

Basic Immunology

Immunology of dental caries

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Dental caries

Latin, *decay*

Localized **decay** of tooth tissue

Sugar + bacteria = acid, dissolving the hard tissue of tooth

Prevalence: 95% in developed countries

Leads to loss of ~ **US\$ 27 billion** annually worldwide

Prevention!!! **Physical** (brushing teeth) + **chemical** (fluoride)

Dental caries



Pathophysiology

- Carbohydrates are fermented into acid by bacteria
- Acid ($\sim pH < 5.2$) leads to demineralization of enamel and dentin

Carbohydrates

Glucose

Fructose

Sucrose

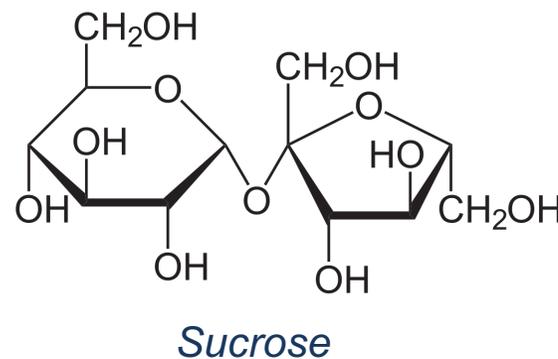
Bacteria

Streptococci

Lactobacilli

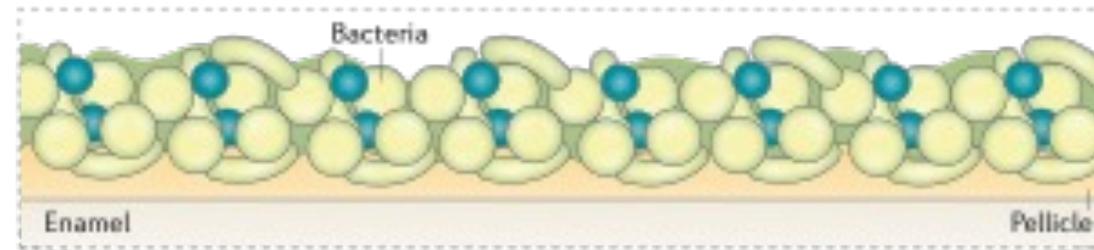
Actinomyces

Most important: S. mutans

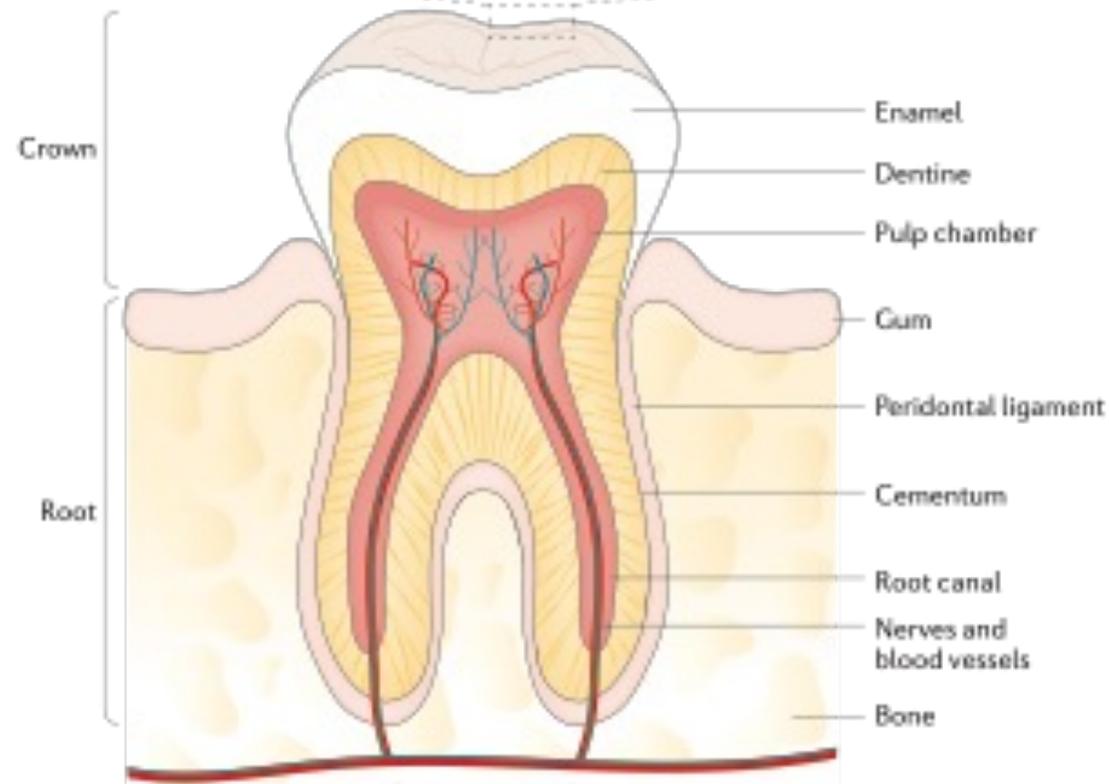


Pathophysiology: Biofilm

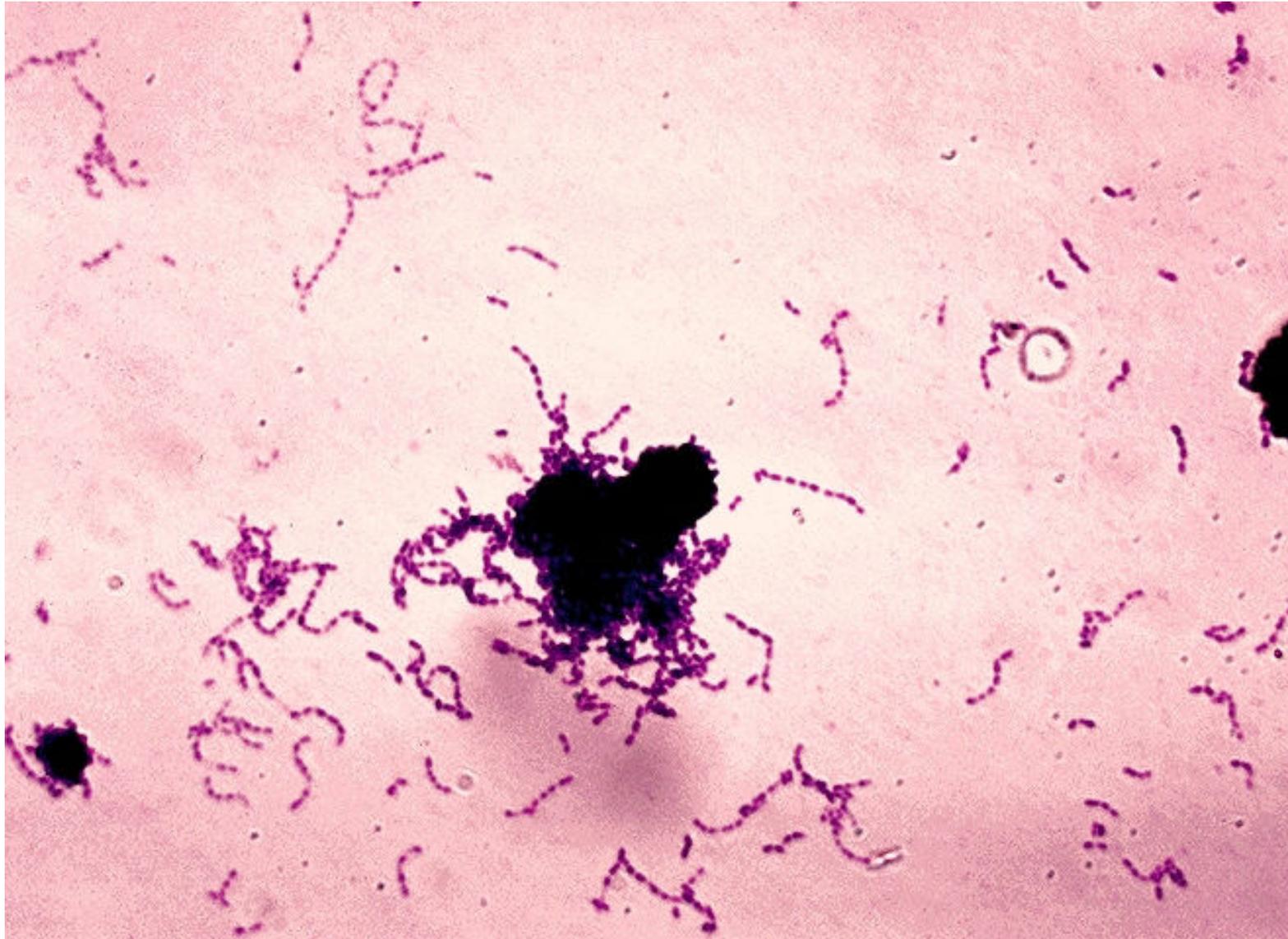
Dental
Biofilm



Proteins+
glycoproteins



Streptococcus mutans



Streptococcus mutans

Gram-positive, facultative anaerobe bacterium

Produces high amounts of extracellular polysaccharide, enhancing adhesion to tooth surface

Metabolizes sucrose to lactic acid via glucansucrase

Tolerates low pH (active excretion of protons)

Antigens:

- Glucosyltransferase (GTF)

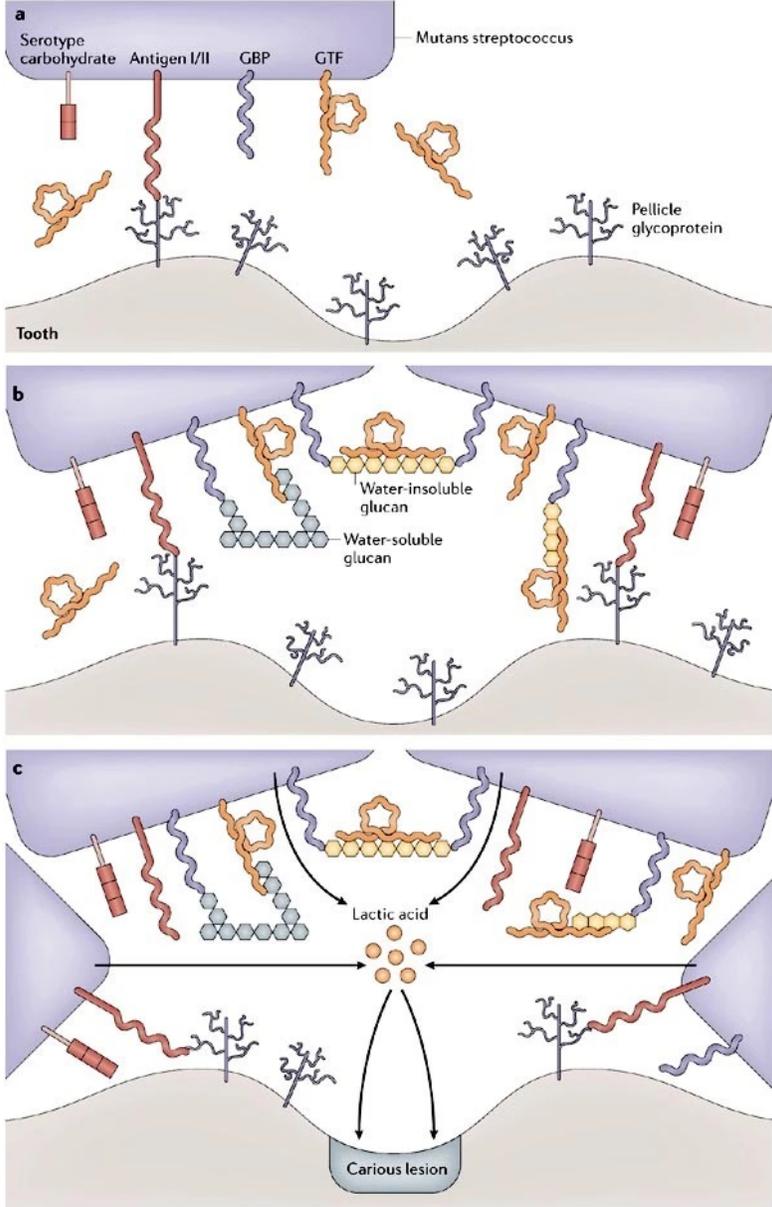
 - Synthesis of adhesive glucans*

- Streptococcal antigen I/II (SA I/II)

 - Adhesin, important in bacterial colonization*

 - Vaccination against SA I/II antigen?*

Streptococcus mutans



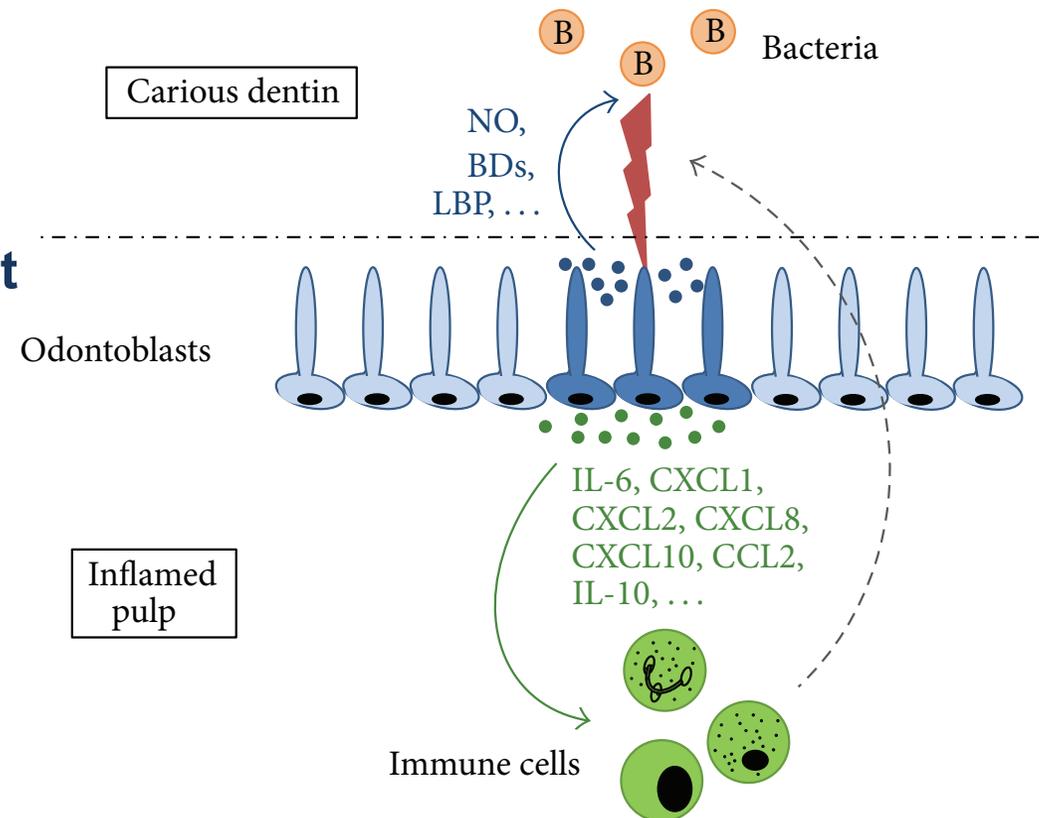
Immune response

Humoral response

- Elevated serum IgG to *S. mutans*
- Salivary antibody response less consistent

Odontoblast defense against dentin-invading bacteria

- TLR2, TLR4
- antibacterial molecules (blue)
- proinflammatory cytokines (green)



Immunization against caries

Active immunization

Mucosal (oral/nasal) or systemic immunization

Repeated immunizations needed

Few human studies

Passive immunization

mAb against SA I/II fragment 3 prevented colonization of S. mutans

Antibody in milk...?

Natural immunity to caries

Individuals with low caries experience had higher levels of serum IgG against SA I/II and salivary IgA against GTF

Genetic factors

HLA-DR6: low incidence of caries

HLA-DR6+ lymphocytes: stronger response against cariogenic bacteria (*S. mutans*)

HLA-DR4: higher risk of caries

BRUSH YOUR TEETH!!!

