



LECTURE

Dentin Part-3

Dr. Sajda Gajdhar
Oral Pathology and Microscopy



LEARNING OUTCOMES

1. Classification of dentin based on formation
2. Explain the age changes of dentin and their clinical applications.
3. Describe the mechanisms of the dentin sensitivity.

CLASSIFICATION (according to formation):

- PRIMARY DENTIN

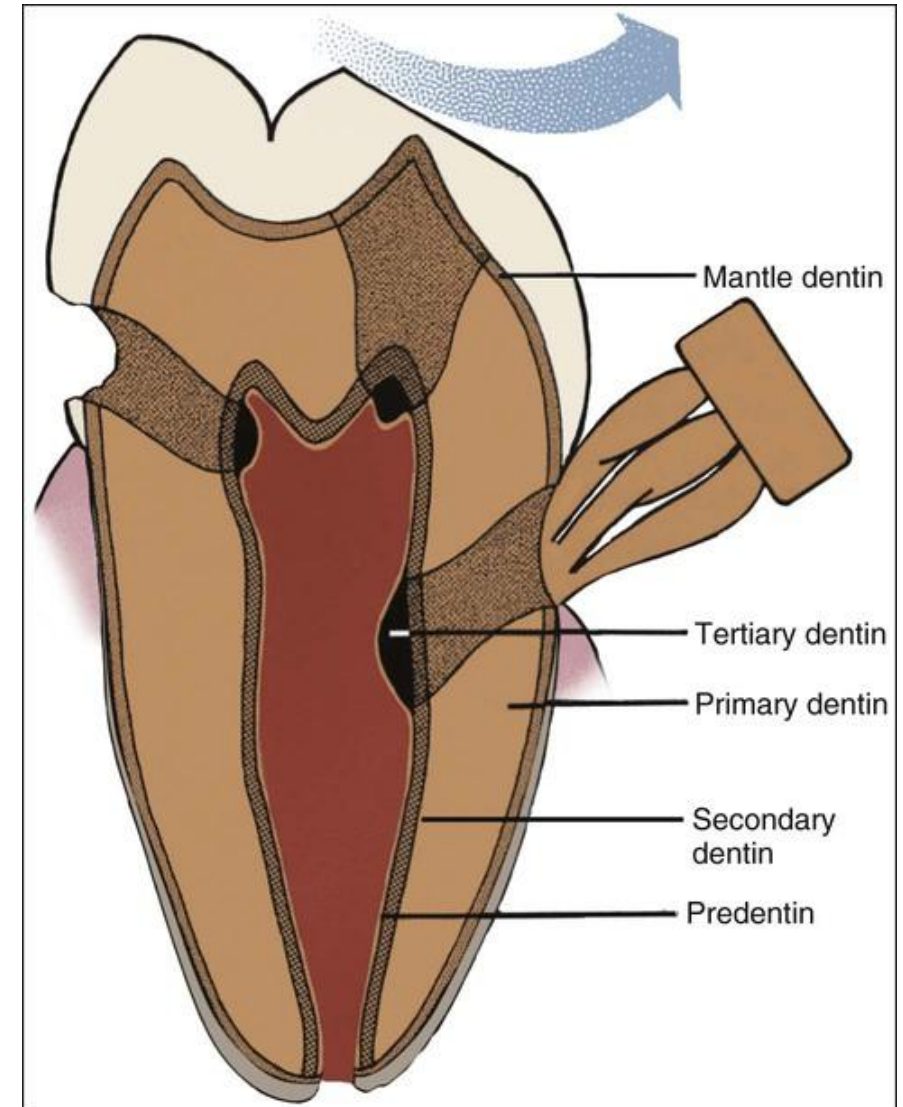
1. Mantle Dentin
2. Circumpulpal Dentin

- SECONDARY DENTIN

- TERTIARY DENTIN

1. Reparative dentin
2. Reactionary dentin

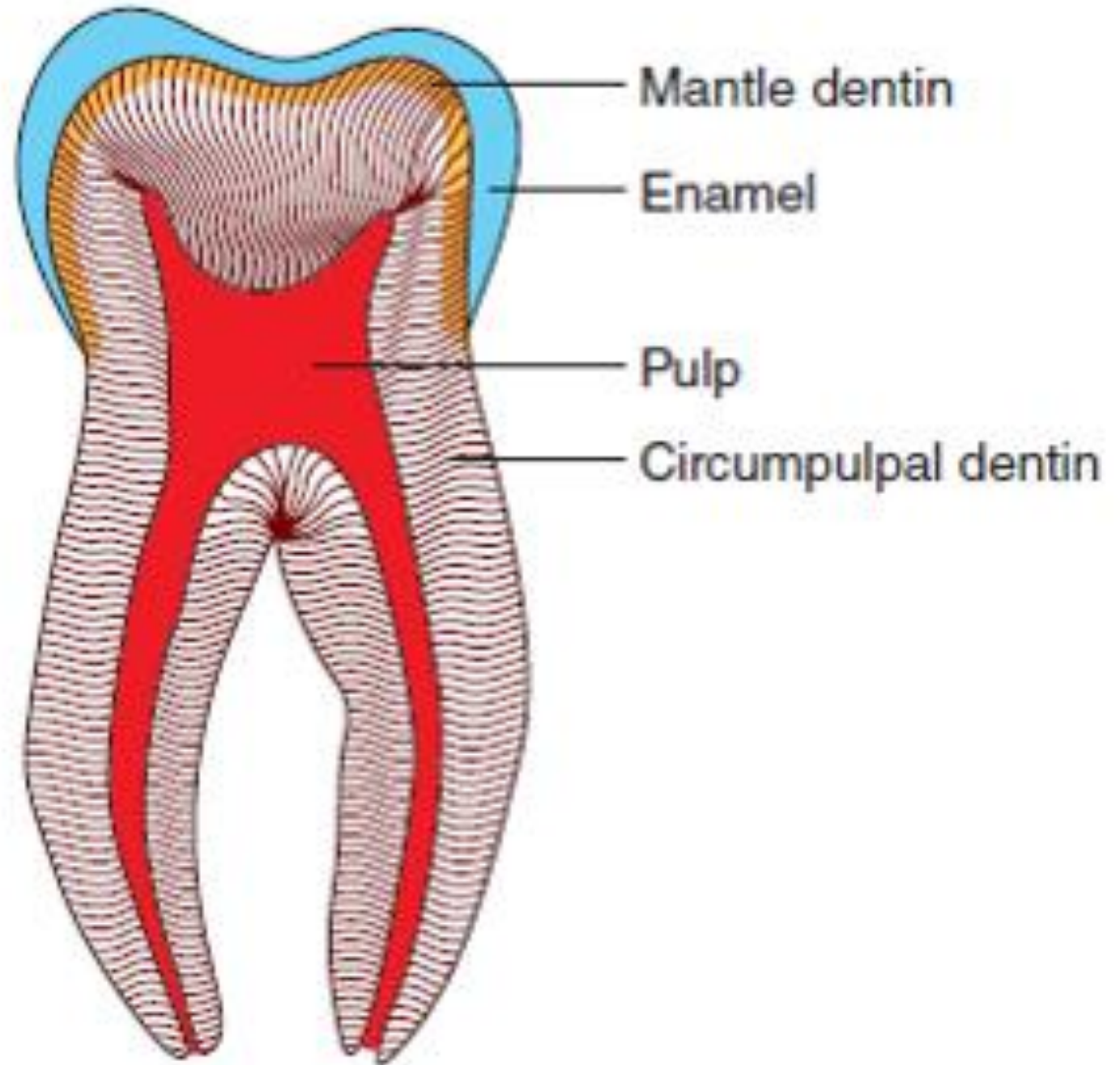
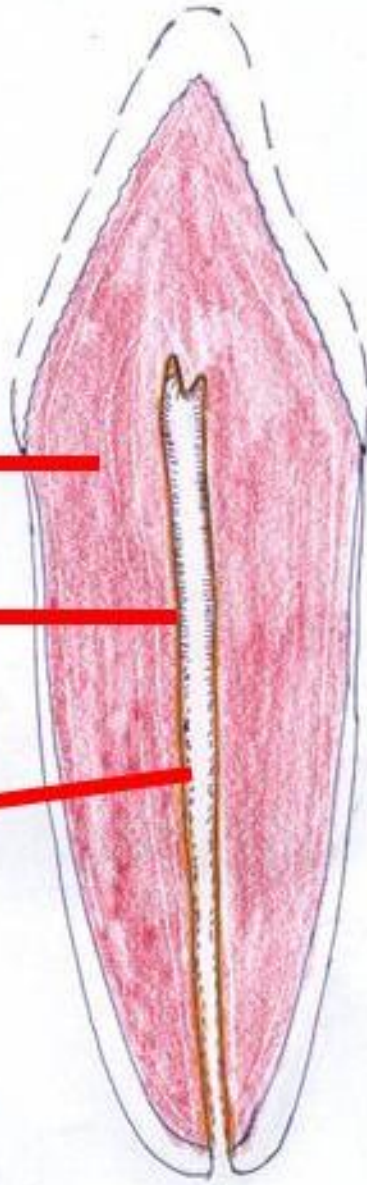
- PREDENTIN



Dentin

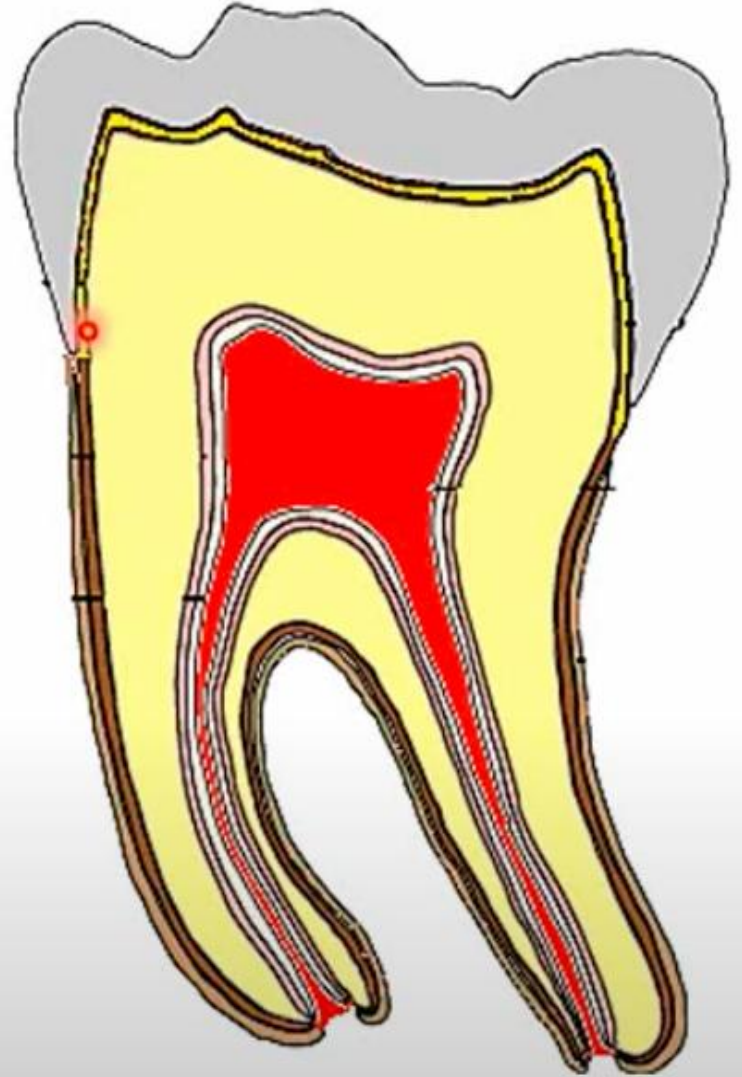
Predentin

**Odonto
blasts**



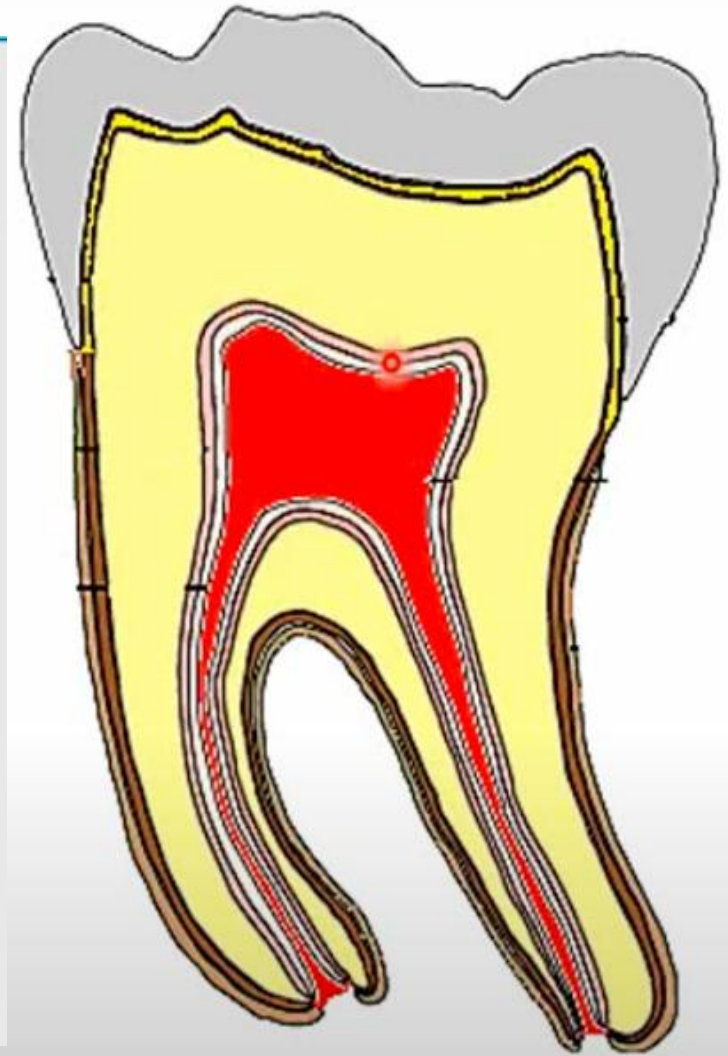
Primary Dentin

- Primary dentin form most of the tooth structure
- Also known as circumpulpal dentin
- Outer most layer of primary dentin is known as mantle dentin



Secondary dentin

- Develops after completed root formation
- Laid down as continuation of primary
- Tubular structure (less regular than primary)
- Change of tubules direction at the transition from primary to secondary dentin
- Slower rate of matrix deposition
- Uneven deposition: more on roof and floor of pulp chamber - leads to reduction of pulp space (PULP RECESSION)

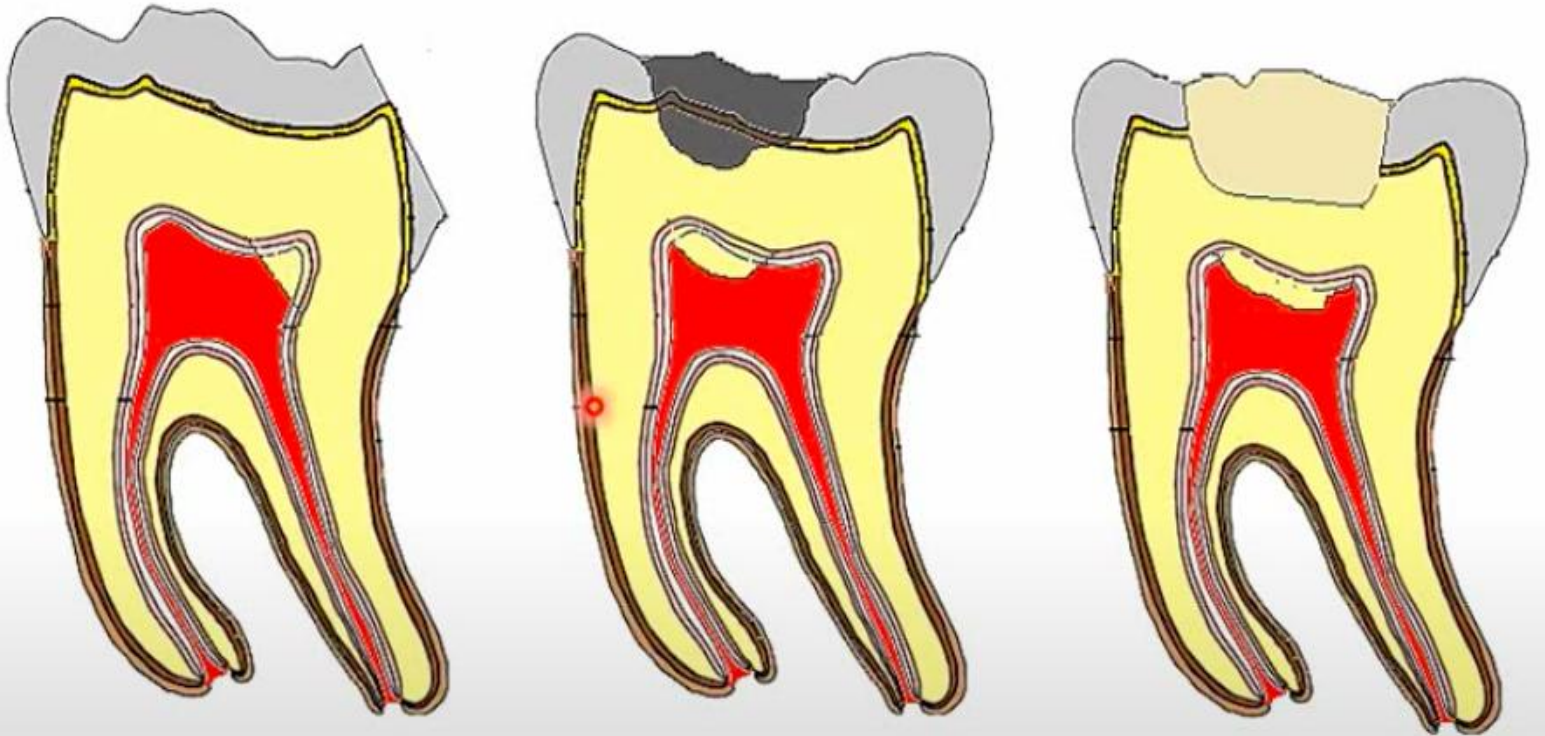


Tertiary dentin

➤ Tertiary dentin is only deposited in a localized area

➤ Produced in reaction to

1. Tooth wear
2. Dental caries
3. Restorative procedures



Primary Dentin

Physiological

Odontoblasts

Till root completion

Circumpulpal dentin

Tubular structure regular

Deposited equally

Secondary Dentin

Physiological

Odontoblasts

Form after root
completion

Tubular structure less
regular

Deposited more at roof
and floor of pulp chamber

Tertiary Dentin


Stimulus

Odontoblasts /
odontoblast like cells

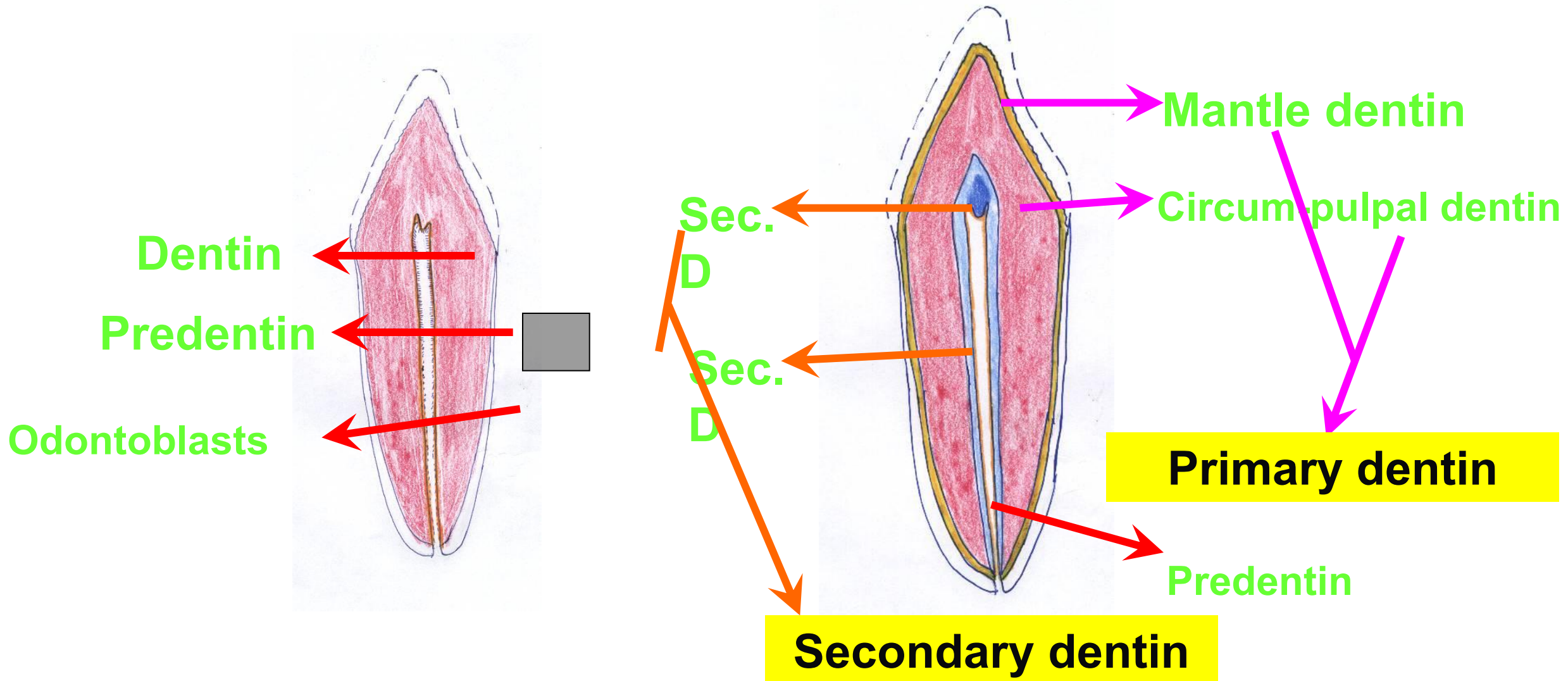
Form only in response to
stimulus

Reactionary Dentin
Reparative Dentin

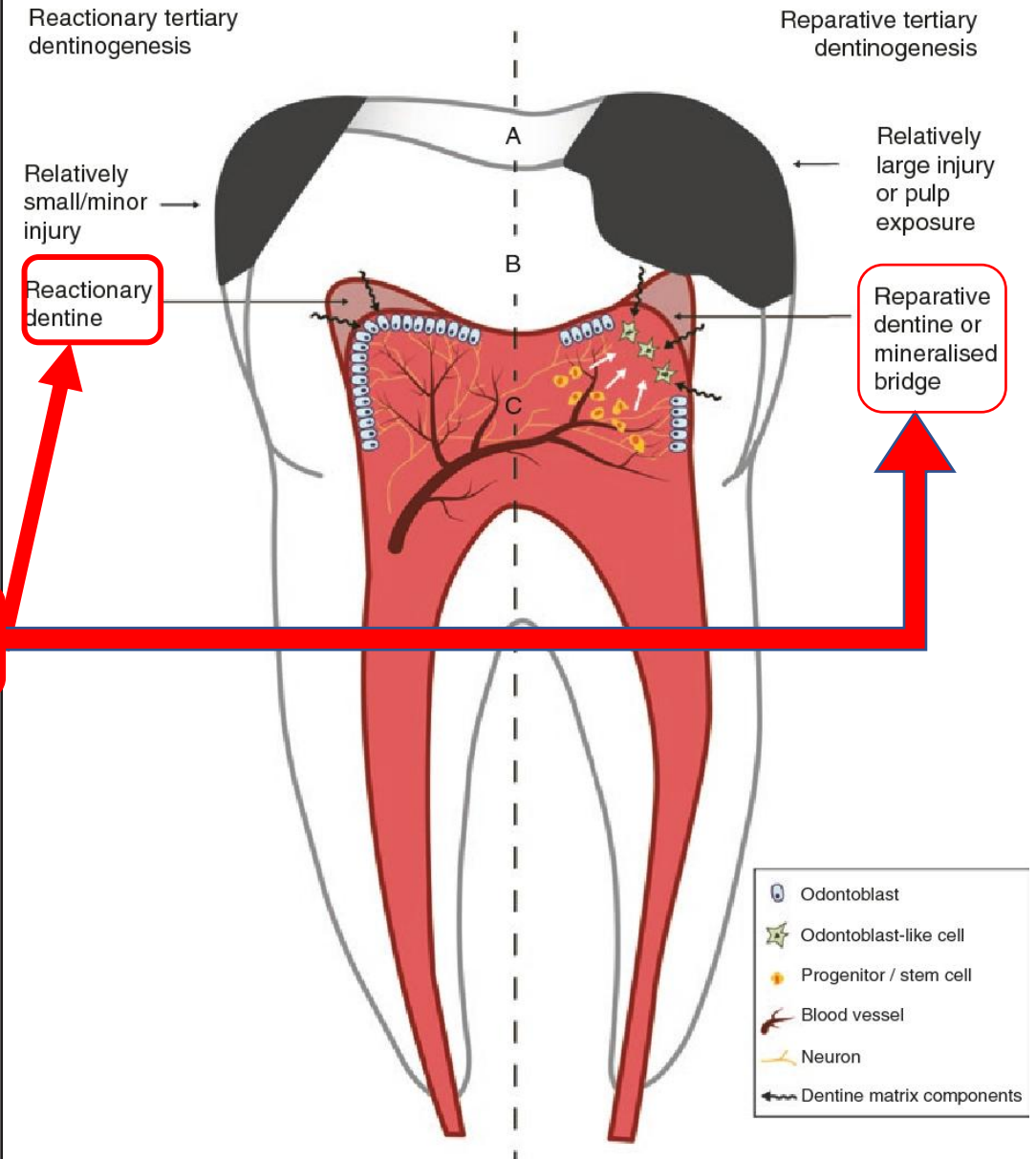
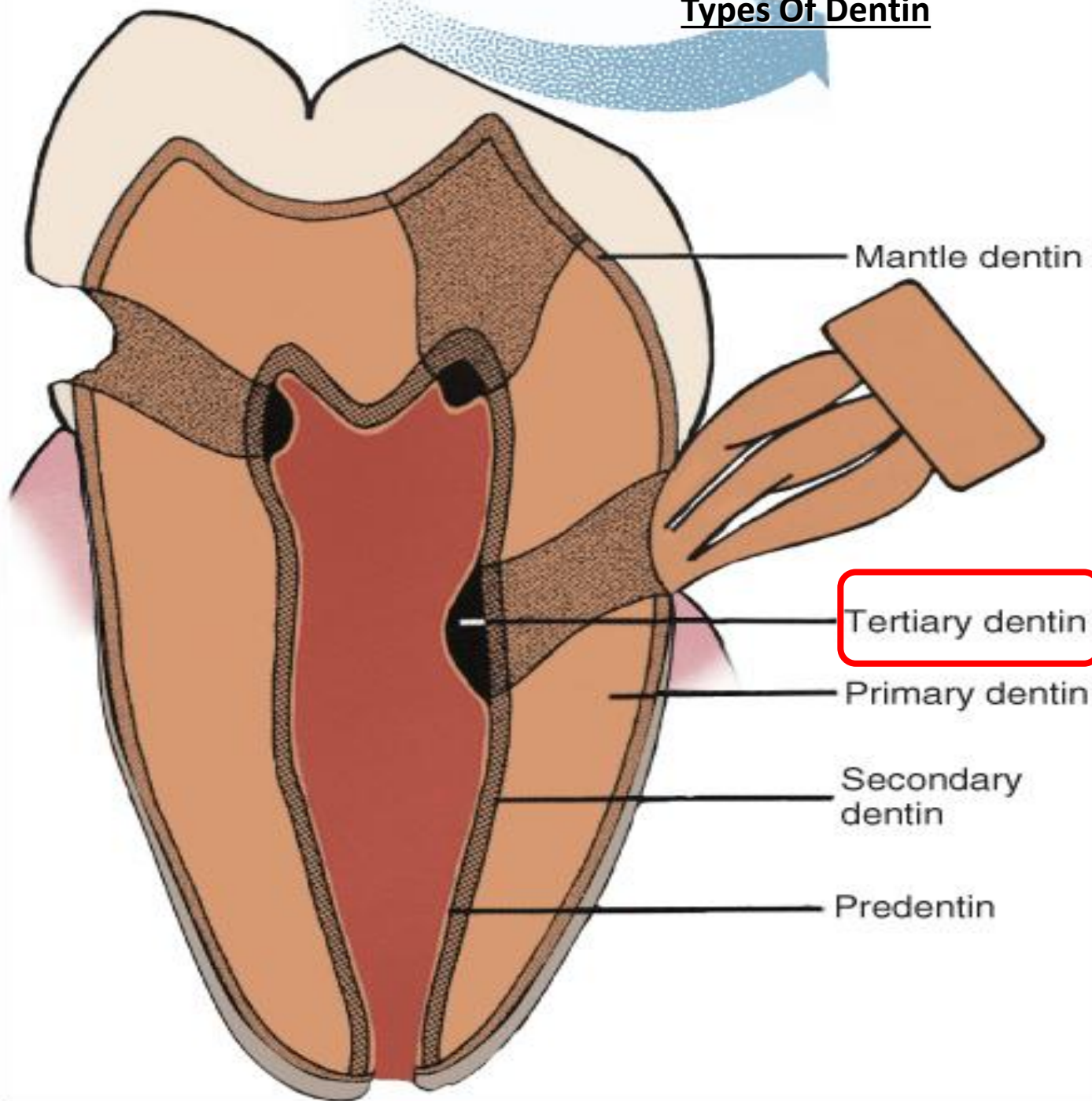
Least regular or no
tubules

Deposited in a localized
area 

Types Of Dentin



Types Of Dentin

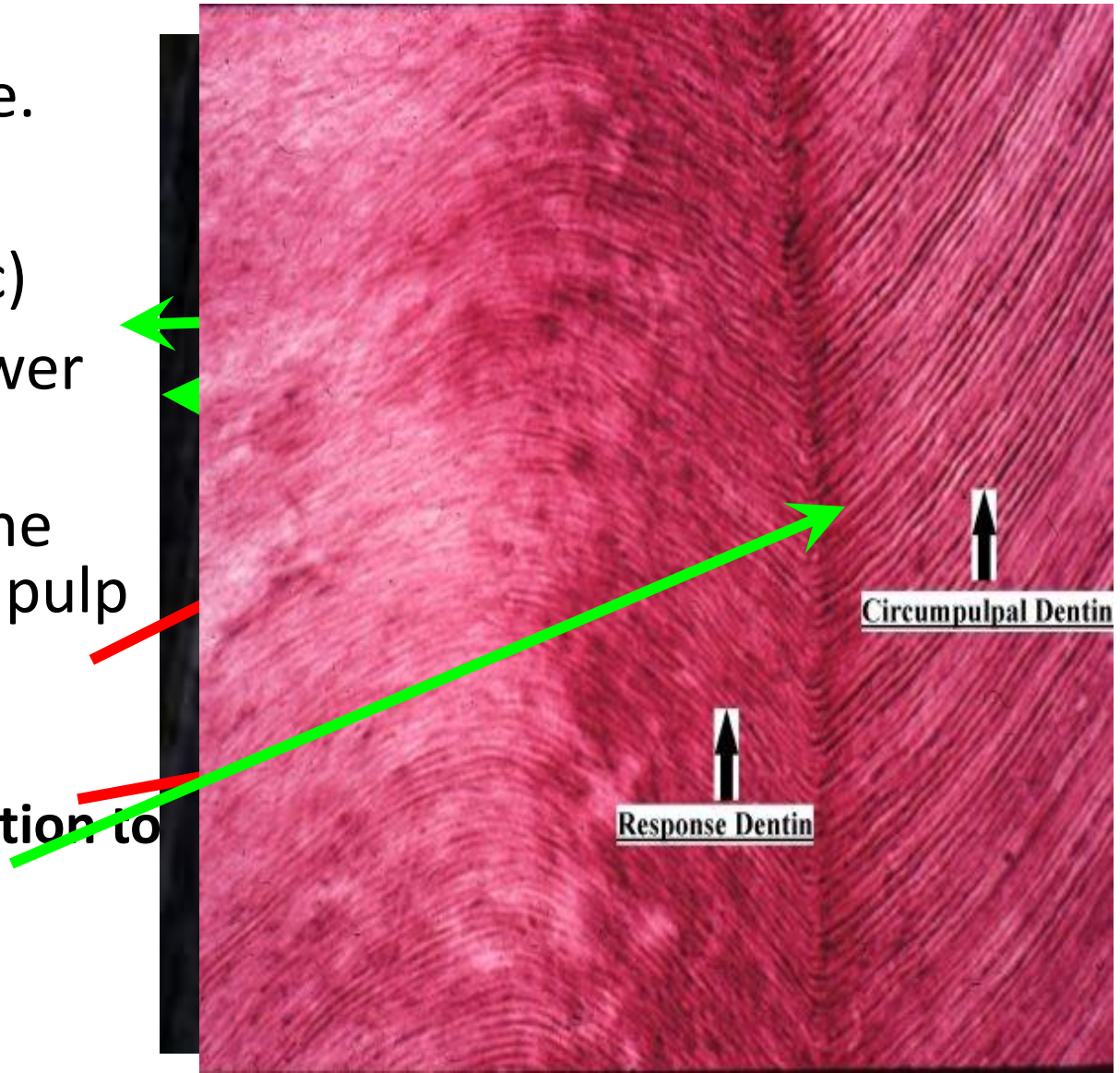


Age Changes Of Dentin

- Secondary dentin
- Occurs on the entire pulpal surface.
- After root formation is completed.
- Not due to trauma(It is physiologic)
- Odontoblasts form dentin at a slower rate.
- Results in decrease in the size of the pulp cavity and obliteration of the pulp horns

STRUCTURE:

- The dentinal tubules change their direction to a more wavy course
- The no of dentinal tubules are fewer



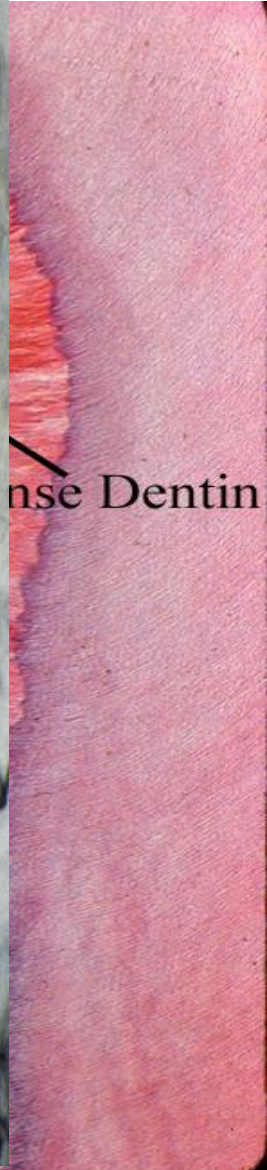
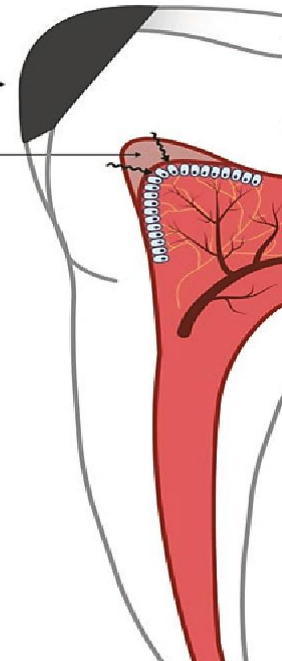
Tertiary dentin (A. Response dentin)

- Defense mechanism
- **mild stimulus NO damage to odontoblast**
- The dentin is formed at a localized area.
- The dentinal tubules are less in number and irregular in arrangement.

Reactionary tertiary
dentinogenesis

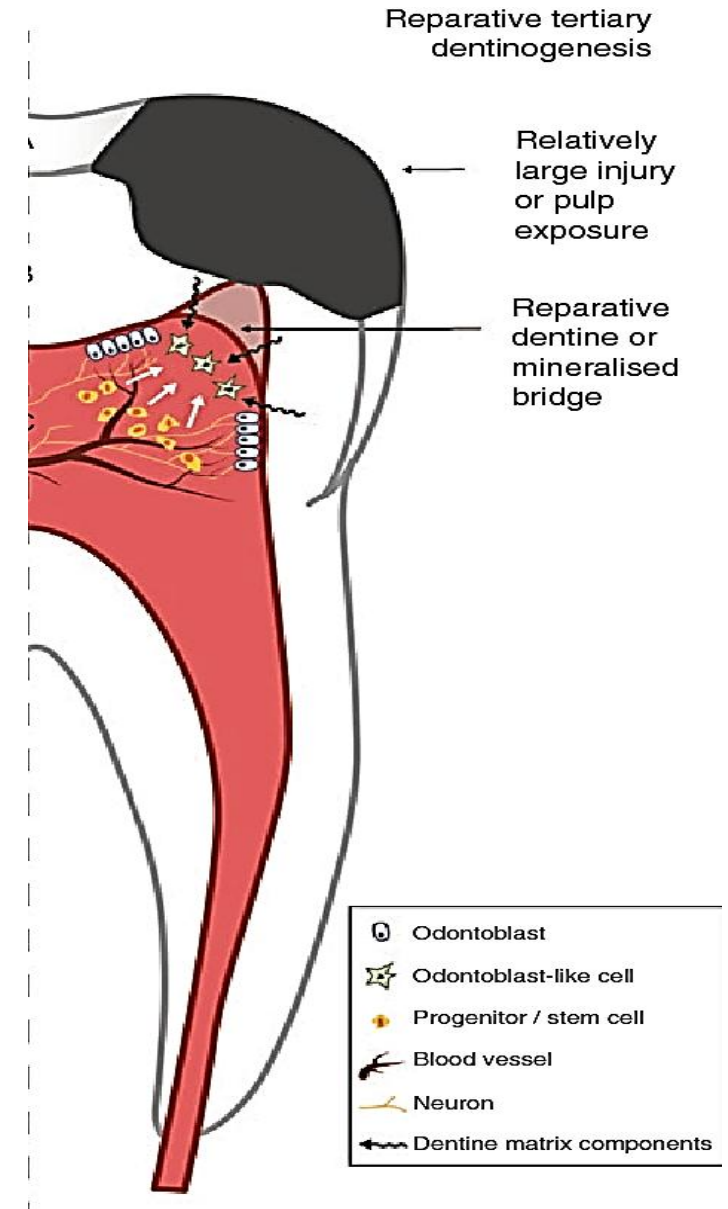
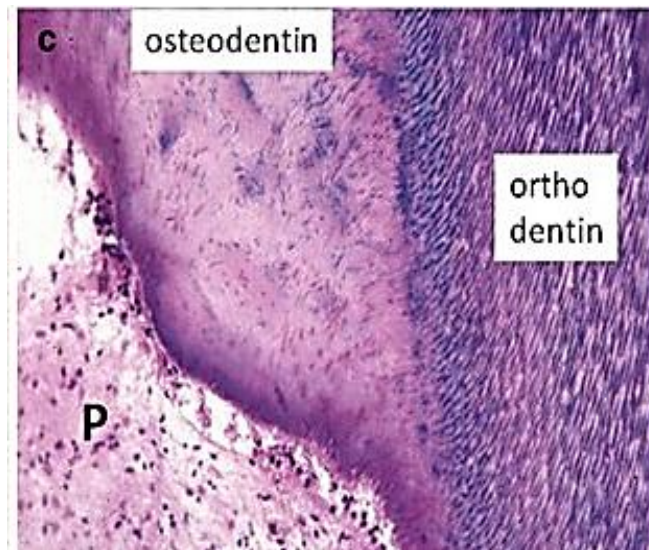
Relatively
small/minor
injury

Reactionary
dentine



Tertiary dentin (B. Reparative dentin)

- **Aggressive stimulus**
- UMC from the subodontoblastic layer will differentiate and replace the **degenerated odontoblasts** to form reparative dentin.
- It is heterogeneous dentin structure
- It may be:
 - Atubular dentin
 - Osteodentin
 - Vasodentin

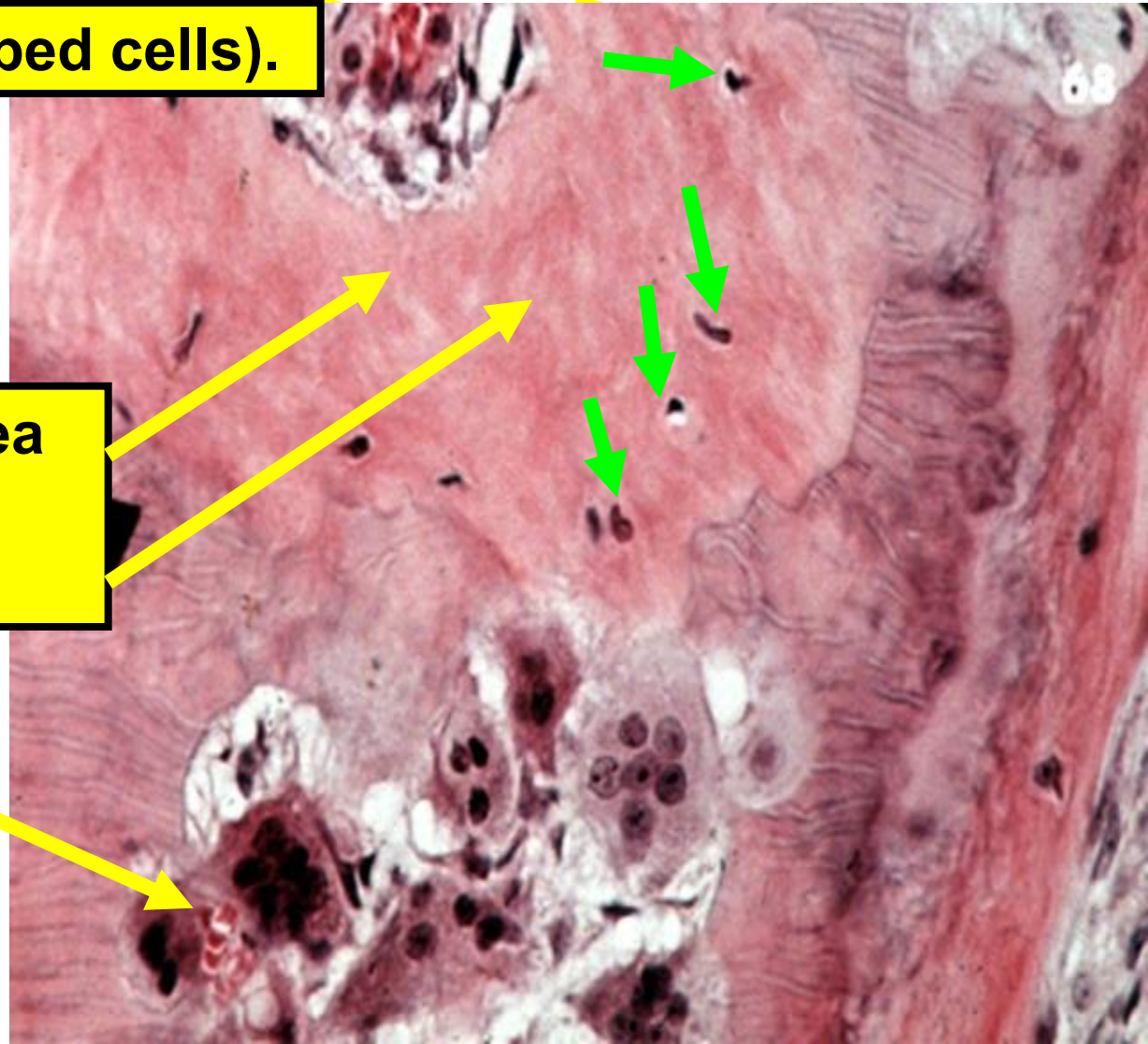


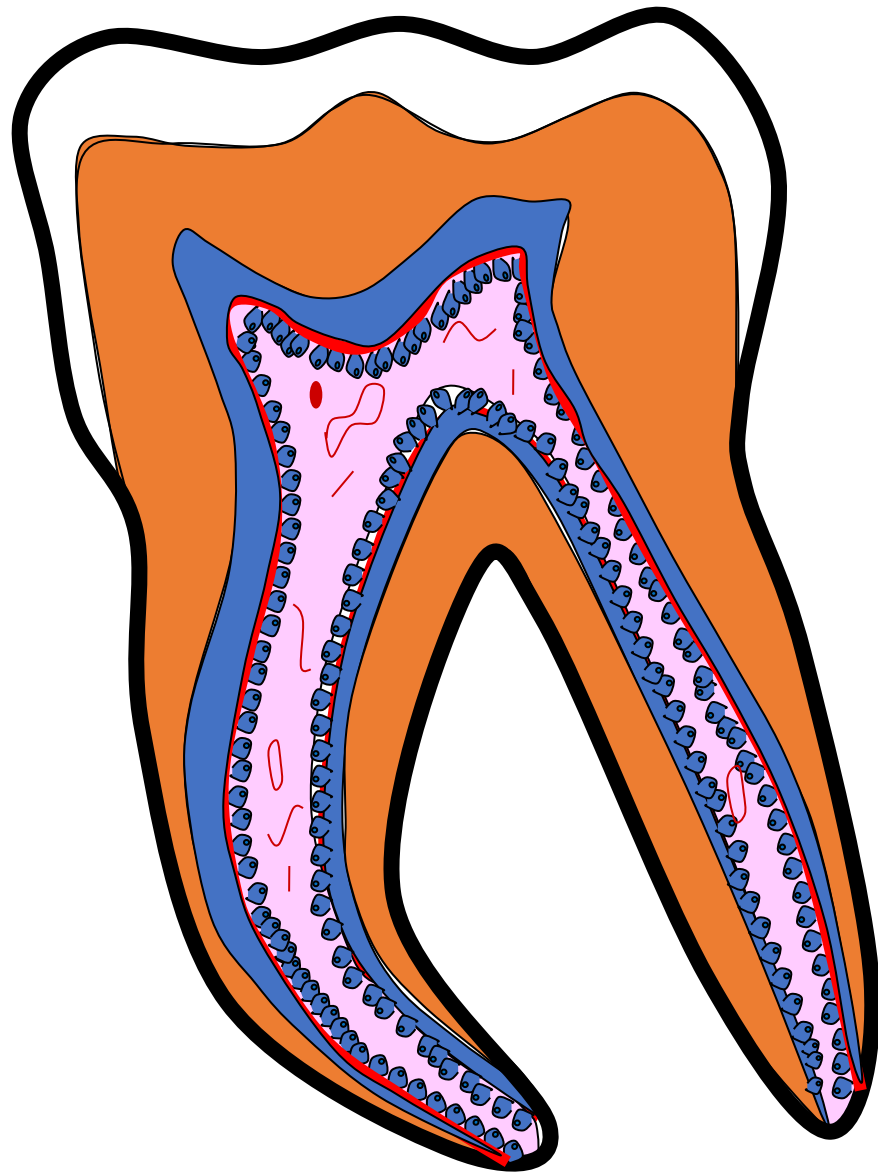
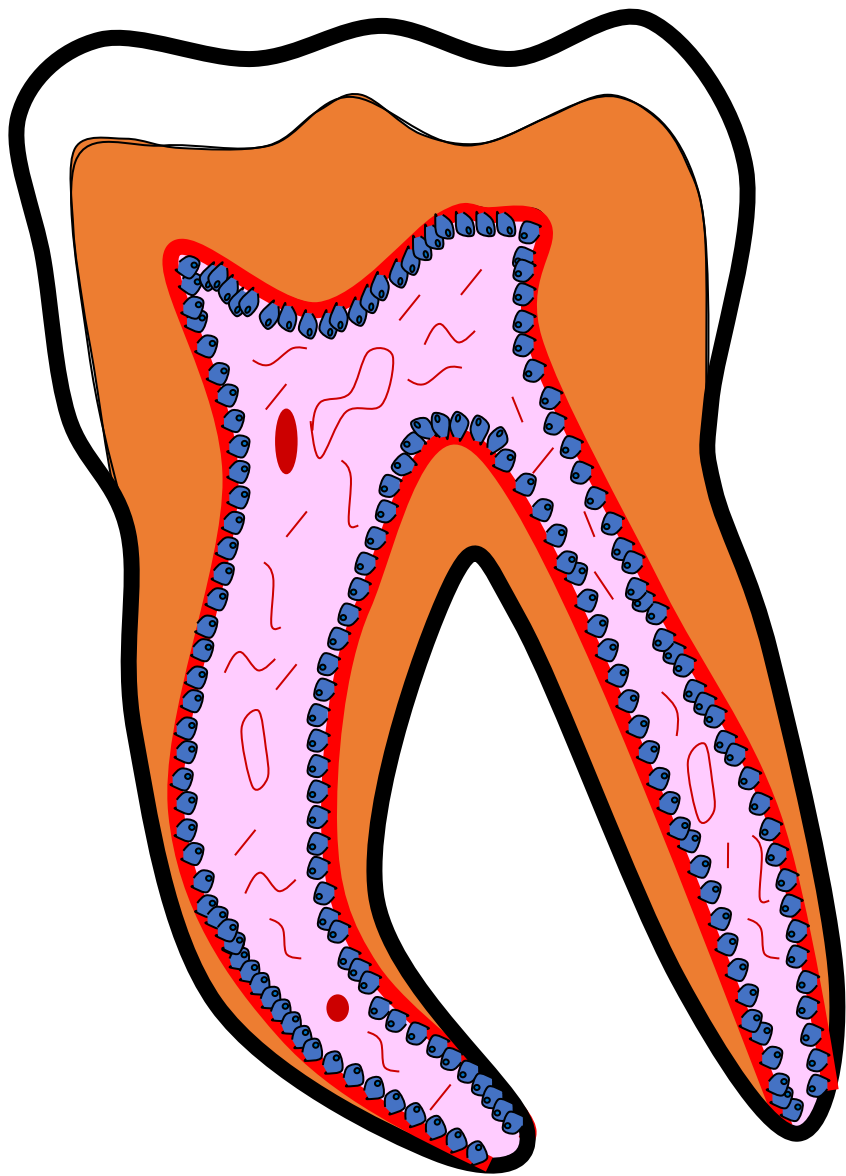
Types Of Reparative Dentin

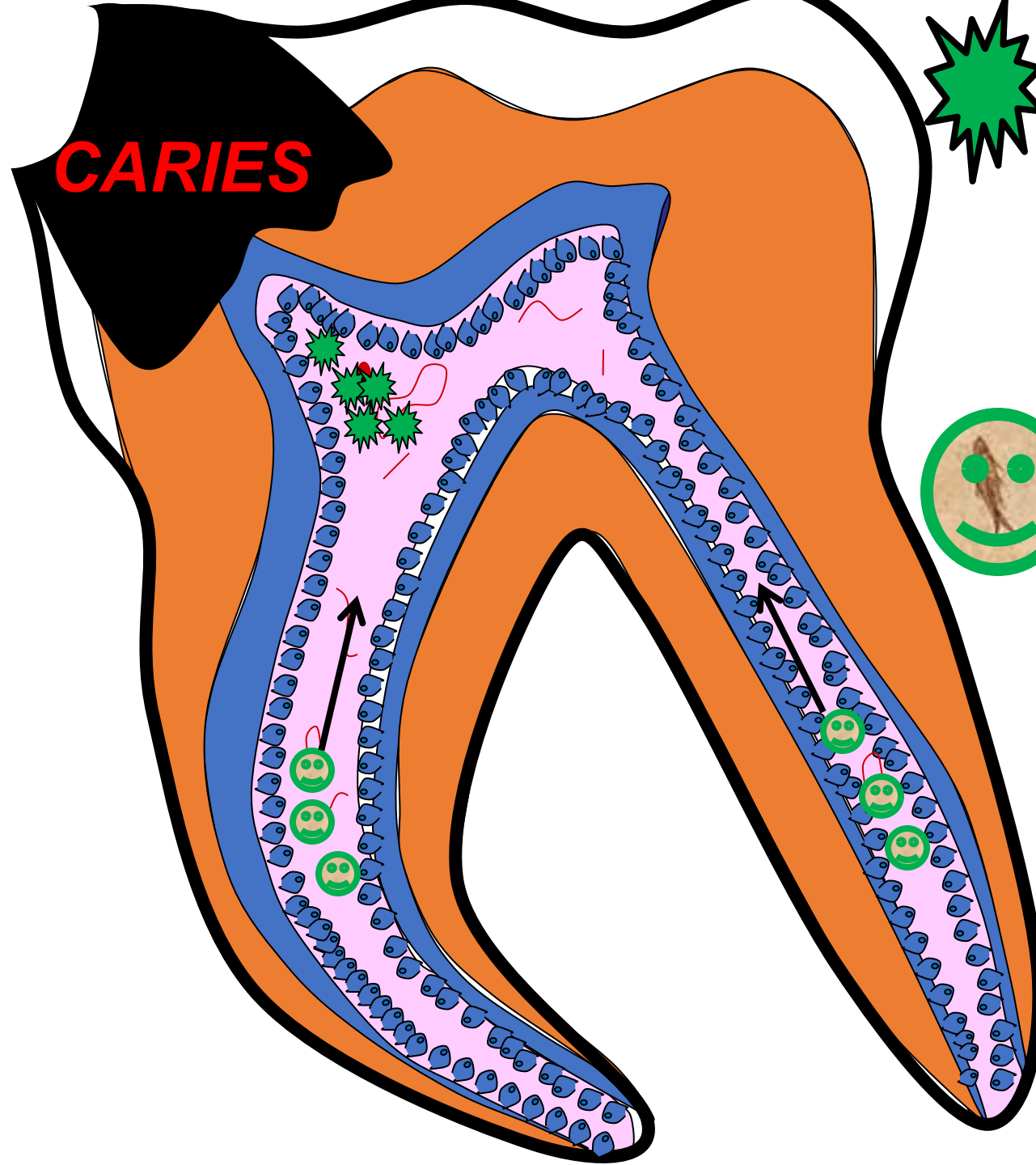
Osteodentin (entrapped cells).

Atubular dentin (area without dentinal tubules)

Vasodentin (entrapped b.v.)







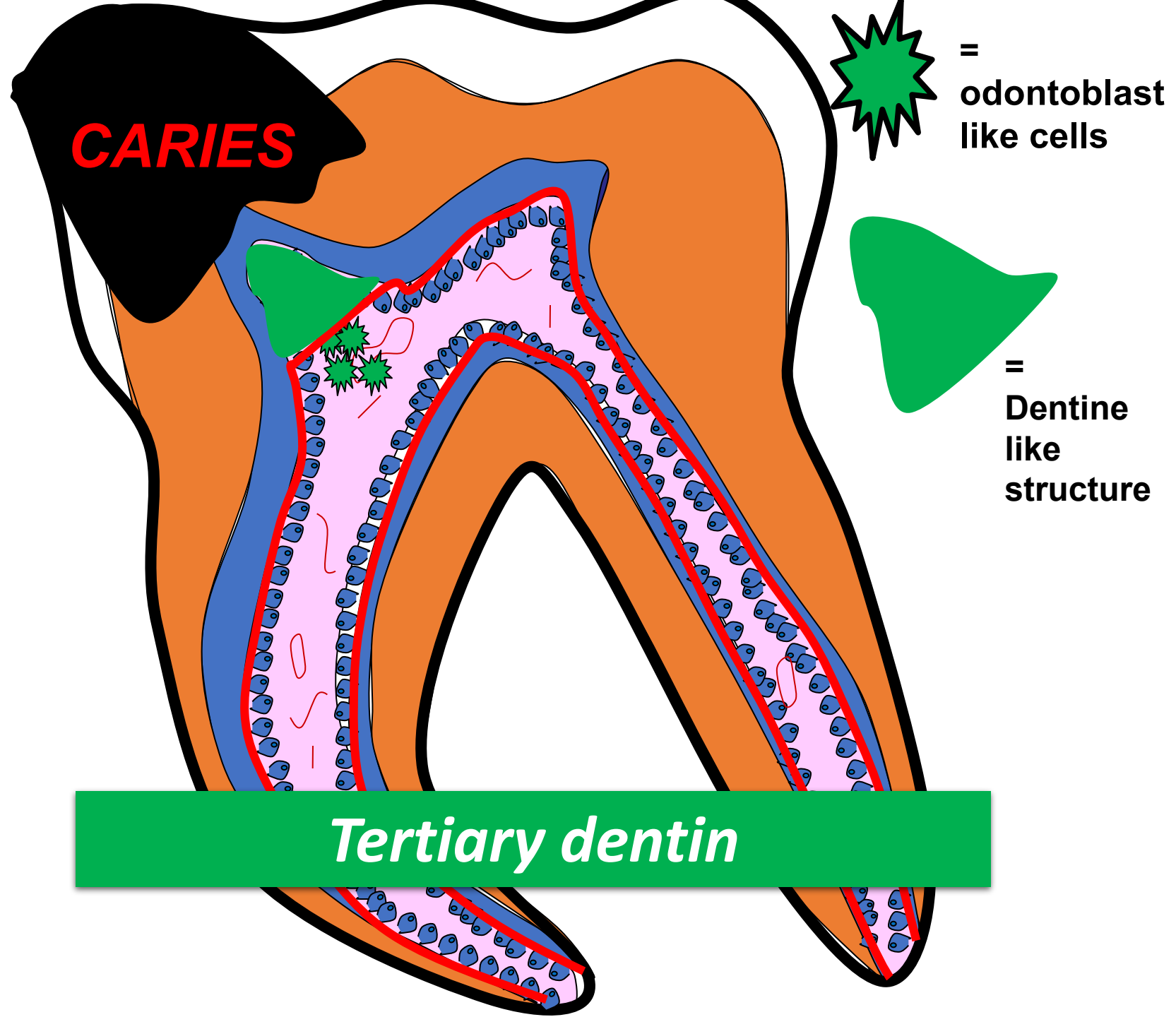
CARIES



=
odontoblast
like cells



=
U.M.C



- **Clinically:** ●

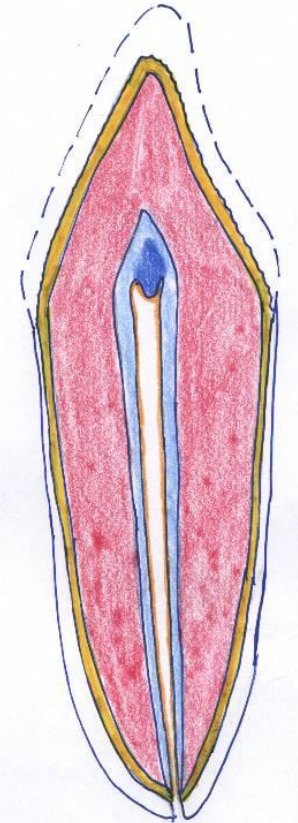
- The decrease of the pulp chamber height and obliteration of the pulp horns (pulp recession) make the liability of pulp exposure during cavity preparation much less likely to occur

Cavity preparation in young patients carries a greater risk of exposing of pulp



- The localized area of dentin formation increase the time taken by caries to reach the pulp (barrier)

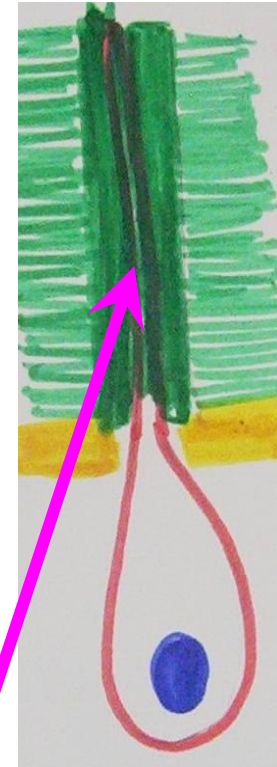
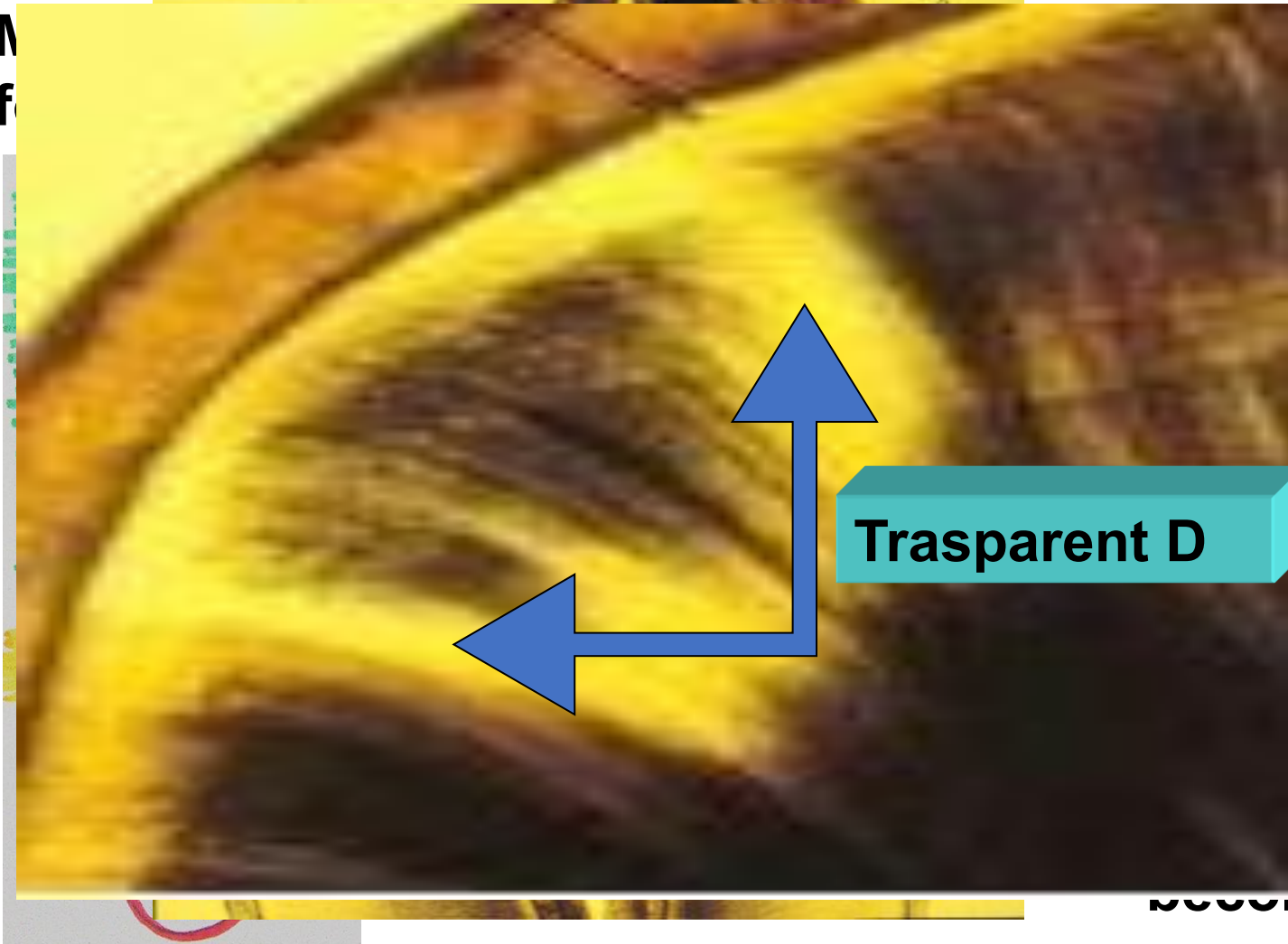
Due to the property of reparative dentin formation – **pulp capping** can be used



What about the “age changes in the 1ry Dentin” ?

A- Transparent (Sclerotic Dentin)

★ M
f

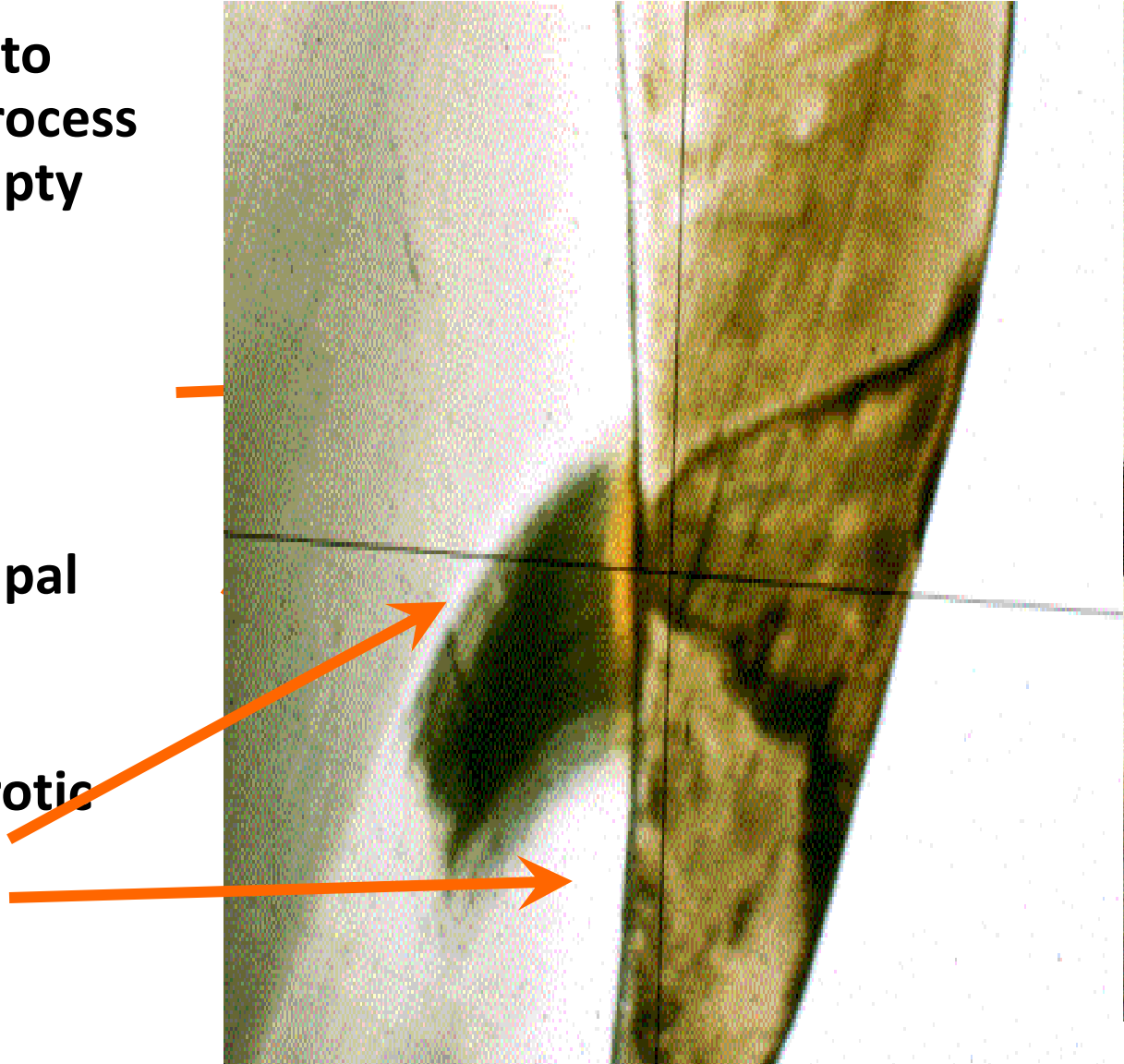


When the DT
become obliterated.

The affected area have occluded dentinal tubules, so the dentin have uniform **refractive index**. So this area of dentin appear translucent by transmitted light.

B- Dead Tracts

- Severe stimulation to dentin leads to destruction of the odontoblastic process and odontoblasts. This leads to empty and wide dentinal tubules.
- These areas appear black with transmitted light.
- Under the dead tracts from the pulpal surface, reparative dentine will be formed.
- The dead tract surrounded by sclerotic dentin.

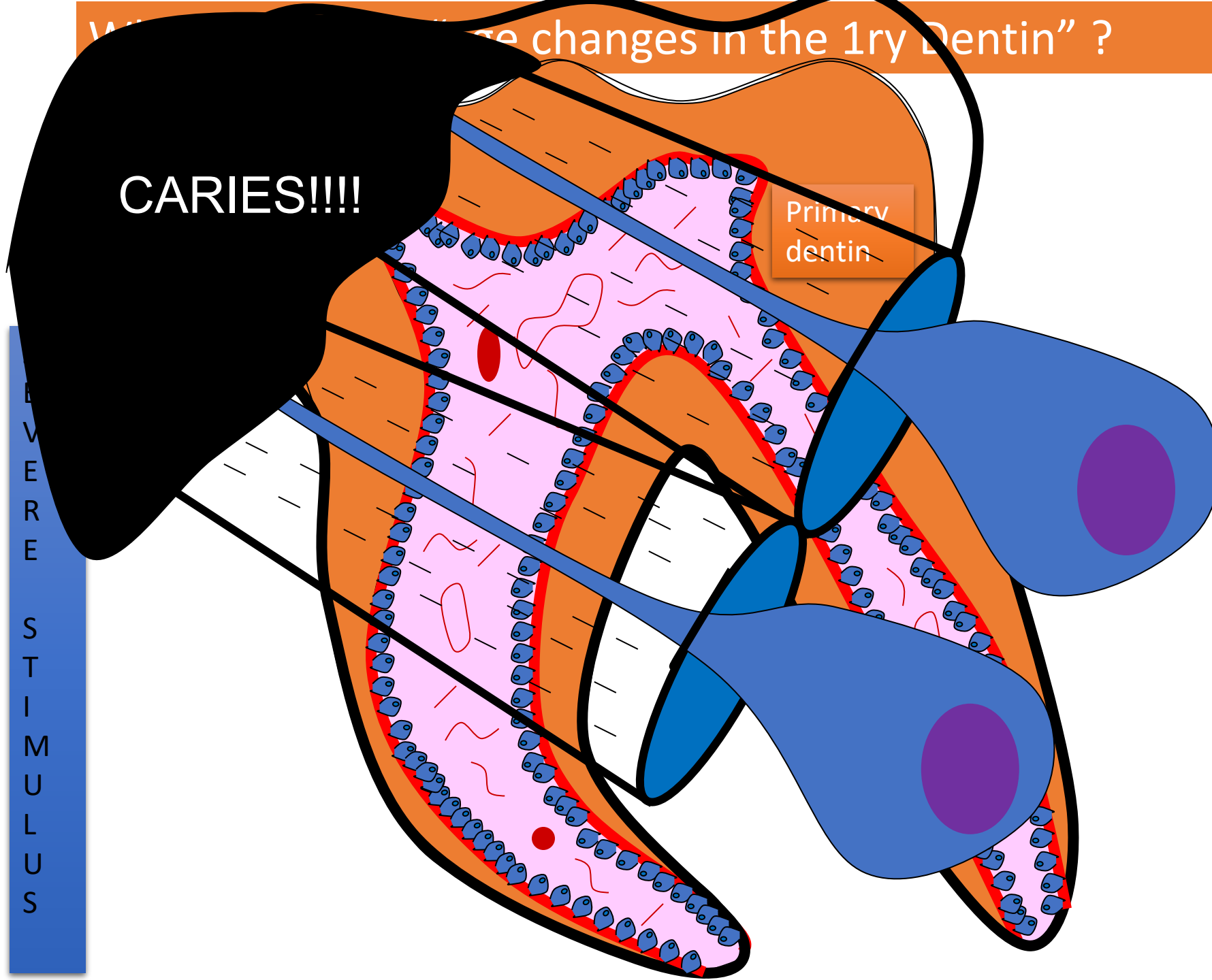


Will there be changes in the 1ry Dentin" ?

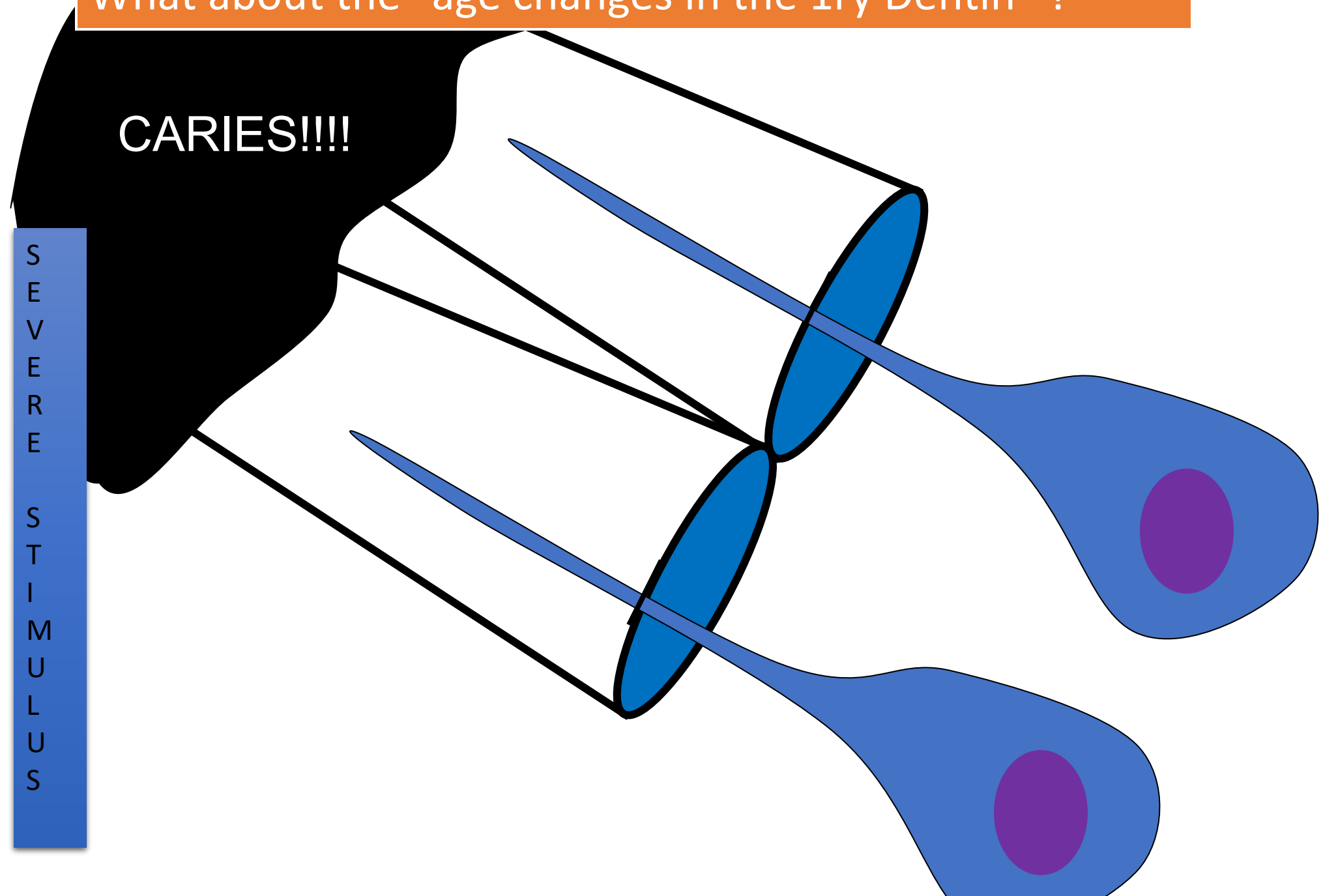
CARIES!!!!

Primary
dentin

REVERSIBLE
STIMULUS



What about the “age changes in the 1ry Dentin” ?

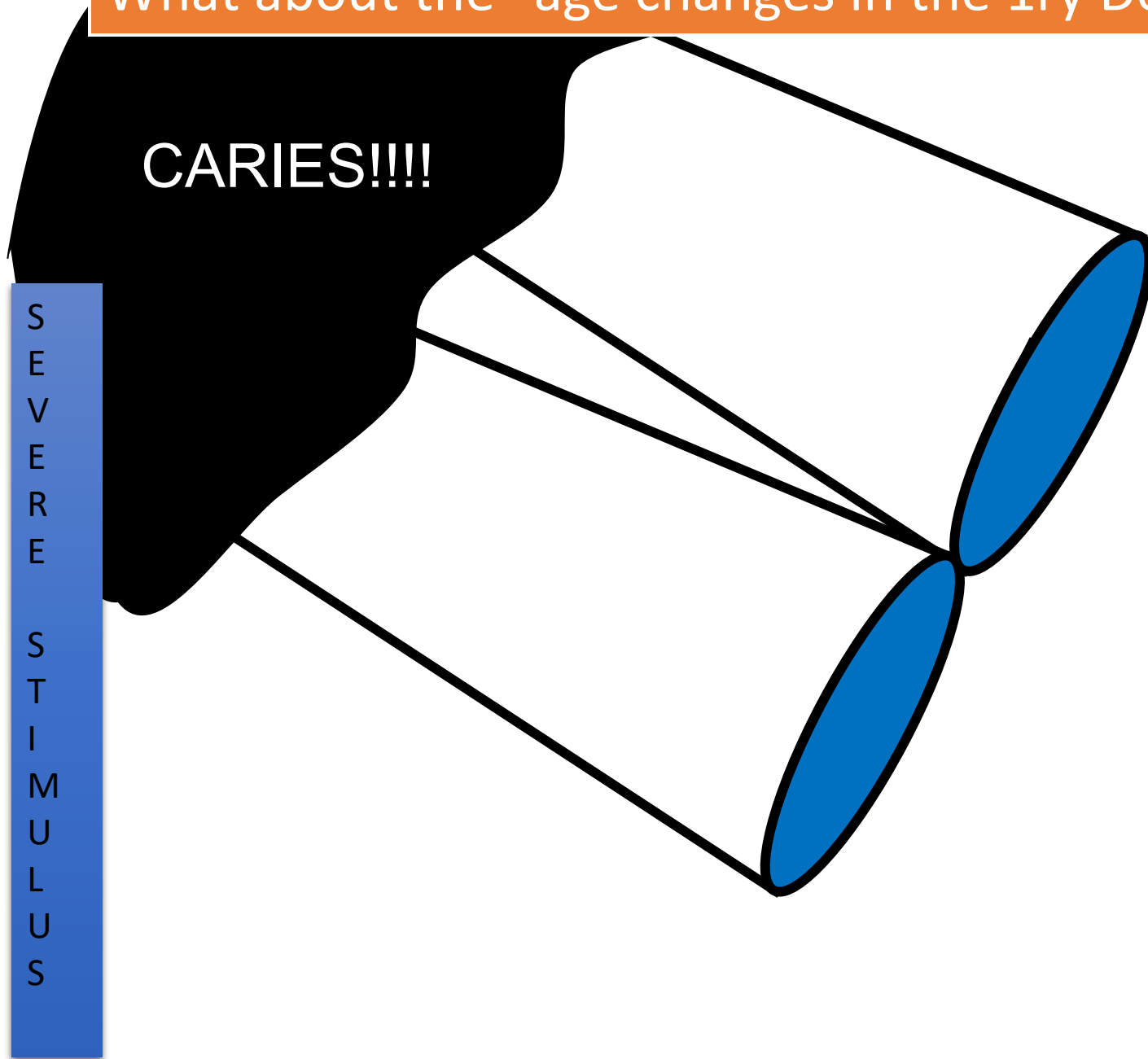


What about the “age changes in the 1ry Dentin” ?

CARIES!!!!

S
E
V
E
R
E

S
T
I
M
U
L
U
S



What about the “age changes in the 1ry Dentin” ?

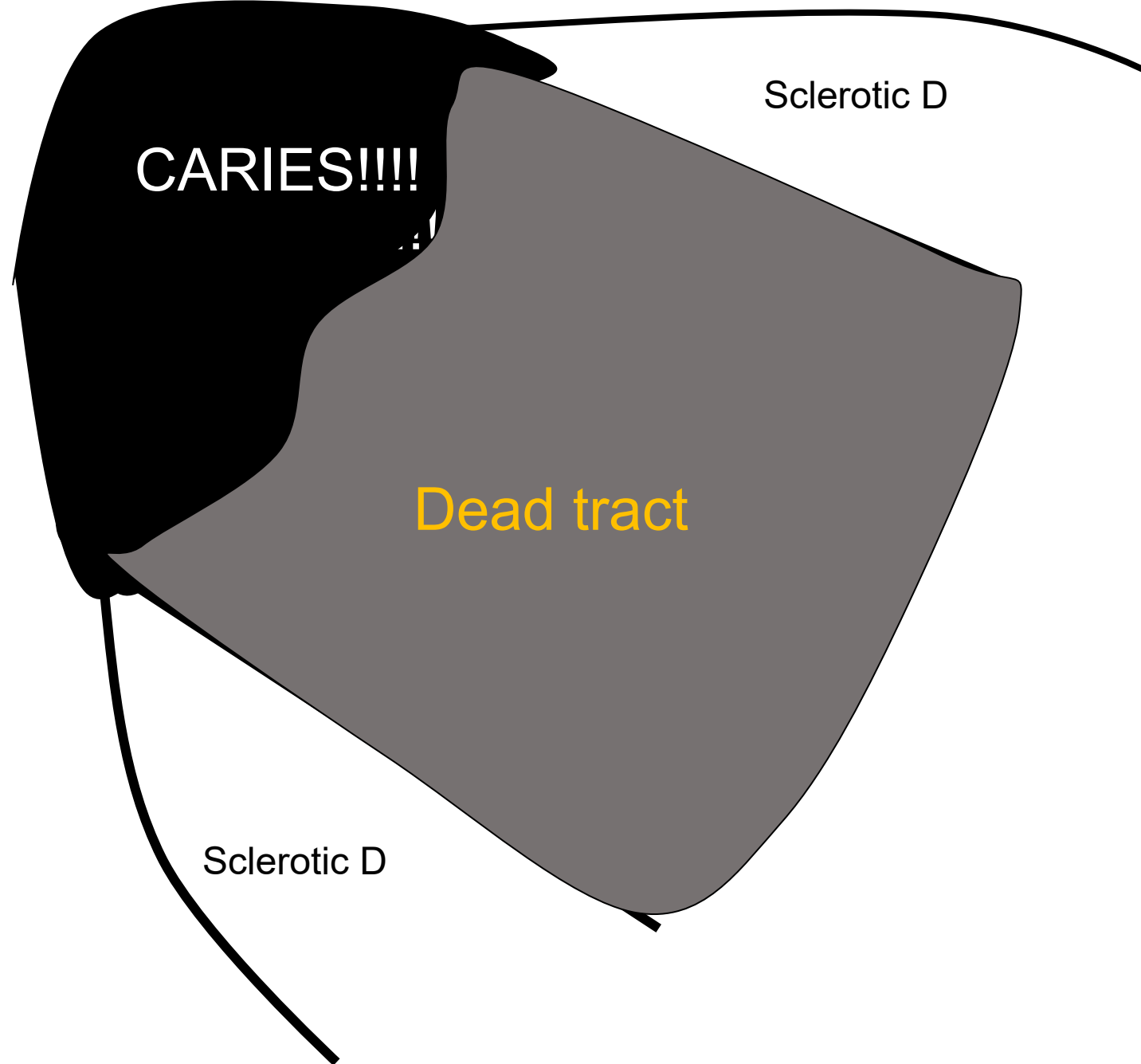
CARIES!!!!

S
E
V
E
R
E

S
T
I
M
U
L
U
S

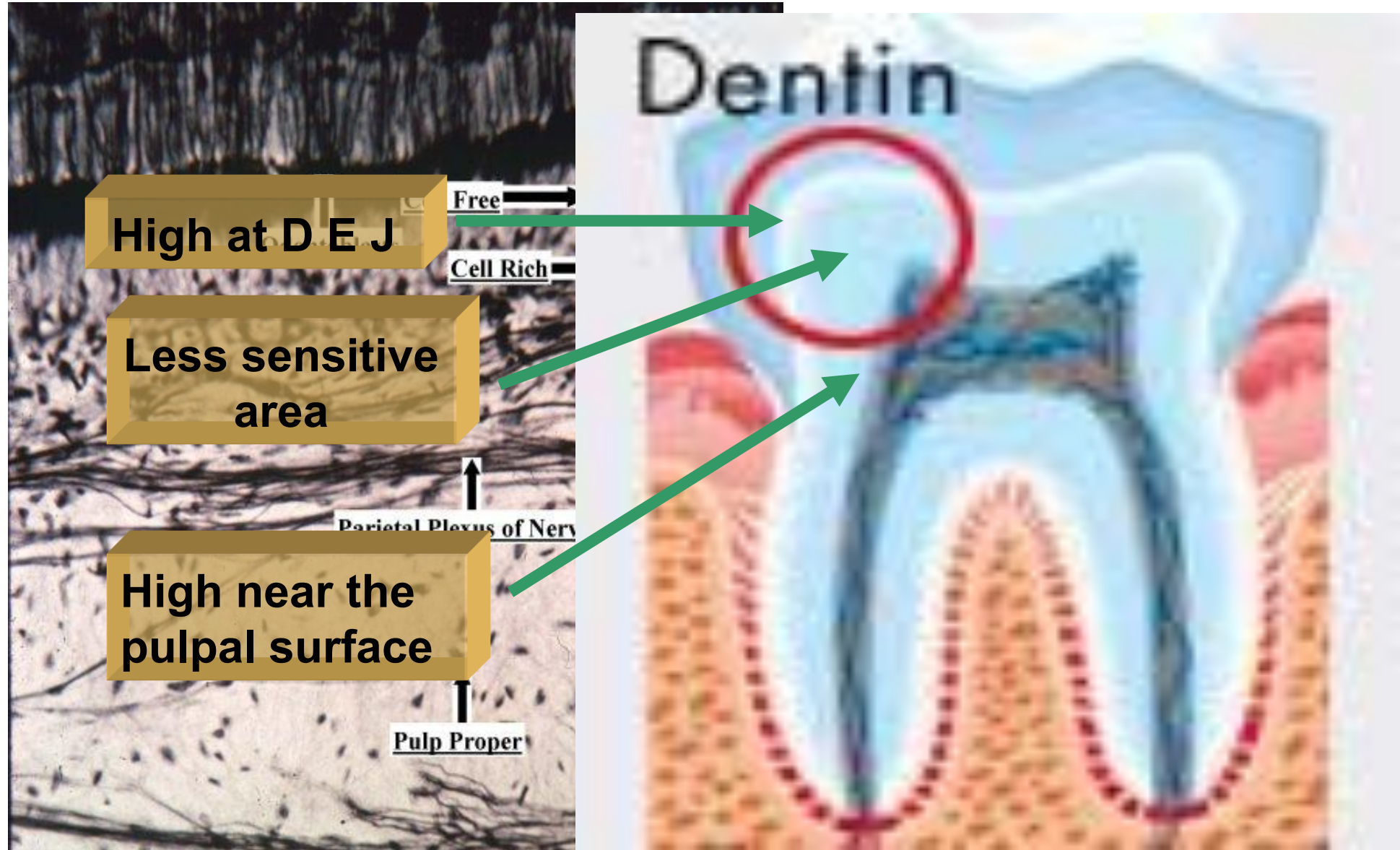
Area of destruction

A diagram of a tooth cross-section. A large, irregular black shape on the left side of the tooth represents a cavity, with the text 'CARIES!!!!' written inside it. To the left of the tooth, a vertical blue bar contains the words 'SEVERE' and 'STIMULUS' stacked vertically. A blue, cloud-like thought bubble is positioned to the right of the cavity, with the text 'Area of destruction' inside it. Two black lines extend from the top and bottom of the tooth, pointing towards the right.



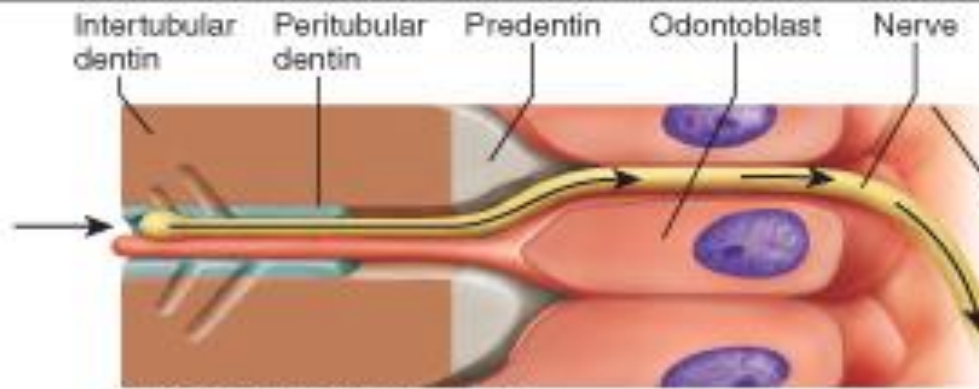
Dentin Sensitivity

Innervations Of Dentin



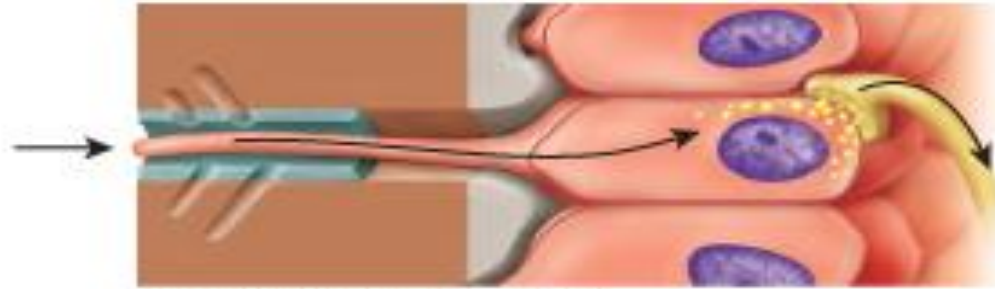
Theories Of Pain Transmission Through Dentin.

Direct neural stimulation



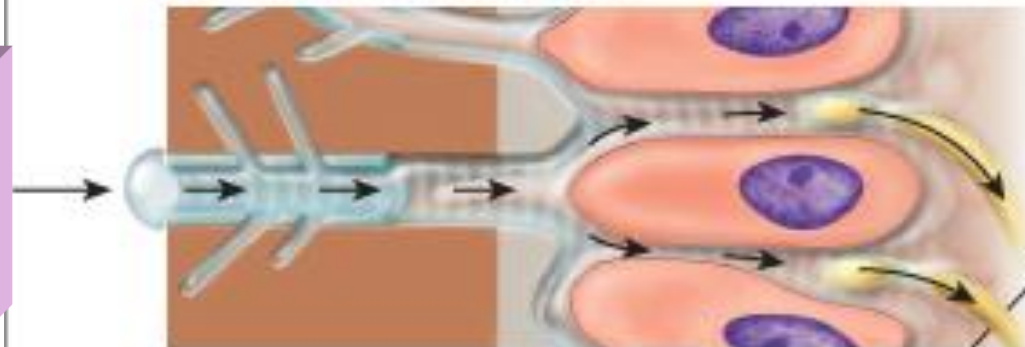
A. Dentin directly innervated

Odontoblastic transduction theory

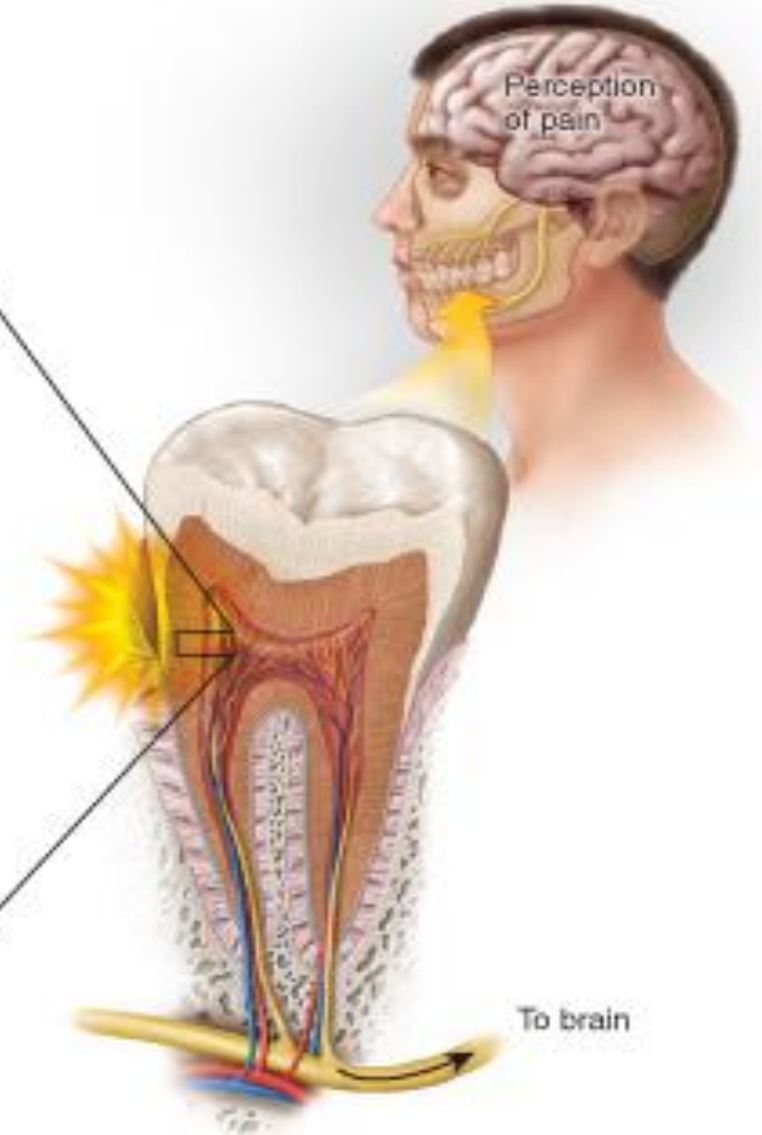


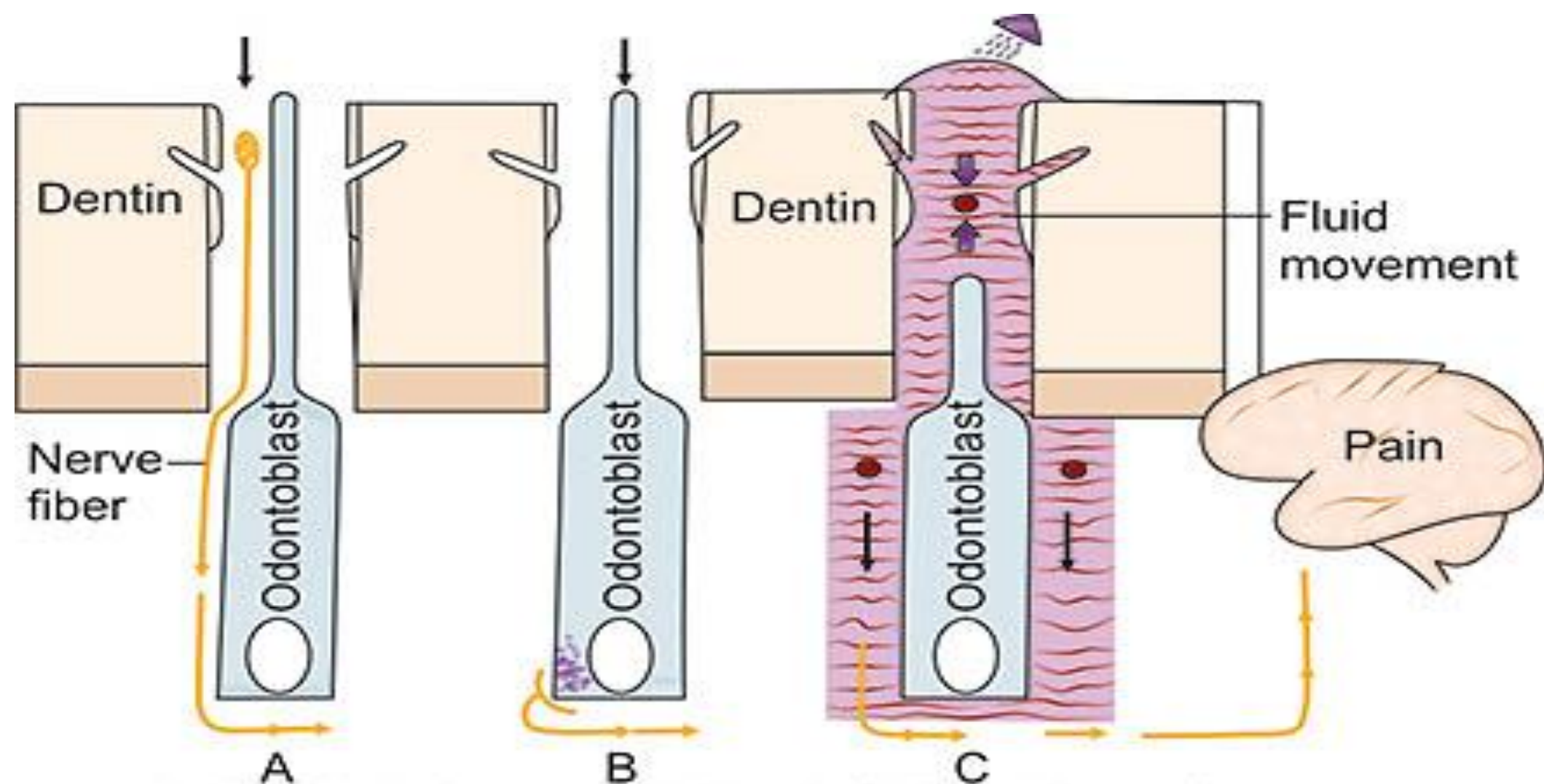
B. Odontoblasts act as receptors

Fluid or hydrodynamic theory



C. Fluid movement through tubules stimulates receptors in pulp

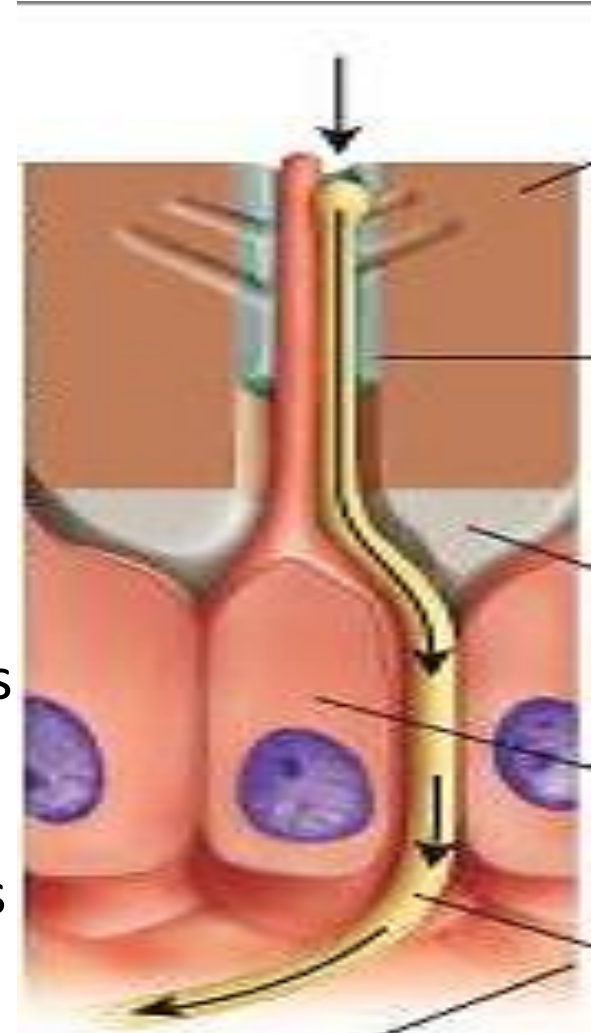




- A Dentin is innervated directly (Neural theory)
B Odontoblast act as a receptor (Transduction theory)
C Receptors are in the pulp and are stimulated by fluid movement through the tubules (Hydrodynamic theory)

Direct neural stimulation

- The dentin contains nerve endings that respond when it is stimulated.
- **All The following evidences against this theory:**
 - a- The **Intra tubular nerves** ends between the odontoblasts and may extend into the DT for short distance and loop back
 - b- The absence of nerve fibers in the outer dentin layer (at DEJ) which is the most sensitive region.
 - C - Also the application of local anesthetics to the surface of dentin does not affect the sensitivity.



Odontoblastic transduction theory

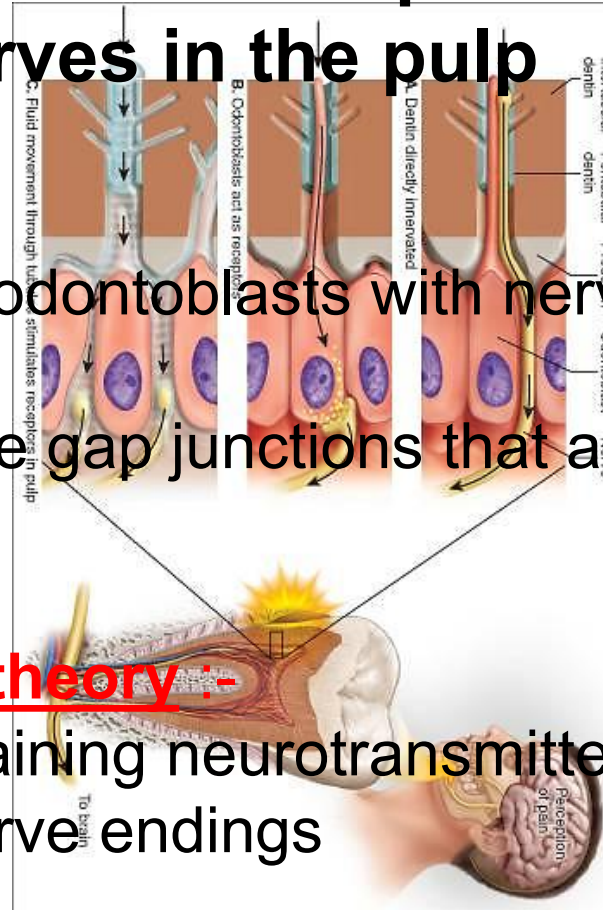
- The odontoblasts serve as receptors and are coupled to nerves in the pulp

Support to this theory :-

- 1- A close relationship of the odontoblasts with nerve endings is present
- 2- Adjacent odontoblasts have gap junctions that are sites of electronic coupling.

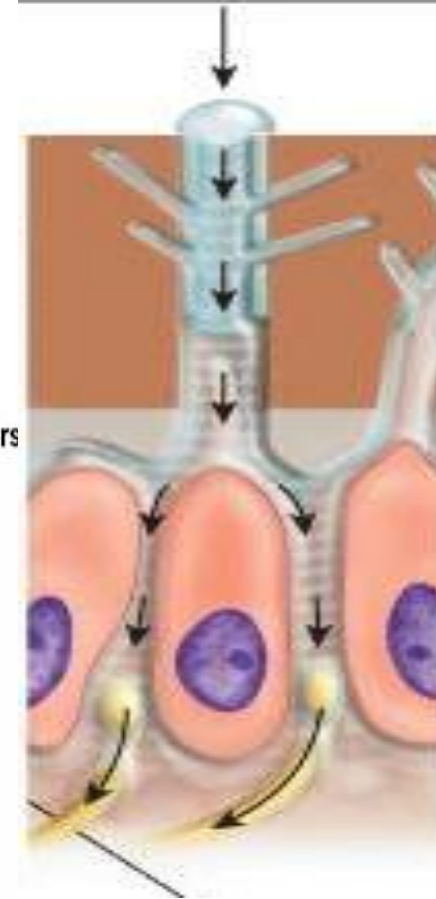
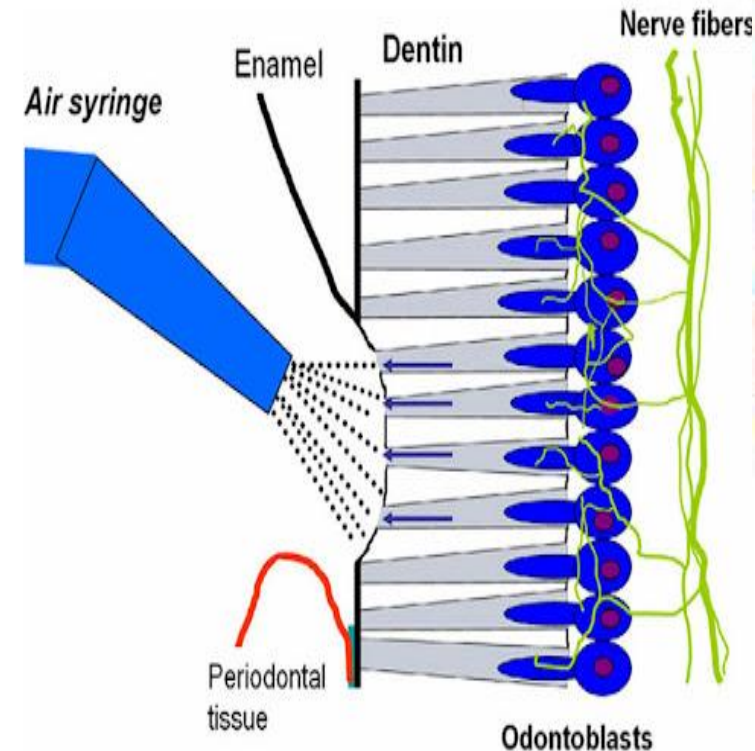
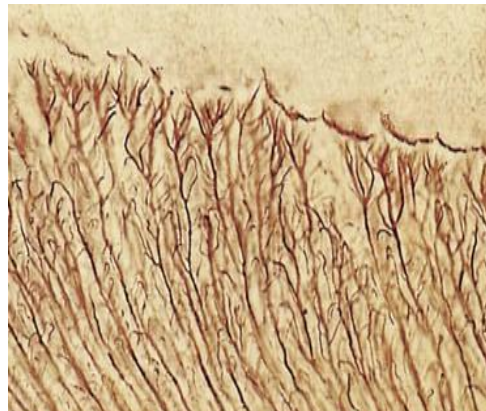
The argument against this theory :-

- There are no vesicles containing neurotransmitter substances in the odontoblasts adjacent to the nerve endings



Fluid or hydrodynamic theory

- **Most accepted theory**
- The tubular nature of dentin permits fluid movement to occur within the tubule when a stimulus is applied, a movement registered by pulpal free nerve endings close to the odontoblasts.
- The increased sensitivity at the dentino-enamel junction is explained by the profuse branching of tubules in this region.



Best wishes for exam

