

Lesson 27

Microbiology of caries.



MICROBIOLOGY AND IMMUNOLOGY OF DENTAL CARIES

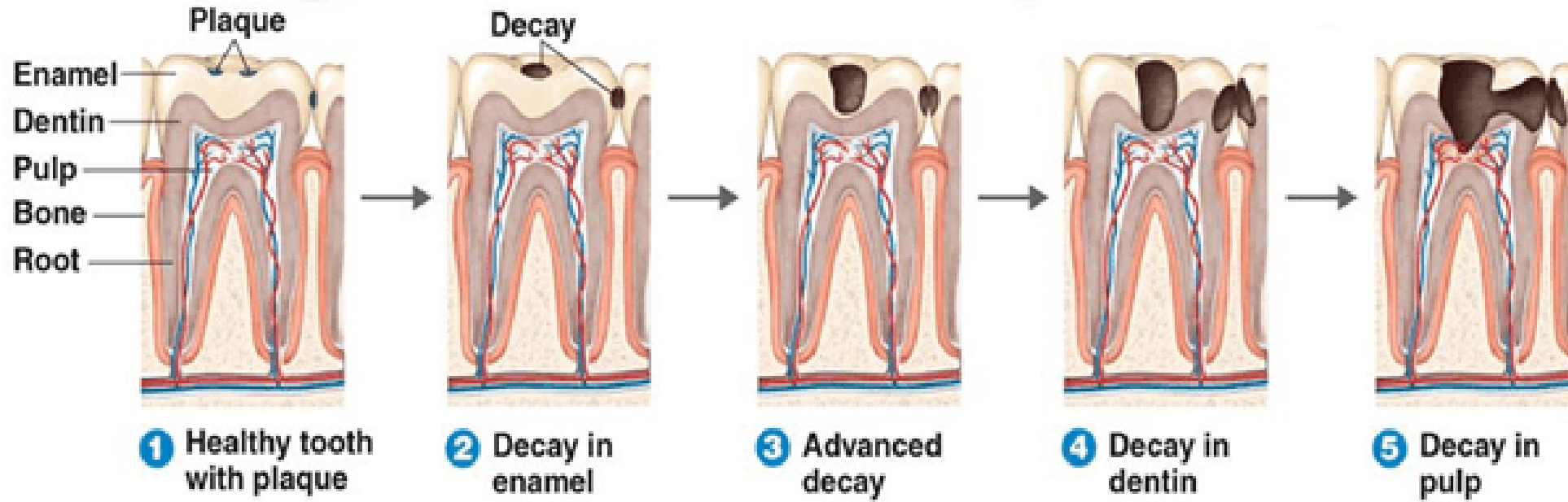
- ▶ **CARIES** is a pathological process in which **demineralization** and **softening** of the hard tissues of the tooth occurs, followed by the formation of a cavity. The processes of demineralization and remineralization are constantly taking place in the enamel.
- ▶ **Demineralization**: prolonged contact with the products of microorganisms of the oral cavity - organic acids leads to a gradual increase in micro- spaces between crystals of enamel prisms, in particular- microdefects formed between the crystals of enamel prisms penetrate microorganisms and damage the enamel. The long process of demineralization is completed by the dissolution of a stable surface layer of enamel and the formation of a cavity in the tooth, **caries** develops.

Tooth decay

This dental disease is one of the most common. Epidemiology indicates that it is diagnosed in 93% of people. This pathological process is often found in children. In 98% of children, at least one milk tooth hurt once in a lifetime. Caries is a slow process that affects the hard tissues of the teeth. The name of the disease is derived from the Latin word "caries", which means "rotting". A deep pathological process develops as a result of both external and internal adverse factors.

- ▶ poor oral hygiene, where food debris comes from;
- ▶ the presence of plaque and stone;
- ▶ incorrect bookmark, due to which a milk tooth in a newborn may not develop and erupt in the same way;
- ▶ violation of the chemical composition of dentin and enamel;
- ▶ a number of diseases, from where there is a violation of the composition of saliva;
- ▶ malnutrition.

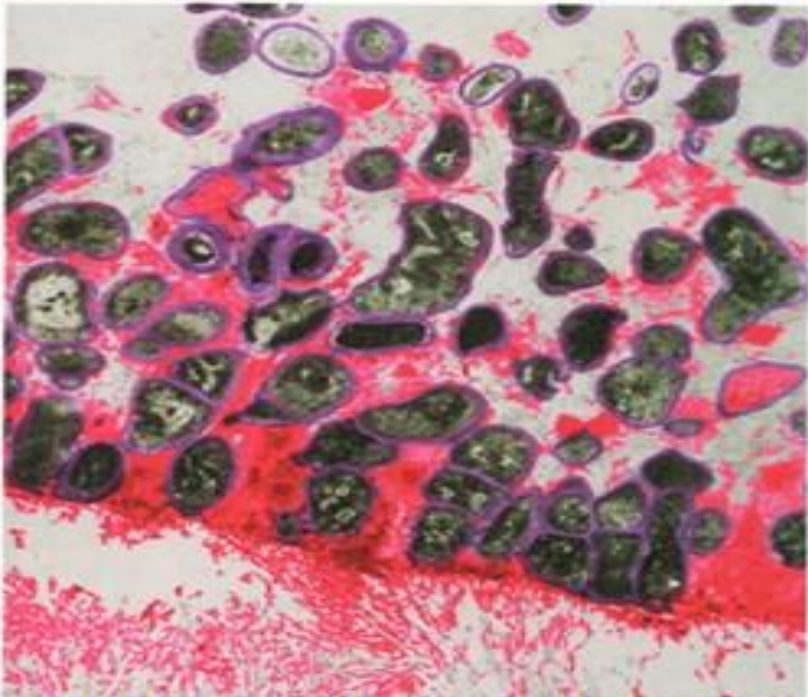
The Stages of Tooth Decay



Percentage of the microflora of a Five-day human plaque

Types of bacteria	Non-carious teeth	carious teeth
Acidophilus bacteria		
Streptococcus	45	55
Actinomyces	5	7
Lactobacillus	4	12
Leptotrichia	2	7
Corynebacterium	6	2
Всего:	62	83
Proteolytic bacteria		
Peptostreptococcus	3	3
Fusobacterium	5	5
Vibrio	6	2
Veillonella, Neisseria	10	1
Spirochetes	2	0
Другие	12	6
Всего:	38	17

Bacteria in dental plaque and mucosal fold



Glucan formation allows bacteria to attach to teeth, forming dental plaque. On the stained MukpooToography of a section of plaque on the surface of the tooth, bacterial cells are visible in the Dextran matrix (red fibrils)



Bacteria in the fold of the oral mucosa

2 MKM

The most important in the development of caries are: **streptococci** (Streptococcus mutans), **lactobacilli** (Lactobacillus casei), **actinomyces** (Actinomyces viscosus).

The **leading role** is played by **Streptococcus mutans** (D.Clark, 1924). S.mutans differs from other streptococci in colony morphology , fermentation of mannitol, sorbitol, inulin, as well as antigenic properties. Of the 8 S. mutans serovars: a, b, c, d, e, f, g, h. Serovar c is more common. The cariesogenicity of **S.mutans** is associated with its ability to attach to the smooth surface of teeth and form cariesogenic plaques. S. mutans has the enzyme **glucosyltransferase**, which converts sucrose into soluble **glucans** and an **insoluble polymer (dextran)**, which ensures the attachment of streptococci to the tooth surface and the formation of dental plaques. With the help of fructosyltransferase, fructans are formed. Under the influence of cariesogenic factors , the processes of **demineralization and depolymerization** occur in the enamel of teeth , resulting in irreversible carious lesion.

All strains of *S. mutans* have cariesogenic properties , the cariesogenicity of *S. sanguis* is very high. *S. salivarius* does not have cariesogenicity.

Cariesogenicity is caused by **LACTIC acid**, the ability to dissolve calcium.

Streptococci give mainly lactic acid, lactobacilli - also propionic, acetic and butyric.

More than 50 enzymes have been identified in plaque that have a destructive effect on tooth tissue.

The primary stage of caries development is the action of **proteolytic enzymes** of neisseria, vail- nella, fusobacteria, spirochaetes, etc., lamellae, organic shells of prisms and enamel bundles are destroyed. This facilitates the access and deep penetration of microorganisms into the depth of the enamel, followed by the dissolution of oxyapatite under the influence of acids.

Organic

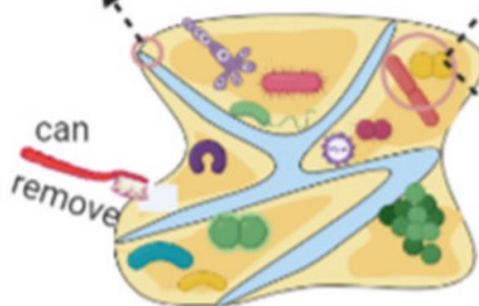
- salivary glycoproteins
- extracellular polysaccharides (glucans & fructans)
- lipid material

Inorganic

- calcium & phosphorus (bulk)
- sodium, potassium, fluoride

Primitive circulatory channels

- circulates nutrition & waste

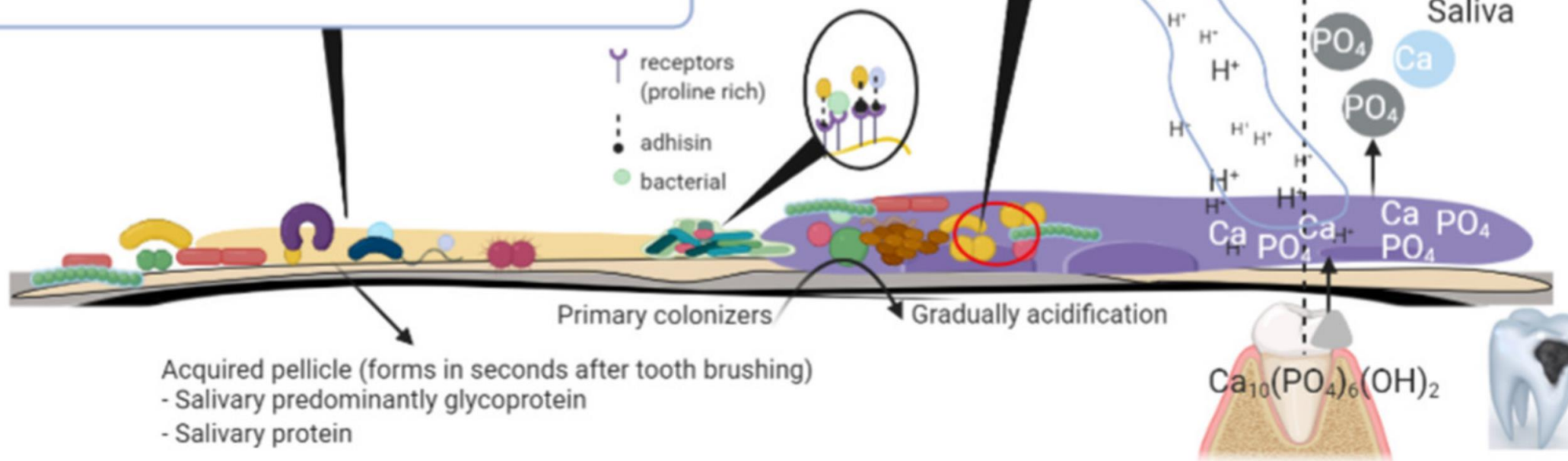
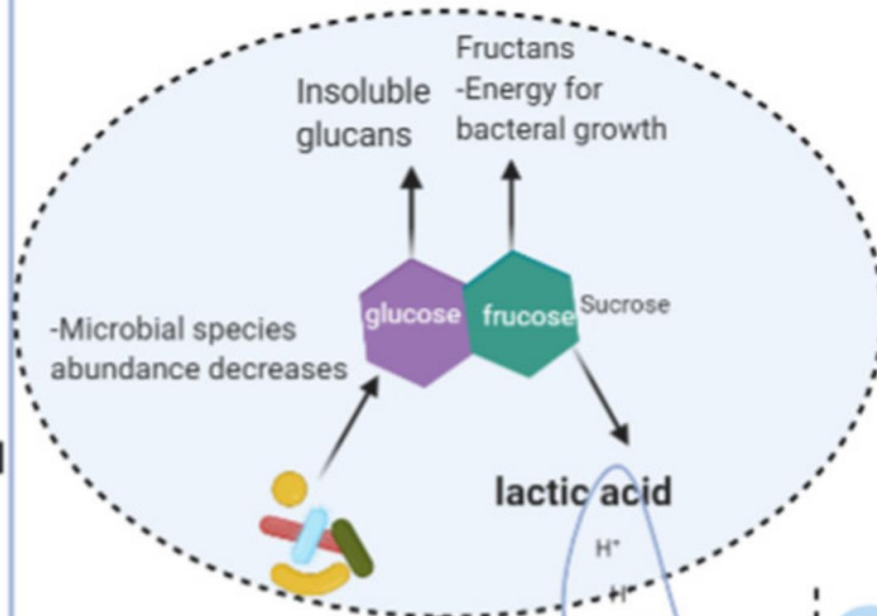


Matrix

Derived from crevicular fluid bacteria saliva

700 distinct microbial species

- Predominantly bacteria
- Few yeasts & viruses



ORAL MICROORGANISMS

ACTIVATORS

Specific proteins
of
saliva

Glucose
Fructose
Sucrose

PLAQUE

Cariogenic factors
(acids, chelators, enzymes)

Depolymerization of
the enamel matrix

-DENTAL CARIES

INHIBITORS

Antimicrobial factors in
saliva

proteolysis inhibitors

Immunoglobulin

Dextranase

Fluorine

Buffer capacity of saliva

Remineralizing

SYSTEMS

Oral hygiene

Demineralization

enamel

PULPITIS - is the most common complication of the carious process. Ways of infection penetration:

- from the carious cavity through the dentine tubules, or directly when the pulp is exposed;
- through cracks in the enamel without carious lesions;
- less often, infection occurs through deep denture pockets with alveolar pyorrhea;
- very rarely there is inflammation of the pulp as a result of infection by a hematogenic route.

Acute pulpitis is characterized by the development of exudative processes, inflammation proceeds according to the type of hyperergic reaction with sharp swelling of the pulp tissue and pain syndrome. After a few hours, the inflammation acquires the character of a purulent process, infiltrates and abscesses are formed. The result of acute pulpitis is pulp necrosis, or the process acquires one of the forms of chronic pulpitis, occurring with exacerbation.

Prevention of caries

- ▶ **Increase of tooth resistance:** fluorides (F) increase the resistance of teeth to acid, inhibit cariesogenic microbial enzymes (after 30 years - ?)
- ▶ **Reduction of sucrose in the diet,** replacement with xylitol, which is not decomposed by microbial enzymes in the oral cavity.
- ▶ **Antimicrobial effects:** oral hygiene, treatment of diseases of the teeth and oral mucosa, rinsing.

Data on the anti-cariogenic effect of coffee (trigonellin) have been obtained.

Significantly assess the risk of developing caries.

- ▶ The high significance of the correlation of levels between the content of streptococci and lactobacilli and the frequency of caries in children aged 2.5 years and older was noted. Genotyping showed their relationship with the microflora of mothers. These technologies are useful for the prevention of intrafamilial caries. The time between 19 and 31 months of a child's life is defined as a "discrete window of infection", which is important to consider when planning a caries prevention strategy in children.
- ▶ Determining the titer of bacteria in saliva is one of the main ways to identify people at high risk of caries and carry out appropriate prevention.
- ▶ It is especially helpful to screen mothers in maternity clinics with the hope of improving their children's dental health.

Periodontitis

The development of periodontitis directly depends on the level of microbial contamination of the oral cavity and vice versa - on the effectiveness of hygiene measures.

The main role in the etiology of periodontitis is played by *Streptococcus mutans*, *Actinomyces viscosus* u *Bacteroides melaninogenicus*. The amount of endotoxins (LPS) in the fluid of dental pockets correlates with the clinical stage of inflammation.

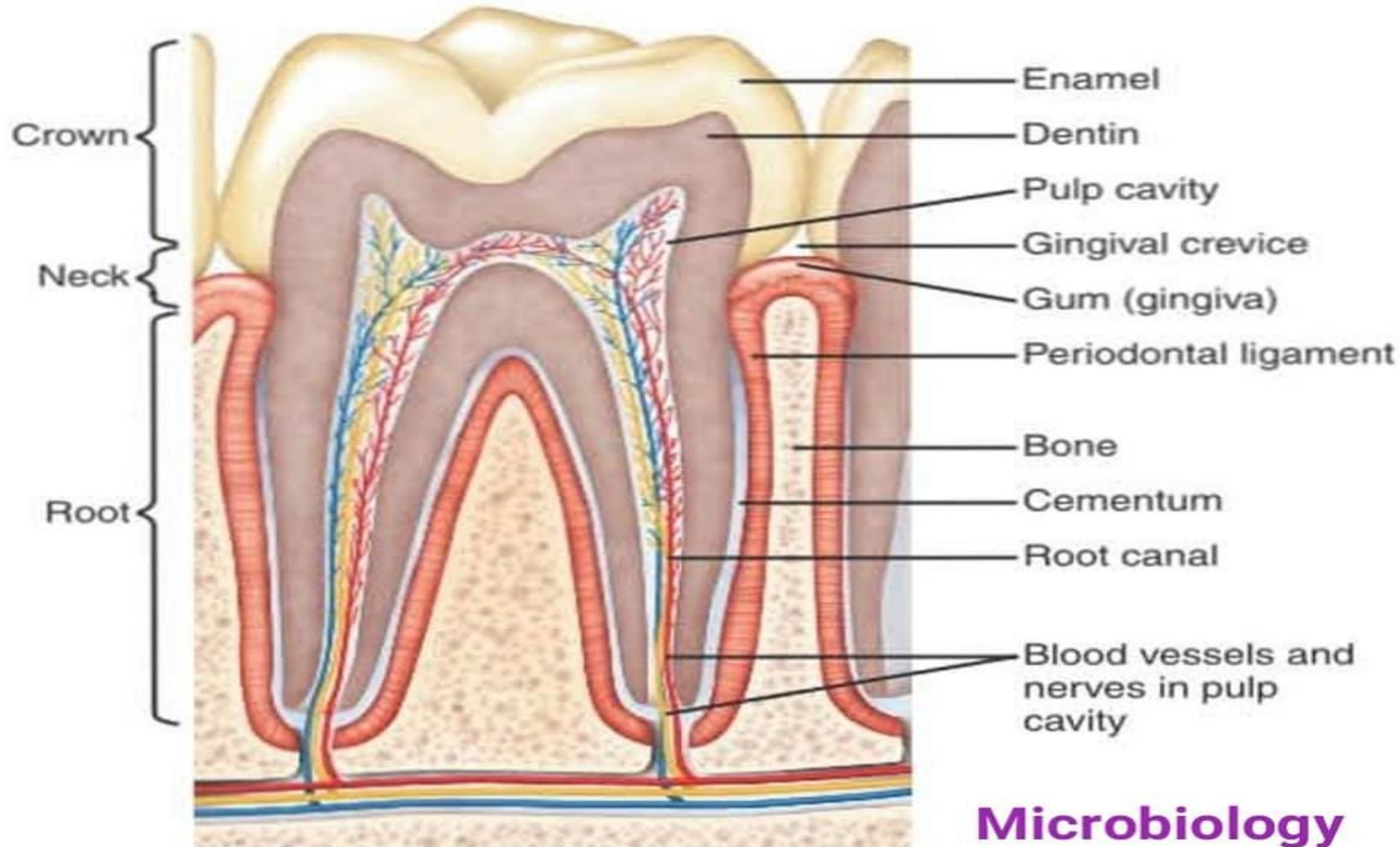
Collagenase, hydrolyzing the collagen of the gums and bones of the alveolar process, causes the destruction of the protein stroma of these tissues. Only ***Prevotella melaninogenicus*** is able to break down not only denatured, but also **native gum collagen**. Bacterial **elastase** affects the vascular wall and causes increased bleeding of the gums.

S. sanguis produces a protease that cleaves saliva IgA.

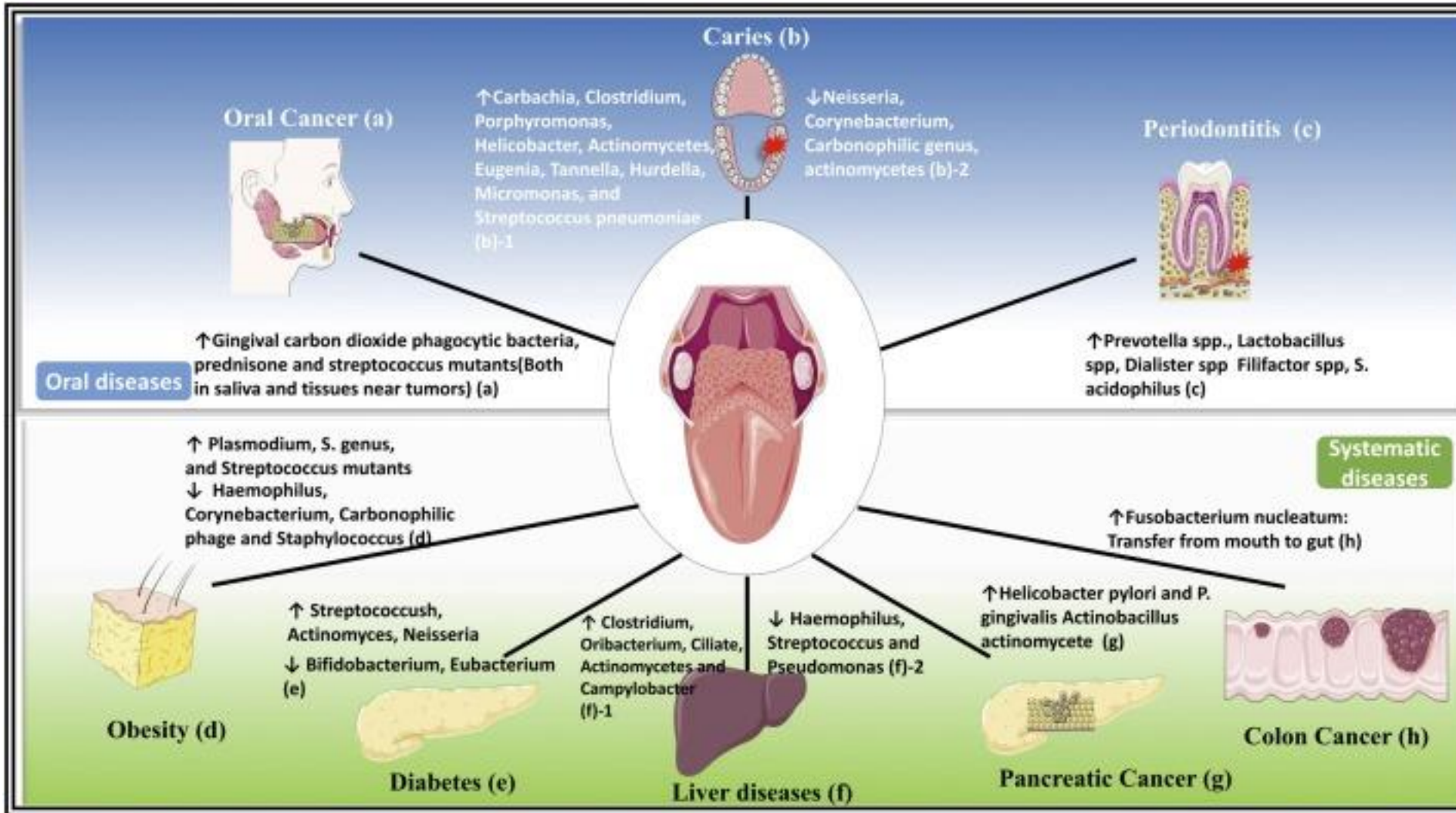
Plaque microorganisms stimulate the secretion of lymphokines by T-lymphocytes, they activate procollagenase, enhance the chemotaxis of granulocytes and monocytes, stimulate osteoclasts, and also increase vascular permeability.



A healthy human tooth



**Microbiology
Notes**







Is caries transmitted?