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ENAMEL

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Lec 8

Enamel

Enamel is the hardest calcified matrix of the body. The cells that are responsible for formation of enamel, the *ameloblasts*, are lost as the tooth erupts into the oral cavity, and hence enamel cannot renew itself. Amelogenesis which is (the formation of enamel occurs during formative and maturative stages of the ameloblasts).



Life Cycle of the Ameloblasts

According to their function, the life span of the cells of the inner enamel epithelium can be divided into six stages:

(1) Morphogenic stage.

(2) Organizing or histodifferentiation stage.

(3) Formative or secretory stage .

(4) Maturative stage.

(5) Protective stage.

(6) Desmolytic stage.

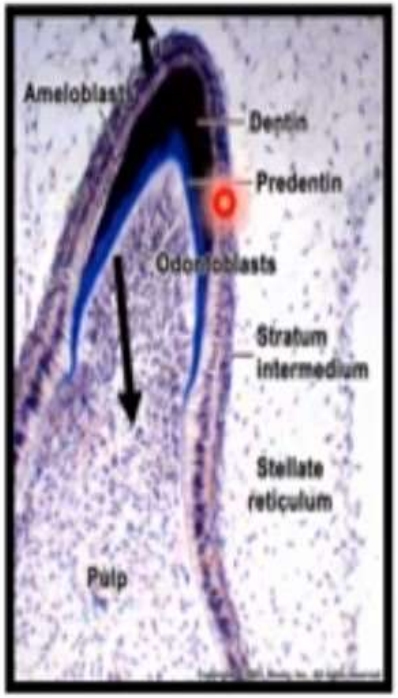


MORPHOGENIC STAGE

Before the ameloblasts are fully differentiated and produce enamel, they interact with the adjacent mesenchymal cells, determining the shape of the dentinoenamel junction and the crown (CEJ) .



Amelogenesis





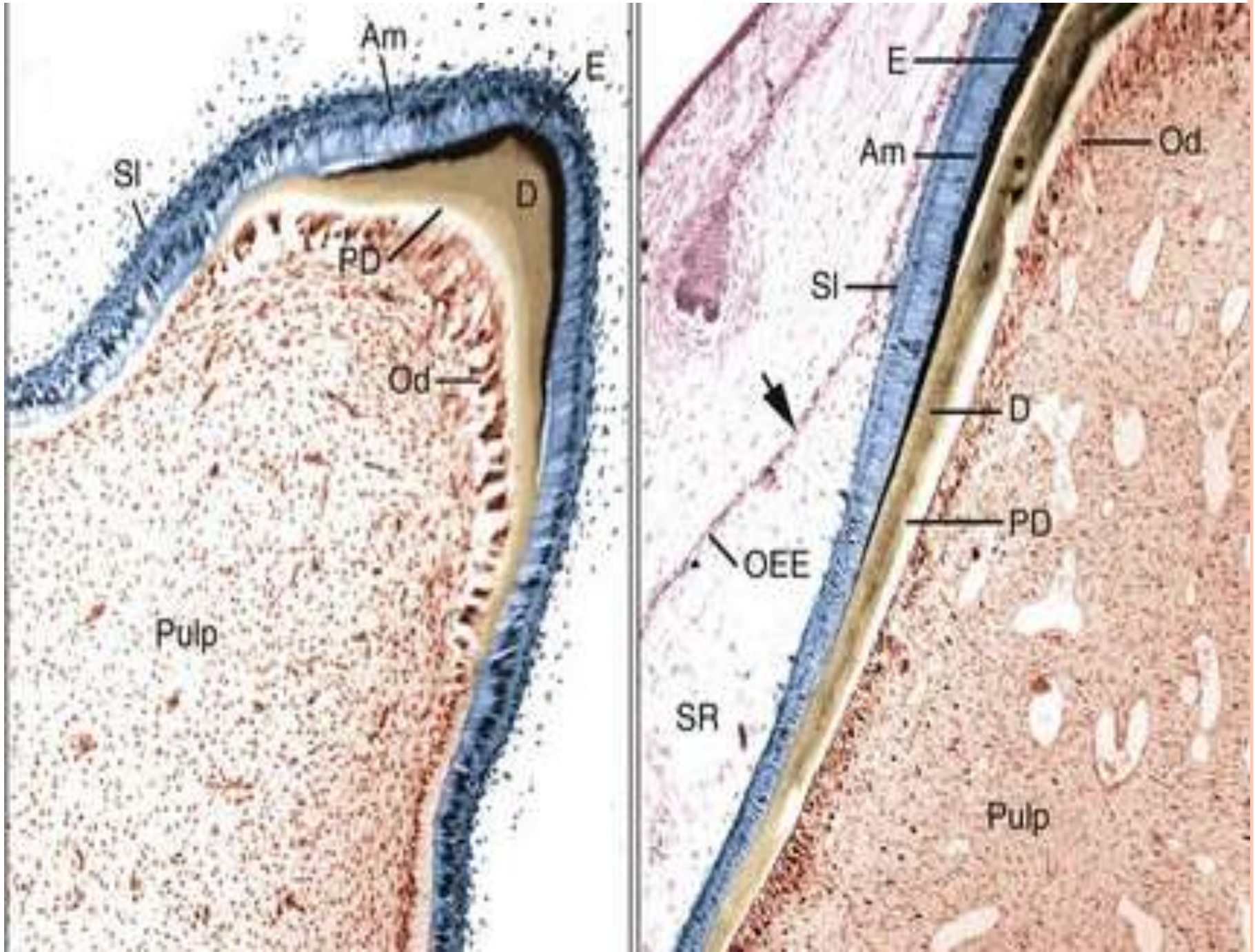
Organizing or histodifferentiation stage

In the organizing stage of development the inner enamel epithelium interacts with the adjacent connective tissue cells, which differentiate into odontoblasts to form dentin. This stage is characterized by a change in the appearance of the cells of the inner enamel epithelium.

Formative or secretory stage

The ameloblasts enter their formative stage after the first layer of dentin has been formed. The presence of dentin seems to be necessary for the beginning of enamel matrix formation.




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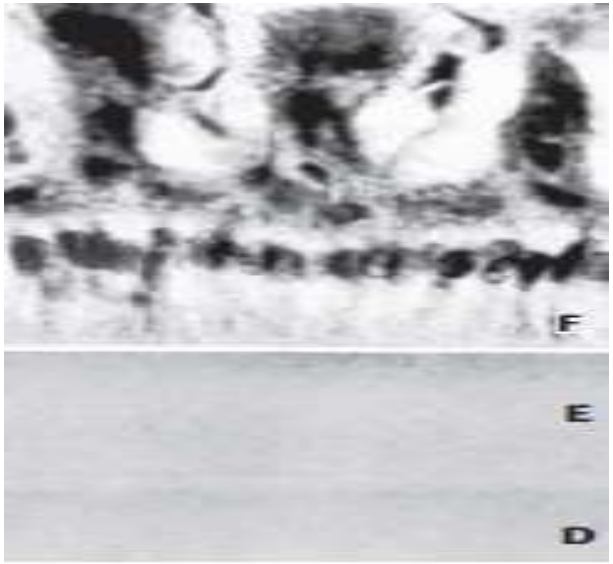
MATURATIVE STAGE

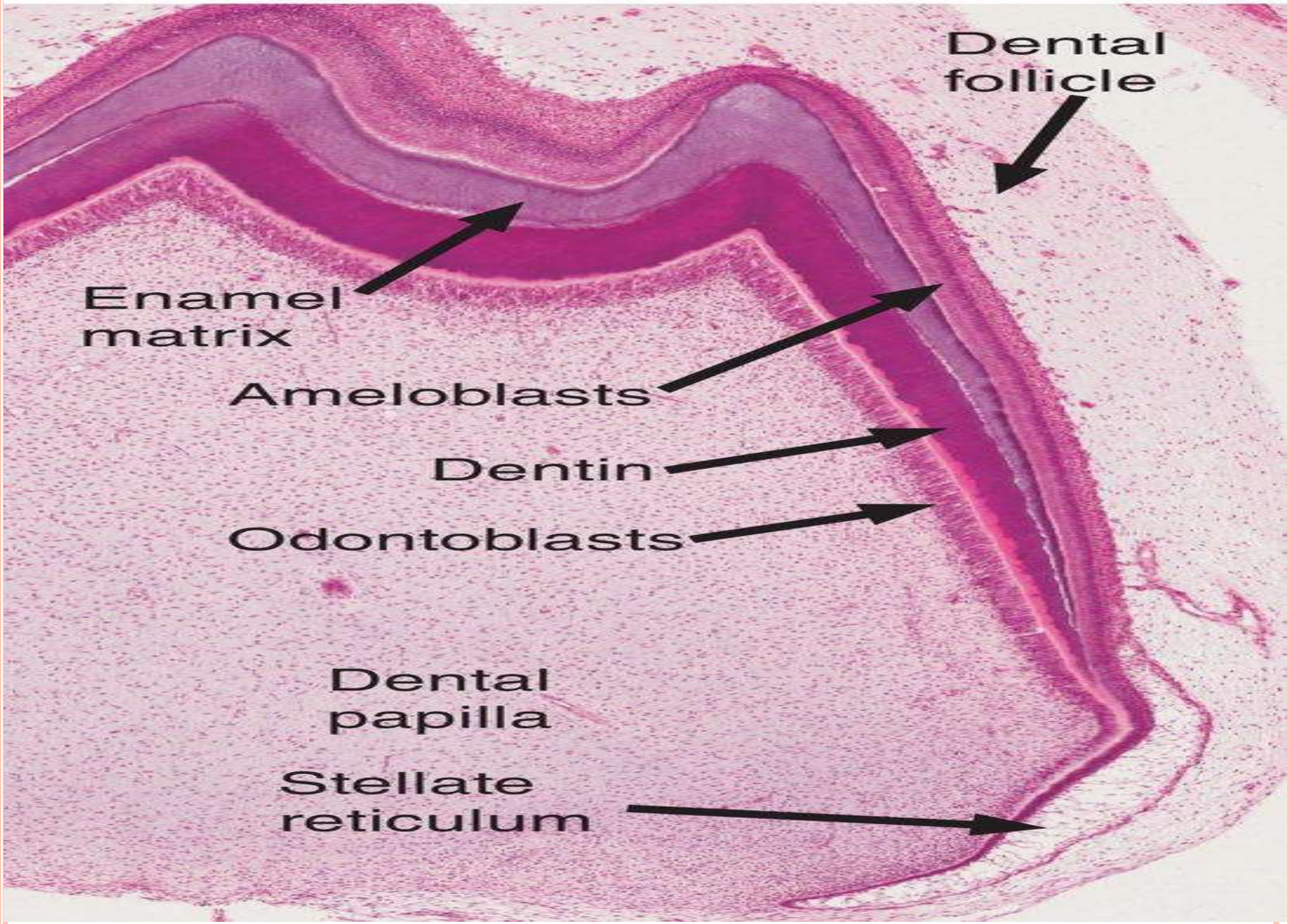
Enamel maturation (full mineralization) occurs after most of the thickness of the enamel matrix has been formed in the incisal area.

In the cervical parts of the crown, enamel matrix formation is still progressing at this time.



During enamel maturation the ameloblasts are slightly reduced in length and are closely attached to enamel matrix.




(a)
Dental follicle
Enamel matrix
Ameloblasts
Dentin
Odontoblasts
Dental papilla
Stellate reticulum

PROTECTIVE STAGE

When the enamel has completely developed and has fully calcified, the ameloblasts cease to be arranged in a well-defined layer and can no longer be differentiated from the cells of the stratum intermedium and outer enamel epithelium .



These cell layers then form a stratified epithelial covering of the enamel, the so-called reduced enamel epithelium. The function of the reduced enamel epithelium is that of protecting the mature enamel by separating it from the connective tissue until the tooth erupts.



DESMOLYTIC STAGE

The reduced enamel epithelium proliferates and seems to induce atrophy of the connective tissue separating it from the oral epithelium, so that fusion of the two epithelia can occur. It is probable that the epithelial cells elaborate enzymes that are able to destroy connective tissue fibers by desmolysis. Premature degeneration of the reduced enamel epithelium may prevent the eruption of a tooth.

Life cycle of Ameloblasts

consists of following stages

- Morphogenic stage
- Organizing stage
- Formative stage
- Maturative stage
- Protective stage

AMELOGENESIS

Amelogenesis, or enamel formation, is a two-step process. When enamel first forms, it mineralizes only partially to approximately 30% . Subsequently, as the organic matrix breaks down and is removed, crystals grow wider and thicker. In this process the organic matrix and water are lost and mineral is added after the full thickness of the enamel layer has been formed to attain greater than 96% mineral content.

Amelogenin is the major component of enamel matrix proteins. Ameloblastin and enamelin are the other important proteins of the enamel matrix.

Recently, amelotin, a new protein was reported to be secreted by maturative ameloblast. This protein is suggested to help in enamel formation.

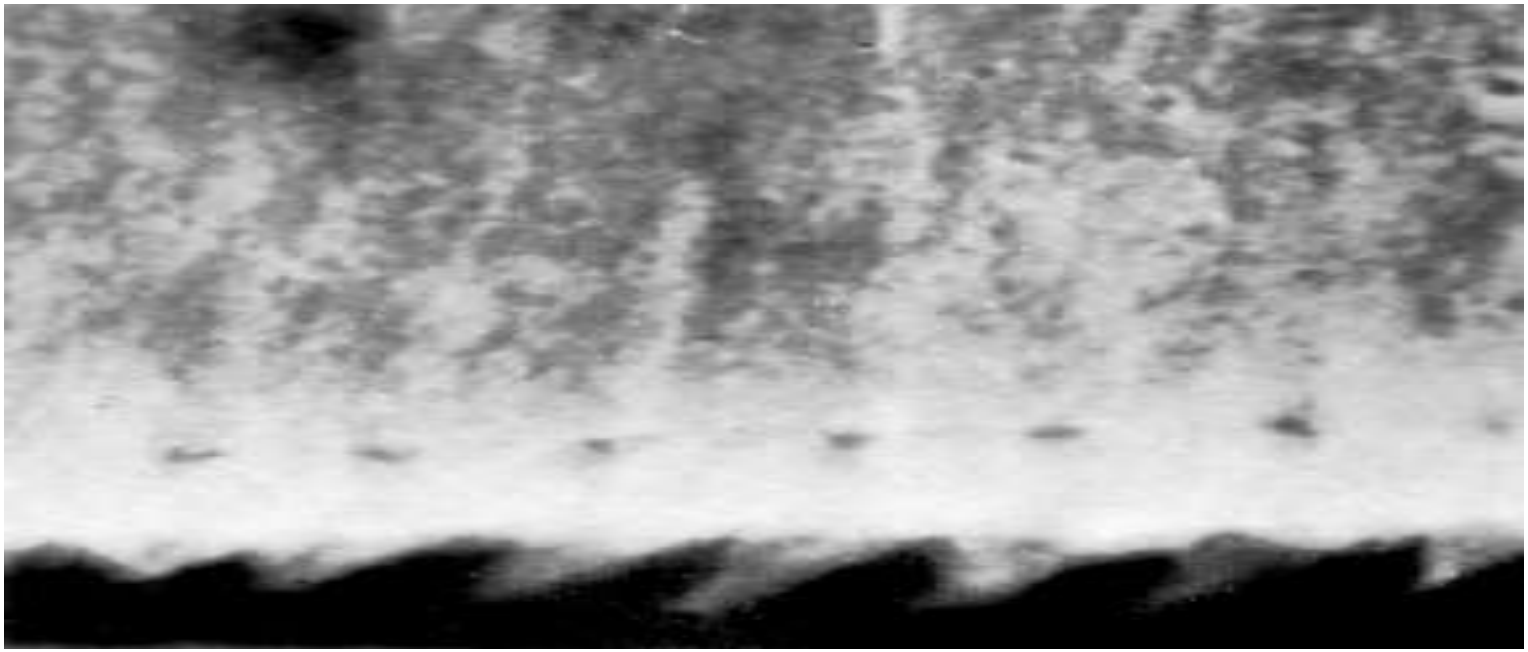


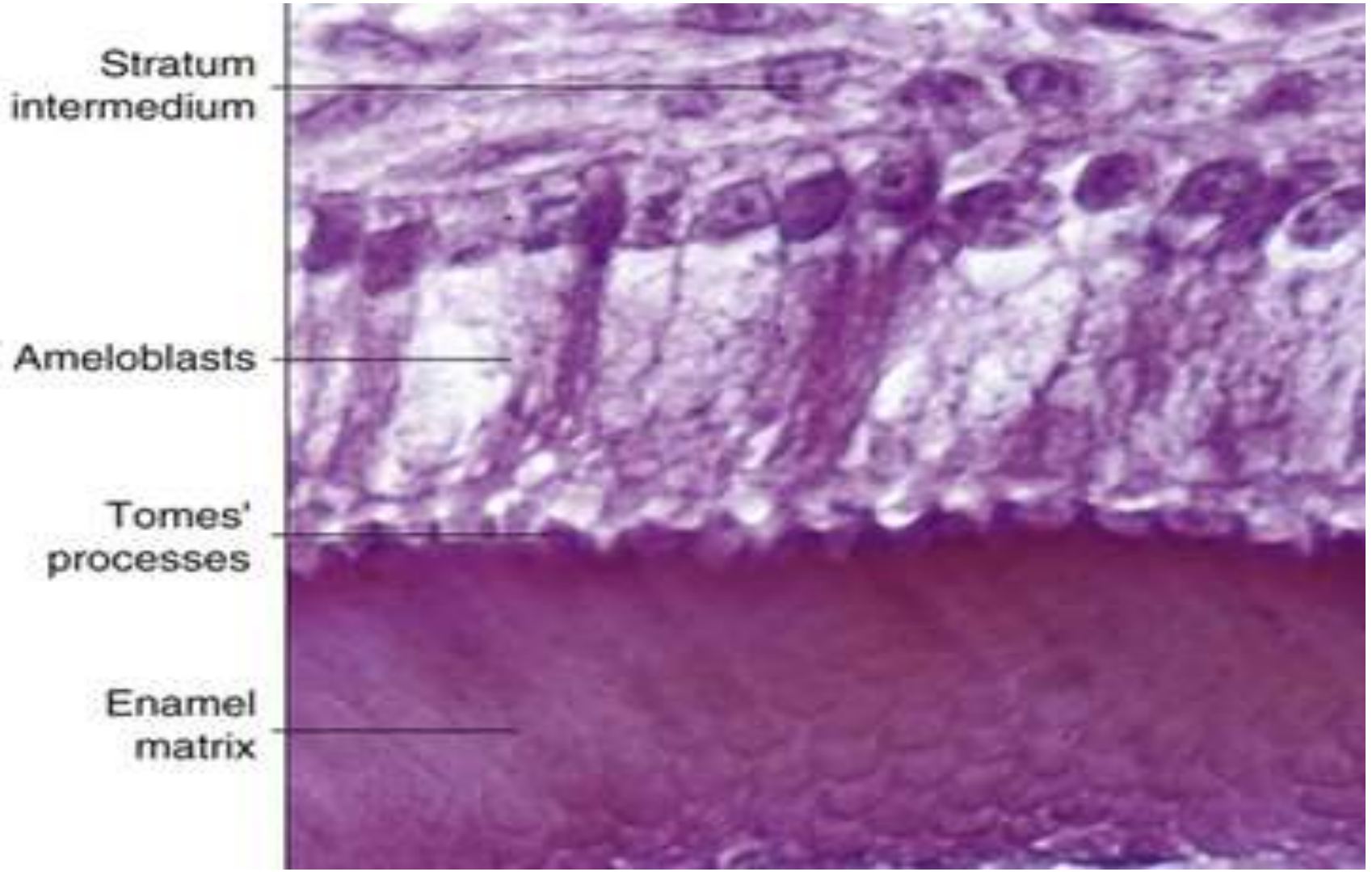
The rate of formation of enamel is 4 µm/day, therefore to form a layer of enamel of 1 mm thickness it would take about 240 days. The rate of enamel formation is more in permanent teeth than in deciduous teeth.



Development of Tomes' processes

The surfaces of the ameloblasts facing the developing enamel are not smooth. The projections of the ameloblasts into the enamel matrix have been named Tomes' processes.

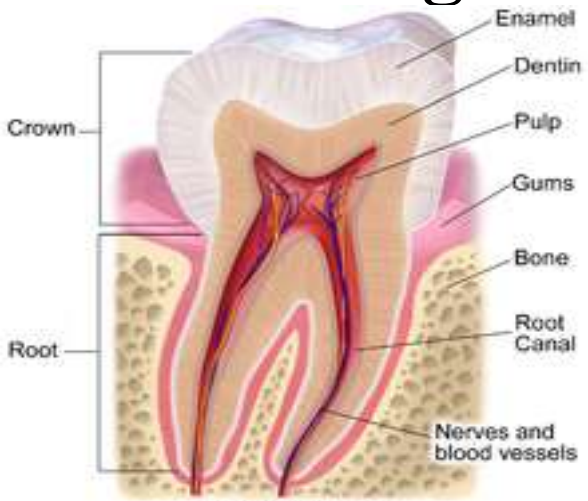



Stratum intermedium
Ameloblasts
Tomes' processes
Enamel matrix

ENAMEL STRUCTURE

Physical Characteristics:

1-Enamel forms a protective covering of variable thickness over the entire surface of the crown. On the cusps of human molars and premolars the enamel attains a maximum thickness of about 2 to 2.5 mm, thinning down to almost a knife edge at the neck of the tooth .



Tooth Anatomy

The enamel was found to be thicker in the lingual surfaces of maxillary molars and in the buccal surfaces of mandibular molars. The shape and contour of the cusps receive their final modeling in the enamel.

Because of its high content of mineral salts and their crystalline arrangement, enamel is the hardest calcified tissue in the human body. The function of the enamel is to form a resistant covering of the teeth, which forming a suitable for mastication.

The structure and hardness of the enamel forming a brittle or bright teeth.

The density decreases from the surface to the deeper regions.



2-Enamel has always been observed as a non-electrical conductive material: it is in fact an insulator at room temperature.

3-The color of the enamel-covered crown ranges from yellowish white to grayish white. It has been suggested that the color is determined by differences in the translucency of enamel, yellowish teeth having a thin, translucent enamel through which the yellow color of the dentin is visible and grayish teeth having a more opaque enamel.

- Thank you

