



# LECTURE

# Dentin Part-1

Dr. Sajda Gajdhar

Oral Pathology and Microscopy

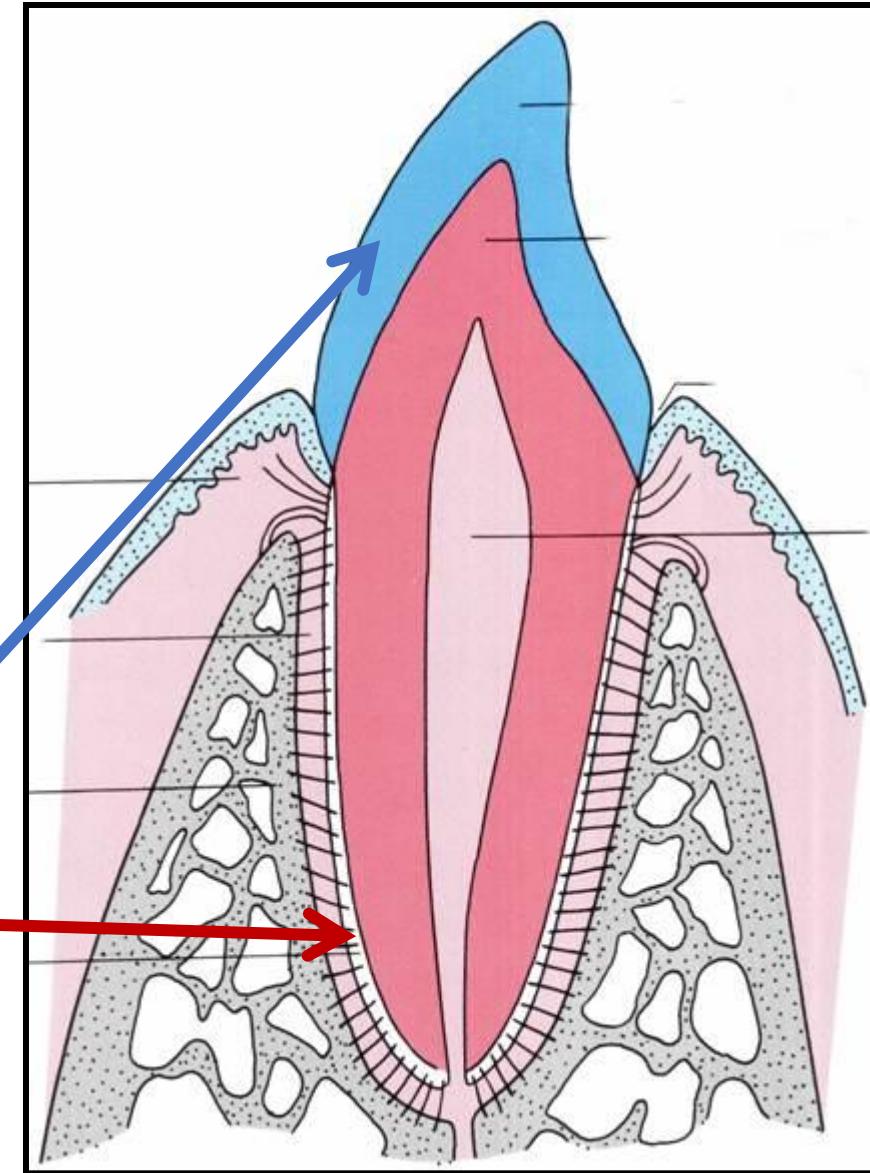


# Lecture learning outcomes:

1. Describe physical and chemical properties of dentin
2. Differentiate structures of dentin from enamel.
3. Understand the steps of dentin development and dentiongenesis

**Dentin:** is the mineralized tissue that forms the main bulk of the tooth

- 😊 In crown it is covered by enamel
- 😊 In root it is covered by cementum



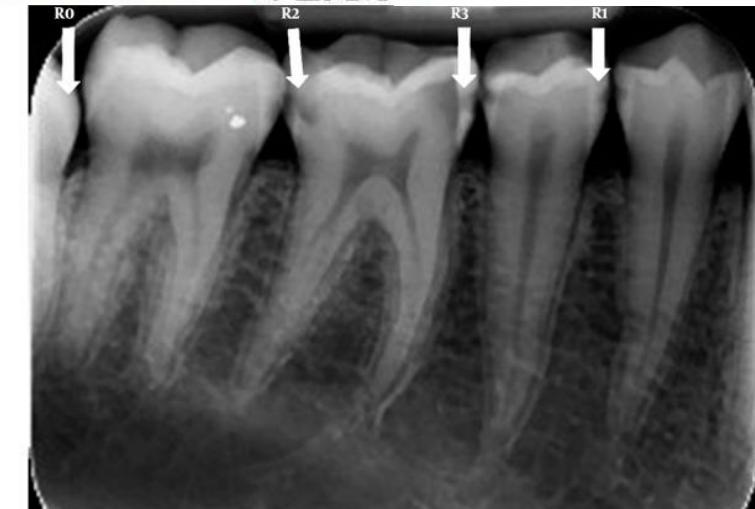
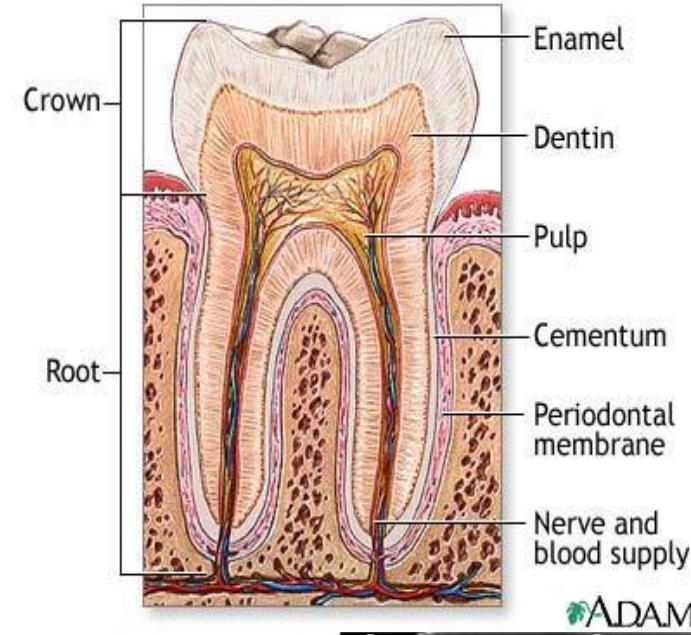
*Two major properties which  
differentiate dentin from enamel*

Dentin is  
sensitive

Dentin is formed  
throughout life.

# Physical properties:

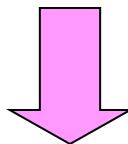
- Colour: Light yellowish
- Visco-Elastic.
- Hardness: less than enamel but more than cementum and bone.
- X-ray : more radiolucent than enamel and more radio-opaque than cementum.
- Semi-permeable
- Thickness: varies from 3-10 mm



# Chemical Characters Of Dentin

What is collagen

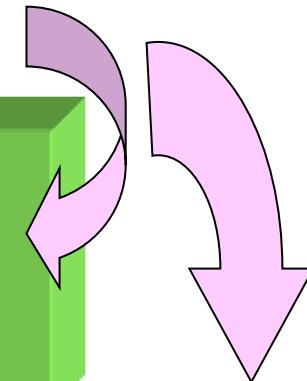
**65-70% inorganic  
material**



**Hydroxyapatite  
crystals**

**35-30% organic  
material**

**Collagen  
type I 90%**



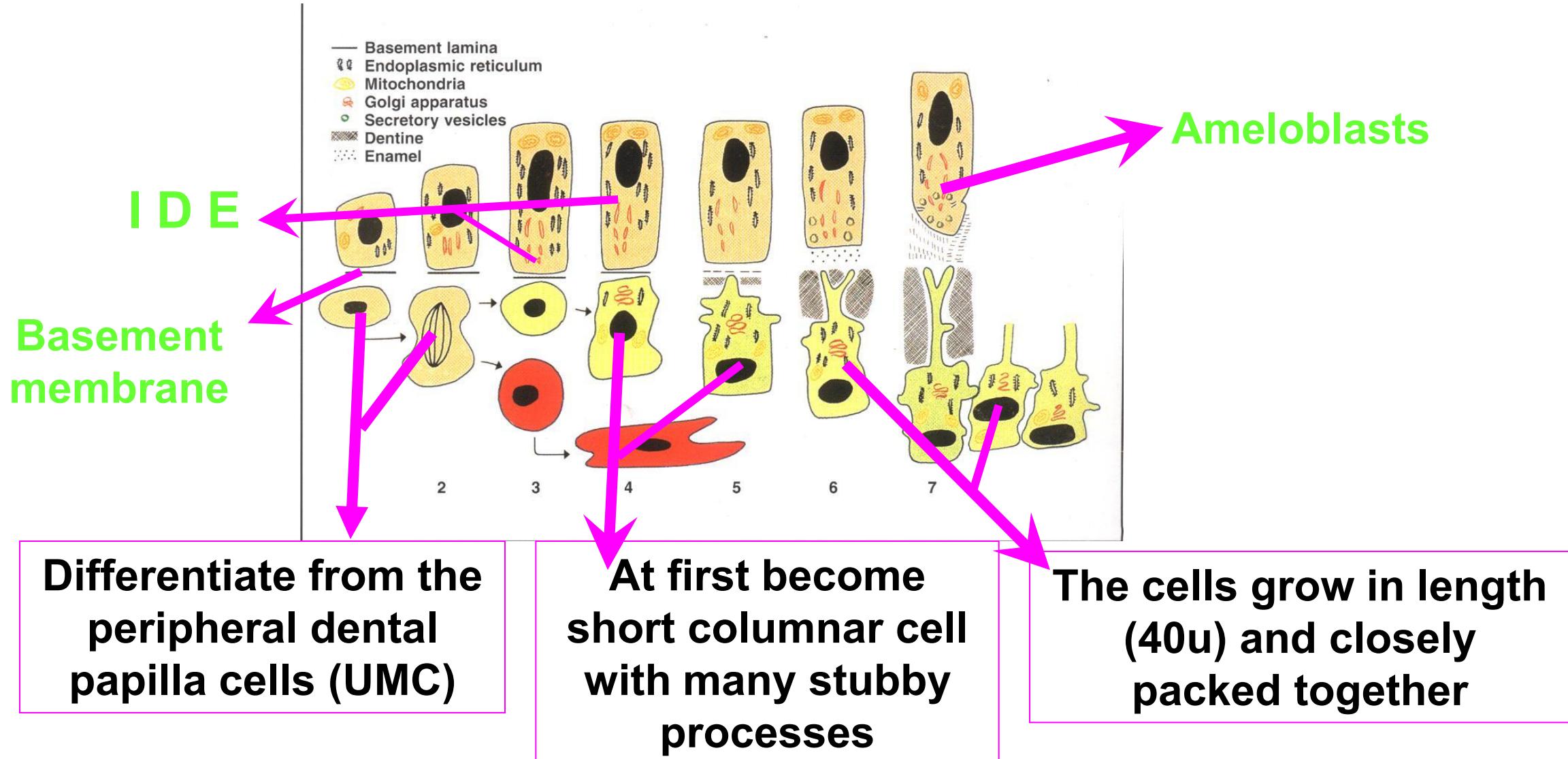
**glycoproteins  
and lipids**

**inclusions of  
non-collagenous  
proteins**

**Water**

# Dentin Development

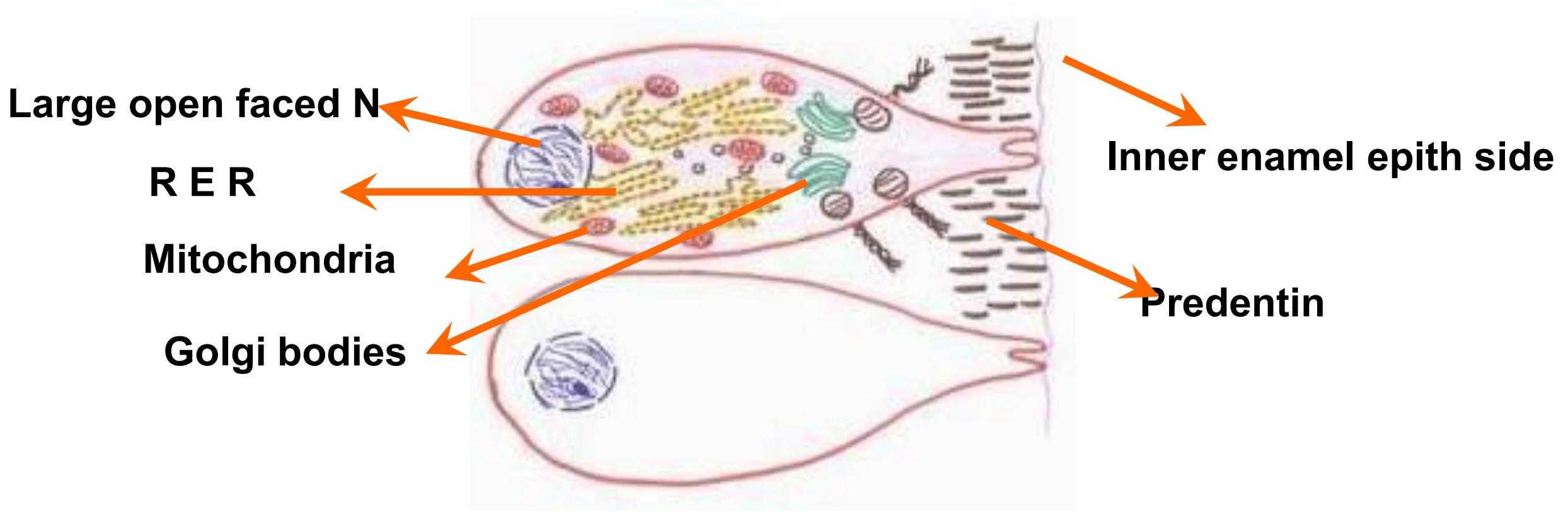
## 1- Differentiation of odontoblasts.



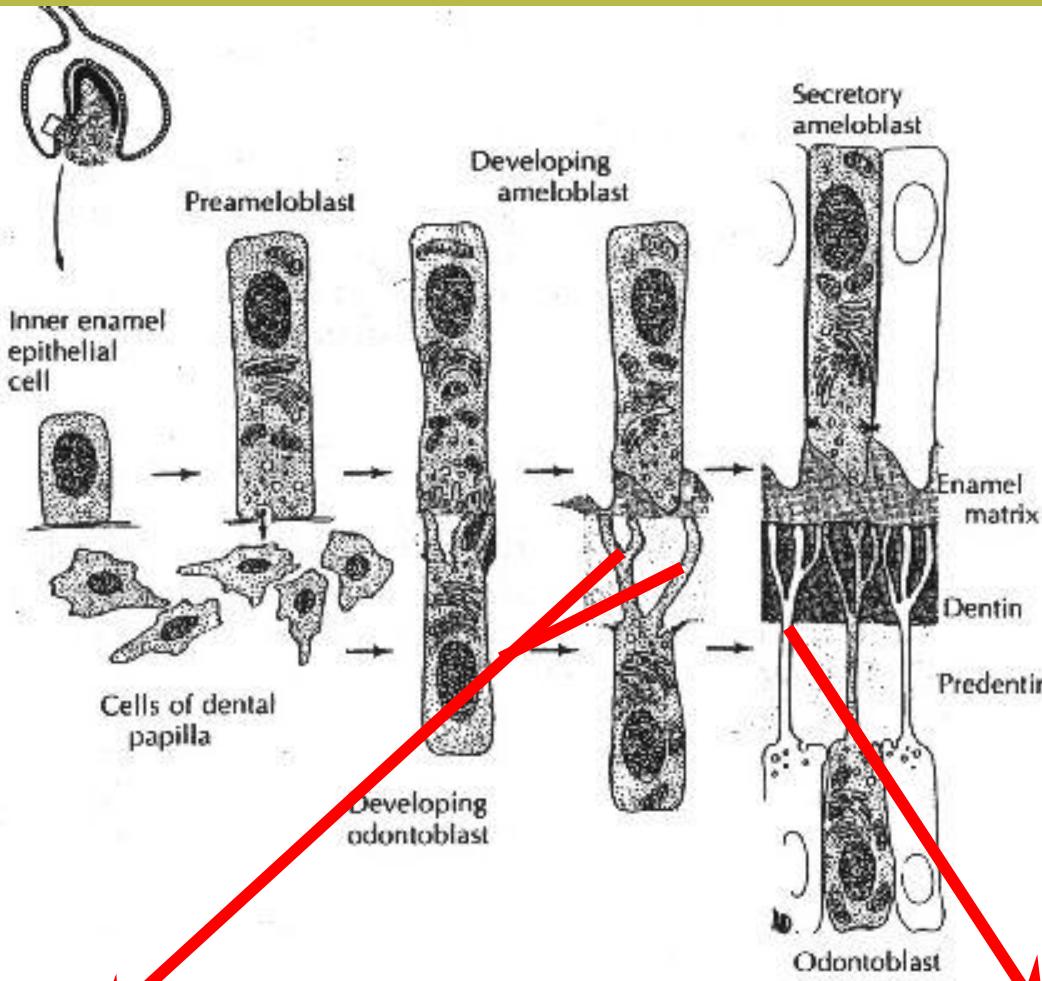
## **2- Formation of the predentin**

Odontoblast becomes a protein forming and secreting cell.

-  R E R , Mitochondria and Golgi bodies
-  Ribonucleic acid and alkaline phosphatase



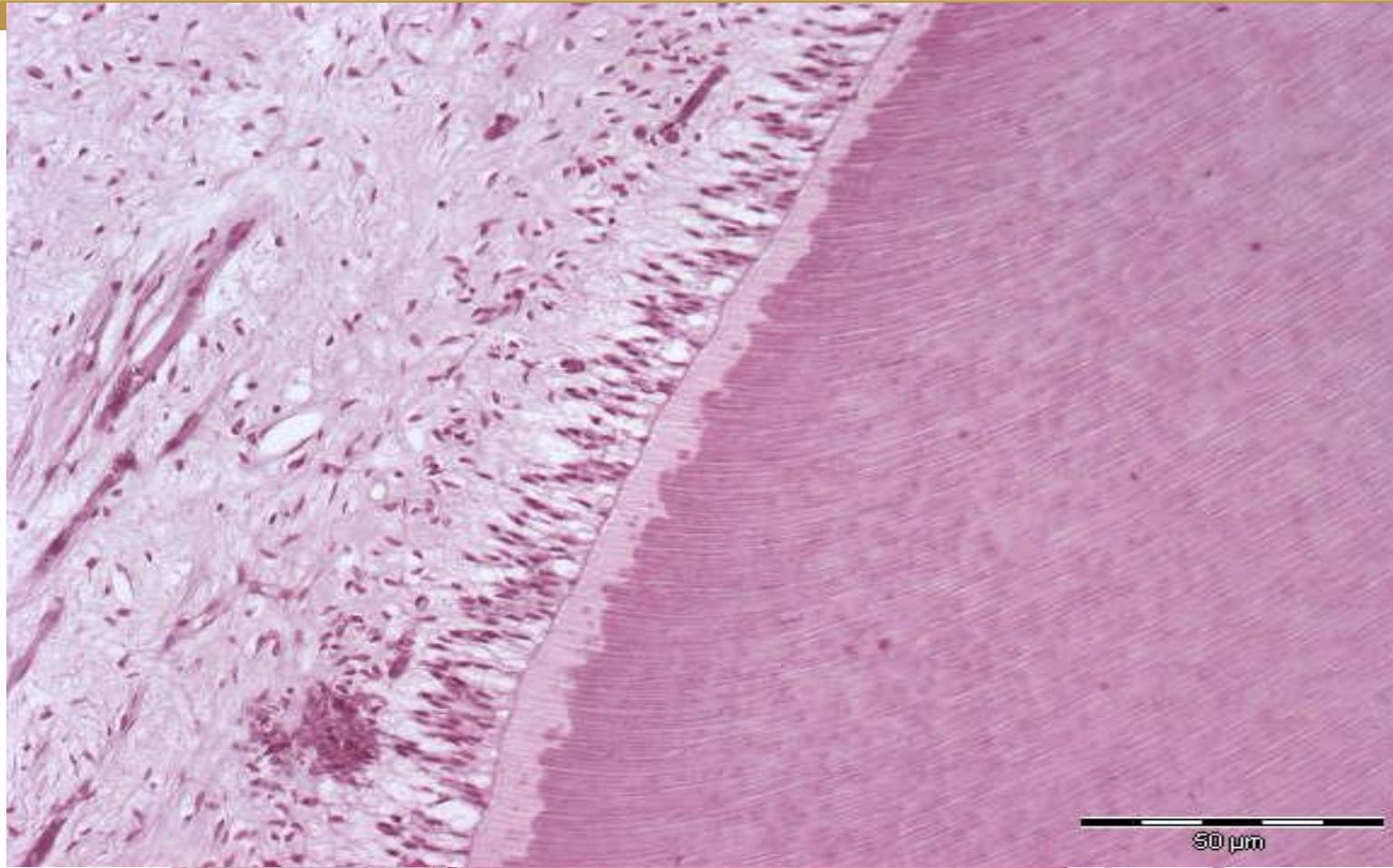
### **3- Odontoblastic process formation**



At first more than one process

As more D is laid down, the cells recede and leave single process (**Tomes' fiber**)

## 4- Quiescent state of odontoblasts

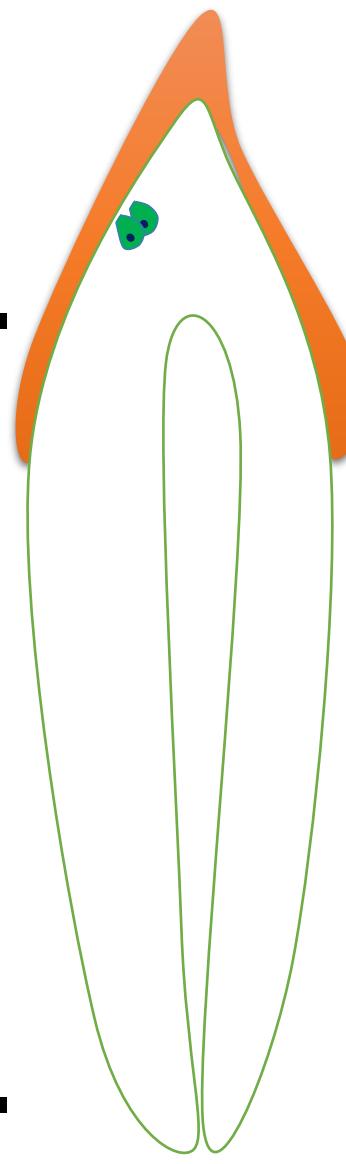
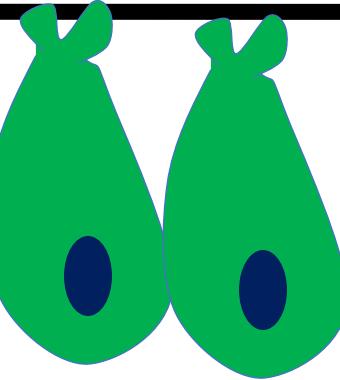


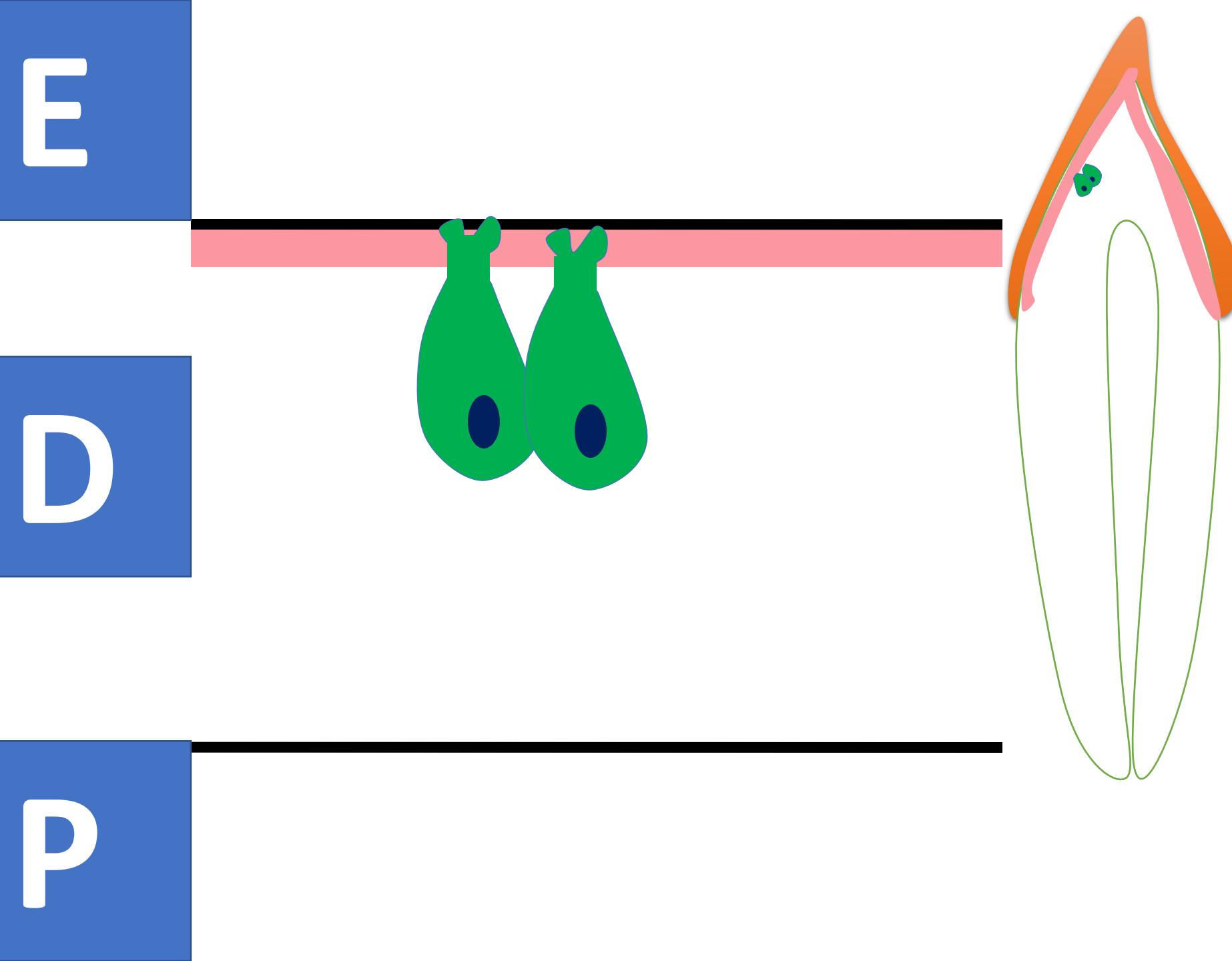
**The odontoblasts decrease in size and form dentin in a slow rate**

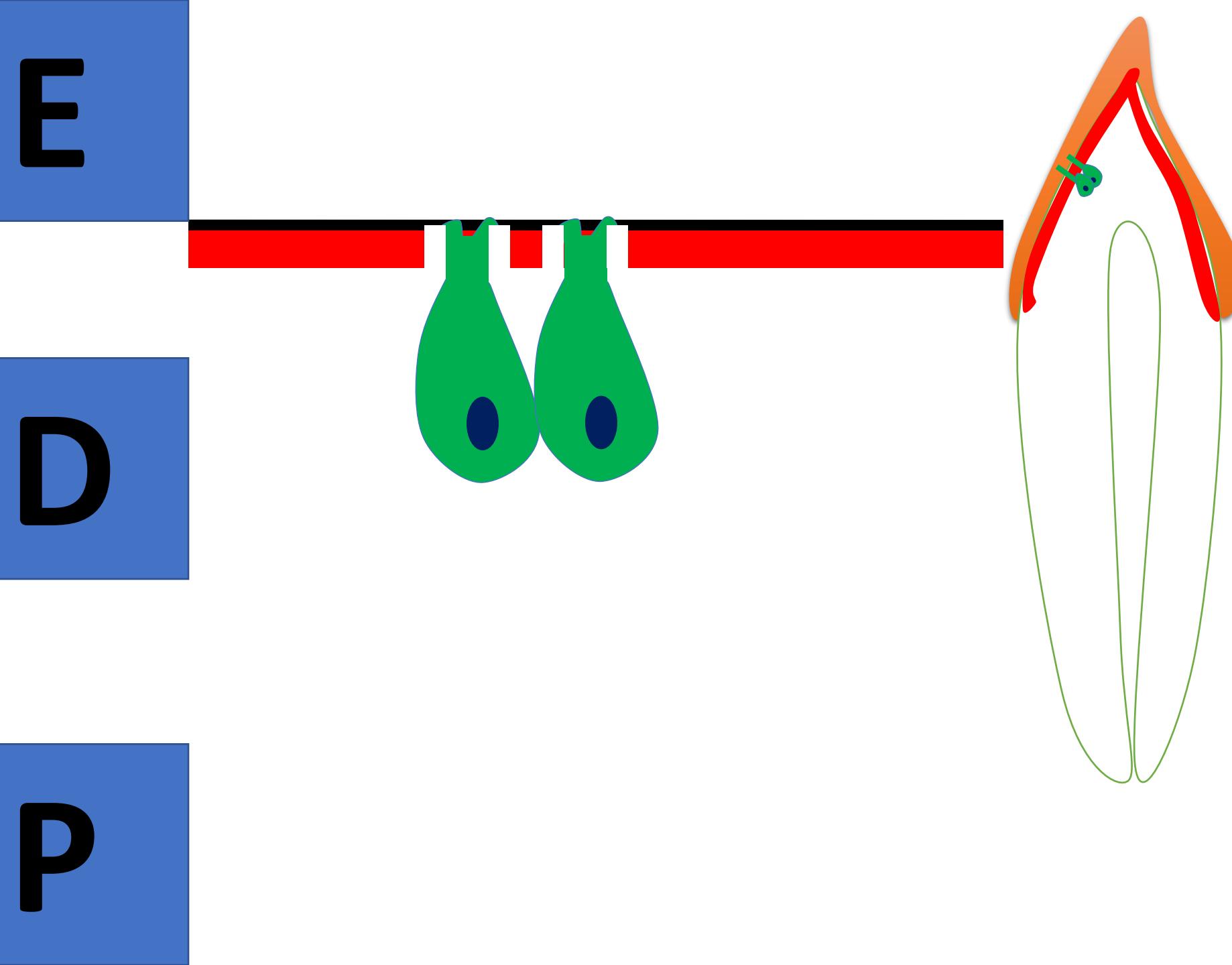
**E**

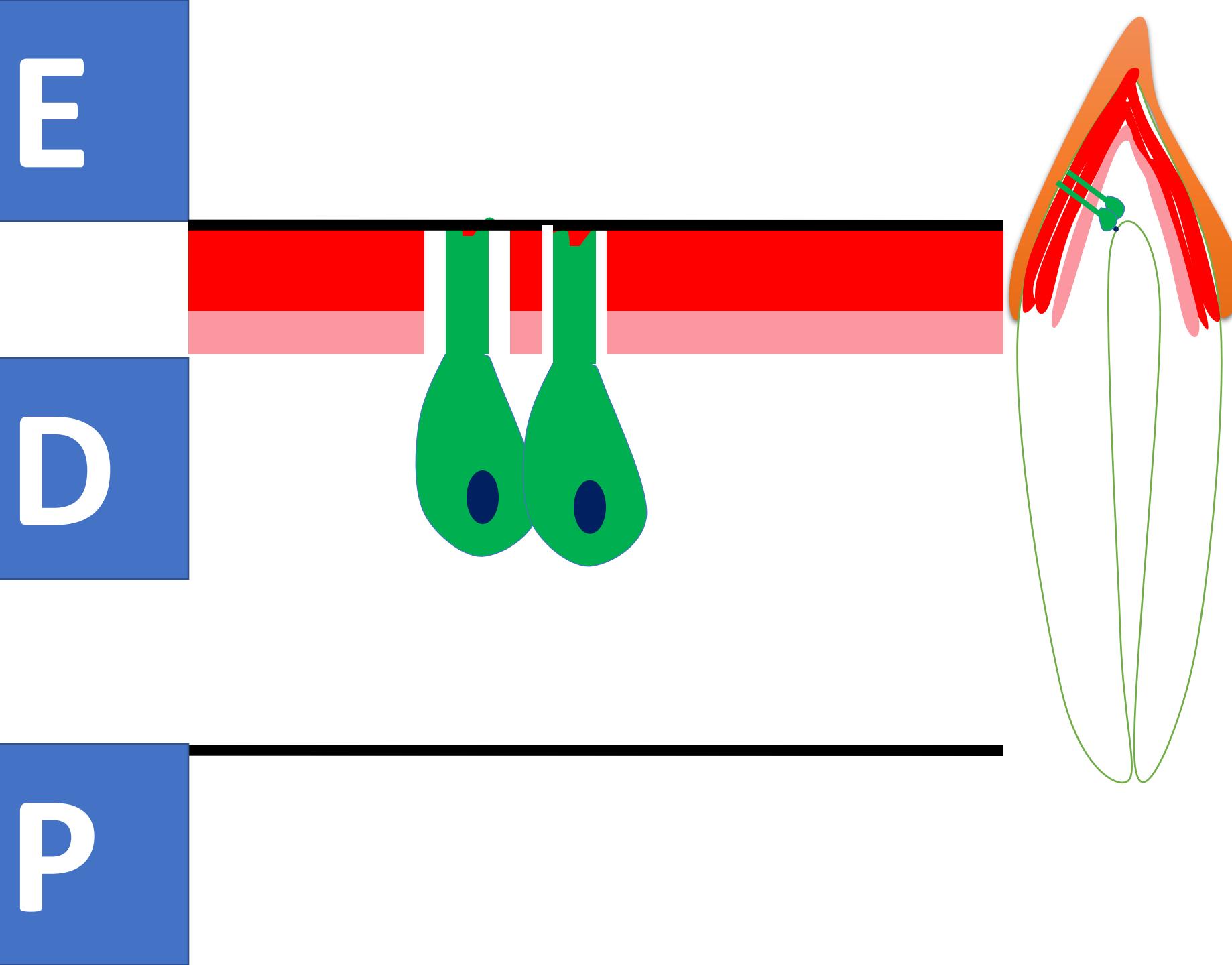
**D**

**P**





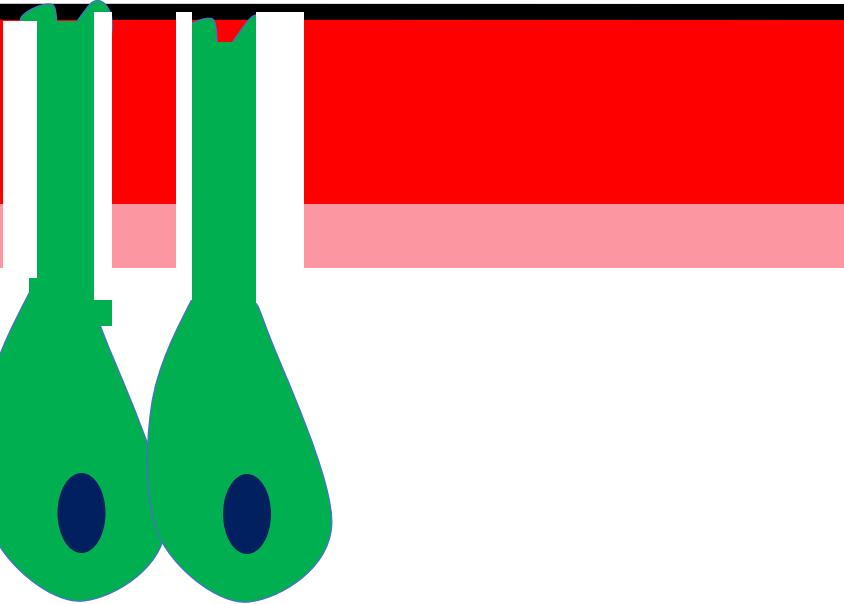


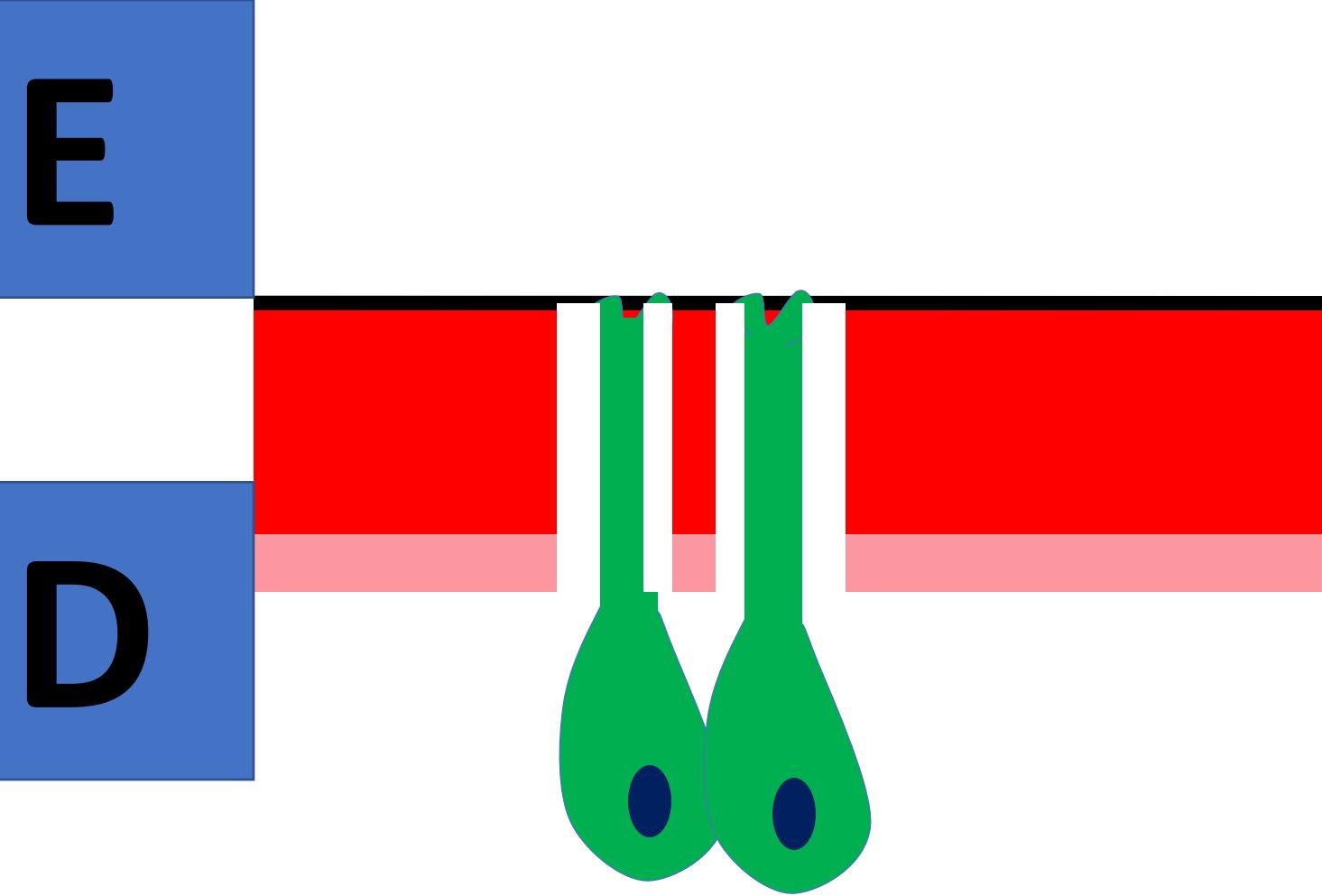


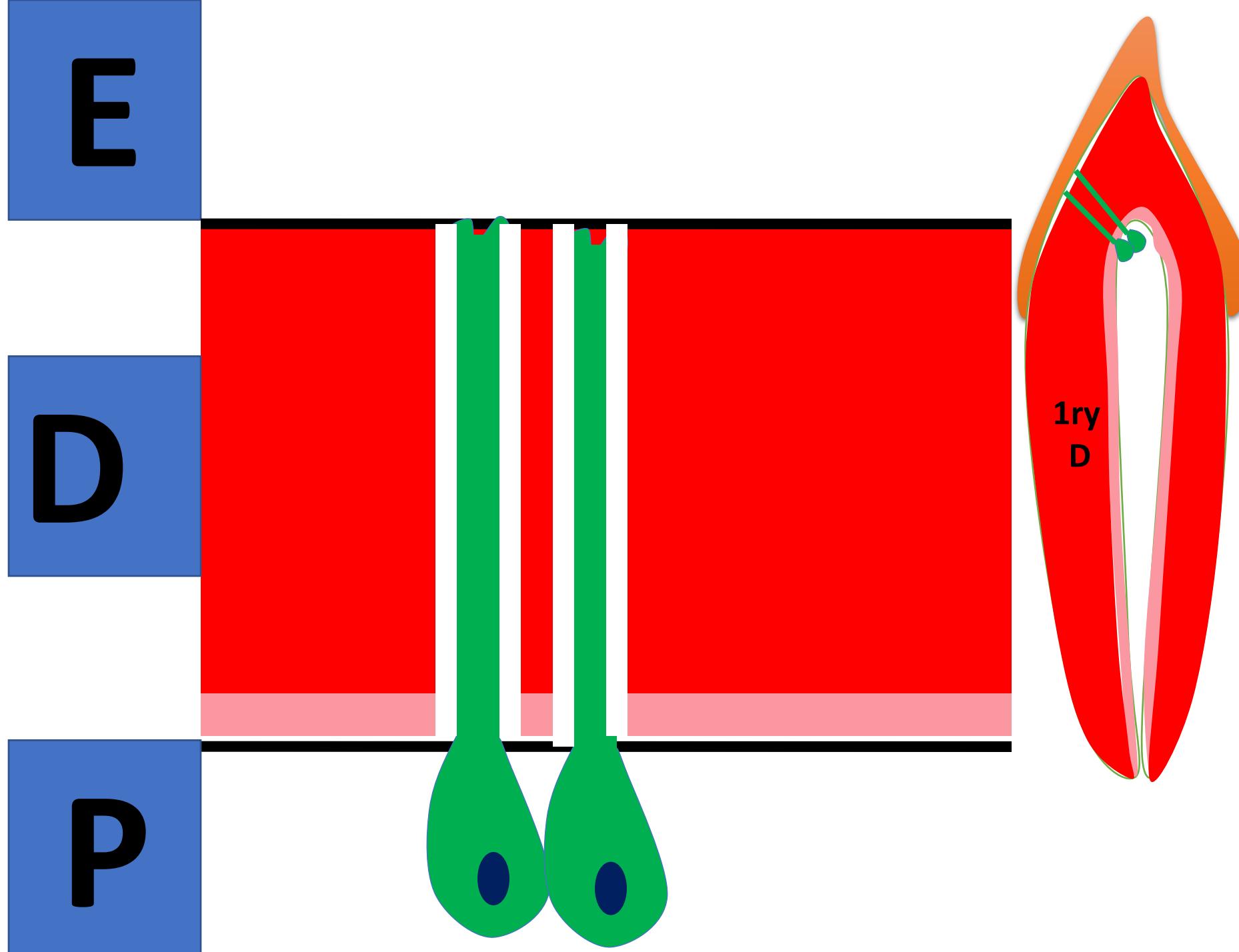
**E**

**D**

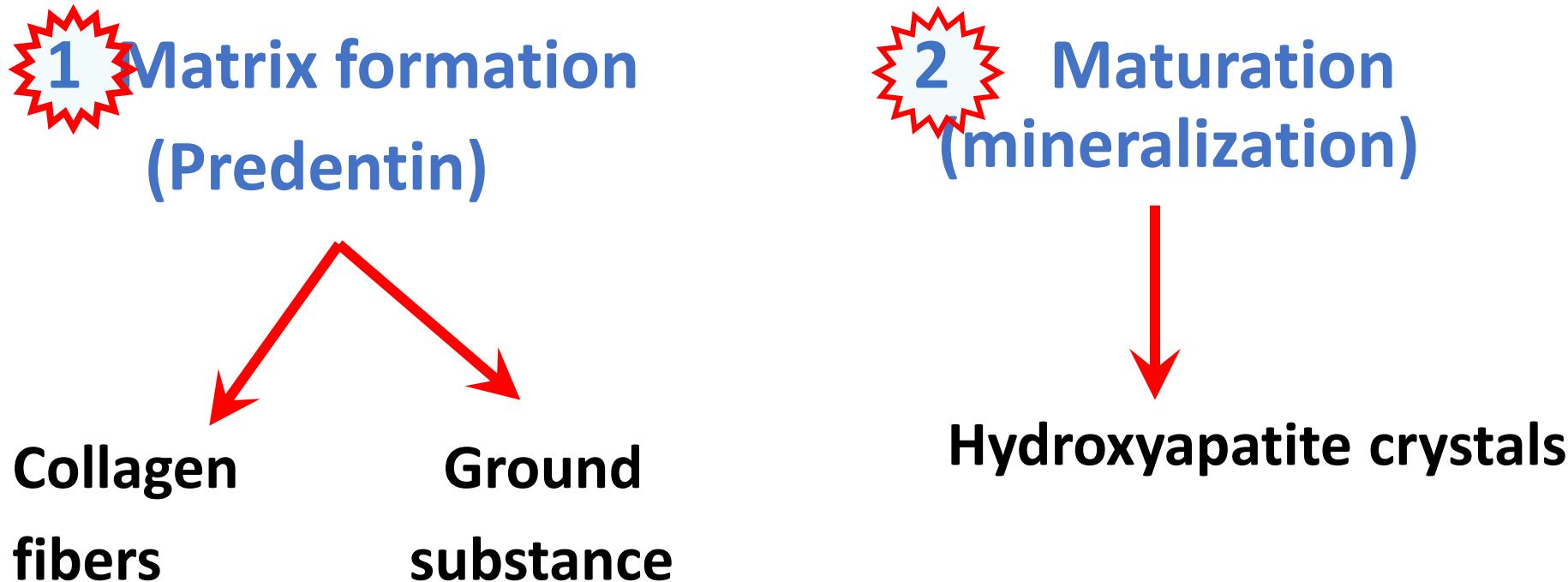
**P**







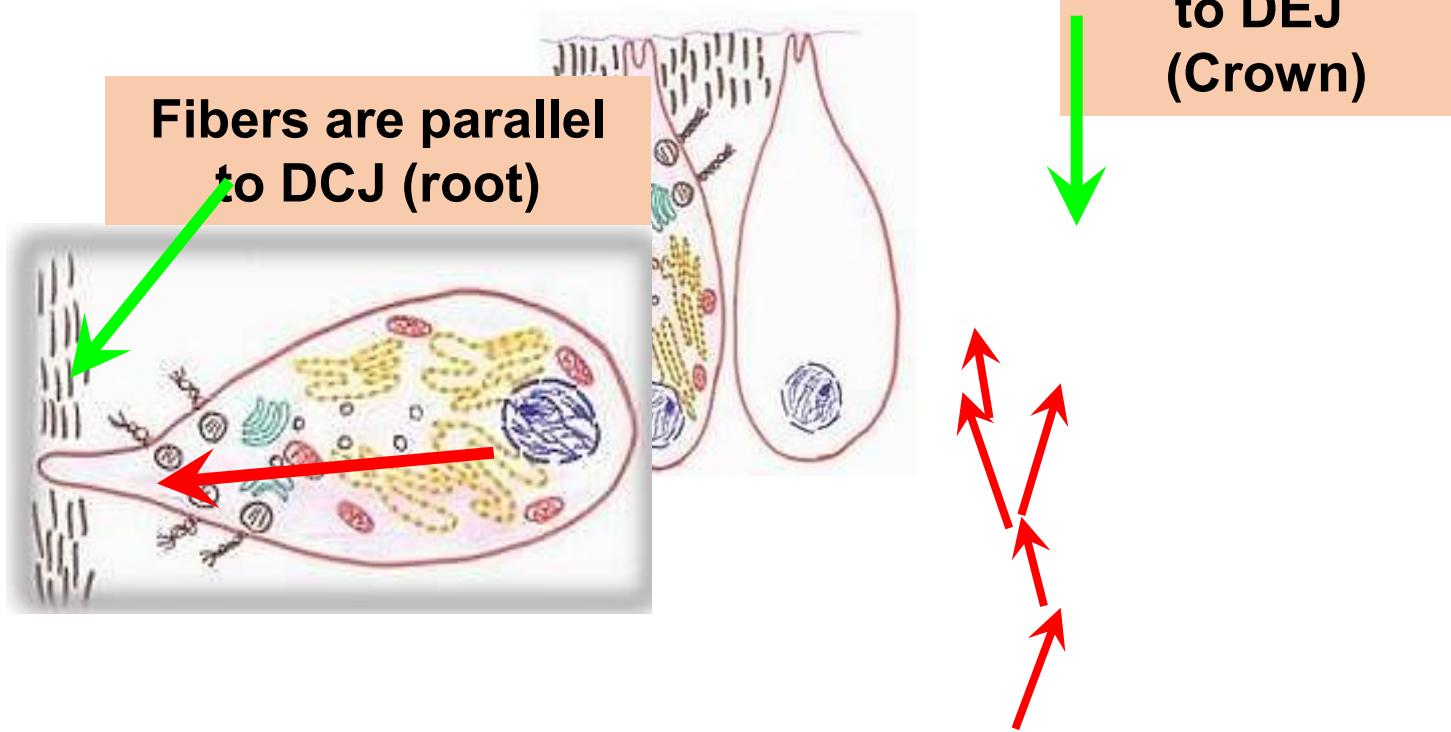
# Dentinogenesis



# 1- Matrix formation

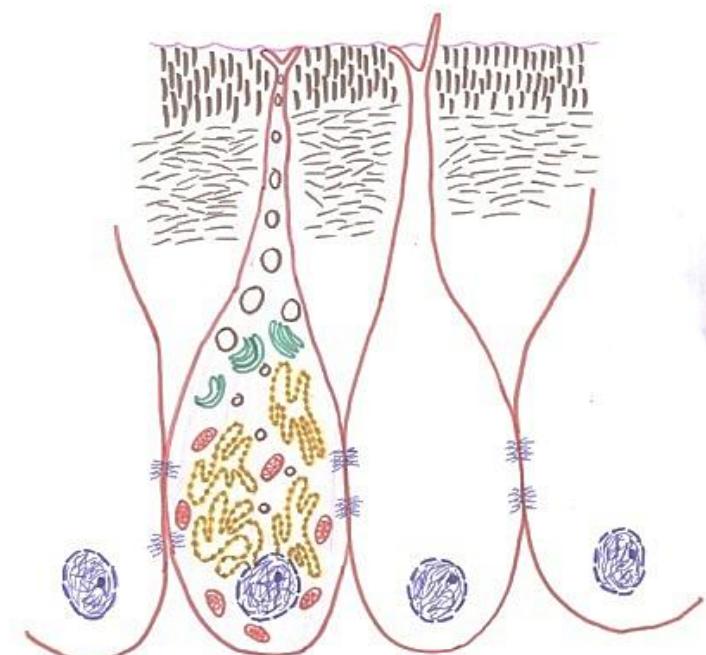
## A- Mantle dentin

- The first formed dentin layer in crown  
And root(10-20 um)



## B- Circumpulpal dentin

The fibers are parallel to DEJ (right or oblique angle to DT)



## 2- Mineralization

Budding of matrix vesicles

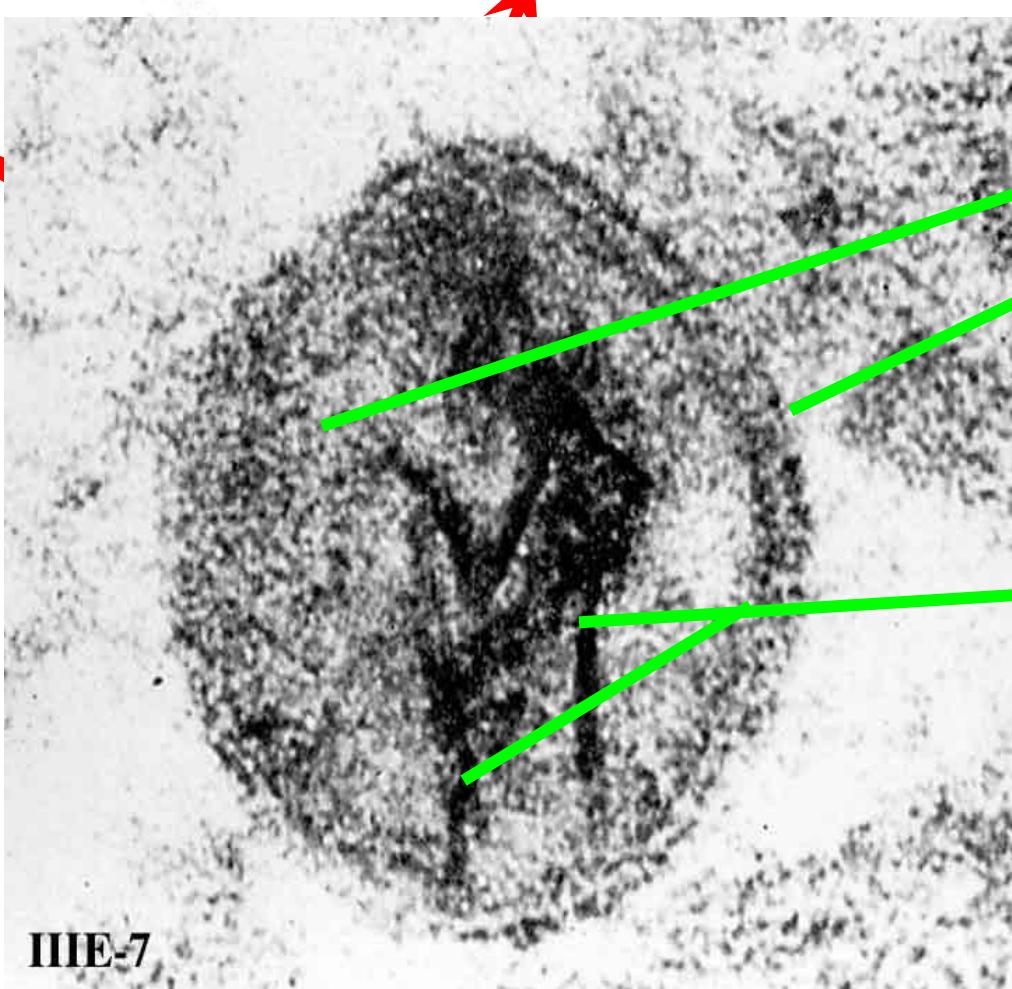
Rupture of matrix vesicles

Mineralization of the  
mantle dentin

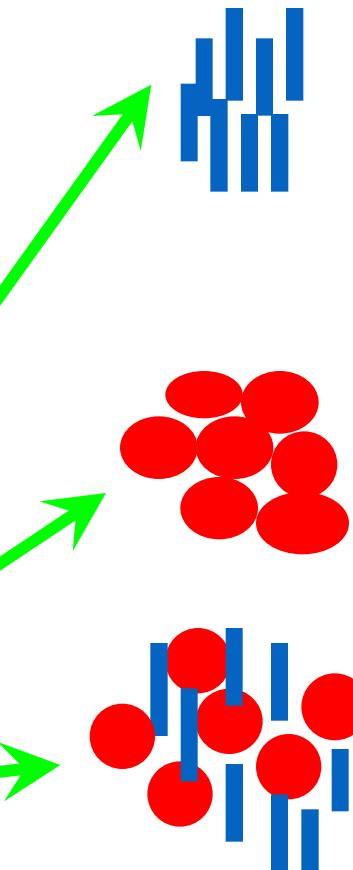
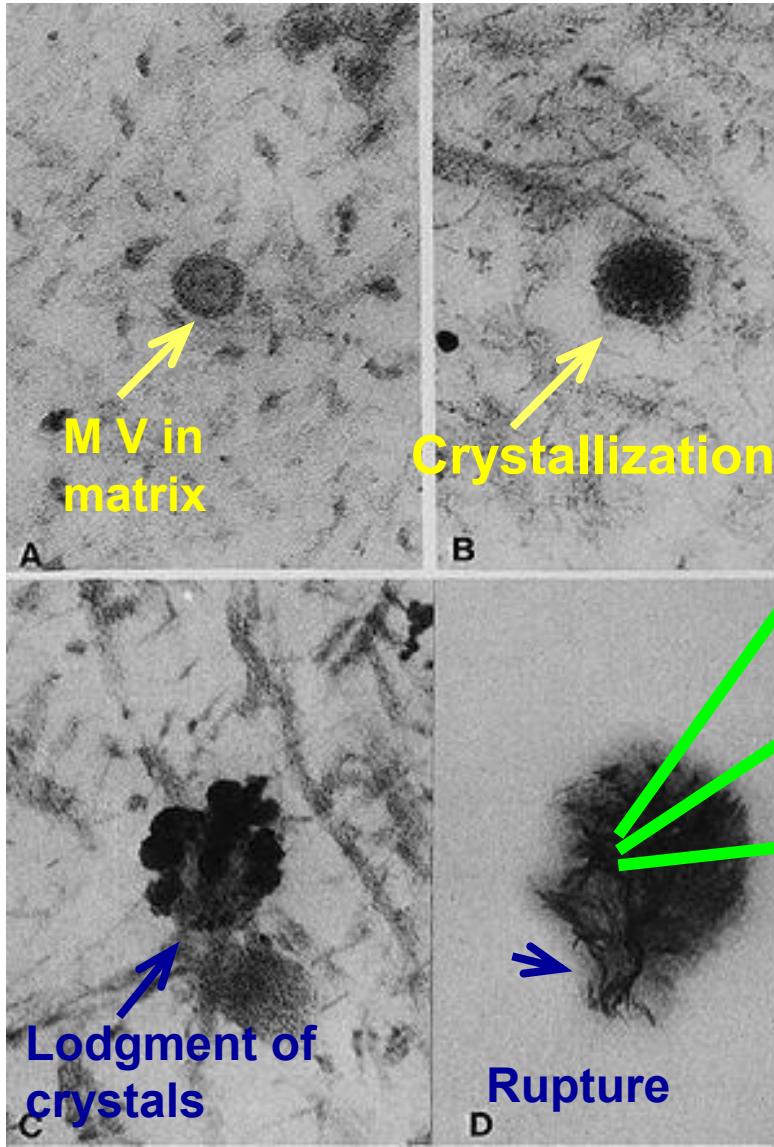
**Matrix vesicle**

Has membrane  
rich in alkaline  
phosphatase

Calcium and phosphate  
ions undergo  
crystallization



# Pattern Of Mineralization



1- Linear at the mantle dentin area

2- Globular in circumpulpal dentin just below mantle dentine

3- Combination in the remaining circumpulpal dentine of the crown and root

# Lecture 2



# LECTURE

# Dentin Part-2

Dr. Sajda Gajdhar

Oral Pathology and Microscopy

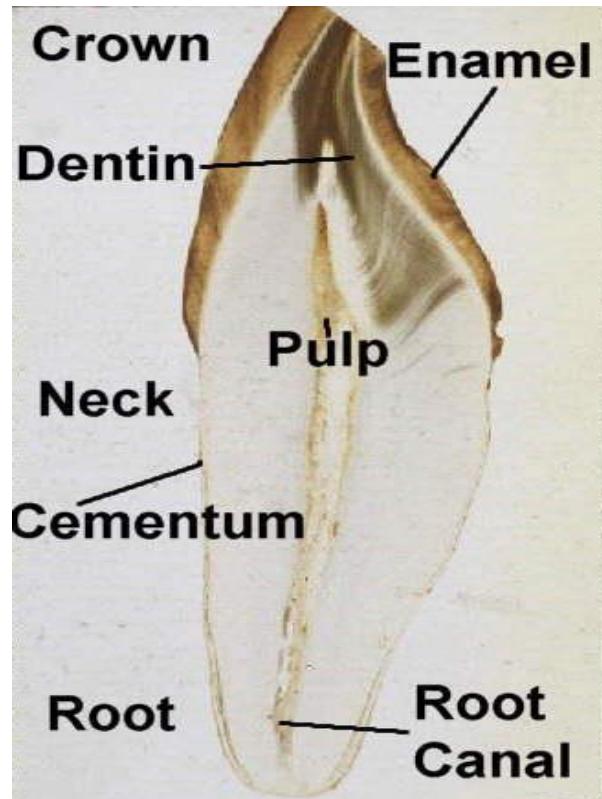


# **LEARNING OUTCOMES**

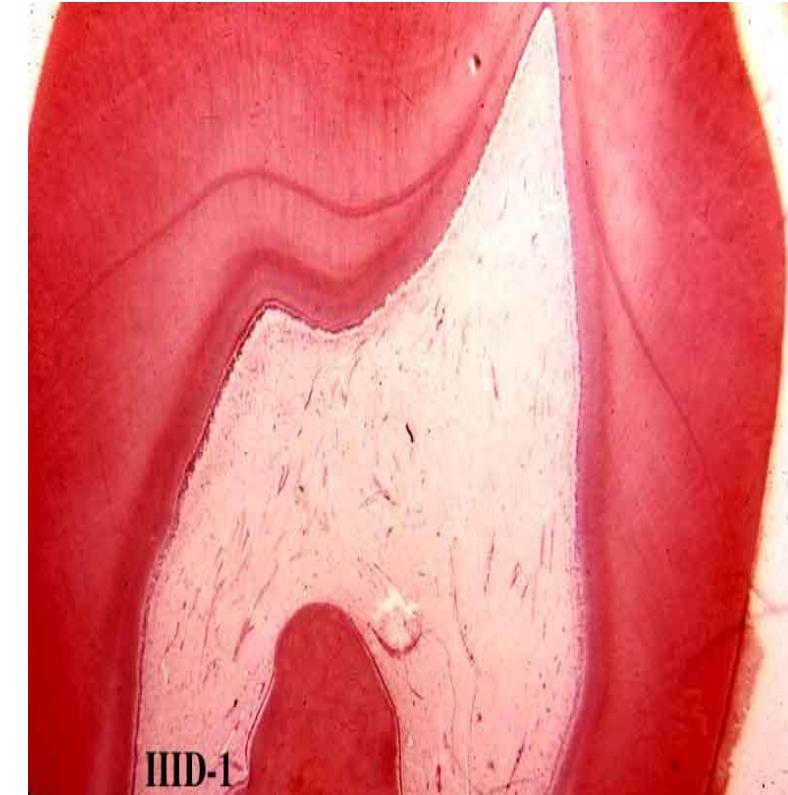
1. Explain the microscopic structure (Histology) of Dentin.
2. Classification of dentin based on structure.
3. Differentiate between different types of dentin.

# How To Study The Histological Structures Of Dentin

- Ground section  
(inorganic part)



- Decalcified section  
(Organic part)

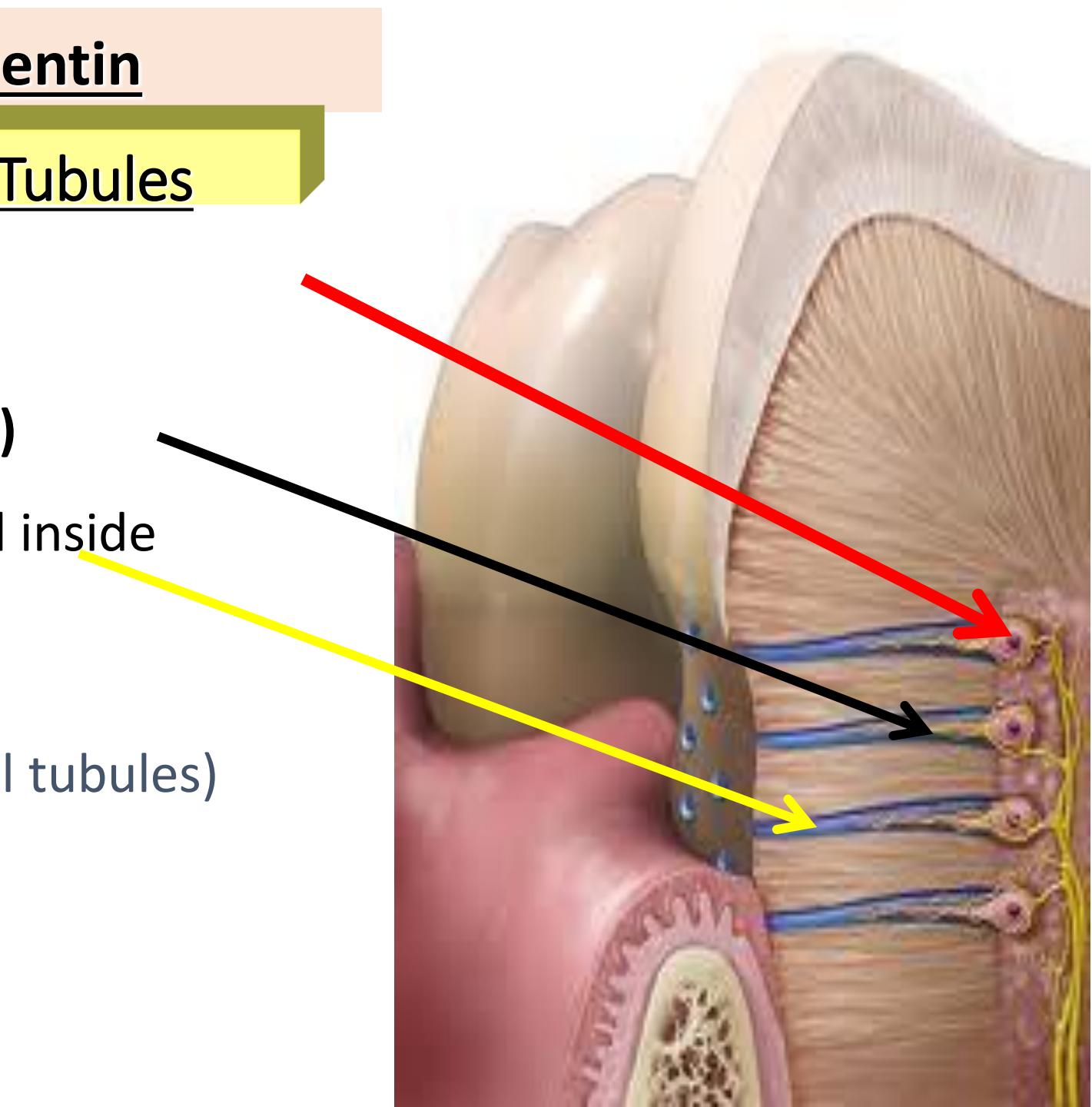


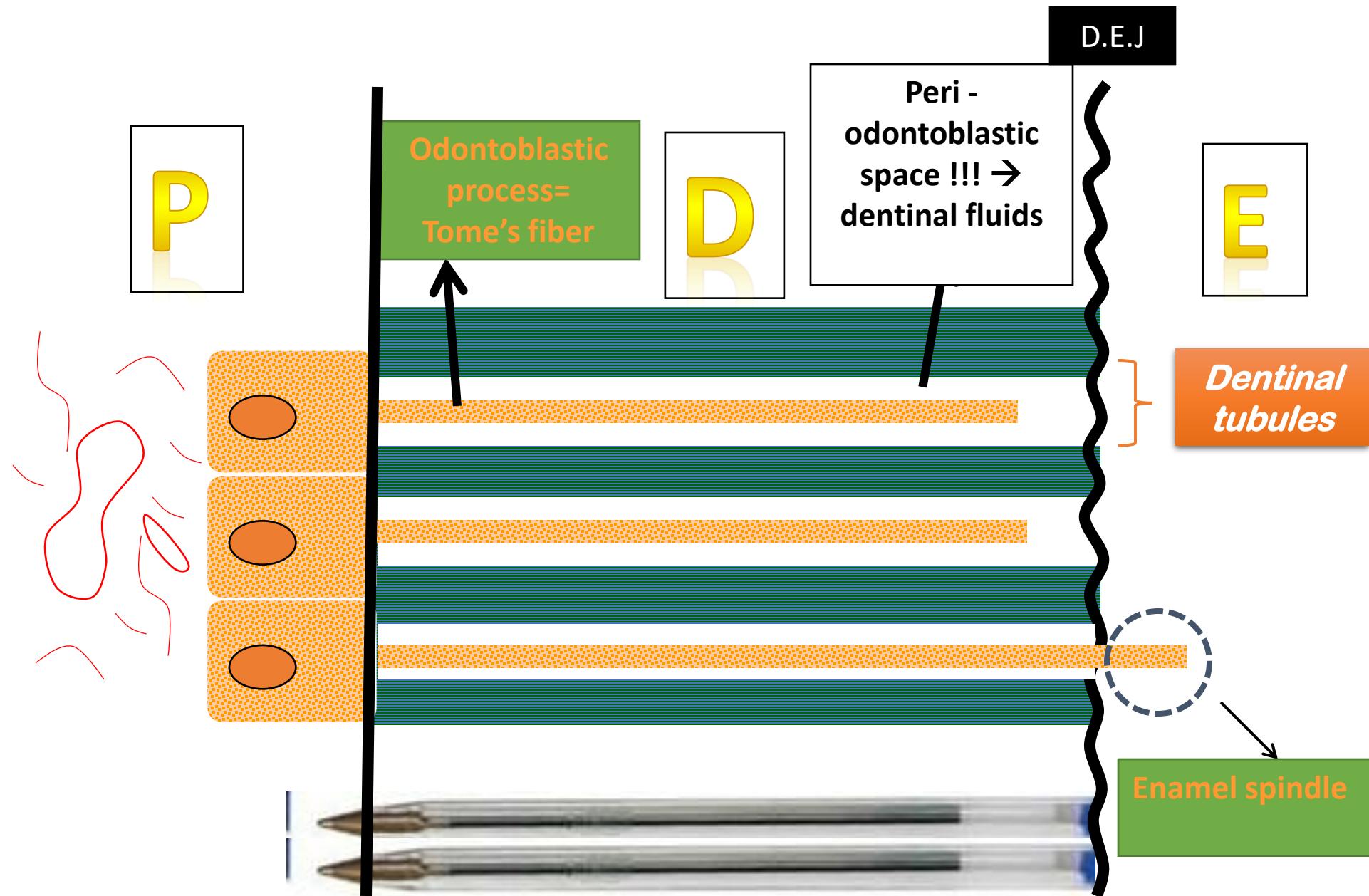
# Histological Structure Of Dentin

## Odontoblasts And Dentinal Tubules

### •(Odontoblast)

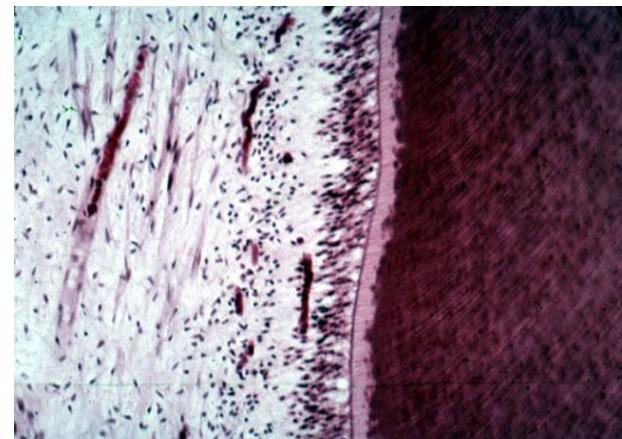
- . It is formed of cell body with  
**Odontoblastic process**)
- . Odontoblastic processes extend inside  
**(Dentinal Tubules)**
- . Dentin consists of  
(parallel tubules) called(dentinal tubules)



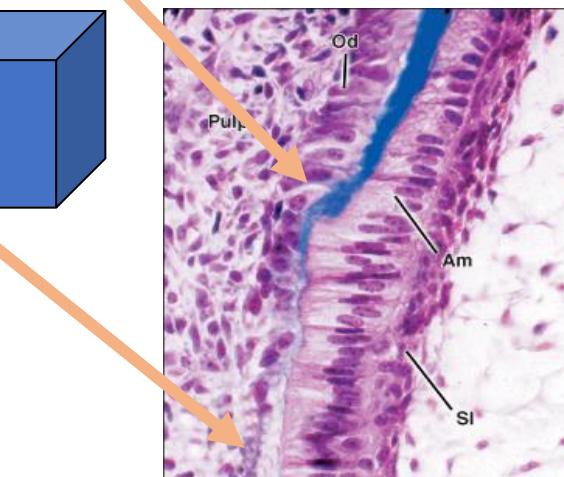
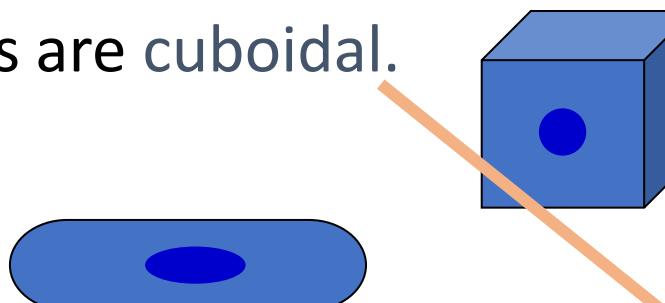


## 1- The odontoblasts

form a continuous layer around the pulpal surface of dentin.



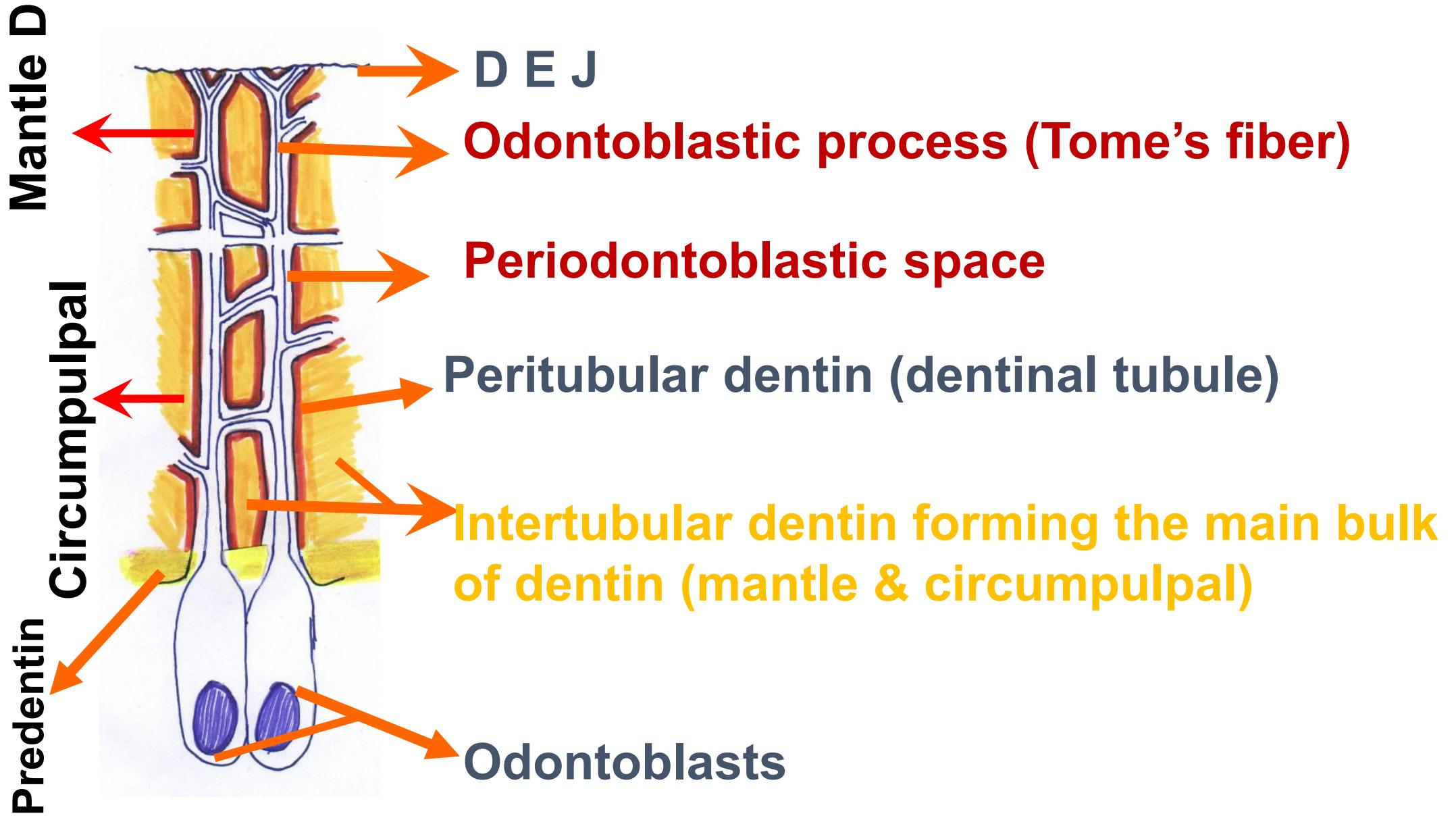
- In crown (pulp chamber) the cells are closely backed together (pseudostratified columnar).
- Near to the beginning of root canal the cells are columnar.
- In the mid portion of the root the cells are cuboidal.
- In the apical part the cells are flat.



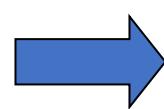
- The odontoblastic process gives off along its course **lateral branches** which unit with the lateral branches of the adjacent process. (**responsible for permeability**)
- The lateral branches are contained in lateral extension of the dentinal tubules.
- At the outer surface of dentine, the odontoblastic process and dentinal tubules will terminate by dividing into two **terminal branches**



# Odontoblasts And Dentinal Tubules

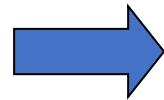
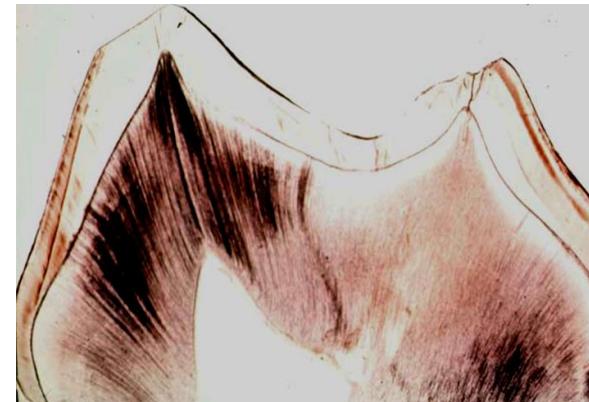


## 2-The unit structure of dentin is dental tubules



### Diameter

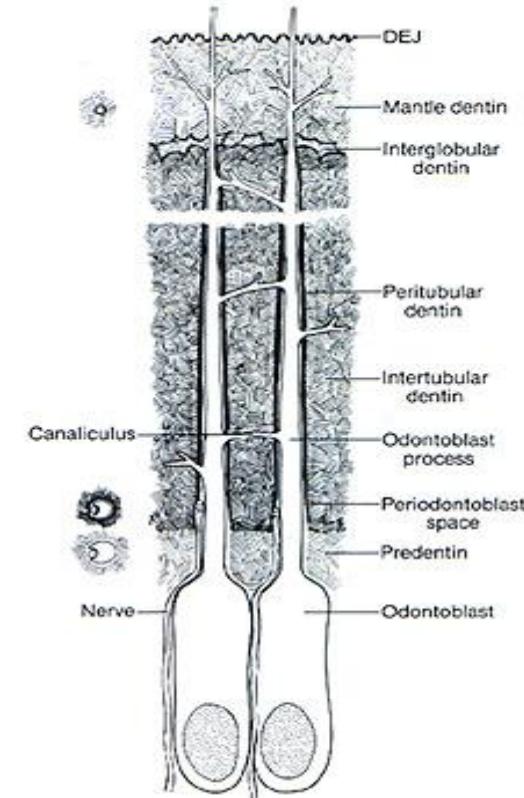
D.T. taper from pulpal surface outwards

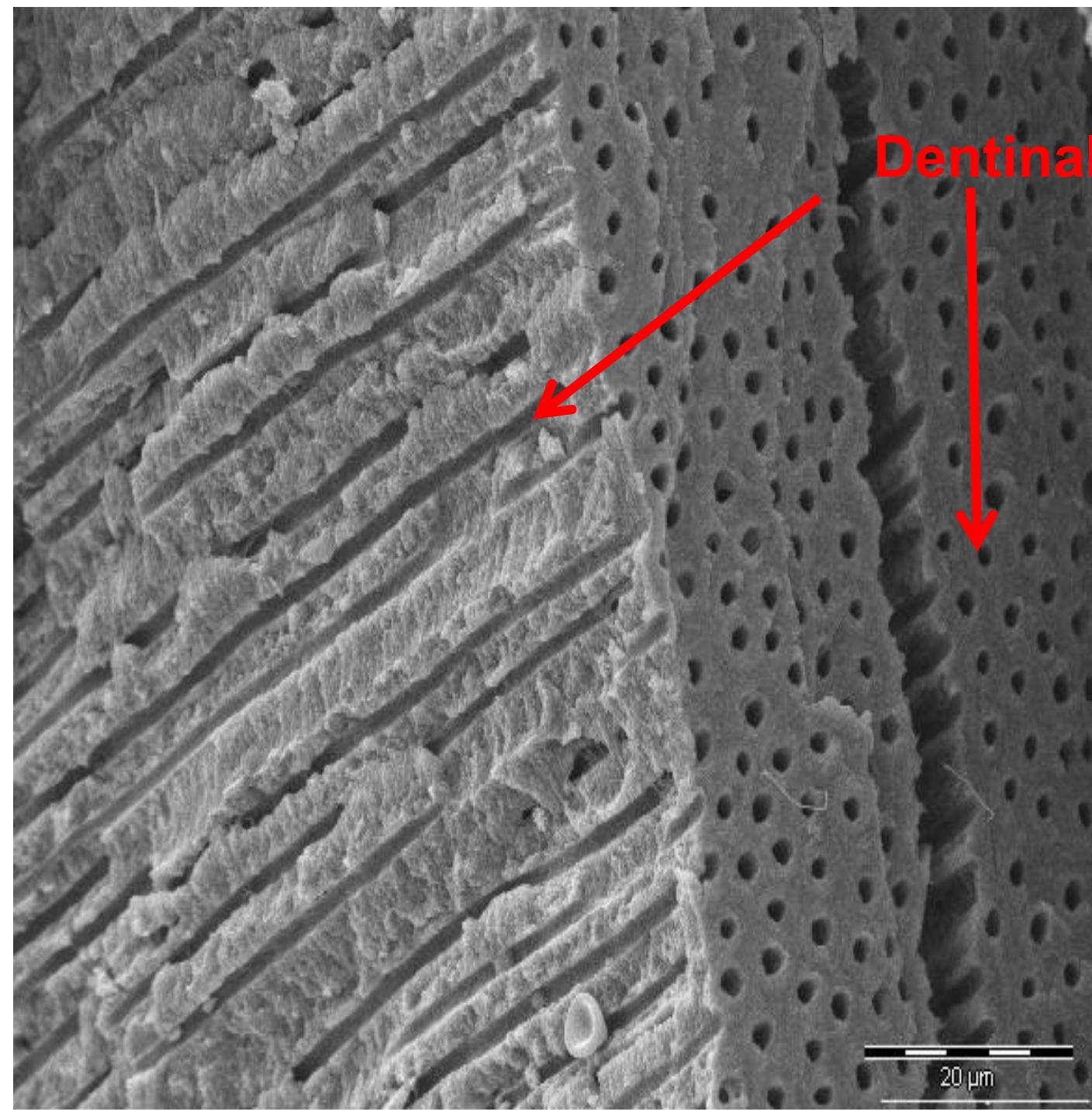


### Branches

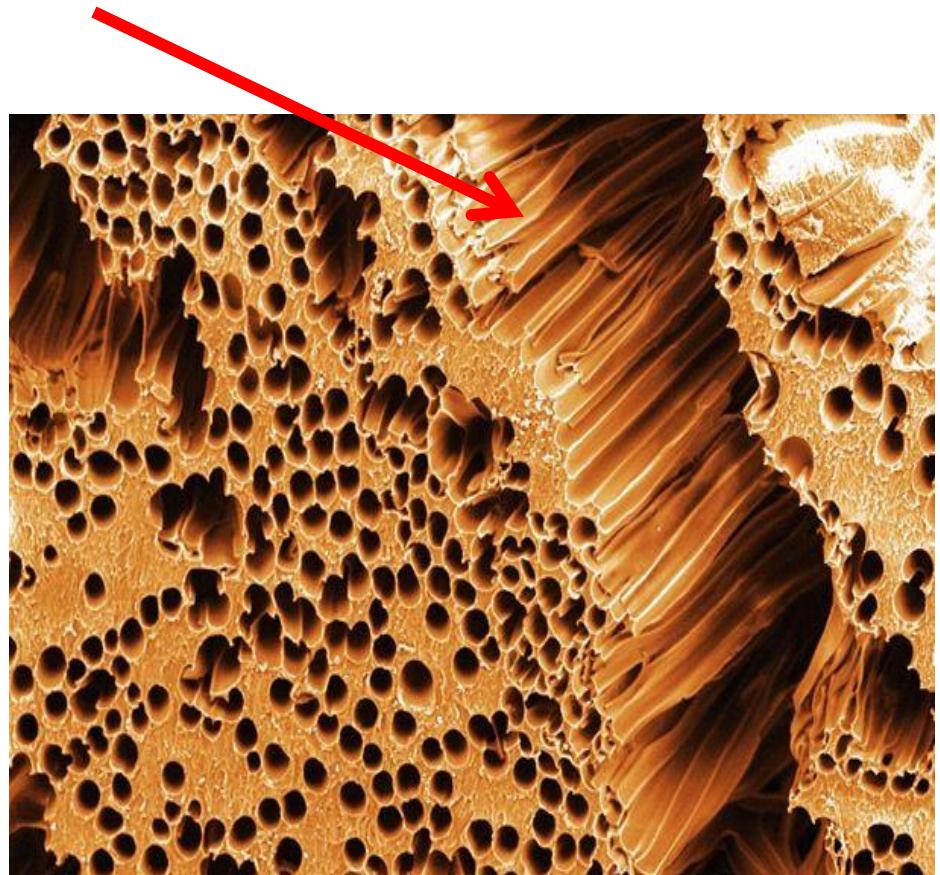
lateral branches  
Responsible for  
permeability

terminal branches  
forming a plexus  
beneath DEJ

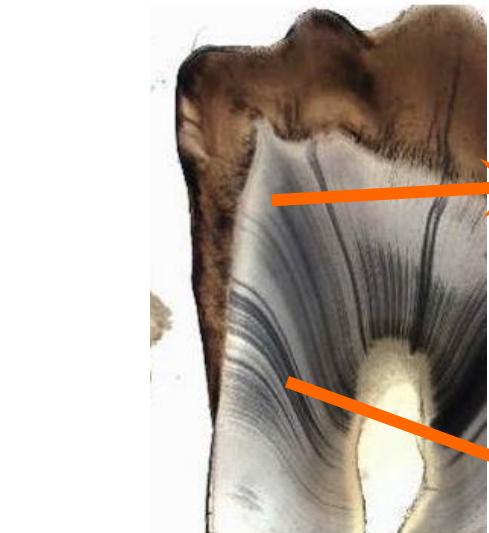




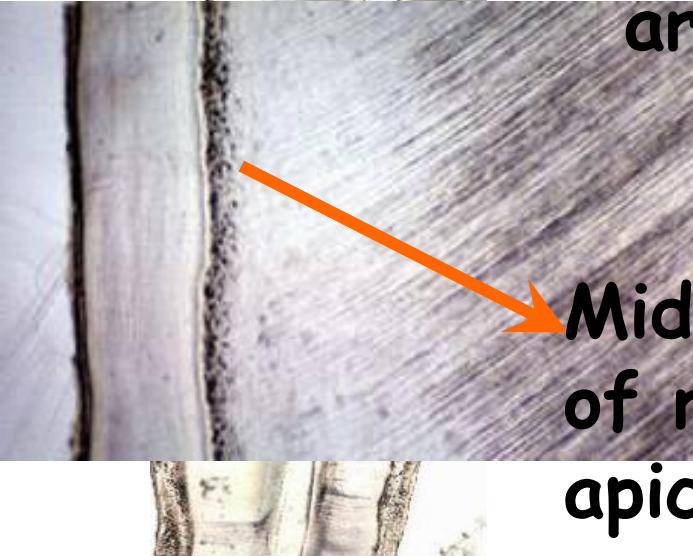
Dentinal tubules



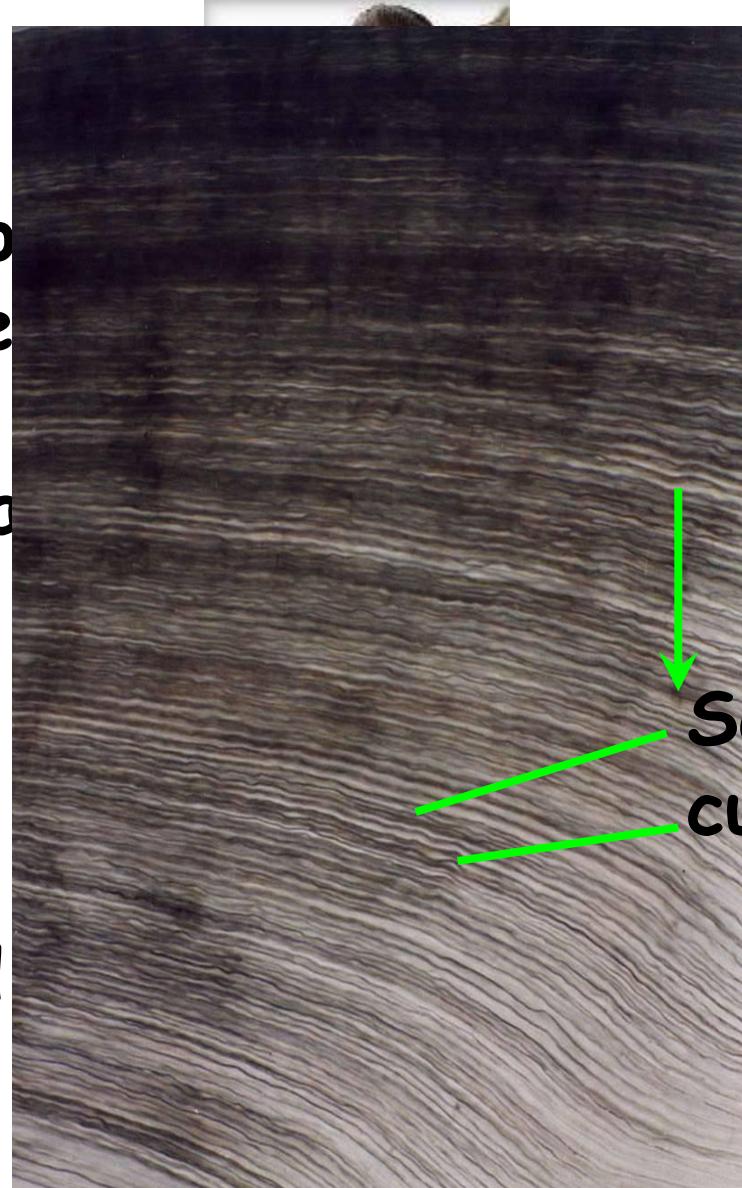
# Course of D.Ts.(L.S. Ground section)



At the cuspal  
or (incisal edge)



Mid portion  
of root and  
apically



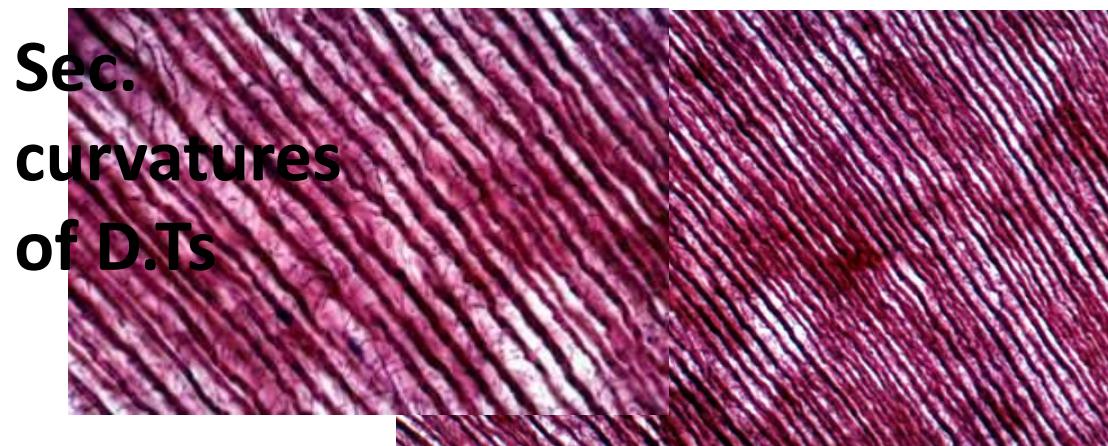
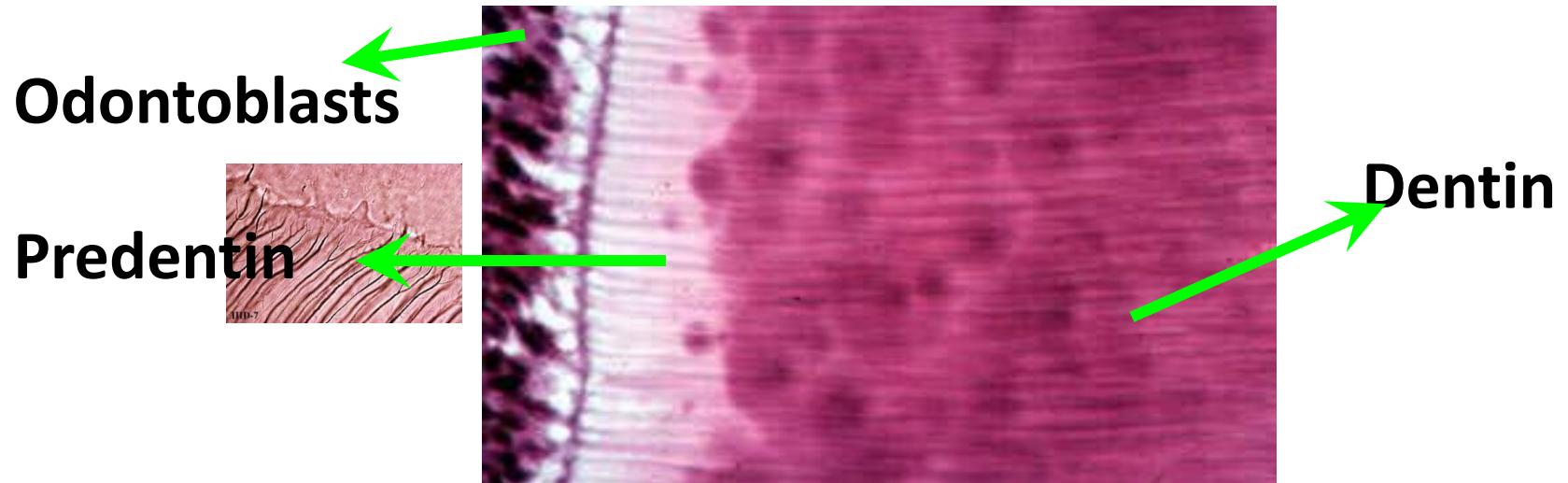
ight

shape

Secondary  
curvatures

raight

# Decalcified section of D.Ts

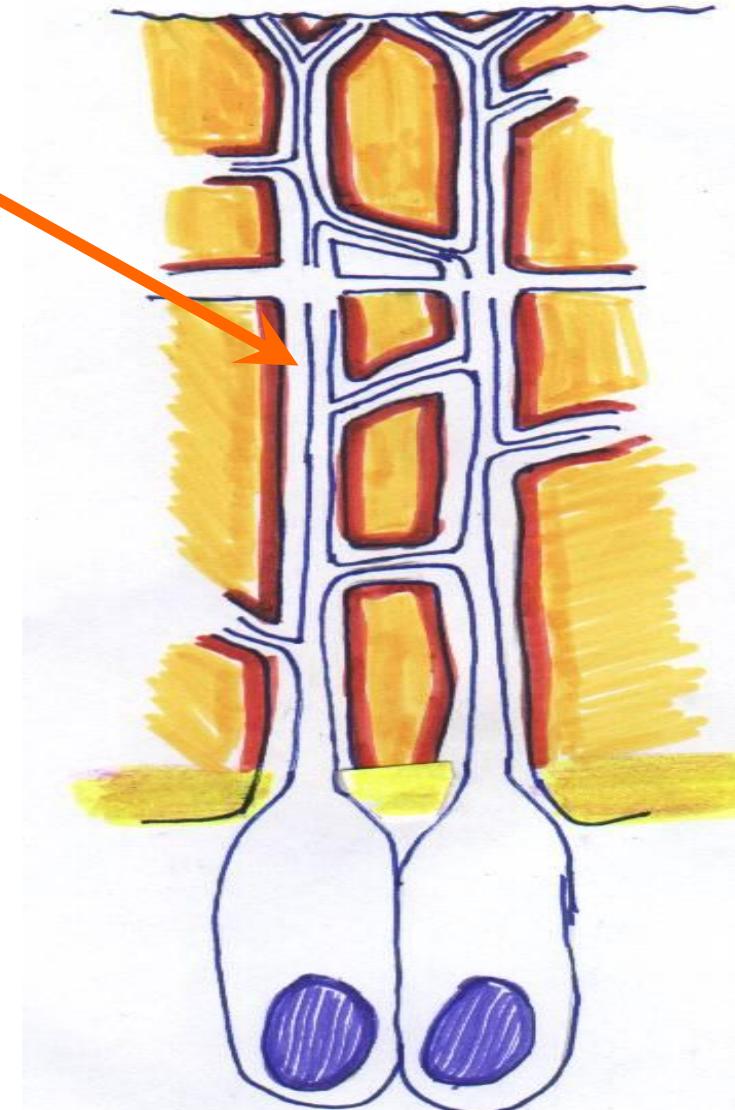


Terminal  
branches

## Histological structure of Dentin (Odontoblasts & dentinal tubules)

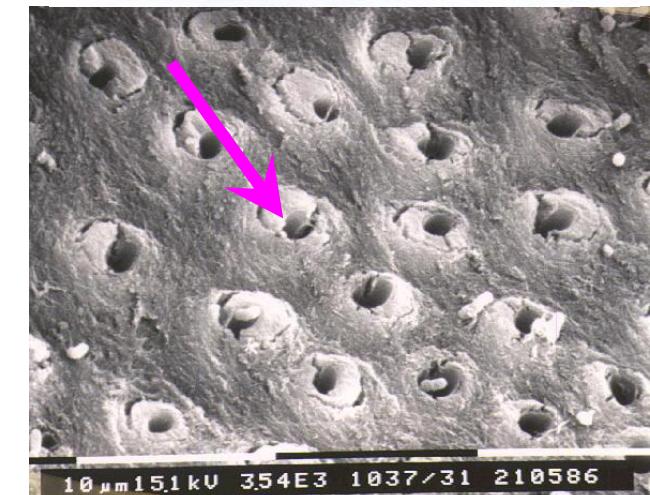
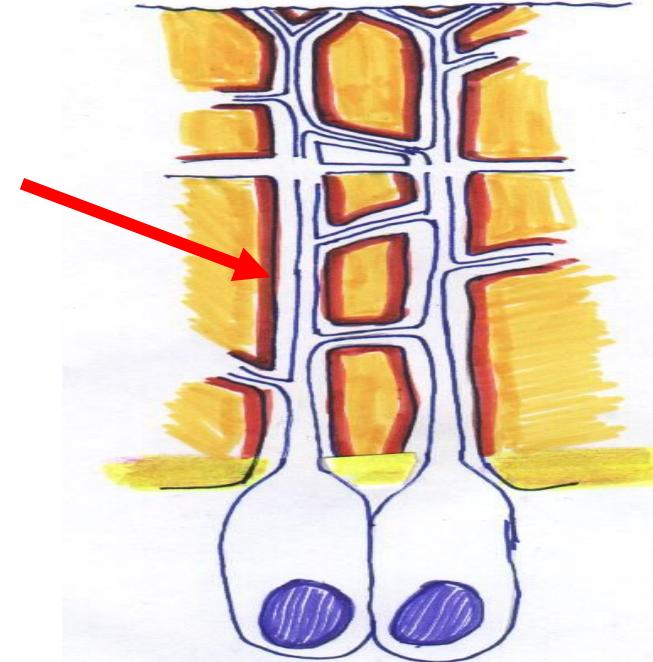
### 1-Periodontoblastic space.

- It is the space between the odontoblastic process and the wall of dentinal tubules.
- It is filled with dentinal fluid (lymph)
- The odontoblastic process and periodontoblastic space are the soft tissue of dentin.



## 2- Peritubular dentin (Intratubular dentin)

- It is a highly calcified zone surrounding each odontoblastic process and it forms the inner wall of the tubule
  - It is more mineralized than the rest of dentin by 40% more.
- ⦿ In T S ground section through the dentinal tubules shows that the **peritubular dentin** seen as *translucent rings*
- It is continuously formed within the tubules leading its narrowing so it is termed Intratubular dentin

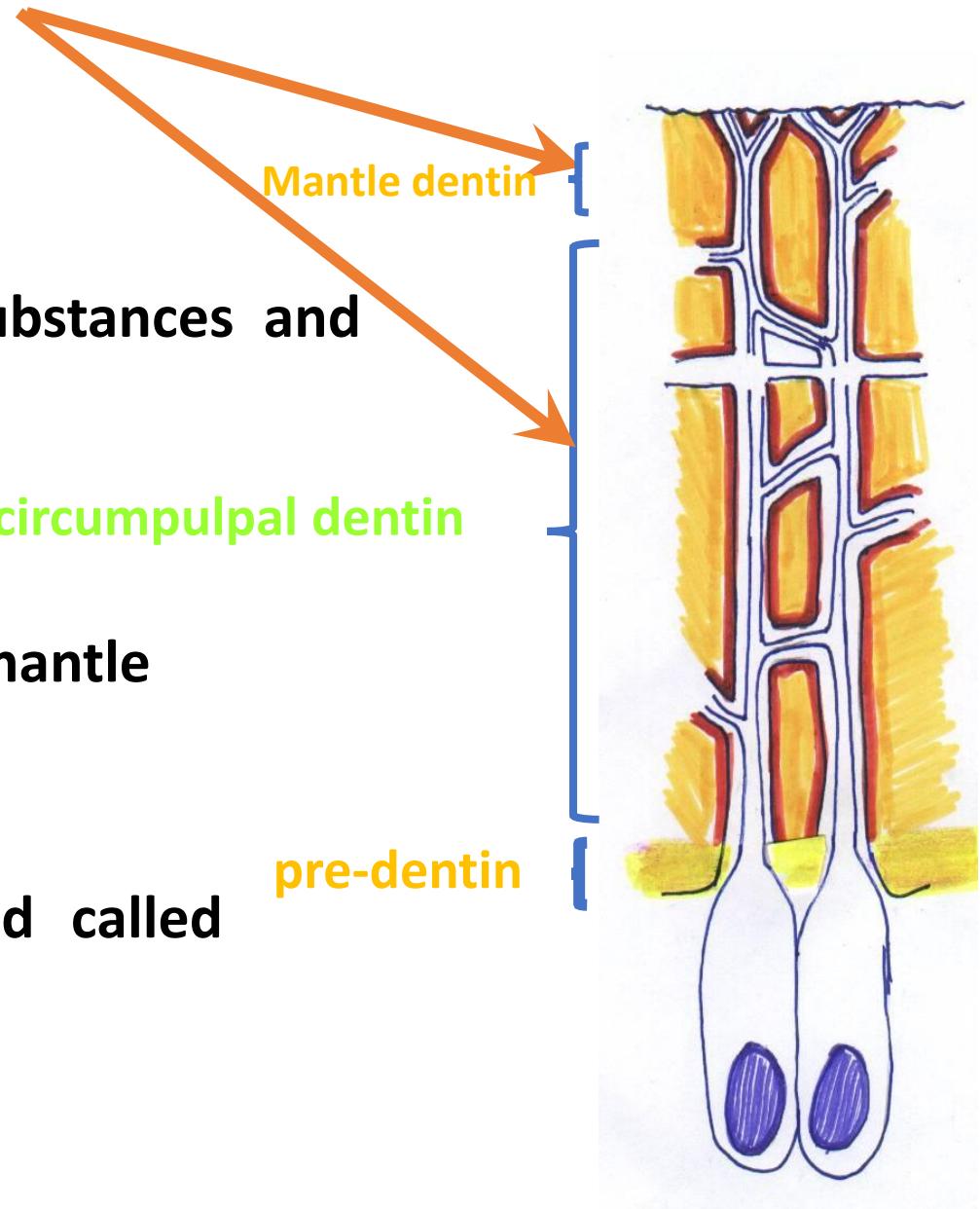


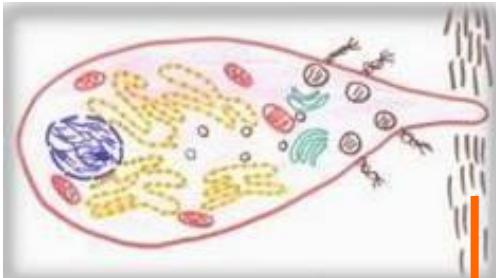
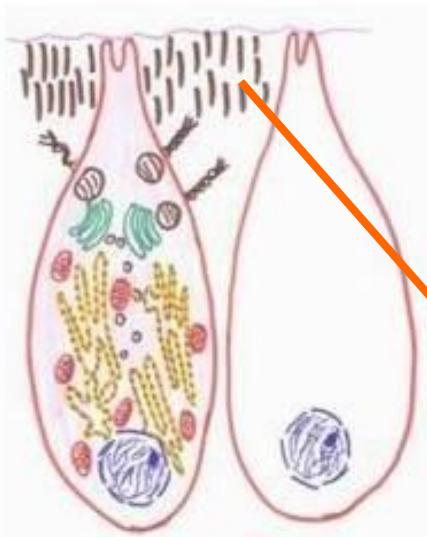
### 3- Intertubular dentin:

- It is present between the dentinal tubules.
- It forms the main bulk of dentin.
- It consists of fine collagen fibers in ground substances and apatite crystals.

A- The first secreted layer of this dentin is called mantle dentin

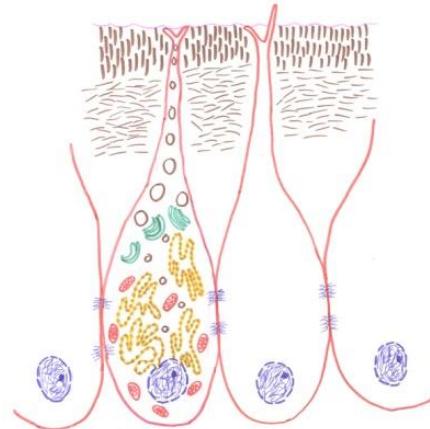
B- The rest of the dentin is secreted later and called circumpulpal dentin





Crown

Root



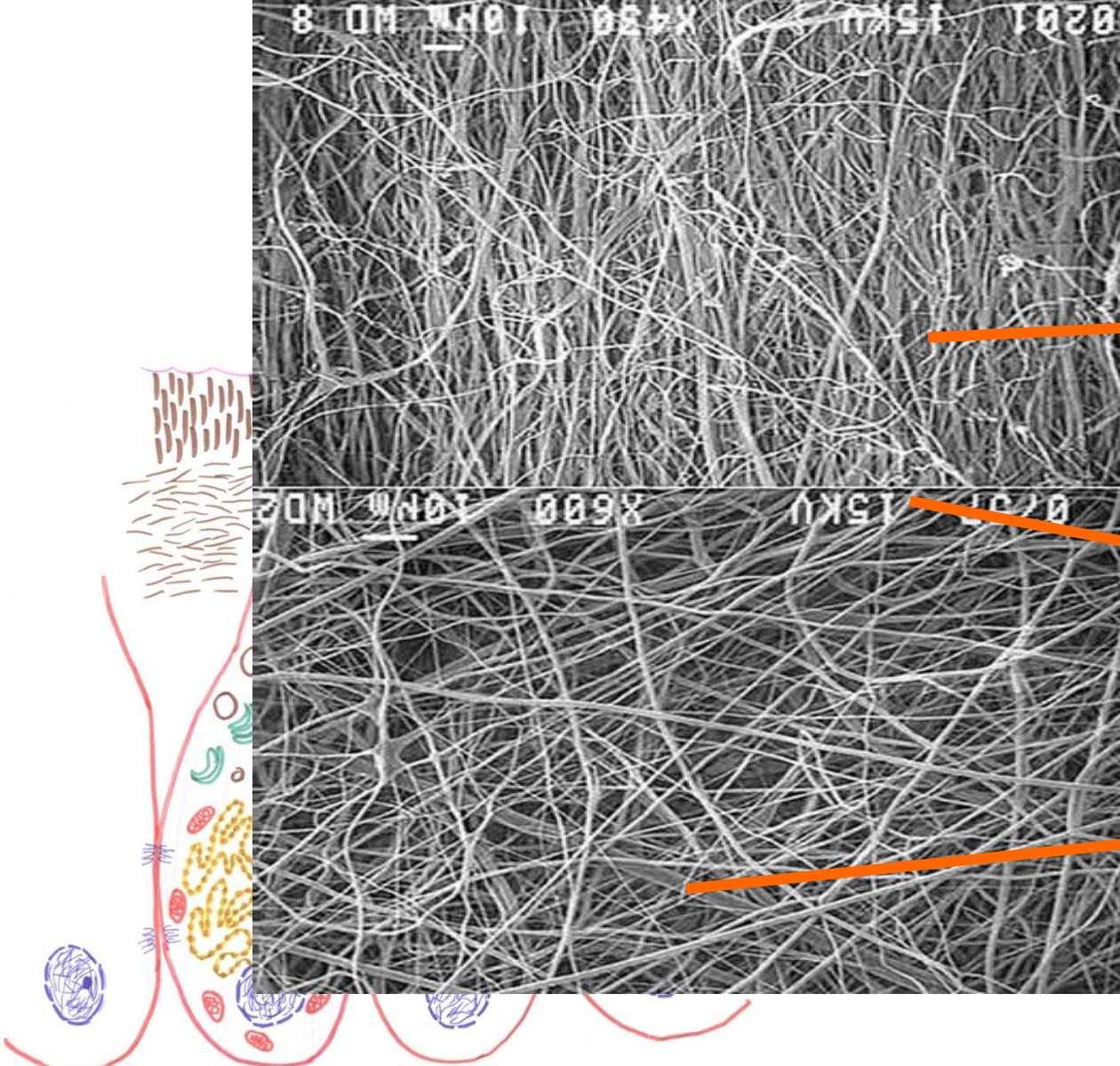
### Mantle dentin

- Thickness: 10-20 um
- Diameter of collagen fibers: large
- Direction of collagen fibers : right angle to DEJ
- Ground substance: from odontoblasts and the cell free zone
- Mineralization: linear form

### Circumpulpal dentin

- Thickness: bulk of the tooth
- Diameter of collagen fibers: small
- Direction of collagen fibers : parallel to dentin surface(DEJ)
- Ground substance: from odontoblasts
- Mineralization:
  - Globular below mantle dentin then
  - Mixed in the remaining circumpulpal dentin.

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**Mantle dentin**

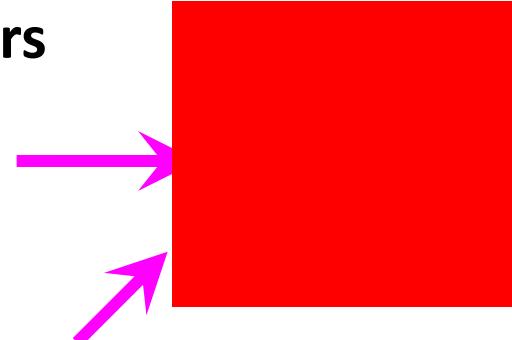
**Circumpulpal dentin. The fibers are parallel to DEJ ( right or oblique angle to DT)**

**Crowding of the cells and appearance of junctional complex**

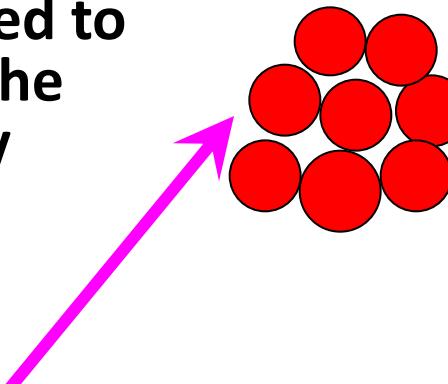
# 4-Interglobular Dentin

## (Unmineralized or hypomineralized )dentin areas

- Calcification of dentin in some areas occurs in a form of globular pattern.



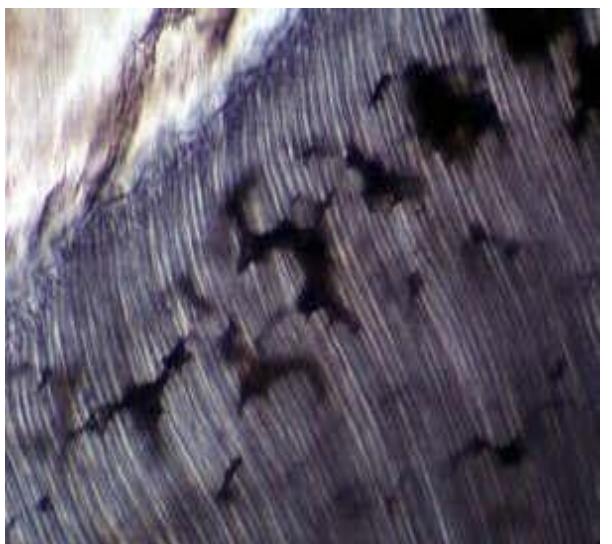
- These globules fuses together to form homogenous substance.



- Sometimes globules in some areas failed to fuse. Area of organic matrix between the globules remain uncalcified or partially mineralized.



- These areas bonded by the curved outlines of the adjacent globules.



- **Interglobular dentin**

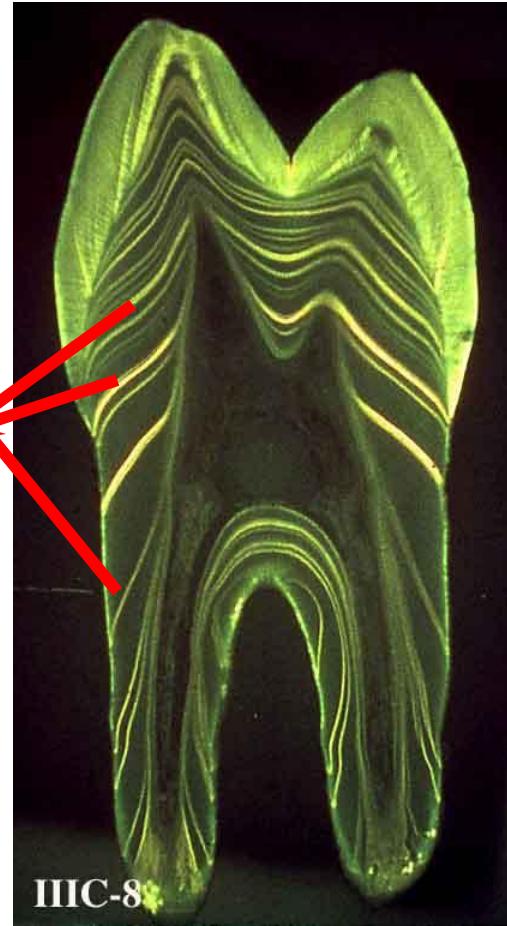
- **(Size)** Large
- **(Cause)** Areas of unmineralized or hypomineralized dentin (sometimes present).
- **(Site)** Appear in the **crown** just below mantle dentin.  
In badly formed tooth it appear in the root dentin
- **(DT)** Dentinal tubules **cross** the IGD without the peritubular dentin

- **Tomes' granular layer**

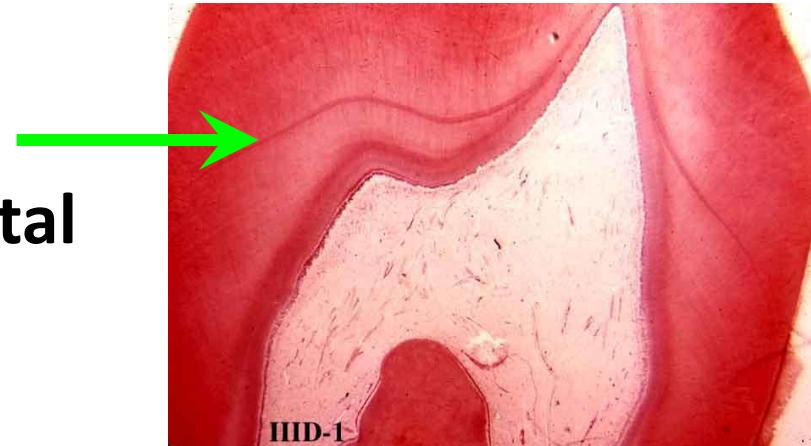
- **(Size)** Small granular in appearance
- **(Cause)** it results from the looping of the terminal portions of DT (always present) .
- **(Site)** Appear in the **root** adjacent to the cementum.
- **(DT)** Dentinal tubules do **not cross** this layer
- **(IL)** Does **not follow** any incremental pattern.

# Incremental Lines Of Dentin

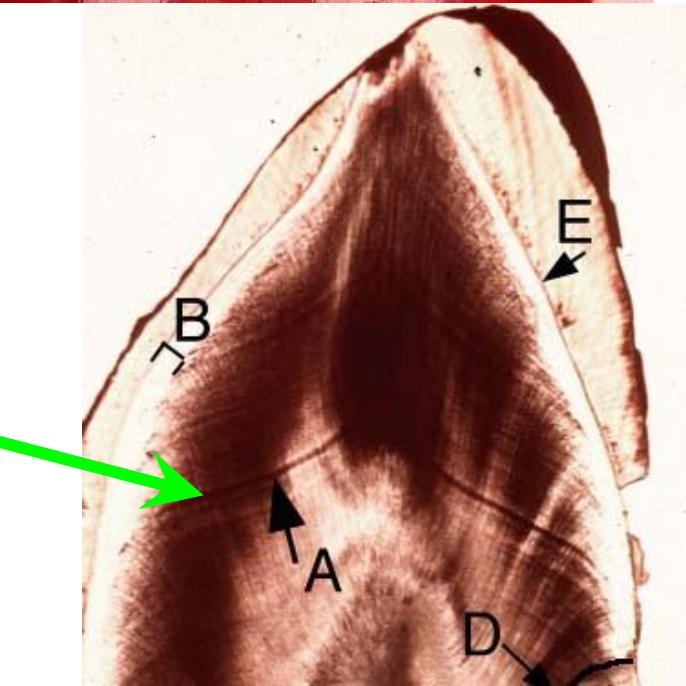
Incremental lines of  
von Ebner



Neonatal  
line



Contour  
line of  
Owen



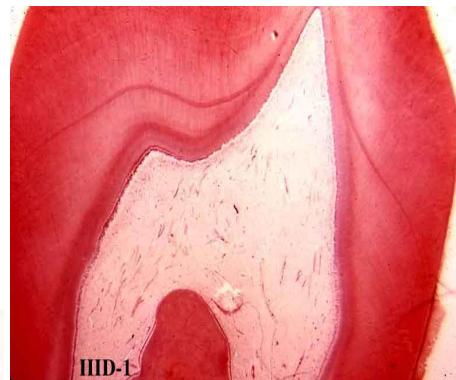
# 1-Incremental Lines of Von Ebner

- They are lines which denotes incremental pattern of formation in dentin.
- It is a 5 day cycle or increment in which the change in collagen fiber orientation is more clear. This 5-day cycle is called incremental lines of Von-Ebner(separated by 20  $\mu$ ).



# 2-Contour lines of Owen

- They represent areas of hypocalcification, so
- They appear as accentuated contour lines within dentin
- They denotes periods of illness and inadequate nutrition.
- They result due to disturbance in mineralization process.

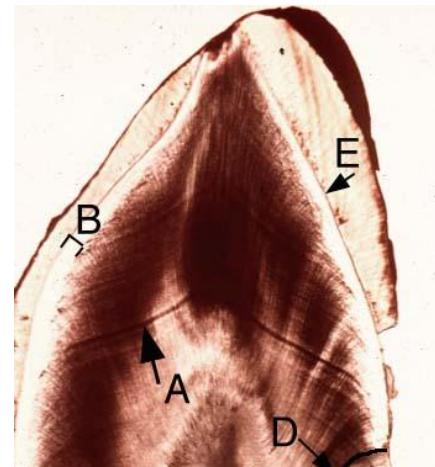


# 3-Neonatal line:

It is present in all deciduous teeth and the 1 st permanent molars.

**Causes** 1- Disturbance in nutrition.

2- Change in the environmental condition at birth.



**Best wishes for exam**

