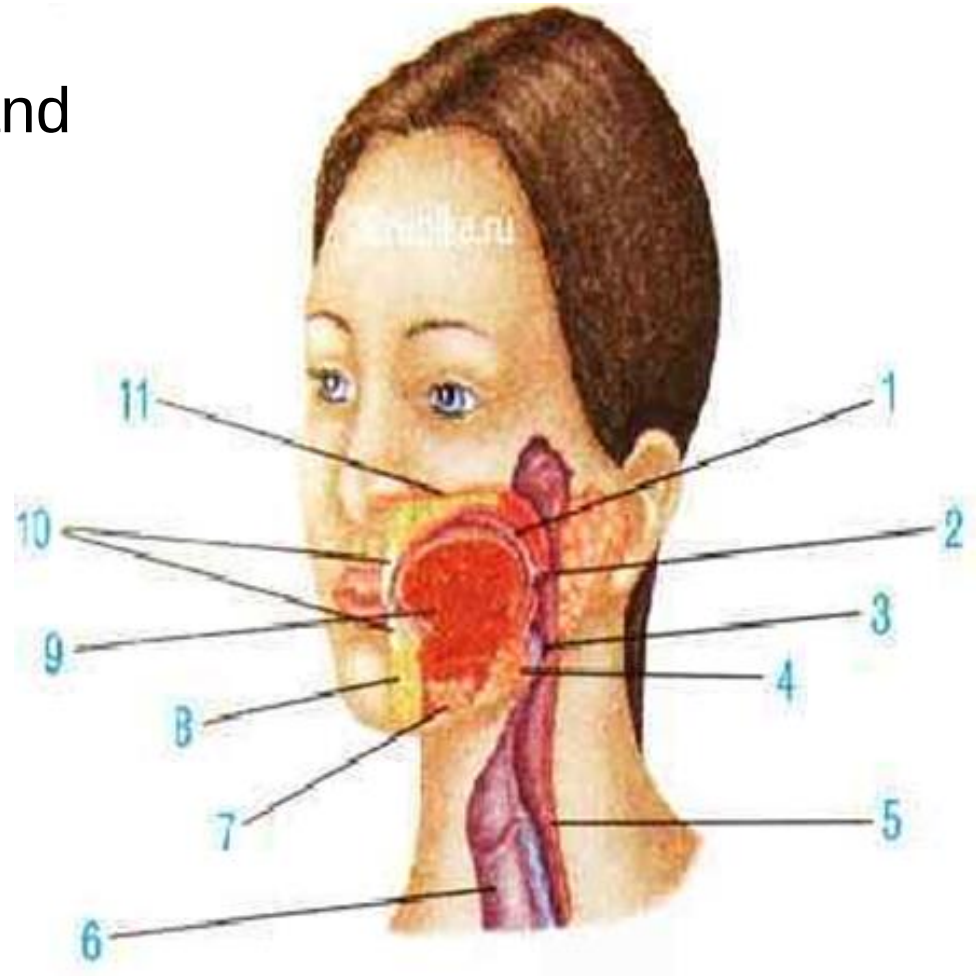
Lesson 26

Oral infections. dental biofilms.
The occurrence of dental plaque

Oral cavity

1.Soft palata
2. Epiglottis
3. Submandibular gland
4.Esophagus
5. Trachea
6. Sublingual gland
7. Jawbone
8. Language
9. Teeth
10. Hard palate



Local immunity of the oral cavity

Protective barrier function

Non-specific protection factors:
Features of the structure of the mucous membranes State of normoflora Lymphocytes macrophages Desquamation of the buccal epithelium

Specific protection factors sIgA

The protective function of oral fluid

Non-specific protection factors: Lysozyme lactoferrin Peroxidase Beta lysozyme Mucin Interferon

Specific protection factors sIgA

Oral microbiota

The oral cavity is a favorable habitat for a large number of microorganisms

the right amount of nutrients., stable optimal temperature,
slightly alkaline reaction, constant humidity are a prerequisite
for adhesion, colonization and reproduction of microbes

The formed community of microbes is a complex and dynamic
microecosystem called dental biofilm (dental plaque, dental plaque).

Oral microbiota

- The microbiota of the oral cavity (biocenosis) is a collection of representatives of various taxonomic groups of microorganisms living in the oral cavity, consisting in biochemical, immunological and other types of interaction with each other and the macroorganism.

In the plaque and gingival sulcus.In their number can reach 200 billion

According to the data, the number of bacteria in the oral fluid is 43 million-5.5 billion per 1 ml.

- In the oral cavity of newborns towards the end of the first week, they find:streptococci, neisseria, lactobacilli, yeast-like fungi, actinomycetes.

- Colonization with Gram-negative obligate anaerobes begins with teething.

- The composition of the microflora of the oral cavity,qualitative and quantitative changes in its depend on age, nutrition, hygiene, resistance of mucous membranes, pathological processes in the teeth and gums.

Normal oral microbiota

AUTOCHTHONIC

RESIDENT
(permanent resident)

TRANSITOR
(temporarily occupied)

ALLOCHTHONOUS

Penetrating into
the oral cavity from
other biotopes

- The oral cavity, its mucous membranes and the lymphoid apparatus in the maxillofacial region play an important role in the interaction of the body with the surrounding microbial world.

- As a result of evolution between macro- and micro-organisms

- complex multi-component and contradictory relationships have developed

- On the one hand, they are involved in the digestion of food in the oral cavity,the synthesis of vitamins, have a positive effect on the body's immune system, and counteract pathogenic microflora.

- On the other hand, they synthesize acids, which have a destructive effect on the hard tissues of the tooth, and are one of the etiological factors of caries. They have the ability to invade, resulting in the development of inflammatory diseases.

AEROBIC FLORA

GRAM(+)

streptococci

S. hominis, S. mitis, S.sanguis, S. mutans

CORYNEBACTERIA

lactobacilli

L.acidophilus, L.fermentum, L.salivarius

GRAM(-)

NEISSERIA

N.sicca, N.perflava, N.subflava

Hemophilic bacteria

H.influenzae, H.parainluenzae, H.haemolyticus

ANAEROBIC FLORA

GRAM(+)

PEPTOCOCCI
P. niger
PEPTOSTREPTOCOCCI
P. prevotii actinomycetes
A. israelii, A. viscosus
bifidobacteria

GRAM(-)

BACTEROIDS
(also Porphyromonas and Prevotella)

FUSOBACTERIA
F.plauti, F.nucleatum
LEPTOTRICH
L. buccalis

OTHER: TREPONEMAS (T. macrodenticum, T. microdenticum), MYCOPLASMS (M. orale, M. pneumoniae), MUSHROOMS r. Candida, PROTOSE (E. gingivalis, T. tenax)

Supragingival plaque

- *Streptococcus*
- *Capnocytophaga*
- *Corynebacterium*
- *Uncl. Pasteurellaceae*
- *Uncl. Neisseriaceae*
- *Fusobacterium*

Subgingival plaque

- *Streptococcus*
- *Fusobacterium*
- *Capnocytophaga*
- *Prevotella*
- *Corynebacterium*
- *Uncl. Pasteurellaceae*

Keratinized gingiva

- ***Streptococcus***
- ***Uncl. Pasteurellaceae***

Hard palate

- ***Streptococcus***
- *Uncl. Pasteurellaceae*
- *Veillonella*
- *Prevotella*
- *Uncl. Lactobacillales*
- *Gemella*

Buccal mucosa

- ***Streptococcus***
- *Uncl. Pasteurellaceae*
- *Gemella*

Throat

- ***Streptococcus***
- *Veillonella*
- *Prevotella*
- *Uncl. Pasteurellaceae*
- *Actinomyces*
- *Fusobacterium*
- *Uncl. Lachnospiraceae*

Tongue dorsum

- ***Streptococcus***
- *Veillonella*
- *Prevotella*
- *Uncl. Pasteurellaceae*
- *Actinomyces*
- *Fusobacterium*
- *Uncl. Lactobacillales*
- *Neisseria*

Palatine tonsils

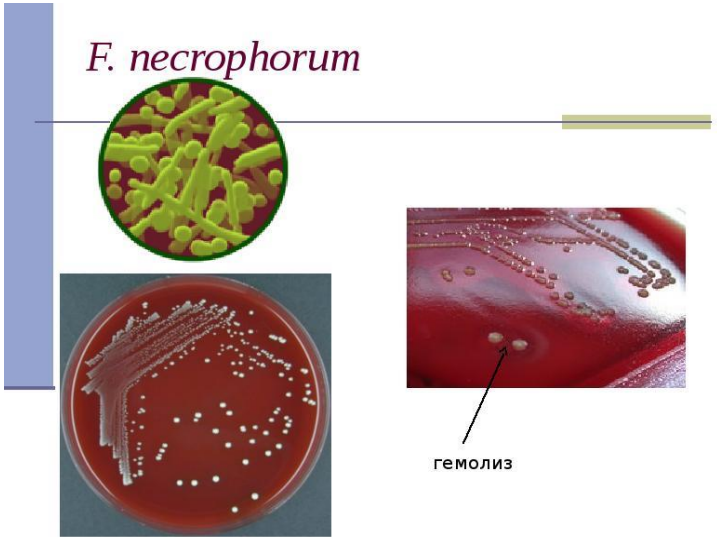
- *Streptococcus*
- *Veillonella*
- *Prevotella*
- *Fusobacterium*
- *Uncl. Pasteurellaceae*

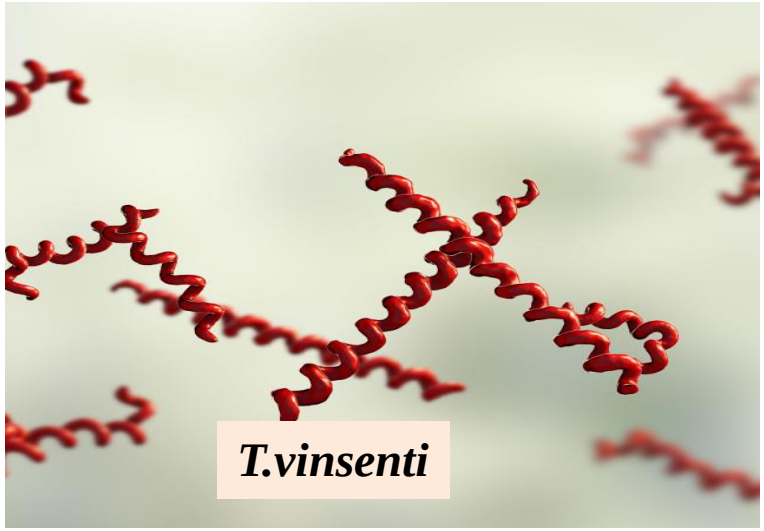
Saliva

- *Prevotella*
- *Streptococcus*
- *Veillonella*
- *Uncl. Pasteurellaceae*
- *Prevotella*
- *Streptococcus*
- *Veillonella*

Oral microbiota

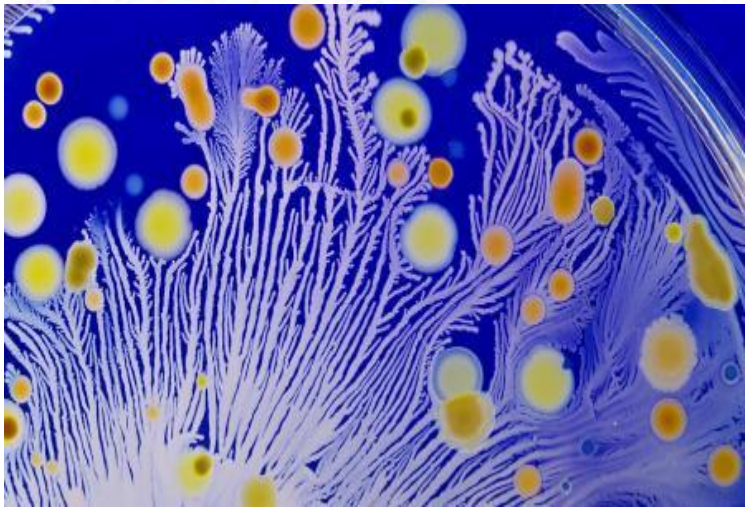
Among the anaerobic microbiota of the oral cavity,bacteria of the genera Veillonella, Bacteroides, Prevotella, Fusobacterium are most common. Spirochetes found in the oral cavity are mainly represented by T.denticola, T.vinsenti, which live in the gum pockets





Oral microbiota

Actinomycetes (A.viscosus, A.israeli, etc.) are permanent inhabitants of the oral mucosa are involved in the formation of dental plaque and tartar



- The resident microbiota of the oral cavity is made up of streptococci -50%, veillonella -25% and other microorganisms -25%

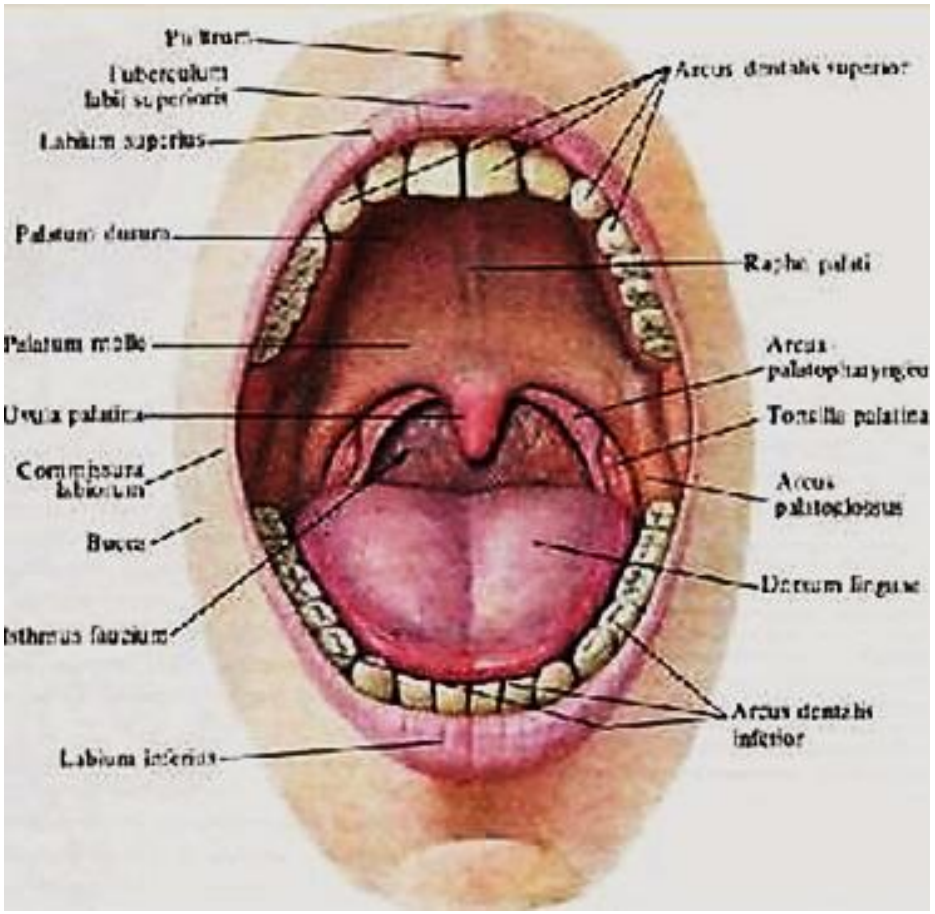
- Bacteroids, lactobacilli, spirochetes, fungi, protozoa, which normally constitute a certain part of the microflora of the oral cavity, are present in tissues in a small amount compared to streptococci, veilonella and diphtheroids.

- There are antagonistic and synergistic relationships between the permanent oral microbiota. Streptococci (S.salivarus, S.sangius, S.mitis), veillonella and diphtheroids are among the stabilizing microflora of the oral cavity, S.mutans, lactobacilli, bacteriodes and actinomycetes are considered as representatives of the microbiota

Microorganisms live in various biotopes
A biotope is an area with homogeneous ecological conditions and certain biocenosis.

Biotopes of the oral cavity:

- oral mucosa
- salivary gland ducts
  the saliva they contain
  gingival groove zone
- plaque.
- oral fluid (saliva)



ORAL MUCOSA

- The most extensive biotope in terms of area and diverse habitat conditions. The mucosal biofilm is strictly structured, so the mucosal microflora varies significantly in different areas.

- Predominantly gram-negative anaerobic and facultative anaerobic flora, as well as microaerophilic streptococci: S. mitis, vegetates on the surface of the mucous membrane. Back of tongue = S. salivarius.

- In the sublingual region, on the inner surface of the cheeks, in the folds and crypts of the oral mucosa, obligate anaerobic species usually predominate: - veillonella, - peptostreptococci, - lactobacilli, - streptococci = S. mitis

- On the mucosa of the hard and soft palate, palatine arches, tonsils, there are a large number of: a variety of streptococci, corynebacteria, neisseria, hemophils and pseudomonads, yeast-like fungi, nocardia.

DUCTS OF THE SALIVARY GLANDS

Due to the high bactericidal activity of enzymes, lysozyme, secretory immunoglobulins and other factors of specific and nonspecific protection, saliva in the ducts of the glands of a healthy person should be practically sterile.

There may be a small amount of bacteria, mainly related to obligate anaerobic species (veillonella, peptostreptococcus

Gingival fluid = transudate, which is secreted in the region of the gingival groove and is almost immediately contaminated by the microflora of the gingival mucosa and oral fluid.

This is the main habitat for representatives of the genera: Bacteroides, Porphyromonas, Prevotella. Also there are protozoa, yeast-like fungi, mycoplasmas.

ORAL FLUID

- The basis of the oral fluid is saliva secreted from the ducts of the salivary glands,

which is populated by a variety of microflora: microbes constantly enter here, multiplying on the oral mucosa, in the gingival groove, pockets, folds and in dental plaque: - they remain viable for a long time, - many species (in particular, those that do not have adhesion factors to the mucosa or enamel) actively multiply (vibrios, selenomonads, spirochetes and spirilla)

- through it, interaction between other parts of the microbiocenosis of the oral cavity is carried out

- Oral fluid is the most important biotope of the oral cavity, because:
  - various regulatory influences are realized by the macroorganism.
- The oral fluid contains a significant amount of: - veillonella, microaerophilic streptococci S. salivarius, - facultative anaerobic streptococci, aerococci (staphylococci, neisseria and other aerobic cocci), - mycoplasmas.

BIOFILM OF TEETH

The most complex and multicomponent biotope that forms on the surface of the tooth. in the composition of dental plaque, almost all representatives of the microbial flora of the oral cavity are determined. but their number varies considerably in different people and at different periods of their lives.
This biotope is the result of the vital activity of various microorganisms of the oral biocenosis. in its formation, the decisive role belongs to the macroorganism and environmental factors that influence it throughout life (diet, lifestyle, occupational hazards, etc.).

According to modern concepts, dental plaque (plaque) is a typical variant of a biofilm - a symbiotic community of microbial species that forms in fluid liquid media. violations of the quantitative and qualitative composition of symbionts of a given biotope, violations of their interaction with the macroorganism lead to the occurrence of dental caries and periodontitis.

Bacteria - intermediate colonizers

obligate aerobes

- **Micrococcus**

obligate anaerobes

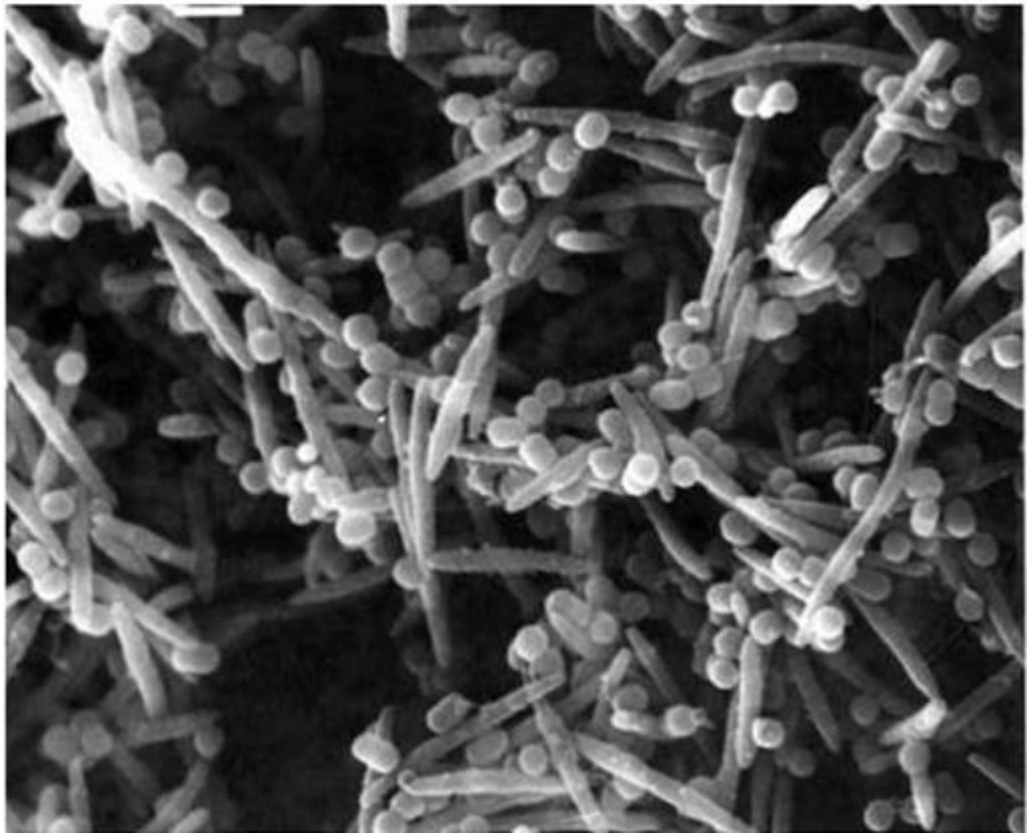
- **Bacteroides**

Optional anaerobes

- **Staphylococcus**
- **Streptococcus**
- **Lactobacillus**

The dominant position is occupied by obligate anaerobic gram-negative rods and convoluted bacteria. In chronic periodontitis, fusobacteria are found in sufficiently large numbers in samples taken from “healthy” and “affected” areas of the gum tissue. It is therefore assumed that F. nucleatum is considered as intermediate between the initial and late colonizers of the tooth surface.

fragment of dental tissue biofilm

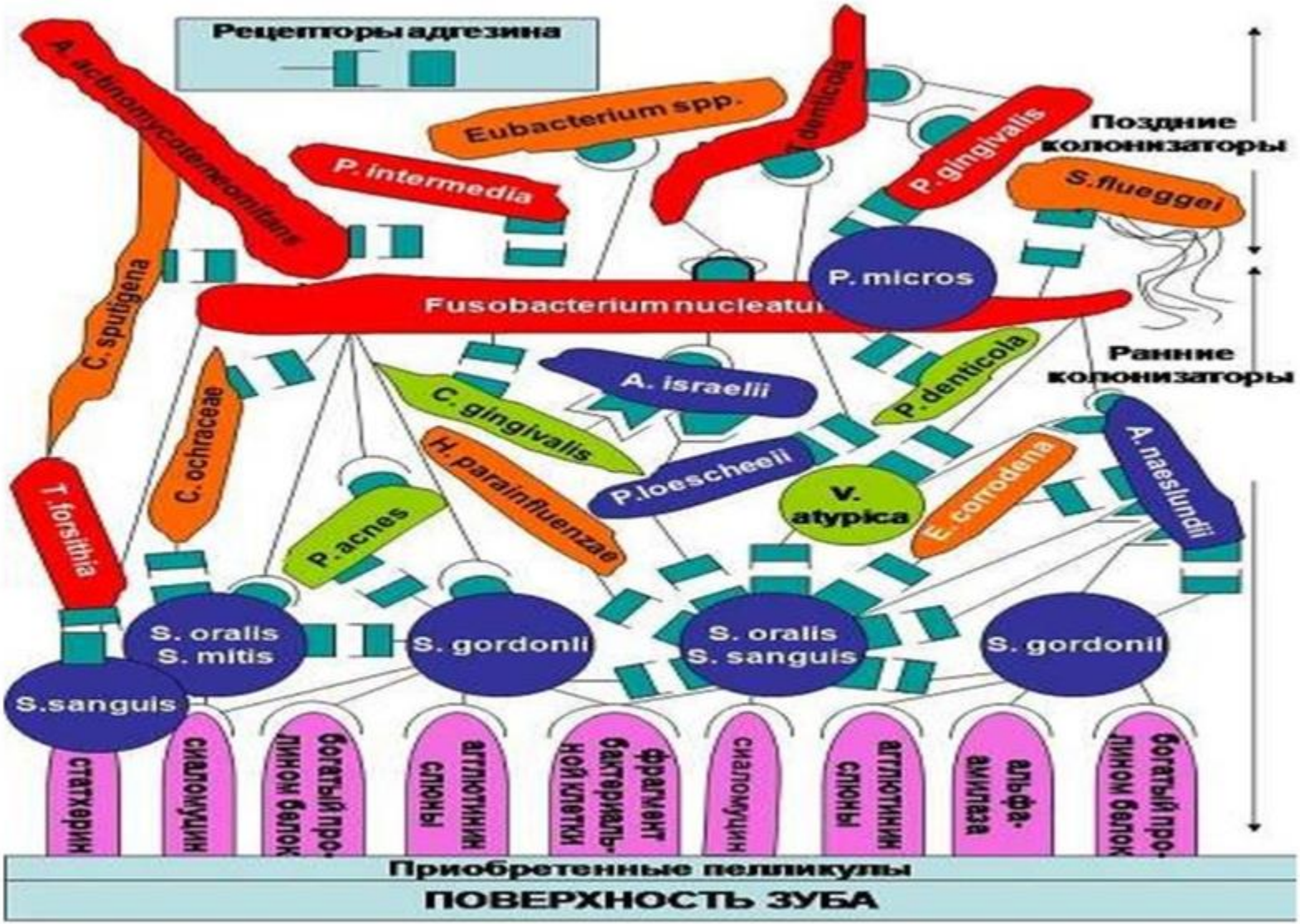


Electron microscopic image of coaggregation of rod-shaped F.nucleatum and ovoid P.gingivalis (x2000)

Dental film under the microscope

In 1 g (ml) of plaque, 100,000-1 billion microorganisms are found.

Biofilm Model



secondary colonizers

- A.Actinomycetemcomitans
- Prevotella gingivalis
- Treponema spp
- Eubacterium spp.
- Veionella atypica

- Forming films ultimately contribute to periodontal damage

- These microorganisms do not form coaggregates

Dental plaque

- Almost 90% of the microflora of the oral cavity is concentrated in dental plaque.
- In the formation of plaque, the individual characteristics of the organism (diet, lifestyle, professional habits) play a significant role.
- Dental plaque is an important etiological and pathogenetic component of inflammatory periodontal diseases and caries.

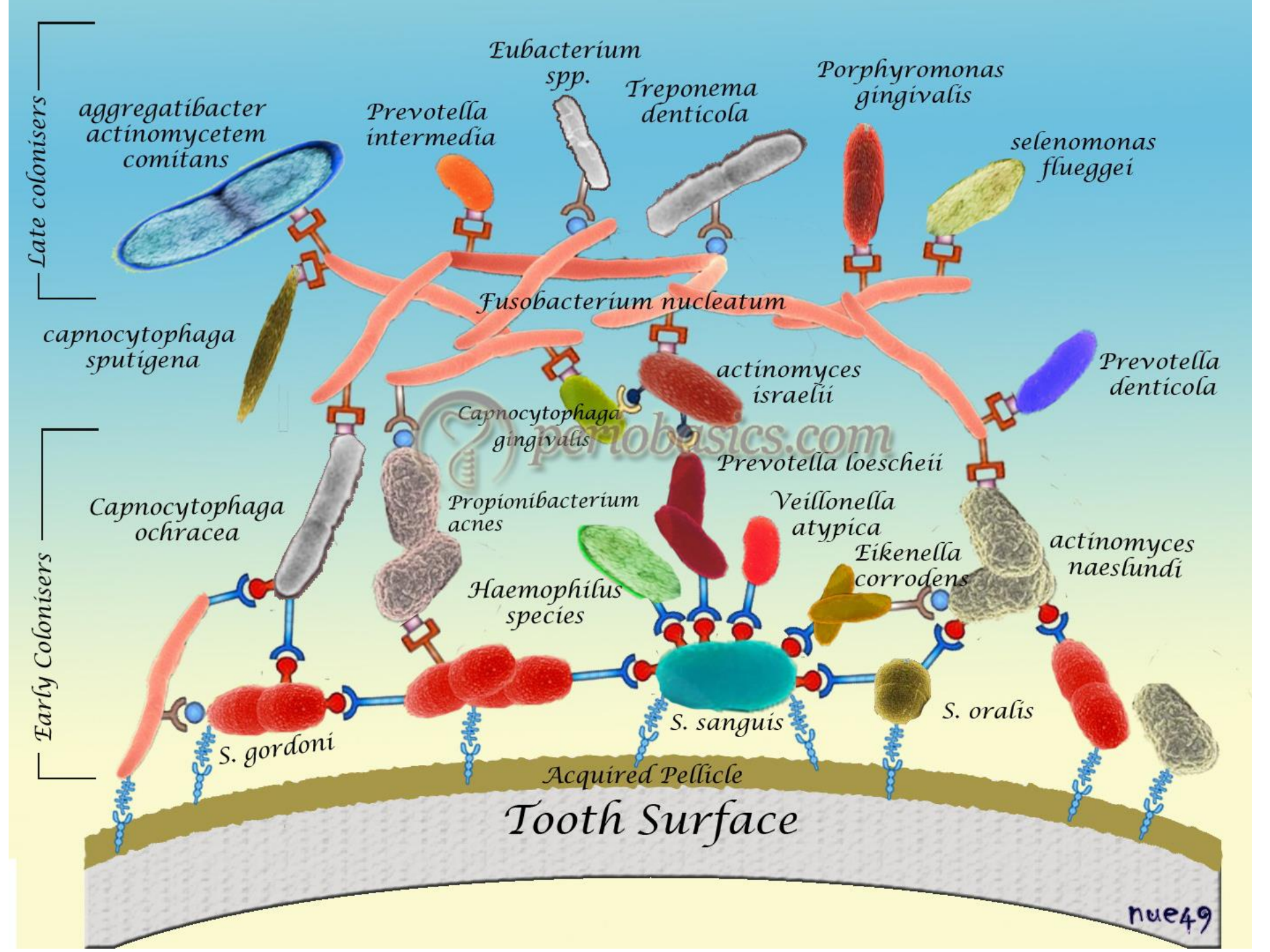
Dental stones

- Formed from dental plaque as a result of precipitation of calcium salts

- If oral hygiene is not observed, an inflammatory reaction of the periodontium develops.

- Quantitative and qualitative disorders in the composition of symbionts of a certain biotope, violation of their interaction with the macroorganism play a decisive role in the occurrence of caries and periodontitis.

Bacteria	Gingival crevice	Coronal plaque	Tongue dorsum	Buccal mucosa	Saliva
Streptococcus salivarius	<0.5	<0.5	20	11	20
Streptococcus mitis	8	15	8	60	20
Streptococcus sanguis	8	15	4	11	8
Streptococcus mutans	?	0-50	<1	<1	<1
Enterococci	0-10	<0.1	<0.01	<0.1	<0.1
Gram positive filaments	35	42	20	?	15
Lactobacilli	<1	<0.005	<0.1	<0.1	<1
Veillonella spp.	10	2	12	1	10
Neisseria spp.	<0.5	<0.5	<0.5	<0.5	<1
Bacteroides oralis	5	5	4	?	?
Bacteroides	6	<1	<1	<1	<1
melanogenicus	5	1	<0.5	<0.5	?
Vibrio sputorum	2	<0.1	<0.1	<0.1	<0.1
Spirochetes	3	4	1	?	<1
Fusobacterium spp.					


Late colonisers
Early Colonisers
aggregatibacter actinomycetem comitans
Prevotella intermedia
Eubacterium spp.
Treponema denticola
Porphyromonas gingivalis
selenomonas flueggei
Fusobacterium nucleatum
capnocytophaga sputigena
actinomyces israelii
Prevotella denticola
Capnocytophaga gingivalis
Prevotella loescheii
Capnocytophaga ochracea
Propionibacterium acnes
Veillonella atypica
Eikenella corrodens
actinomyces naeslundi
Haemophilus species
S. gordoni
S. sanguis
S. oralis
Acquired Pellicle
Tooth Surface
periobasics.com
nue49

Oral infections

Dental disease: caries
pulpitis
periodontitis

Periodontal disease: gingivitis
periodontitis
periodontal disease
periodontoma

Mucosal lesions: stomatitis of various etiologies

Oral infections

Cheilitis - inflammation of the red border, mucous membrane and skin of the lips.

Stomatitis is a disease in which the mucous membrane of the oral cavity becomes inflamed.Stomatitis is accompanied by the appearance of painful sores and wounds in the mouth.

Glossitis is an inflammatory process that affects the tongue.

Gingivitis - inflammation of the gums

Palatinitis (inflammation of the palate) is an inflammation of the mucous membrane covering the palate.

Zayeda - cracks in the corners of the mouth that occur when the mucous membranes of the oral cavity and lips are affected and pass to the skin