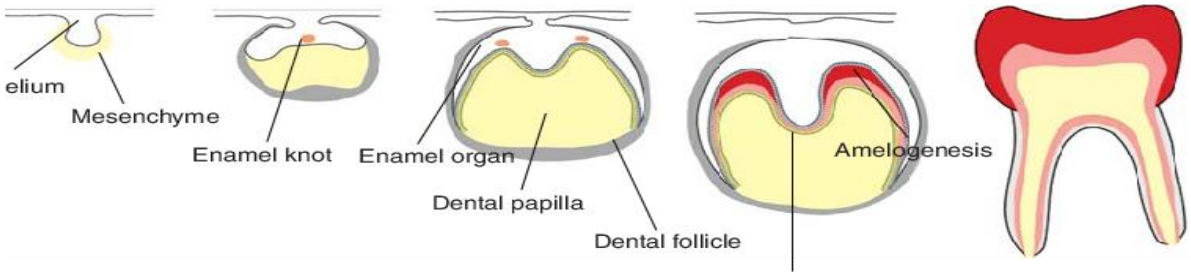
LECTURE
DEVELOPMENT OF TOOTH(ODONTOGENESIS)
PART-II



DR SAJDA GAJDHAR
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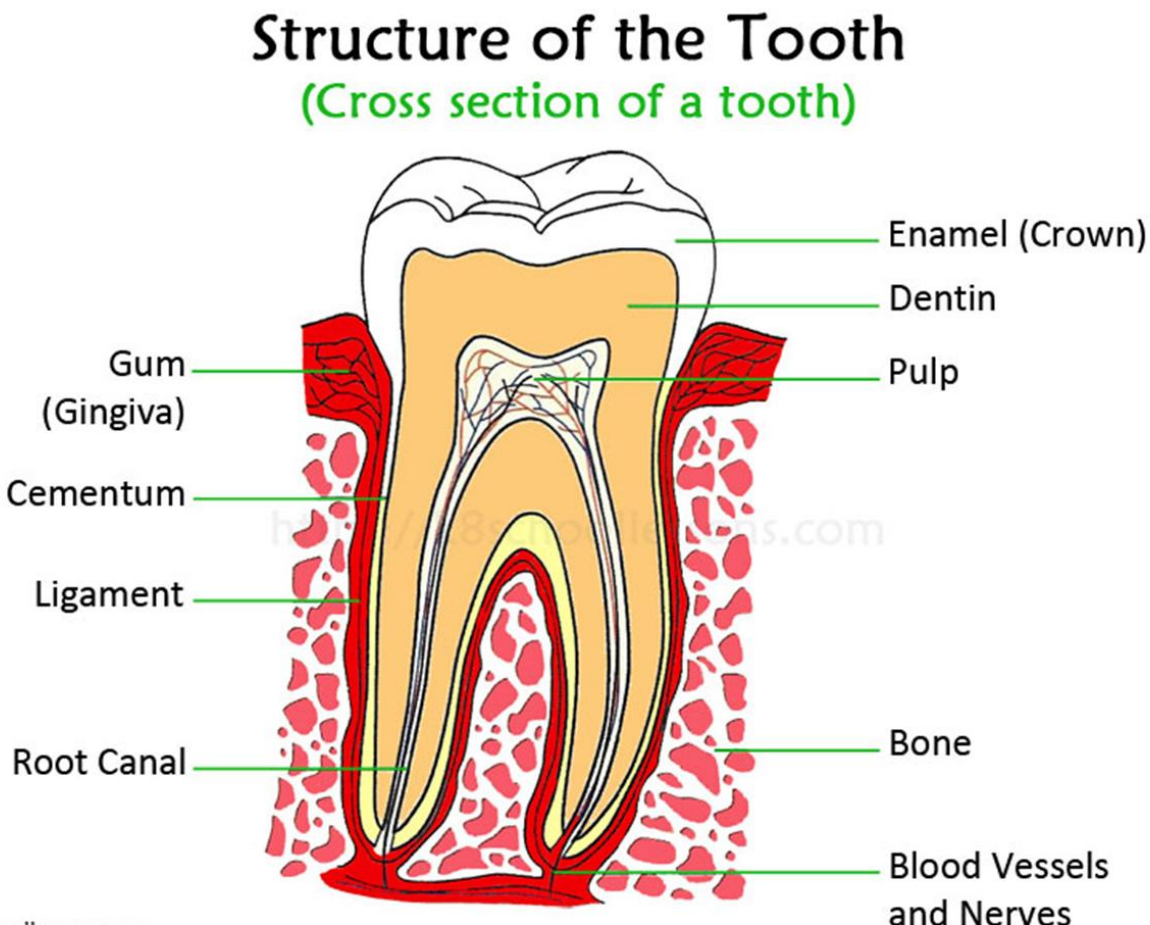
ORAL CAVITY IN HEALTH

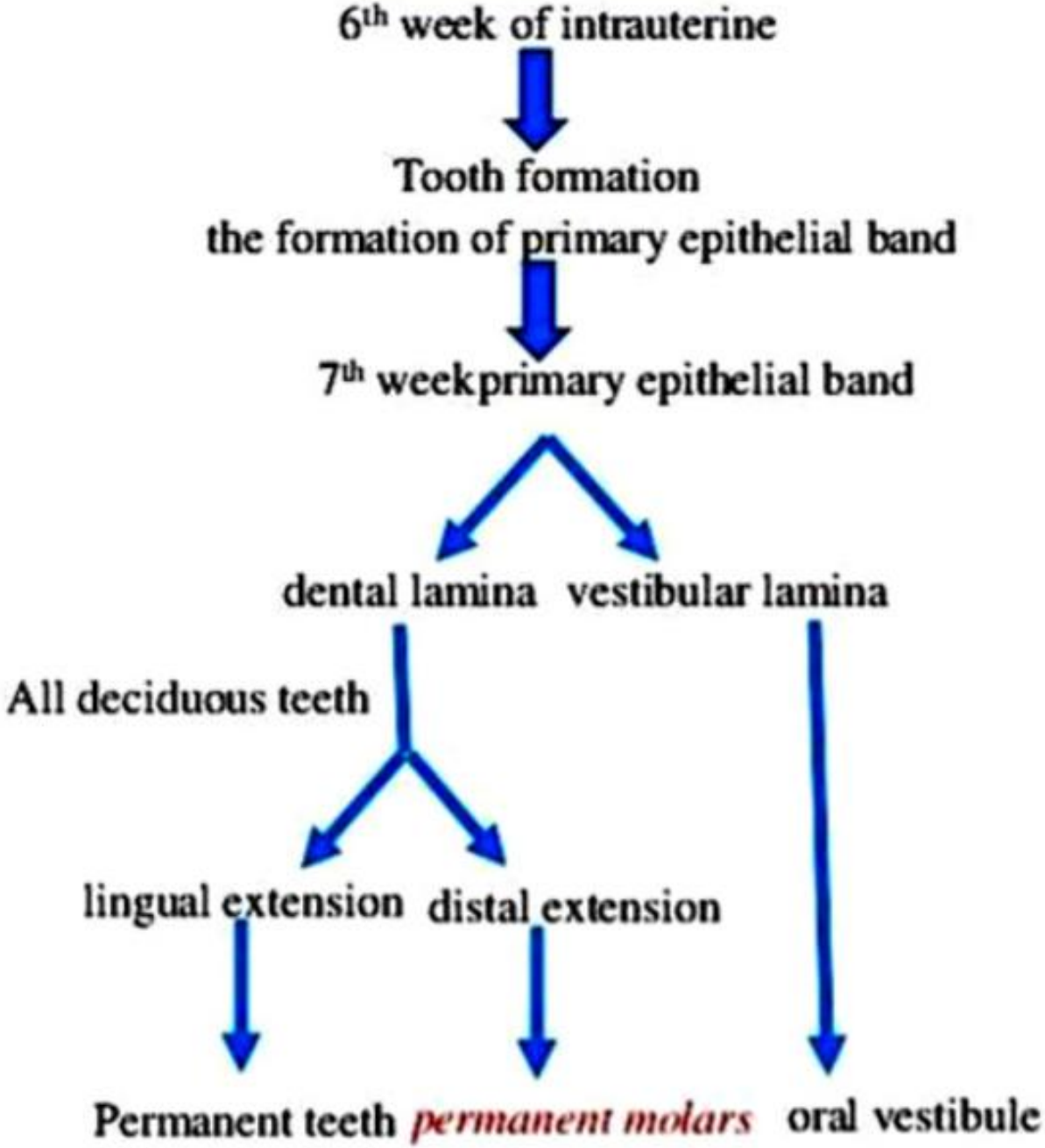
LECTURE LEARNING OUTCOMES

1. Classify the stages of tooth development
2. Enumerate the morphological and physiological stages of tooth development
3. Explain the bud and cap stage of development of tooth.

- The development of the tooth involves many **complex biological processes**.

- The fundamental developmental processes is similar for all teeth.




6th week of intrauterine
Tooth formation
the formation of primary epithelial band
7th weekprimary epithelial band
dental lamina
vestibular lamina
All deciduous teeth
lingual extension
distal extension
Permanent teeth
permanent molars
oral vestibule

STAGES OF TOOTH DEVELOPMENT AND GROWTH

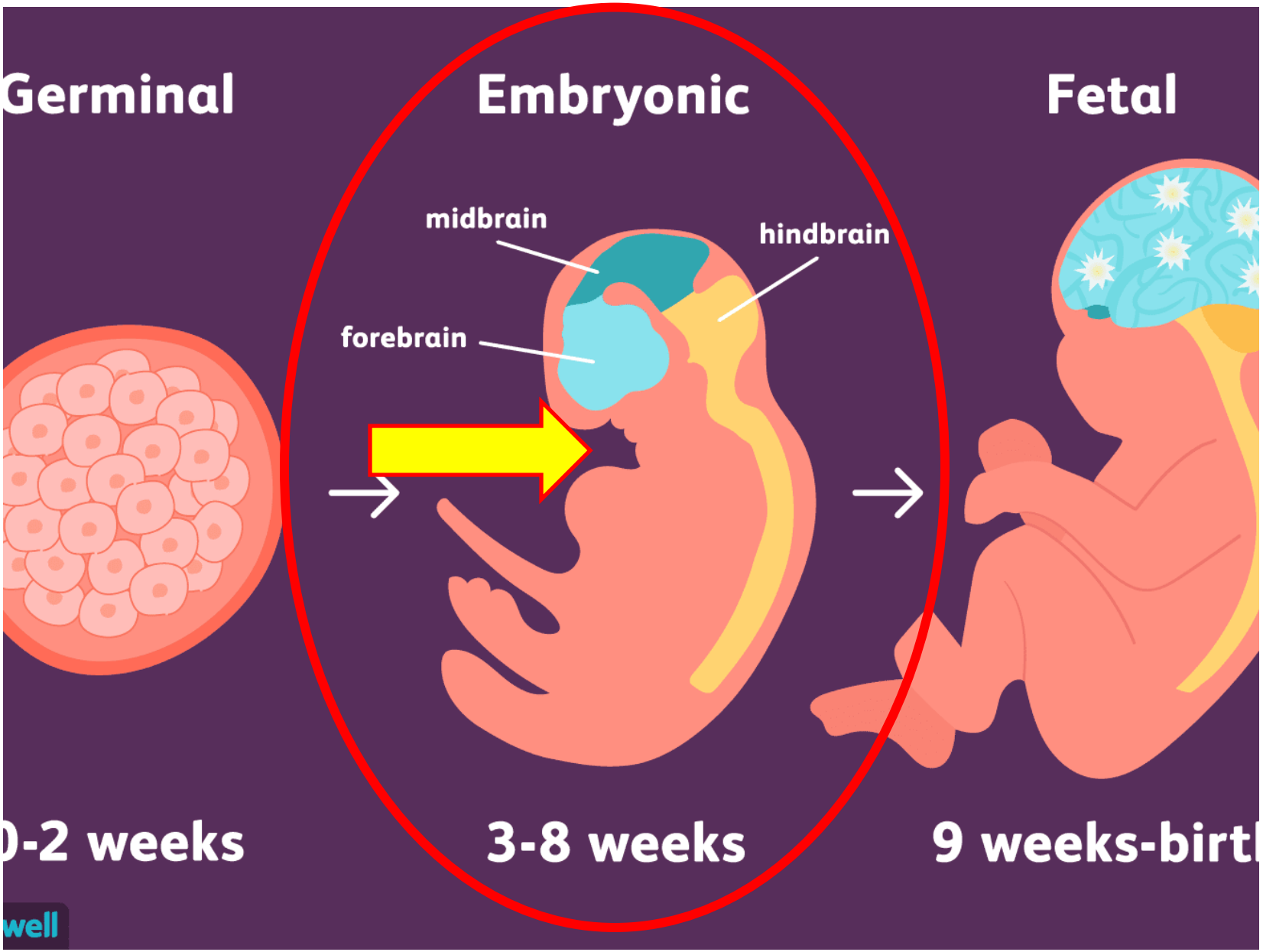
STAGES OF TOOTH DEVELOPMENT MAY BE DESCRIBED ACCORDING TO:

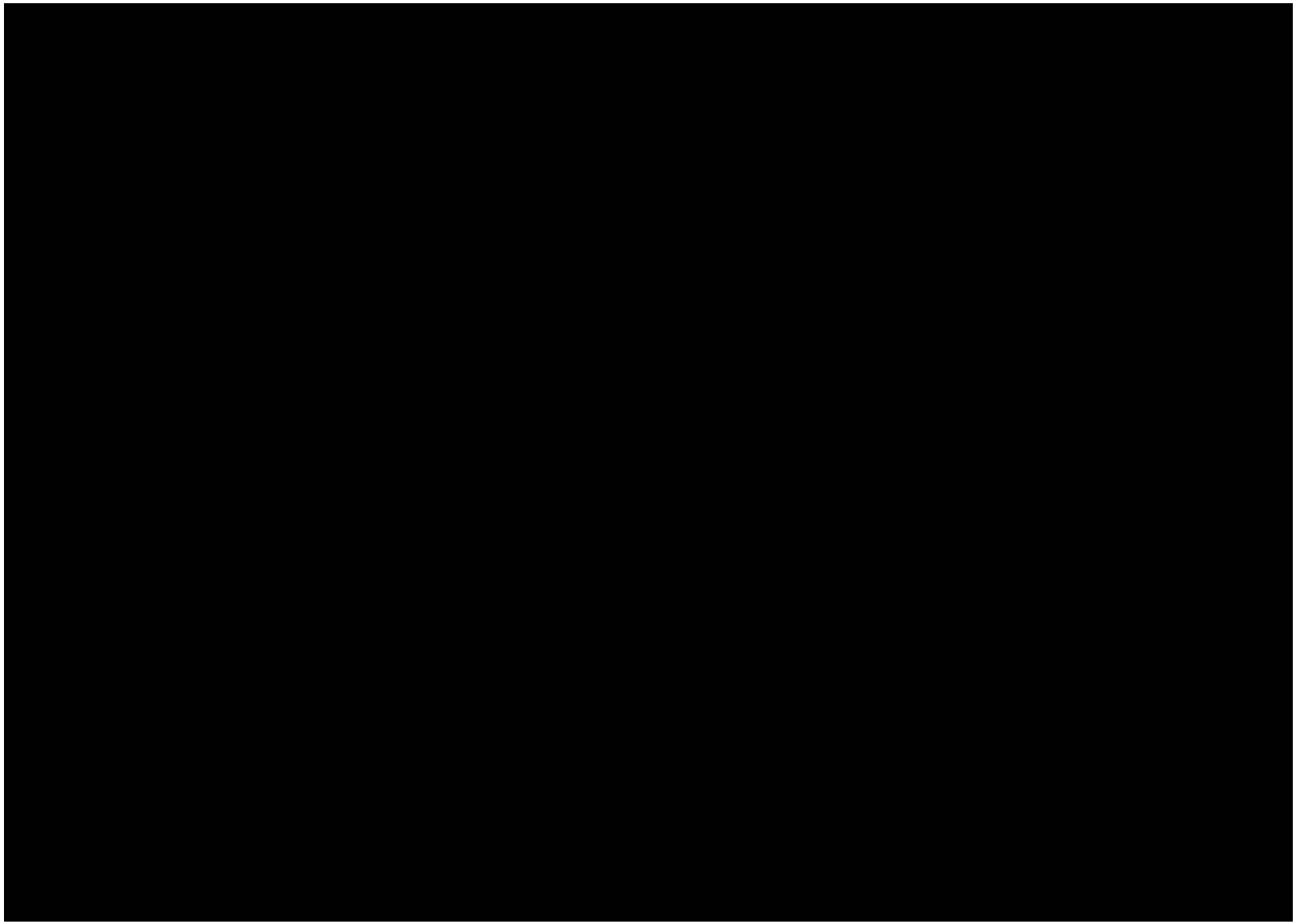
1- Changes in the morphology of the developing tooth (*MORPHOLOGICAL STAGES*)

2- Its physiological changes (*HISTOPHYSIOLOGICAL STAGES*)

DEVELOPMENTAL STAGES

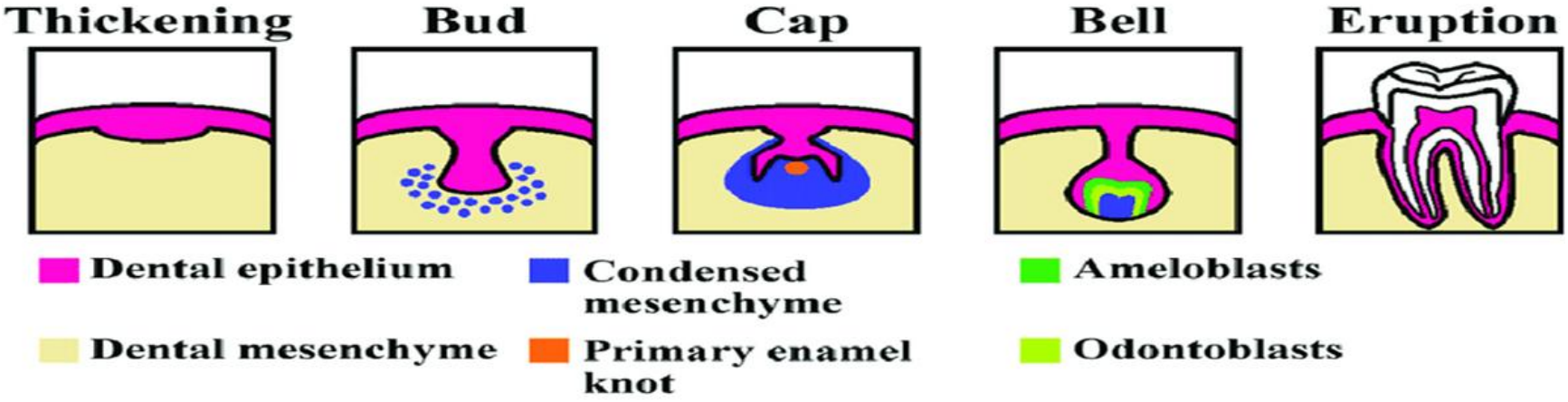
Morphological	Physiological
1. Dental lamina	• Initiation
2. Bud stage 3. Cap stage	• Proliferation
4. Early Bell stage	• Histodifferentiation
5. Advanced Bell stage	• Morphodifferentiation(shape and size of teeth determined)
6. Formation of enamel and dentin matrix	• Apposition


Germinal
Embryonic
Fetal
midbrain
hindbrain
forebrain
0-2 weeks
3-8 weeks
9 weeks-birt

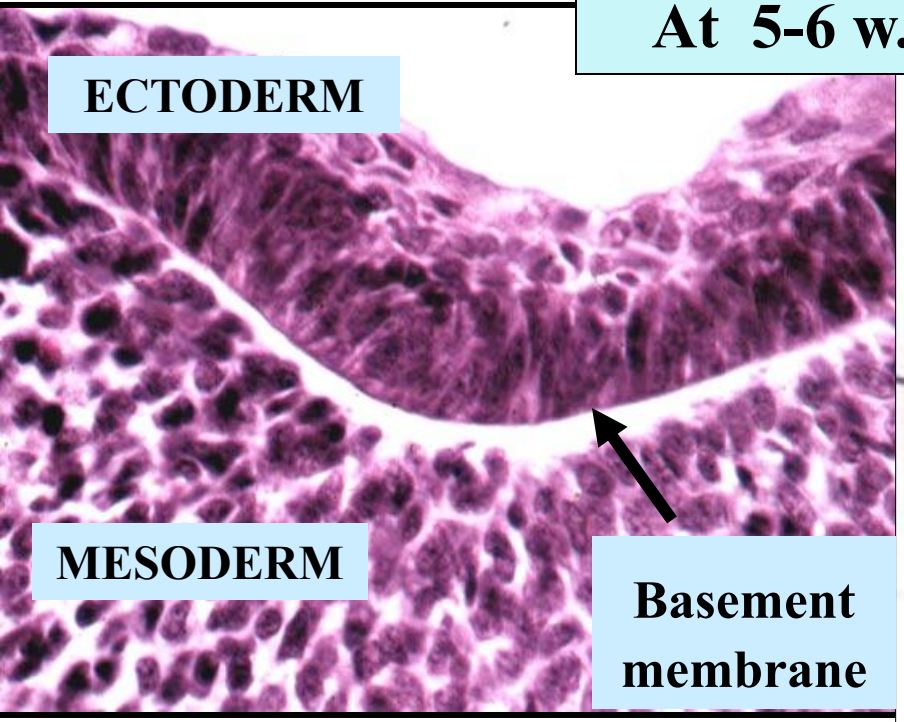


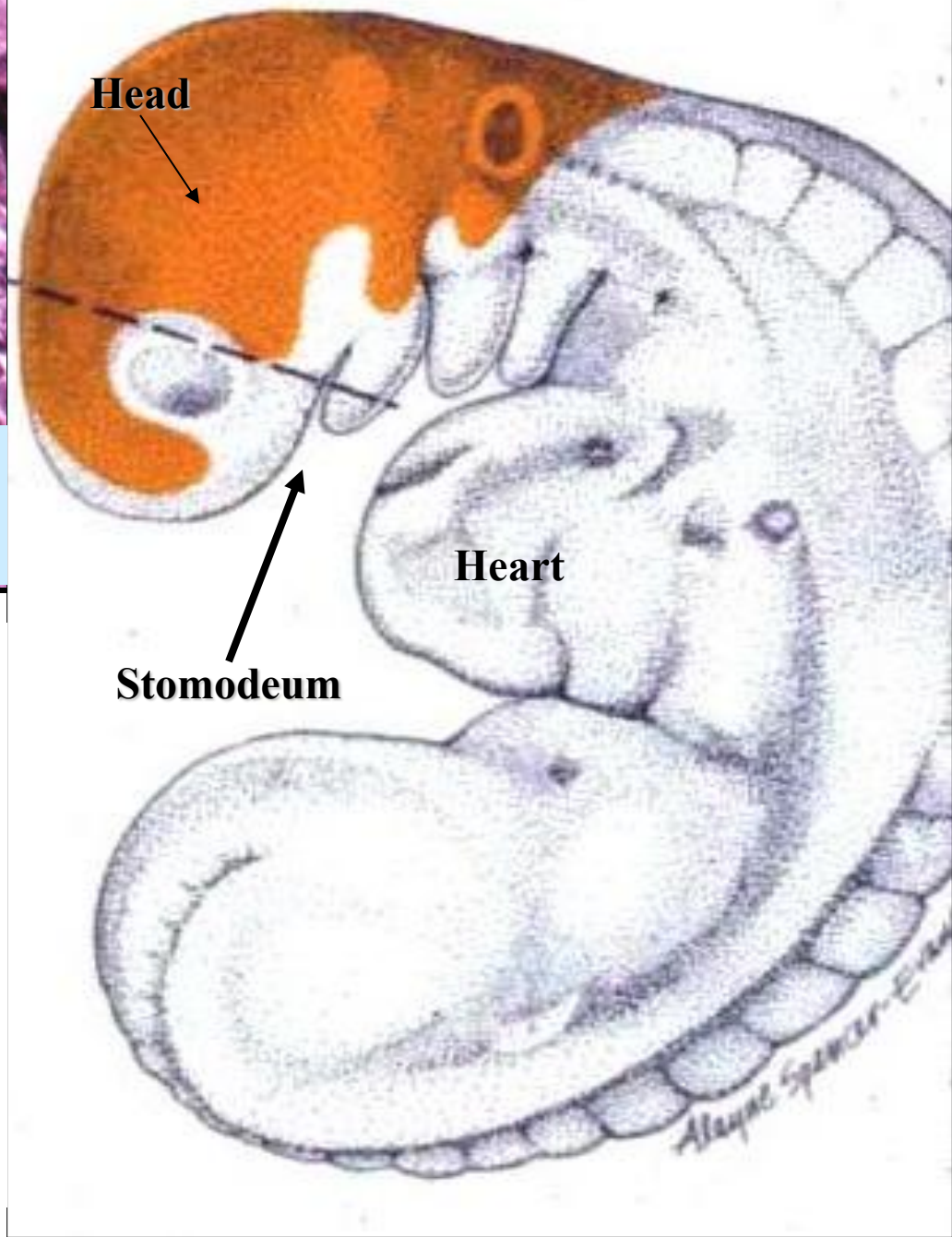
MORPHOLOGICAL STAGES

1. Bud stage برعم
2. Cap stage قبعة
3. Bell stage (early & advanced) جرس



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.

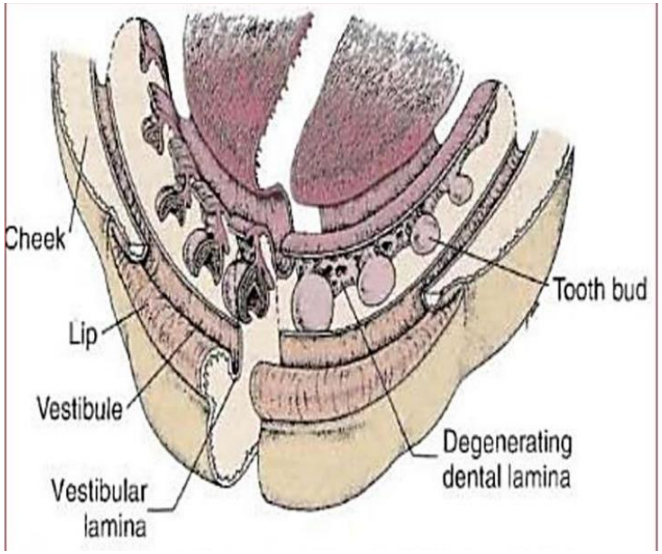
The mesoderm containing ectomesenchymal cells is separated from the oral ectoderm by a basement membrane.

Developmental stages of tooth development

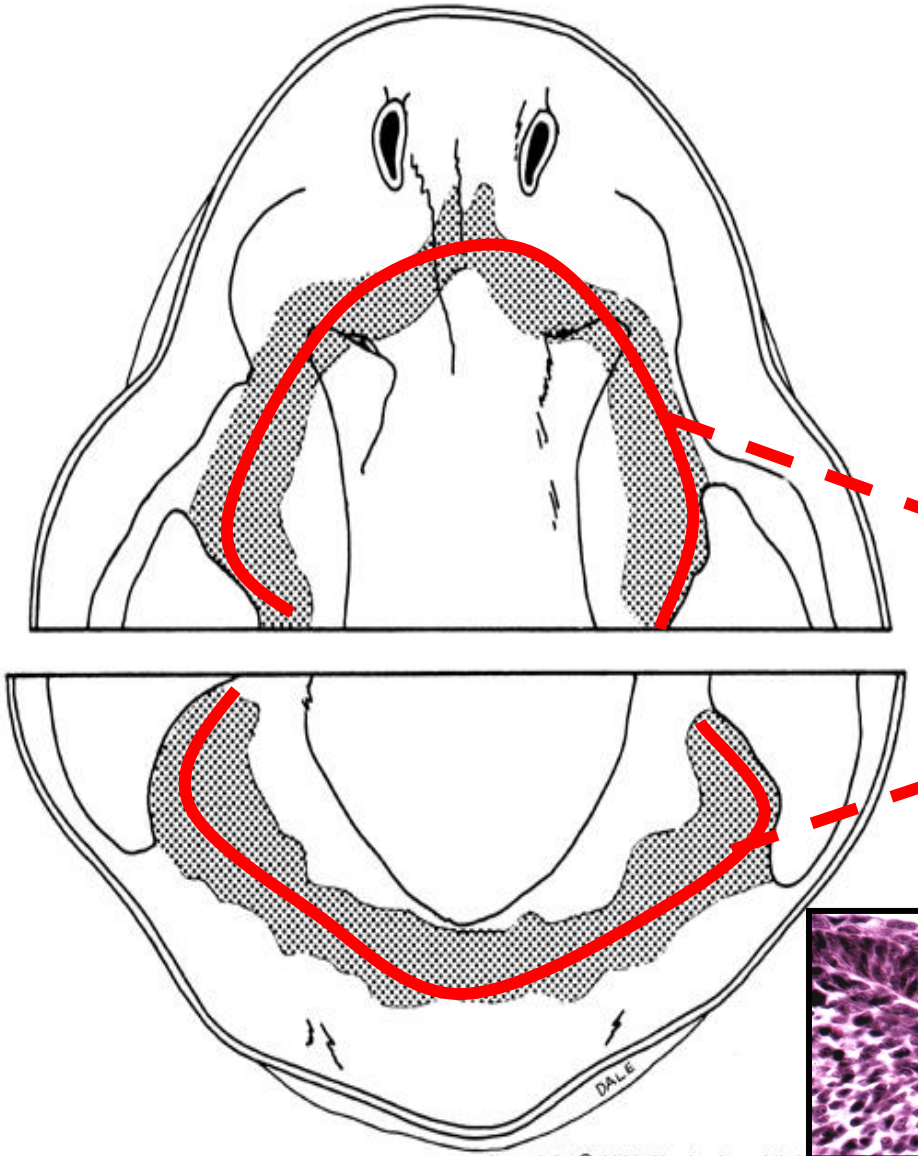
- The anterior aspect of the dental lamina, continued and localized proliferative activity leads to the formation of a series of epithelial outgrowths(10 in upper and 10 in lower) into the ectomesenchyme at sites corresponding to the positions of the future deciduous teeth.
- Each of this growths from Dental lamina represent the beginning of enamel organ of deciduous tooth.
- Ectomesenchyme cells accumulate around these outgrowths. From this point,
- Based on shape of enamel organ

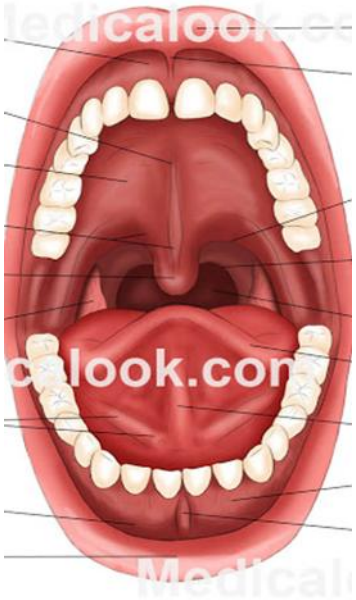
  tooth development proceeds in three stages:

  1. Bud stage
  2. Cap stage
  3. Bell stage

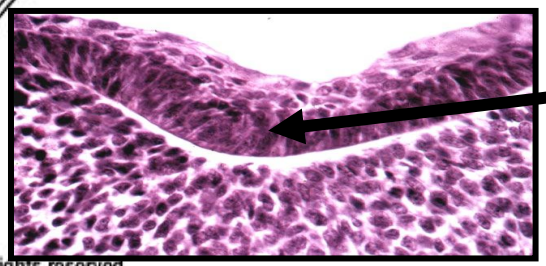


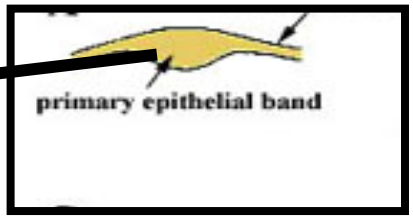
Early tooth development





Primary epithelial bands

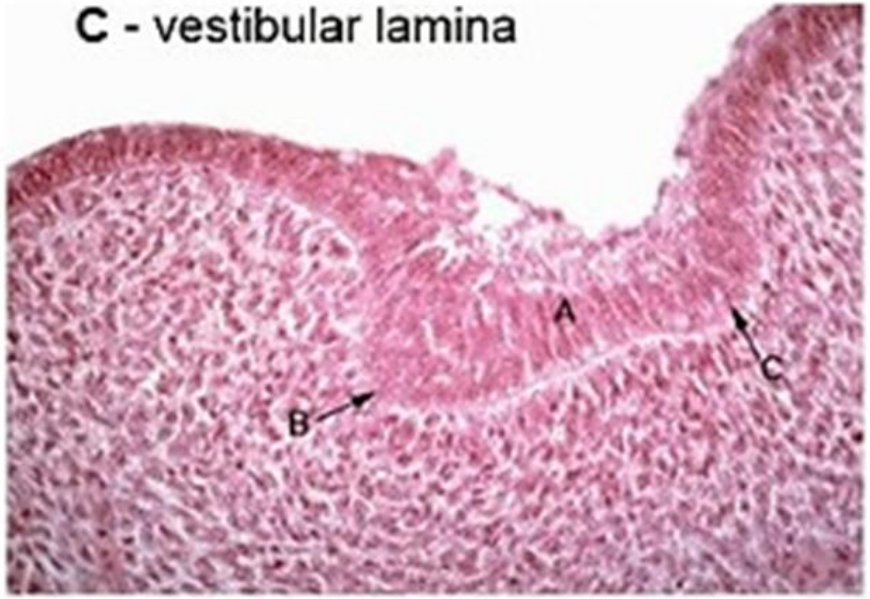




DENTAL LAMINA

A - oral epithelium
B - primary epithelial band

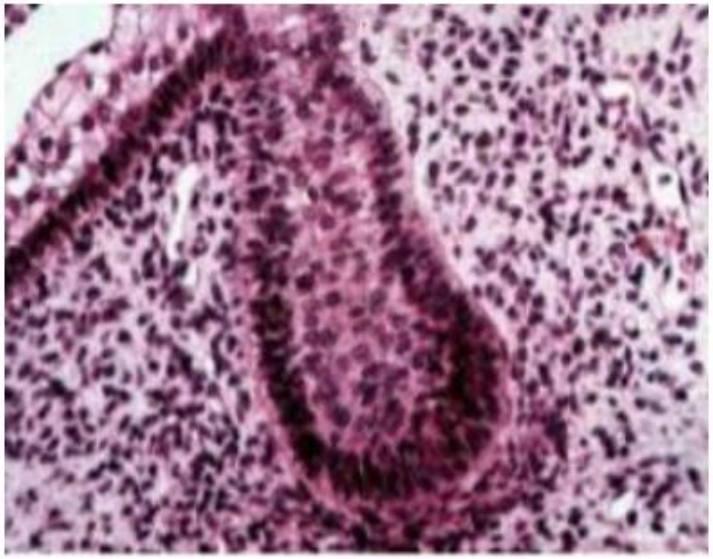
A - primary epithelial band
B - dental lamina
C - vestibular lamina



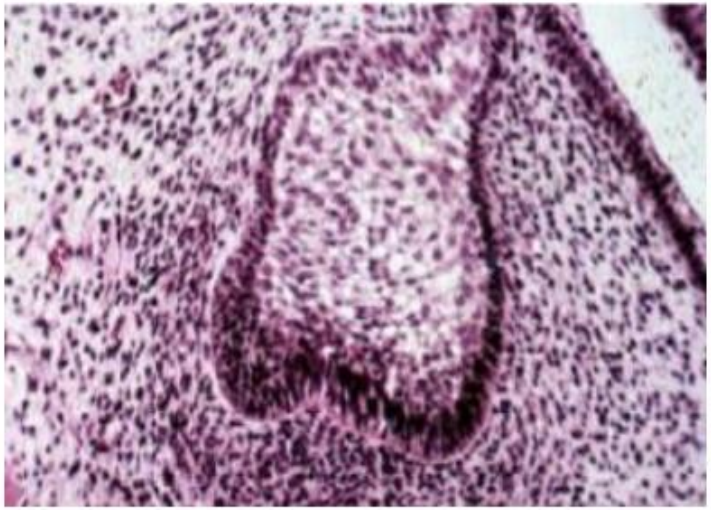

Early Tooth Development:
Bud, Cap and Bell Stages

Histologic Stages

Bud Stage



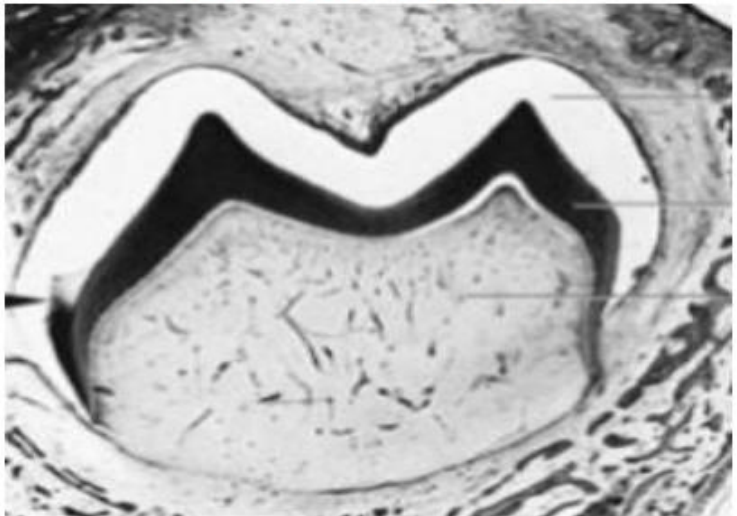
Cap Stage



Bell Stage

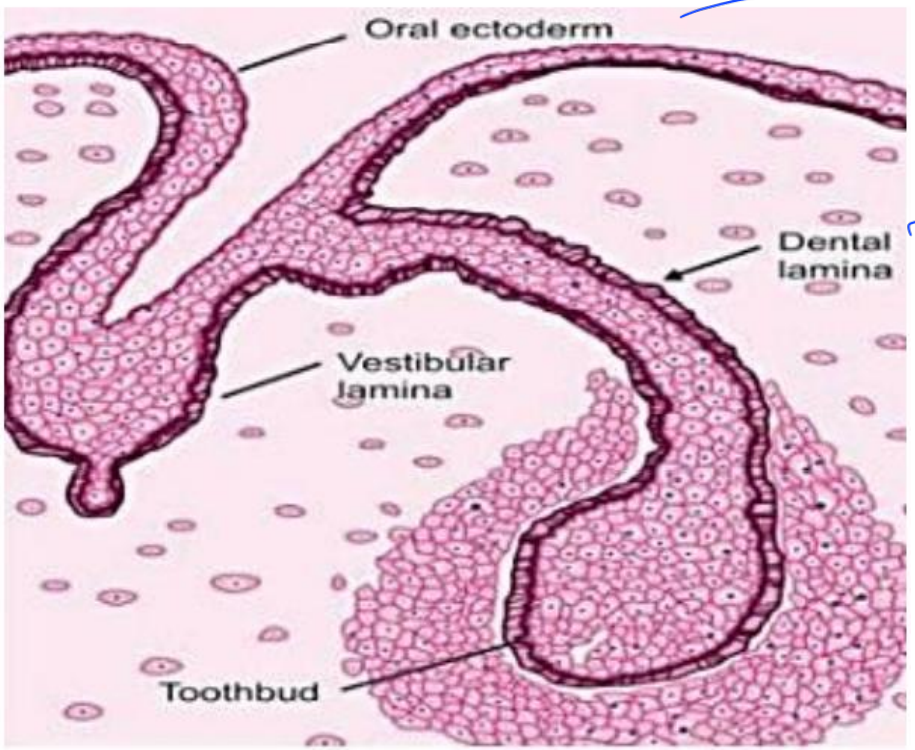
Early

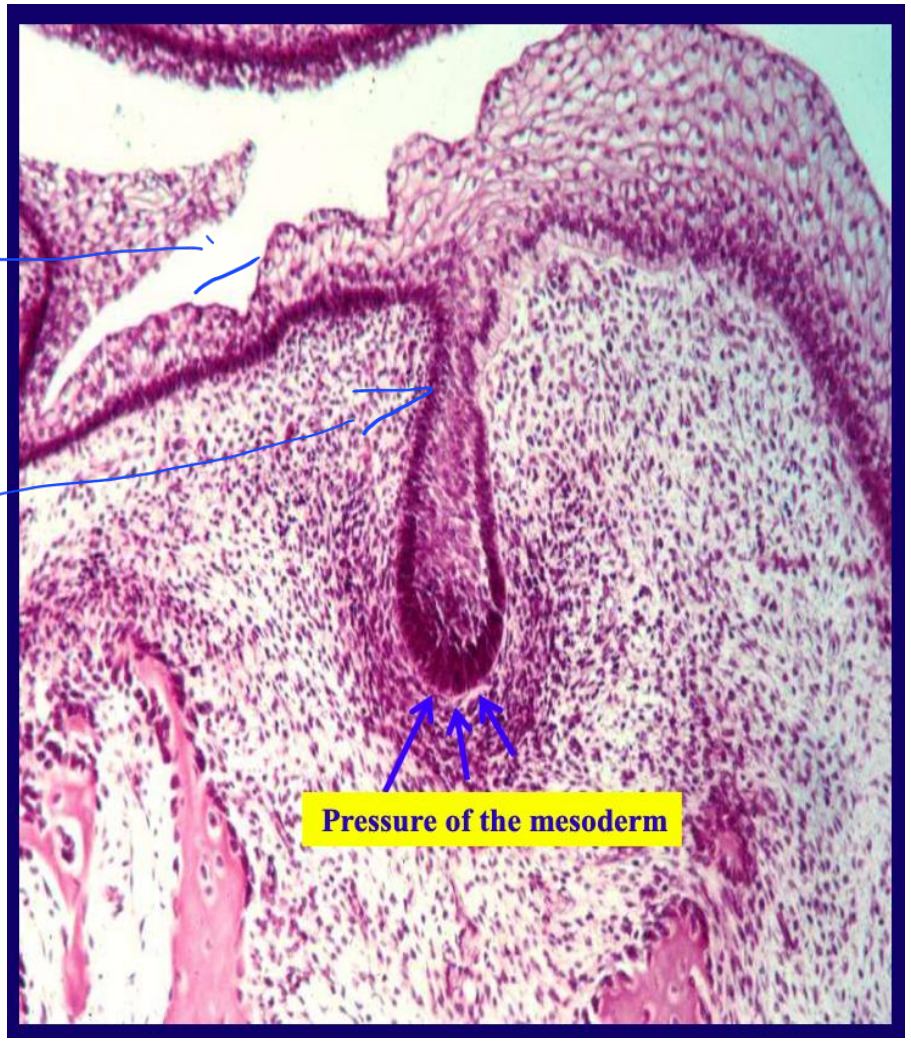
Advanced/Late



BUD STAGE

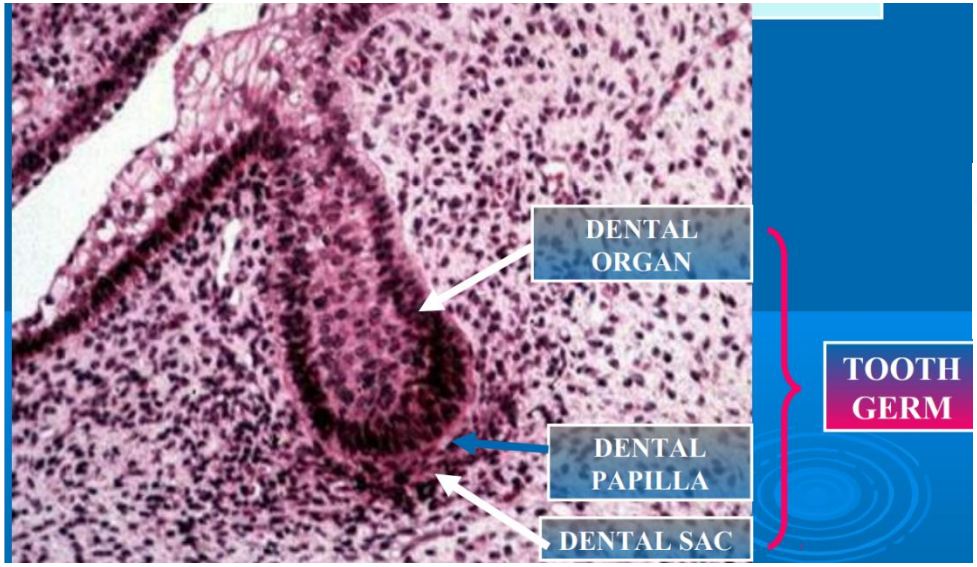
برعم





The cells of the dental lamina proliferates and form rounded bud like stracture called the dental or enamel organ.

- This is the initial stage of tooth formation where the enamel organ resembles a small bud.
- The cells of the dental lamina proliferates forming rounded buds called the dental or enamel organ into the underlying ectomesenchyme.
- The ectomesenchyme condenses below the enamel organ & is called the dental papilla.
- The ectomesenchyme that encircle both the enamel organ & the dental papilla is called dental sac



Histology of bud shaped enamel organ

- The epithelium of the dental laminae is separated from the underlying ectomesenchyme by a basement membrane.
- In the bud stage, the enamel organ consists of peripherally located low columnar cells and centrally located polygonal cells.

- As a result of this topographic alteration , the round shaped tooth bud is transformed to a cap shaped structure .

CAP STAGE

قبعة

Differential growth results in increase in the size of the enamel organ & change in its shape to exhibit a cap shape with short & broad connection to the dental lamina.

CAP STAGE

The cap- shaped enamel organ has a convex outer surface & concave inner surface.

In this stage 3 structures are formed/well defined:

1. Enamel organ
2. Dental papilla
3. Dental sac or Dental follicle

Primordial Component	Embryonic Origin	Basic Tissue Type	Adult Derivatives
Enamel Organ	Ectoderm	Epithelium	1. Enamel 2. Part of the epithelium of the dentogingival junction in the newly erupted tooth 3. The epithelial cell rests of Malassez
Dental Papilla	Ectomesenchyme	Connective Tissue	1. Dentin 2. Pulp
Dental Sac	Ectomesenchyme	Connective Tissue	1. Cementum 2. Periodontal Ligament 3. Alveolar Bone

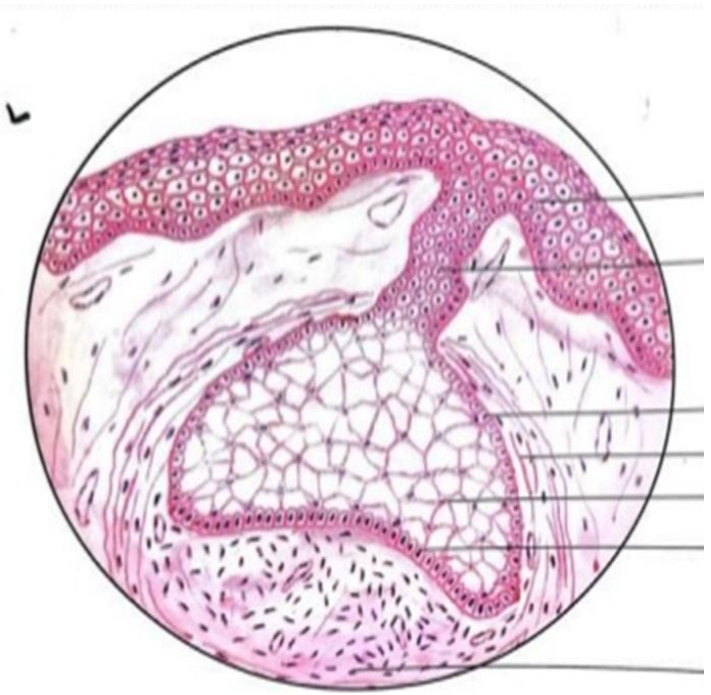
TOOTH GERM = EO + Dental Papilla + Dental Sac

Histodifferentiation starts in cap stage

Peripheral cells differentiate into Outer enamel epithelium and Inner enamel epithelium

Central cells synthesize & secrete hydrophilic Glycosaminoglycans which

pulls water into the enamel organ from the dental papill that forms the Stellate reticulum



1. Outer enamel epithelium

Cuboidal cells covering convexity of enamel organ

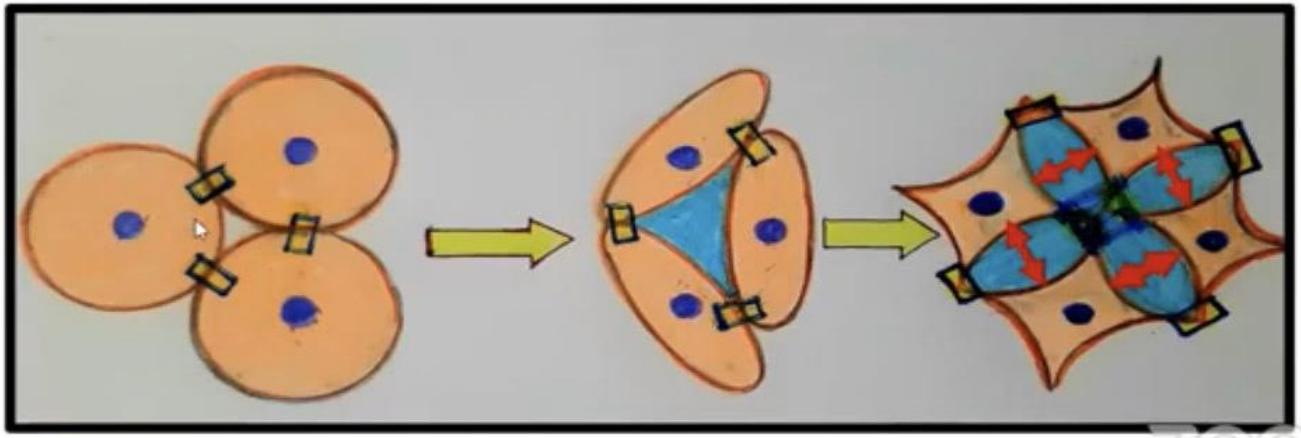
2. Inner enamel epithelium

low columnar cells covering concavity of enamel organ

3. Stellate reticulum

It is the network of stellate shaped cells in the center. It gives cushion-like consistency to the enamel organ.

Why stellate reticulum cells become star shaped



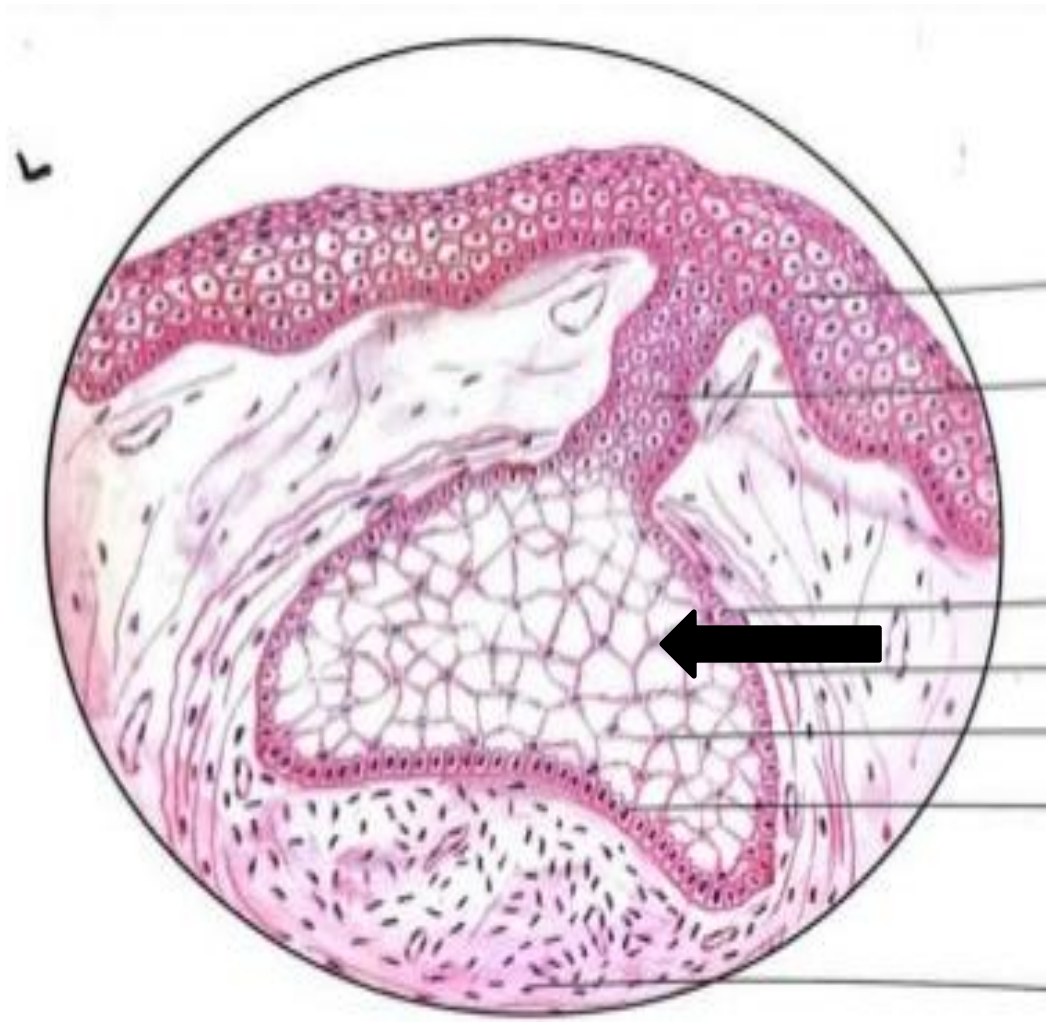
Polygonal cells located at centre of enamel organ synthesize & secrete hydrophilic Glycosaminoglycans which

It pulls water into the enamel organ from the dental papilla

As a result polygonal cells are stretched and maintain contact with each other by cytoplasmic process and become star shaped

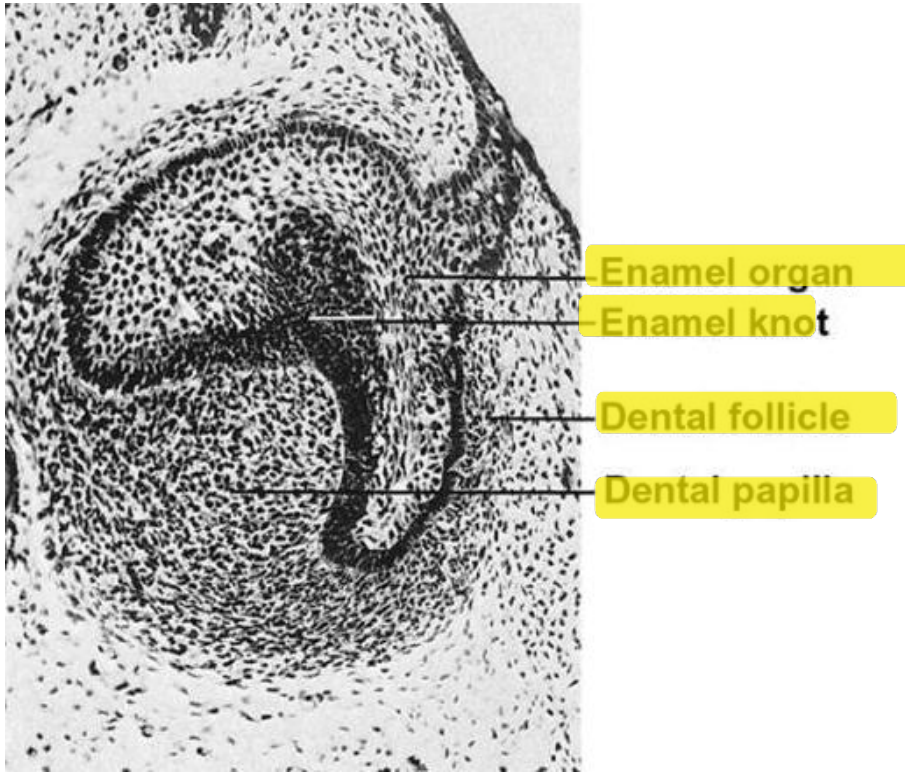
As star shaped cells form a cellular network, they are called Stellate reticulum

STELLATE RETICULUM



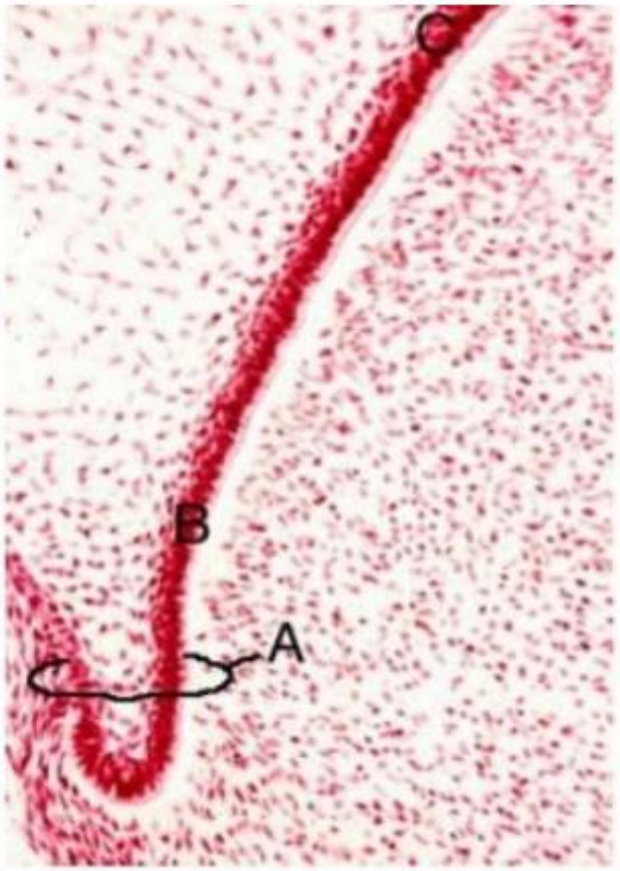
Transient structures in cap stage

- Enamel Knot: A condensation of ectodermal cells in the central region of the inner enamel epithelium that may bulge towards the dental papilla.
- It extends towards the outer enamel epithelium forming a strand of cells (Enamel cord).
- They are both transient structures.
- They may have a role in **determining the initial position of the first cusp of tooth during crown formation.**



Cervical Loop OR Zone of Reflexion

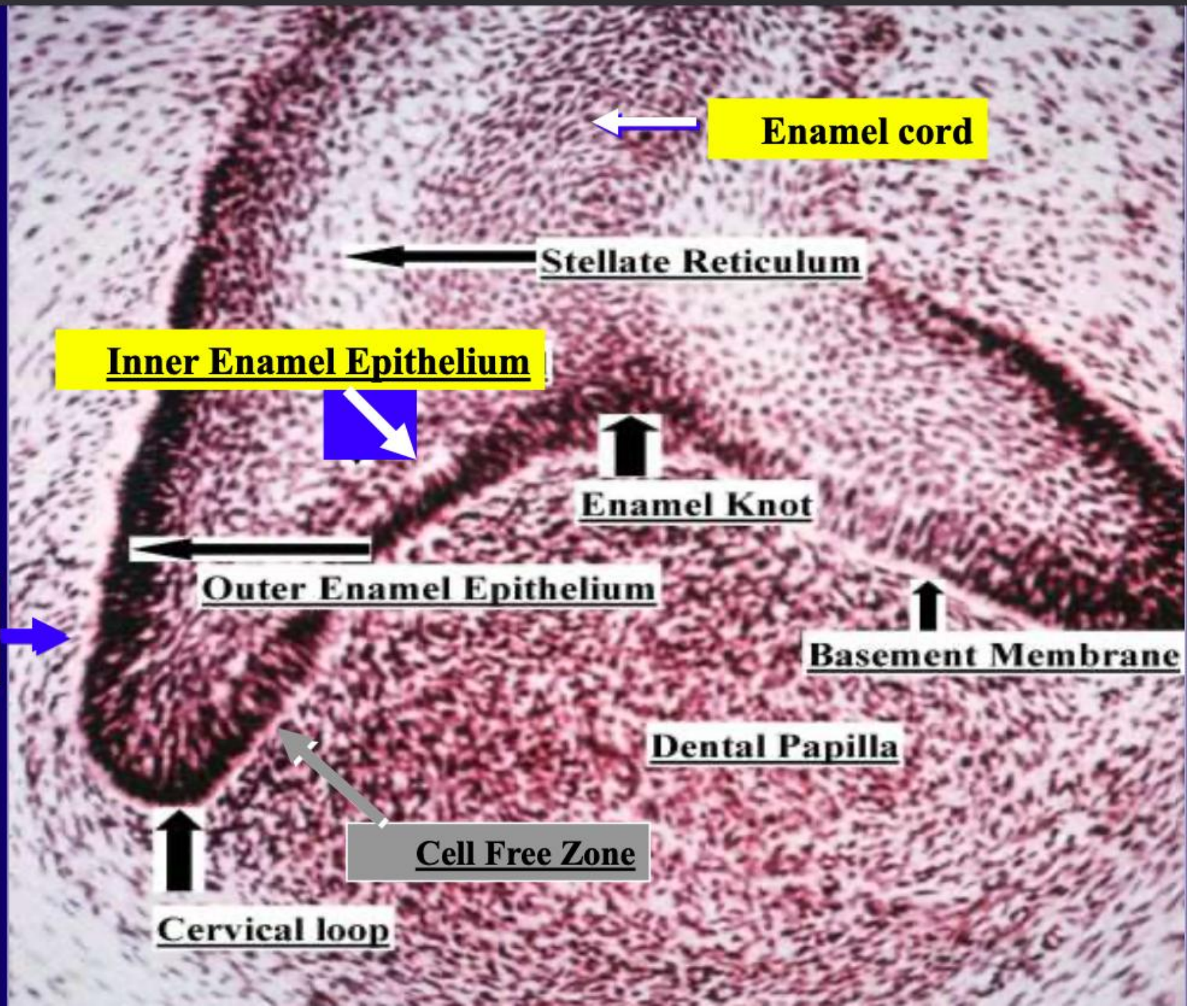
It is the region where the inner and outer enamel epithelia meet. It is the site from where the root formation starts



Legend: **A**, Cervical loop; **B**, Least differentiated; **C**, Most differentiated

Cap stage

ENTAL
(follicle)



REFERENCES

- ORBANS's Oral HISTOLOGY AND AND EMBRYOLOGY (page no 24-47)
- TEN CATE'S ORAL HISTOLOGY


THANK
YOU!