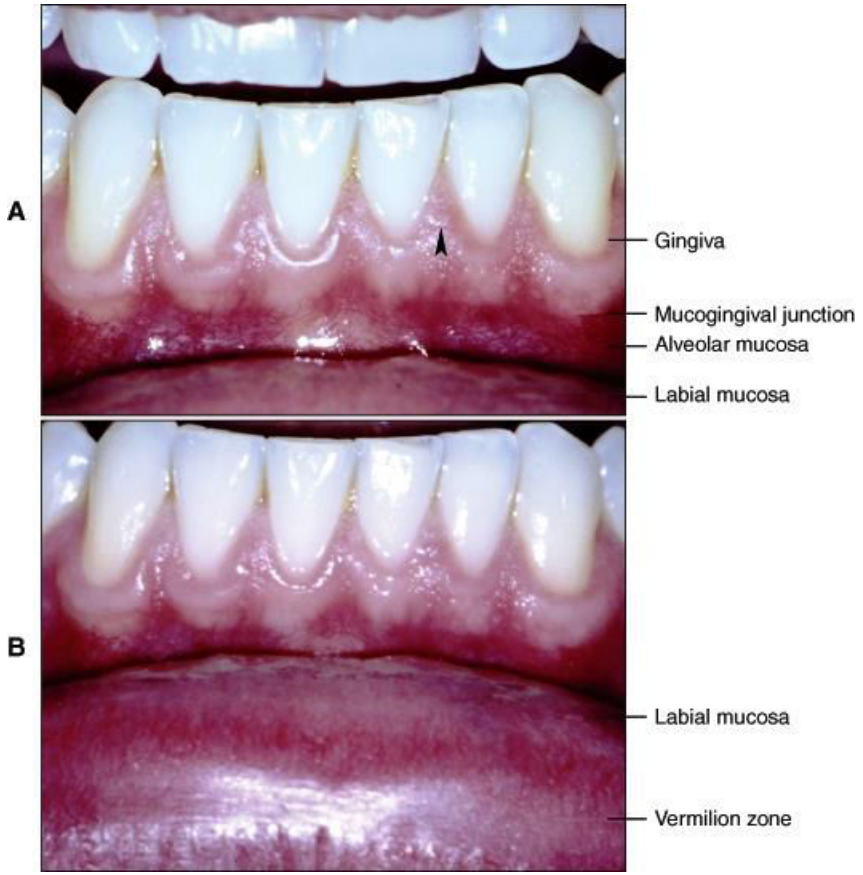
i) Free gingiva

ii) Attached gingiva

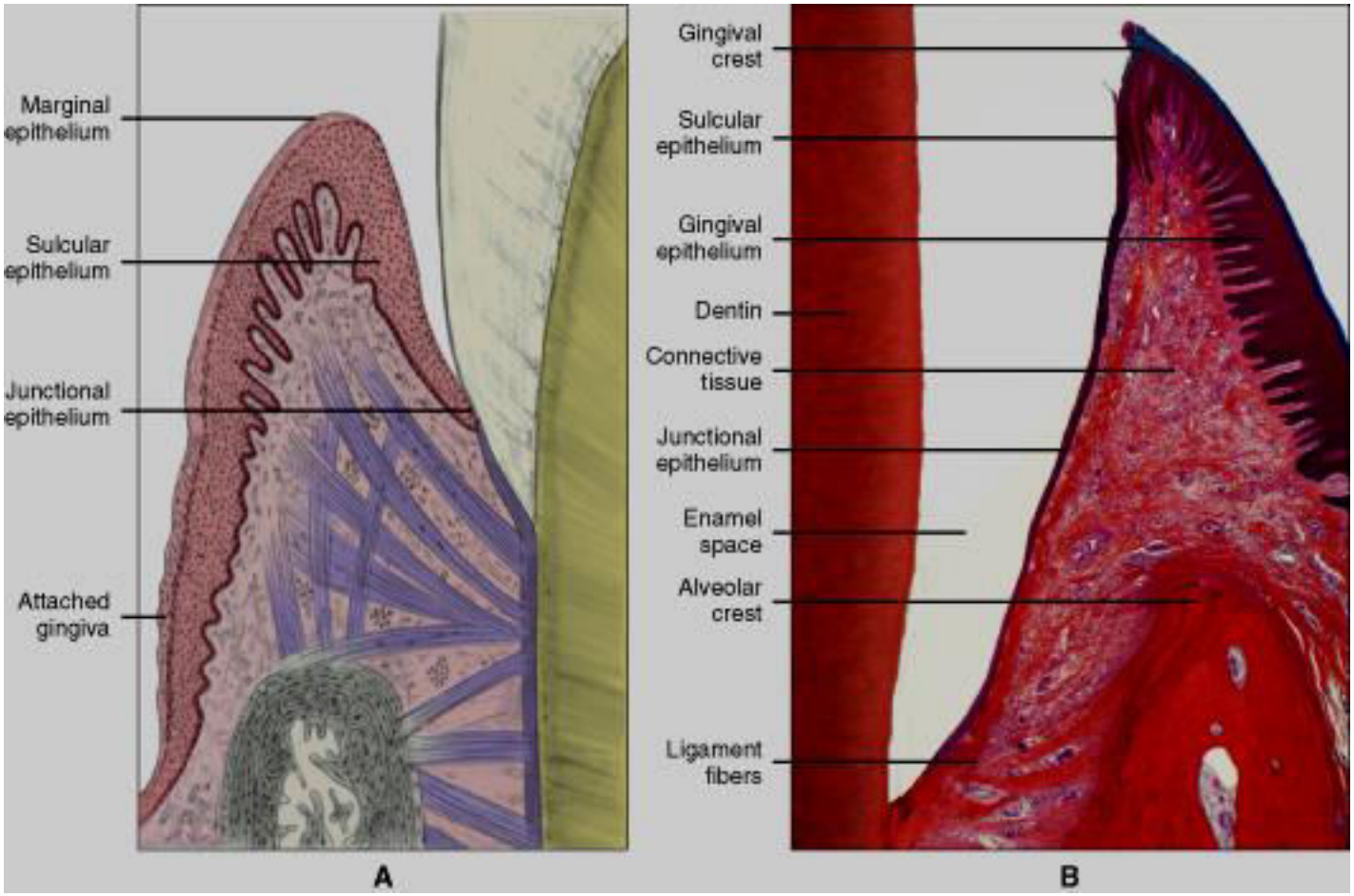
iii) Interdental gingiva.




Nonkeratinized
(lining) mucosa
Mucogingival
junction
Keratinized
(masticatory) mucosa


A
Gingiva
Mucogingival junction
Alveolar mucosa
Labial mucosa
B
Labial mucosa
Vermilion zone

A. Different types of epithelium
B. Histologic section showing tissues



- Gingiva and alveolar mucosa are separated by the mucogingival junction.

- The alveolar mucosa is thin and loosely attached to the periosteum by a well-defined submucous layer of loose connective tissue , and it may contain small mixed glands.

- The depression corresponds to the center of heavier epithelial ridges

- **Functional adaptations to mechanical impacts.**
- **Disappearance of stippling- an indication of edema**.

- The degree of stippling and the texture of collagenous fibers vary with the different individuals, according to age and sex.

Interdental papilla

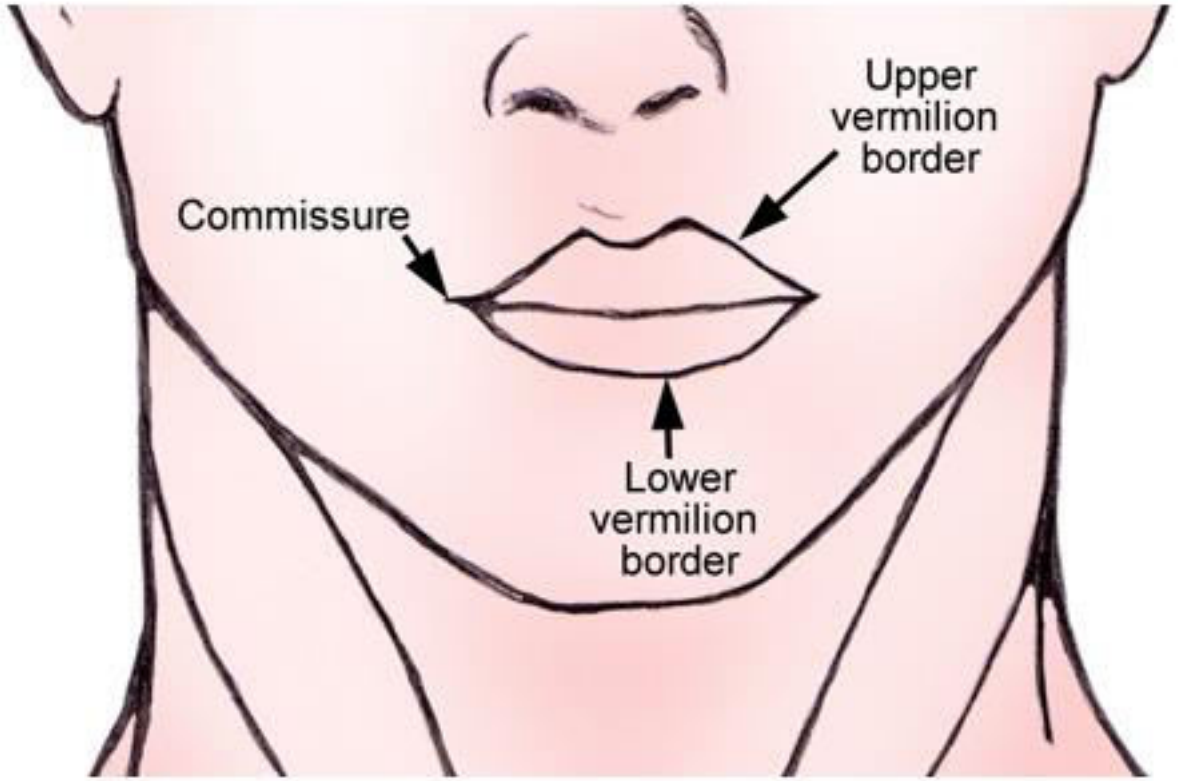
- Part of gingiva that fills the space between two adjacent teeth.
- The interdental papilla when viewed from the oral or vestibular aspect, the surface is triangular.
- In a 3 dimensional view the interdental papilla of the posterior teeth is **tent shaped**, where as **pyramidal** between the anterior teeth.

- **Col:** It is the central concave area which fits below the contact point seen in the tent shaped interdental papilla of the posterior teeth.
- It is covered by non-keratinized epithelium and is more vulnerable to periodontal diseases.

BLOOD SUPPLY

- It is chiefly from the branches of the alveolar arteries.
- The lymph vessels of gingiva lead to submental and submandibular lymph nodes.
- It is also well innervated by various nerve endings.

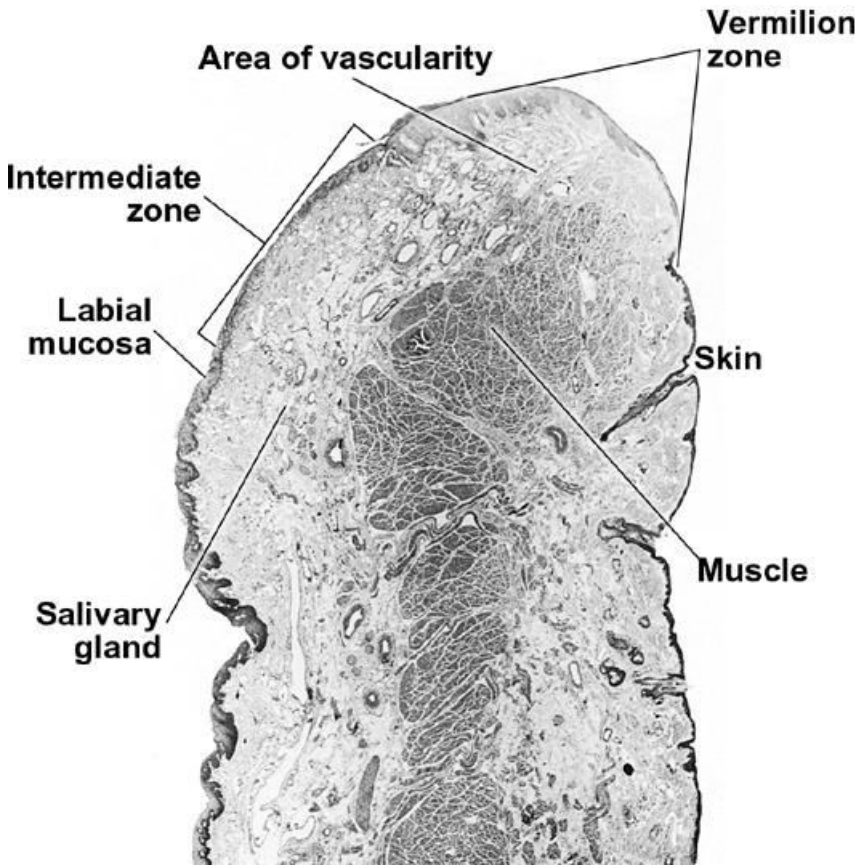
Vermilion border of lip



Vermilion zone of lip

- It is the red/transitional zone between the skin and mucous membrane of the lip.
- Only in humans
- [illegible] is covered by [illegible] epithelium.

- Papillae of connective tissue are few and short.
- Sebaceous & sweat glands are seen, along with hair follicles
- The epithelium of the mucous membrane of the lip is not keratinized.



- The vermilion/transitional zone is characterized by
1. Mildly keratinised epithelium
2. Numerous, densely arranged, long papillae of the lamina propria, carrying large capillary loops close to the surface.

- Pink/Red color of lip -Blood is visible through thin parts of translucent epithelium
- No mucous glands present.
- Like the skin, the transitional zone is exposed to atmosphere, but no glands present to keep it moist or preventing it from drying
- So lips become dry easily and we lick our lips to moisten it.

NON KERATINIZED AREAS

- Lining mucosa is found on lip, cheek, vestibular fornix and alveolar mucosa. They have **thick non keratinized** epithelium and thin lamina propria.

- The reflectory mucosa found in fornix vestibule and in the sublingual sulcus at the floor of oral cavity has a submucosa that is loose and of considerable volume.

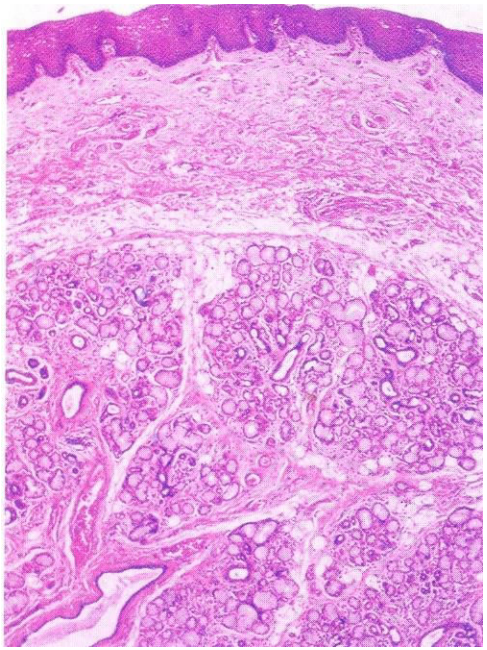
- The mucous membrane is movably attached to deep structures and **does not restrict the movement** of lips, cheek and tongue.

- The mucosa of the soft palate is intermediate between this type of lining mucosa and the reflecting mucosa.

LIP AND CHEEK

- The epithelium of mucosa of lips and cheeks is stratified squamous nonkeratinized epithelium.
- The lamina propria consists of dense connective tissue and has short, irregular papillae.

- Submucous layer consists of strands of densely grouped collagen fibers. **These strands limit the mobility of the mucous membrane, holding it to the musculature and preventing its elevation into folds and preventing from lodging between the teeth**.



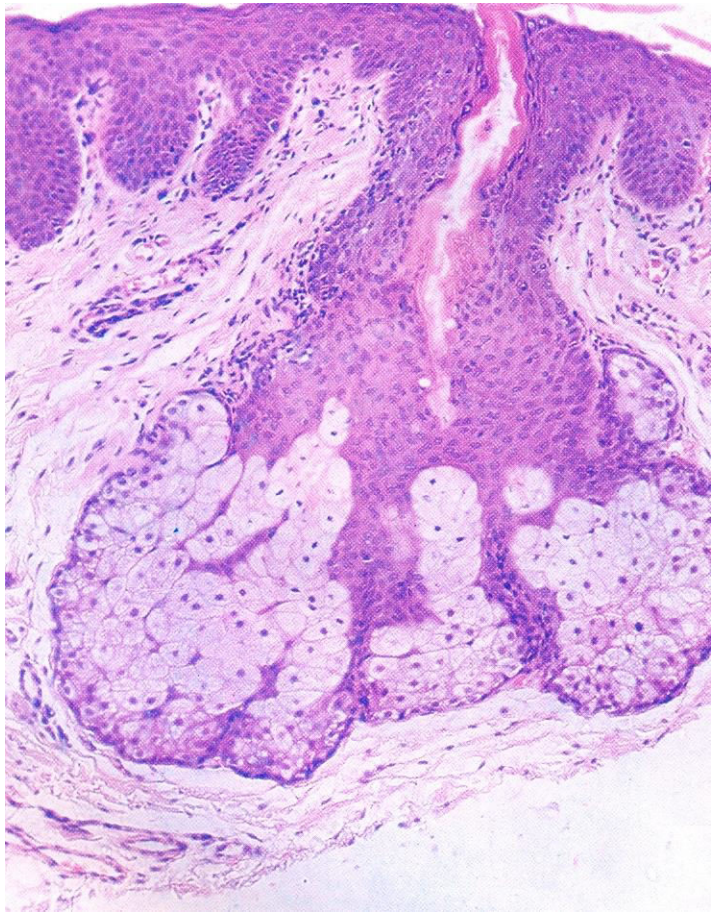
9-8 Photomicrograph

- The mixed minor salivary glands of the lips are situated in the submucosa whereas in the cheek glands are larger and are found between bundles of buccinator muscle and sometimes on its outer surface.

- Some isolated sebaceous glands called **Fordyce's spot** may occur lateral to the corner of mouth and are often seen opposite to molars.

- A comparison of masticatory and buccal mucosa shows that in keratinized tissue epithelium is thinner.

Fordyce's spot



Vestibular fornix and alveolar mucosa

- The mucosa of the lips and cheeks reflects from the vestibular fornix to the alveolar mucosa covering the bone.

- The median and lateral labial frenula are folds of the mucous membrane containing loose connective tissue. No muscle fibers are found in these folds.

Inferior surface of tongue; floor of oral cavity

- The mucous membrane on the floor of the oral cavity is thin and loosely attached to the underlying structures to allow for the free mobility of the tongue.

- The epithelium is nonkeratinized, and the papillae of the lamina propria are short.

- The submucosa contains adipose tissue. The sublingual glands lie close to the covering mucosa in the sublingual fold.

- The mucous membrane of the inferior surface of the tongue is smooth and relatively thin. The epithelium is nonkeratinized.

- The papillae of the connective tissue are numerous but short. Here the submucosa cannot be identified as a separate layer. It binds the mucous membrane tightly to the connective tissue surrounding the bundles of the muscles of the tongue.

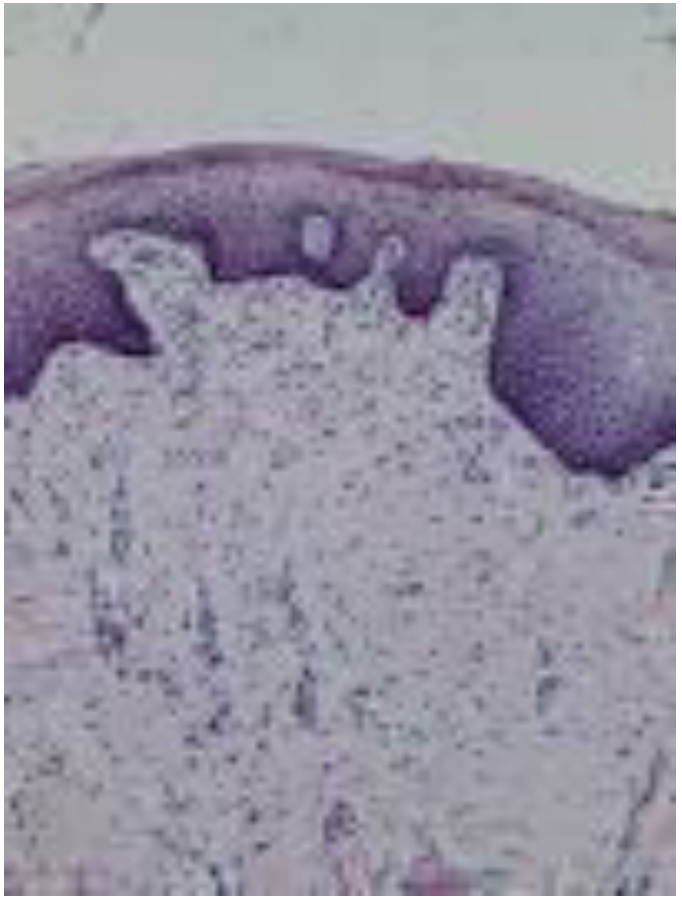
Soft palate

- The mucous membrane on the oral surface of the soft palate is highly vascularized and reddish in color, noticeably differing from the pale color of the hard palate.

- The papillae of the connective tissue are few and short. The stratified squamous epithelium is nonkeratinized. The lamina propria shows a distinct layer of elastic fibers separating it from the submucosa.

- It also contains taste buds.

- Typical oral mucosa continues around the free border of the soft palate for a variable distance and is then replaced by nasal mucosa with its pseudo stratified ciliated columnar epithelium.



	Lips and cheeks	Vestibule	Alveolar mucosa	Inferior surface of tongue	Floor of mouth	Soft palate
Epithelium	•Non – keratinized •Lip –thin •Cheeks-thick	•Thick non keratinized mucosa loosely connected to under lying structure	•Thin non keratinized • Epithelial ridges and papillae low and often missing. •Mucous membrane is loosely attached to periosteum	•Non keratinized epithelium •Smooth and thin mucous membrane	•Non keratinized epithelium, thin , loosely attached to under lying structure	•Non keratinized epitheliu m •Highly vascular mucous membran e

	Lips and cheeks	Vestibule	Alveolar mucosa	Inferior surface of tongue	Floor of mouth	Soft palate
Lamina propria	•Dense connective tissue •Short irregular papillae	•Loose connective tissue •Thin lamina propria	•Papillae low & often absent. •Blood vessels present close to surface.	•Papillae short & numerous	•Papillae are short	•Papillae few and short. •Distinct fibers separate it from submucosa

	Lips and cheeks	Vestibule	Alveolar mucosa	Inferior surface of tongue	Floor of mouth	Soft palate
Sub mucosa	Dense collagen fibers. Loose connective tissue with fat and small mixed glands present in between glands of lips—in sub mucosa glands of cheek in—between bundles of buccinator or on outer surface	Loosely textured sub mucosa large in volume	Well defined small mixed glands may be present	Cannot be identified as a separate layer	Adipose tissue present reflects to inferior surface of tongue and continues as ventro lingual mucosa	Contains a continuous layer of mucous glands taste buds present.

	Masticatory mucosa	Lining mucosa
Colour	Light pink	Dark red
Surface	Stippled	Only areas
Attachment	Firmly attached to underlying periosteum	Loose attachment
Epithelium	Thin and keratinized	Thick and non keratinized
Intercellular bridges	Wider and prominent	Small and not prominent
Epithelium rete ridges	Numerous	Less in number
Connective tissue papillae	Numerous and high	Few and short
Lamina propria	Shows only presence of collagen fibers	Both collagen and elastic fibers are seen
Submucosa	Not recognized	Very distinct
Underlying tissue	Bone	Muscle fibers

SPECIALIZED MUCOSA

- Dorsal lingual mucosa
- Taste buds
- The specialized (sensory) mucosa is so called because it bears taste buds, which have sensory function.

DORSAL SURFACE OF TONGUE

•The mucous membrane of the tongue is composed of two parts, with different embryologic origins and is divided by the V-shaped groove, the sulcus terminalis (terminal groove).

- The anterior two thirds of the tongue, where the mucosa is derived from the first pharyngeal arch, often is called the body or papillary part.

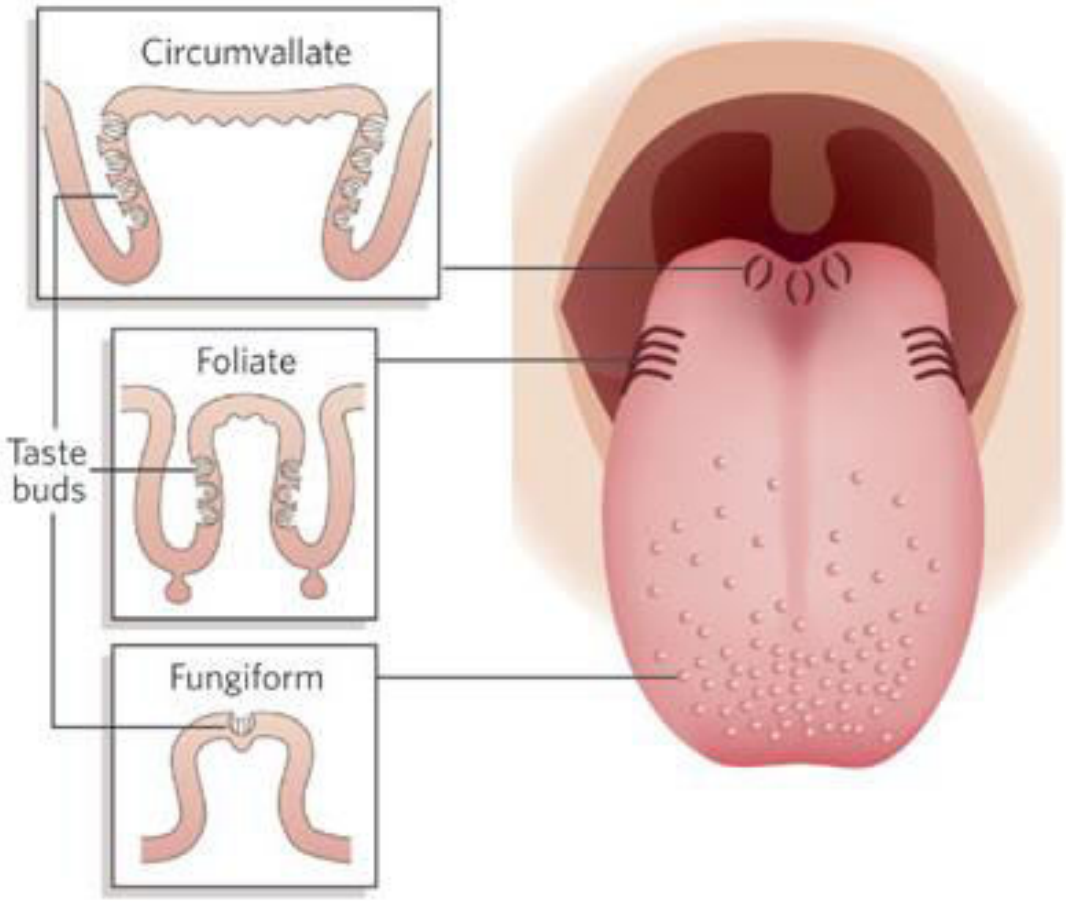
- The posterior third, where the mucosa is derived from the third pharyngeal arch, called the base

- The mucosa covering the base of the tongue contains extensive nodules of lymphoid tissue, the lingual tonsils.

On anterior part:- Numerous papillae are seen-

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

TONGUE SHOWING DIFFERENT PAPILLAE



Filliform papillae

- Pointed, thread shaped, cone shaped, these are epithelial structures containing connective tissue from which secondary papillae protrude towards epithelium.
- Responsible for velvety appearance of tongue and are most numerous.

- About 2 mm long arranged in rows parallel to sulcus terminalis, are conical or flame shaped with tips often showing several points.
- Epithelium covering the papillae are relatively thick and keratinized.

- **Taste buds are absent**

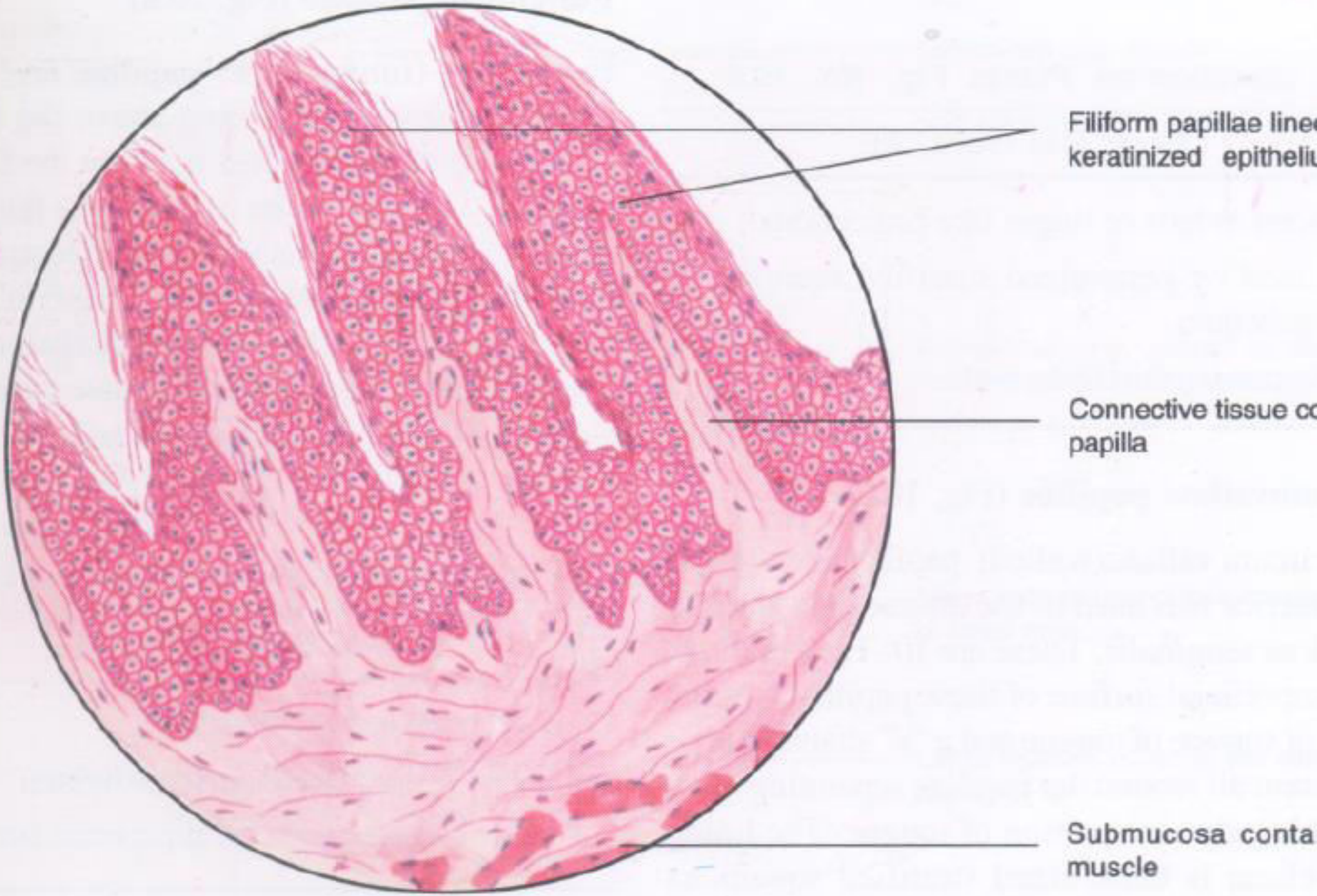


Fig. 10.6 Filiform papillae of tongue

Fungiform papillae

- Randomly dispersed among the Filiform papillae.
- They may attain a height up to 2 mm and are mushroom shaped, round and reddish prominence.
- Surface epithelium is nonkeratinized & somewhat thinner than that of Filiform papillae.

- The domed surface of the fungiform papillae may bear one or more taste buds
- The connective tissue is very vascular, decreased thickness of epithelium coupled with an increase in vascularity enables them to be identified because of their intense pink color.

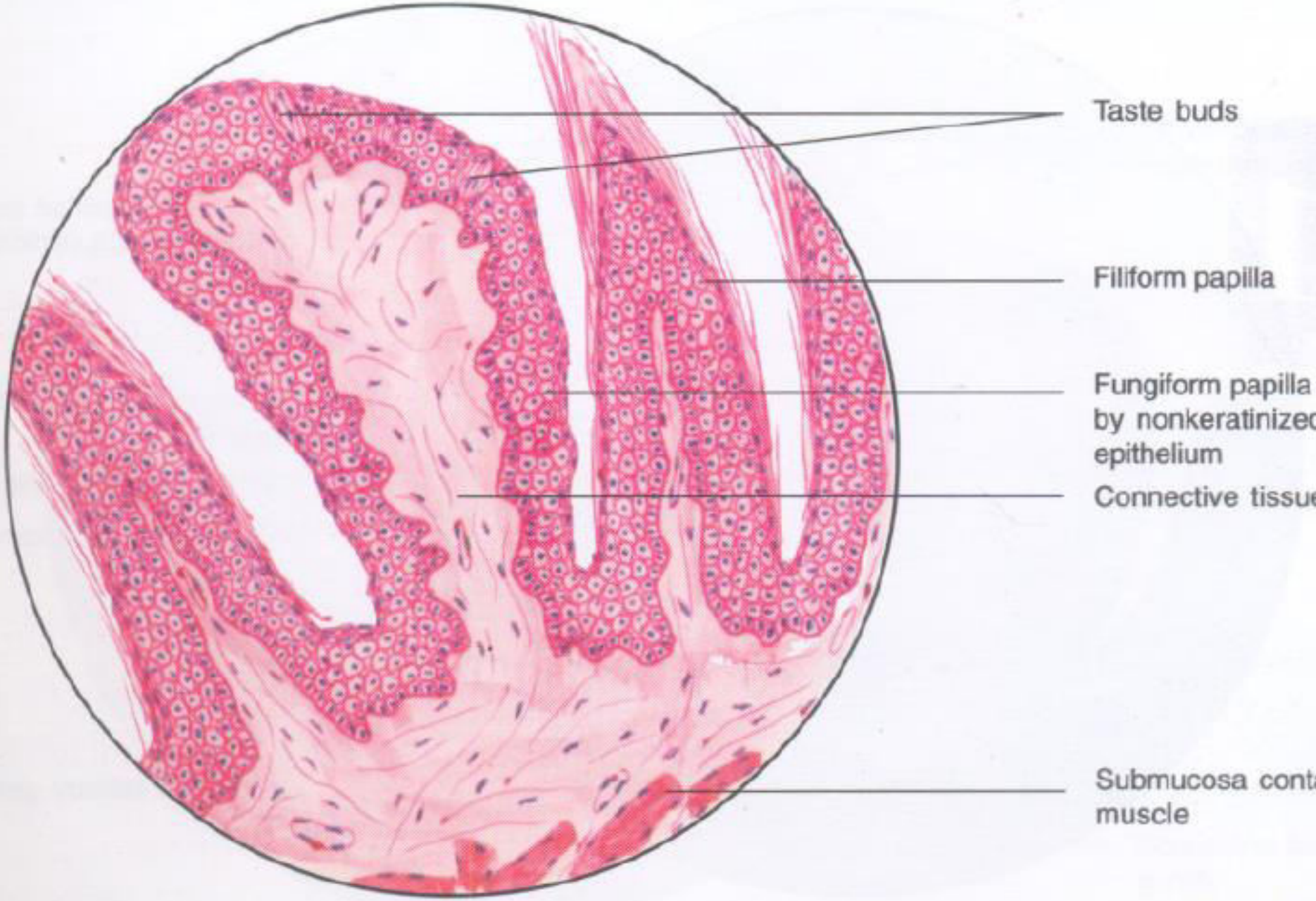
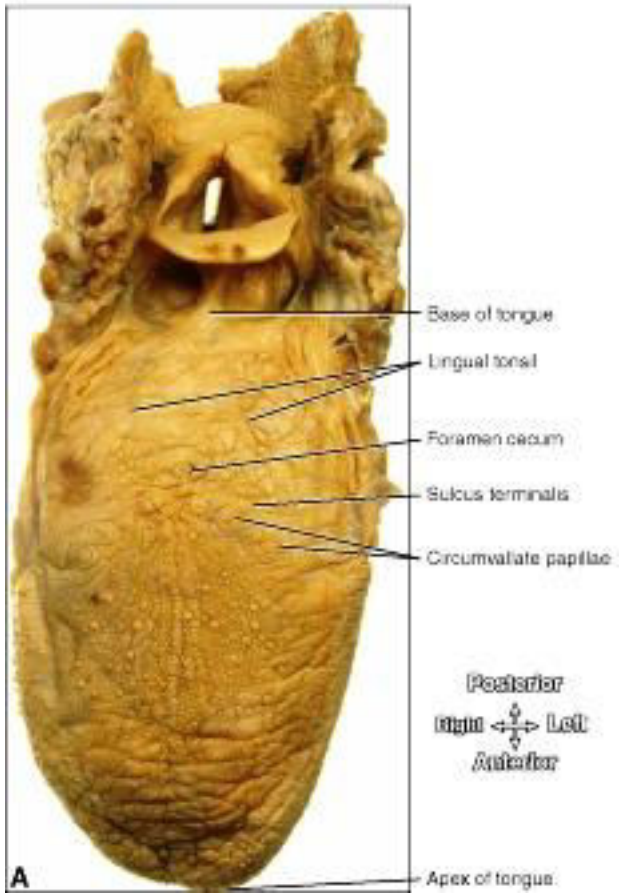


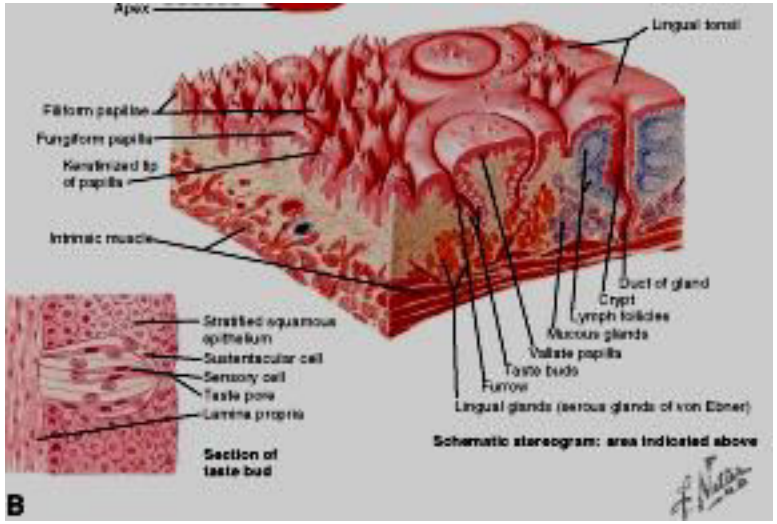
Fig. 10.8 Fungiform papillae of tongue

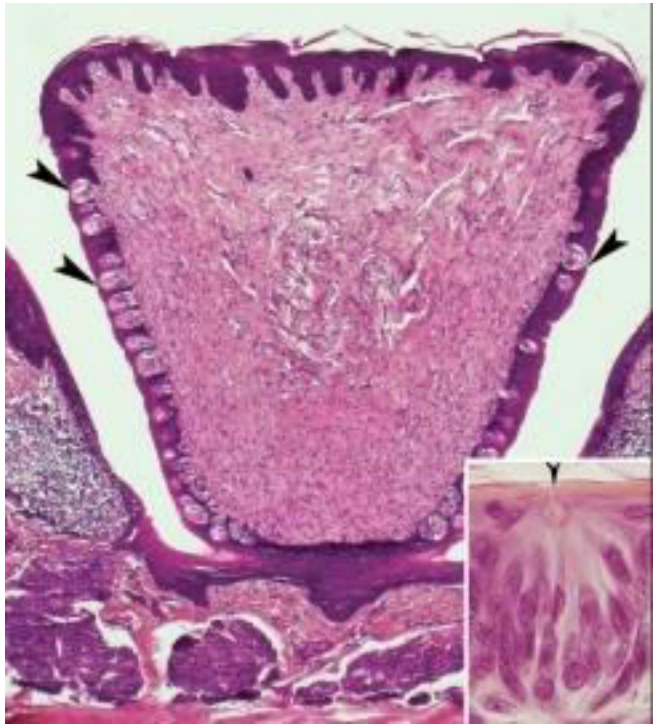
Circumvallate papillae

- They are 8 to 10 in number, vallate(walled) papillae.
- Present just anterior to sulcus terminalis.
- They are largest of the lingual papillae, may be over 1 mm in length and up to 3mm in diameter.



- They are not a result of mucosal evagination, rather they are epithelial invagination i.e. don't protrude above the surface of the tongue but are bounded by a deep circular furrow, only connection to the substance of the tongue is at their narrow base.
- On lateral surface – numerous taste buds seen.





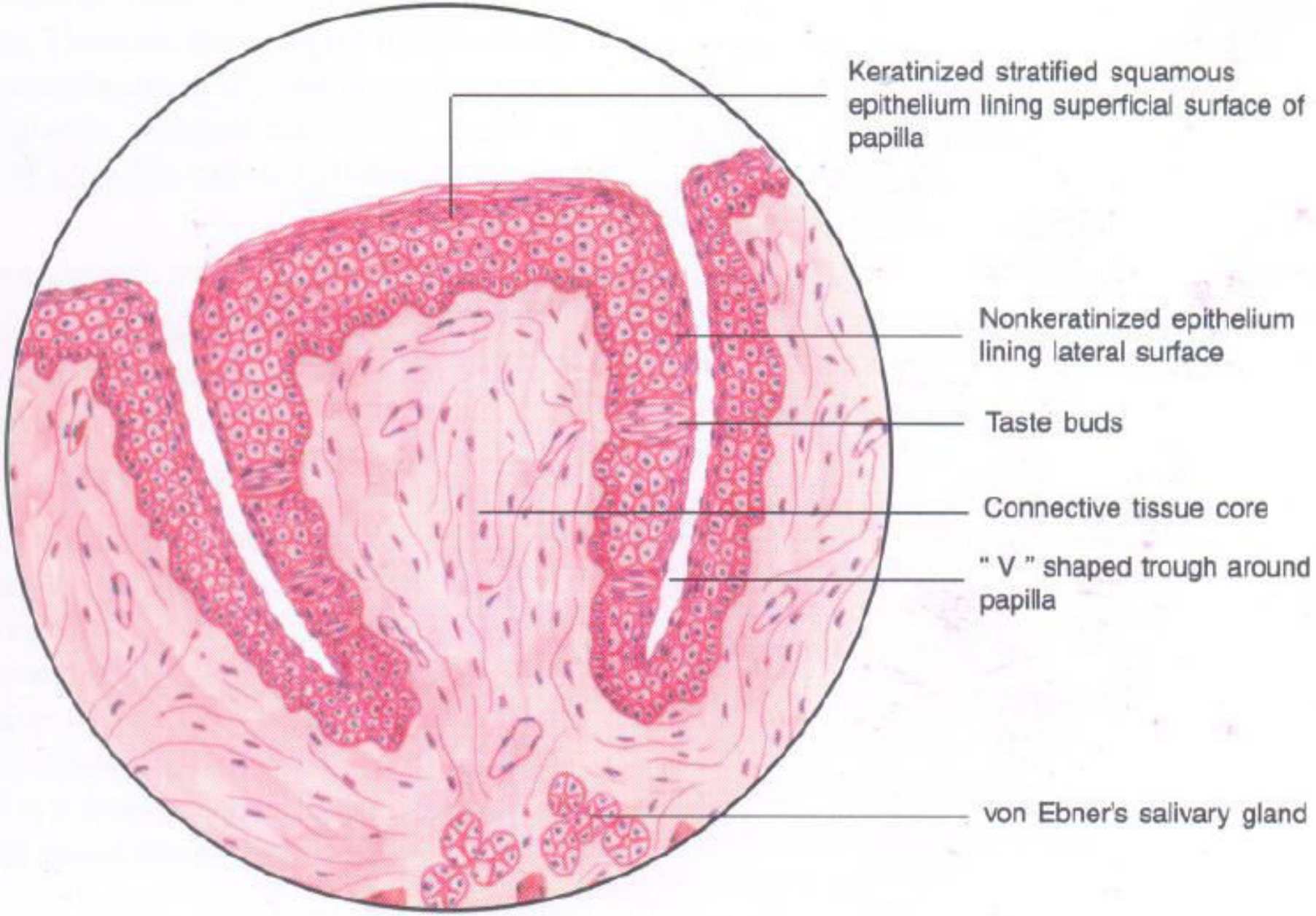


Fig. 10.7 Circumvallate papilla of tongue

- The ducts of small serous glands called **von Ebner's** glands open into the trough, serve to wash out the soluble elements of food and are source of salivary lipase.

Foliate papillae

- Foliate papillae are parallel mucosal folds at posterior lateral border of the tongue.
- These mucosal clefts are well developed at birth, however with growth and maturation they undergo atrophic changes. So that at maturity they get reduced to rudimentary structures, 3 to 8 in numbers.
- Taste buds are contained along the walls of the fold.

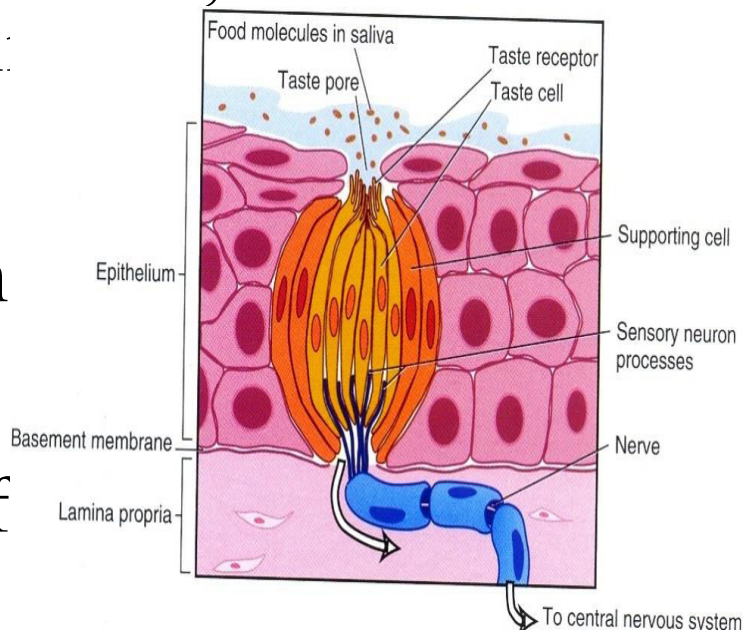
TASTE BUDS

- Small ovoid or barrel-shaped in
  about 80µm high and 40µm thi
- Extend from basal lamina to su
  epithelium.

- Outer surface –covered by few flat epithelial cells, that surround a small opening, taste pore – leads into a narrow space lined by supporting cells of the taste bud.

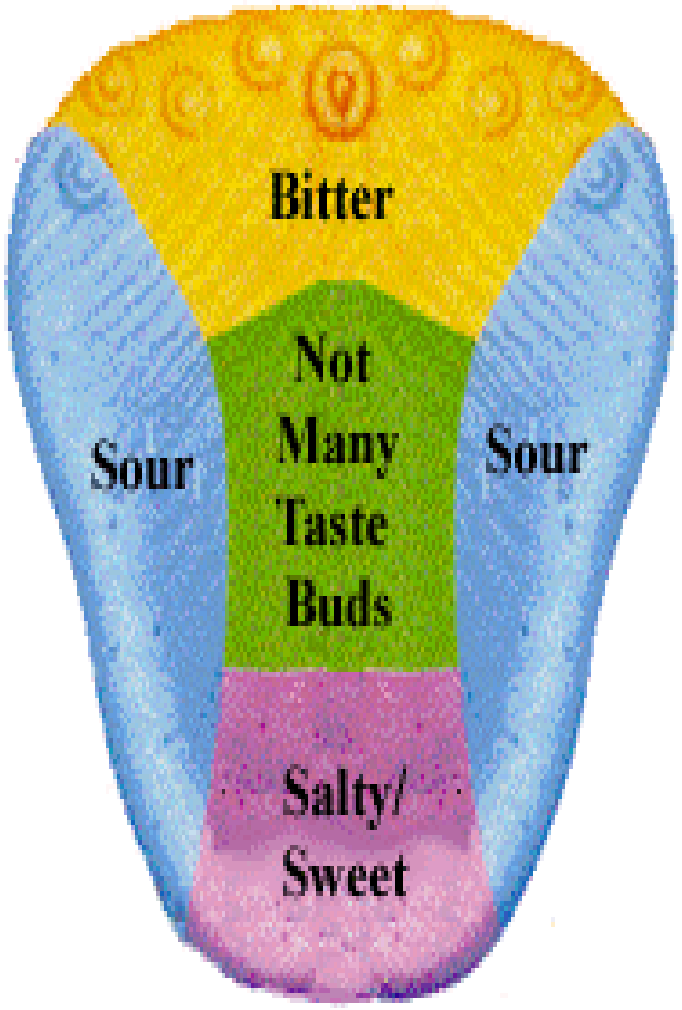
- Outer supporting cells are arranged like staves of a barrel .

- Inner cells-shorter and spindle shaped-between them are arranged 10-12 neuroepithelial cells, the receptors of taste stimuli, are slender, dark-staining cells that carry fingerl their superficial end.
- A rich plexus of nerves is foun the taste buds.
- Taste buds also present on surf epiglottis



Primary taste sensations

- Sweet- at tip of tongue.
- Salty-lateral border of tong
- Bitter-posteromiddle part o
- Sour-posterolateral part of
- Bitter and sour on palate al



- Fungiform papillae -: at tip- sweet,
  at borders –salty
- Circumvallate papillae -: Bitter
- Foliate papillae -: Sour

- Epithelial cells that ultimately keratinize are called ***keratinocytes***.

- The epithelium contains a smaller group of cells that **do not possess cytokeratin filaments** & so they do not have the ability to keratinize. They are known as **non-keratinocytes**.

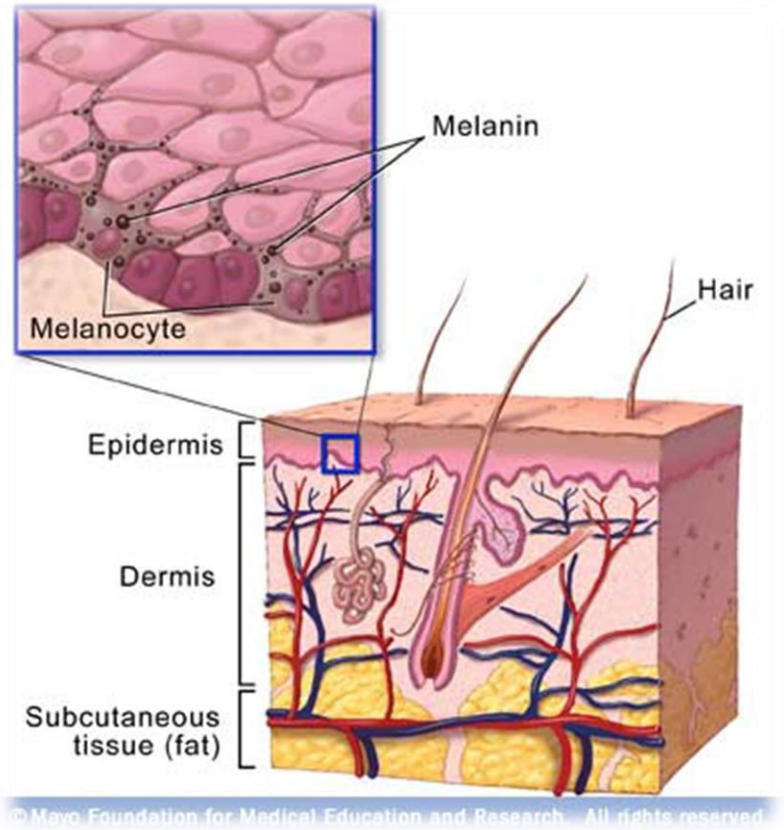
- At ultrastructural level they have been identified as
- Melanocytes
- Langerhans cells
- Merkel cells
- Inflammatory cells
- All Except Merkel cells lack desmosomal attachment, lack tonofilaments too and don't take part in maturation.

Non Keratinocytes

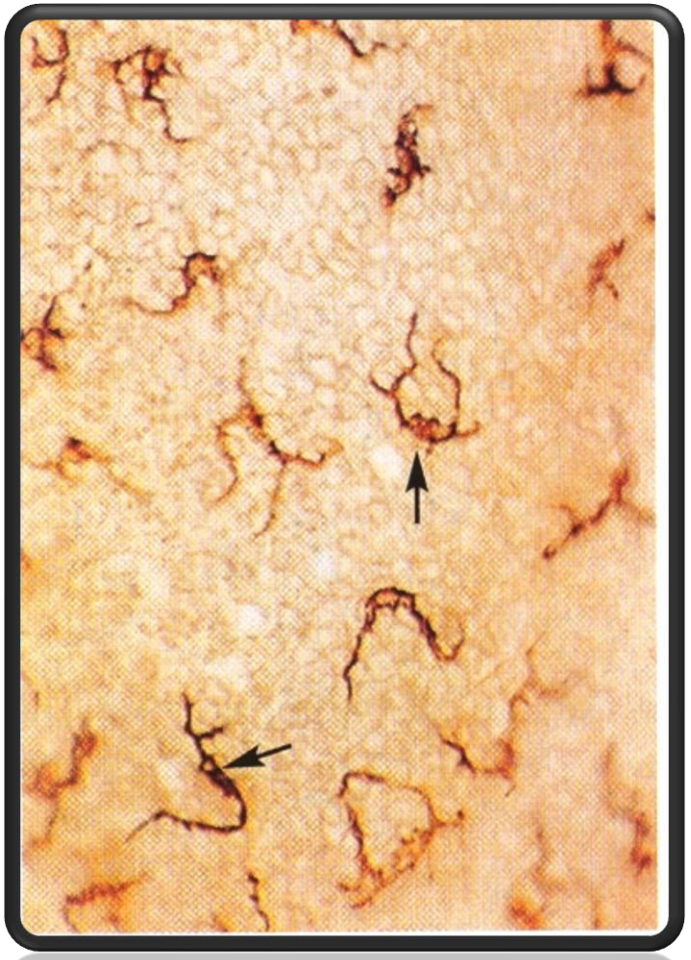
- Do not show mitotic activity
- Do not undergrow maturation
- Do not arrange in layers
- Do not attach with adjacent keratinocytes by desmosomes
- Dendritic & appear **clear** in routine H& E stained section
- Migrate from neural crest cells

Melanocytes & Pigmentation

- Endogenous pigmentation by Hemoglobin & Melanin.
- Melanin produced by melanocytes situated in basal layer.
- Arise from neural crest ectoderm & enter the epithelium at about 11 wks of gestation.
- Melanin synthesized by melanocytes in the form of melanosomes.



- Melanophages may be seen in CT
- Commonly pigmented areas gingiva, buccal mucosa, palate.
- Nevus, Melanoma.
- Exogenous pigmentation by Amalgam, lead, bismuth etc.
- Burtonian's line



Langerhans cells

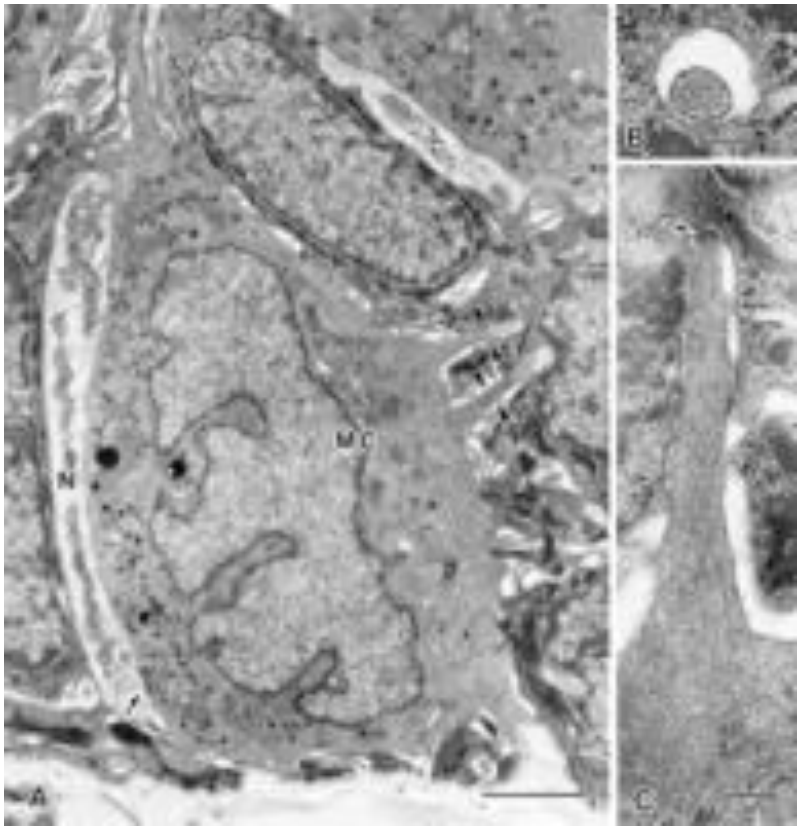
- Dendritic cell seen in suprabasal layer.
- Lacks desmosomal attachment.
- Ultrastructurally, presence of rod or flask shaped granule known as Birbeck granule.

- Appear at same time as melanocytes
- Move in & out of epithelium
- Source is bone marrow.
- Immunologic function.

Merkel Cell

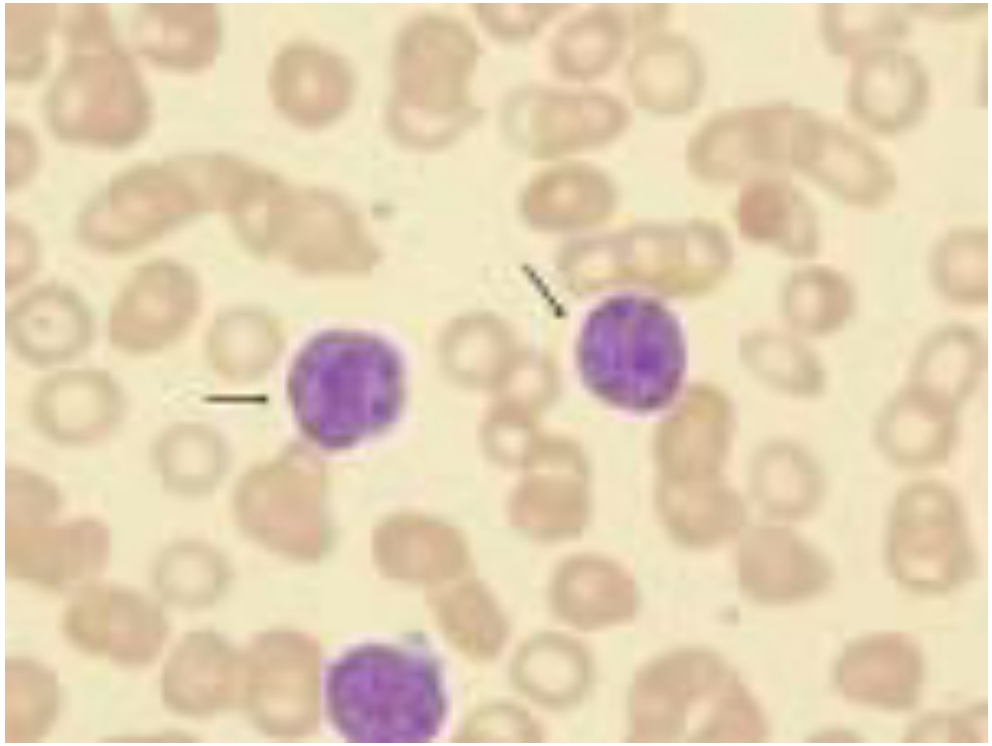
- Situated in basal layer
- Non dendritic
- Few tonofilaments & occasional desmosomes
- Characteristic presence of membrane bound vesicle in the cytoplasm.
- Have a sensory function &

respond to touch.



Inflammatory cells

- Lymphocyte most frequently found cell.
- PMN's & Mast cells may also be present.
- Associated with langerhans cells and responsible for activation of T lymphocytes.

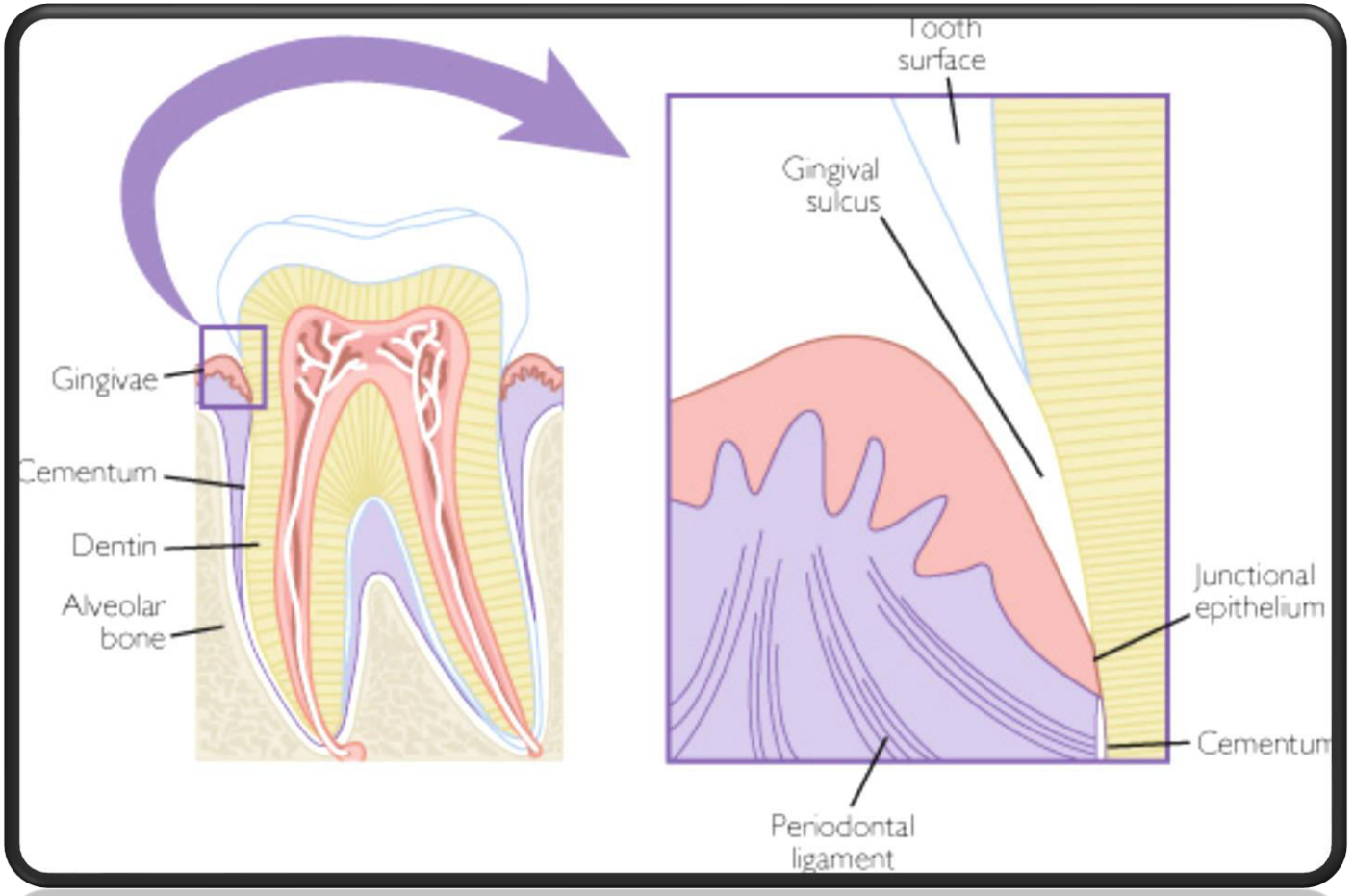


Junction of the epithelium and lamina propria

- The region where C.T. of the lamina propria meets the overlying Epithelium is an undulating interface at which papillae of the CT interdigitate with epithelial ridges.

- This arrangement provide large interface area and better attachment.

- Masticatory mucosa has greater number of papillae per unit area.
- In lining mucosa papillae are fewer and shorter.
- Also represent a major interface for metabolic exchange as there are no blood vessels in epithelium.


Gingivae
Cementum
Dentin
Alveolar bone
Tooth surface
Gingival sulcus
Junctional epithelium
Cementum
Periodontal ligament

Gingival sulcus

- It is a crevice or invagination made by gingiva as it joins with tooth surface .
- Gingiva at its margin remains free i.e. doesn't join the tooth called Free gingival margin.
- Sulcus extends from free gingival margin to dentogingival junction (junction between tooth surface and gingival tissues)

- Depth of healthy gingival sulcus varies from 0.5 to 3mm with an average of **1.8 mm**
- Sulcus is filled with crevicular fluid (GCF) which passes into oral cavity and mixes with saliva.
- GCF contains immunological components and cells of blood eg. WBCs ,PMNLs, IgG, IgM, & IgA.

JUNCTIONS IN ORAL MUCOUS MEMBRANE

1. Mucocutaneous junction
2. Mucogingival junction
3. Dentogingival junction

DENTOGINGIVAL JUNCTION

- The junction between gingiva & tooth - **DENTOGINGIVAL JUNCTION.**
- The epithelium of gingiva which gets attached to the tooth –**Junctional /Attachment epithelium**
- The union between this epithelium & tooth -
  - **Epithelial Attachment**

- Resembles RER in structure (a basal layer & few layers of flattened cells)
- Nondifferentiating, nonkeratinizing tissue.
- It extends upto 2 mm on the surface of the tooth
- Has highest turnover rate of 5-6 days, so regenerates readily.

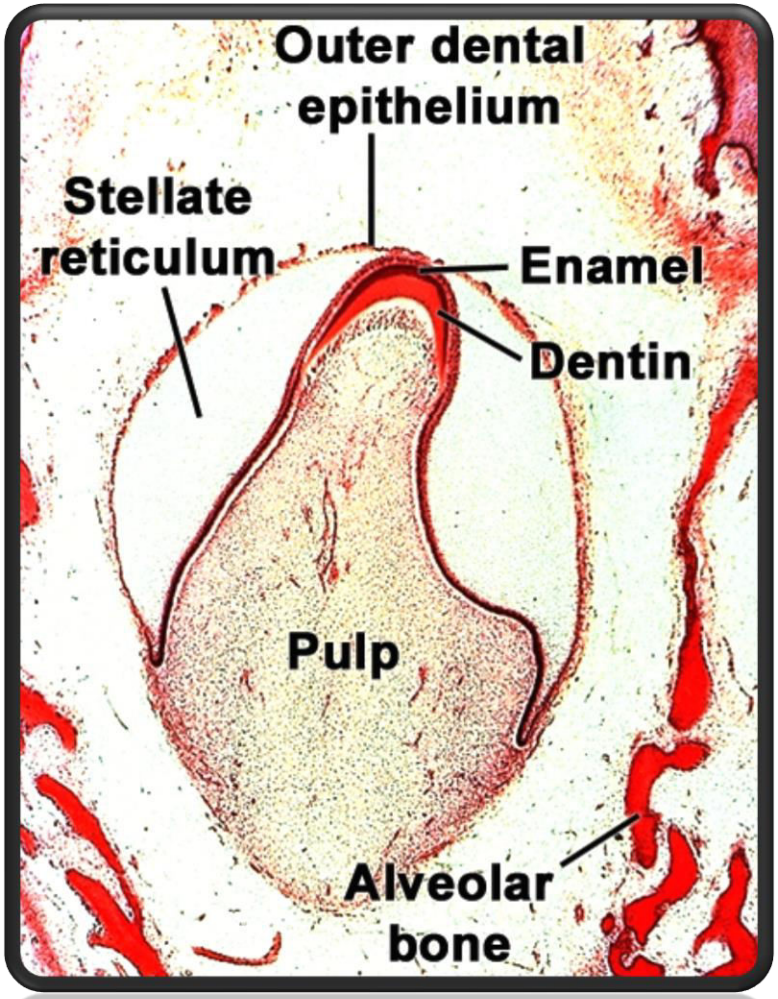
- Highly permeable
- It is a point of least resistance to mechanical forces and bacterial attack.

- Firmness of this junction is maintained by gingival division of periodontal ligament.
- Deeper extention of sulcular epithelium is junctional (attachment) epithelium, which lines floor of gingival sulcus and is attached to tooth surface by way of epithelial attachment.

Development of junctional (attachment) epithelium

- When the ameloblasts finish formation of the enamel matrix, they leave a thin membrane on the surface of the enamel, the ***primary enamel cuticle***

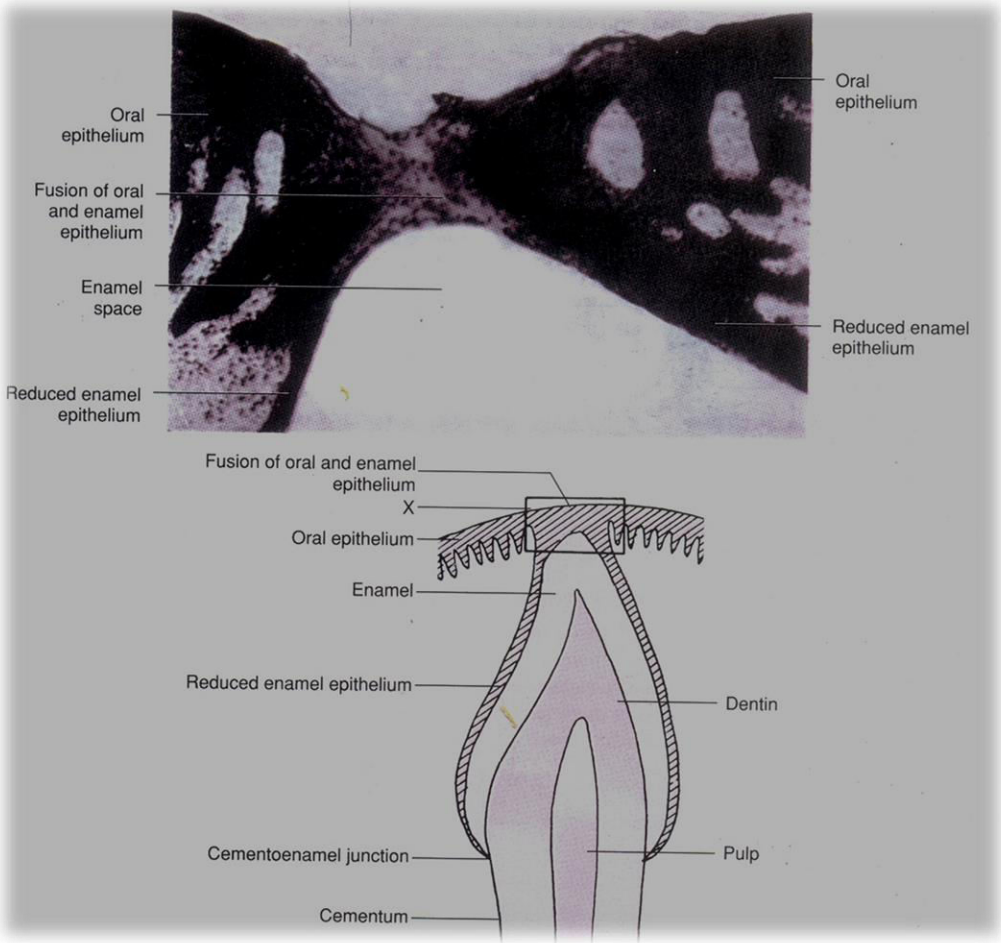
- This cuticle is connected with the interprismatic enamel substance and the ameloblasts.


Outer dental epithelium
Stellate reticulum
Enamel
Dentin
Pulp
Alveolar bone

Reduced Enamel Epithelium(RER)

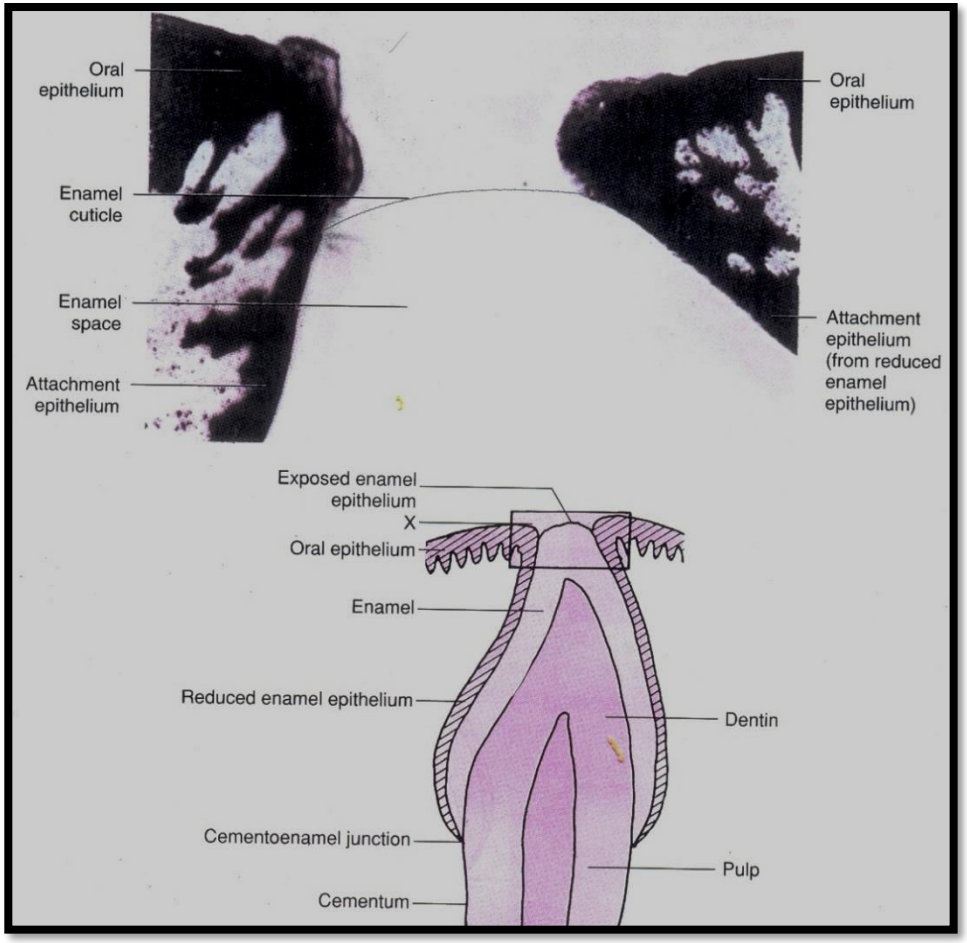
- The ameloblasts shorten after the primary enamel cuticle has been formed, and the epithelial enamel organ is reduced to a few layers of flat cuboidal cells, which are then called ***Reduced Enamel Epithelium (RER).***

- Under normal conditions RER covers the entire enamel surface, extending to the cementoenamel junction, and remains attached to the primary enamel cuticle.


Oral epithelium
Fusion of oral and enamel epithelium
Enamel space
Reduced enamel epithelium
Oral epithelium
Reduced enamel epithelium
Fusion of oral and enamel epithelium
X
Oral epithelium
Enamel
Reduced enamel epithelium
Dentin
Cementoenamel junction
Cementum
Pulp

- During eruption, the tip of the tooth approaches the oral mucosa, and the reduced enamel epithelium and the oral epithelium meet and fuse.
- The remnant of the primary enamel cuticle after eruption is referred to as **Nasmyth's membrane**.

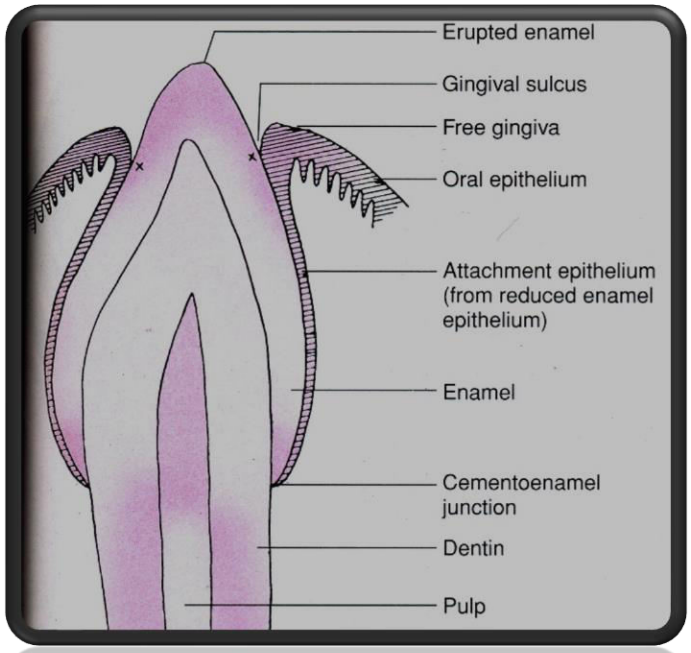
- The epithelium that covers the tip of the crown degenerates in its center, and the crown emerges through this perforation into the oral cavity.


Oral epithelium
Enamel cuticle
Enamel space
Attachment epithelium
Oral epithelium
Attachment epithelium (from reduced enamel epithelium)
Exposed enamel epithelium
X
Oral epithelium
Enamel
Reduced enamel epithelium
Dentin
Cementoenamel junction
Pulp
Cementum

- The reduced enamel epithelium, remains organically attached to the part of the enamel that has not yet erupted.

- Once the tip of the crown has emerged, the reduced enamel epithelium is termed the ***primary attachment epithelium***.

- At the margin of the gingiva the attachment epithelium is continuous with the oral epithelium.
- As tooth erupts, the reduced enamel epithelium grows gradually shorter.



Shift of dentogingival junction

- The position of the gingiva on the surface of the tooth changes with time.
- When the tip of the enamel first emerges through the mucous membrane of the oral cavity, the epithelium covers almost the entire enamel.
- The attachment epithelium separates from the enamel surface gradually while the crown emerges into the oral cavity.

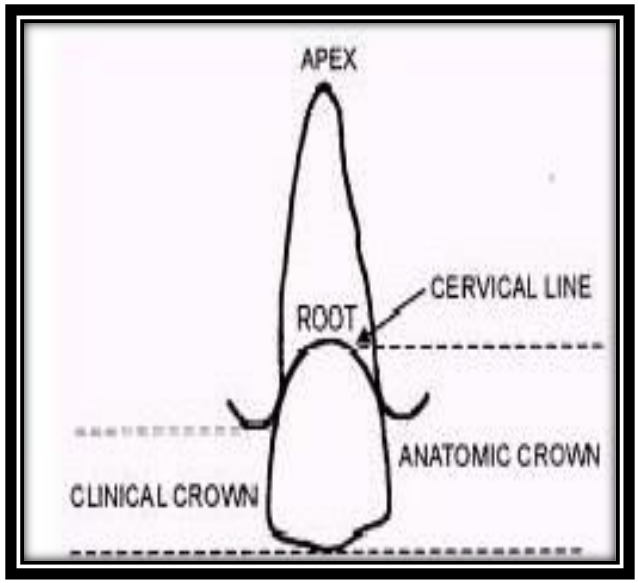
- When the tooth first reaches the plane of occlusion one third to one fourth of the enamel still remains covered by the gingiva. A gradual exposure of the crown follows.
- ***Active Eruption.***
- ***Passive Eruption***.

- Further **recession** exposing the cementum may ultimately occur. At that stage the reduced enamel epithelium has disappeared and the primary attachment epithelium is replaced by a ***Secondary Attachment Epithelium*** derived from the gingival epithelium.

- **Anatomical crown :-** The enamel-covered

  part of a tooth.
- **Clinical crown :-** The exposed part of a tooth

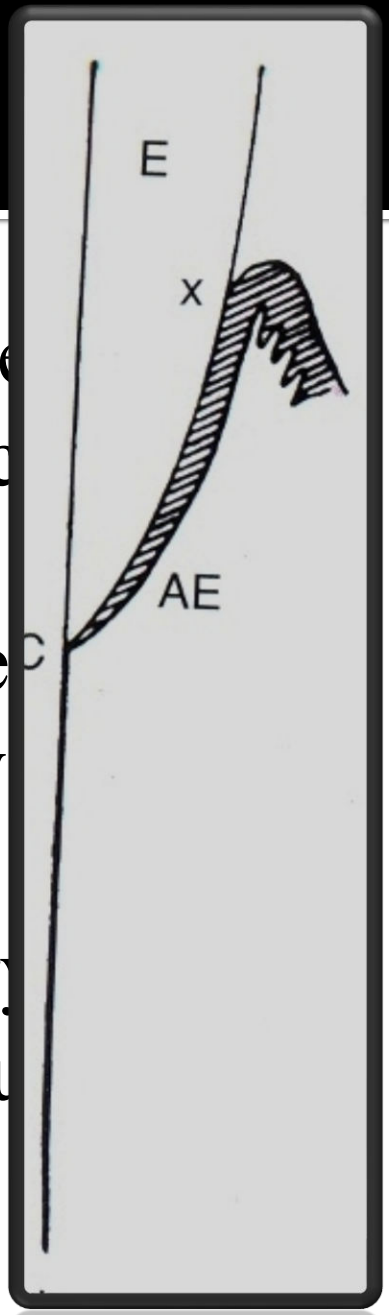
  within the oral cavity.



- Crown exposure involving passive eruption and further recession has been described in four stages.
- The first two may be physiologic.
- Many conceive of the last two as normal also, but there is a strong possibility that they are pathologic.

FIRST STAGE

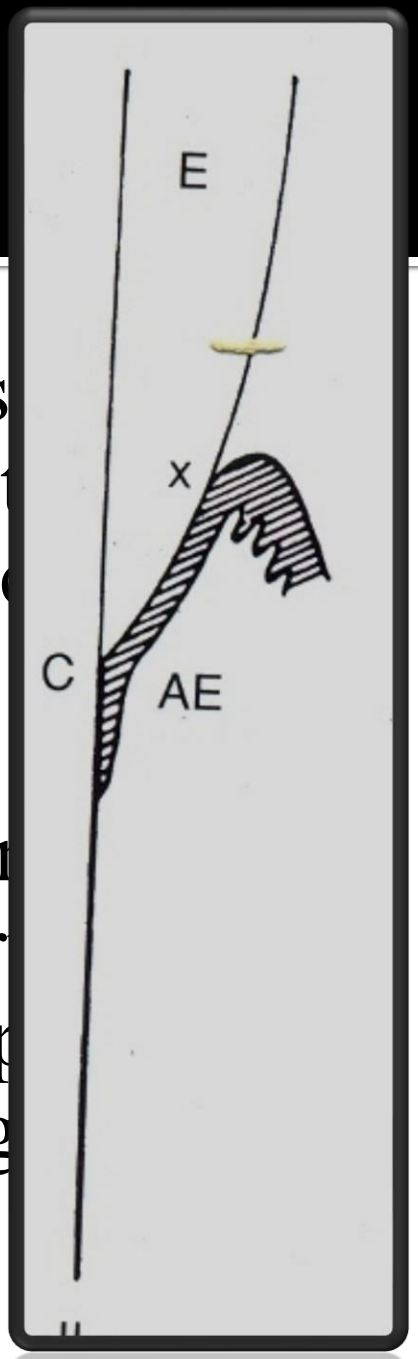
- The bottom of the gingival sulcus re
the region of the enamel-covered c
some time
- The apical end of the attachment e
(reduced enamel epithelium) stay
Cemento-enamel junction.
- This relation persists in primar
shedding and, in permanent teeth, u
the, age of 20 or 30 years.



SECOND STAGE

- The bottom of gingival sulcus is enamel, and the apical end of the at epithelium has shifted to the surfa cementum.

- This entails dissolution of fiber bur were anchored in the cervical par cementum, now covered by the ep and an apical shift of the ging transseptal fibers.



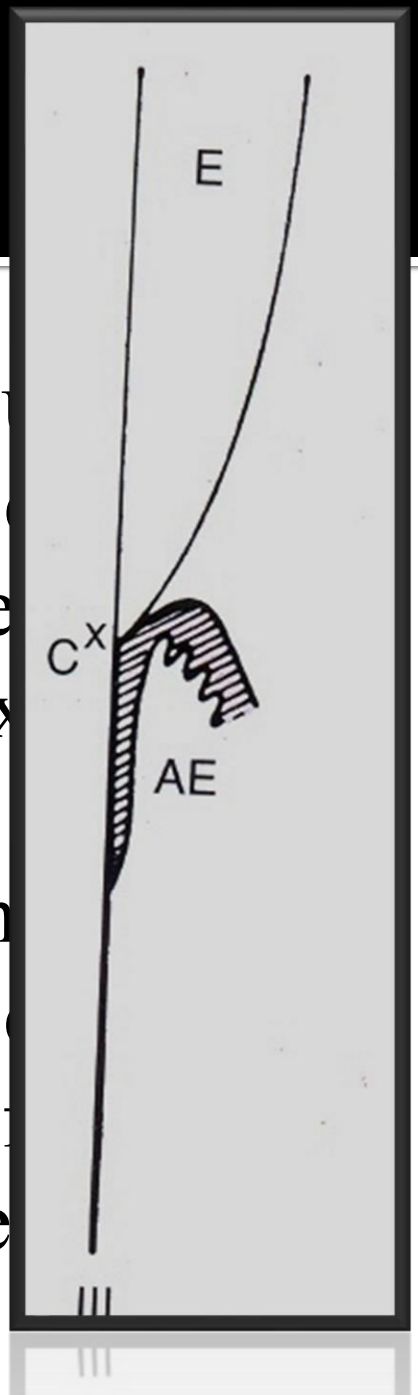
- The destruction of the fibers may be caused by enzymes formed by the epithelial cells, by plaque metabolites or enzyme or by immunologic reactions as manifestations of periodontal disease.

- This stage of tooth exposure may persist to the age of 40 years or later.

THIRD STAGE

- When the bottom of the gingival s
the cementoenamel junction, the
attachment is entirely on the ceme
the enamel-covered crown is fully ex

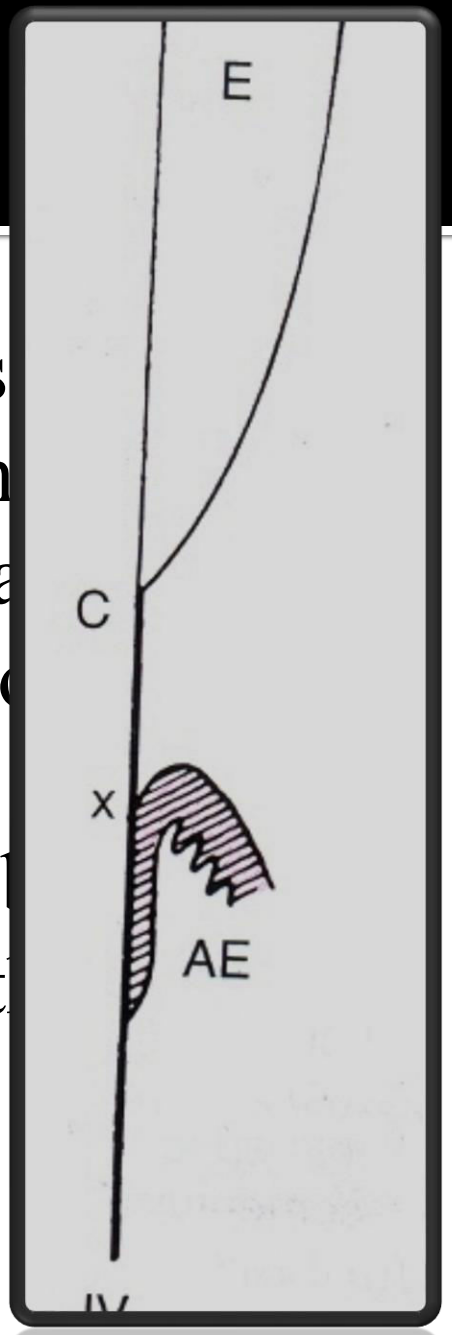
- This stage in the exposure of a tooth
is a passive manifestation. The
shifts gradually along the surface o
and does not remain at the ceme
junction.



FOURTH STAGE

- The fourth stage represents recess
gingiva. When the entire attachm
cementum, the gingiva may appea
but the process is regarded as pathol

- In some cases the fourth stage is ol
persons during their twenties. In ot
at 50 years of age or older the teeth
the first or second stage.



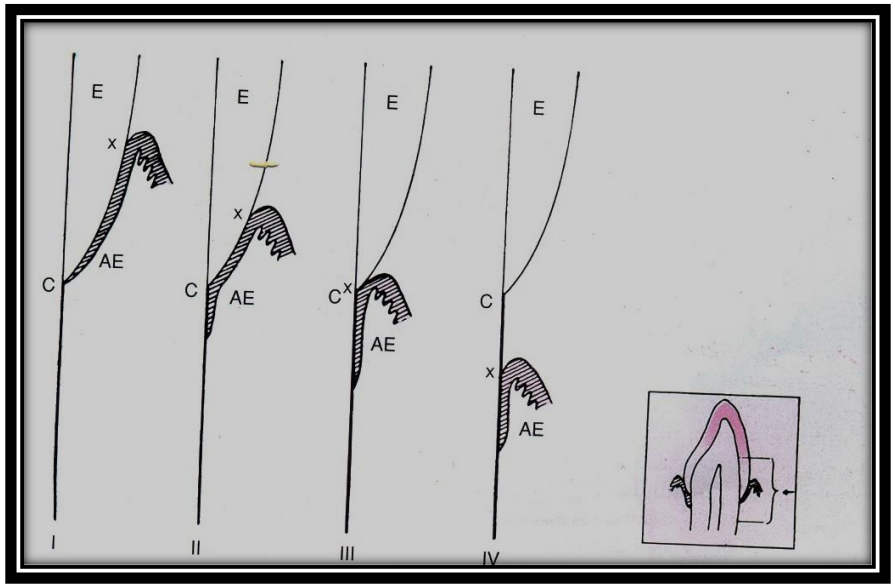
- The rate varies also in different teeth of the same jaw and on different surfaces of the same tooth. One side may be in the first stage and the other in the second or even the fourth stage.

- Gradual exposure of the tooth makes it necessary to distinguish between the anatomic and the clinical crowns of the tooth.

- That part of the tooth covered by enamel is the anatomic crown. The clinical crown is the part of the tooth exposed in the oral cavity.

- In the first and second stages the clinical crown is smaller than the anatomic crown.

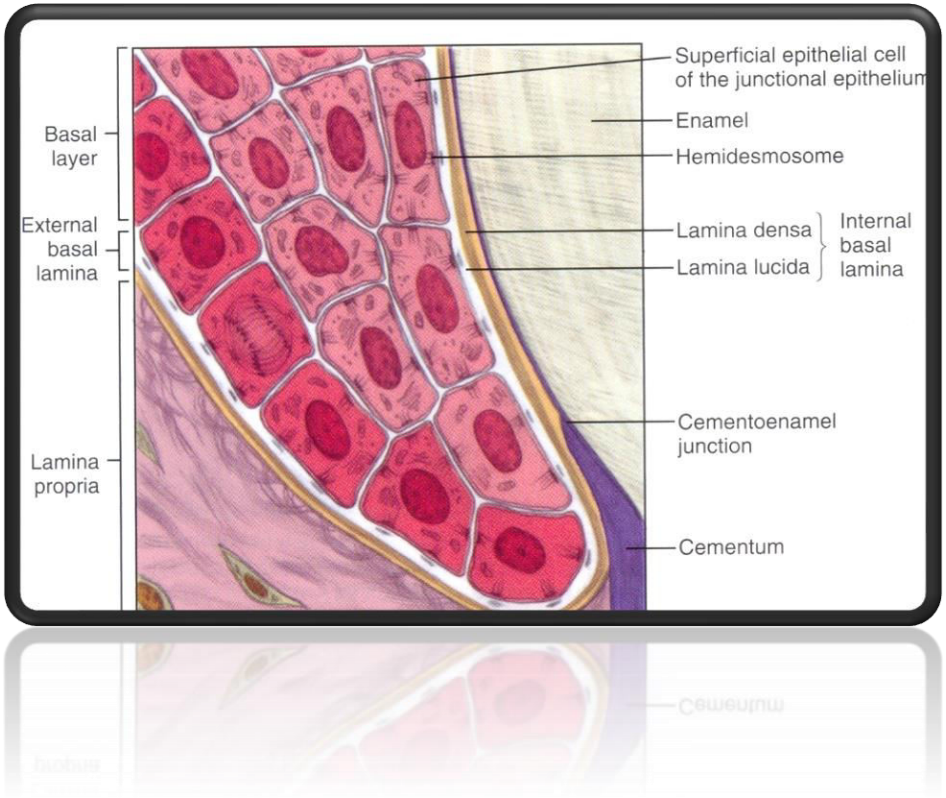
- With recession (third stage) the entire enamel-covered part of the tooth is exposed, and the clinical crown is equal to the anatomic crown.
- Later the clinical crown is larger than the anatomic crown because parts of the root have been exposed (fourth stage).



SULCUS AND CUTICLES

- The primary cuticle mediating an organic union between ameloblasts and the enamel.
- When the ameloblasts are replaced by the oral epithelium, a secondary cuticle is formed.

- Secondary enamel cuticle and the cemental cuticle are referred to as **Dental Cuticle**.
- These cuticles are microscopically ----an amorphous material between the attachment epithelium and the tooth.


Basal layer
External basal lamina
Lamina propria
Superficial epithelial cell of the junctional epithelium
Enamel
Hemidesmosome
Lamina densa
Lamina lucida
Internal basal lamina
Cementoenamel junction
Cementum

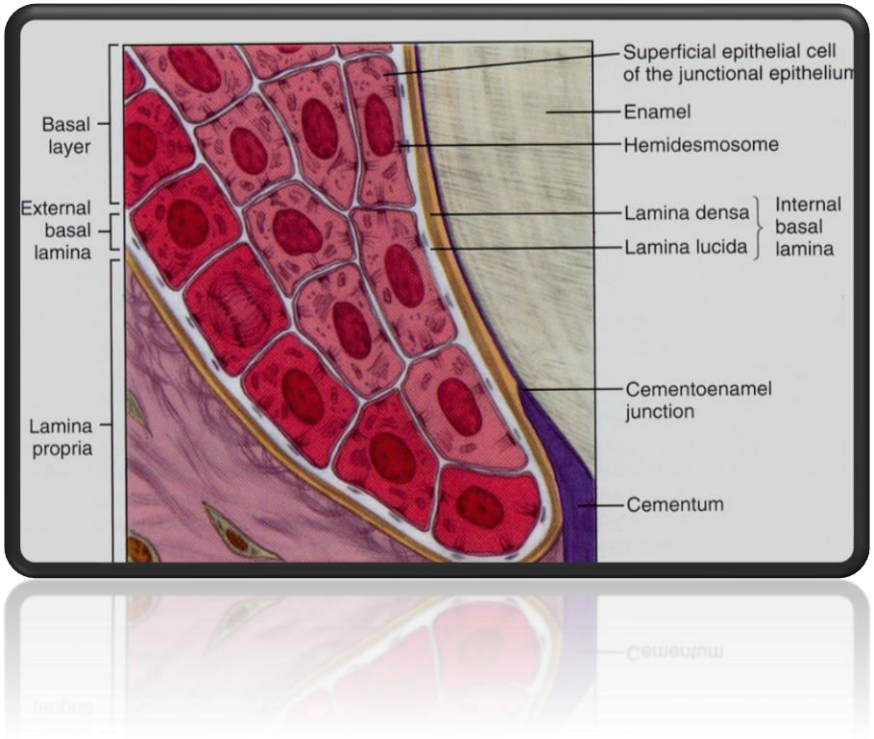
EPITHELIAL ATTACHMENT

- The ultrastructural attachment of the primary attachment epithelium to the tooth was first shown by Stern and confirmed by Listgarten and Schroeder, to be **basal lamina** to which hemidesmosomes are attached.
- *This mode of attachment* is referred to as the ***epithelial attachment***.

- The secondary attachment epithelium composed of cells derived from the oral epithelium forms an epithelial attachment identical with that of the primary attachment epithelium, that is a basal lamina and hemidesmosomes.

- It is submicroscopic, approximately 40nm wide, and formed by the attachment epithelium.

- **Internal basal lamina-** attaches the cells of attachment epithelium to the tooth via hemidesmosomes
- **External basal lamina-** attaches the basal cells of attachment epithelium to lamina propria



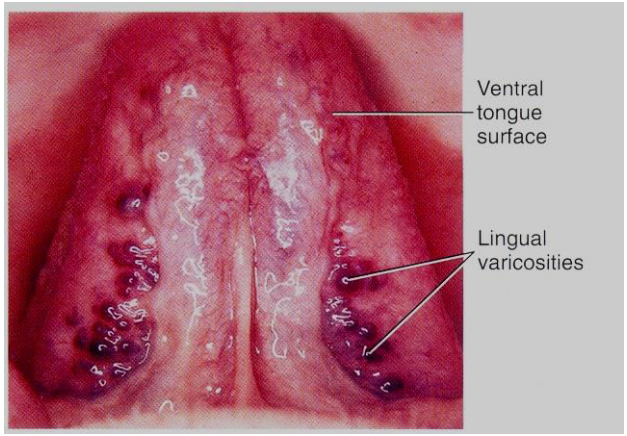
Migration of attachment epithelium

- The deepest /basal layer of AE undergoes constant & rapid cell division.
- The cells migrate in coronal direction.
- They do not undergo differentiation as other cells of keratinised/non keratinised epithelium.

- They synthesize basal lamina & so the attachment is maintained by the hemidesmosomes while migration towards coronal direction.
- The apical migration of the sulcus –due to detachment of basal cells & a reestablishment of their epithelial attachment at a more apical level.

Age changes

- With age mucosa becomes smooth & dry
- Filiform papillae reduced-tongue appears smooth
- Varicose veins on ventral surface of tongue
- Ectopic sebaceous glands (Fordyce's spot)



Turnover rate

- The time taken for a cell to divide & pass through the entire epithelium –Turnover rate/Turnover time
- Turnover time for oral mucosa –higher than skin
- Amongst oral mucosa-junctional epithelium-highest Turnover rate (4-6 days)
- Nonkeratinized mucosa -Faster Turnover rate than keratinized