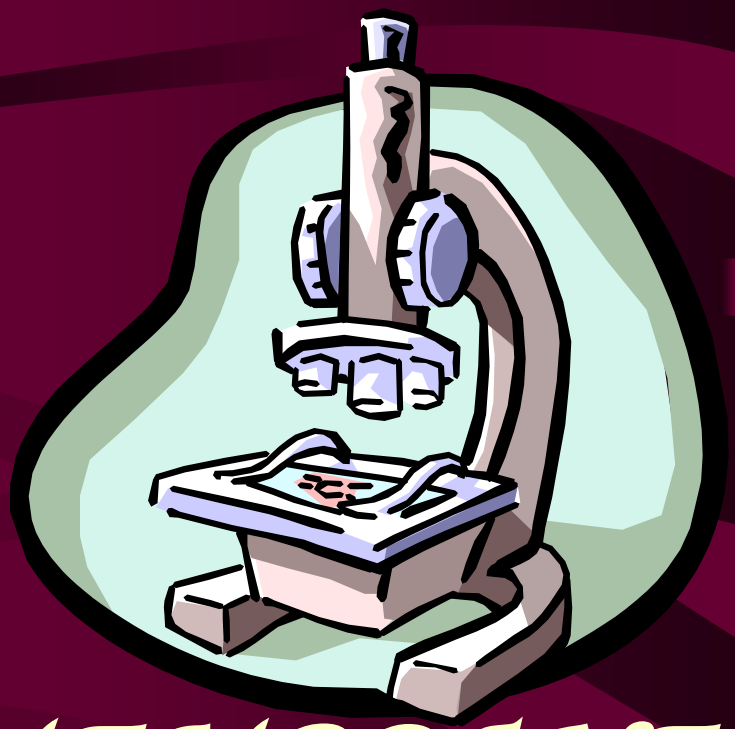


ORAL MUCOUS MEMBRANE

DEPARTMENT OF ORAL AND MAXILLOFACIAL PATHOLOGY & ORAL MICROBIOLOGY

MUCOUS MEMBRANE:

The term mucous membrane is used to describe the moist lining of the intestinal tract, nasal passages, and other body cavities that communicate with the exterior.

In the oral cavity this lining is called the oral mucous membrane, or oral mucosa.

Oral cavity consists of two parts:

Outer vestibule which is bounded by lip and cheeks

The oral cavity proper, which is bounded

- Superiorly by hard and soft palates,
- Inferiorly by the floor of the mouth and base of the tongue.
- Posteriorly by pillars of the fauces and tonsils

Both are separated by the alveolus bearing the teeth and gingiva.

FUNCTION OF THE ORAL MUCOSA:

PROTECTION:

As a surface lining, the oral mucosa separates and protects deeper tissues and organs in the oral region from the environment of the oral cavity

It protects against mechanicla forces, surface abrasions and microorganisms.

SENSATION:

Oral mucosa contain receptors that respond to temperature, touch, and pain; there also are the taste buds, which are not found any where ese in the body.

SECRETION:

Minor salivary glands are associated with the oral mucosa.

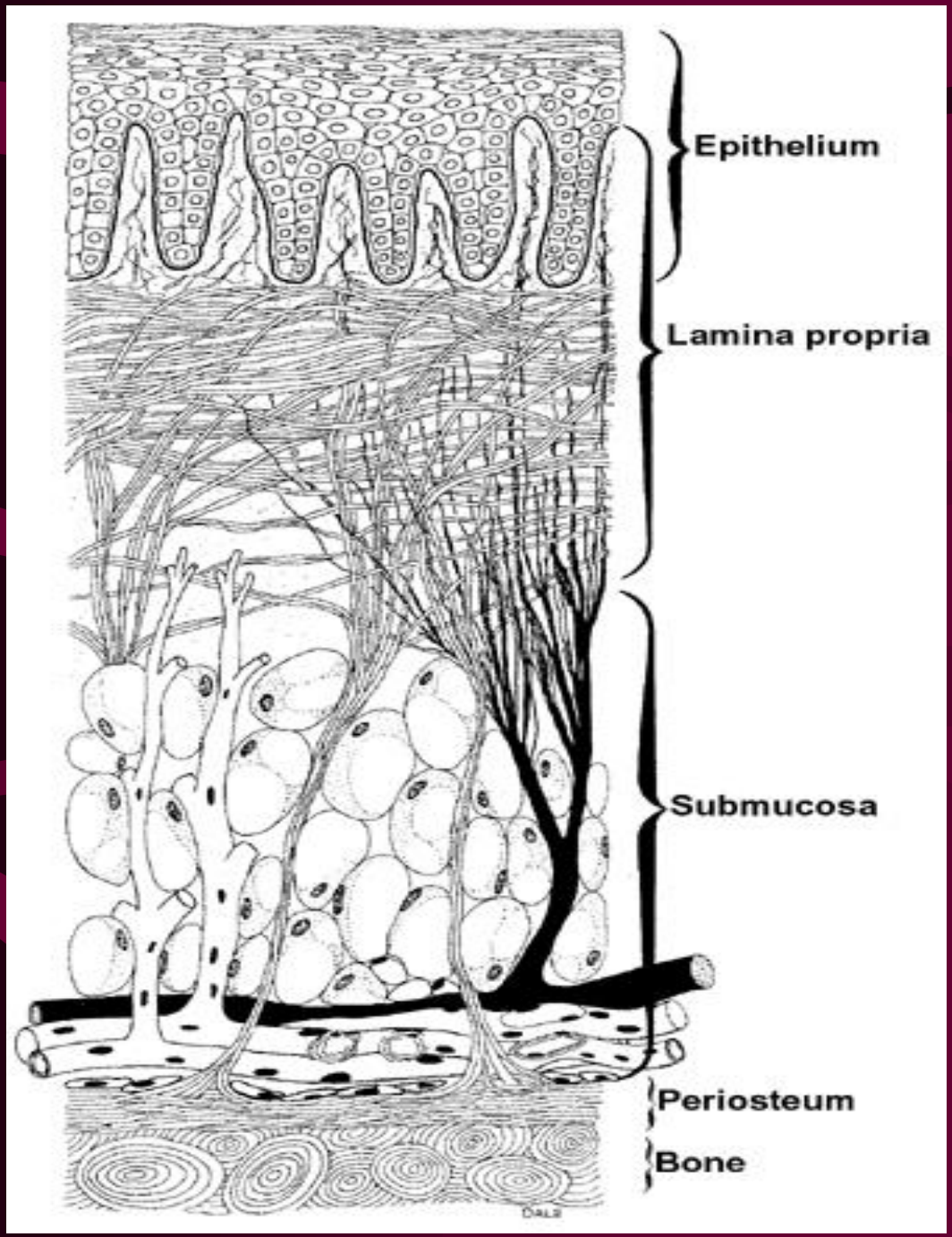
The major salivary glands are situated far from the mcosa, and their secretions pass through the mucosa via long ducts.

Oral mucous membrane is composed of two layers: epithelium and connective tissue.

These two layers forms the interface that is folded into corrugations.

Papillae of CT protrude towards the epithelium carrying blood vessels and nerves.

The epithelium in turn is formed into ridges that protrude toward the lamina propria. These ridges interdigitate with eh papillae and called epithelial ridges.



MAIN TISSUE COMPONENTS OF THE ORAL MUCOSA.

BASEMENT MEMBRANE:

It is a 1 to 4 um wide and relatively cell free zone.

It stain positively with PAS stain indicating that it contains neutral mucopulysaccharides (glycosaminoglycans).

It al so contains fine argyrophilic reticulin fibers as well as special anchoring fibrils.

Evident at light microscope level.

It is within the connective tissue.

LAMINA PROPRIA:

It is connective tissue of variable thickness that supports the epithelium.

It is divided into two parts for descriptive purposes.
Papillary & Reticular.

PAPILLARY PORTION is named for the papillae.

The collagen fibers are loosely arranged and many capillary loops are present.

RETICULAR PORTION:
The term reticular means net like and refers to the arrangement of the collagen fibers; it has nothing to do with so called reticulin fiber situated beneath the basal lamina

Here collagen fibers are arranged in thick bundles tha tend to lie parallel to the surface plane.

The interlocking arrangement of the connective tissue papillae and eth epithelial ridges and the epithelial ridges and the even finer undulations and projections found at the base of each epithelial cell increases the are a of contact between the lamina propria and epithelium.

This additional area facilitates exchange of material between the epithelium and the blood vessels in the CT.

Cells with heavily arranged pedicles (serrations) may serve to strengthen the attachment to the CT.

SUBMUCOSA:

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

It contains glands, blood vessels, nerve, and also adipose tissue. It is in the submucous layer that large arteries divide into smaller branches which then enter lamina propria.

The nerve fibers are myelinated as they traverse the submucosa but lose their myelin sheath before splitting into their end arborizations.

Looseness and density of submucosa determines whether the mucous membrane is movably or immovably attached to the deeper layers.

EPITHELIUM:

Epithelium of OMM is of stratified squamous variety.
It may be keratinized, nonkeratinized or nonkeratinized, depending on location.

A common feature of all epithelial cells is that they contain keratin intermediate filaments as a component of their cytoskeleton. This is one of the distinguishing features of an epithelial cell, regardless of its function.

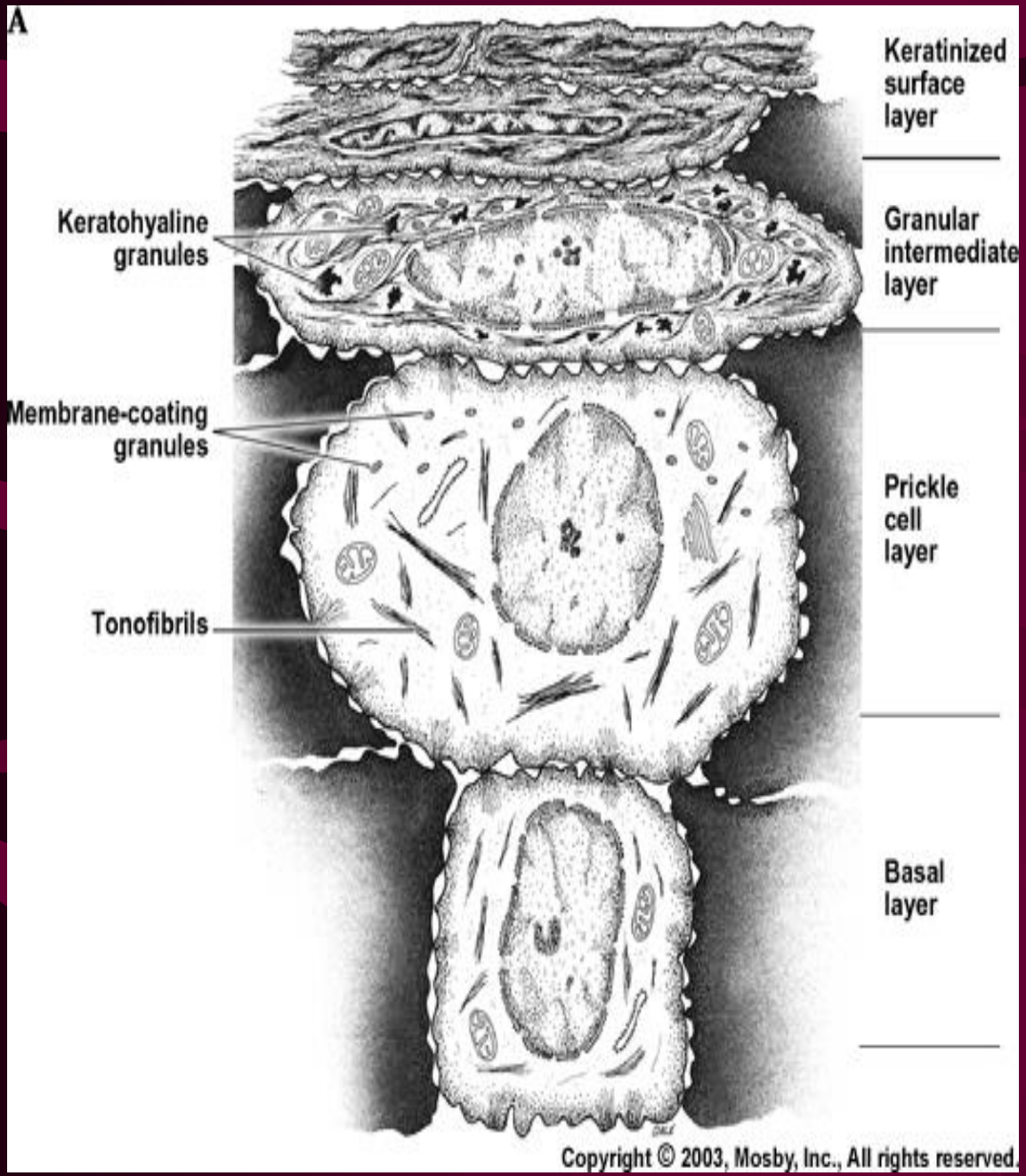
The analogous components of CT cells are called vimentin; in muscles cells they are called desmin, and in nerve cells neural filaments,

KERATINIZING EPITHELIUM:

Keratinizing oral epithelium has 4 cell layers:

Stratum basale
Stratum spinosum
Stratum granulosum, &
Stratum cornium.
(Stratum-layer).

A single cell is, at different times, a part of each layer. After mitosis, a single cell may remain in the basal layer and divide again, or may migrate as keratinocytes(differentiation) & forms a keratinized squama (a dead cell filled with densely packed protein contain within a toughened cell membrane. After reaching the surface it desquamates.



DIFFERENT CELL LAYERS OF KERATINIZING EPITHELIUM

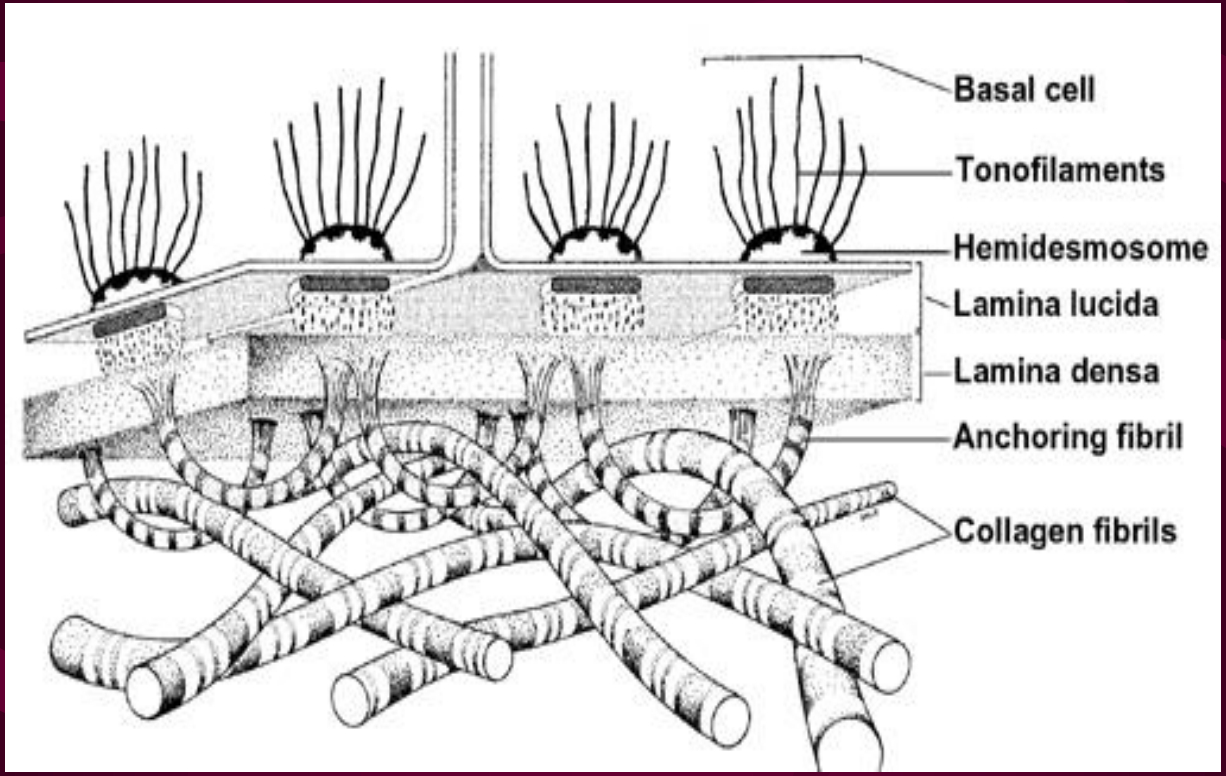
STRATUM BASALE:

Basal layer is made up of cells that synthesize DNA & undergo mitosis and provides new cells and that is why it is called **stratum germinativum.**
Some mitotic figures may be seen in spinous cell layer.

Basal cells are made up of two populations.
One population is serrated and heavily packed with tonofilaments, which are adaptations for attachment, and the
Other is nonserrated and composed of slowly cycling stem cells .the stem cells give rise to a population of cells amplified for cell division, the proliferative compartment.

The serrated basal cells are a single layer of cuboid or high cuboid cells that have protoplasmic processes, pedicles , projecting from their basal surfaces toward the connective tissue.

Specialized structures called hemidesmososmes which abut on the basal lamina are found on the basal surface .
They consists of a single attachment plaque, the adjacent plasma membrane, and an associated extra cellular structure that appears to attach the epithelium to the connective tissue.



The BASAL LAMINA is made up of …….

Lamina lucida:

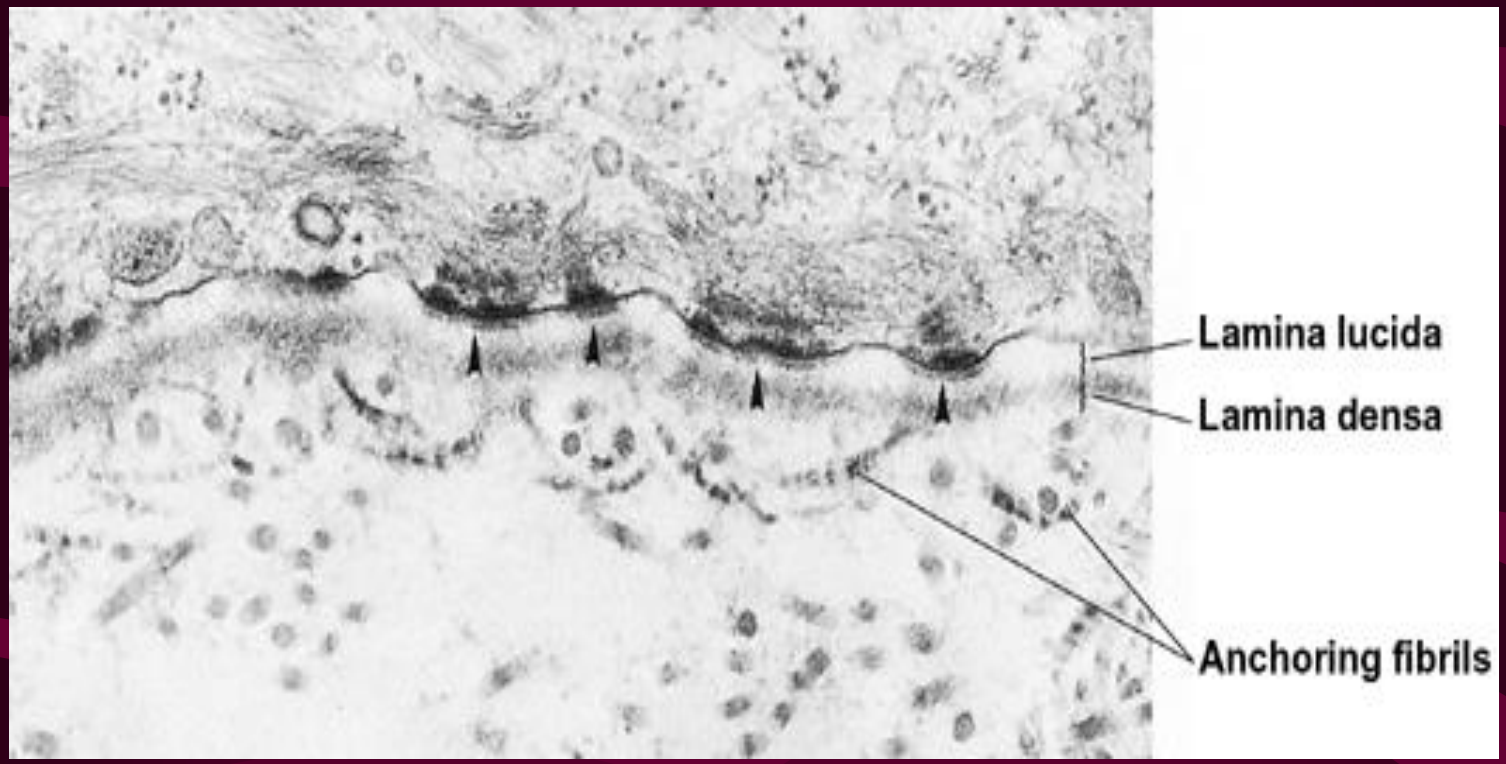
A clear zone just bwlow the epithelial cells

It contains laminin and bullous pemphigoid antigen.

Lamina densa:

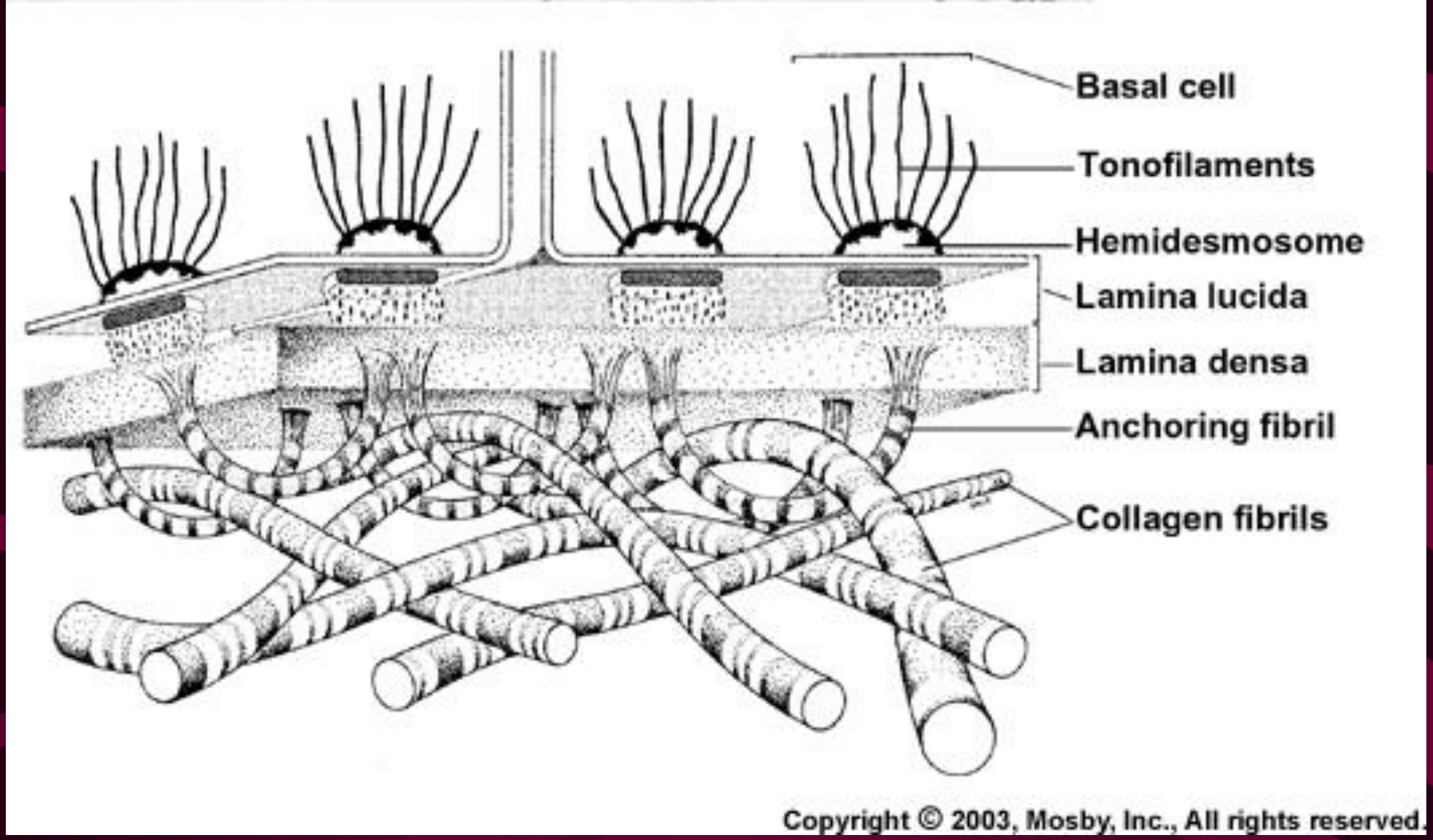
A dark zone beyond the lamina lucida and adjacent to the connective tissue.

It contains type IV collagen and an antigen bound by the antibody KF-1.

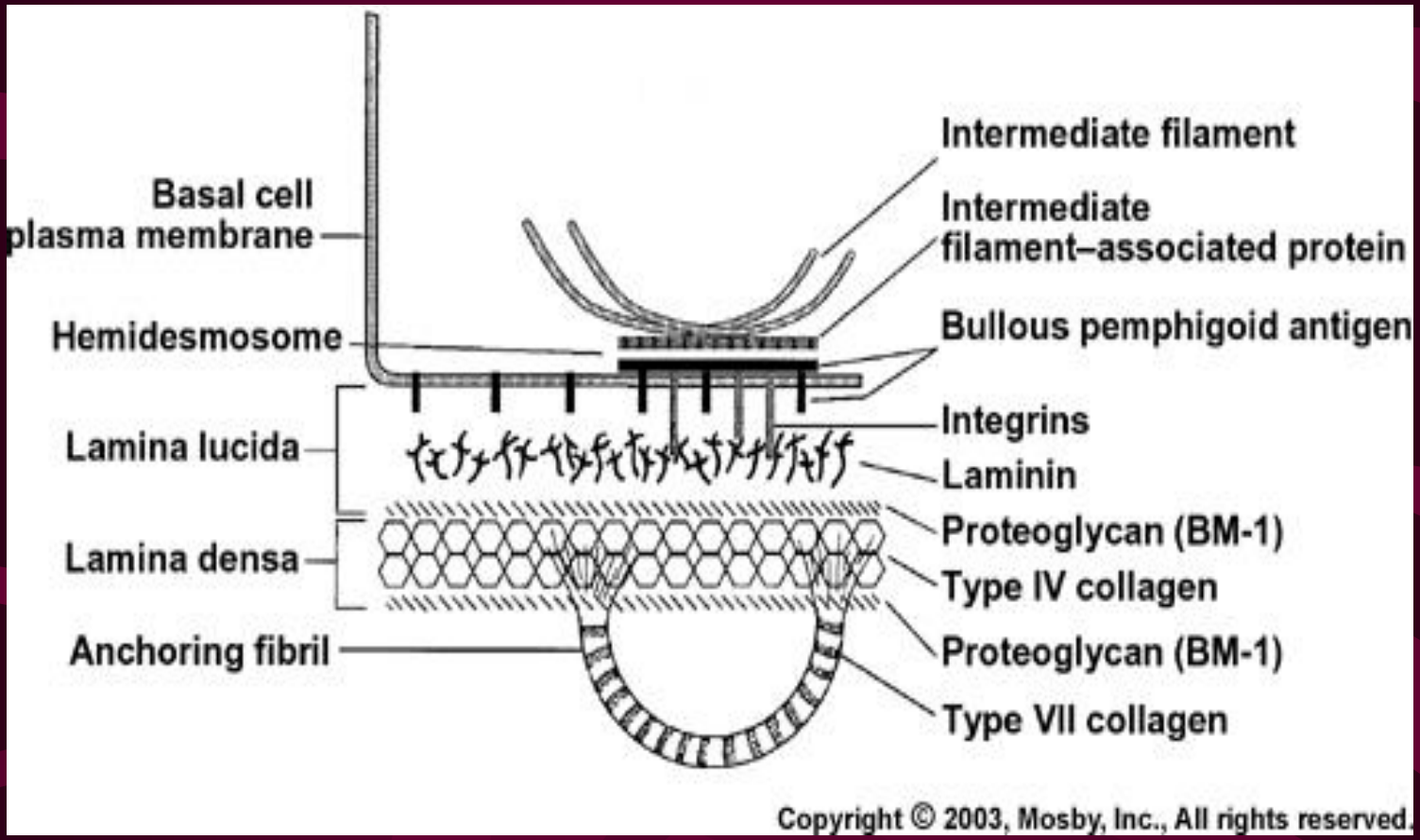


ULTRASTRUCTURE OF BASAL LAMINA.

High-magnification electron micrograph of the complex in oral mucosa. Hemidesmosomes (arrowheads) at the plasma membrane of epithelial basal cells receive bundles of tonofilaments. Adjacent to the membrane are the lamina lucida and lamina densa. Several striated anchoring fibrils loop into the lamina densa, and some contain within their loops cross sections of collagen fibrils.



Details the fine structure of the junction between epithelium and connective tissue.



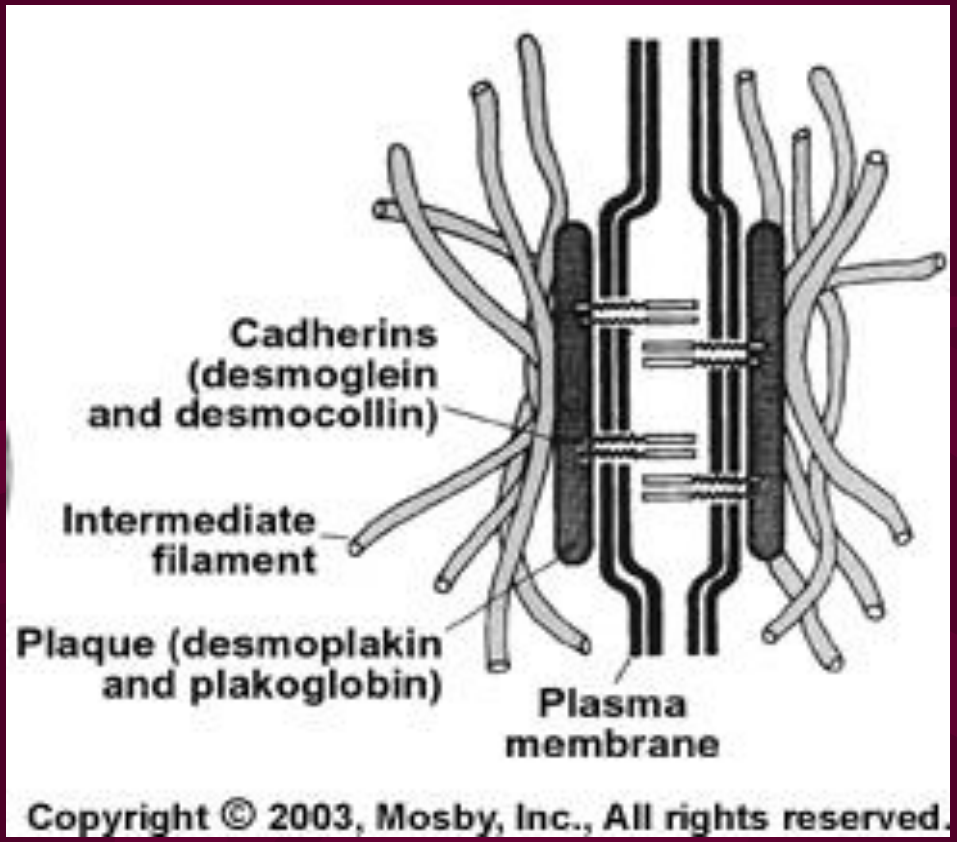
The location of principal molecular constituents of the junction.

Lateral border of adjacent basal cells are closely apposed and are connected by DESMOSOMES.

These are circular oval area s of adjacent cell membranes, adhering by specialized intracellular thickenings (known as attachment plaques) into which bundles of tonofilaments insert.

Tonofilaments loop around within the plaques an pass out again; they do not cross into adjacent cells, as was once thought. Although the term hemidesmosomes and its morphologic appearance suggest this structure is half of desmosome, immunocytochemical studies indicate that desmososmes sand hemidesmosomes are distinct structural entities.

SUMMARY OF CELLULAR JUNCTIONS



Molecular organization of the desmosome:

Tonofilaments (intermediate filaments) insert into the plaques and do not pass across the intercellular space as do the cadherins.

Other types of junctions seen between cells of the oral epithelium are…

Gap junctions:

The membranes of adjacent cells run closely together, seperated by only a small gap.

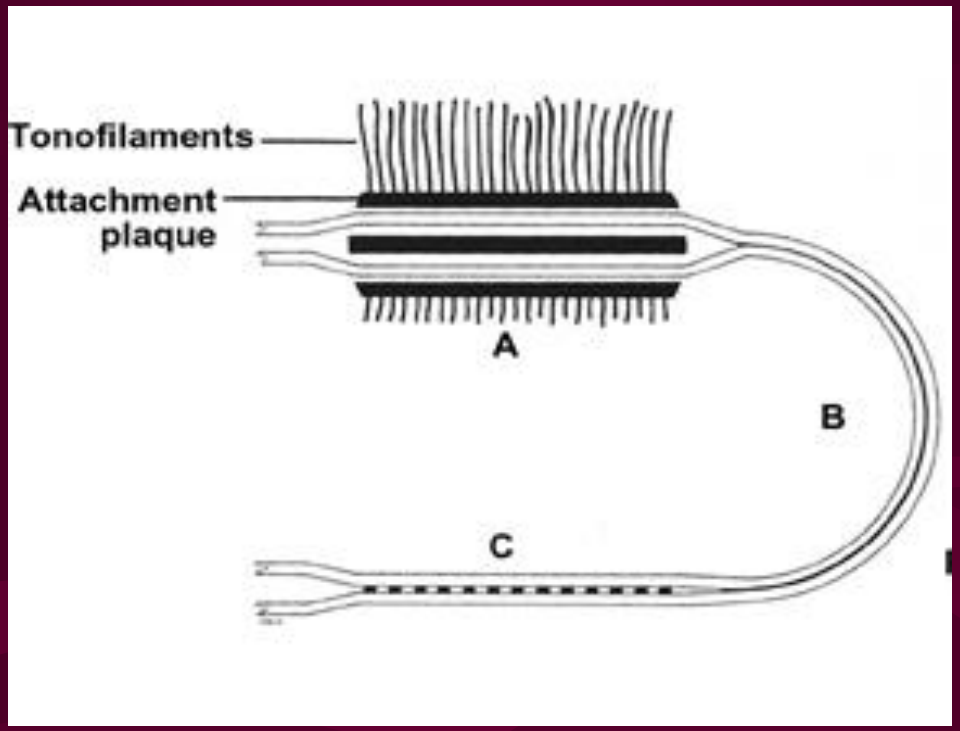
Such junctions allowelectrical or chemical communication between the clels rather than having any mechanical function and are seen only occasionally in oral epithelium.

Tight junctions:

Found rarely I oral epithelium

Adjacent cell membranes are tightly apposed and there is no intercellular space.

These junctions may serve to seal off and compartmentalize the intercellulare areas.



The three types of intercellular junctions seen in adjacent cells of oral epithelium:

A, desmosome;

B, tight junction;

C, gap junction.

STRATUM SPINOSUM:

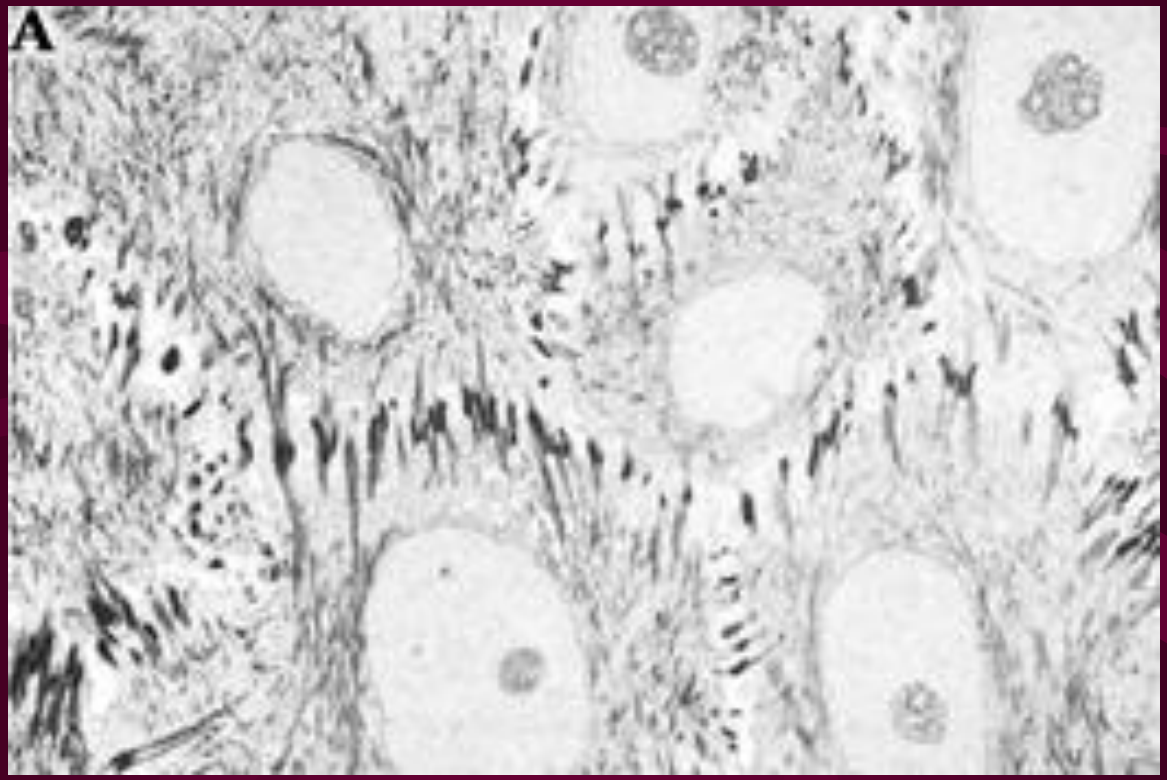
Irregularly polyhedral & larger from basal cells.
On light microscopy, it appears that the cells are joined by "intercellular bridges" and bundles of tonofibrils seem to course from cell to cell across these bridges.

Electron microscopy shown that the intercellular bridges" are desmosomes and tonofibrils are bundles of tonofilaments.

Tonofilament network and the desmosomes appear to make up a tensile supproting system for the epithelium.

Of all the four cell layers, spinous cells are most active in protein synthesis.

Intercellular spaces are large and distended & contain glycosaminoglycans, glycoproteins and fibronectin; So, desmosomes are made more prominent, which gives “prickly” appearance to these cells, hence the name prickle cell layer.



Electron micrographs of prickle cells from keratinized gingival epithelium.

STRATUM GRANULOSUM:

It contains flatter and wider cells contains basophilic keratohyaline granules.

Nuclei shows signs of degeneration and pyknosis, also synthesizes protein but less amount.

Upper part of prickle cell layer and stratum granulosum presents a organelle called the MEMBRANE-COATING OR LAMELLATE GRANULE (also called KERATINOSOME, or ODLAND BODY).

These are small membrane-bound structures, about 250 nm in size and containing glycolipid, that may originate from the Golgi system.

In keratinizing epithelium they are elongated and contain a series of parallel lamellae.

Membrane coating granules discharge their contents into the intercellular space forming an intercellular lamellar material, which contirbutes to the permeability barrier which forms at the junction of granular and cornified layer.

Electron micrograph of membrane-coating granules in oral epithelium. Elongated lamellate type seen in keratinized epithelium.

STRATUM CORNEUM:

It is made up of keratinized squama, which are larger and flatter than the granular cells.

All of the nuclei and other orgaelles suc as ribosomes and mitochondria have disappeared.

The layer is acidophillic(red staining with H&E staub) and is histologically amorphous.

Keratohyaline granules have disappeared.

Ultrastructurally the cells of the cornified layer are composed of densely packed filaments developed from the tonofilaments, altered, and coated by the basic protein of keratohyalin granule, filaggrin (named for its function in filament aggregation). Epithelial cells that ultimately keratinize are called keratocytes or keratinocytes.

PARAKERATINIZATION:

There is incomplete removal of organelles from the cells of the granular layer , so that the nuclei remain as shrunken pydnotic structures, and remnants of other organelles may also be present in the keratinized layer.

It is found in gingiva.

When keratinization occurs in the normally nonkeratinized tissue, it is called Keratosis.

NONKERATINIZING EPITHELIUM:

The layers in nonkeratinizing epithelium are as follows

- Stratum basale
- Stratum intermedium
- Stratum superficiale.

STRATUM BASALE.. Of both the type of epithelium are similar.

STRATUM INTERMEDIUM:

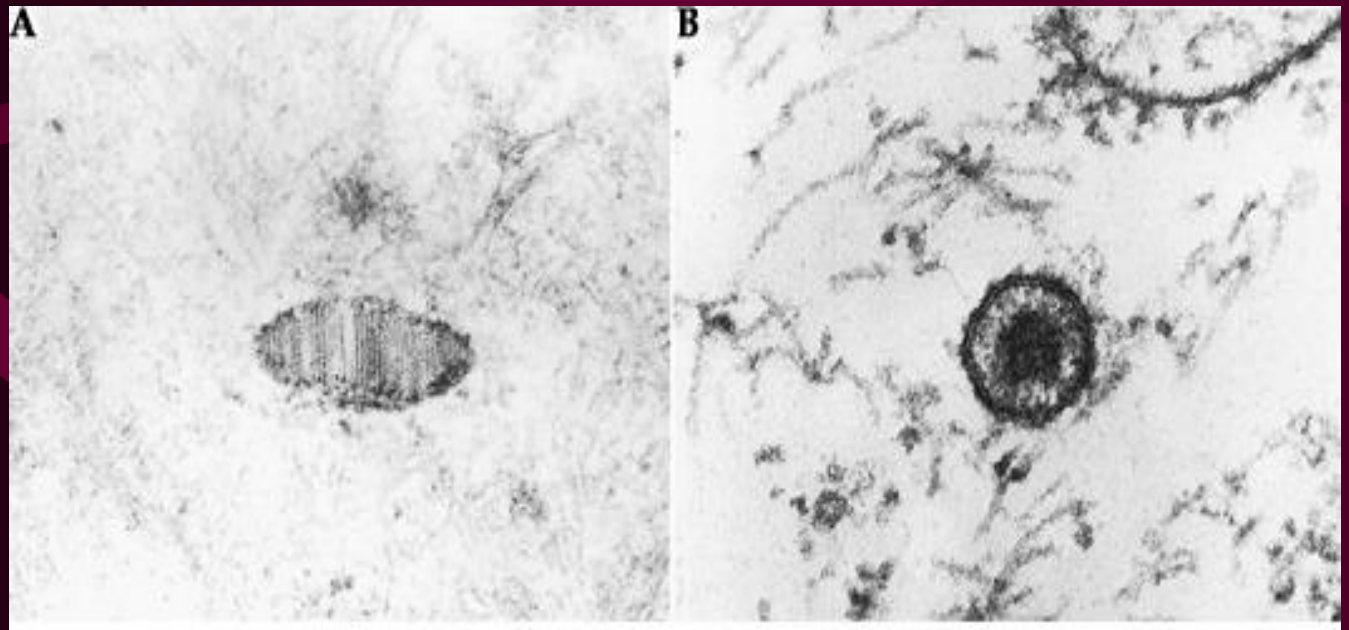
The cells of this layer are larger than cells of the stratum spinosum.

The inter cellular space is not obvious and distended and hence the cells do not have a prickly appearance.

These cells do contain some keratin intermediate filaments, but they differ biochemically from those in keratinizing epithelia and are sparsely distributed within cells.

The cells are attached by desmosomes and other junctions, and their cell surfaces are more closely applied than are spinous cells.

On rare occasions, keratohyaline granules can be seen at this level, but they differ from the granules in keratinized epithelium (A) and appear as regular spherical structure surrounded by ribosomes but not associated with tonofilaments (B).



There is no stratum granulosum, nor there is stratum corneum.

STRATUM SUPERFICIALE:

The cells appear more flattened than in preceding layer.

Cells contain dispersed tonofilaments and nuclei, the number of other cell organelles having diminished.

There is accumulations of glycogen in cells of the surface layer.

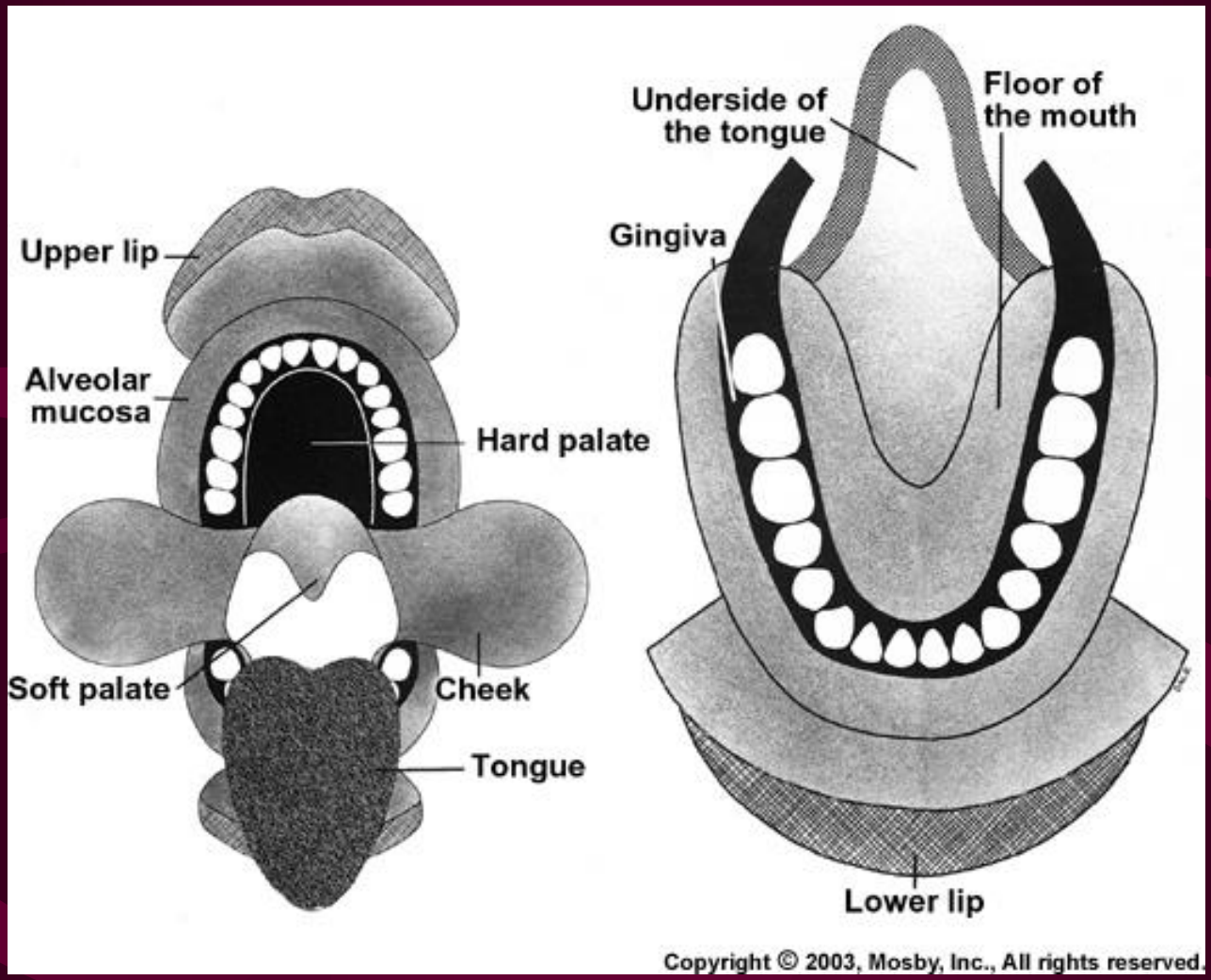
The surface layer of nonkeratinizing layer thus consists of cells filled with loosely arranged filaments that are not dehydrated. They can thus form a surface that is flexible and tolerant of both compression and distention.

SUBDIVISIONS OF ORAL MUCOSA:

Based on functional criteria it may be subdivided into 3 major types.

1. **Masticatory mucosa:**
    a. Gingival
    b. Hard palate
2. **Lining or reflecting mucosa:**
    a. Lip
    b. Alveolar mucosa
    c. Cheek
    d. Floor of the mouth
    e. Soft palate
    f. Vestibular fornix
    g. Inferior surface of tongue
3. **Specialized mucosa**
    a. Dorsum surface of tongue
    b. Taste buds

SUBDIVISIONS OF ORAL MUCOSA



MASTICATORY MUCOSA:

KERATINIZED MUCOSA:

Mucosa bound to bone and they are immovable and bears forces generated when food is chewed.

LINING MUCOSA:

Usually not exposed to such forces. It covers the musculature and they are distensible adapting itself to contraction and relaxation.

They coves all surfaces of oral cavity except masticatory mucosa and dorsal surface of tongue.

SPECIALIZED MUCOSA:

It bears taste buds which have sensory function.

MASTICATORY MUCOSA:

It contains gingiva and hard palate. There are differences in the submucosa of the individual mucosa, other features are similar.

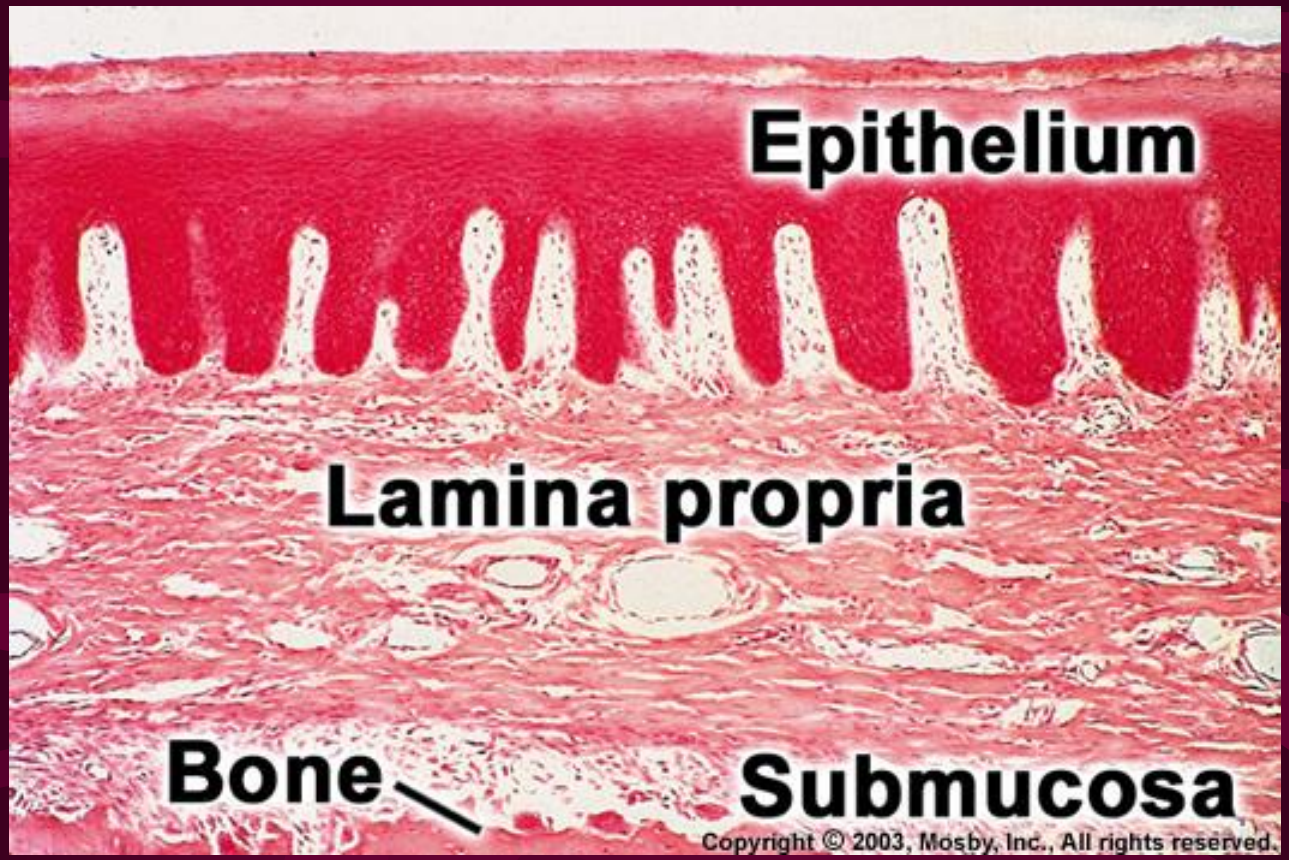
HARD PALATE:

Pink color

Mucous membrane is tightly fixed to underlying periosteum. It has a orthokeratinized often parakeratinized surface.

There are adaptations of the keratinized epithelium to resist masticatory forces. They are the increase in no,. and length of desmosomes, the increase density of tonofilaments the complementory grooved and ridge etc.

Lamina propria is made up of dense c.t. which is thicker in anterior region than posteior par t of palate and has numerous papilla.



MUCOSA OF HARD PALATE

SUBMUCOSA:

Different regions of hard palate differ because of varying structure of submucous layer. The following zones can be distinguished.

1. Gingival region, adjacent to teeth
2. Palatine raphe, extending from incisive or palatine papilla posteriorly.
3. Anterolateral area of fatty zone.
4. Posterolateral area of glandular zone.

ZONES WITHOUT SUBMUCOUS LAYER:

These occur peripherally where palatine tissue is identical to gingiva and along midline (palatine raphe)

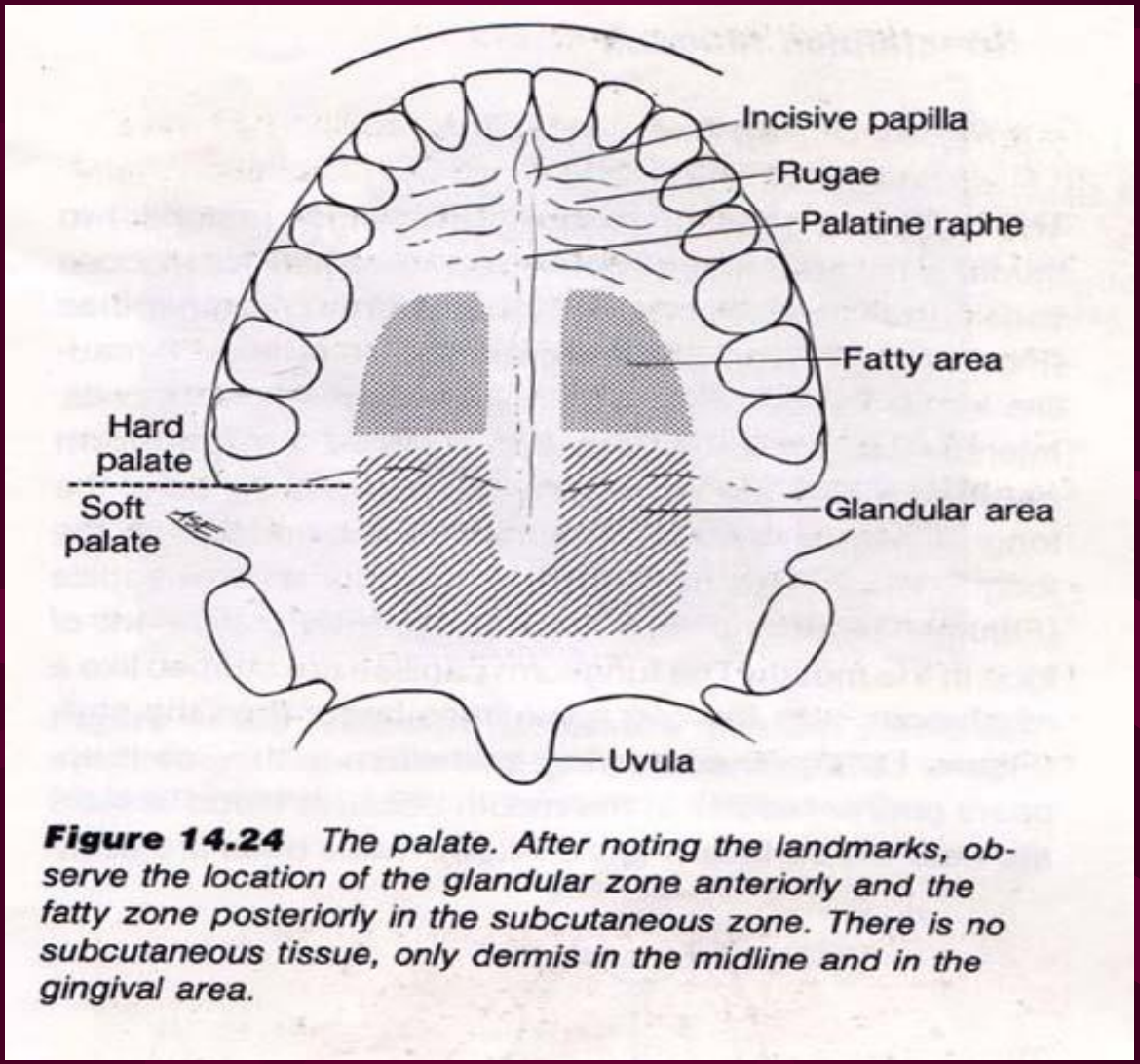
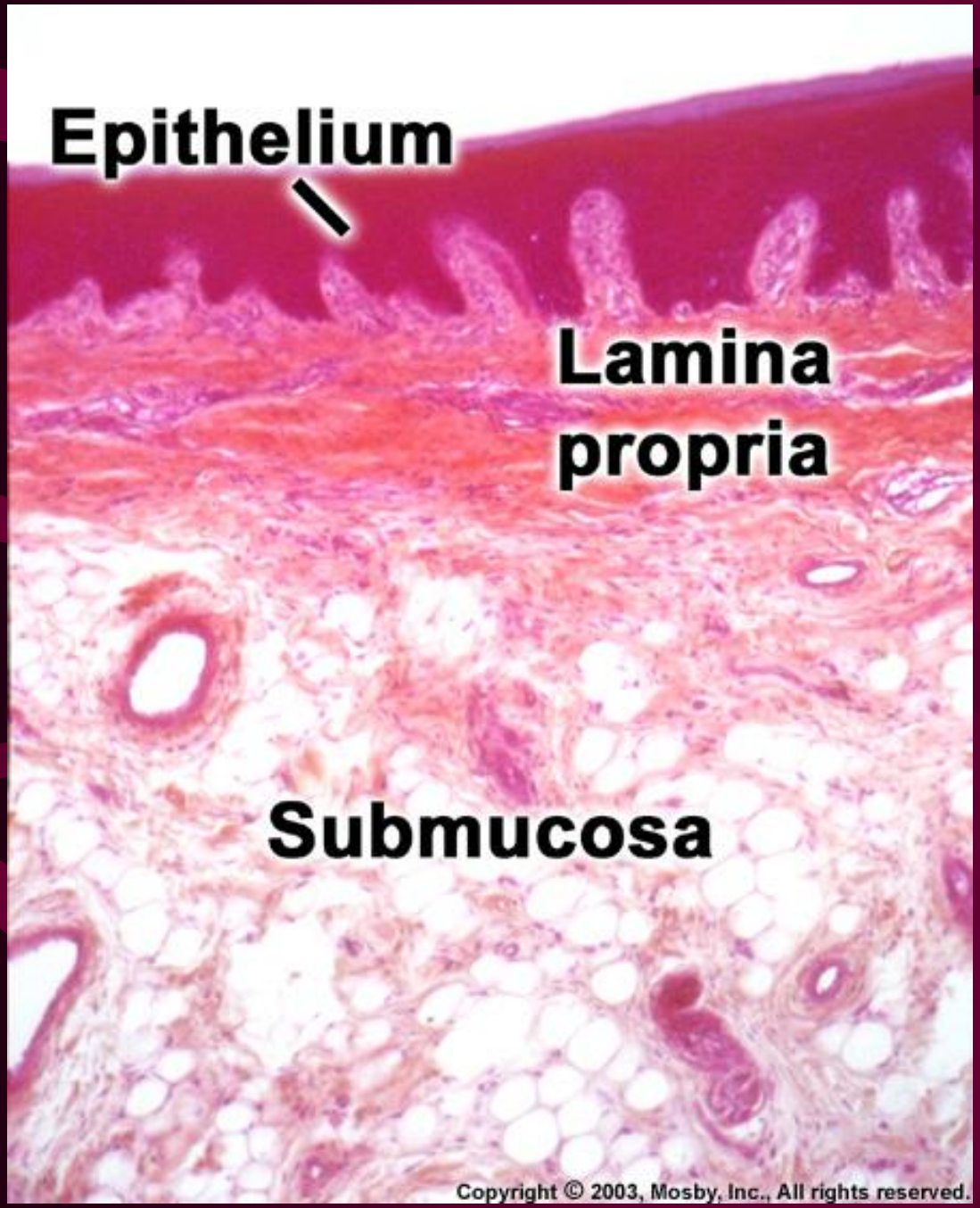


Figure 14.24 *The palate. After noting the landmarks, observe the location of the glandular zone anteriorly and the fatty zone posteriorly in the subcutaneous zone. There is no subcutaneous tissue, only dermis in the midline and in the gingival area.*

THE PALATE: different areas



Palate: The lamina propria consists of a dense connective tissue. Fat can be found in some regions of the submucosa

SUBMUCOUS LAYER:

It occurs in wide regions extending between palatine gingiva and palatine raphe.

Despite extensive submucosa, the mucous membrane is immovably attached to periosteum of maxillary and palatine bones. The attachment is formed by dense bands and trabeculae of fibrous CT that join lamina propria of mucous membrane to periosteum and divide submucosa in compartments.

These compartments are filled with

- Adipose tissue in anterior part
- Mucous glands in posterior part of hard palate, the presence of which gives cushion like action.

The difference between of gingiva and hard palate is only submucosal layer which is thin in gingiva and devoid of fat/glands.

At the junction of alveolar process and horizontal plate of hard palate, anterior palatine vessels and nerve course, surrounded by loose CT. this wedge shape area is large in posterior part and smaller in anterior part.

INCISIVE PAPILLA:

It is formed of dense CT containing oral parts of vestigial nasopalatine ducts.

They are blind ducts lined by simple or pseudo stratified columnar epithelium, rich in goblet cells.

In most mammals, the nasopalatine ducts are patent and together with Jacobson's organ (it is a small ellipsoid structure line by olfactory epithelium that extends from the nose to oral cavity) are called as auxiliary olfactory sense organs.

PALATINE RUGAE:

They are ridges of mucous membrane extending laterally from incisive papilla and anterior part of raphe. It is considered to be an adaptation to masticatory forces.

EPITHELIAL PEARLS:

They consist of concentrically arranged epithelial cells that are frequently keratinized and are remnants of epithelium formed in the line of fusion between palatine processes.

GINGIVA:

It extends from the dentogingival junction to alveolar mucosa. On facial aspects and to mucosa of floor of the mouth and palate on lingual aspects.

It is made up of parakeretinezed (most often) stratified squamous epithelium covering dense lamina propria. The collagen fibers of lamina propria may either insert into the alveolar bone and the cementum of blend with periosteum.

The gingiva can be subdivided into…

1. Free gingiva
2. Attached gingiva.
3. Interdental papilla

COLOR OF GINGIVA:

Normally it is pink but may sometimes have a grayish tint.

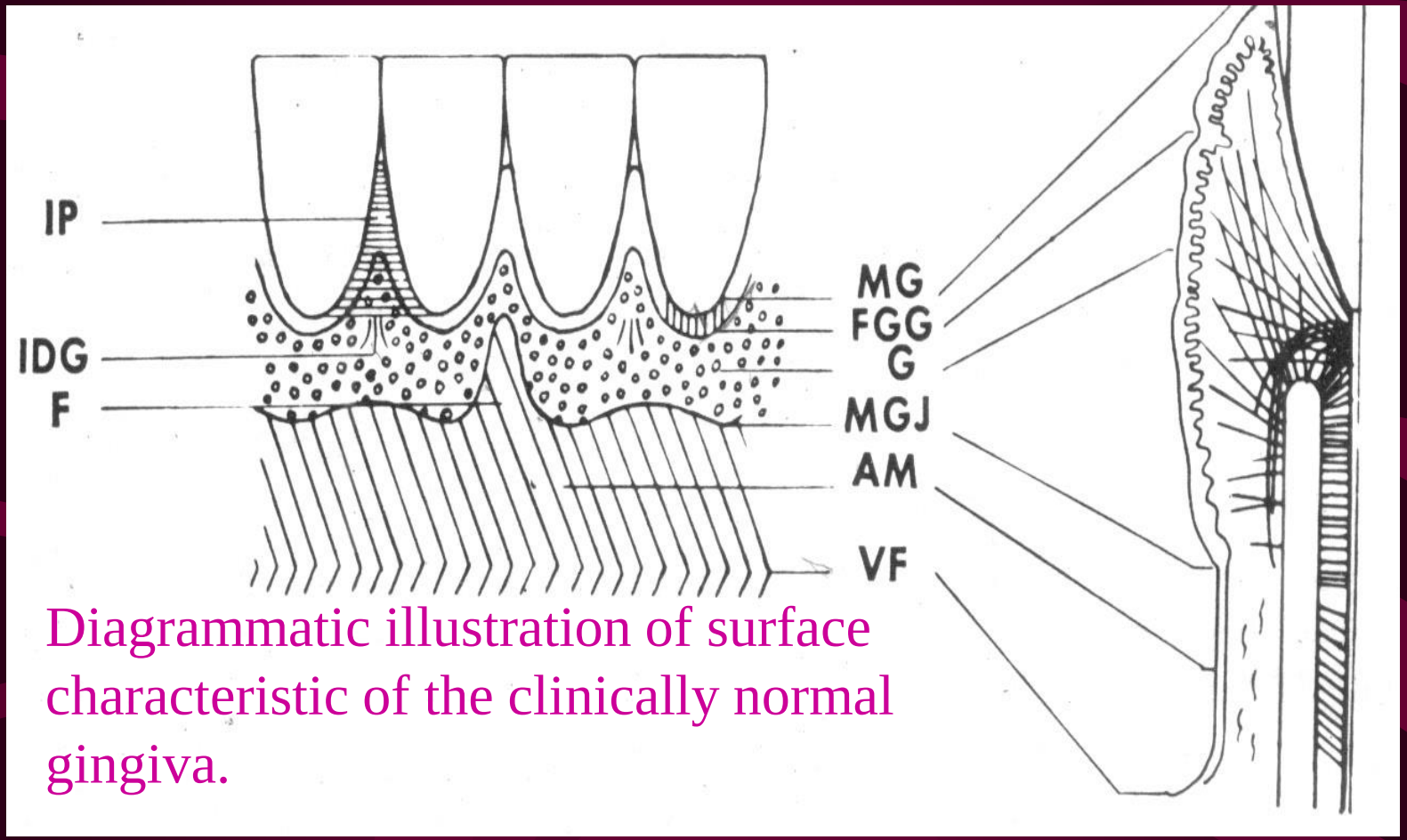
Color depends on

- Surface keratinization
- Presence of melanin pigment

FREE GINGIVAL GROOVE:

The dividing line between the free gingiva and gingiva is free gingival groove which run parallel to the margin of gingiva at a distance of 0.5 to 1.5 mm

It appears in histological section as a shallow V shaped notch at a heavy epithelial ridge.



Diagrammatic illustration of surface characteristic of the clinically normal gingiva.

IP, Interdetnal Papilla; IDG, interdental groove; F, frenum; MG, marginal gingiva; FGG, free gingival groove, G, gingiva; MGJ, mucogingival junction;AM, alveolar mucosa; VF, vestibular fornix.

STIPPLING:

Gingiva is characterized by a surface that appears stippled.

Portions of the epithelium appear to be elevated and between the elevations there are shallow depressions, the net result of which is stippling. The depressions correspond to the center of heavier epithelial ridges.

They probably are functional adaptations to mechanical impacts.

Disappearance of stippling is indication of edema, as in gingivitis.

INTERDENTAL GROOVE:

Gingiva appears slightly depressed between adjacent tyeeth, corresponding to the depression on the alveolar process between eminences of the socket. In these depressions, the gingiva sometimes forms slight vertical folds called interdental groove.

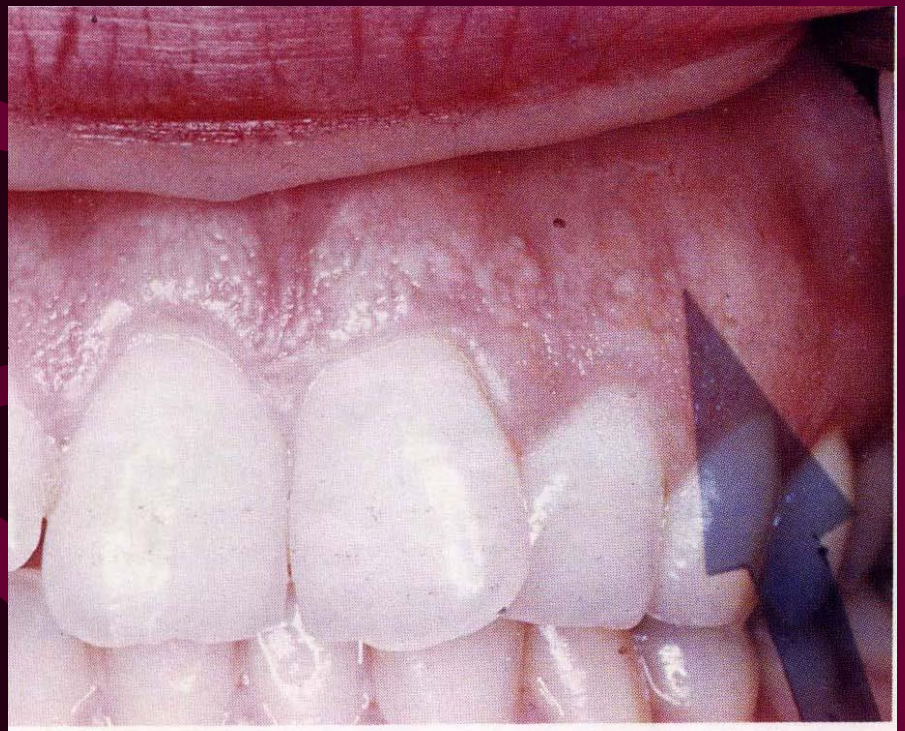


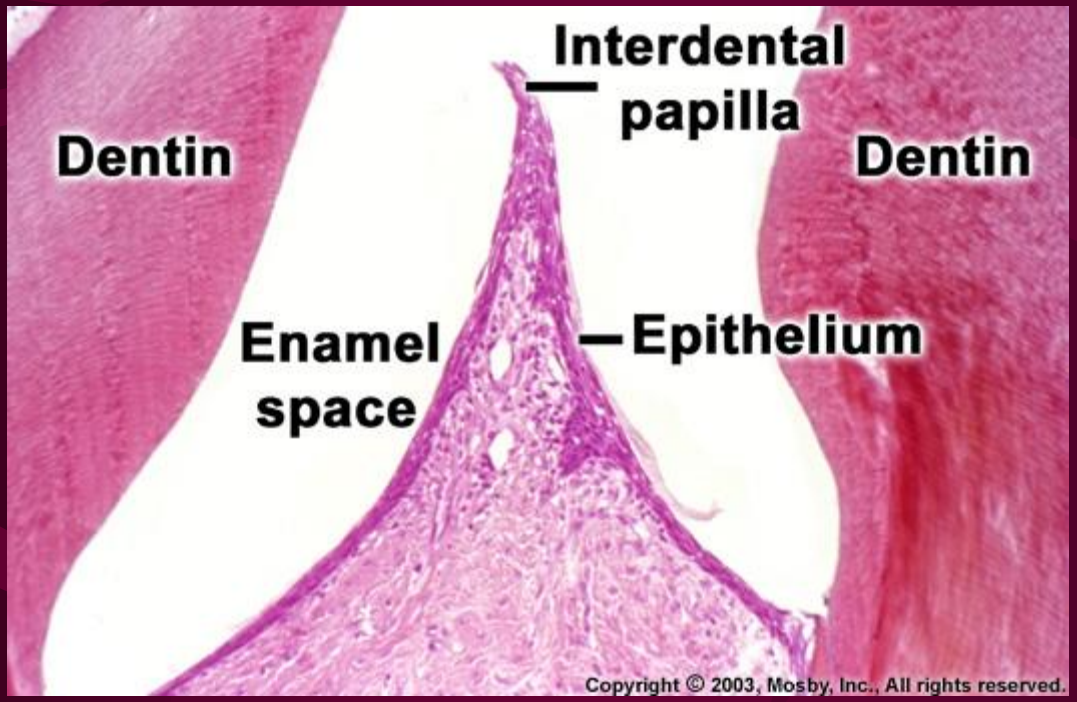
Figure 14.21 *Clinical view of the gingiva showing the free and attached gingiva and an interdental groove* (arrow). *The col is found in this area.*

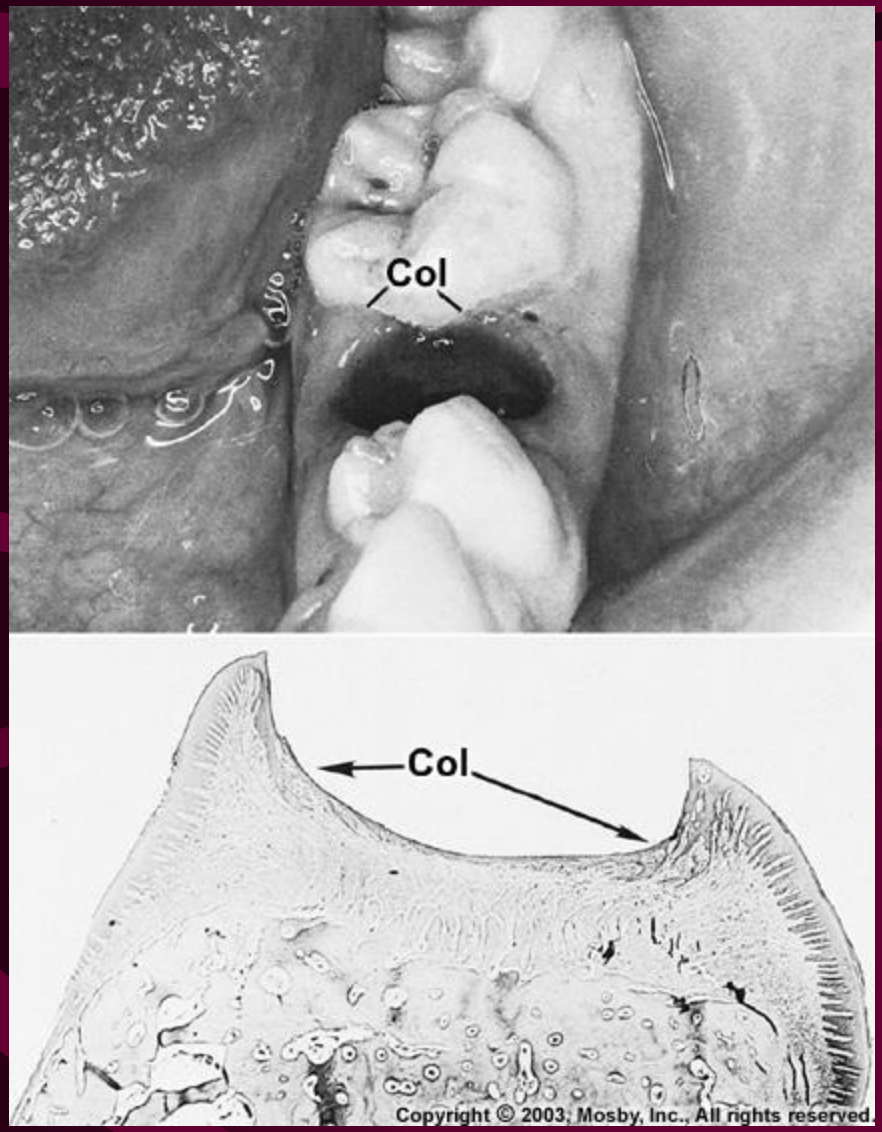
clinical view of the gingiva showing the free and attached gingiva and interdental groove (arrow). The col is found in this area.

INTERDENTAL PAPILLA:

It is that part of gingiva that fills the space between two adjacent teeth.

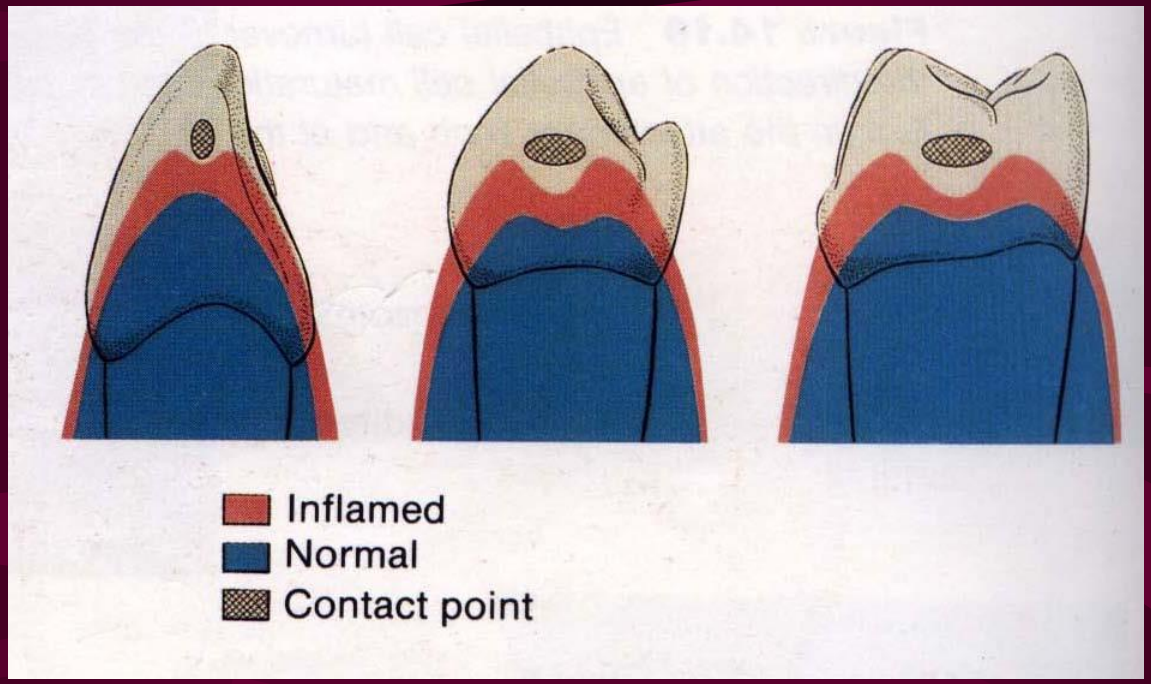
The central concave area fits below the contact point, and this depressed part of the interdental papilla is called **COL** which is covered by nonkeratinized epithelium and it has been suggested that it is more vulnerable to PDL diseases.





Dental col.
A, Clinical appearance.
B, Histologic section.

The distinction between the keratinized gingival epithelium and the epithelium of the col is evident.



The positional relationship of the col in health and disease. Note the col is accentuated in inflammation.

LAMINA PROPRIA:

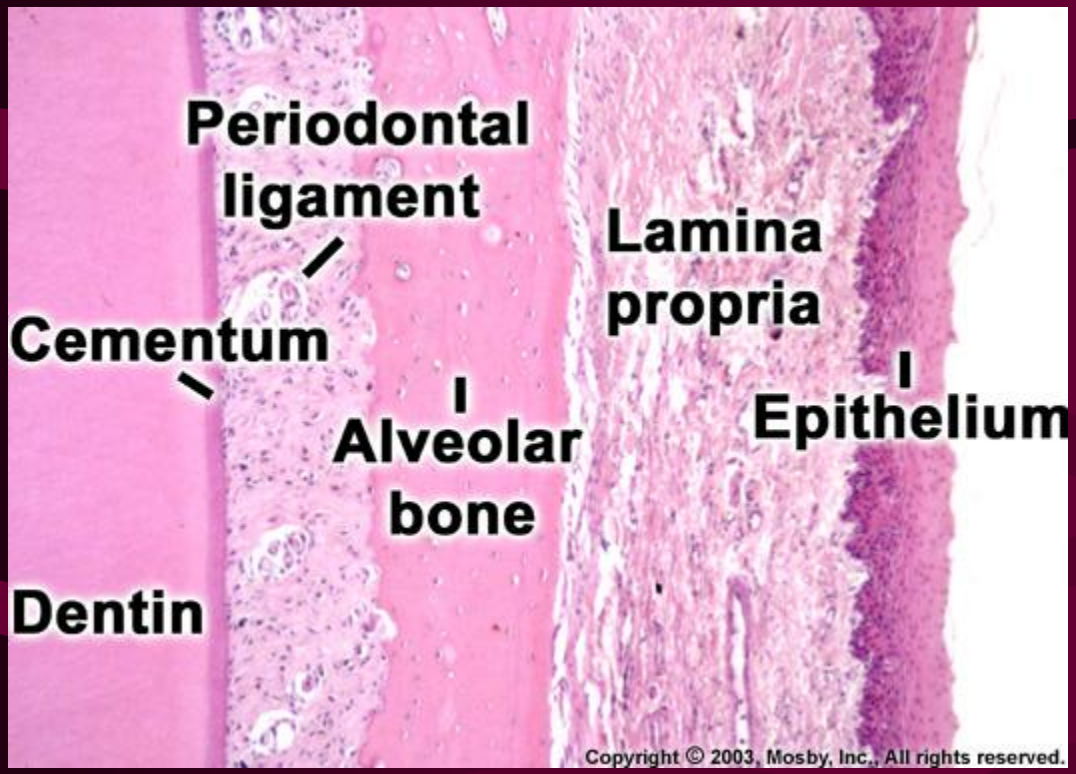
It consists of a dense connective tissue that does not contain large vessels.

Papilla of the CT are characteristically long, slender and numerous.

The tissue of lamina propria contains only few elastic fibers and for the most part they are confined to walls of the blood vessels.

Oxytalan fibers are also present.

Small numbers of lymphocytes, plasma cells, and macrophages are present in the connective tissue of normal gingiva subjacent to the sulcus and are involved in defense and repair.



Attached gingiva. This masticatory mucosa has no distinct submucosa. The collagen fibers of the lamina propria attach directly and firmly to the periosteum of the alveolar bone.

The gingival fibers of the periodontal ligament enter into the lamina propria, attaching the gingiva firmly to teeth.

The gingiva is densely and firmly attached to periosteum of the alveolar bone which is often referred as mucoperiosteum.

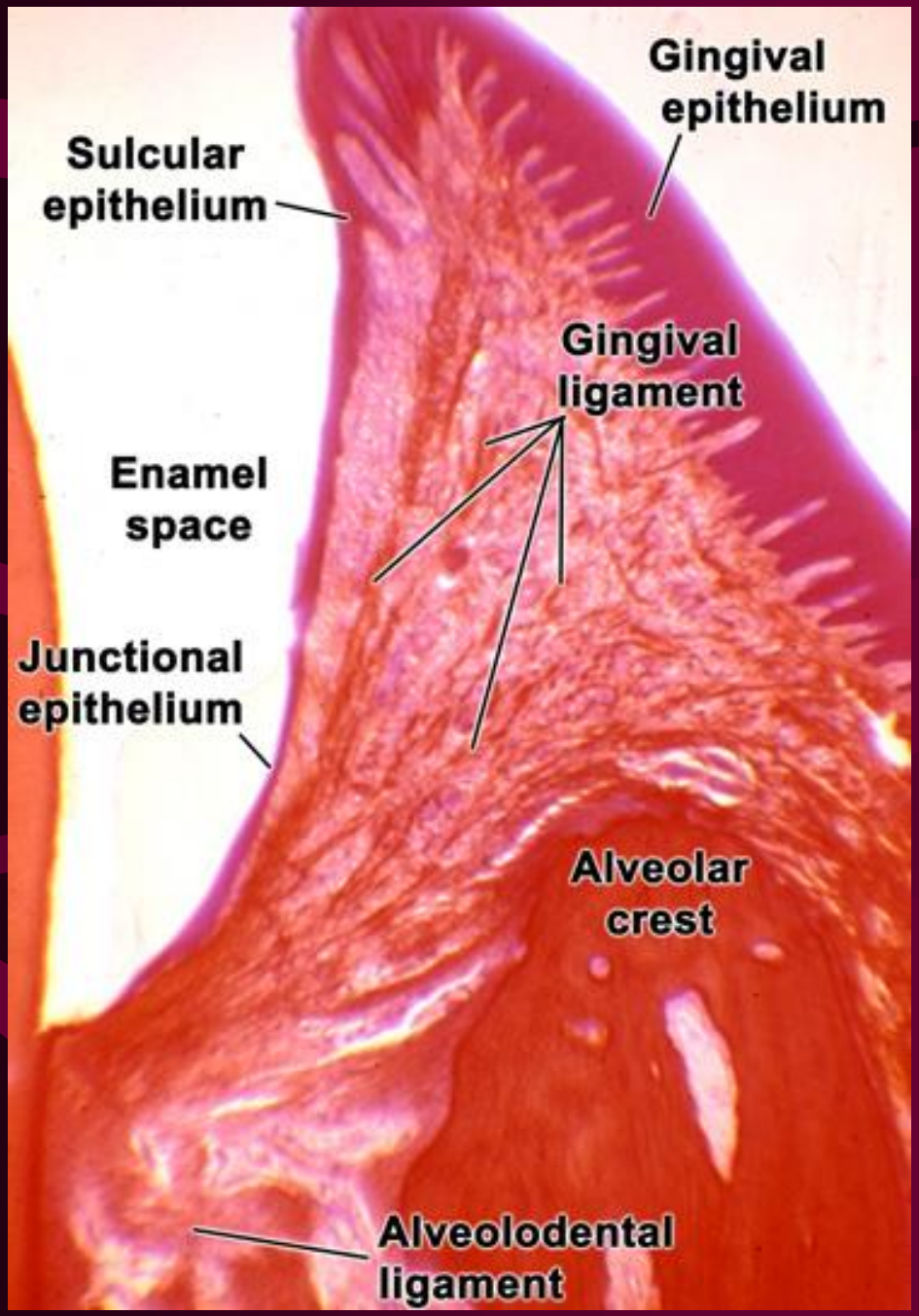
GINGIVAL LIGAMENT:

Dense fibers of collagen in gingiva are sometimes referred to as the gingival ligament.

It is divided in following major groups.

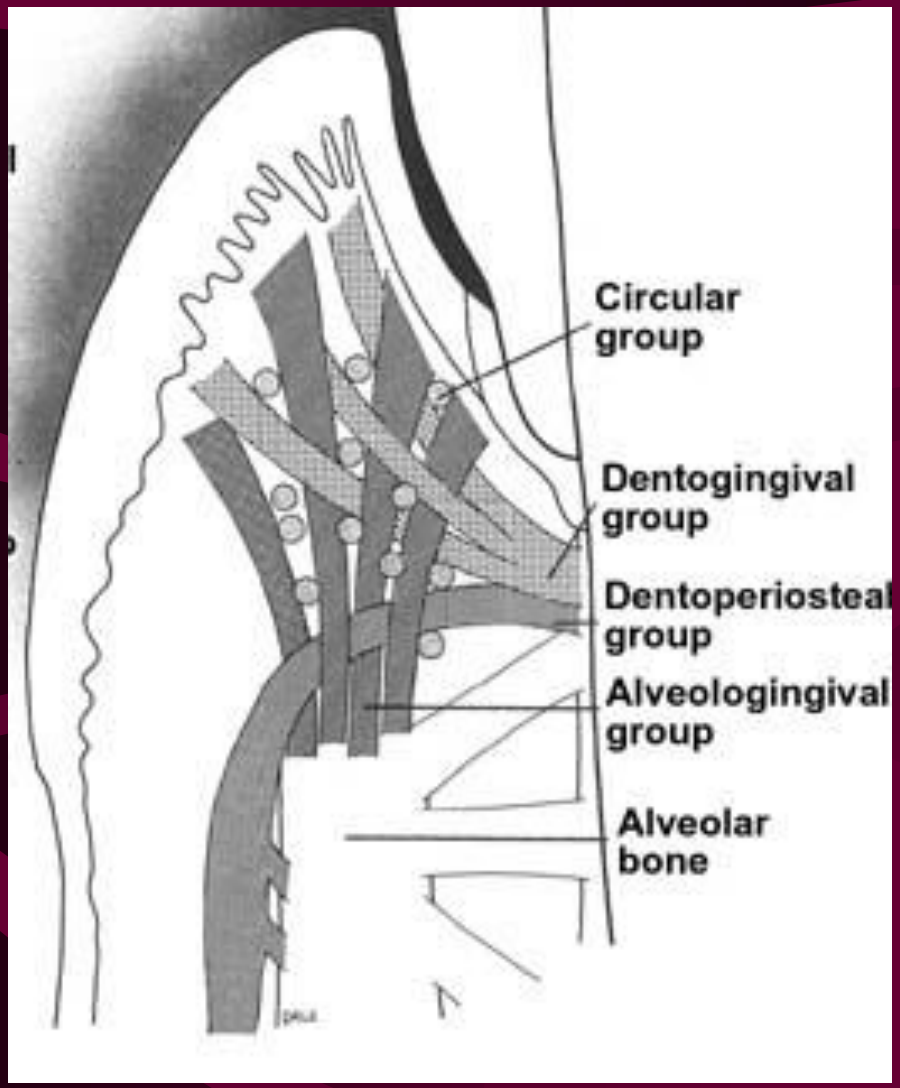
1. Dentogingival group
2. Alveologingival
3. Circular
4. Dentoperiosteal

There are also accessory fibers that extend interproximally between adjacent teeth are also referred to as transseptal fibers. These fibers make up the interdental ligament.

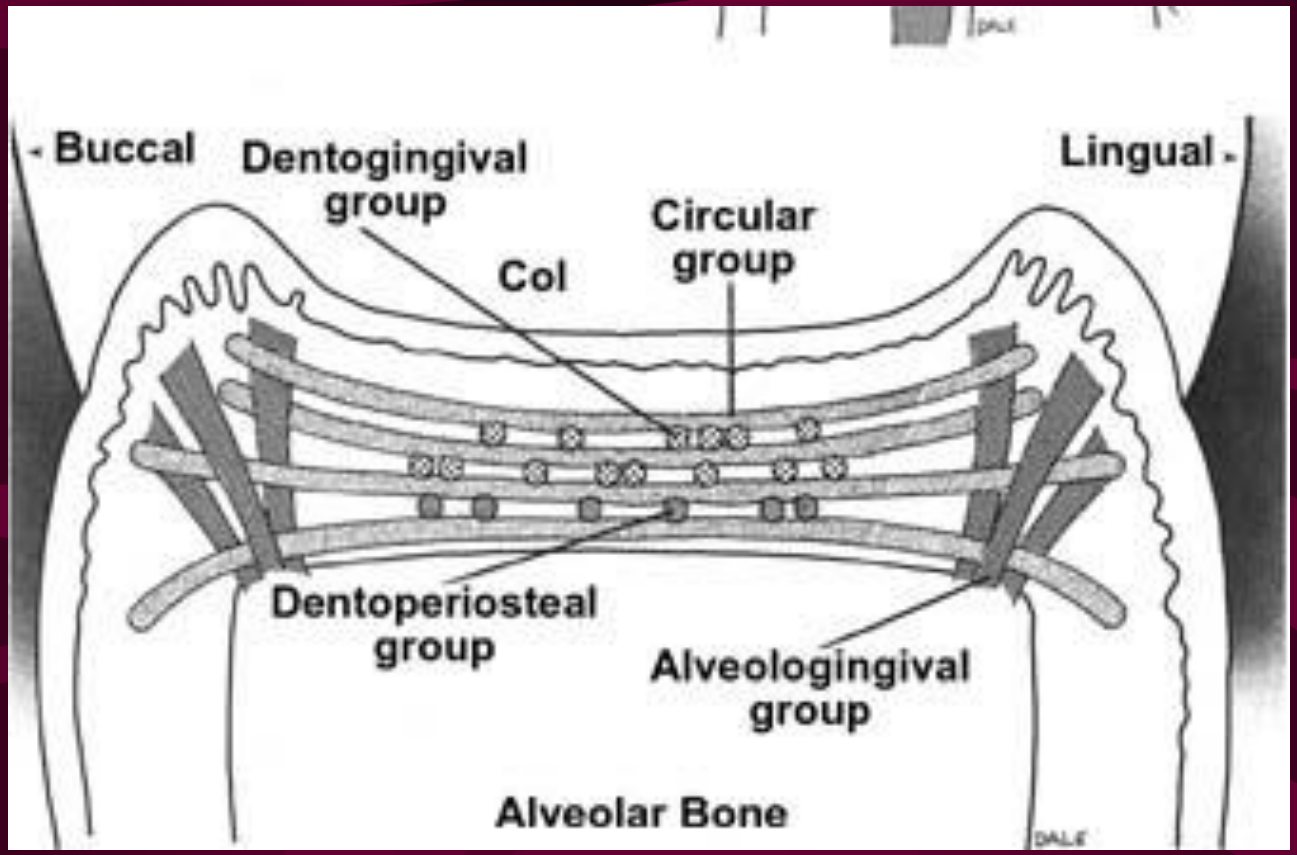


Higher magnification of the gingiva.

Note the various fiber groups in the gingival ligament.



GINGIVAL LIGAMENT, schematic diagram



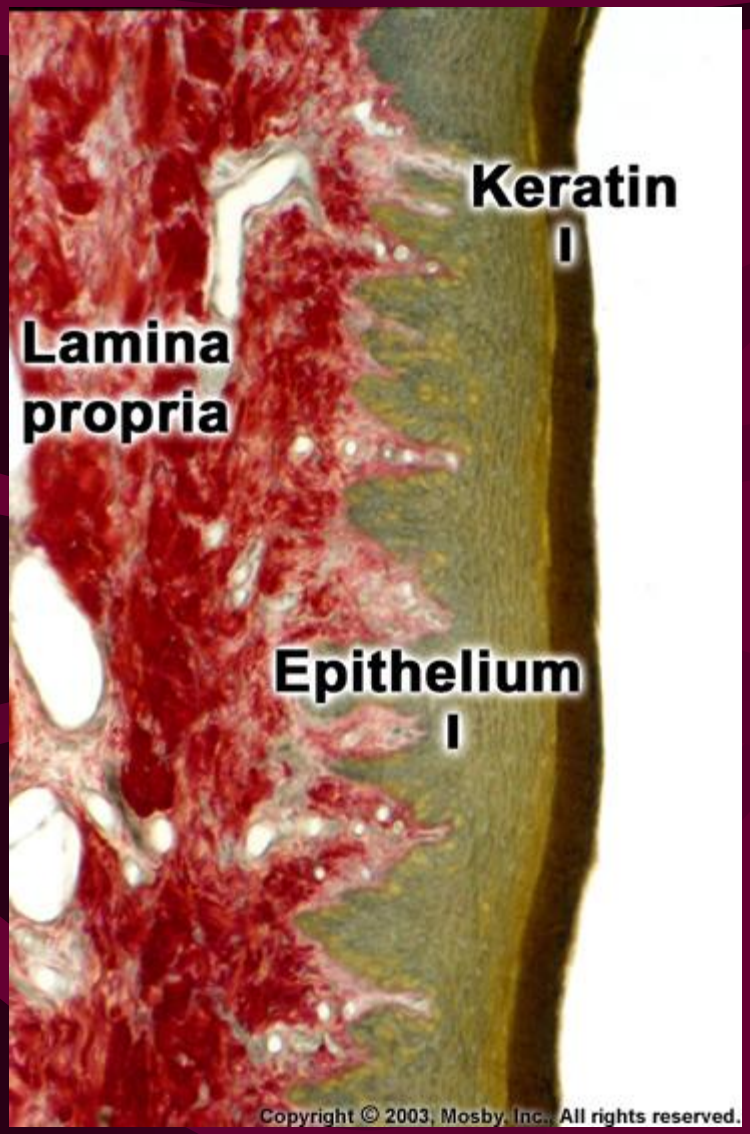
Gingival ligament fibers as seen interproximally related to the gingival col.

GINGIVAL EPITHELIUM:

Following types of epithelial surface layers are present

1. Keratinization (15%), in which the superficial cells from scales of keratin and lose their nuclei.
2. Parakeratinization, in which the superficial cells retain pyknotic nuclei and show some singns of being keratinized.
3. Nonkeratinization(10%), in which the surface cells are nucleated and show no signs of keratinization.

The color of gingiva depends on keratinization, the more highly keratinized the tissue, the whiter and less translucent is the tissue.



Attached gingiva. Note the thick layer of keratin.

OTHER CELL TYPES IN EPITHELIUM:

Langerhans cells:
Found in upper layers of epithelium restricted to zones of orthokeratinization.
They are involved in the immune response.

Merkel cells:
It is presumed to be a specialized neural pressure sensitive receptor cell.

Melanocytes may be found

Other cells such as **lymphocytes and polymorphonuclar leukocytes** are also fund at various levels of the epithelium.

BLOOD SUPPLY:

The blood supply of the gingiva is derived chiefly from the branches of the alveolar arteries that pass upward through the interdental septa.

The interdental alveolar arteries perforate the alveolar crest in the interdental space and end in the interdental papilla, supplying it and the adjacent areas of the buccal and lingual gingiva.

LYMPH DRAINAGE:

The numerous lymph vessels of the gingiva lead to submental and submandibular lymph nodes

NERVE SUPPLY:

Different types of nerve ending can be observed, such as the Meissner or Krause corpuscles, end bulbs, loops, or fine fibers that enter the epithelium as “ultraterminal” fibers

VERMILLION BORDER OF LIP

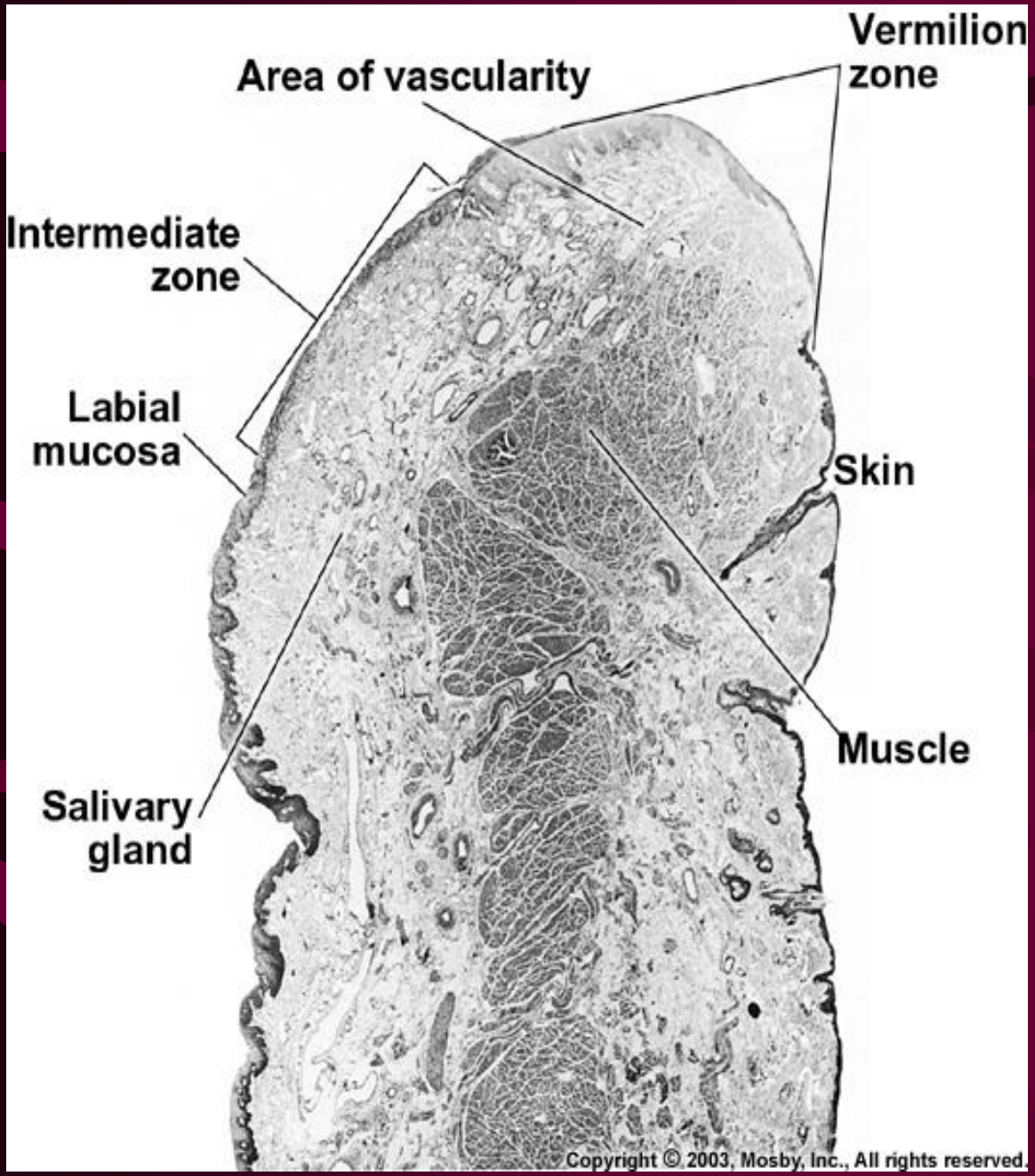
It is a transitional zone between the skin o fthe lip and the MM of lip is the red zone, or the vermilion border.
It is found only in humans.

Skin of the outer surface of the lips is covered by a moderately thick, keratinized epithelium with a rather thick stratum corneum with few and short CT papillae and many sebaceous glands in connection with the hair follicle and sweat glands.

The epithelium of mucous membrane of the lip is not keratinized.

Keratinized epithelium of the skin just below the vermillion zone of the lip.

Sebaceous glands and hair follicles are present within the dermis.



Sagittal section through the lip

The skin covering the external aspect has a thin epidermis and contains hair follicles.

Continuous with this is the vermilion zone, which has a thin epithelium overlying an area of extensive vascularity.

Minor salivary glands occur beneath the labial mucosa, and the extensive muscular tissue represents part of the orbicularis oris.

The transitional region is characterized by numerous, densely arranged, long papillae of the lamina propria, reaching deep into the epithelium and carrying large capillary loops close to the surface.

The blood visible through the thin parts of the translucent epithelium gives red color to the lips. (That is why it is called RED ZONE)

Because this transitional zone contains only occasional sebaceous glands, it is subjected to drying and therefore requires moistening by the tongue.

NONKERATINIZED MUCOSA:
LINING MUCOSA:

It is found on the lip, cheek, vetibular fornix, and alveolar mucosa. Different zones of lining mucosa vary from one another in the structure of their submucosa

- Where the lining mucosa reflects from the movable lips, cheeks, and tongue to the alveolar bone, the submcosa is loosely textured.
- Where lining mucosa covers muscle, as on the lips, cheeks, and underside of tongue, the mucosa is fixed to the epimysium or fascia. In this regions, the mucosa is highly elastic.

These 2 characteristic permit the mucosa to maintain a relatively smooth surface during muscular movement. Thus, heavy folding, which could lead to injury during chewing if such folds were caught between the teeth does not occur.

LABIAL AND BUCCAL MUCOSA:

They consists of epithelium of stratified squamous epithelium variety and a lamina propria that consists of dense connective tissue and has short, irregular papillae.

The submucosa connects the lamina propria to the thin fascia of the muscles and consists of strands of densely grouped collagen fibers there is loose connective tissue containing fat and small mixed glands between these strands.

Dense CT prevents folding of mucosa.

Mixed minor salivary glands:

- Lip: they are in the submucosa.
- Cheeks: they are found between the bundles of the buccinator muscle and sometimes on its outersurface.

Fordyce's spots may occur lateral to the corner of the mouth and are often seen opposite the molars.

FORDYCE'S SPOTS

VESTIBULAR FORNIX:

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

In the fornix, the mucosa is loosely connected to the underlying structures, and so the necessary movements of the lips and cheeks are permitted.

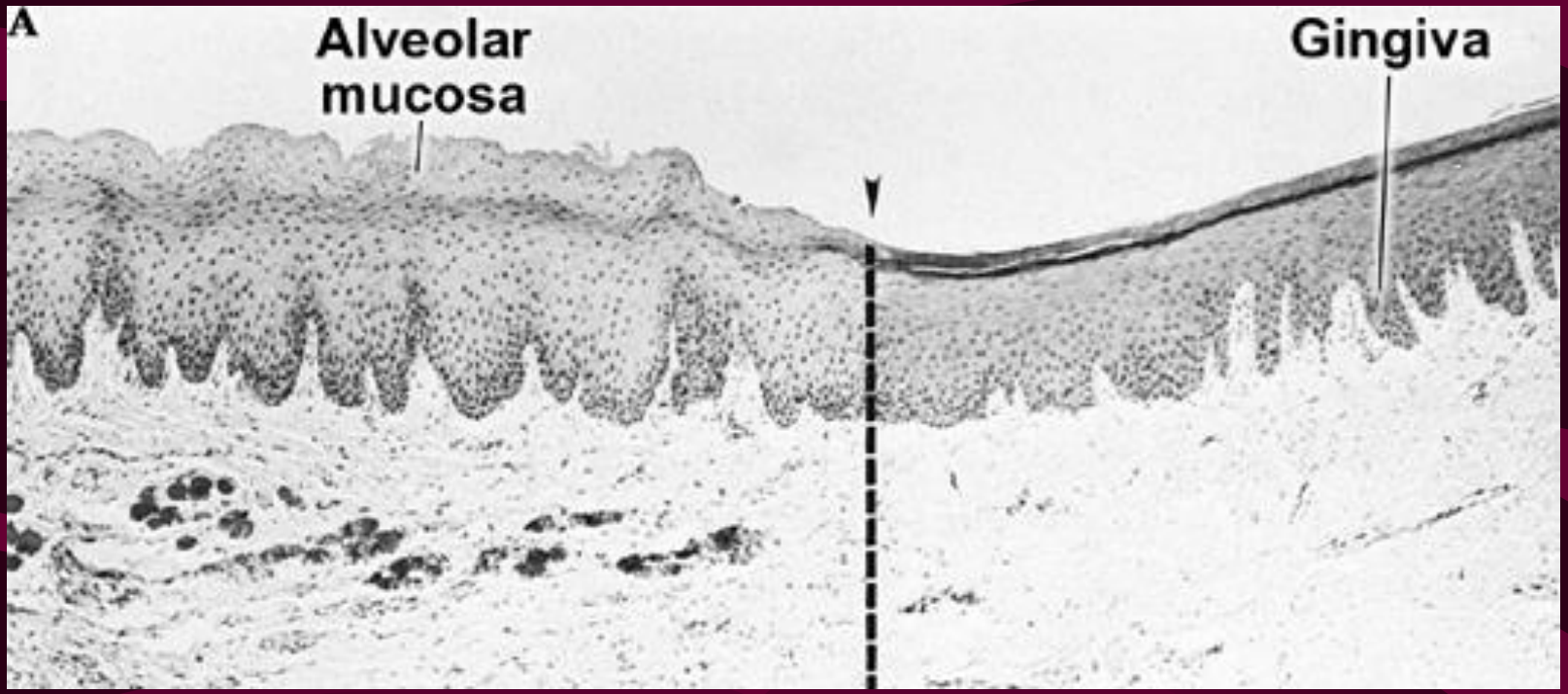
ALVEOLAR MUCOSA:

Thin and nonkeratinized epithelium with missing or low epithelial ridges and papillae.

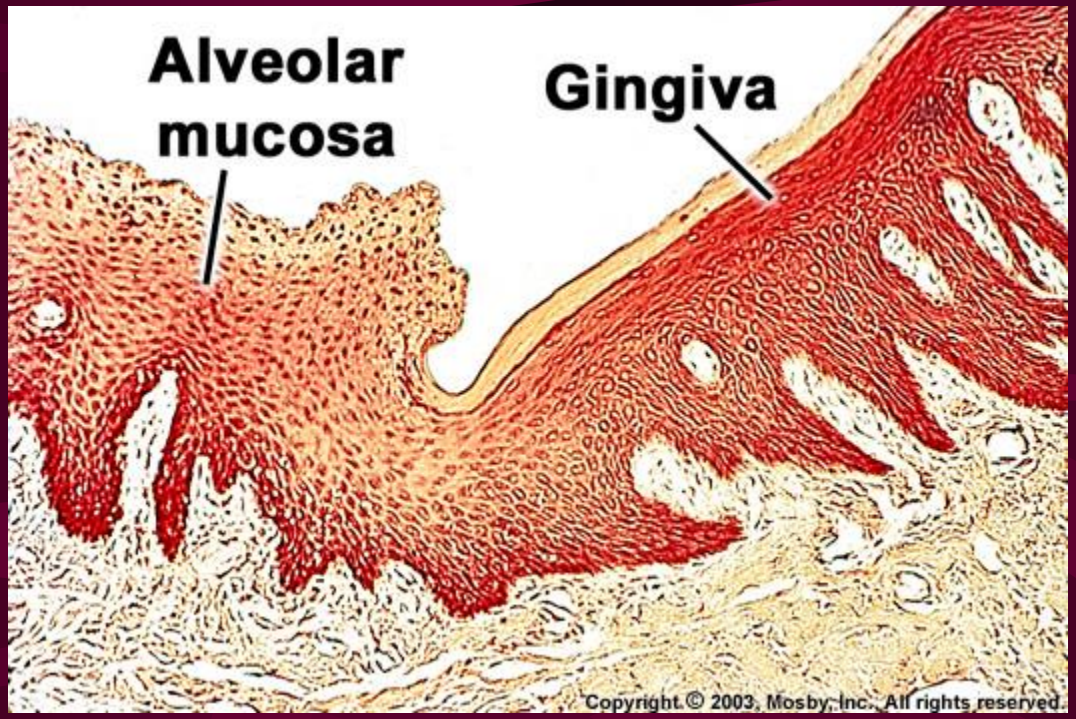
Submucosa is well defined layer of loose connnective tissue and so the alveolar mucosa is attached loosely to the periosteum.

Gingiva and alveolar mucosa are seperated by a mucogingival junction.

The frenula are folds of the mucous membrane containing loose connective tissue devoid of muscles.



Sections through the mucogingival junction (dashed line). In A the differences in thickness, ridge pattern, and keratinization between epithelium of the gingiva and alveolar mucosa are seen.



MUCOGINGIVAL JUNCTION

FLOOR OF THE MOUTH:

Mucosa consists of nonkeratinized epithelium with short papillae of the lamina propria.

The submucosa consist of adipose tissue.

he sublingual glands lie close to the covering mucosa in the sublingual fold.

The sublingual mucosa and the lingual gingiva have a junction corresponding to the mucogingival junction on the vestibublar surface.

INFERIOR SURFACE OF THE TONGUE:

The mucosa is smooth and relatively thin.

The epithelium is nonkeratinized with short and numerous CT papillae.

Here 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:

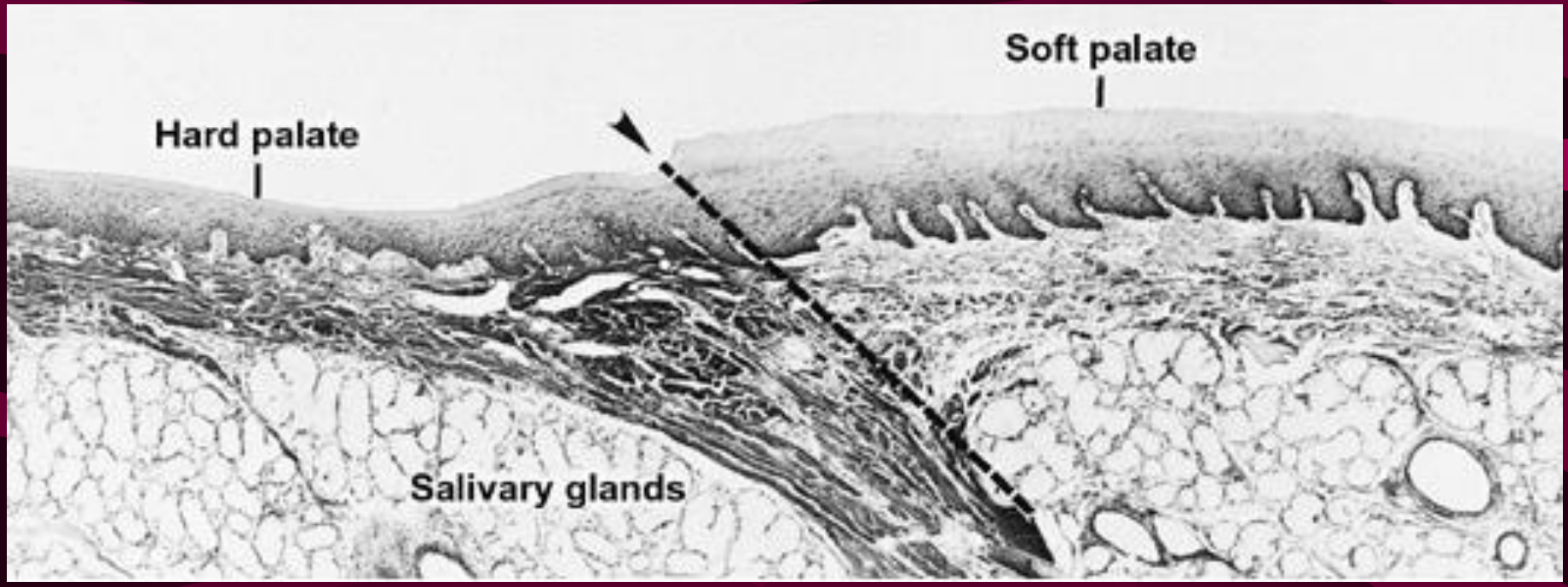
Highly vascular mucous membrane and reddish in color, noticeably differing from the pale color of he hard palate.

Nonkeratinized epithelium with short papillae of CT.

Lamina propria shows a distinct layer of elastic fivers seperating it from the submucosa which is relatively loose and contains an almost continuous layer of mucous glands. it also contins taste buds.

The mucosa is continuous with nasal mucosa with its pseudostratified ciliated columnar epithelium.

Difference between MM of hard palate and soft palate



Photomicrograph of the junction (dashed line) between mucosae covering the hard and the soft palate. The difference in thickness and the ridge pattern between keratinized epithelium of the hard palate and nonkeratinized epithelium of the soft palate is apparent. the thick dense bundles in the lamina propria of the hard palate appear different from the thinner fibers in the soft palate. Extensive minor salivary glands occur beneath the mucosa.

SPECIALIZED MUCOSA:

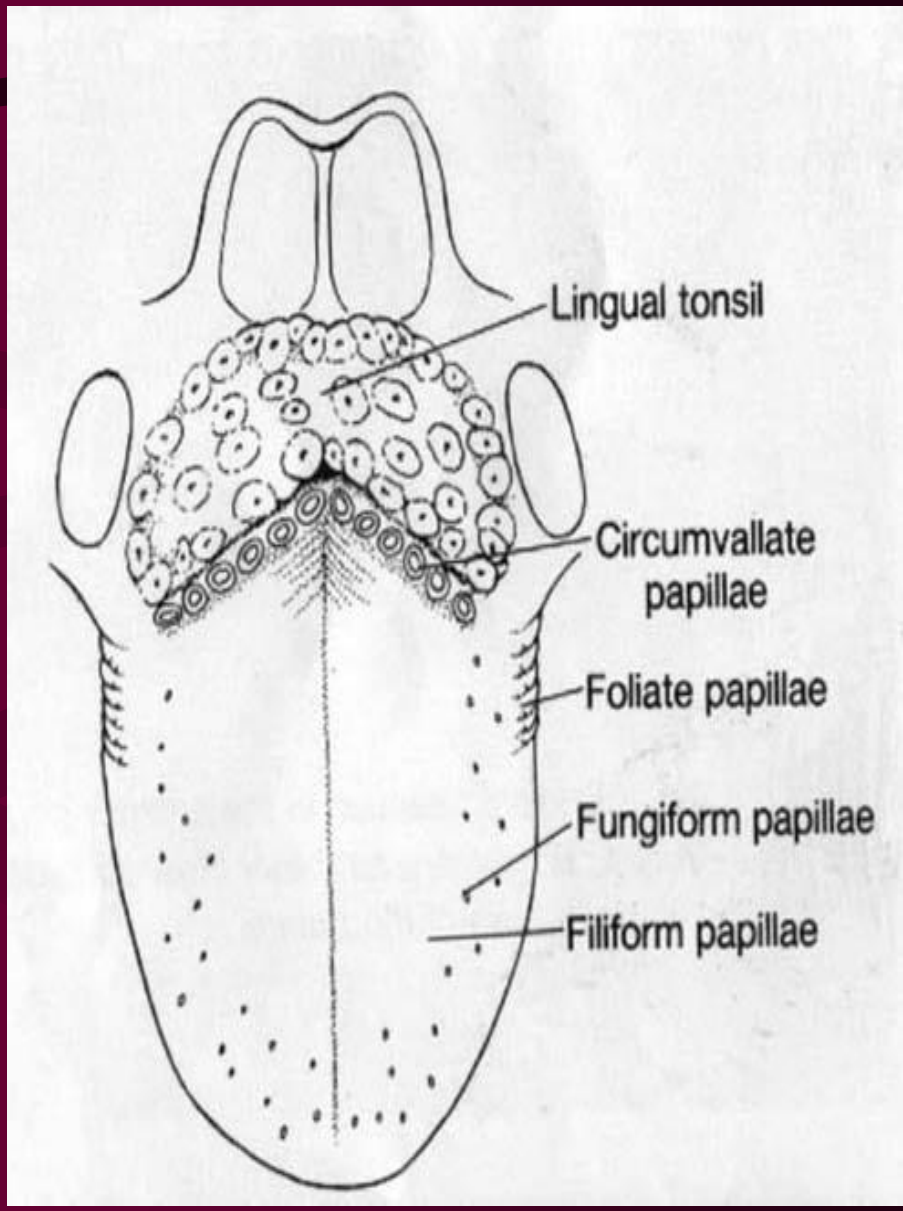
DORSAL SURFACE OF TONGUE:

The mucous membrane of tongue is composed of two parts, with different embryologic origins and different texture and is divided by the V-shaped groove, the SULCUS TERMINALIS.

The anterior 2/3rds of tongue is often called the BODY.

The posterior 1/3rds of tongue is called BASE.

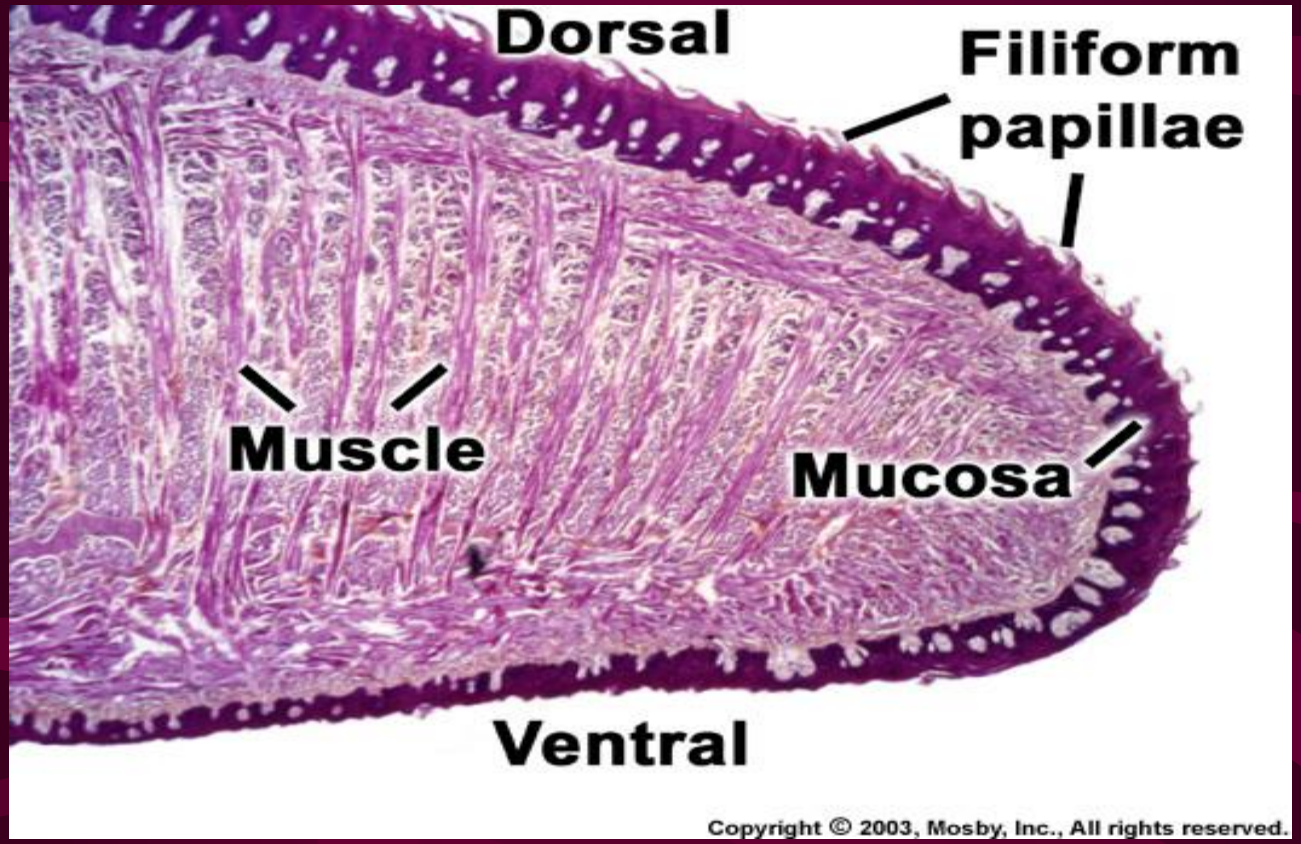
The mucosa of base of tongue contains extensive nodules of lymphoid tissue, the LINGUAL TONSILS.



The fact that base and body develop embryologically from different visceral arches accounts for the different source of nerves of he general senses:

- The anterior 2/3rds of tongue – trigeminal nerve through its lingual branch
- The posterior 1/3rds of tongue – by the glossopharyngeal nerve.

The anterior portion can be termed papillary and the posterior part the lymphatic portion of the dorsolingual mucosa.

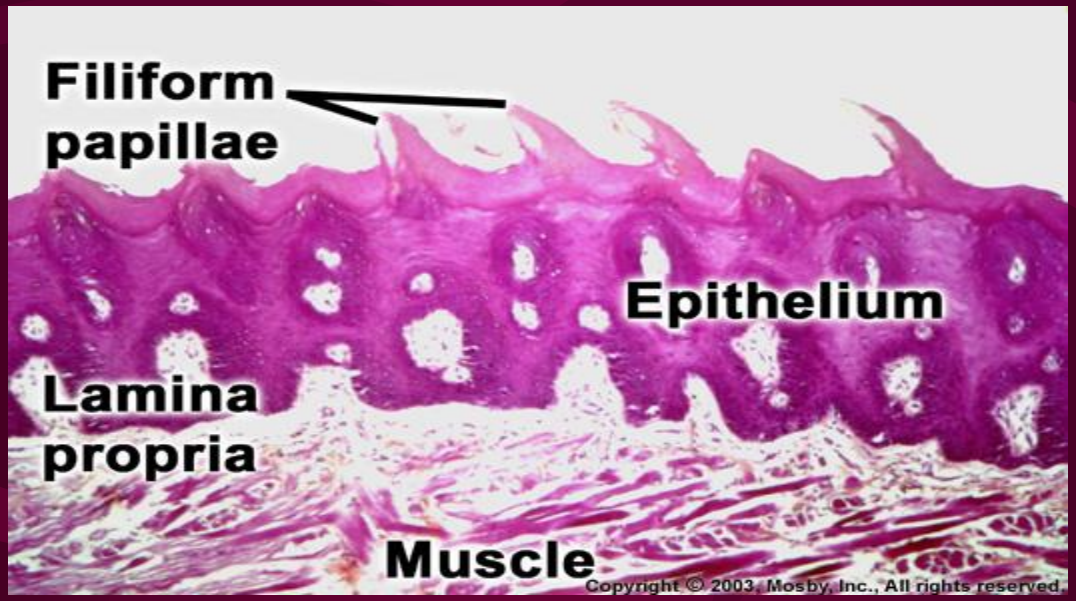


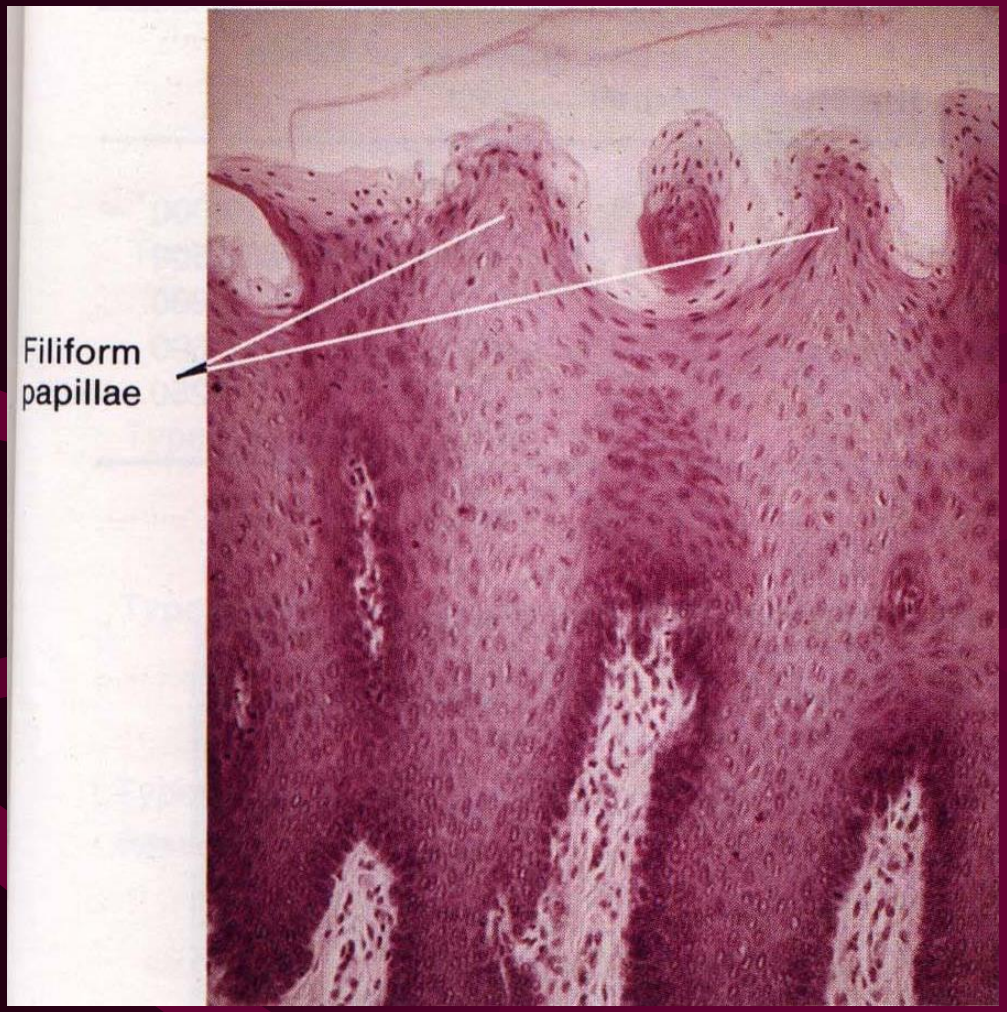
Sagittal section through the tongue.
The dorsal surface is covered by a specialized keratinized and nonkeratinized mucosa, whereas The ventral surface shows a thinner, nonkeratinized epithelium. Filiform papillae cover the entire anterior part of the tongue.

FILIFORM PAPILLAE:

These are numerous fine-pointed, cone shaped papillae that give the dorsal surface a velvet like appearance.

These projections, the filiform (thread-shaped) papillae, are epithelial structures containing a core of connective tissue from which secondary papillae protrude toward the epithelium which is keratinized.



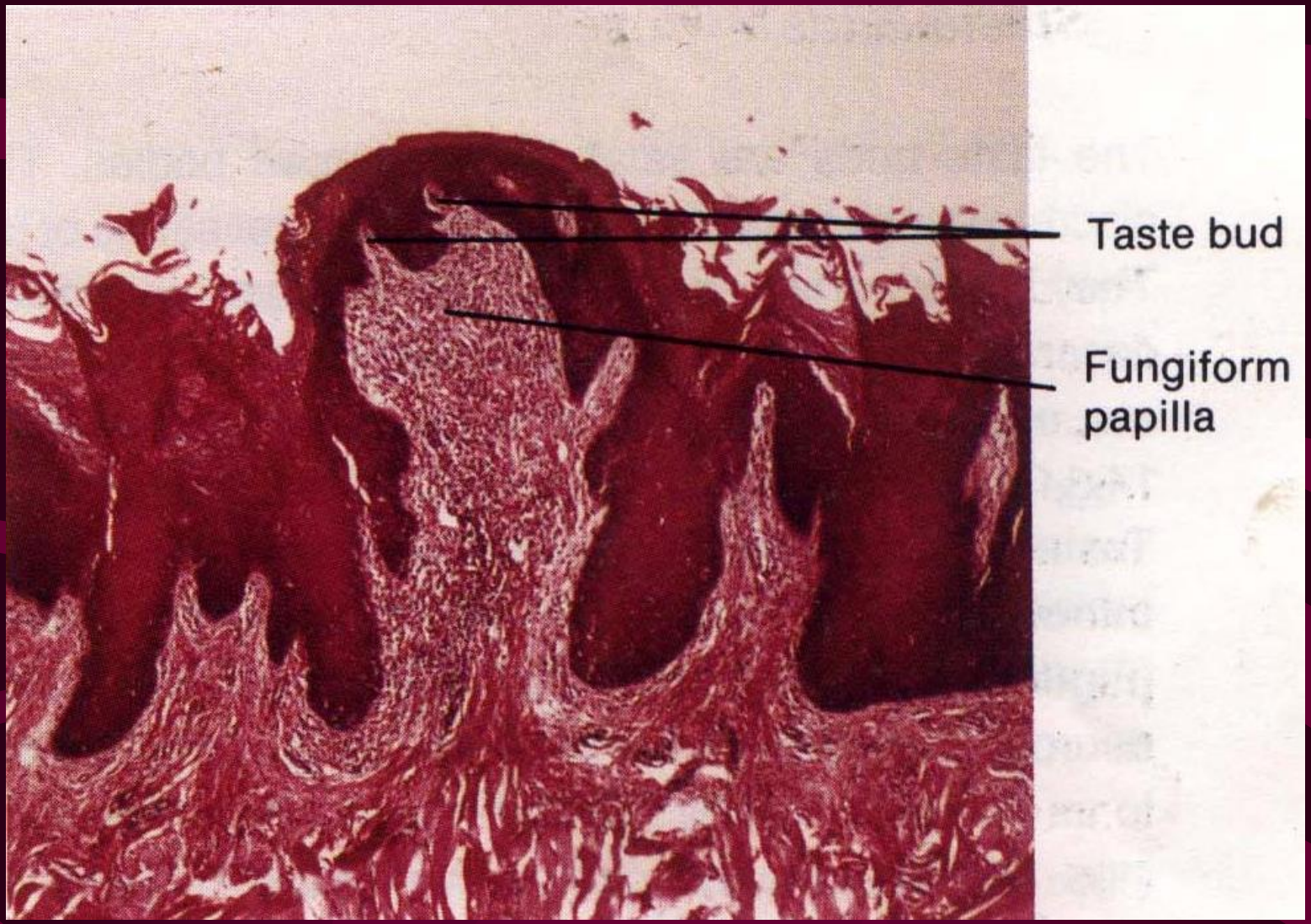


Histology of filiform papillae of tongue

FUNGIFORM PAPILLAE:

Interspersed between the filiform papillae are the isolated fungiform (mushroon shaped) papillae which are round, reddish prominences. The color is derived from a rich capillary network visible through the relatively thin epithelium.

Fungiform papillae contain a few (one to three) taste buds found only on their dorsal surface.



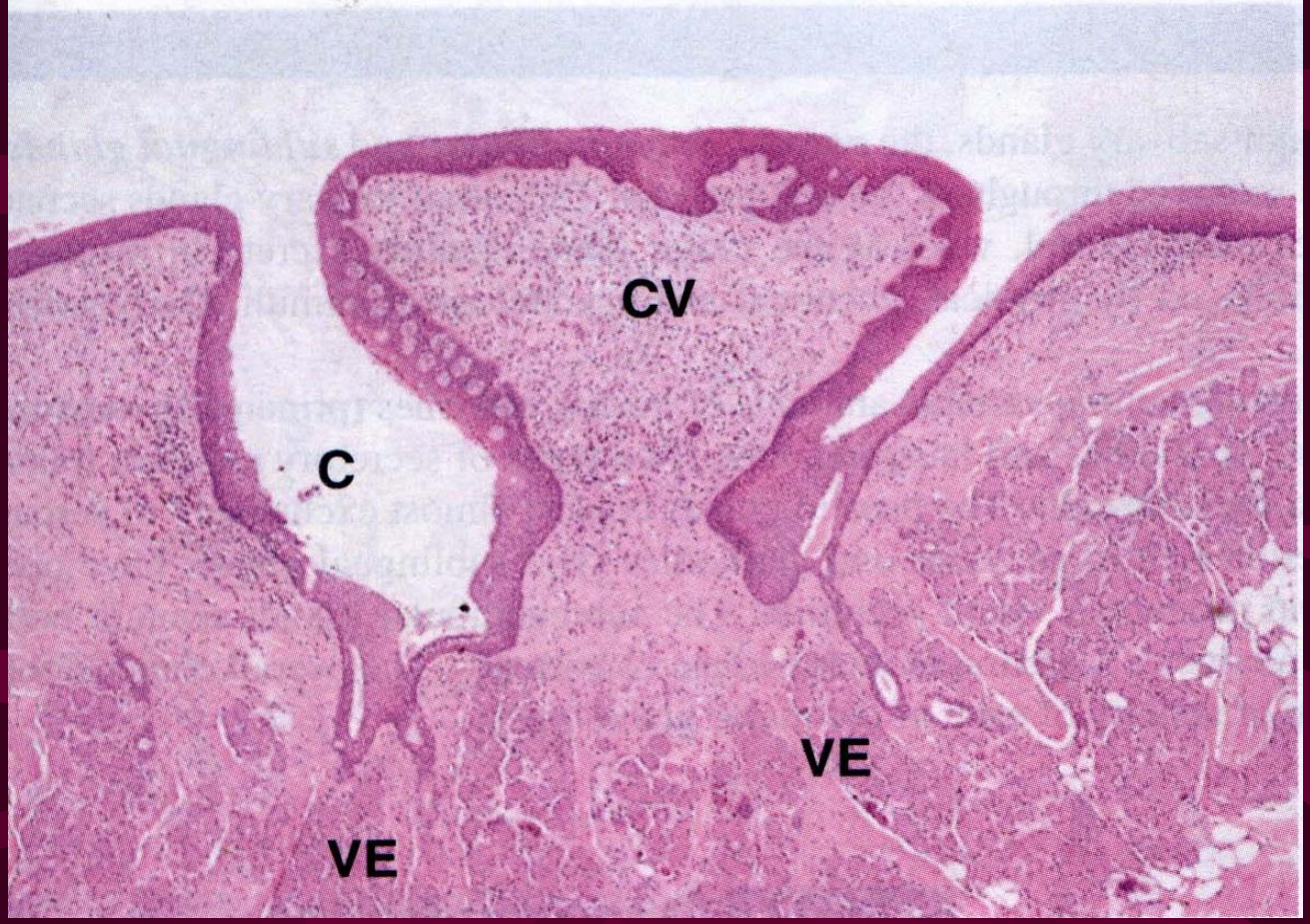
Histologic section of a fungiform papilla with a CT core and epithelial covering. 2 taste buds are located on the dorsal surface of the papilla.

CIRCUMVALLATE PAPILLAE(CV):

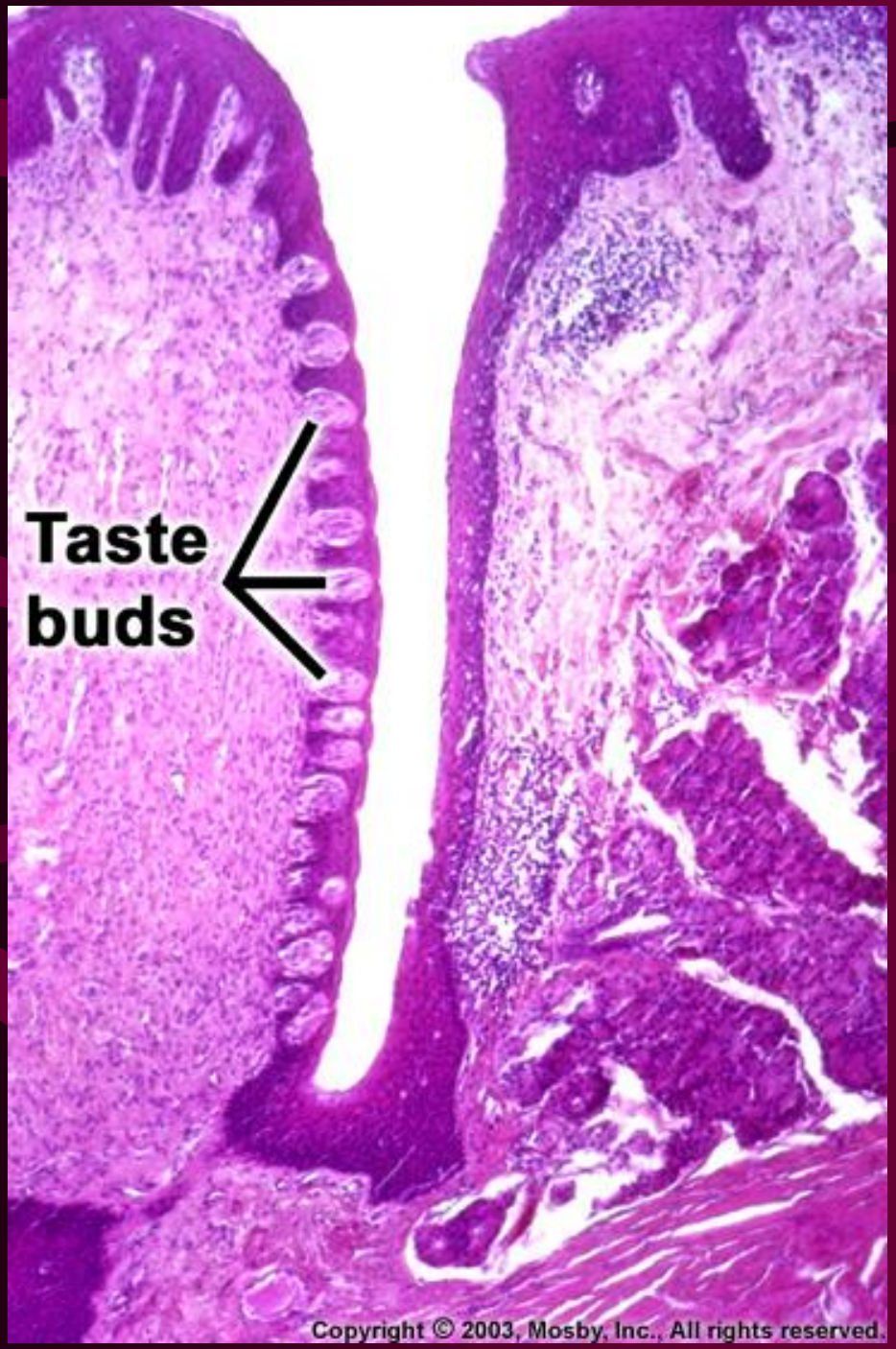
In the front of sulcus terminalis, there eight to ten vallate(walled) papillae.

They do not protrude above the surface of the tongue but are bounded by a deep circular furrow so that their only connection to the substance of the tongue is at their narrow base.

Their free surface shows numerous secondary papillae that are covered by a thin, smooth epithelium.



Aggregations of serous glands, called von Ebner's glands(VE), open into the base of the circumvallate clefts, secreting a watery fluid which dissolves food constituents, thus faciliating taste reception. This is a main source of salivary lipase.



Taste buds line the lateral walls of circumvallate papillae

TASTE BUDS:

These are small ovoid or barrel-shaped intraepithelial organs about 80 um high and 40 um thick. They extend from basal lamina to surface epithelium.

Their outer surface is almost covered by a few flat epithelial cell, which surround a small opening, the taste pore, which leads into a narrow space lined by he supporting cells of the taste buds.

Between the latter are arranged 10 to 12 neuroepithelial cells, the receptors of taste stimuli.

A rich plexus of nerves is found below the taste buds.

LOCATION AND NUMBER OF TASTE BUDS IN THE HUMAN ADULT:

Tongue	10.000
Soft palate	2,500
Epiglottis	900
Larynx and pharynx	600
Oropharynx	250

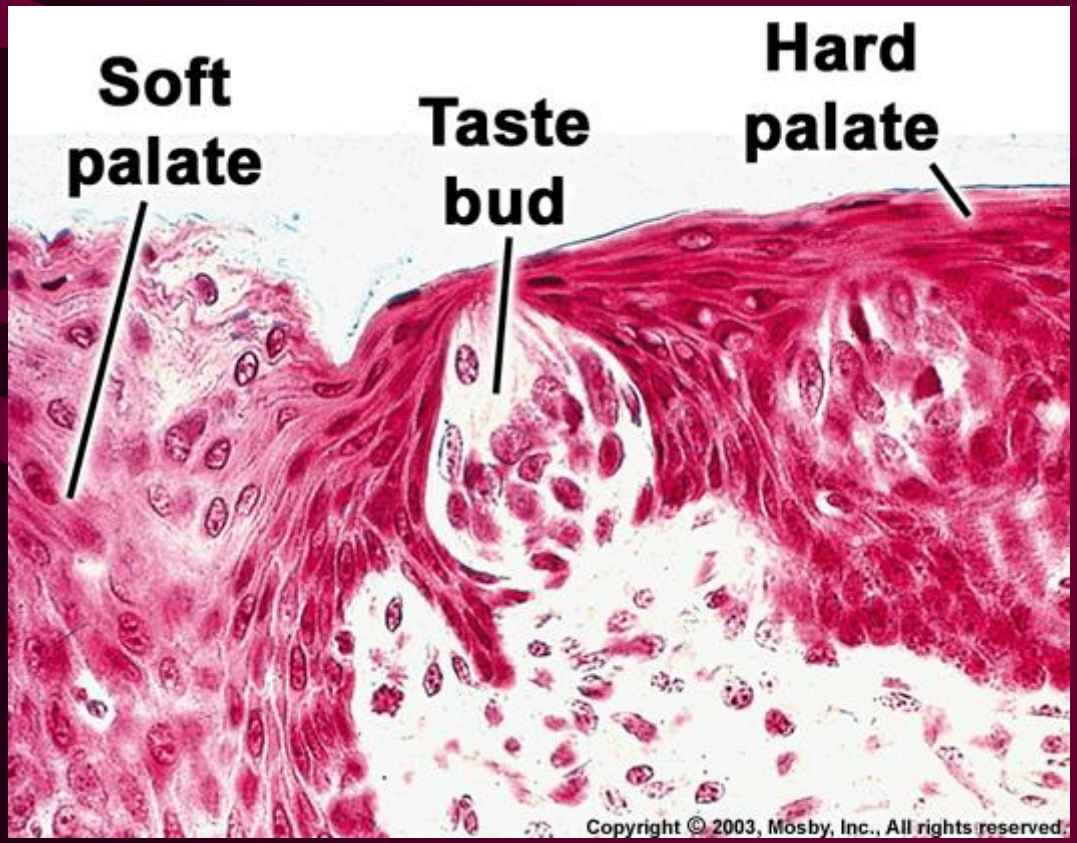
LOCATION:

On inner wall of trough surrounding the circumvallate papillae

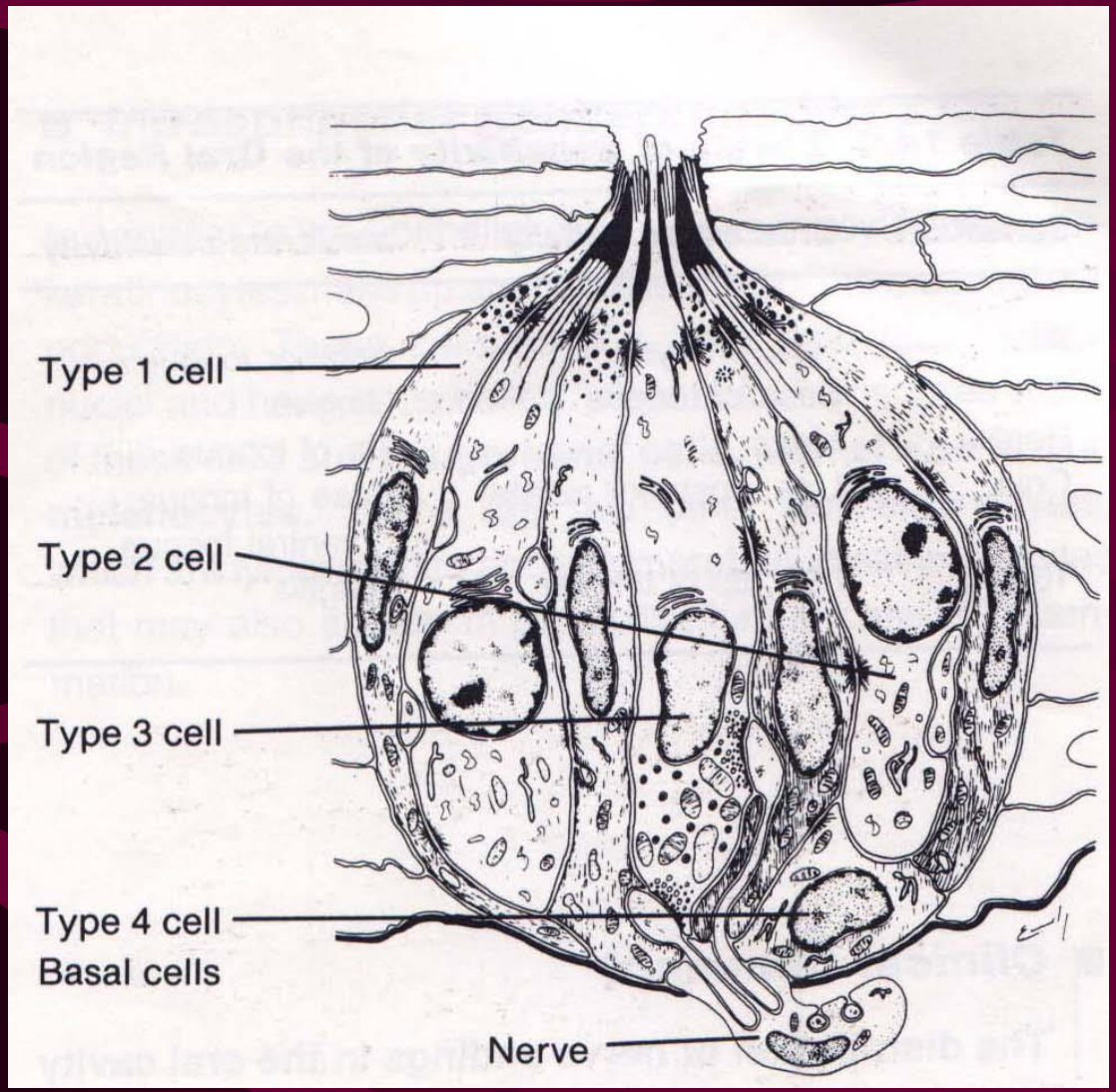
In the folds of the foliate papillae,

On the posterior surface of the epiglossitis

Some of the fungiform papillae at the tip and the lateral borders of the tongue.



Taste bud at the junction of the hard and soft palates.



The cells of the taste bud have been divided into four types:

Type I: Dark cells, 60% of the cells.

Type II:

Light cells, 30% of total cells, contain numerous vesicles and are adjacent to the intraepithelial nerves.They are continuously being replaced, and their existence depends on a functional gustatory nerve

Type III: 7%

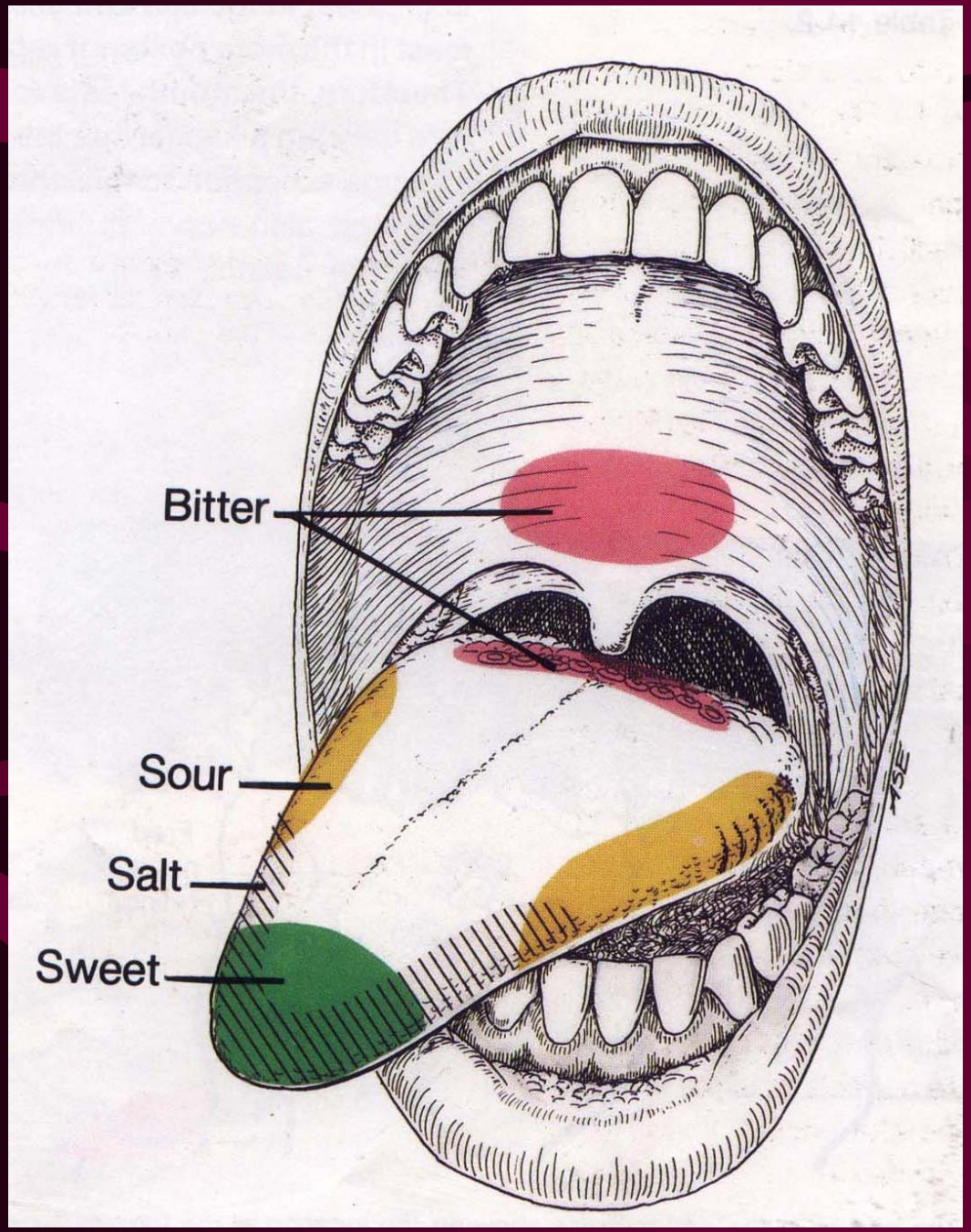
Type IV: Basal cells, 3%

HOW TASTE STIMULI GENERATED?

Taste stimuli probably generated by the adsorption of molecules onto membrane receptors on the surface of the taste bud cells, which activates a signaling cascade mediated by membrane associated proteins such as transducin and gustducin.

The change in membrane polarization that follows stimulates release of transmitter substances, which, in turn, stimulate unmyelinated afferent fibers of the glossopharyngeal nerve (IX), which surround the lower half of the taste cells.

Taste bud cells, together with Merkel's cells, are the only truly specialized sensory cells in the oral mucosa.



LOCATION OF TASTE PERCEPTION ON THE TONGUE IN THE ORAL CAVITY:

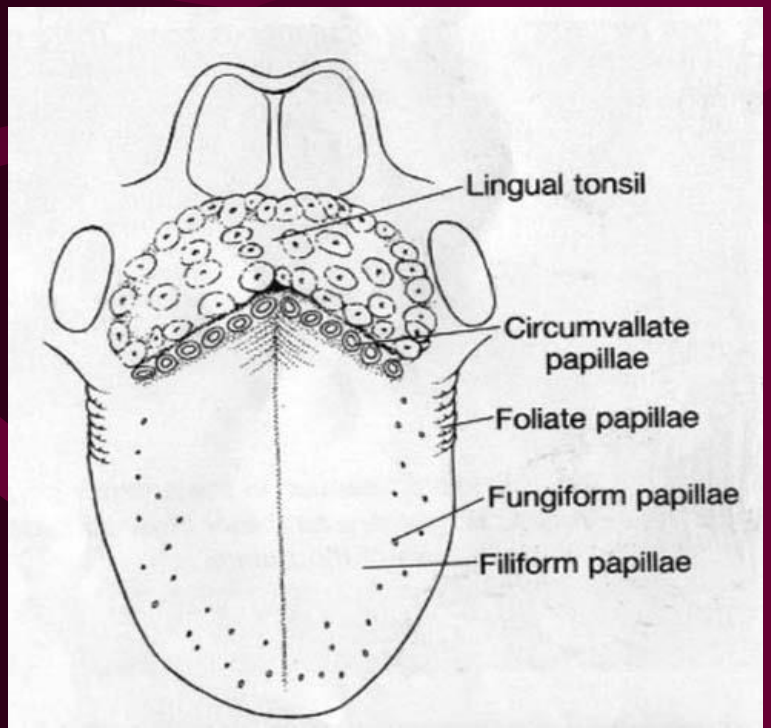
SWEET receptors on tip,
SALTY receptors, on the front and lateral aspect of tongue,
SOUR receptor on the posterio-lateral aspect of tongue, &
BITTER on soft palate and posterior central part of tongue

LINGUAL TONSIL:

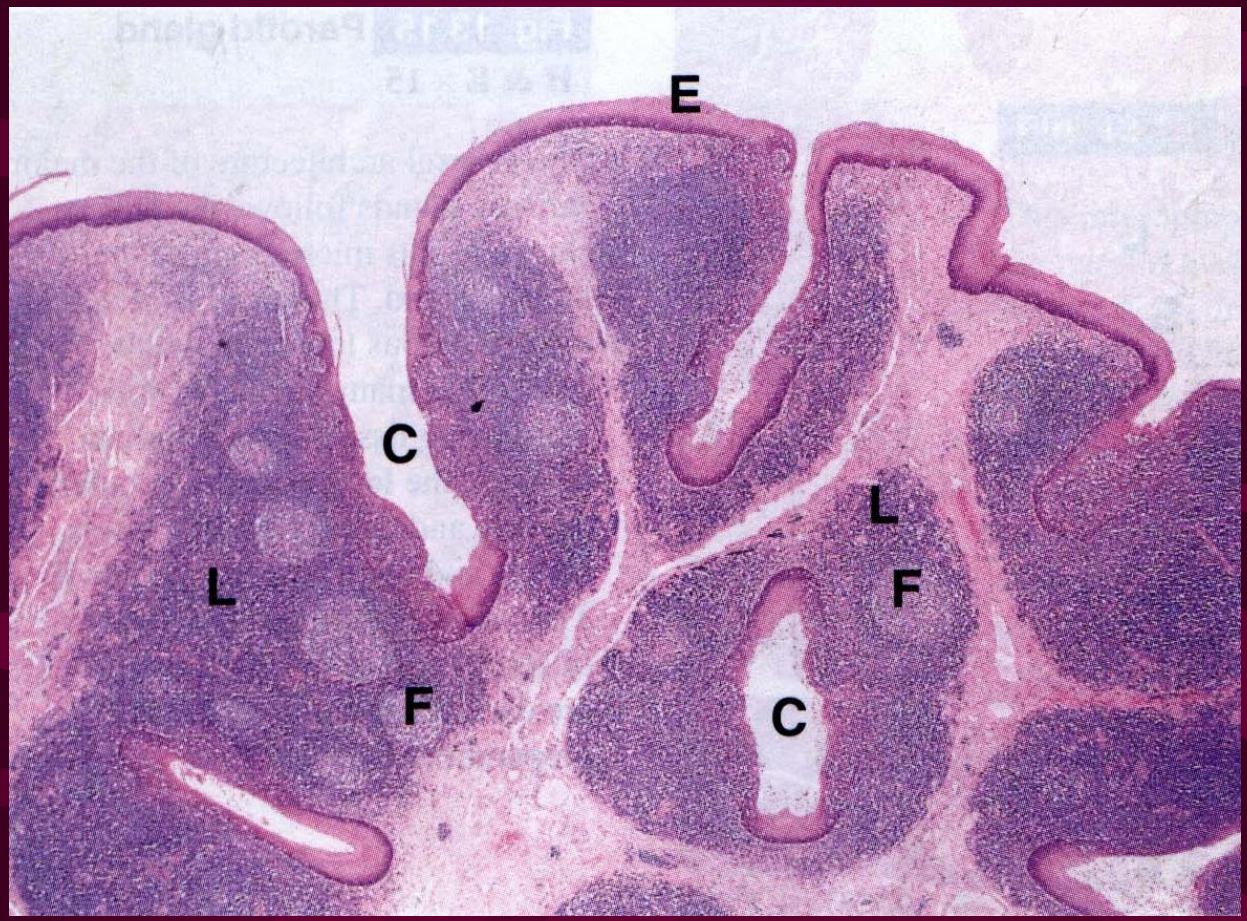
Posterior to the termna sulcus, the surface of the tongue is irregularly studded with round or oval prominences, the lingual follicles. Each of these shows one or more lymph nodules, sometimes containing a germinal center.

Most of these prominces have a small pit at the center, the lingual crypt, which is lined with stratified squamous epithelium.

Together the lingual follicles form the LINGUAL TONSIL.



LINGUAL TONSIL



The posterior surface of tongue has a relatively smooth st.sq. epithelium, E, under which lies masses of lymphoid tissue, L, containing typical lymphoid Follicles,F

DENTOGINGIVAL JUNCTION:

It’s the junction of gingival and of tooth.

It has a great physiologic important.

It is a point of lessened resistance to mechanical forces and bacterial attack.

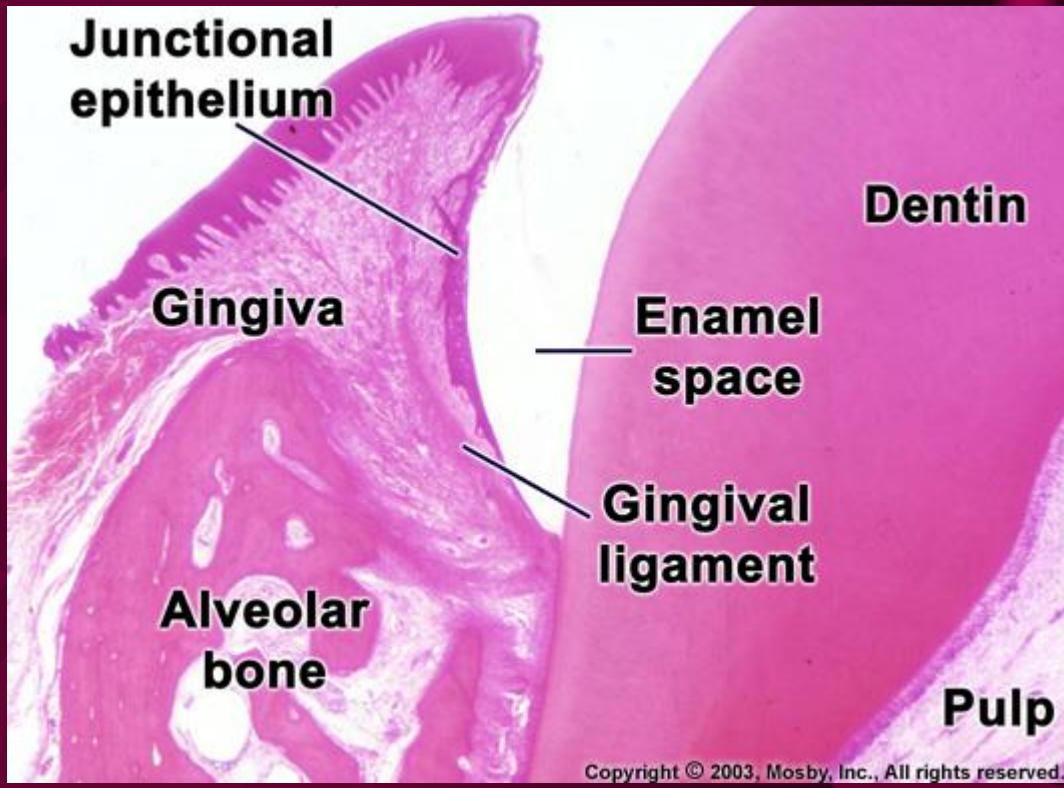
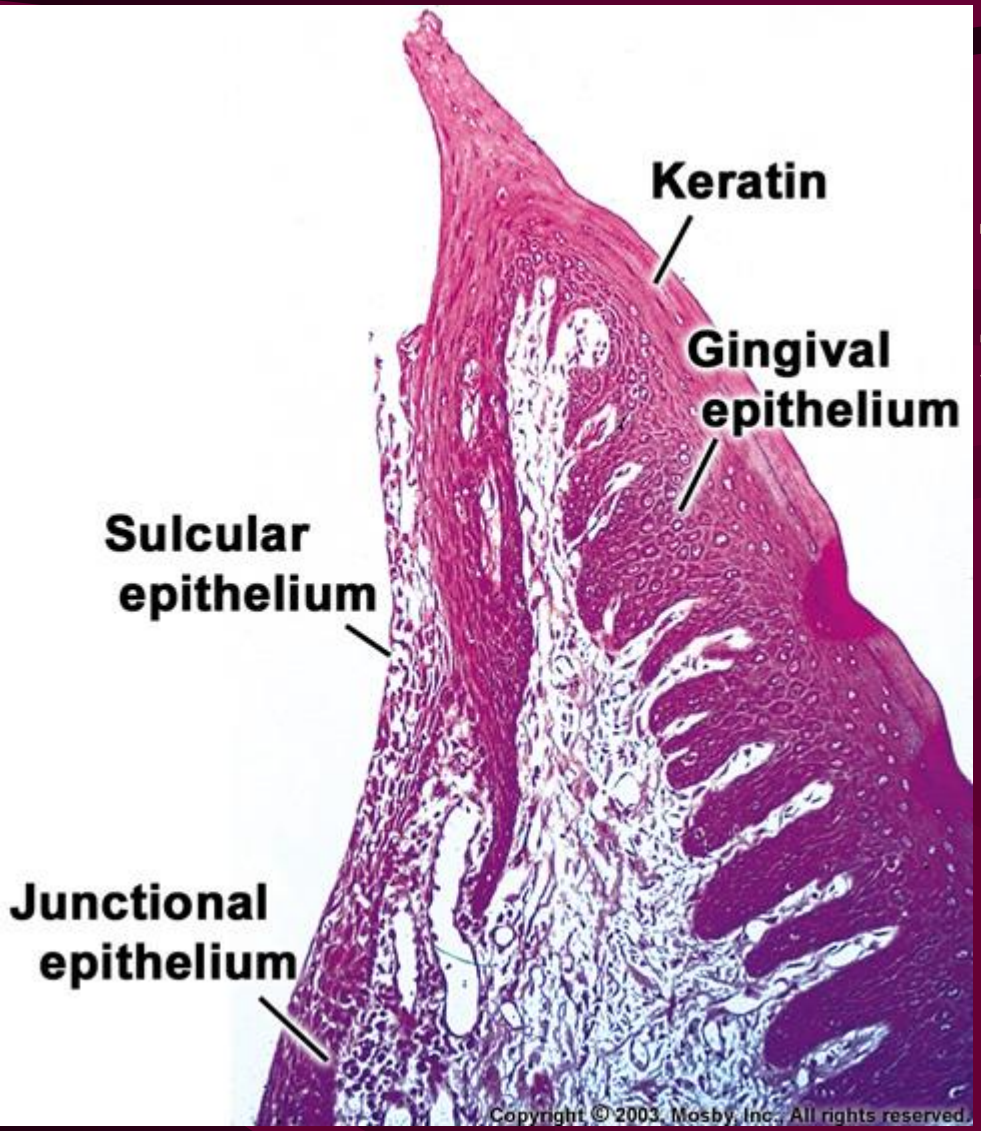


Fig.: The junctional epithelium attaches the gingiva to the tooth surface.



The dentogingival junction. Junctional, sulcular, and keratinized gingival epithelium can all be distinguished

GINGIVAL SULCUS:

It is a shallow groove between the tooth and the normal gingival that extends from the free surface of the junctional epithelium coronally to the level of the free gingival margin.

Depth of the sulcus varies from 0.5 to 3mm, with an average of 1.8mm. Any depth greater than 3 mm can generally be considered pathological a sulcus this deep is known as periodontal pocket.

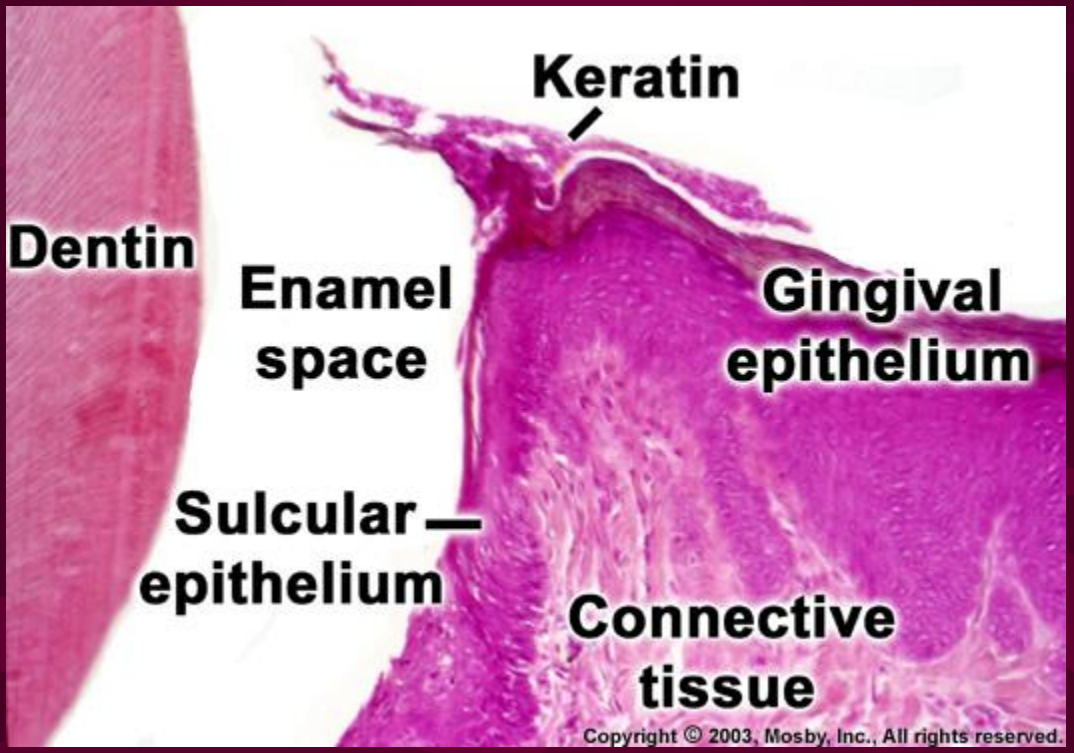
When the tooth becomes functional, the bottom of the sulcus is usually found on the cervical half of the anatomic crown; with age there is a gradual migration of the sulcus bottom, which eventually may pass onto the cementum surface.

SULCULAR EPITHELIUM:

It is a stratified squamous tissue that in many ways is similar to the stratified gingival epithelium.

It differs in one key respect: it is nonkeratinized (because of inflammation in its supporting tissues.

The junction between epithelium and connective tissue is straight, and its closely packed cells are characterized by relatively small amounts of cytoplasm, little rough endoplasmic reticulum, and many tonofilaments.



Free gingiva. The sulcular epithelium is not keratinized, whereas that of the exposed gingival surface is keratinized

DEVELOPMENT OF JUNCTIONAL (ATTACHMENT) EPITHELIUM:

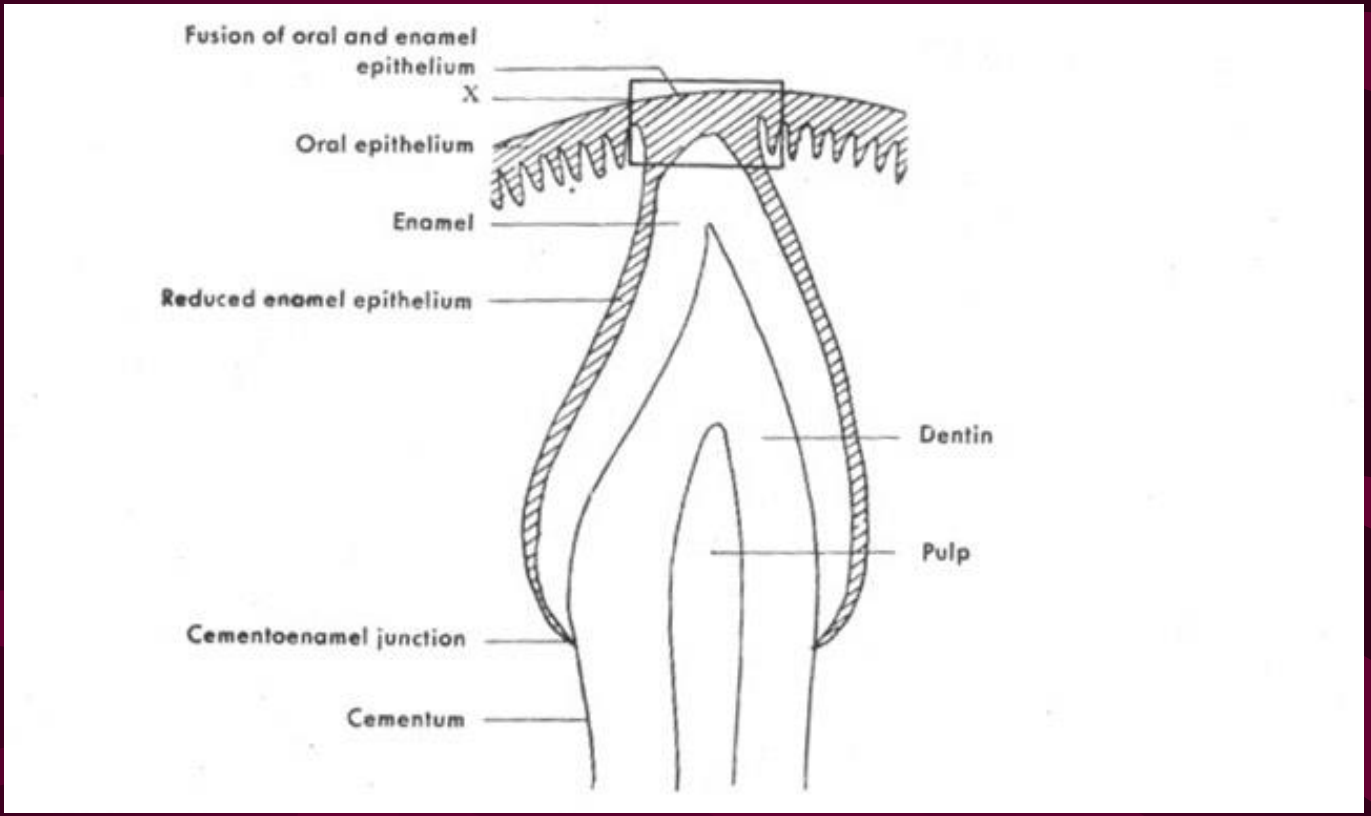
When the ameloblasts finish formation of the enamel matrix, they leave a thin membrane on the surface of the enamel, the **primary enamel** cuticle which may be connected with the interprismatic enamel substance and the ameloblasts.

Reduced enamel epithelium: the ameloblasts shorten after the primary enamel cuticle has been formed, and the epithelial enamel organ is reduced to a few layers of flat cuboid cells, which are then called **reduced enamel epit**helium

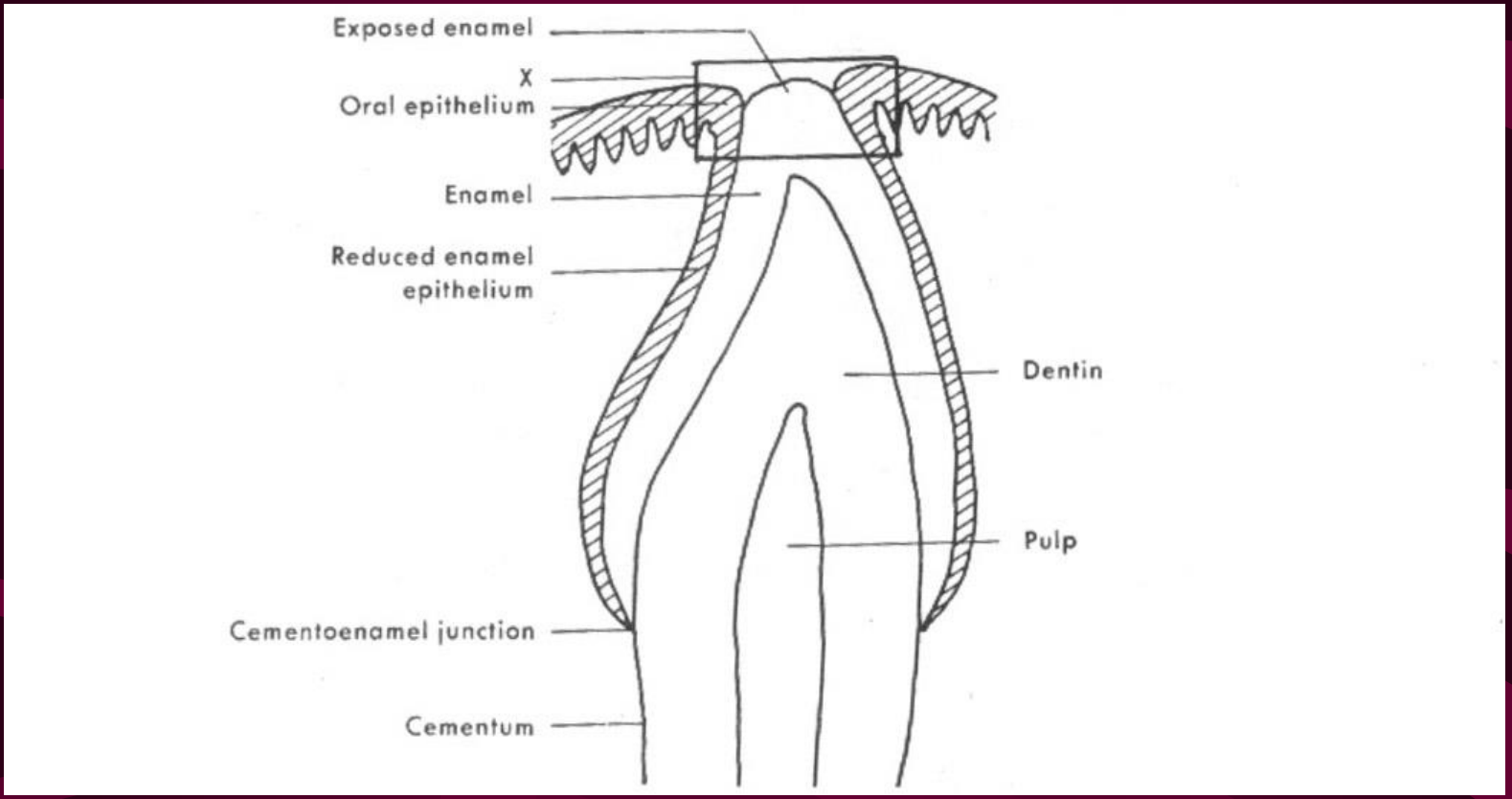
Under normal condition, it covers the entire enamel surface, extending to the cementoenamel junction, and remains attached to the primary enamel cuticle.

During eruption, the tip of the tooth approaches the oral mucosa, and the reduced enamel epithelium and the oral epithelium meet and fuse.

The remnants of the primary enamel cuticle after eruption is referred to as **Nasmyth's membrane.**

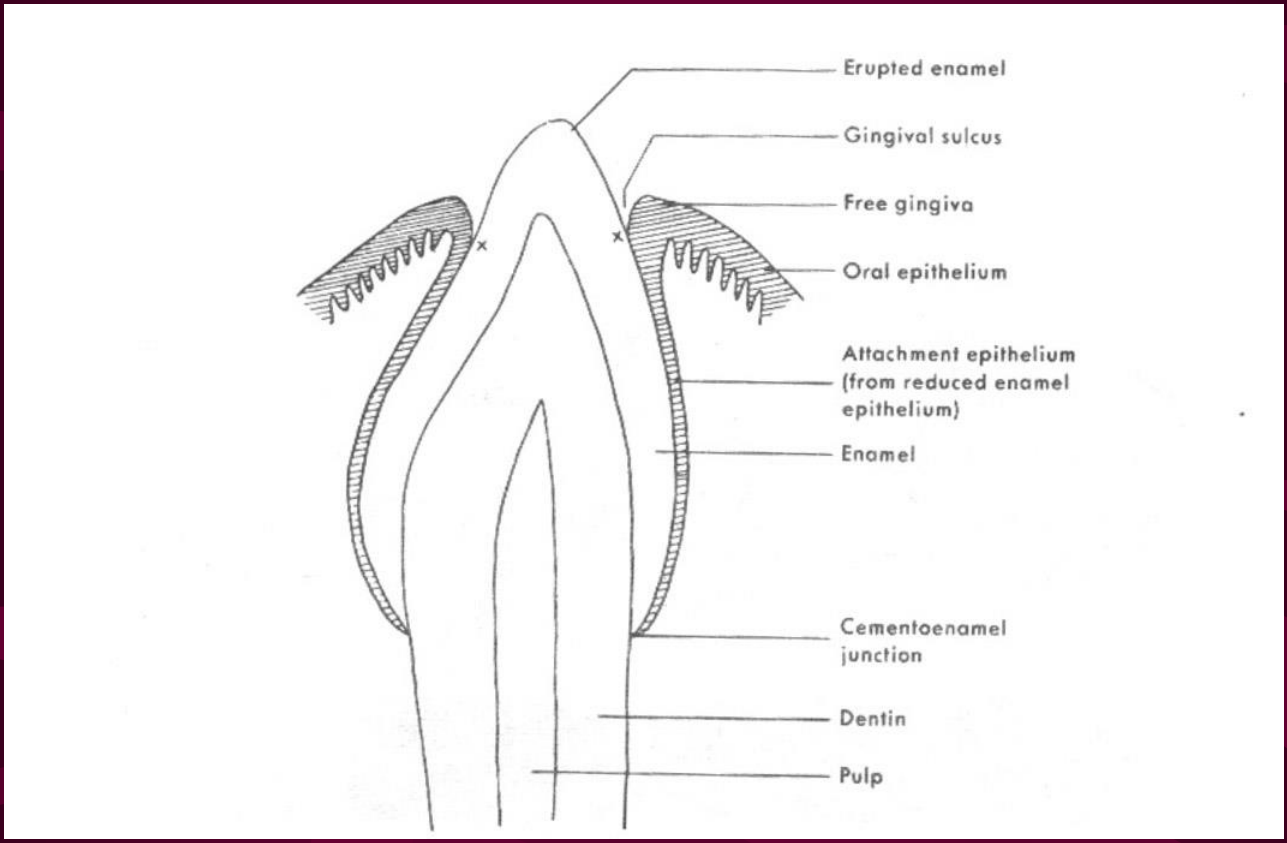


Reduced enamel epithelium fuses with oral epithelium



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

Once the tip of the crown has emerged, the REE is termed **primary attachment epithelium.**



As the tooth erupts, the reduced enamel epithelium grows gradually shorter.

A shallow groove, the gingival sulcus may develop between the gingival and the surface of the tooth and extend around its circumference.

SHIFT OF DENTOGINGIVAL JUNCTION:

The position of the gingival o 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, 1/3rd to 1/4th of the enamel still remains covered by gingival.

An actual movement of the teeth toward the occlusal plane is termed active eruption. The separation of the primary attachment epithelium from the enamel is termed 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

PASSIVE ERUPTION:

Some persons believe passive eruption to be a normal occurrence with aging.

The belief that this is a normal occurrence is probably incorrect, as explained as follows:

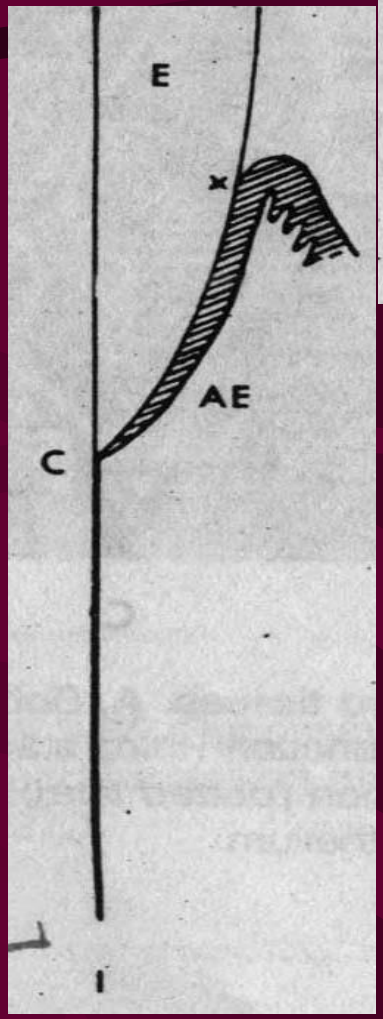
Passive eruption and further recession has been described in four stages:

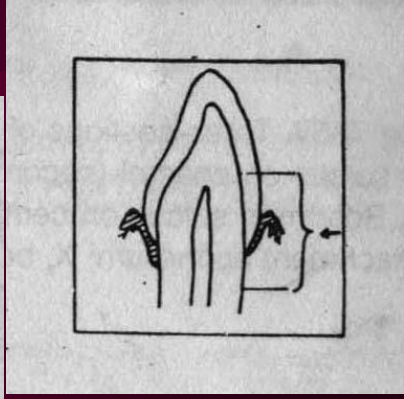
The first two may be physiologic, but there is a strong possibility that they are pathologic.

FIRST STAGE:

The bottom of the gingival sulcus remains in the region of the enamel-covered crown for some time, and the apical end of the attachment epithelium (REE) stays at the cementoenamel junction.

This relation persists in primary teeth almost up to 1 year of age before shedding and , in permanent teeth, usually to the age of 20 to 30 years.

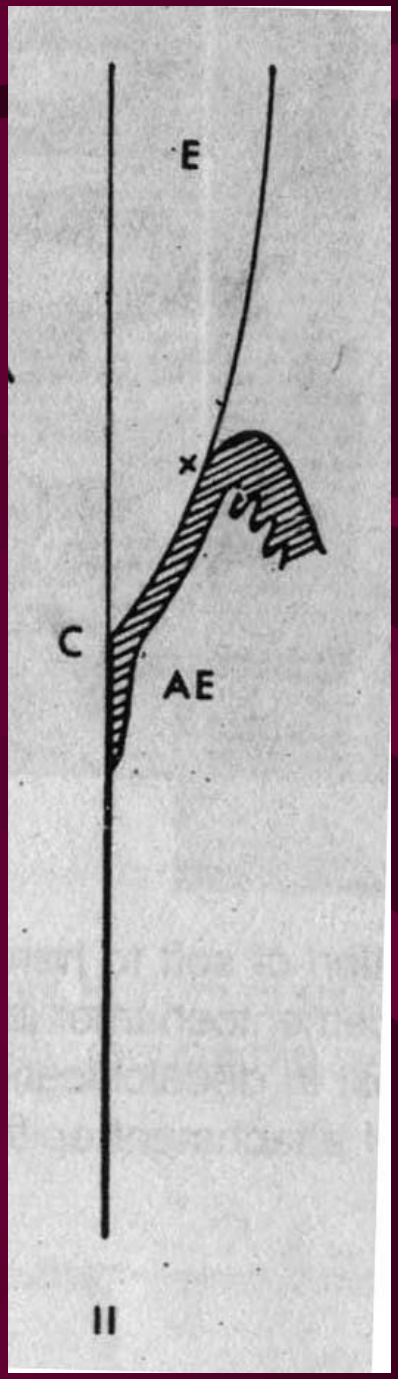




C- Cementoenamel junction
E- Enamel
AE- Attachment Epithelium
X- bottom of the gingival sulcus

SECOND STAGE:

The bottom of the gingival sulcus is still on the enamel, and apical end of the attachment epithelium has shifted to the surface of the cementum.



The down growth of the attachment epithelium (AE) involves dissolution of fiber bundles that were anchored in the cervical parts of the cementum, and an apical shift of the gingival and transseptal fibers.

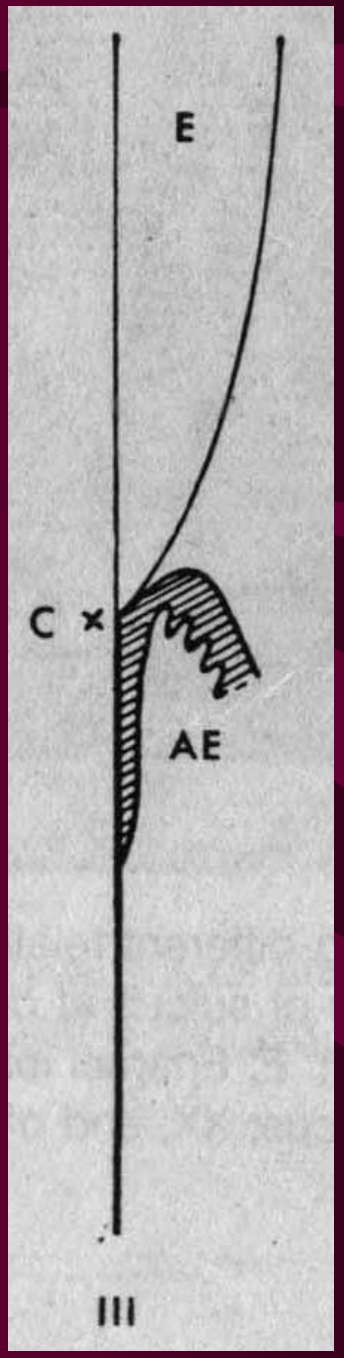
Destruction of fibers may be caused by

1. ***Enzymes*** formed by the epithelial cells,
2. ***Plaque metabolites*** or enzymes, or
3. ***Immunologic reactions*** as manifestations of periodontal disease.

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

THIRD STAGE:

When the bottom of the gingival sulcus is at the cementoenamel junction, the epithelium attachment is entirely on the cementum, and enamel-covered crown is fully exposed.



This stage in the exposure of the tooth no longer passive manifestation.

The epithelium shifts gradually down from CEJ.

This more or less continuous but slow process is regarded as the body**’s** attempt to maintain an intact dentogingival junction in the face of factors that cause its deterioration.

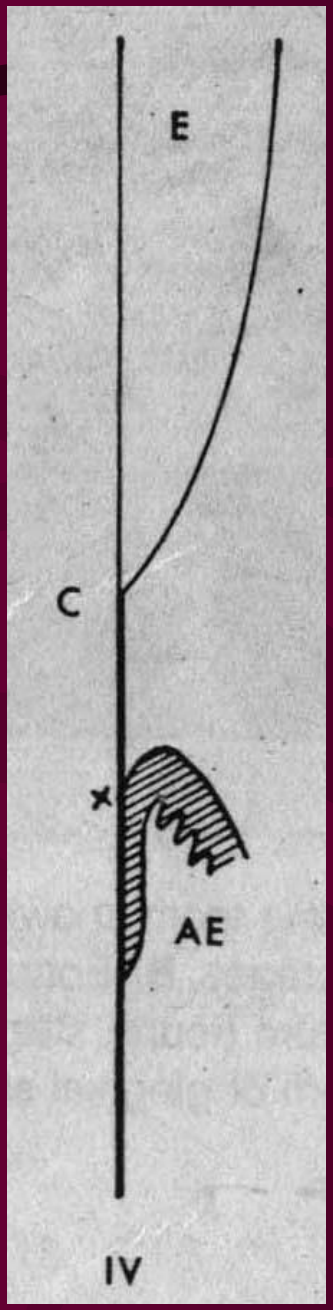
FOURTH STAGE:

It represents recession of the gingival.

The entire attachment is on cementum.

This is regarded as pathologic process.

It may occur without perceptible evidence of inflammatory periodontal disease.



The rates of crown exposure and recession vary in
different persons,
different teeth of the same jaw and in
different surfaces of the same tooth.

The part of the tooth which is covered by enamel is the **ANATOMIC CROWN.**

The part of the tooth which is exposed in the oral cavity is called **CLINICAL CROWN**.

CUTICLES:

Gottlieb and Orban demonstrated the presence of an organic attachment, which they termed the epithelial attachment. The primary cuticle mediates an organic union between ameloblasts and the enamel. When the ameloblasts are replaced by the oral epithelium, a secondary cuticle is formed.

When the epithelium proliferates beyond the cementoenamel junction, the cuticle extends along the cementum.

Secondary enamel cuticle and cemental cuticle are reffered as dental cuticle.

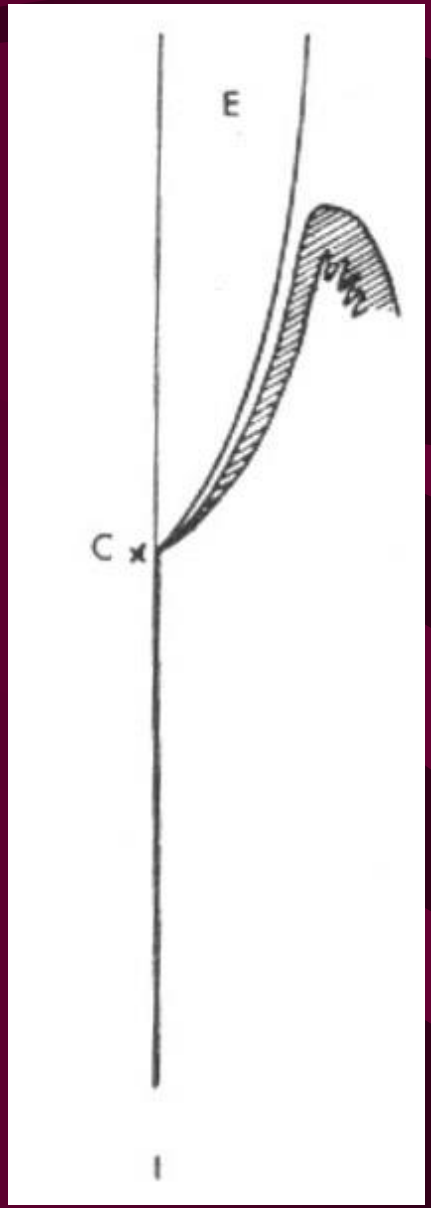
The cuticle is an amorphous material between the attachment epithelium and the tooth.'

DEEPENING OF THE SULCULS:

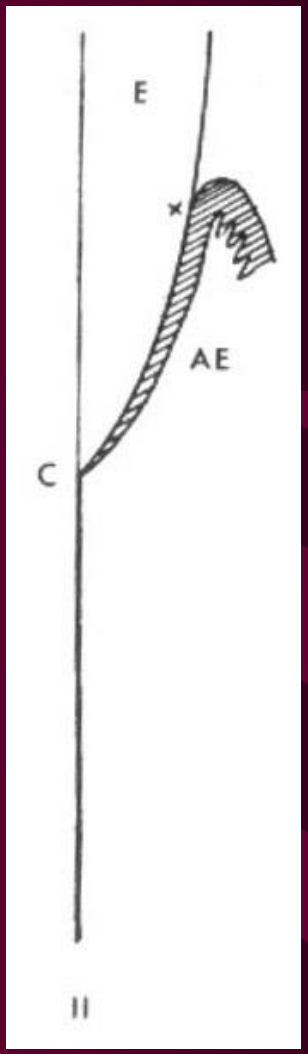
Sulcus deepens as a result of separation of the reduced dental epithelium from the actively erupting tooth.

There are different hypothesis regarding formation of sulcus:

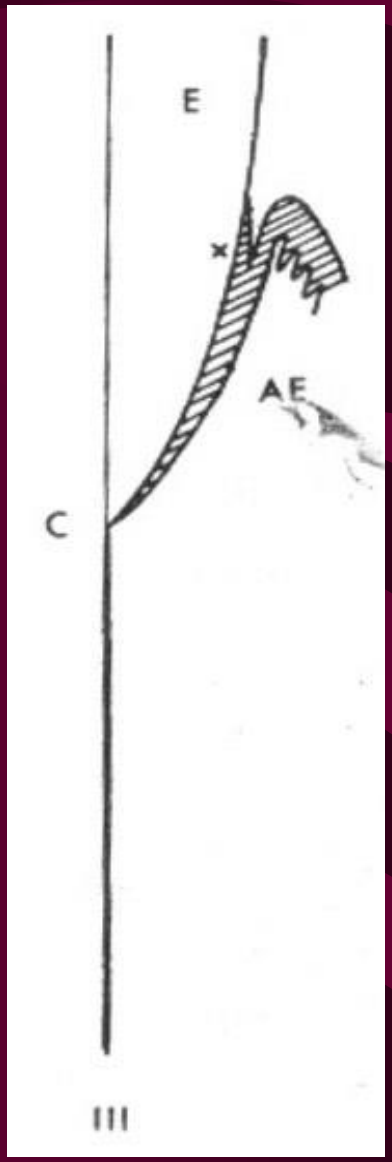
At one time, it was believed that from the time the tip of the crown had pierced the oral mucosa, the gingiva extended to the cementoenamel junction. It was assumed that the attachment of the gingival epithelium to the tooth occurred only at the cementoenamel junction.



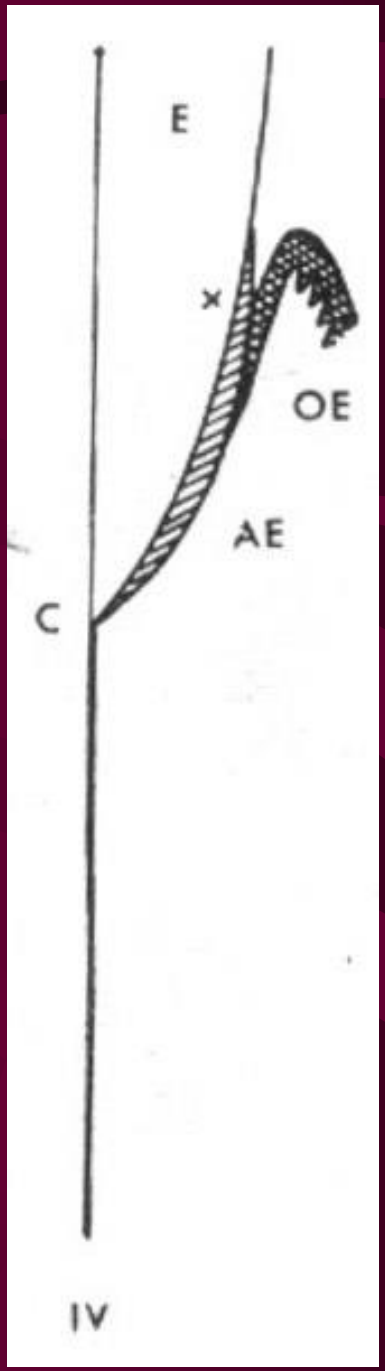
Gottlieb and Orban showed that no cleft existed between epithelium and enamel and that these tissues were organically connected. The gingival sulcus was sown to be a shallow groove, the bottom of which is at the point of separation of attached epithelium from the tooth.



Some investigators contended that the deepening of the gingival sulcus was caused by a tear in the attached epithelium.



Others believed, however, that deepening occurred as a result of the downgrowth of the oral epithelium alongside the reduced enamel epithelium (primar attachment epithelium).



CLINICAL CONSIDERATIONS:

Periodontal disturbances produce a deepened gingival sulcus as a response to plaque toxins and the subsequent immunologic response. Reduction in pocket depth is the primary objective of treatment.

With gingival recession and exposure of the cervical part of the anatomic root, cemental caries or abrasion may occur. Improperly constructed clasps, overzealous scaling and strongly abrasive dentifrices may result in pronounced abrasion.

Whenever submucosa consists of a layer of loose connective tissue, edema or hemorrhage can cause much swelling and infection can spread speedily and extensively.

Injection should be made in to loose submucous connective tissue.

Many systemic disease cause characteristic changes in the oral mucosa

- Metal poisoning (Lead, Bismuth)
- Leukemia
- Pernicious anemia and other blood dyscrasia.
- Measles (red spots with bluish white center can be seen in the mucous membrane of cheeks, Koplik's spots
- Endocrine disturbances.

Changes of the tongue are often of diagnostic significance:

- Strawberry tongue in scarlet fever
- Magneta tongue in pernicious anemia etc.

Age changes:

- Mucous membrane of he mouth may atrophy. The atrophy of the major and minor salivary glands may lead to xerostomia.