L-6

Tooth development

Development of primitive oral cavity and Dental Lamina

PART-1

DR.SAJDA GAJDHAR

COURSE CO-ORDINATOR

ORAL CAVITY IN HEALTH

Lecture learning outcome

1-Describe the origin of the tooth formative cells & the concept of ectodermal mesenchymal interactions involved in tooth development

2-Describe Dental lamina and its derivatives

Tencate's Oral histology ; pages 70-94
James K Avery; pages 63-80

STAGES OF TOOTH DEVELOPMENT AND GROWTH

STAGES OF TOOTH DEVELOPMENT MAY BE DESCRIBED ACCORDING TO:

1- Changes in the morphology of the developing tooth (*MORPHOLOGICAL STAGES*)

2- Its physiological changes (*HISTOPHYSIOLOGICAL STAGES*)

MORPHOLOGICAL STAGES

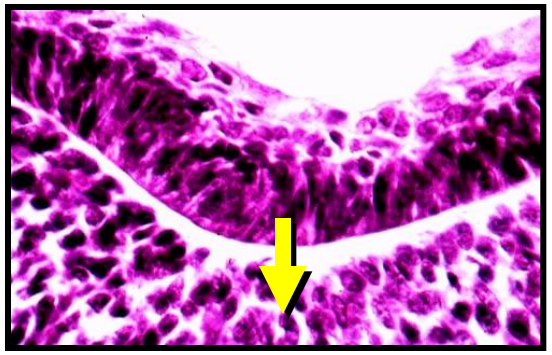
1- DENTAL LAMINA.

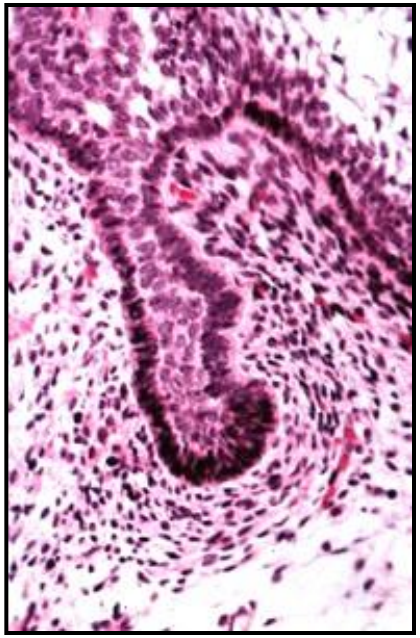
2- BUD-STAGE.

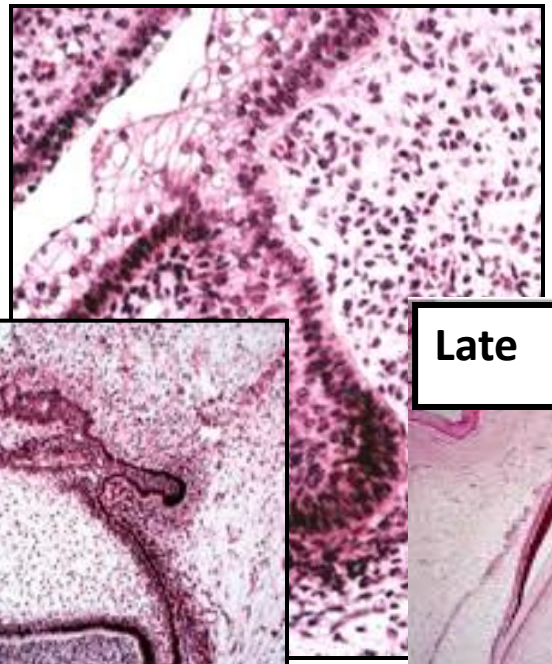
3- CAP-STAGE.

4- BELL-STAGE

(EARLY AND LATE).







HISTOPHYSIOLOGICAL STAGES

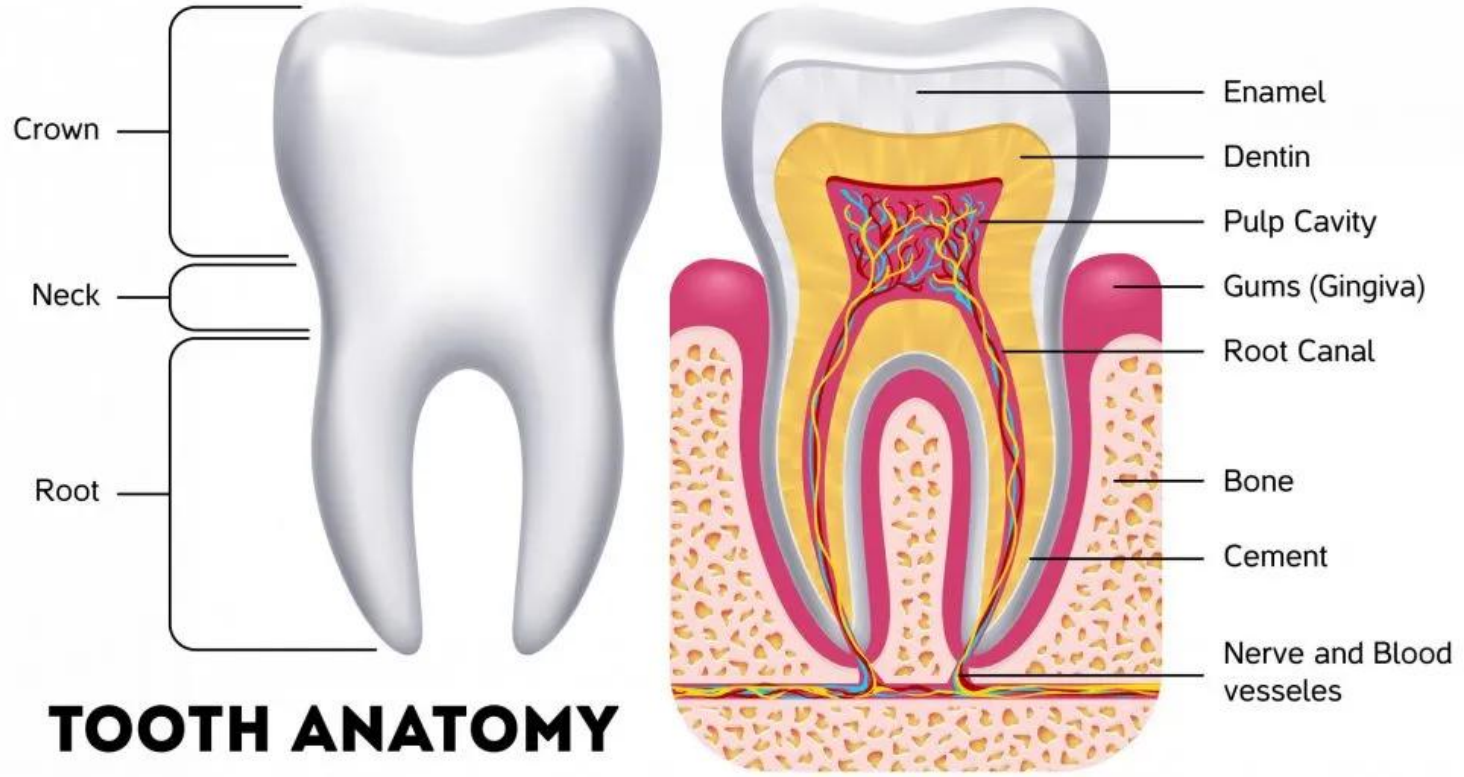
1- INITIATION.

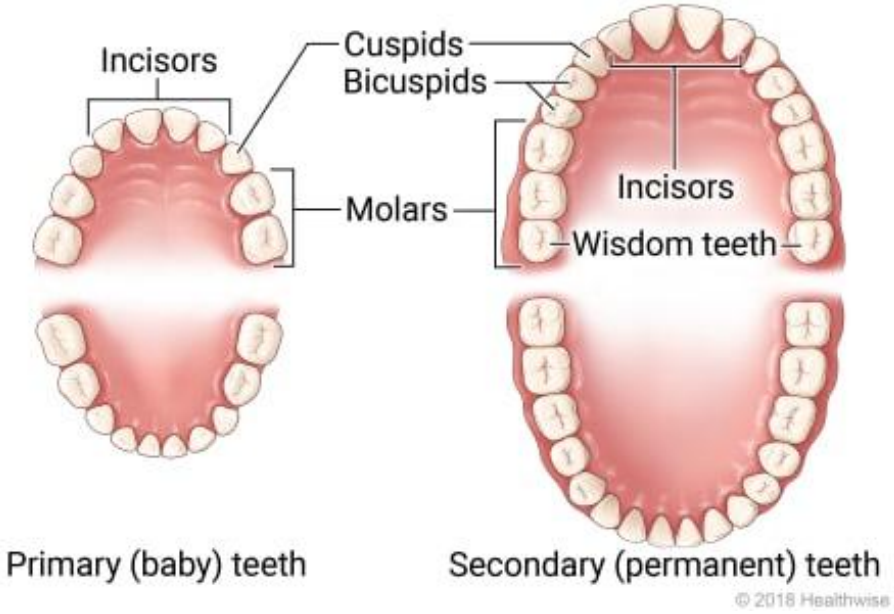
2- PROLIFERATION.

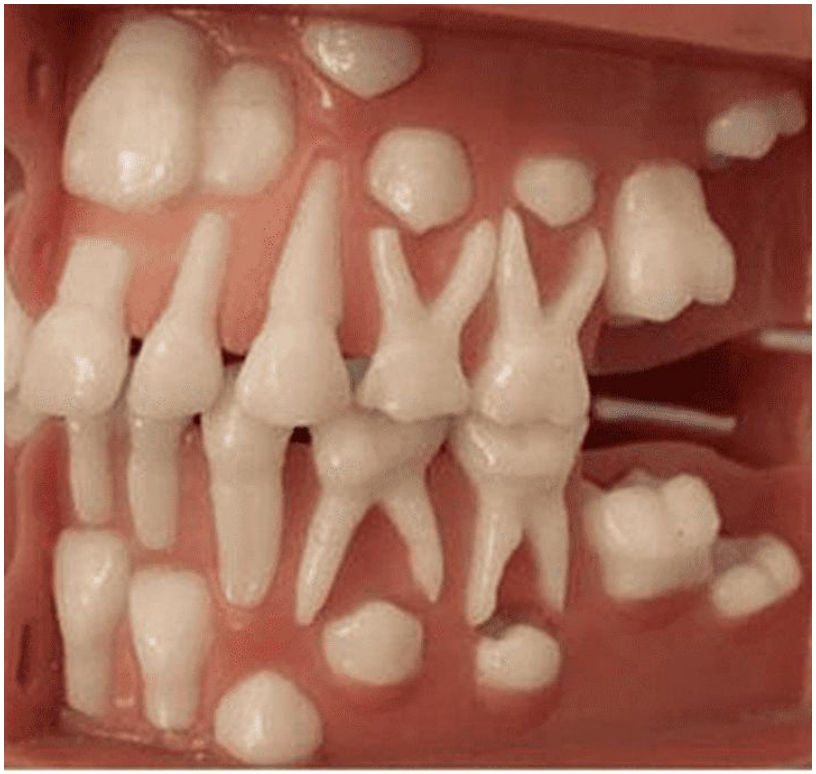
3- HISTO-DIFFERENTIATION.

4- MORPHO-DIFFERENTIATION.

5- APPOSITION.

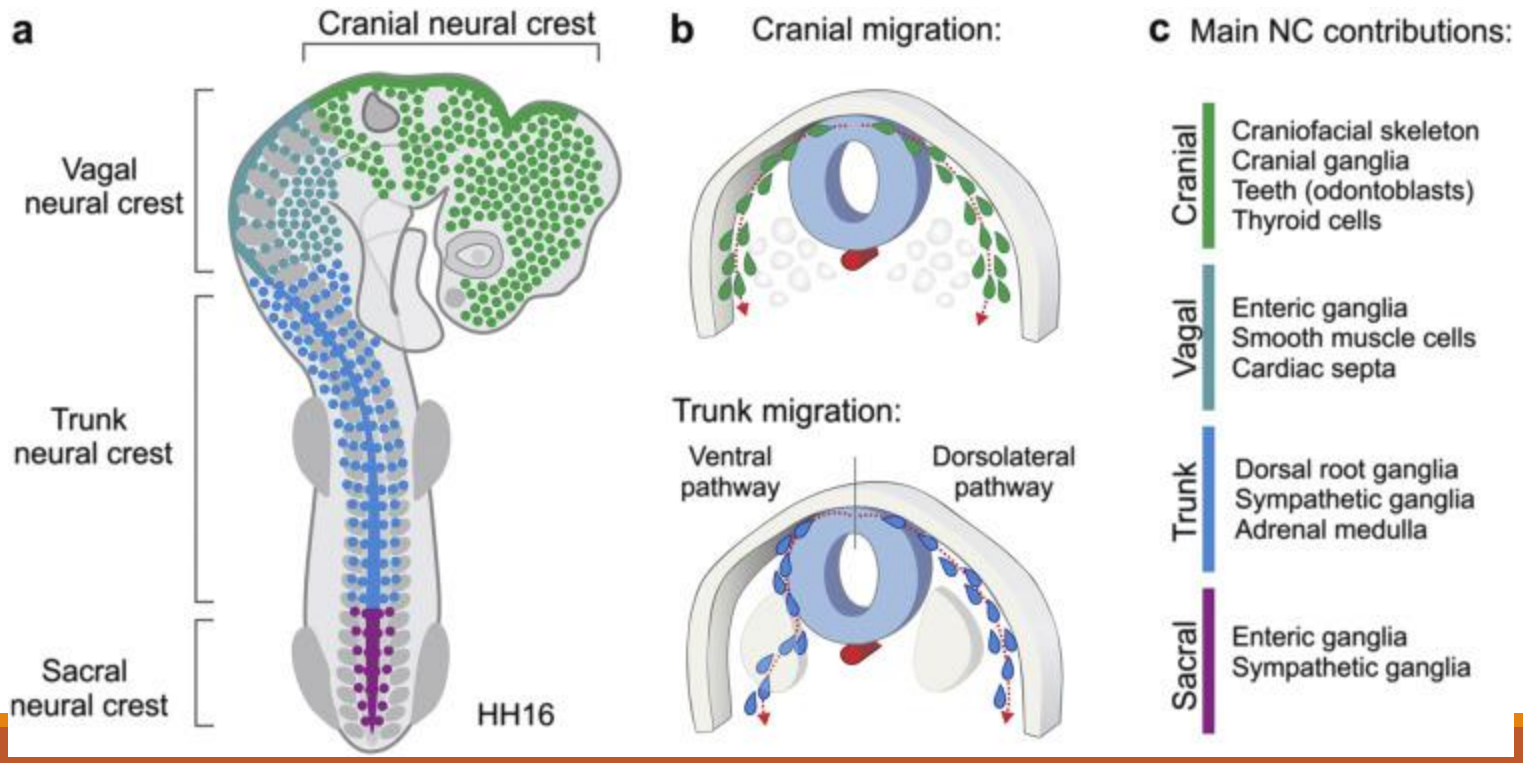

Crown
Neck
Root
TOOTH ANATOMY
Enamel
Dentin
Pulp Cavity
Gums (Gingiva)
Root Canal
Bone
Cement
Nerve and Blood vesseles


Incisors
Cuspids
Bicuspids
Molars
Incisors
Wisdom teeth
Primary (baby) teeth
Secondary (permanent) teeth
© 2018 Healthwise



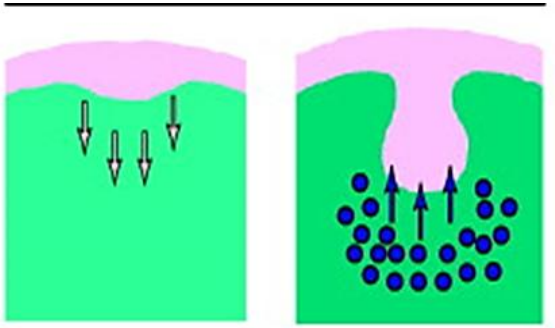
The Neural Crest

- During formation of neural tube, a group of cells separate ⟶ have high capacity to migrate and differentiate extensively in the developing embryo ⟶ neural crest cells



EPITHELIAL MESENCHYMAL INTERACTION

DEFINITION:



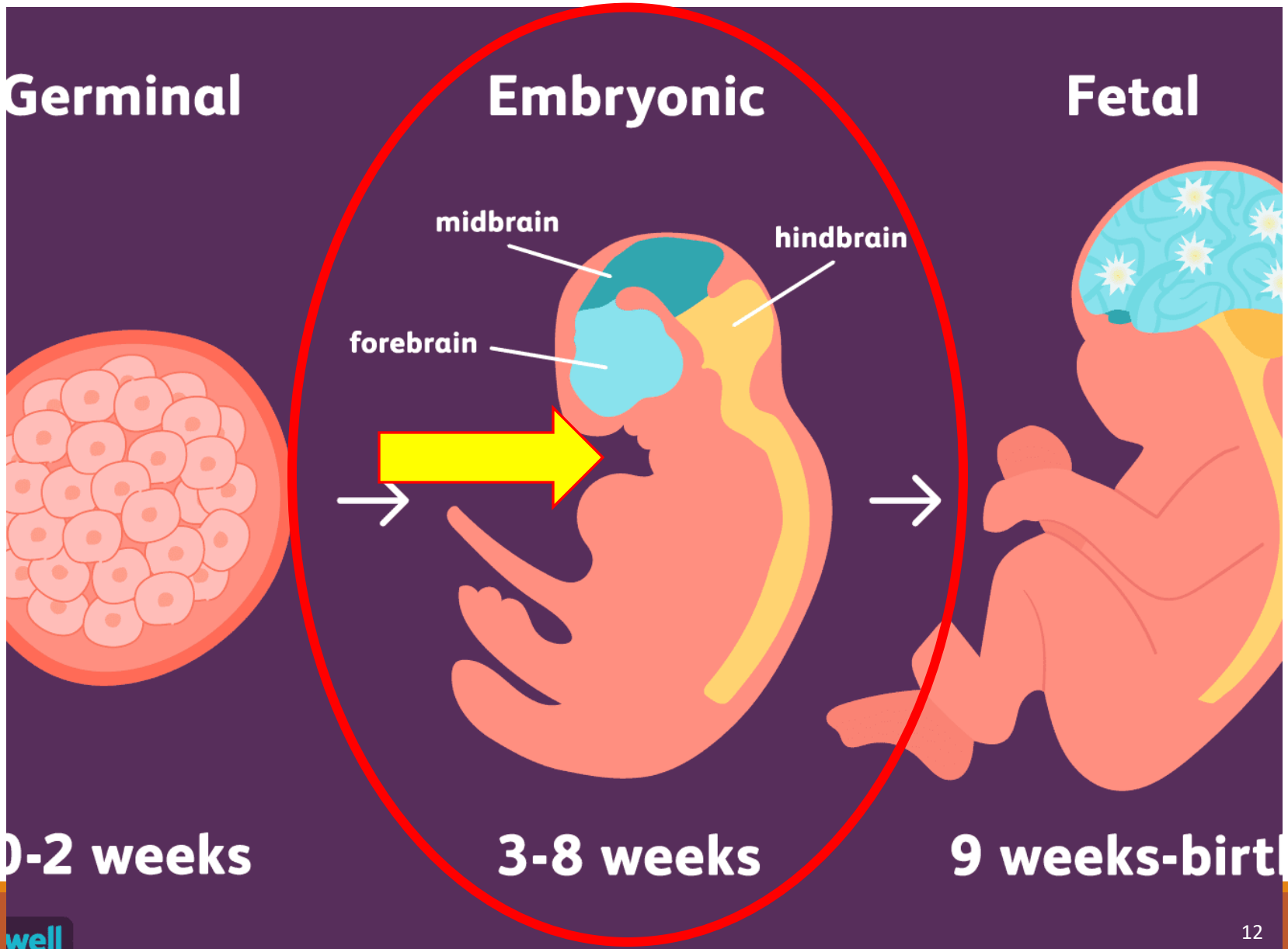
- Are series of programed,
  sequential,
  and reciprocal **communications**
  between the **epithelium** and the **mesenchyme**
  resulting in **differentiation** of one or both of the cell populations involved.

- It is an essential process in odontogenesis.

Video…

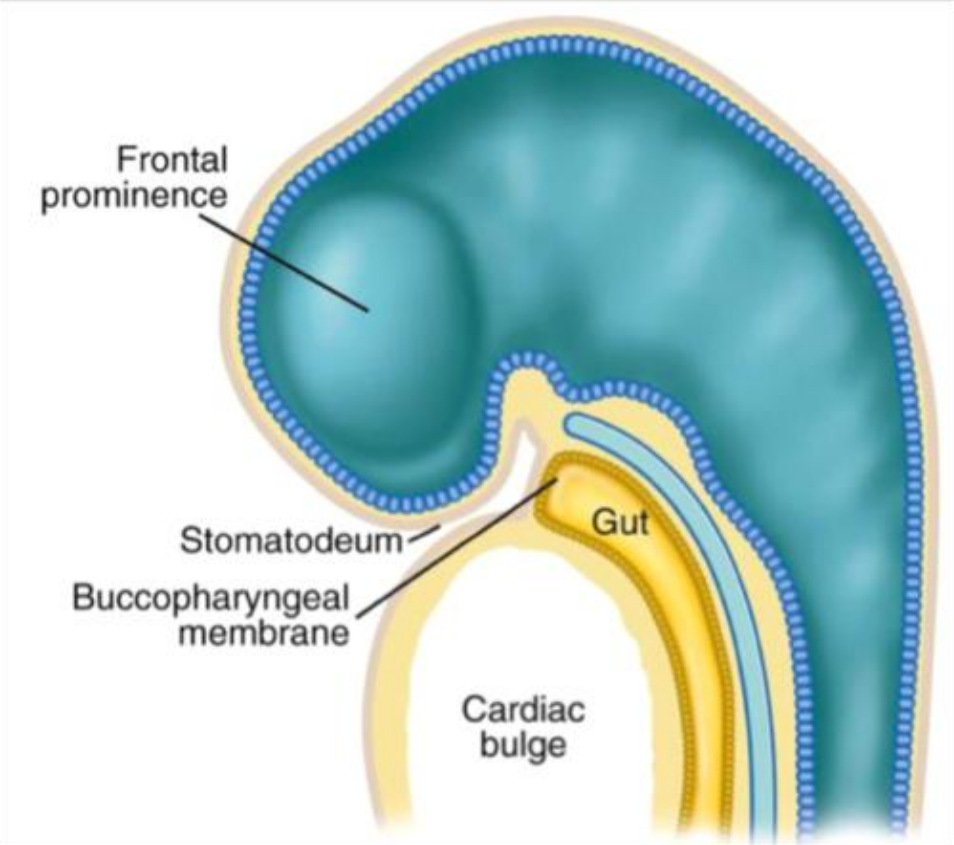
Video…

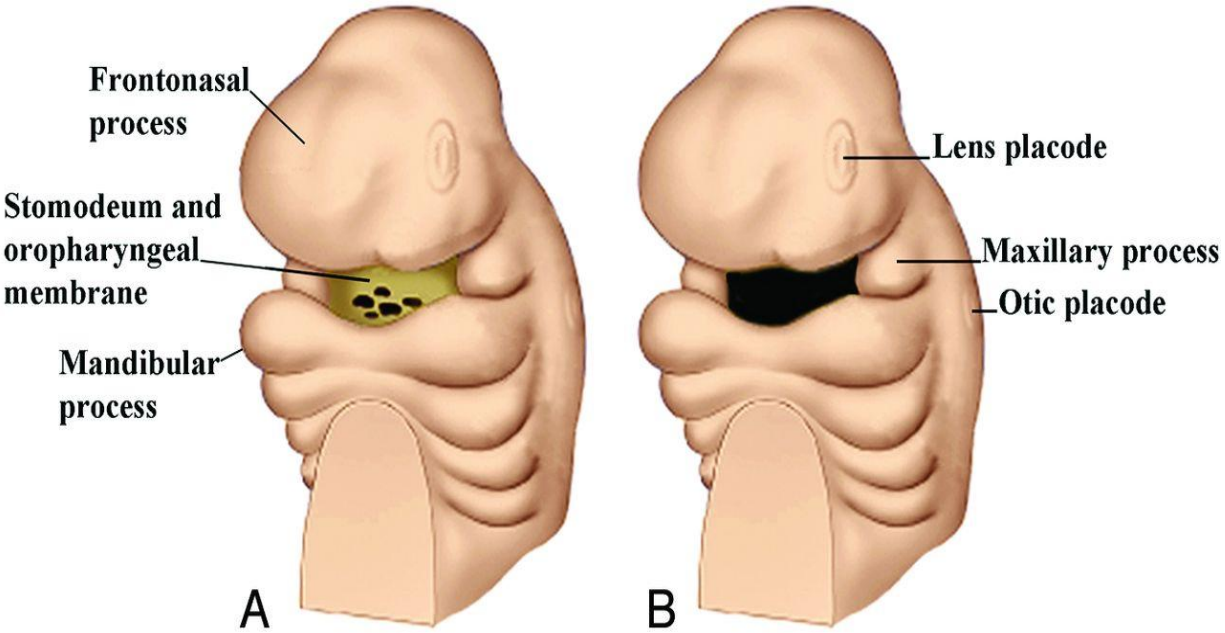
STAGES OF PRENATAL DEVELOPMENT



PRIMITIVE ORAL CAVITY (STOMODIUM) AND BUCCOPHARYNGEAL MEMBRANE

- The primitive oral cavity or stomodeum is lined by stratified squamous epithelium called the oral ectoderm.
- Oral ectoderm contacts the endoderm of gut to form **Buccopharyngeal membrane.**
- It ruptures in 4th week (27th day of gestation) of IUL and connection establish between primitive oral cavity and foregut





Persistent buccopharyngeal membrane

Component of the primary stomodeum

The newly formed stomatodeum lined by 2 – 3 cell **layers** epithelium

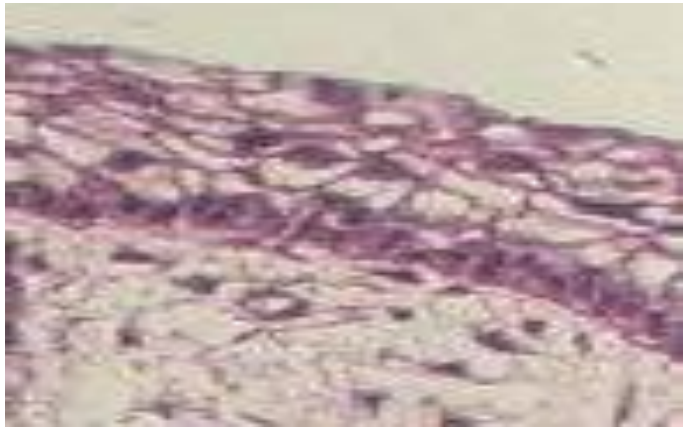
↓

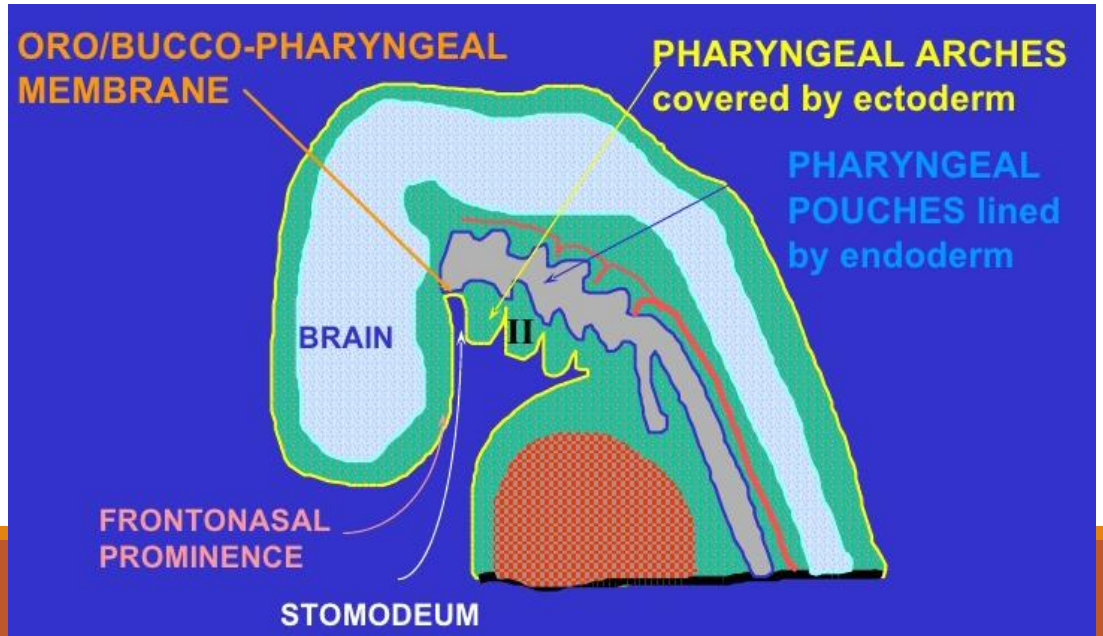
Oral epithelium

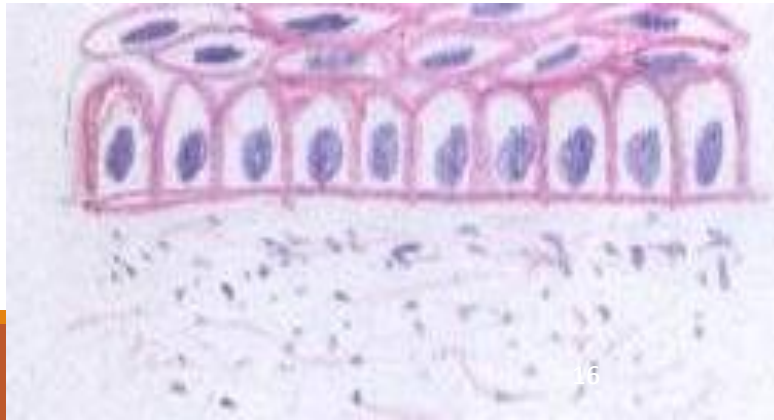
migration of neural crest cells in embryonic connective tissue.

↓

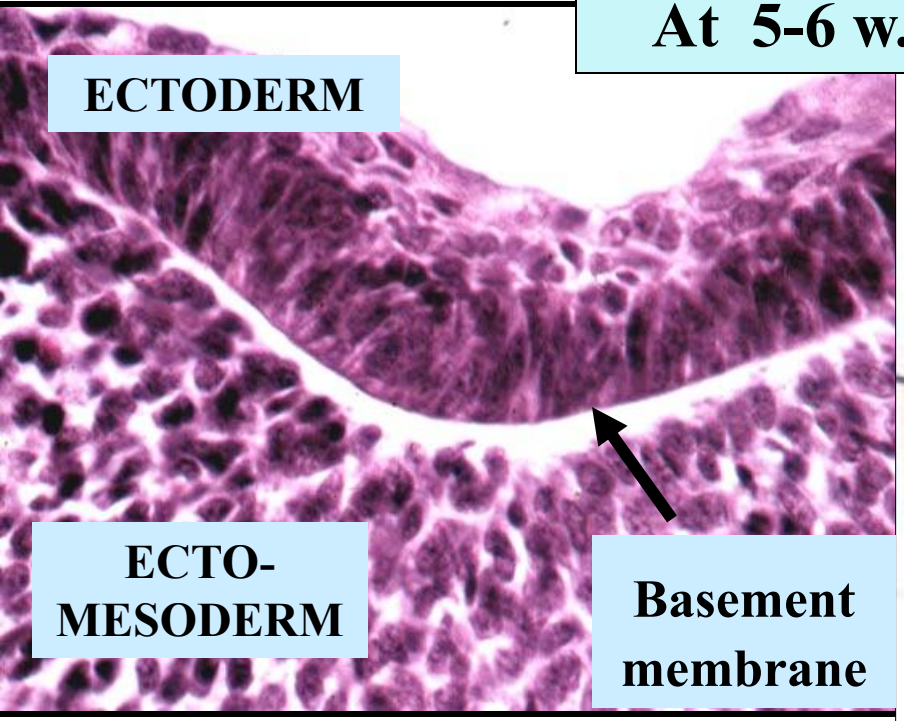
ectomesenchyme

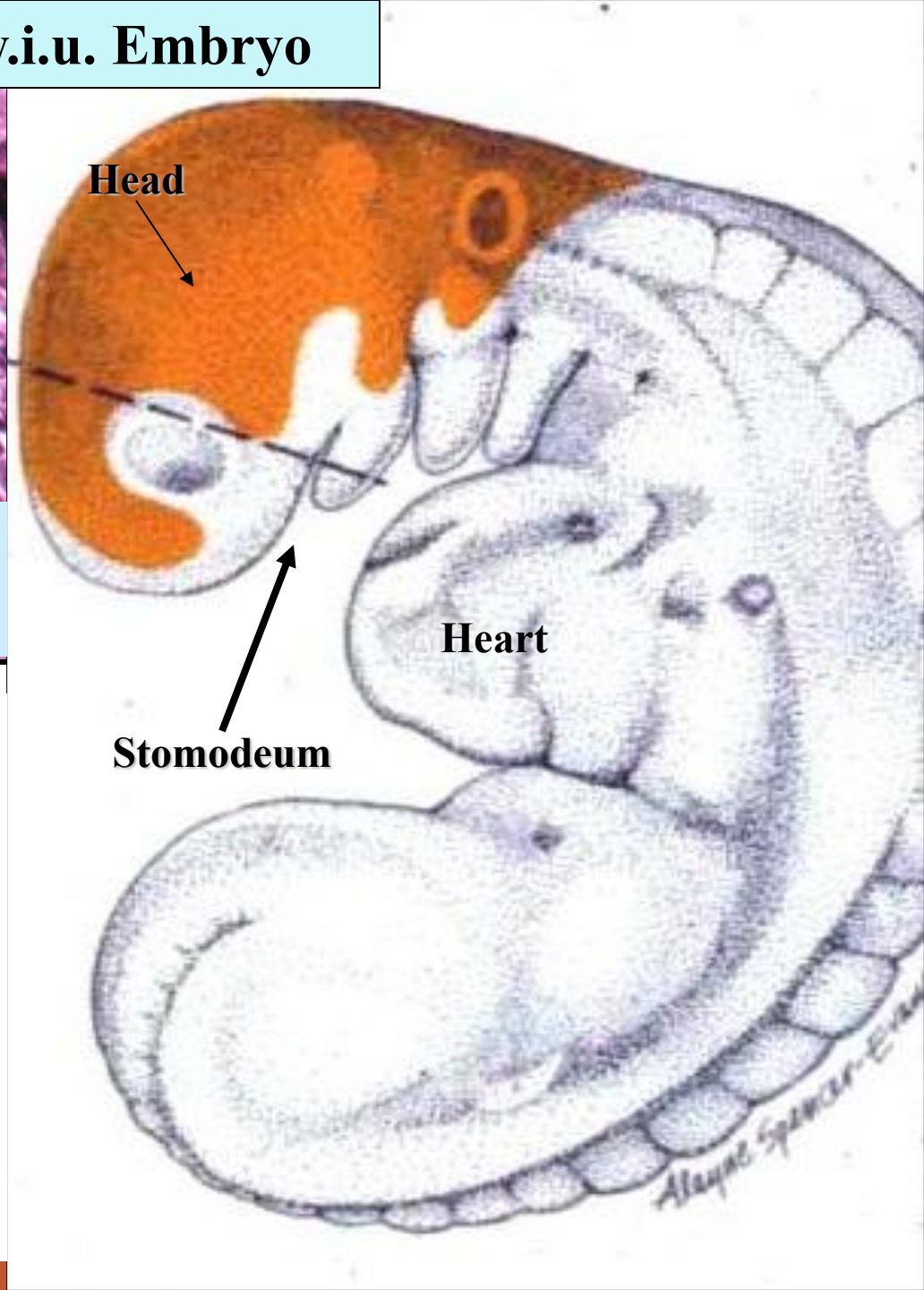






At 5-6 w.i.u. Embryo





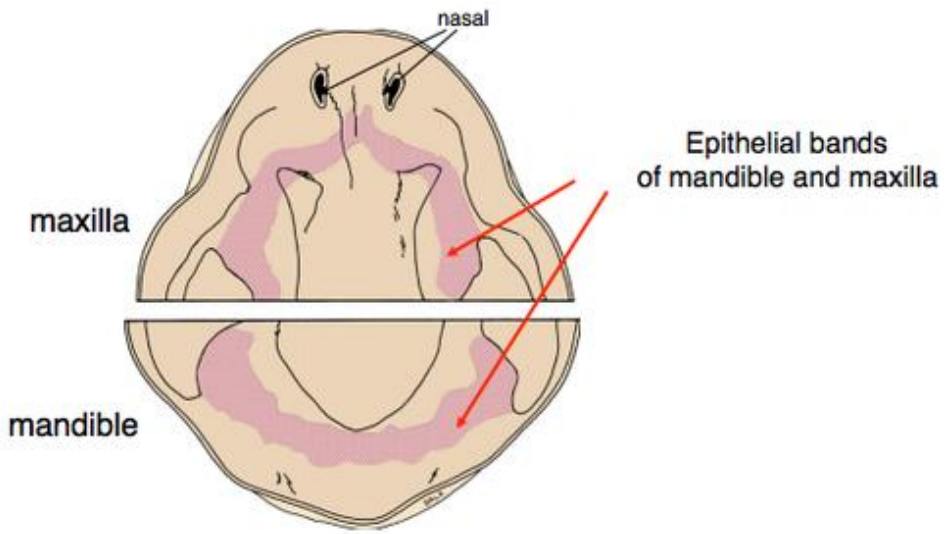
At the age of 5-6 W.I.U., the primitive oral cavity is lined by **ectoderm** composed of 2-3 layers: **basal columnar & superficial flat cells. (Oral Ectoderm)**

The **mesoderm** containing ectomesenchymal cells is separated from the oral ectoderm by a **basement membrane.**

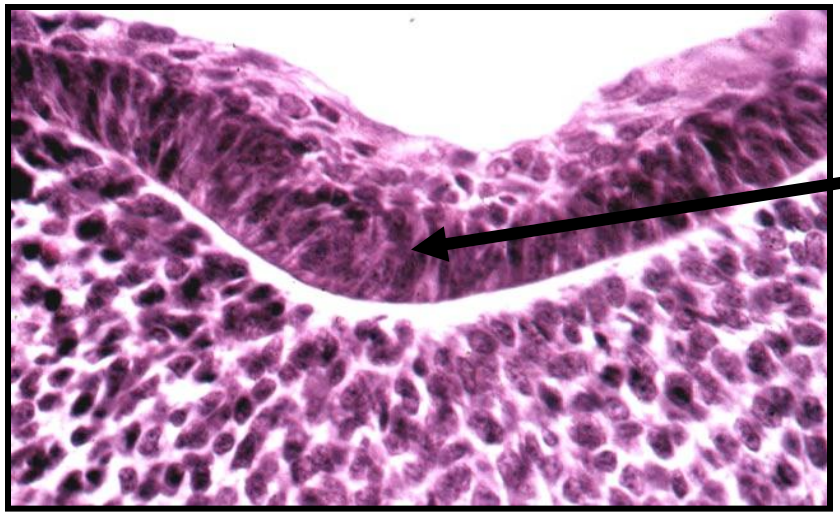
Epithelial proliferation accompanied by ectomesenchyme condensation

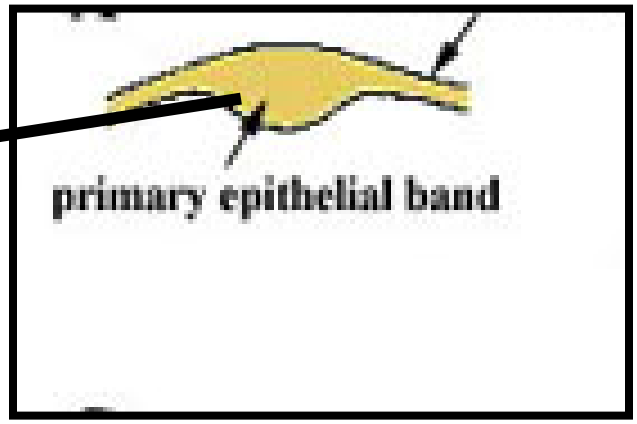
Under the influence of the ectomesenchyme (neural crest cells), ectodermal proliferation in in specific areas of the upper and lower jaws of the primitive stomodeum into **the underlying connective tissue.**

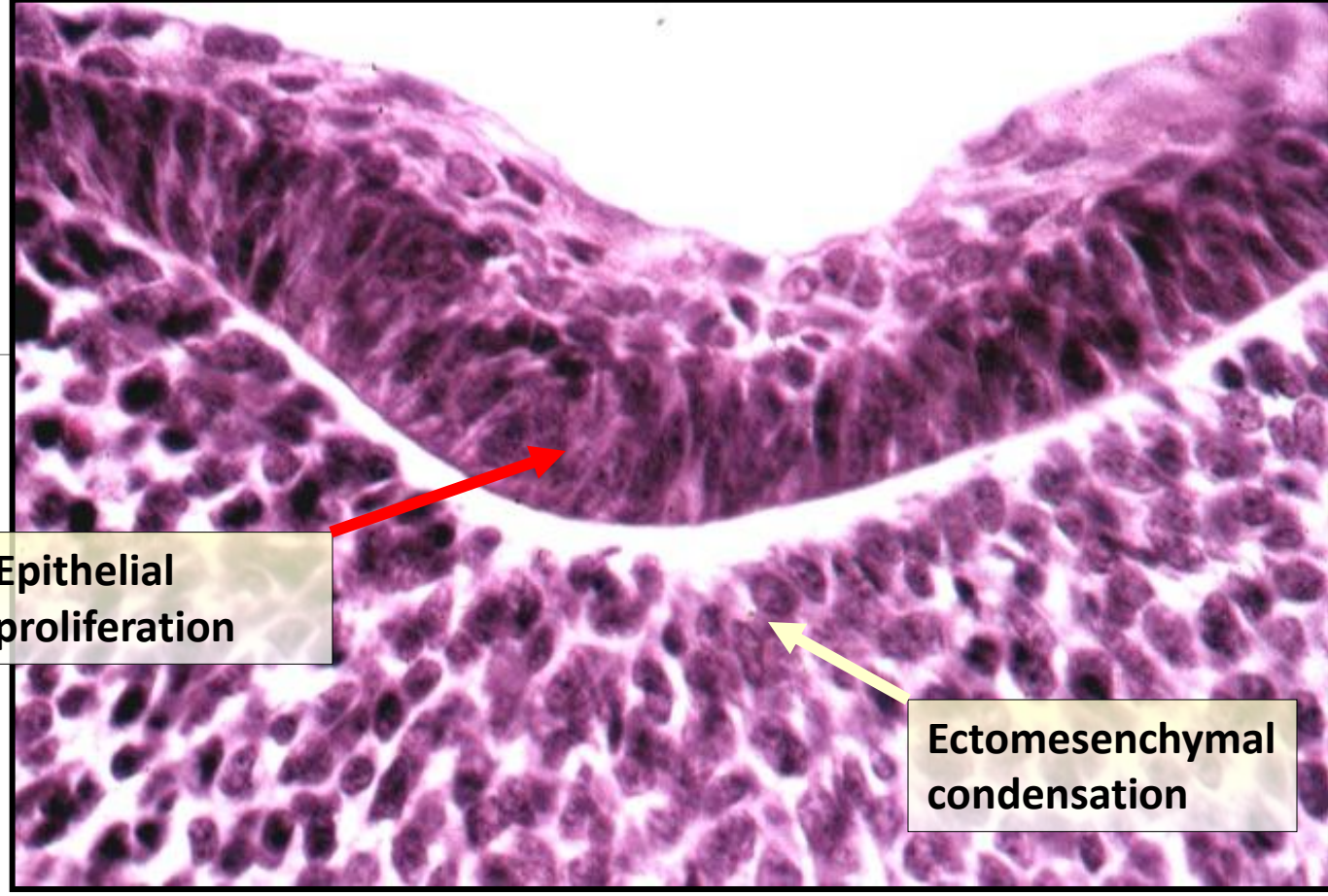
This leads to development of 2 epithelial thickenings having a **horse shoe shaped bands** corresponding to the future upper and lower dental arches. These horse shoe shaped bands are called **"primary epithelial band".**



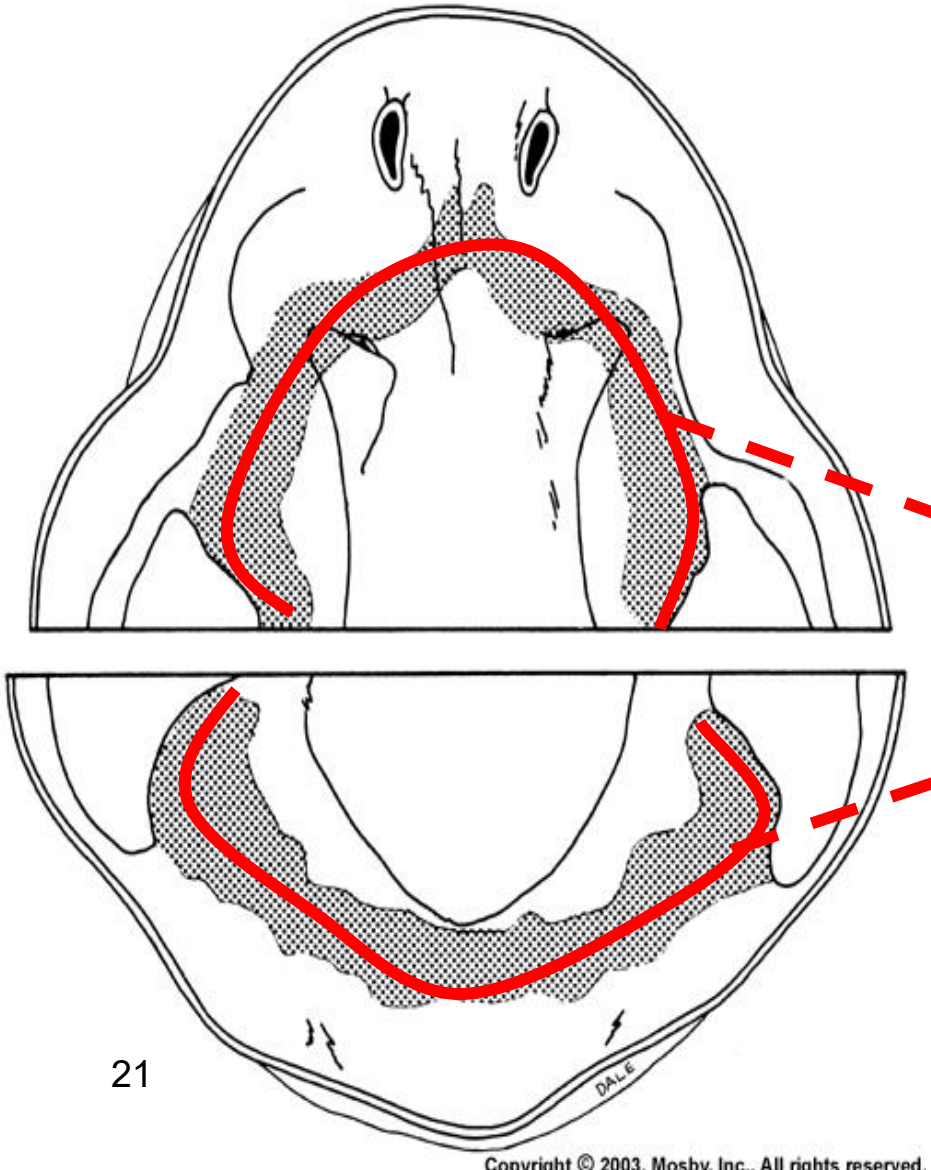
Primary epithelial band







Epithelial proliferation accompanied by ectomesenchyme condensation



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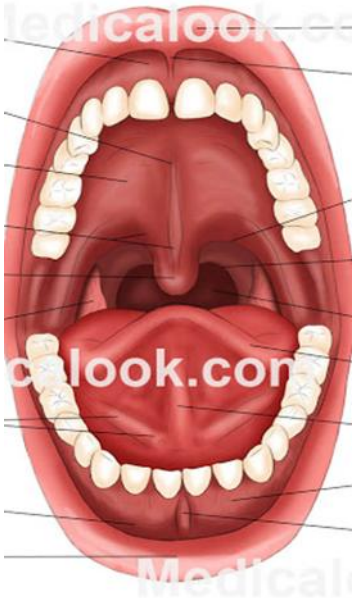


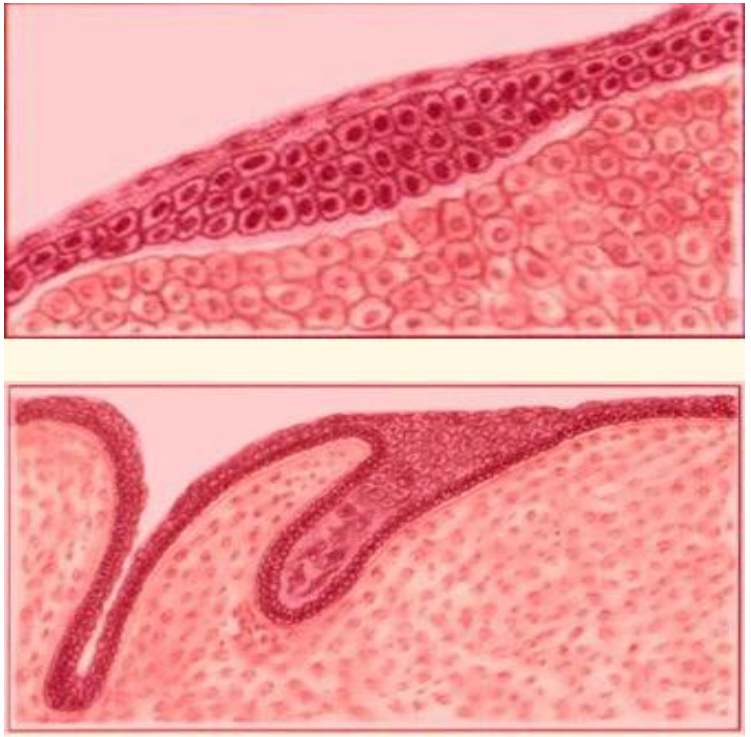
Primary epithelial bands

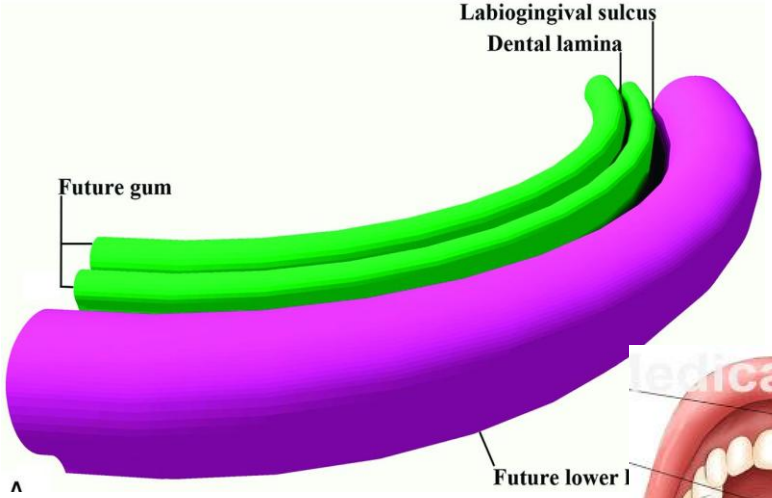
Primary epithelial band gives rise to 2 Laminae

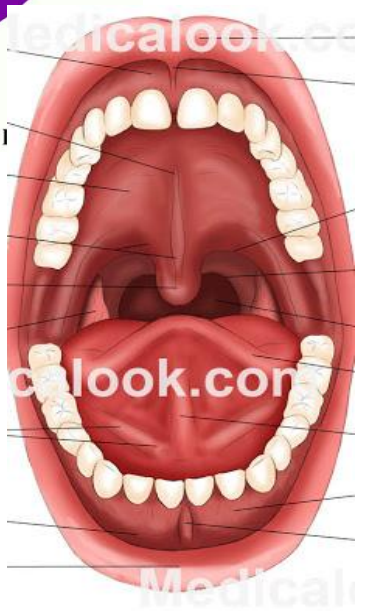
1. Dental Lamina (gives teeth)

2. Vestibular Lamina(forms the vestibule)

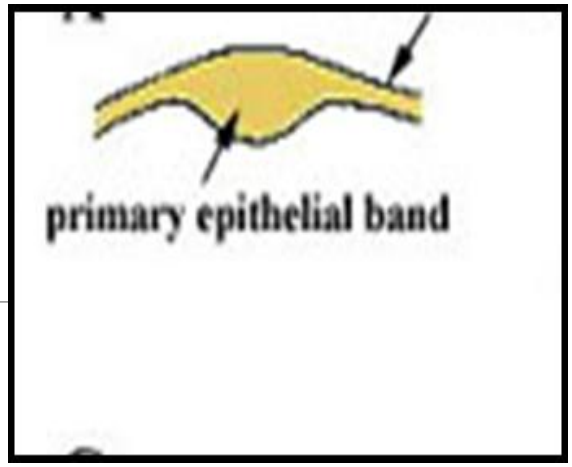
Primary epithelial band

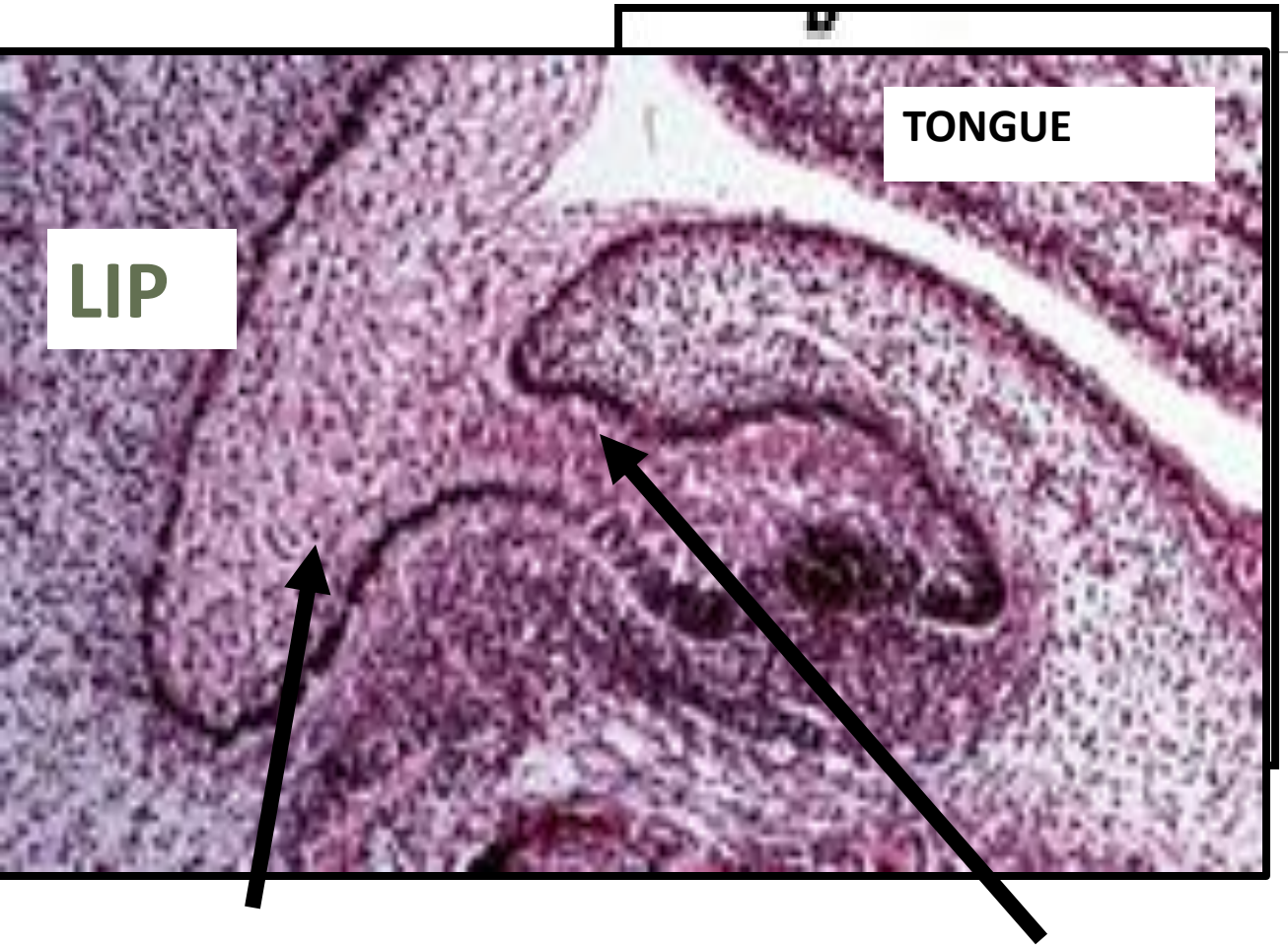




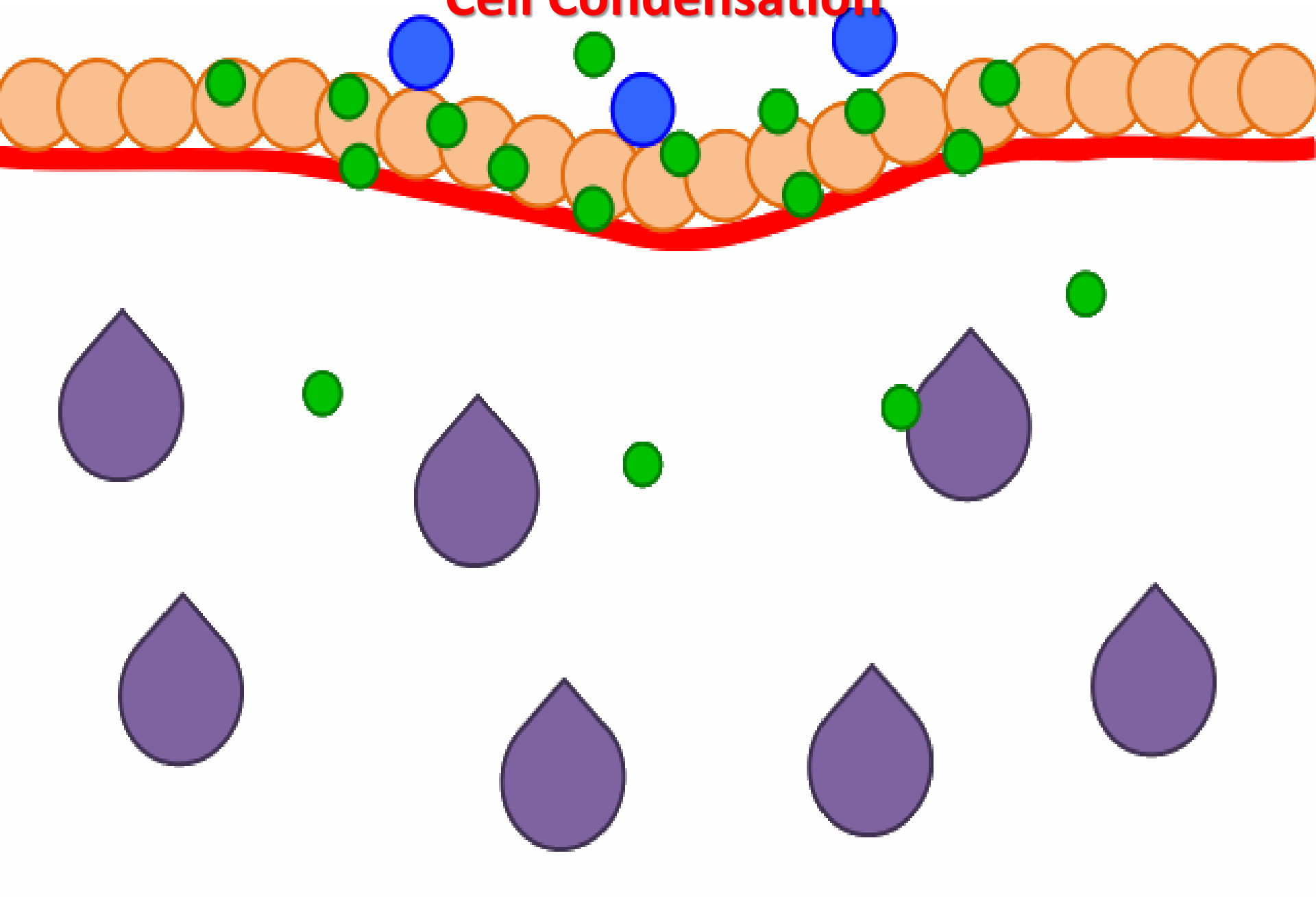


Vestibular and Dental laminae

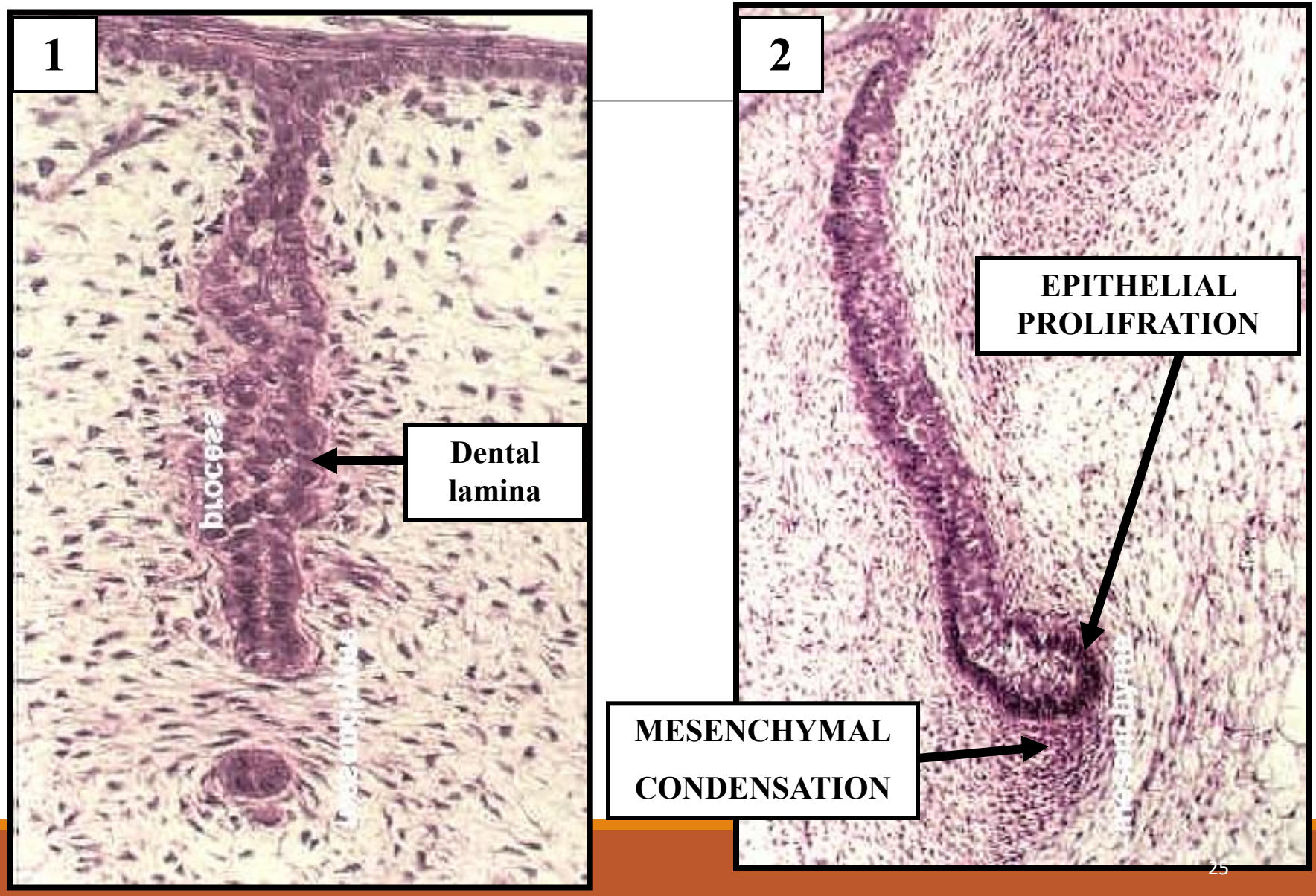

primary epithelial band


TONGUE
LIP
Vestibular lamina
Dental lamina

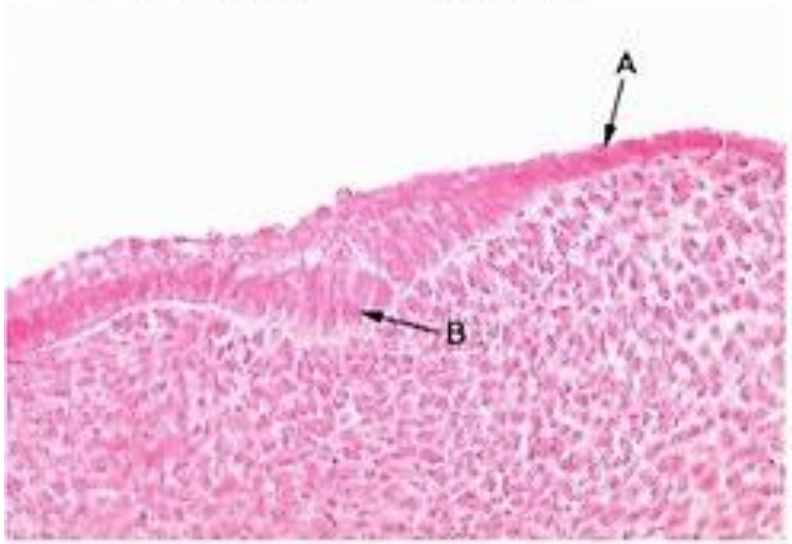
Cell Condensation



Dental lamina

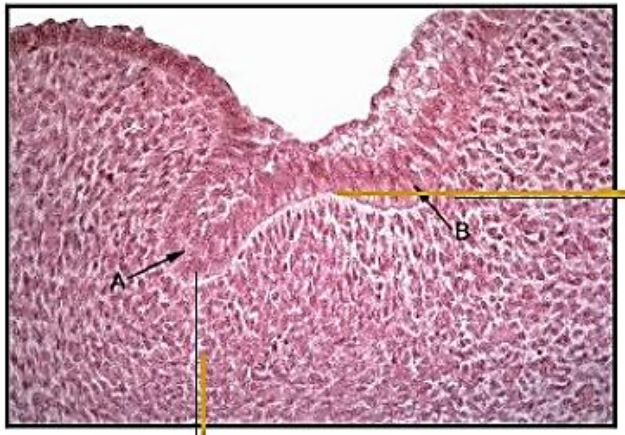


A - oral epithelium
B - primary epithelial band



A - primary epithelial band
B - dental lamina
C - vestibular lamina

7th week



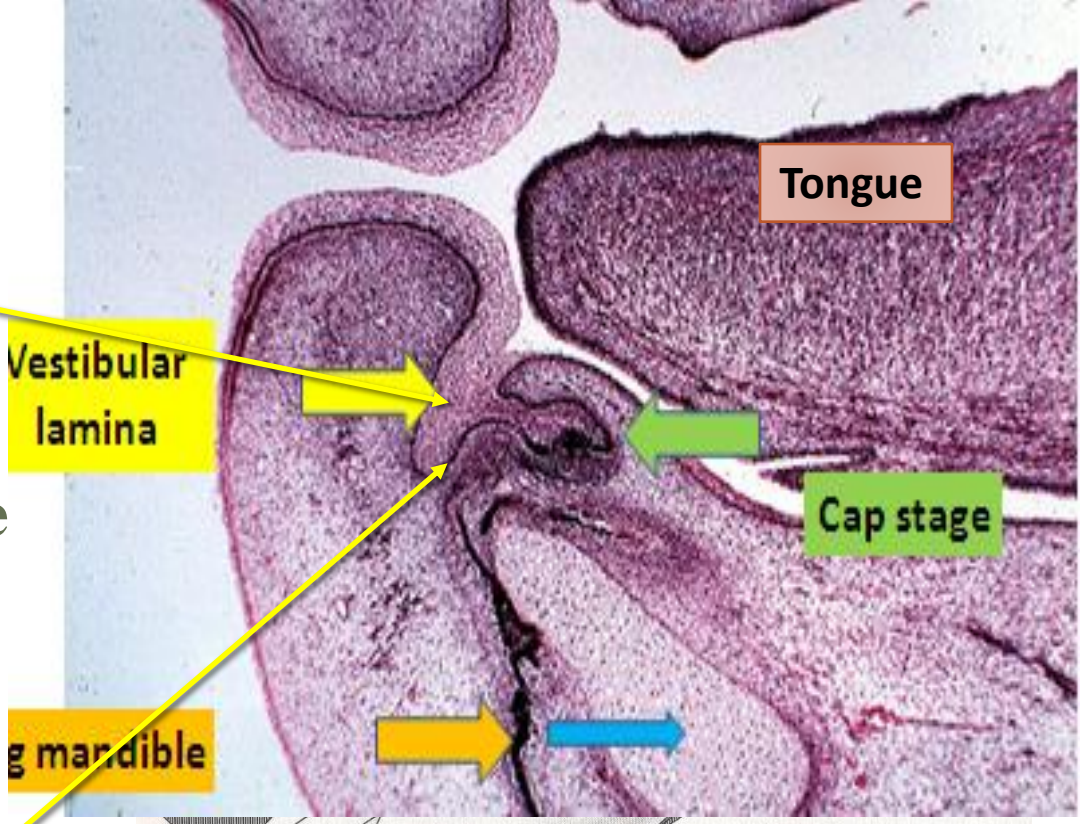
Buccally located
Vestibular lamina

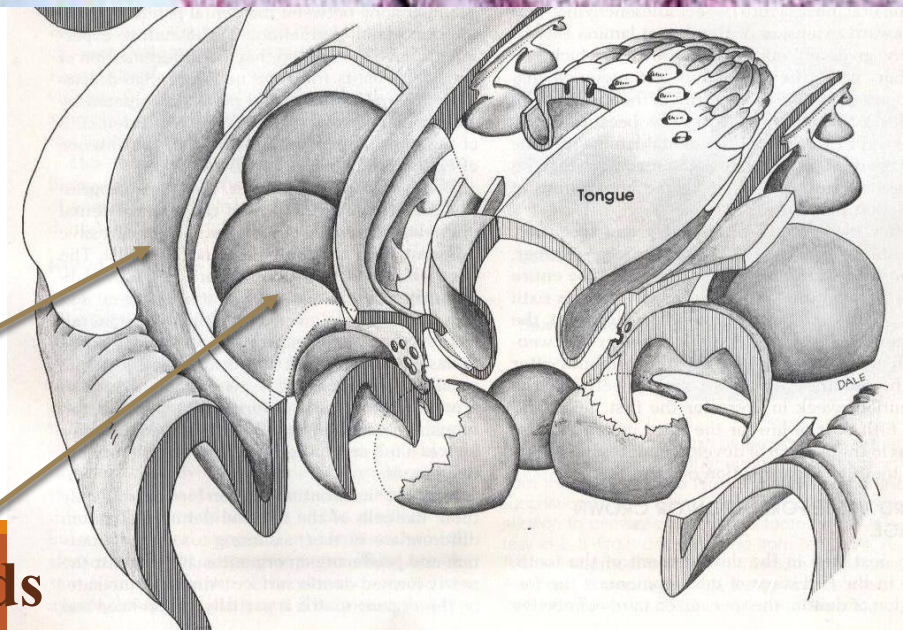
Lingually dental lamina

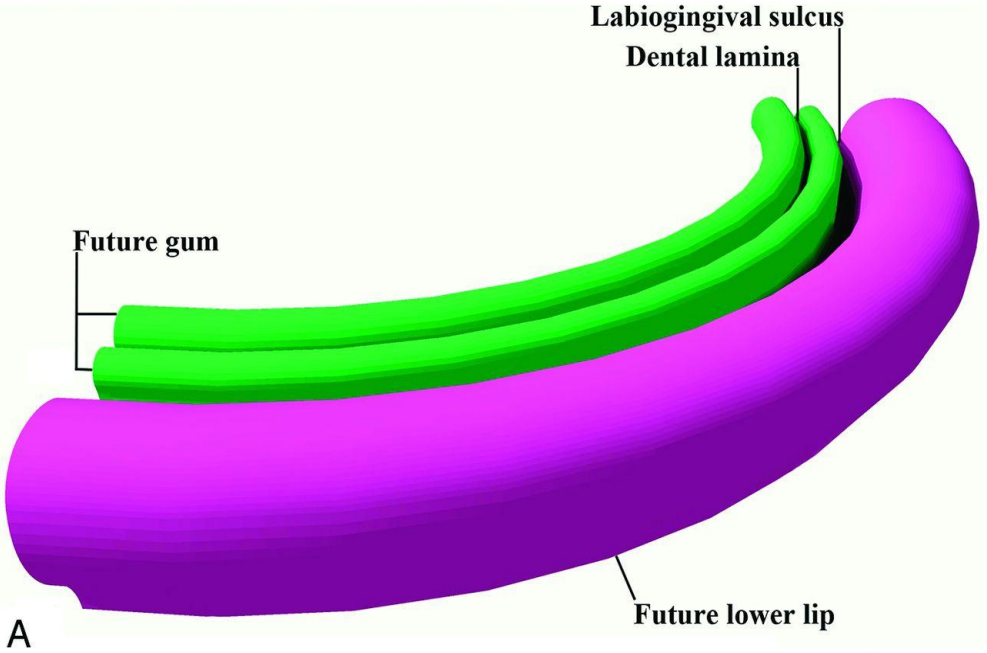
2- VESTIBULAR LAMINA

The vestibular lamina is formed as ectodermal proliferation in the underlying ectomesenchyme buccal to the dental lamina.

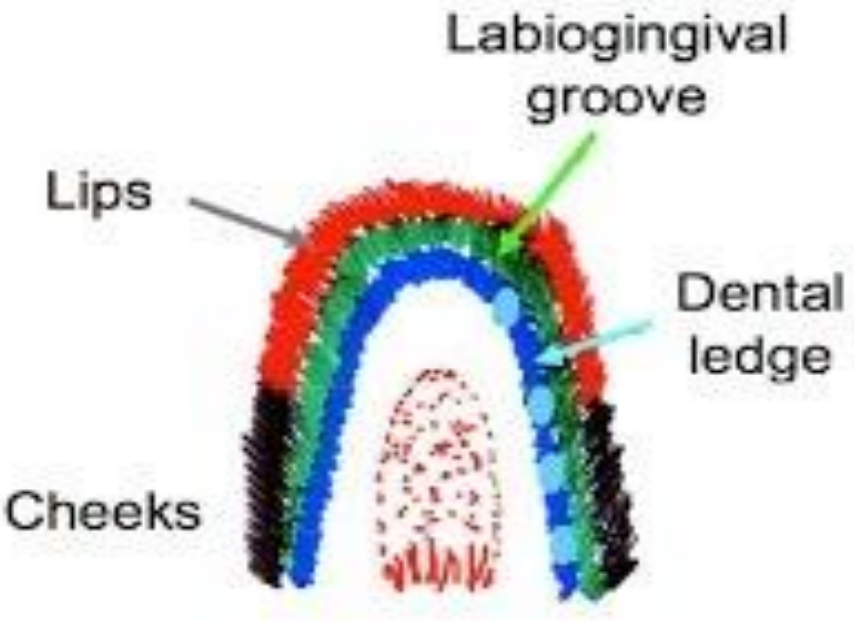
Epithelial degeneration & clifting occurs inside the vestibular lamina to form a groove that will form later the oral vestibule separating the cheek & lip from the teeth bearing area.



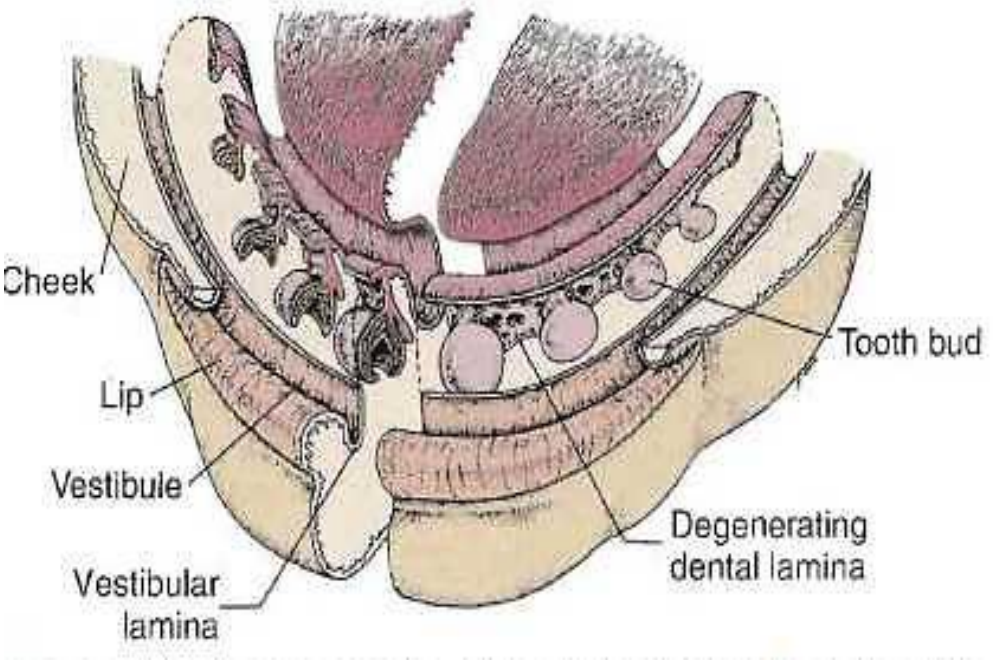


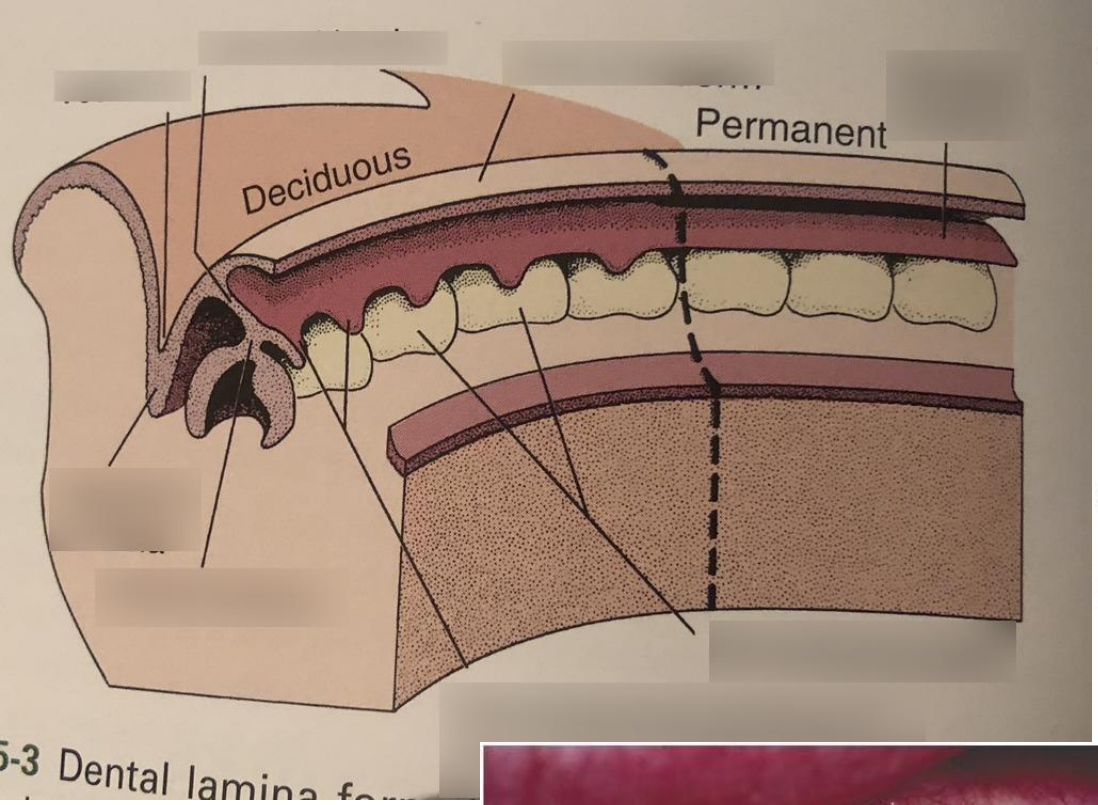

Labiogingival sulcus
Dental lamina
Future gum
Future lower lip

A

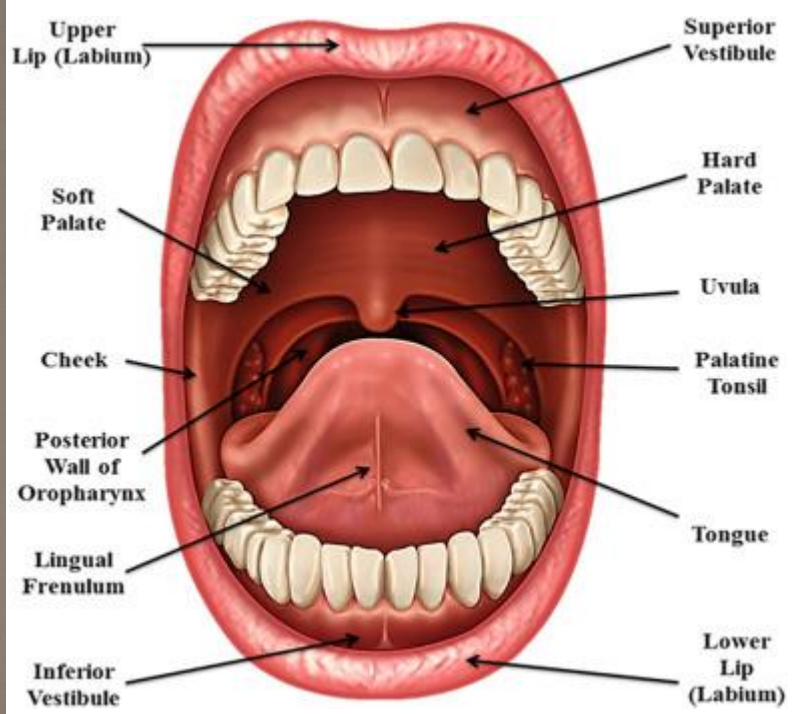

Labiogingival groove
Lips
Dental ledge
Cheeks

B


Cheek
Tooth bud
Lip
Vestibule
Degenerating dental lamina
Vestibular lamina

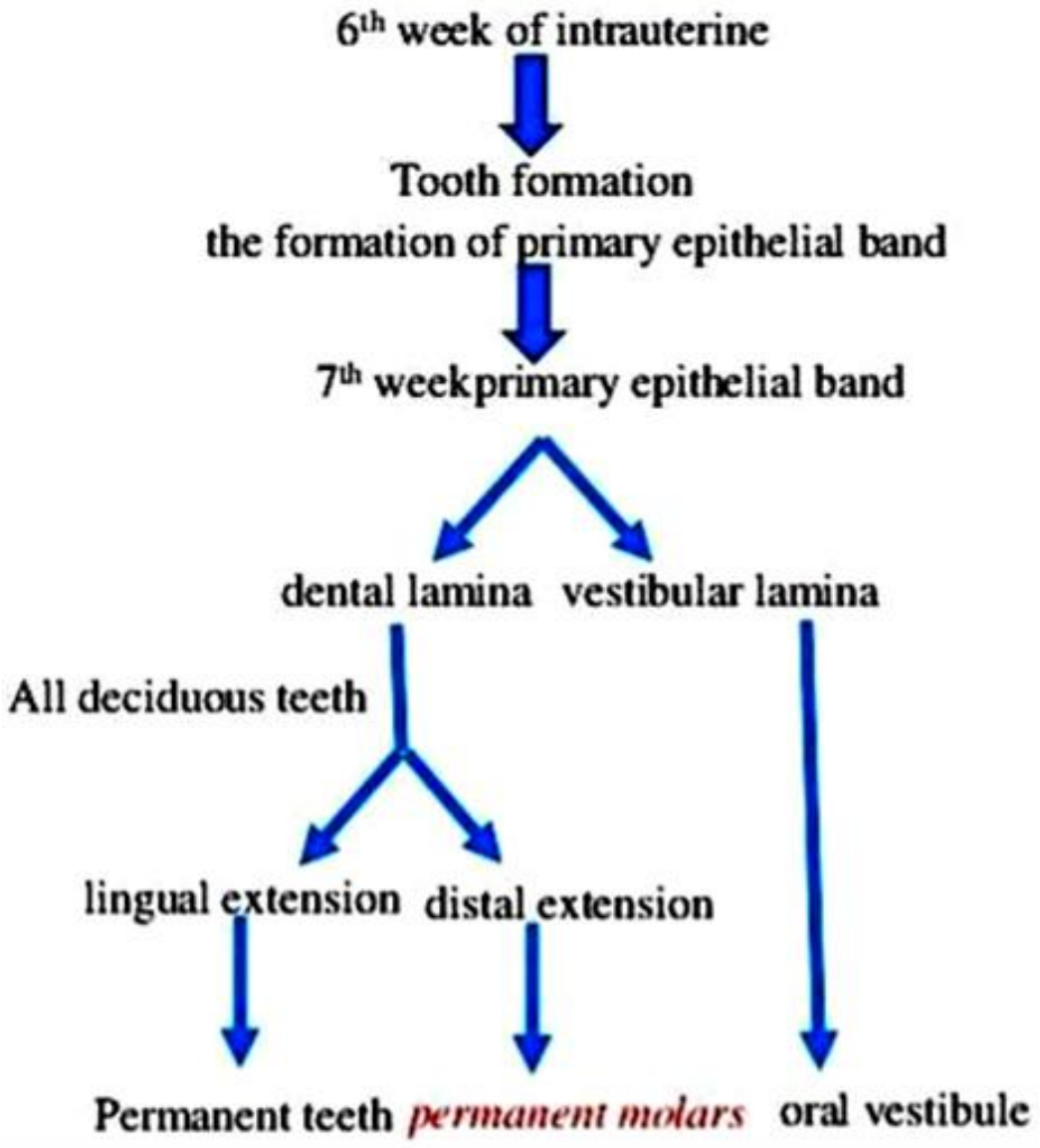


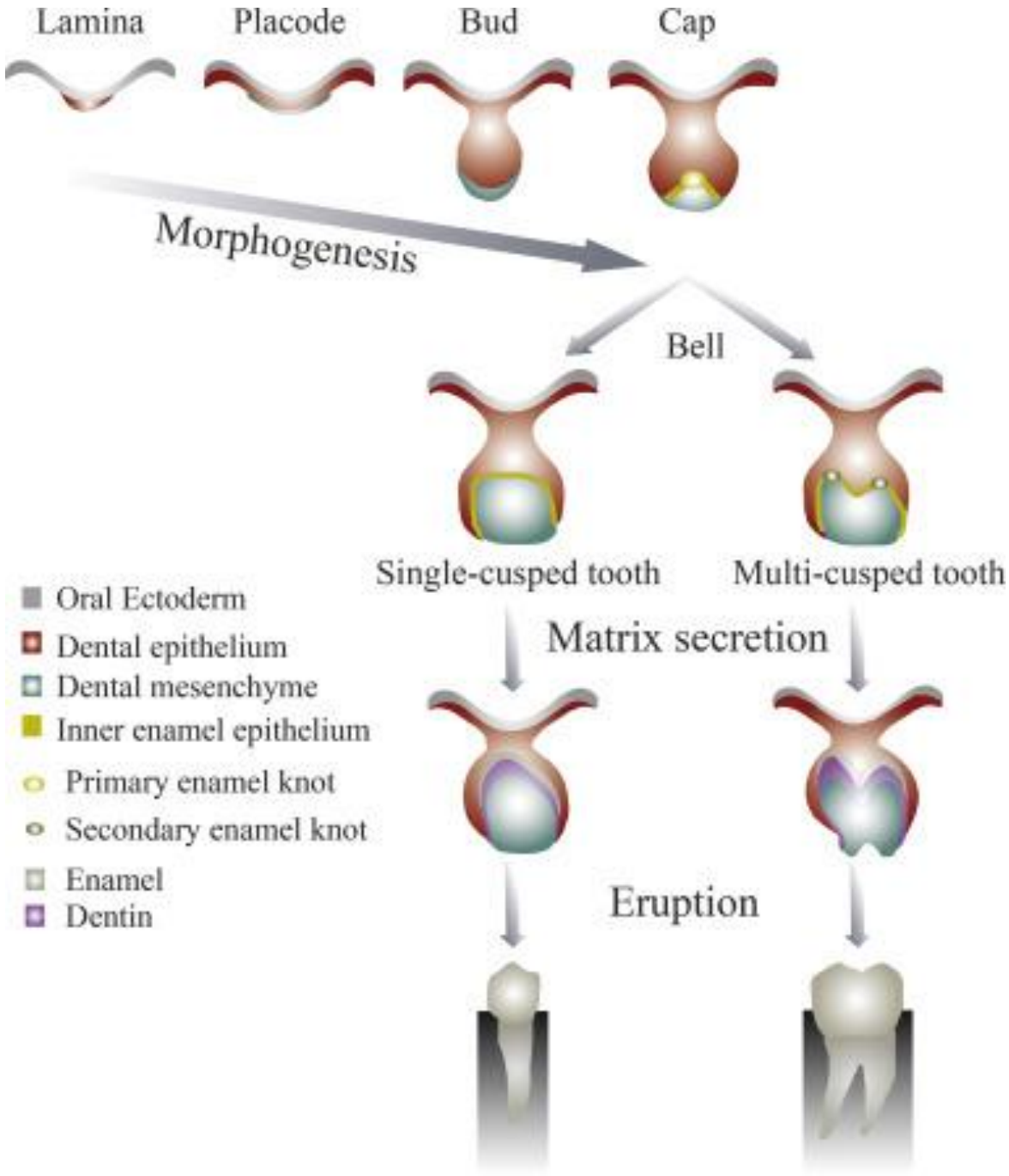
5-3 Dental lamina



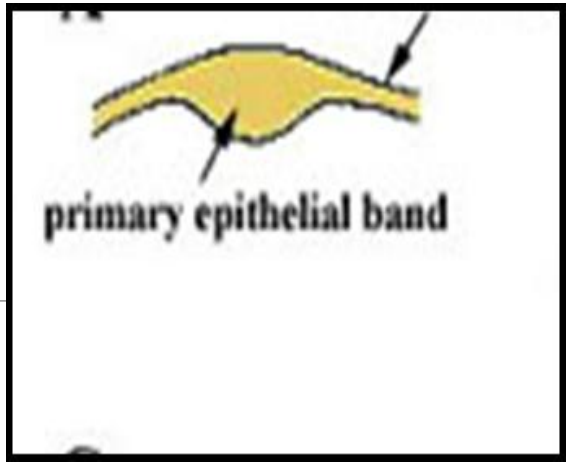
(From Liebgott B: The anatomical basis of dentistry, ed 3, St Louis, 2010, Mosby.)

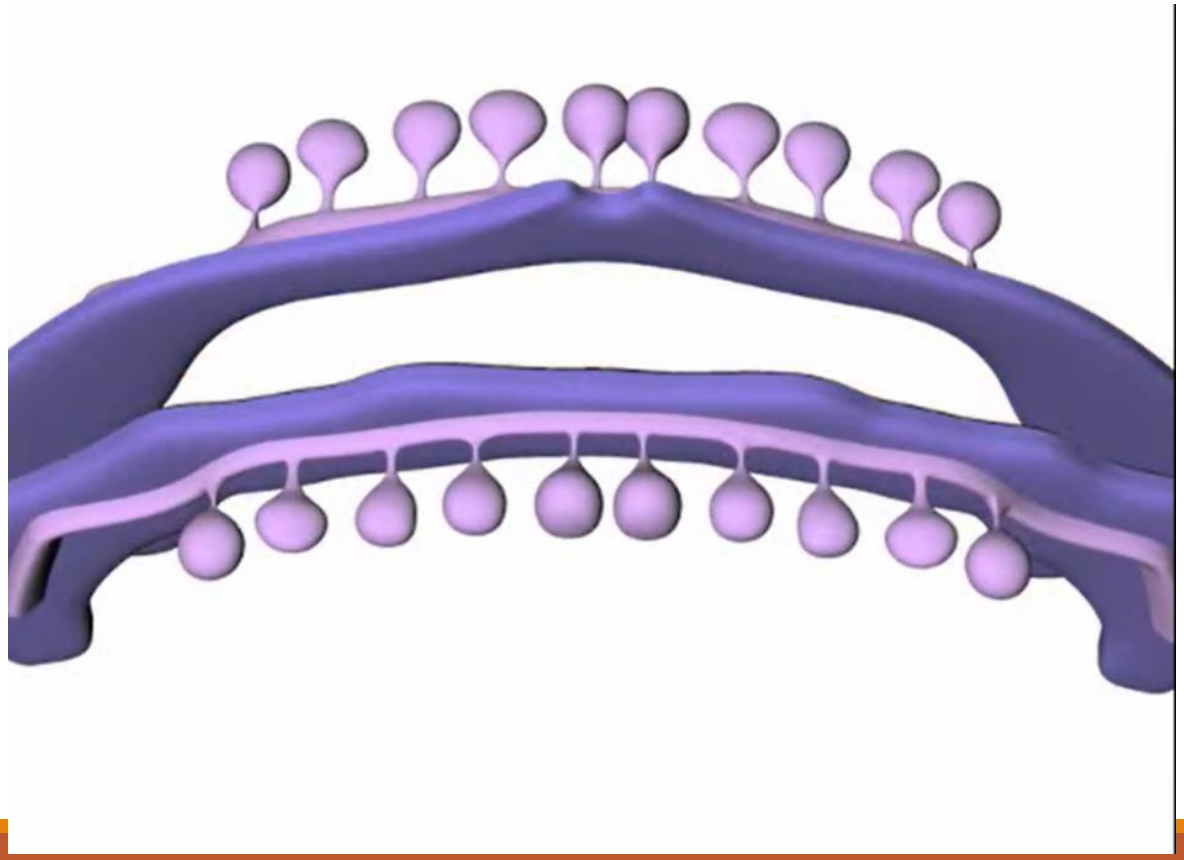
Types of laminae and their derivatives

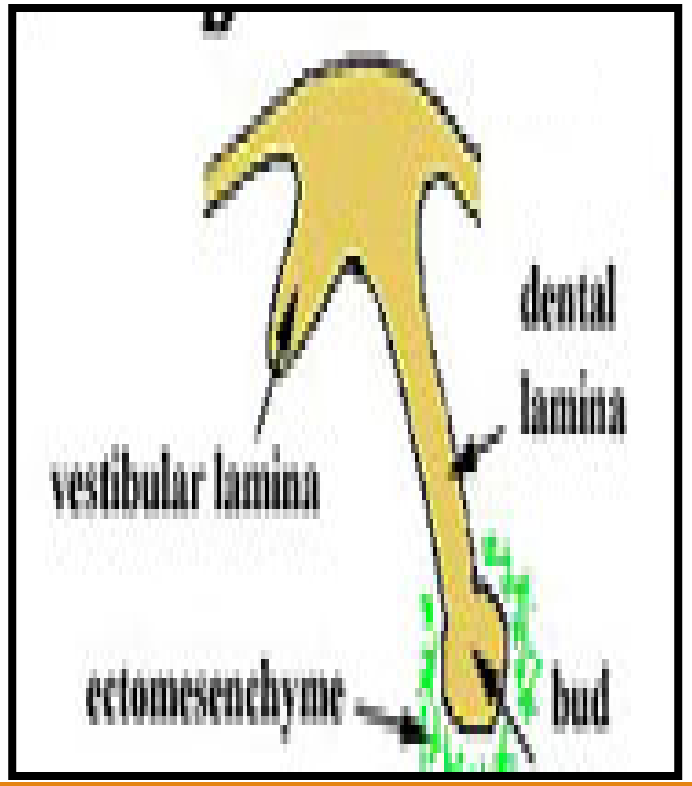



Lamina
Placode
Bud
Cap
Morphogenesis
Bell
Single-cusped tooth
Multi-cusped tooth
Matrix secretion
Eruption
Oral Ectoderm
Dental epithelium
Dental mesenchyme
Inner enamel epithelium
Primary enamel knot
Secondary enamel knot
Enamel
Dentin

Twenty tooth buds begins to appear on Dental lamina in the approximately position of primary teeth



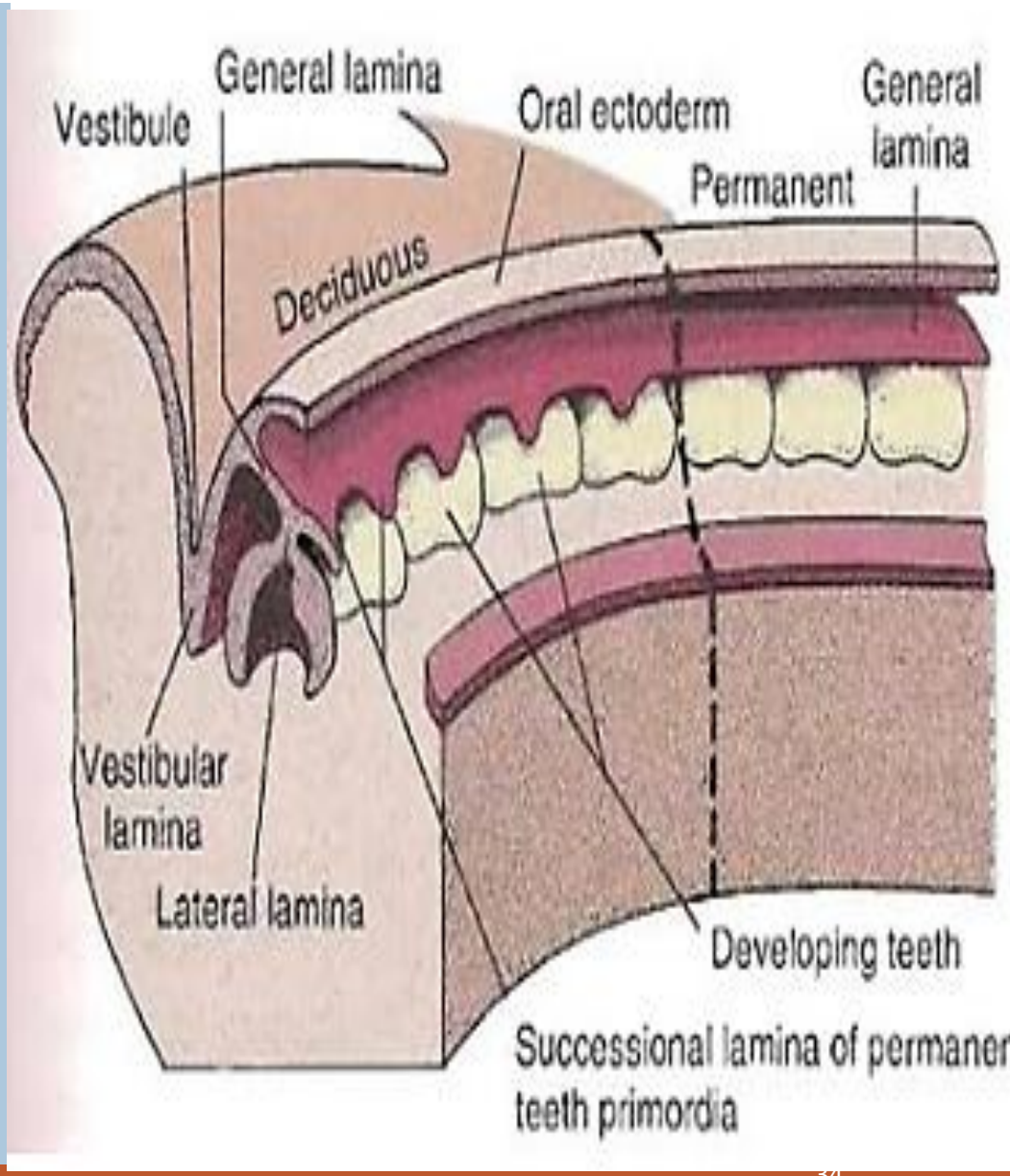




- As each tooth reaches the bell stage the connection with the dental lamina begins to break down

-This happens 1st in anteriors and spread posteriorly

-The primary tooth lamina is now known as the **lateral lamina** (named so as it describes its relation to the successional lamina

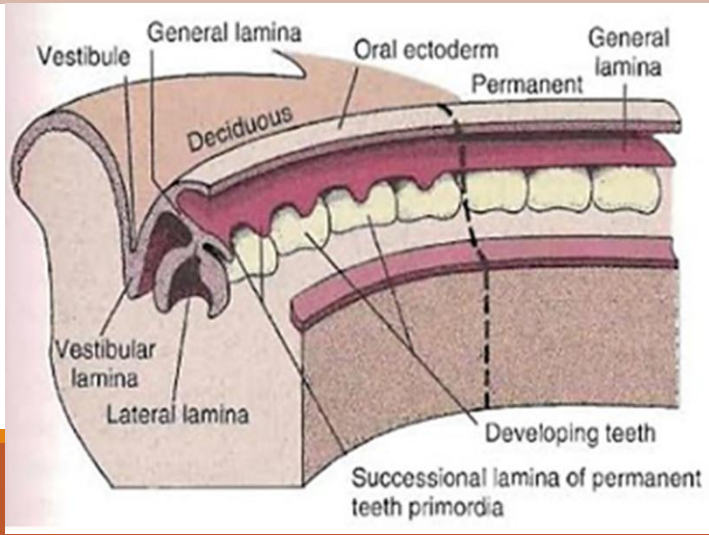


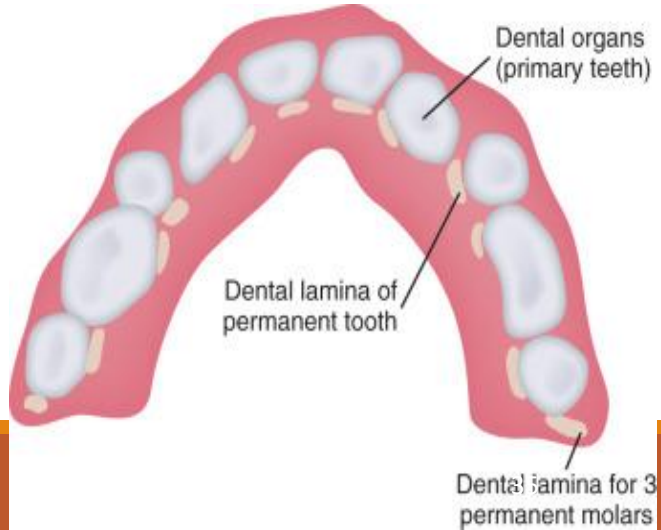
SUCCESSIONAL LAMINA

- In developing primary teeth the dental lamina develops a lingual extension known as SUCCESSIONAL LAMINA which is responsible for formation of the permanent successors.
- Successional lamina go through all stages of tooth development (bud, cap ,bell) and form permanent teeth (incisors , canines and premolars)

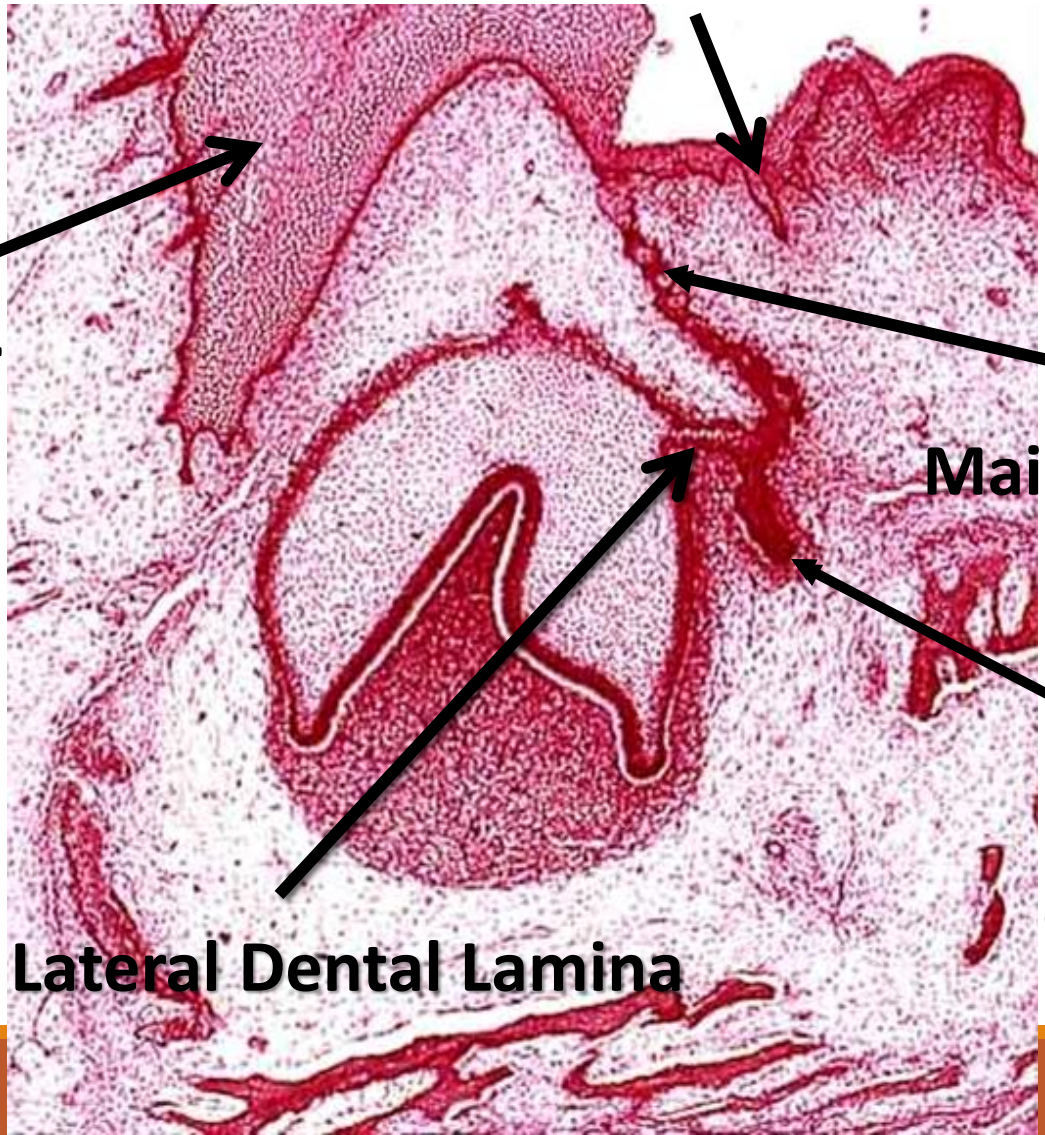
PERMENENT MOLARS develop from a DISTAL EXTENSION OF DENTAL LAMINA and are non successional

THE PERMENET TEETH DEVELOP SLOWER THAN PRIMARY TEETH



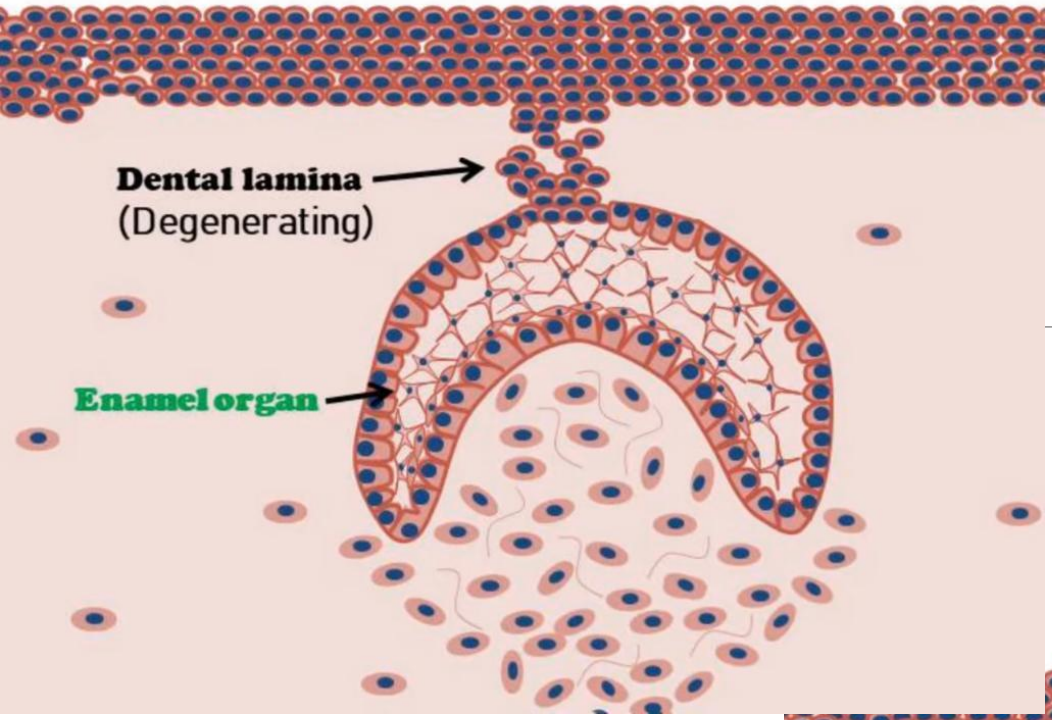


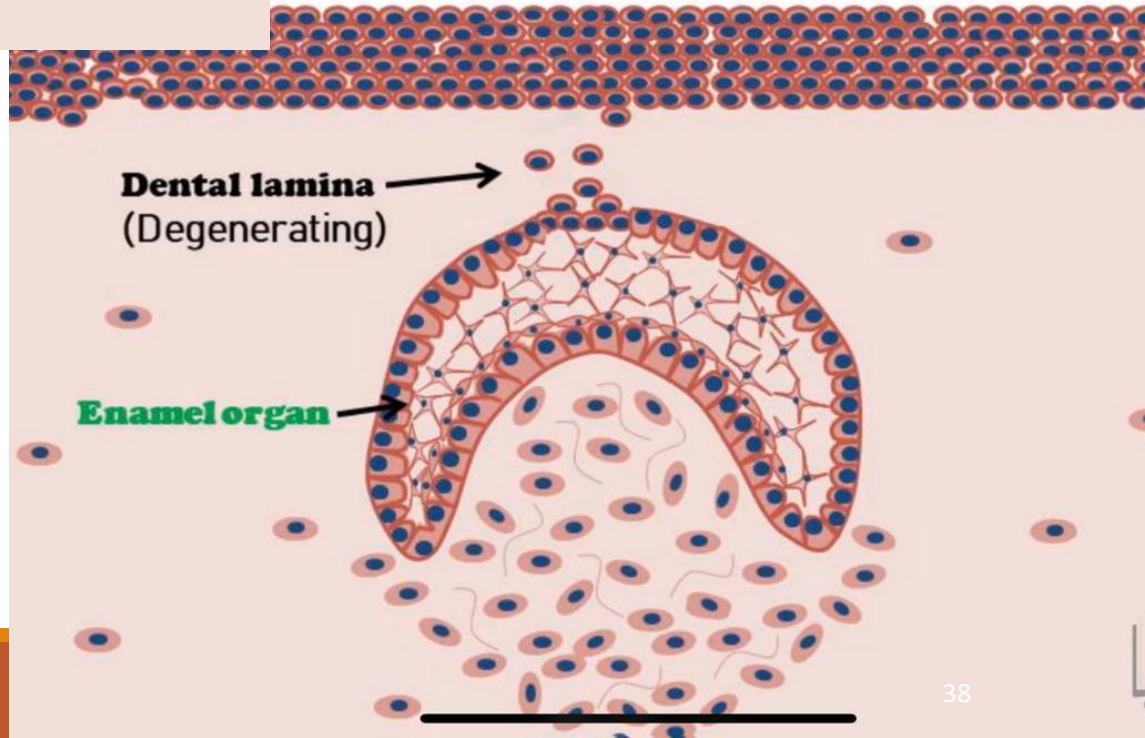
Different types of laminae

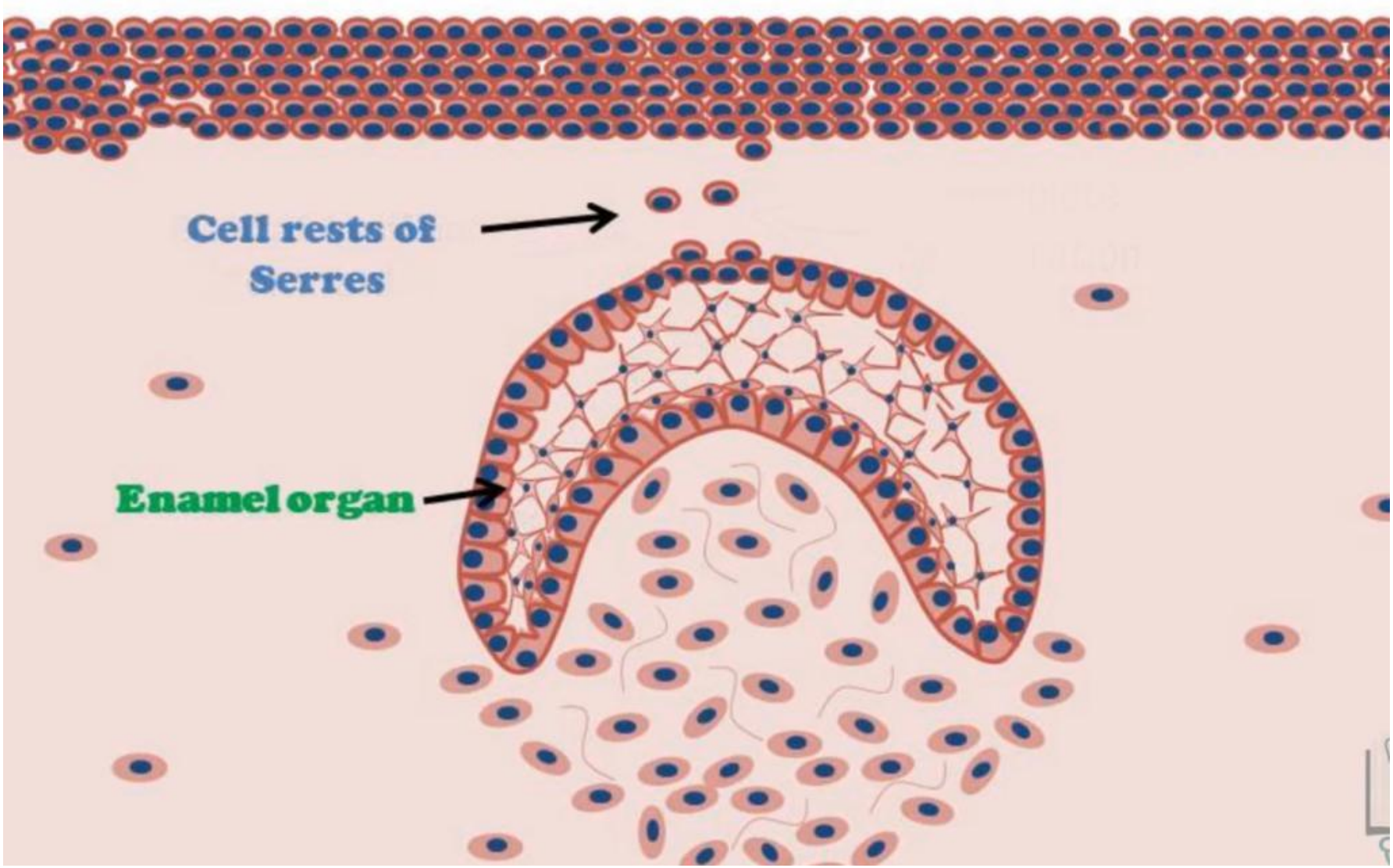


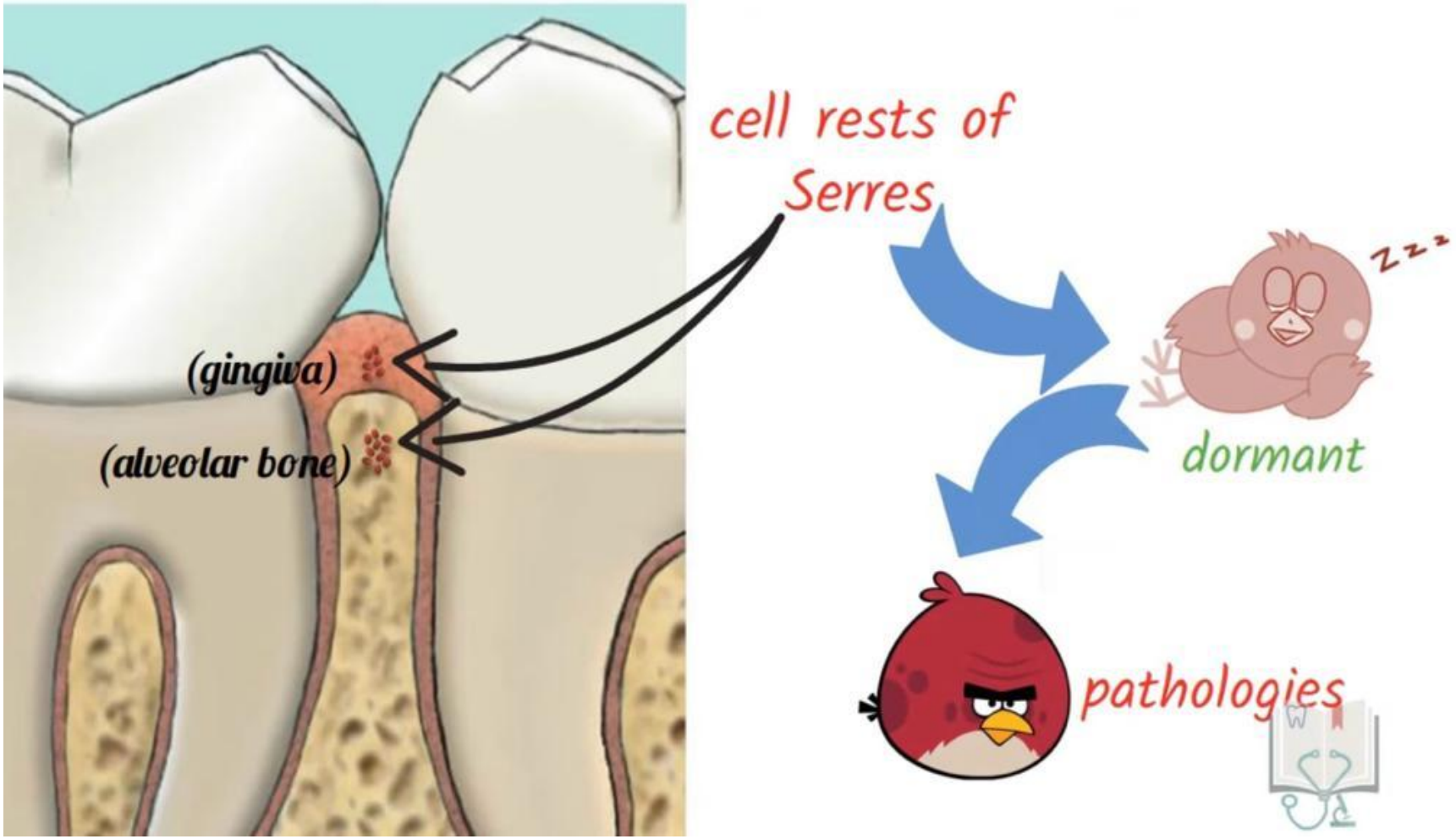
FATE OF DENTAL LAMINA

- Soon after tooth development the dental lamina starts degenerate
- In third molar region: **5 years**
- As the tooth develops the connection breaks and islands of epithelial cell remain within the jaws and gingiva – **“cell rests of serre”**


Dental lamina
(Degenerating)
Enamel organ


Dental lamina
(Degenerating)
Enamel organ


Cell rests of
Serres
Enamel organ


cell rests of Serres
(gingiva)
(alveolar bone)
dormant
pathologies


THANK YOU!