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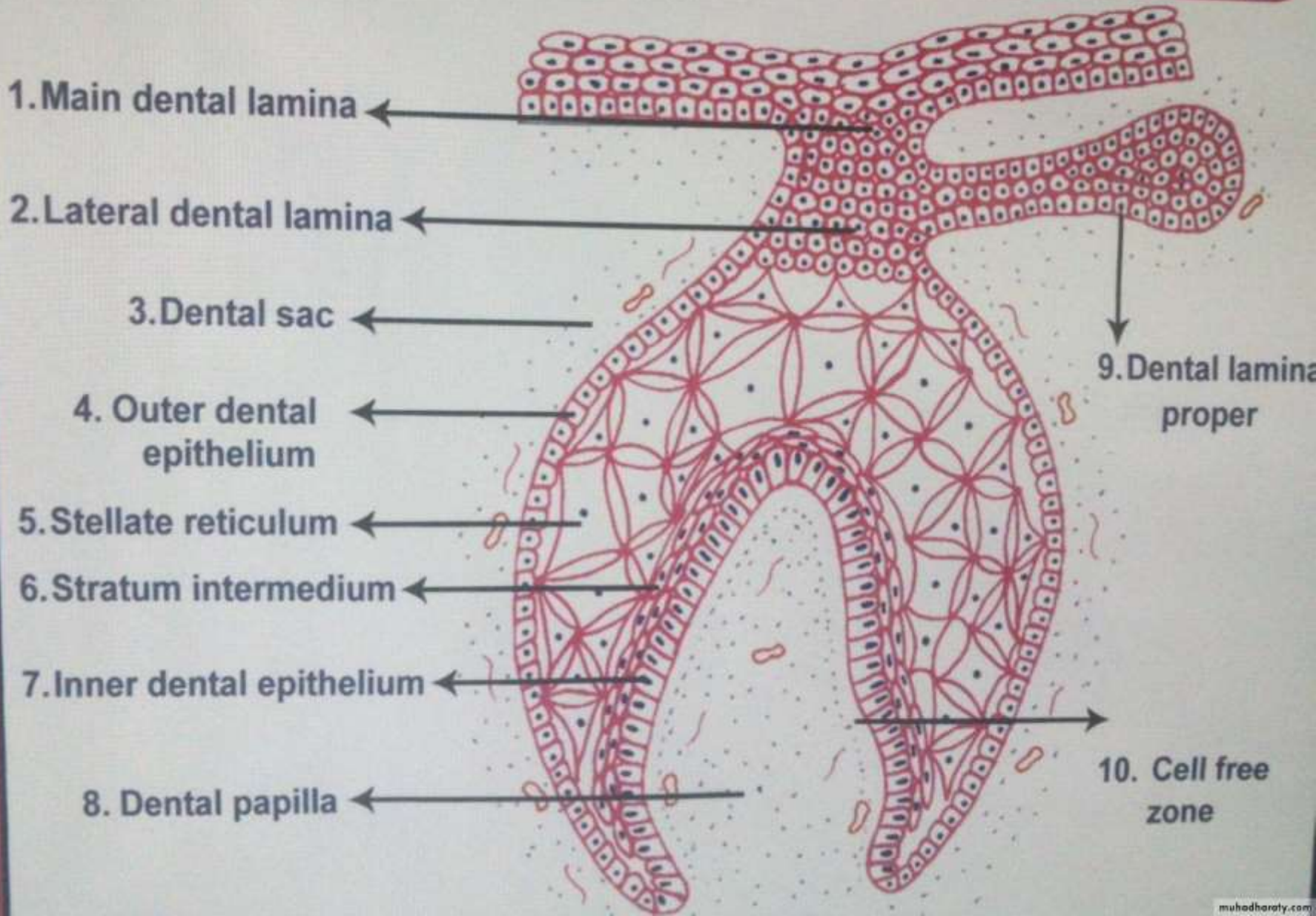
Tooth development

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Lec 7

Bell Stage

As the invagination of the epithelium deepens and its margins continue to grow, the enamel organ assumes a bell shape . In the bell stage, crown shape is determined. The folding of enamel organ to cause different crown shapes is shown to be due to differential rates of mitosis and differences in cell differentiation time. Cells begin to differentiate only when cells cease to divide. The inner enamel epithelial cells which lie in the future incisor region stop dividing earlier and begin to differentiate first.

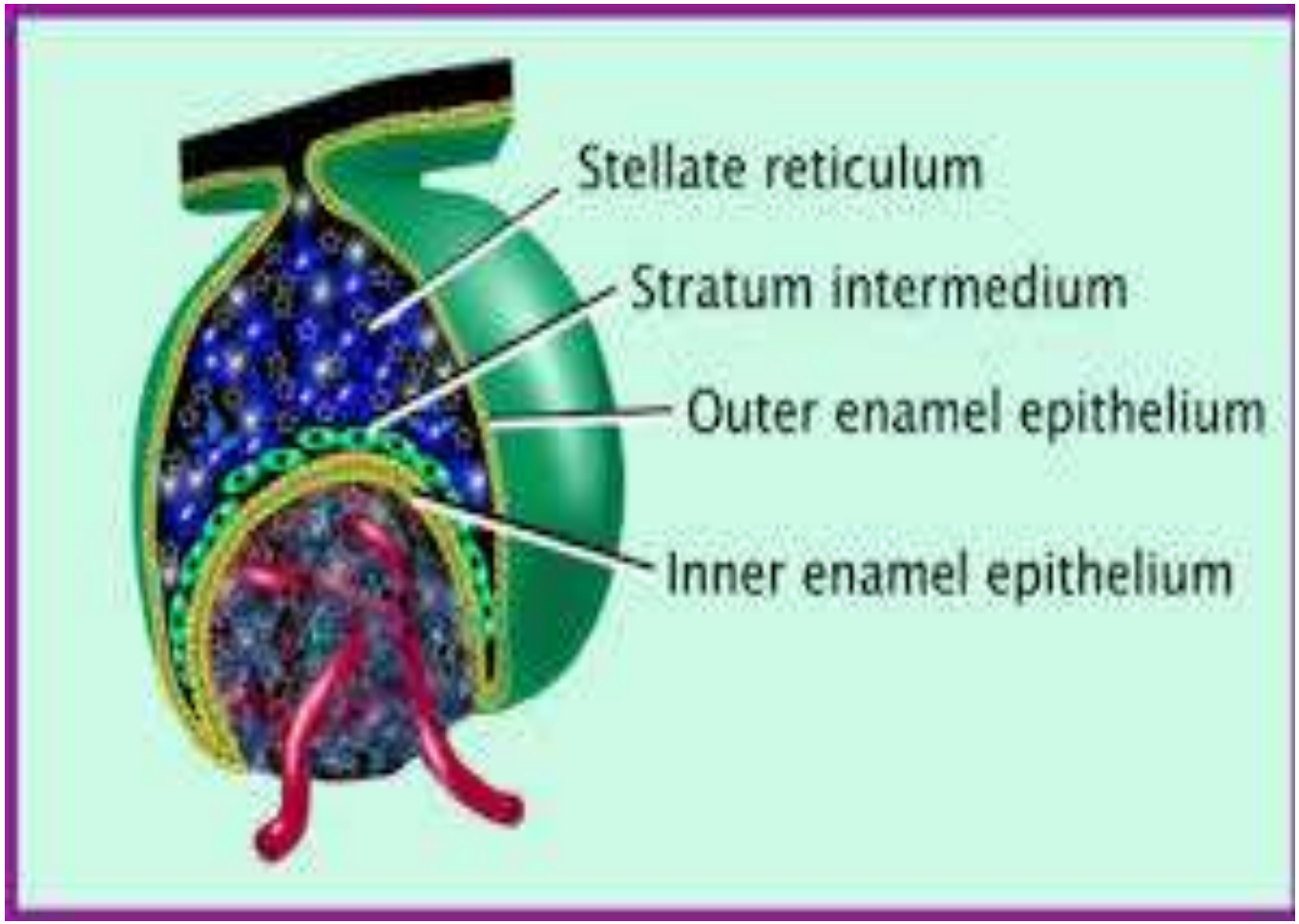
Decalcified section (H & E) Showing Early Bell Stage



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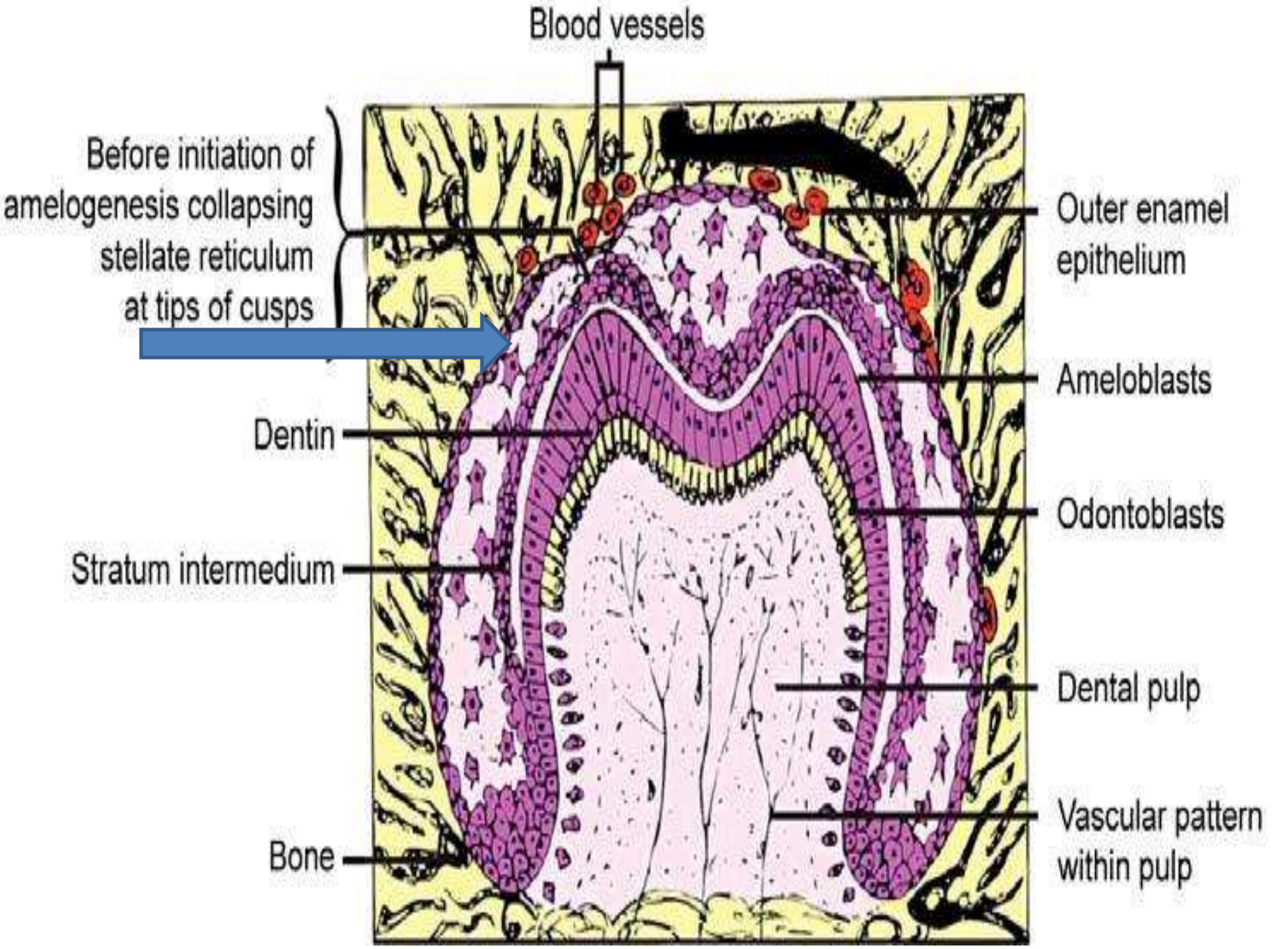
Four different types of epithelial cells can be distinguished in the bell stage of the enamel organ:.

1. **Inner enamel epithelium.**
2. **Outer enamel epithelium.**
3. **Stratum intermedium.**
4. **Stellate reticulum.**


Stellate reticulum
Stratum intermedium
Outer enamel epithelium
Inner enamel epithelium

1. Inner enamel epithelium

The inner enamel epithelium consists of a single layer of cells that differentiate prior to amelogenesis into tall columnar cells called ameloblasts . These cells are 4 to 5 micrometers (µm) in diameter and about 40 µm high. The cells of the inner enamel epithelium exert an organizing influence on the underlying mesenchymal cells in the dental papilla, which later differentiate into odontoblasts.

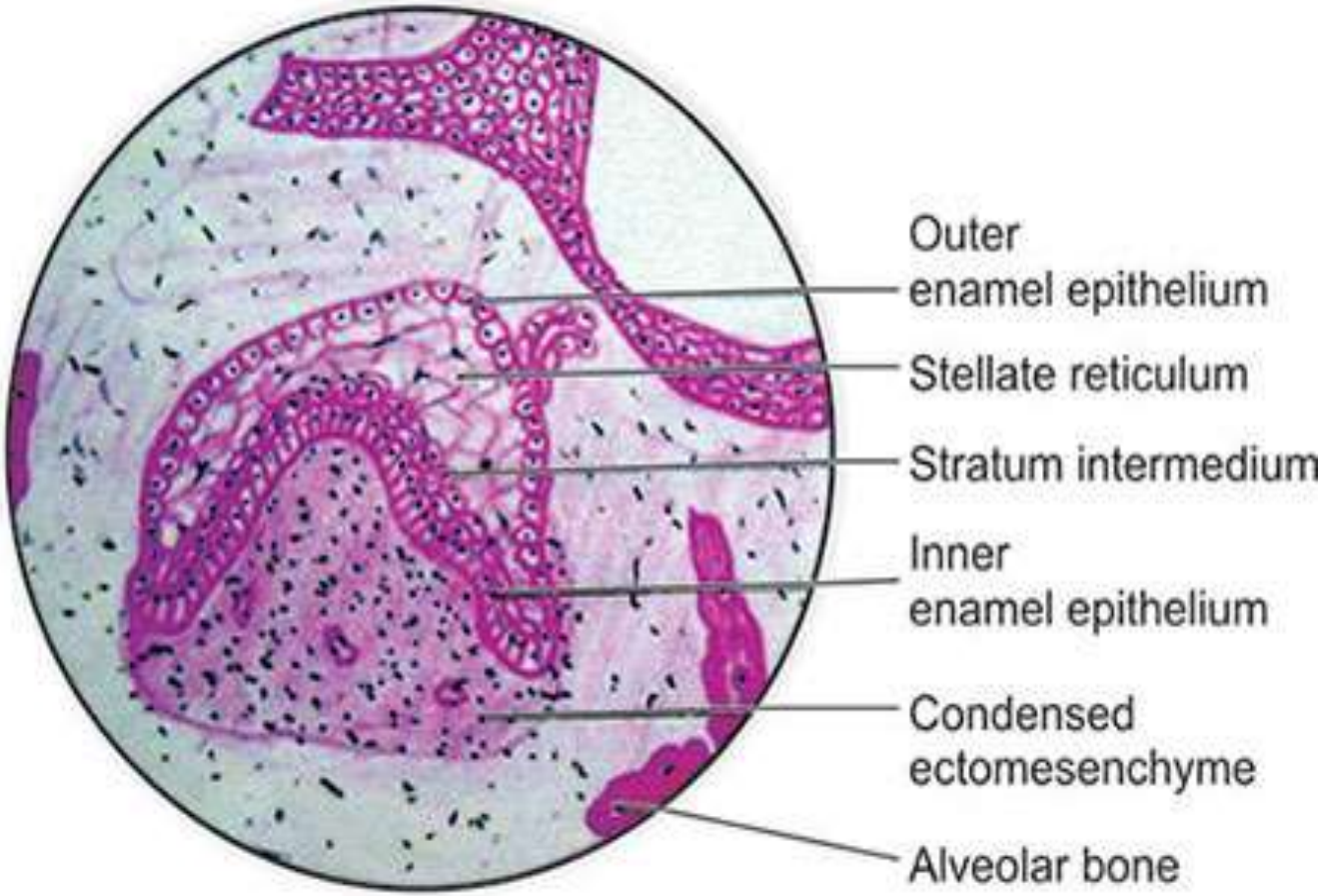

Blood vessels
Before initiation of amelogenesis collapsing stellate reticulum at tips of cusps
Outer enamel epithelium
Ameloblasts
Dentin
Odontoblasts
Stratum intermedium
Dental pulp
Vascular pattern within pulp
Bone

2. Outer enamel epithelium

The cells of the outer enamel epithelium flatten to a low cuboidal form. At the end of the bell stage, during the formation of enamel, the smooth surface of the outer enamel epithelium is laid in folds. Between the folds the adjacent mesenchyme of the dental sac forms papillae that contain capillary loops and thus provide a rich nutritional supply for the intense metabolic activity of the avascular enamel organ.

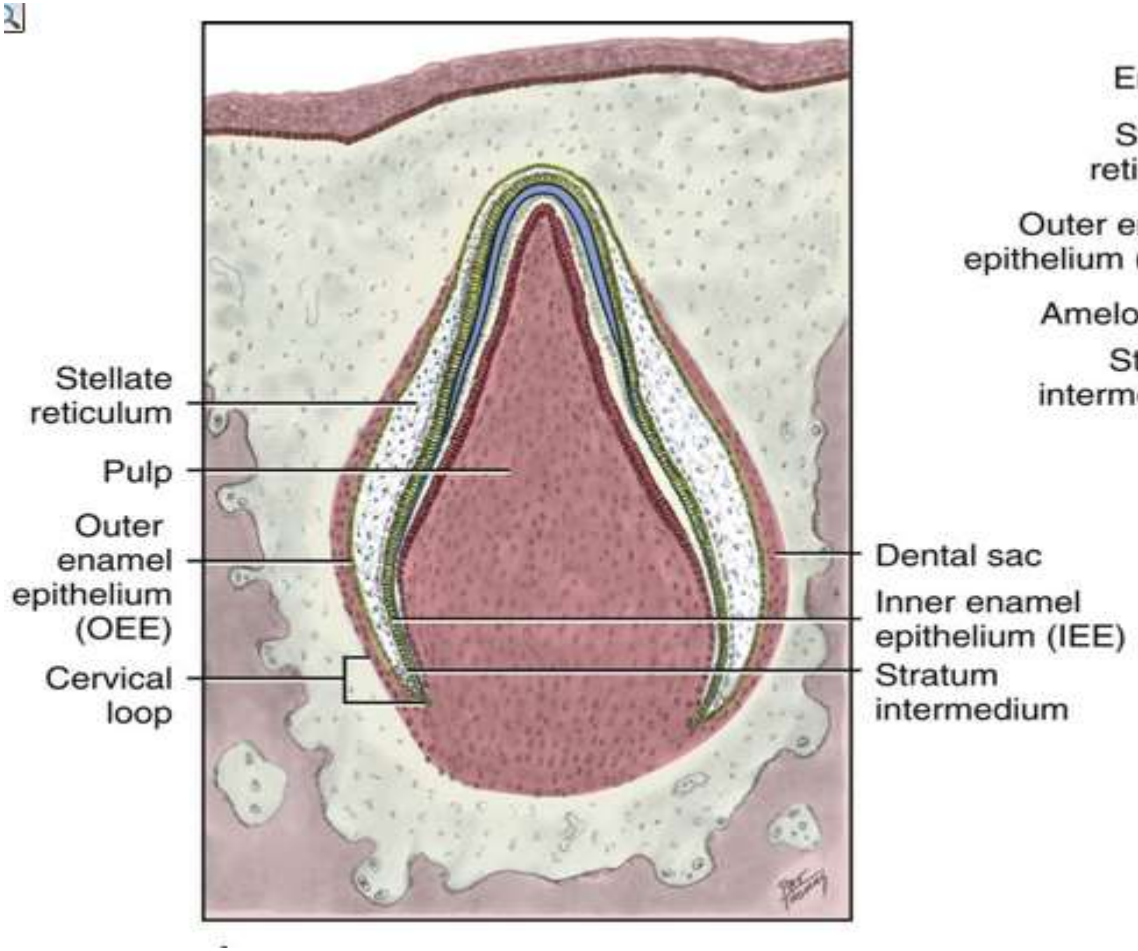
3. Stratum intermedium

A few layers of squamous cells form the stratum intermedium between the inner enamel epithelium and the stellate reticulum, The cells of stratum intermedium work with cells of inner enamel epithelium as a single functional unit and form enamel.


Outer
enamel epithelium
Stellate reticulum
Stratum intermedium
Inner
enamel epithelium
Condensed
ectomesenchyme
Alveolar bone

4. Stellate reticulum

The stellate reticulum expands further, mainly by an increase in the amount of intercellular fluid. The cells are star shaped, with long processes that anastomose with those of adjacent cells. Before enamel formation begins, the stellate reticulum collapses, reducing the distance between the centrally situated ameloblasts and the nutrient capillaries near the outer enamel epithelium.


Stellate reticulum
Pulp
Outer enamel epithelium (OEE)
Cervical loop
Dental sac
Inner enamel epithelium (IEE)
Stratum intermedium

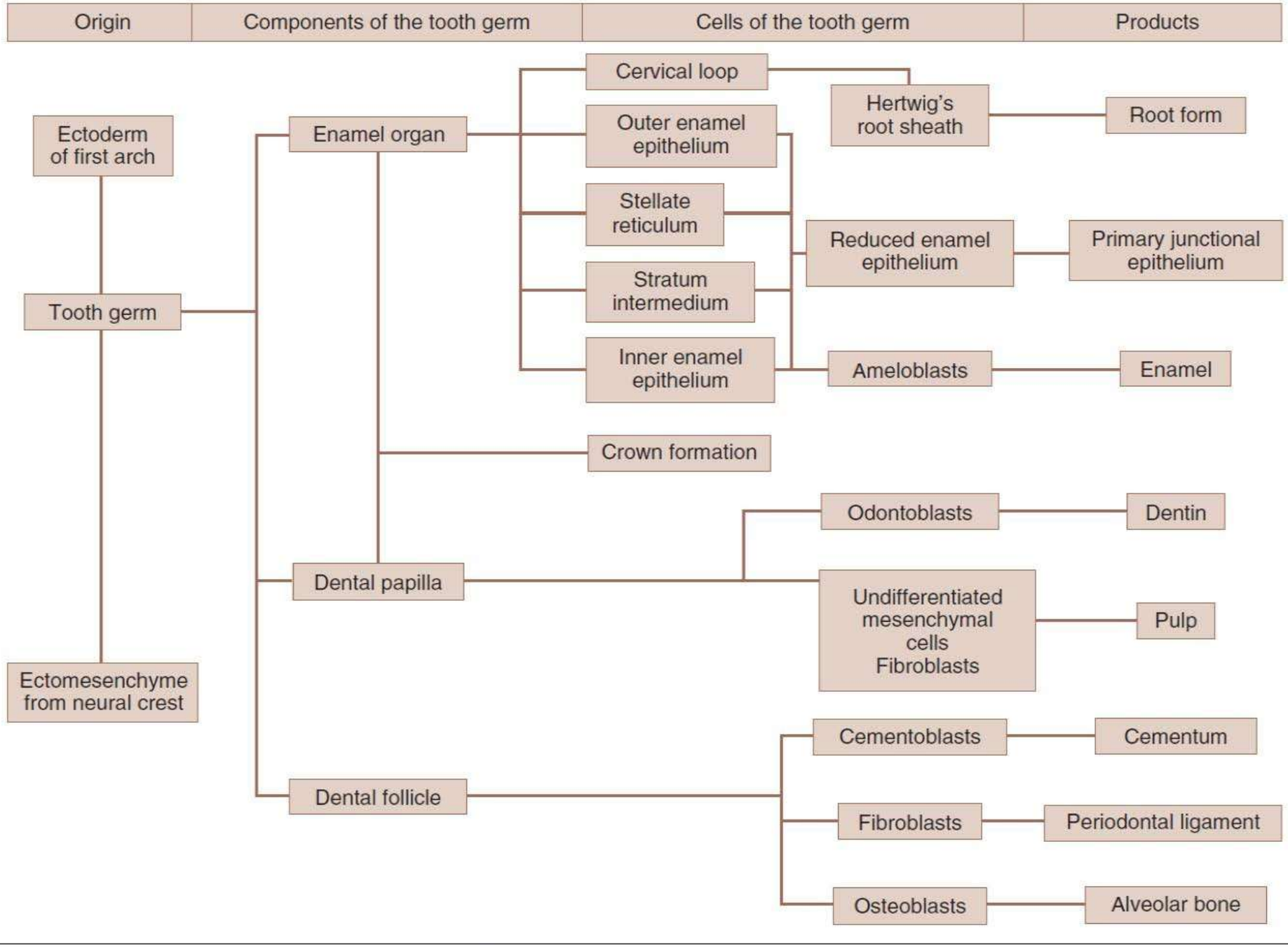
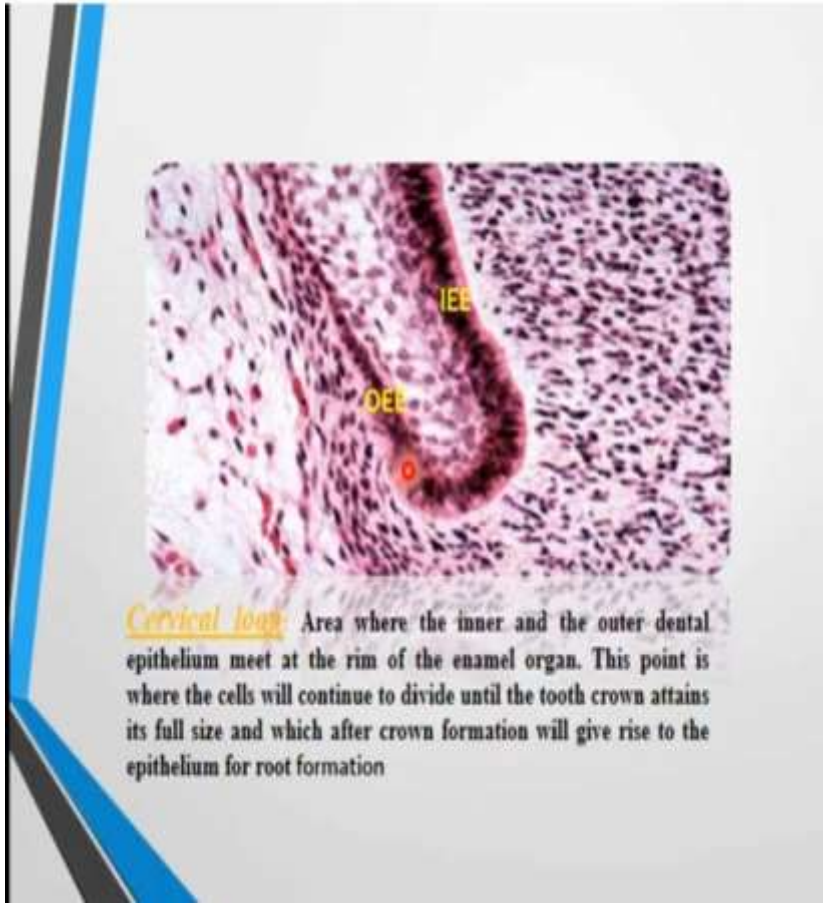
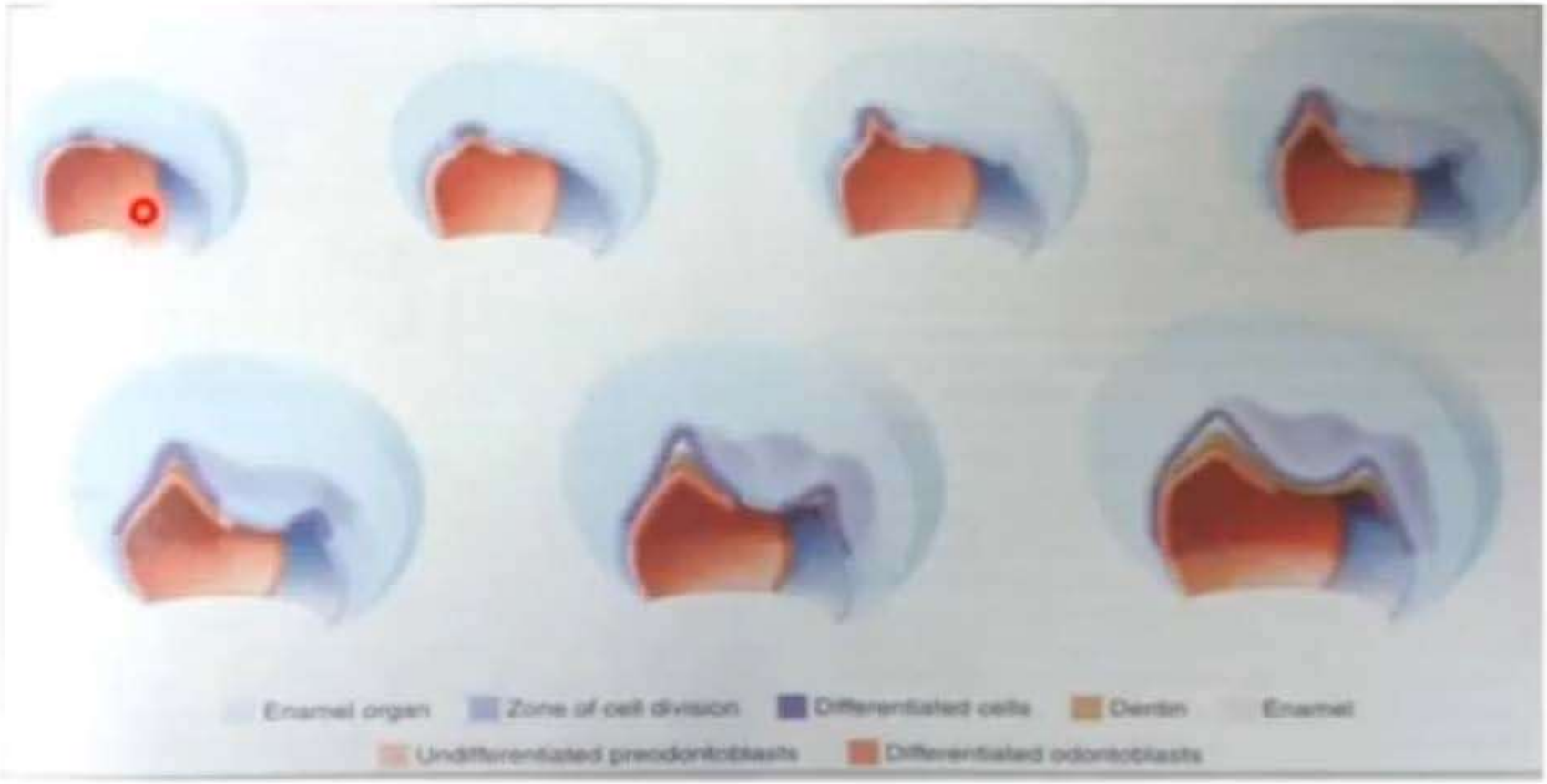


FIGURE 5-35 Summary of tooth formation.

In the future the cervical loop become the hertwigs root sheath to form the root

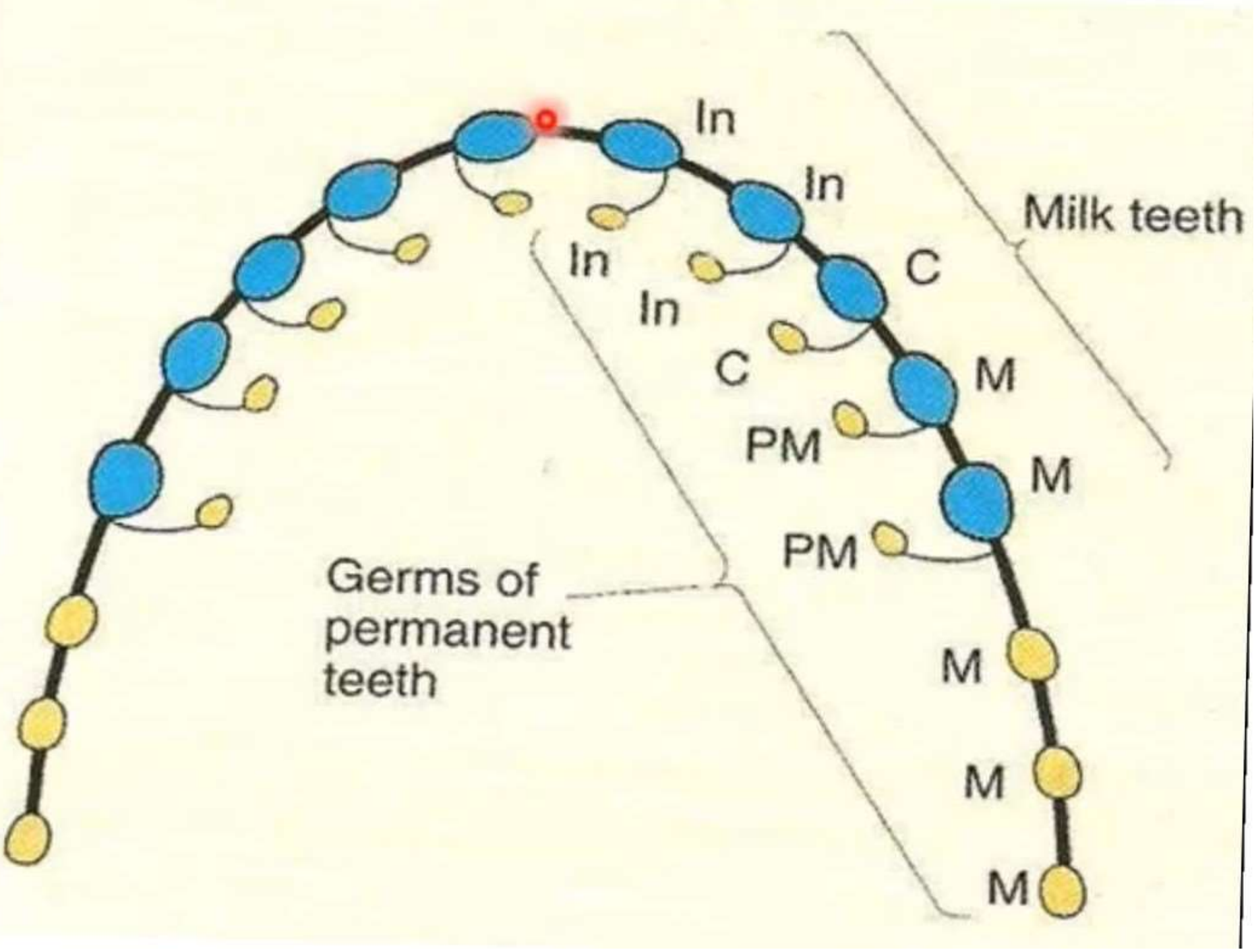




Crown Pattern Formation in the Inner Enamel Epithelium

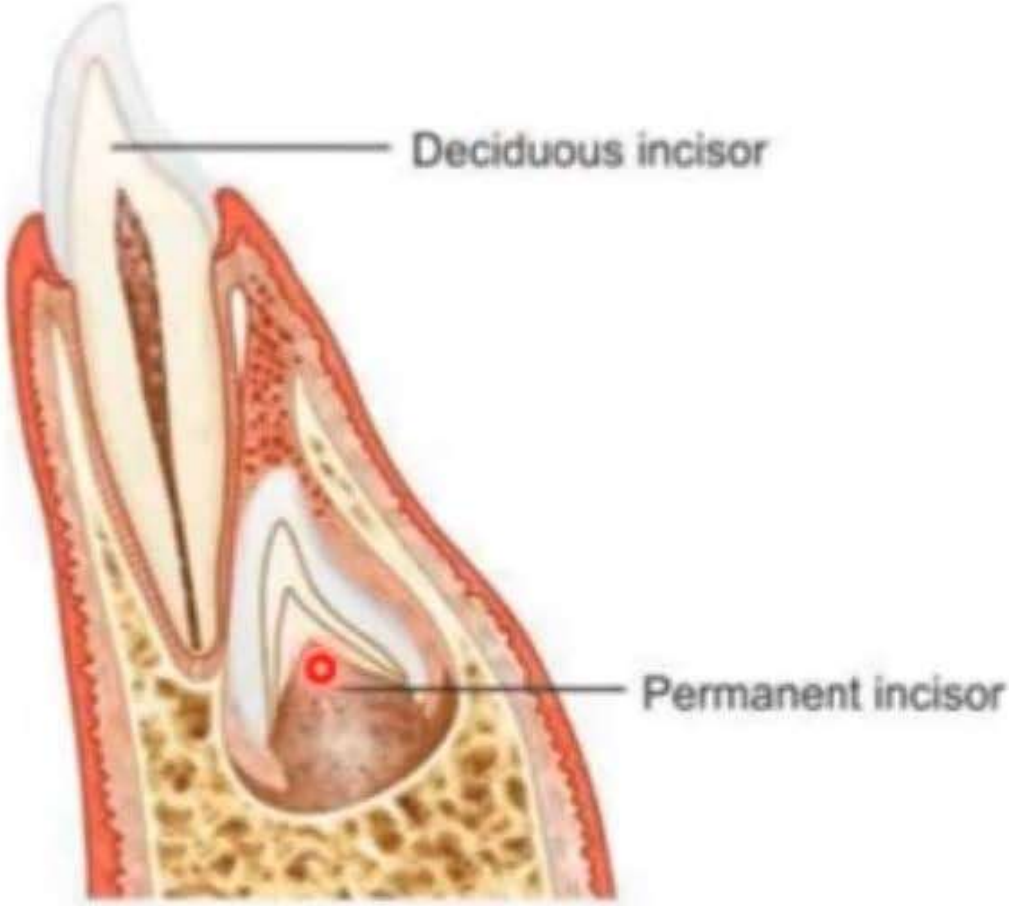
FORMATION OF PERMANENT DENTITION

- Arises from dental lamina.
- Form in essentially the same manner, though at different times.
- The tooth germs that give rise to permanent incisors, canines and premolars form as a result of further proliferative activity within the dental lamina, lingual to the deciduous tooth germ.
- The developing permanent molars have no deciduous predecessor and their tooth germs originate from the dental lamina that extends posteriorly beneath the oral epithelium after the jaws have grown.


In
In
In
In
C
C
M
PM
M
PM
M
M
M
Milk teeth
Germs of
permanent
teeth

PERMANENT SUCCESSORS

DEVELOP FROM SUCCESSIONAL LAMINA ON LINGUAL ASPECT OF THEIR PREDECESSOR TEETH



Fate of dental lamina

- 1- Dental lamina is functional in developing 52 teeth from 6 prenatal weeks until 4 years after birth (development of third permanent tooth).
  2- The dental lamina degenerates by mesenchymal invasions in late bell stage.
  3- Developing tooth lose its connection with dental lamina.
  4- Sometimes remnants of dental lamina remains in the jaws as epithelial rests of Serres(Serres' pearls) .

Nutrition and tooth development

Nutrition has an effect on the developing tooth. Essential nutrients for a healthy tooth include calcium, phosphorus, and vitamins A, C, and D. Calcium and phosphorus are needed to properly form the hydroxyapatite crystals(minerals), and their levels in the blood are maintained by Vitamin D.

Vitamin A is necessary for the formation of keratin, and Vitamin C is for collagen.

Fluoride makes the teeth more resistant to demineralization and subsequent decay.

Developmental disturbances of teeth:

1-Anodontia is a complete lack of tooth development.

2-Hypodontia It is one of the most common developmental abnormalities, The absence of third molars is very common, followed in prevalence by the second premolar and lateral incisor.

3- hyperdontia : is the development of extra teeth. It is believed to be associated with an excess of dental lamina or epithelial rest of Serres.

4- Dilaceration

is associated with trauma that moves the developing tooth bud. As a tooth is forming, a force can move the tooth from its original position, leaving the rest of the tooth to form at an abnormal angle.

5- regional odontodysplasia :

is rare, but is most likely to occur in the maxilla and anterior teeth. The enamel, dentin, and pulp of teeth are affected. These teeth are very brittle. On radiographs the teeth appear more radiolucent than normal, so they are often described as "*ghost teeth*".

6-Natal and neonatal teeth : *Natal teeth* are present at the time of birth. *Neonatal teeth* will erupt during the first 30 days after birth. Although both conditions occur more frequently in females, natal teeth are three times more common than neonatal teeth. The most common location being the mandibular region of the central incisors.

Thank you