ADHERENCE IN ORAL BACTERIA

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Presentation Order

- **Adhesion**
  - **Descriptions**
- **Adhesion mechanisms**
- **Adhesion in oral pathogens**
- **Specific**
  - **Nonspecific**
  - **Directly**
  - **Indirectly**

Question: Why HIV does not contaminate with respiration?

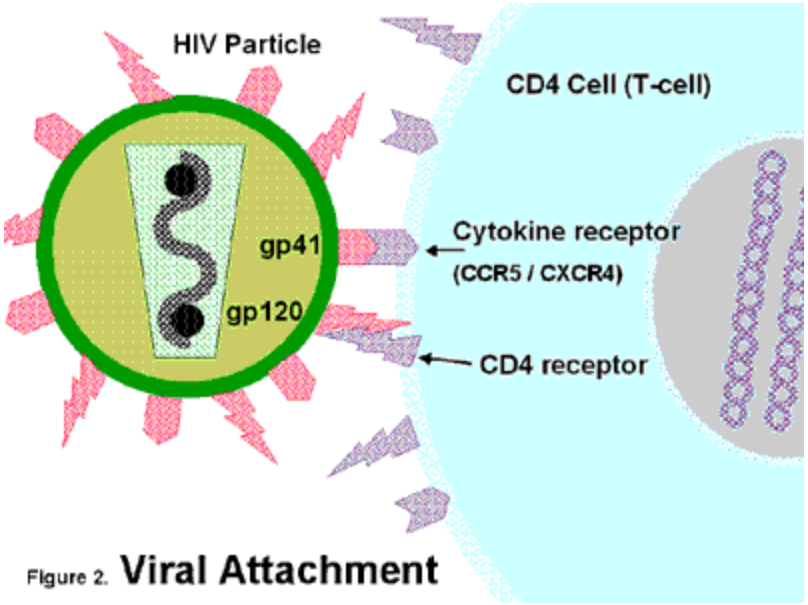
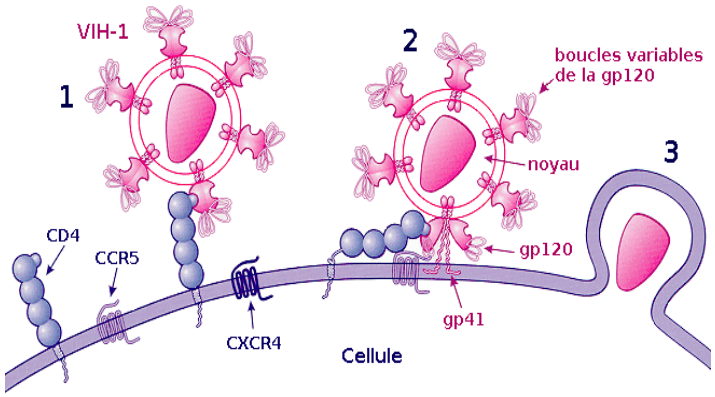
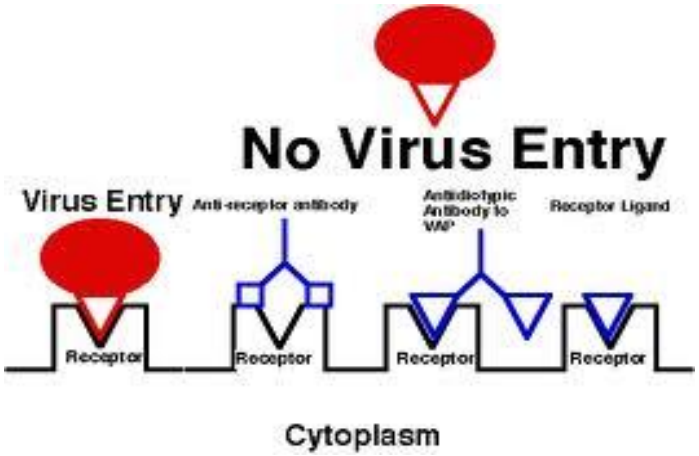
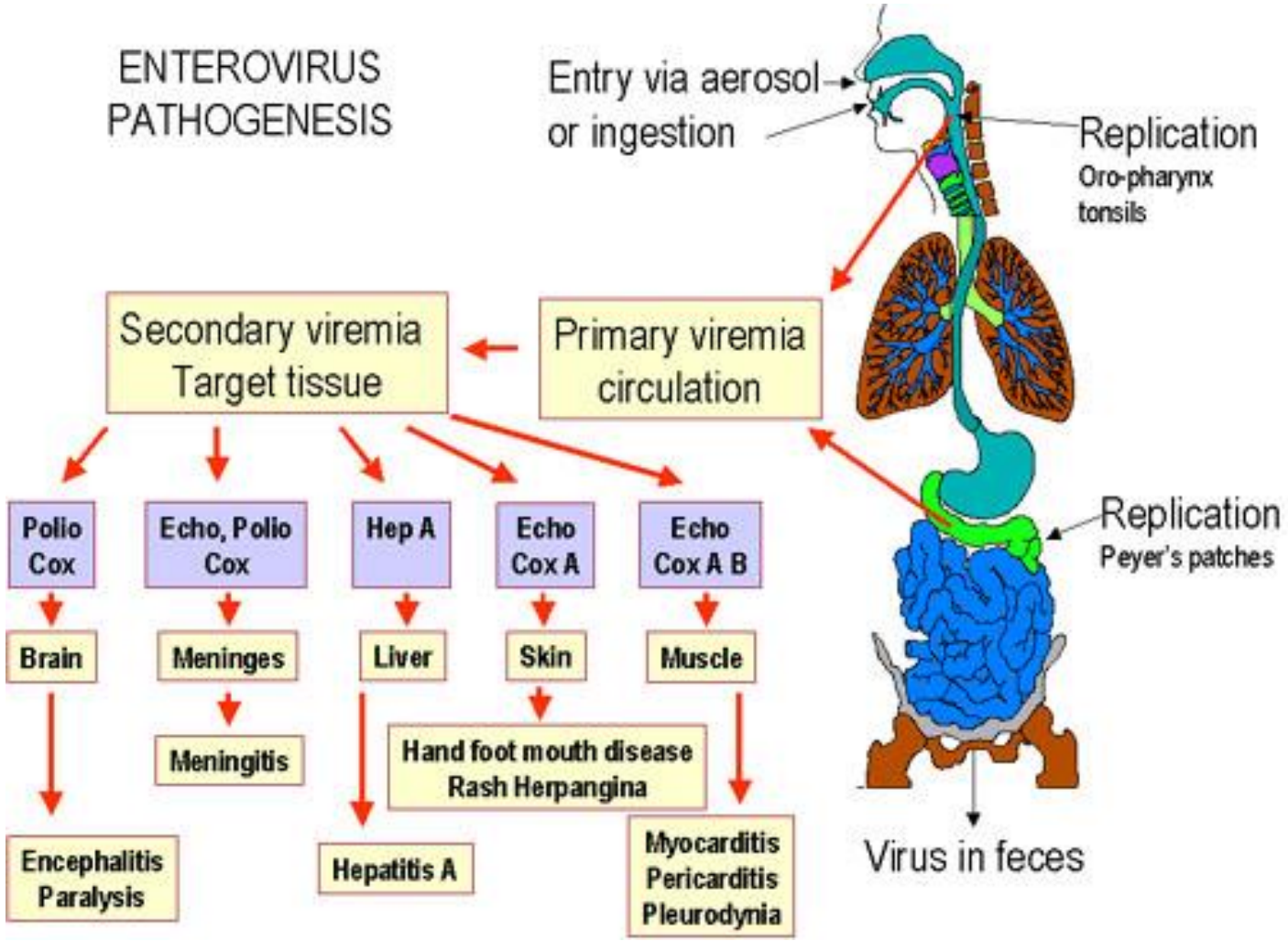


Figure 2. **Viral Attachment**





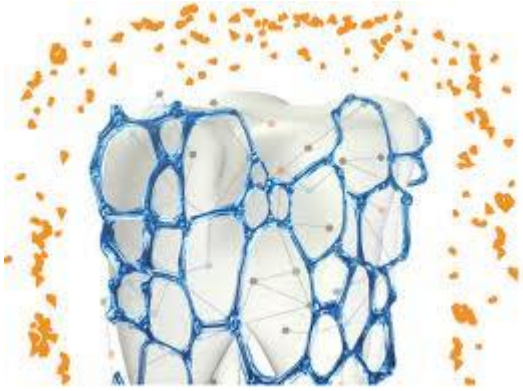

ENTEROVIRUS
PATHOGENESIS
Entry via aerosol
or ingestion
Replication
Oro-pharynx
tonsils
Secondary viremia
Target tissue
Primary viremia
circulation
Polio
Cox
Echo, Polio
Cox
Hep A
Echo
Cox A
Echo
Cox A B
Brain
Meninges
Liver
Skin
Muscle
Meningitis
Hand foot mouth disease
Rash Herpangina
Encephalitis
Paralysis
Hepatitis A
Myocarditis
Pericarditis
Pleurodynia
Replication
Peyer's patches
Virus in feces

Adhesion

Descriptions

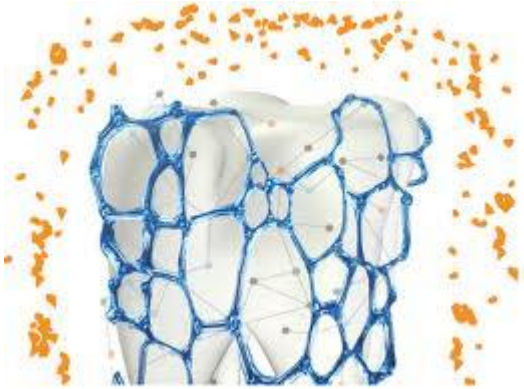
- **Adhesion**
  - Attachment of an m.o to a host

  Adherence
  - Adhesion ability



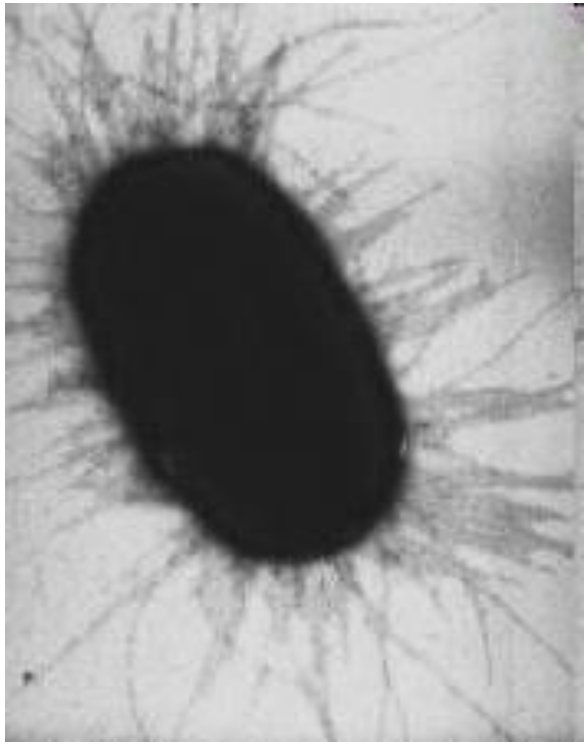
Adhesive Surfaces in Mouth

- **<u>Surfaces that can bacteria attach in mouth;</u>**
  - Keratinized epithelial
  - Non keratinized olmamış epithelial
  - Hydroxyl apatite surfaces(tooth hard tissues, root canal and ceramic restorations)
  - Metal and acrylic surfaces of prothesis



Attachment Organelles of Bacteria

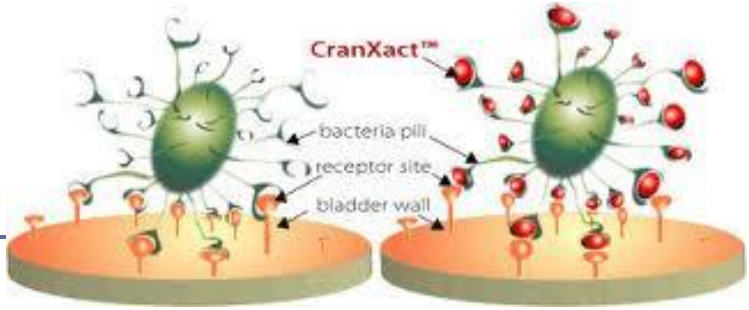
- Fimbria (Pili)
  - Tip 1
  - Tip 2
- Capsule
- Flagella



Attachment Organelles of Bacteria

- Bacteria;
  - Attachment to host tissue fimbriaa (pili) and capsül
- Many oral pathogen attach to mouth tissue
- Fimbria
- **Tip-1 fimbria**
  - Inactive with mannose
  - Many oral pathogen generakky have Tip-1 fimbria
    - Ex: *Actinomyces* and *Porphyromonas gingivalis*
- **Tip-2 fimbria**
  - Not inactivate with mannose

Fimbria



- Proteus, *Escherichia* and *Neisseria gonorrhoeae*
  - Fimbrias urinary system multi layer epithelia
- Enteric rods
  - Intestine villus and colon mucosa
- A group streptococci and C*orynebacterium*
  - Attach to tonsiller mocıosa with host receptors that are suitable for their fimbria

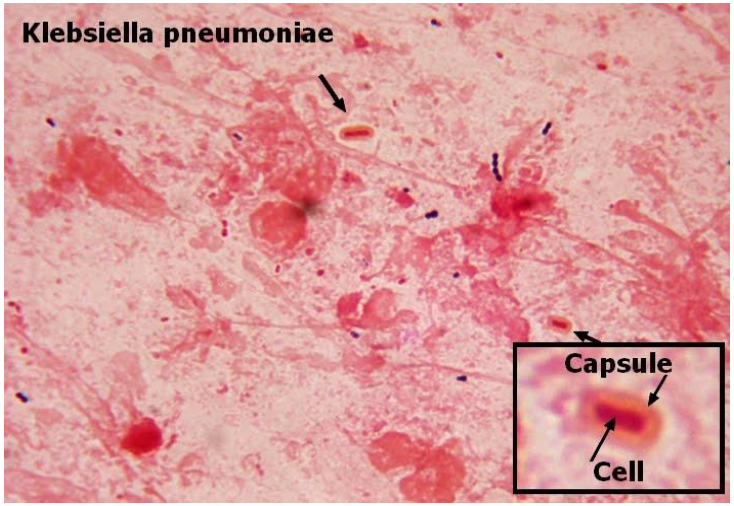
Fimbria

- Fimbria can connect to suitable receptors;
- Can attach to non receptor regions
  - Ex: *Actinomyces* : to enamel and prothsesis surfaces
  - C ve D group streptococci attach to tooth hard tissue

  With thier fimbria

Capsule

- S. pneumoniae, *K. pneumoniae, H. influenzae, N. meningitidis L. pneumophila*
  - Wide capsule
  - Respiratory tract single laeyr cilia epithelial tropism
  - Capsule mediated adhesion do not need specific receptor
  - pH, temperature, ion balance is essential/adequate



Flagella

- İf a bacteria has a flagellum,
- Enhance invasion and spread within tissue

Ex. Although *Vibrio cholerae* has a hard clinic (cholera)

Immobile (no flagellum)) mutants can not attach to intestinal epithelium and avirülant

- Flagellum protein,
  - Enhance adhesion to host tissue
  - EX. Mobile spirochetes
    - Bacteria that reach to apikal region from damaged periodontal membrane and starts retrograd pulpitis

Adherence

- Bakterial adherence is very well selective;
  - Ex: *Streptococcus salivarius* can not attach to tooth hard tissues
  - *Streptococcus mutans* can attach to tooth hard tissues but can not attach to tonque surface
- *Veillonella parvum*
  - Generously between tonque papillas

Leptothrischia

- isolated from Cheek mucosas

Streptococcus miteor, vibrio, fusobacteria and spirokechetes attach to spesific regions of mouth

İmportant. Anh bacteria do not found in any flora accidentally!!!

Adhesion

- Host selectivity,
- Not only bacterial virulance
- Determine disease on which tissue
- EX: *Brucella, Salmonella, P. aeruginosa, Proteus* and other enteric do not attach to mouth tissues
- *Porphyromonas gingivalis;*
  - Gingiva epithelia attaches to keratin bind receptors
  - This property makes bacteria important oral pathogens
- *S. marcescens, E. coli* ve *S. albus;*
  - Even inoculate into mouth, can npt attach and move away quickly (studies)

Oral Pathogens and Adhesion

“Attachment Types”

1. Specific Attachment

- **Direct**
- **Indirect**
  - **Adhesin**
  - **Kriptitop**
  - **Glucan**
  - **Koaggregation bridges**

2. Non Specific

Specific Attachment

Attachment of oral pathogens to mouth tissues

- Mouth mocosa on epithelial cell surfaces;
  - **Glycoprotein** and **glycolipid** receptors
  - This receptors immune comminication/ attacjment of host own cells
  - Complements on bacteria surfaces are made for attachment of these receptors

- Bakteria use these surfaces molecules
- Attach **easily, strongly, quickly, specificly, persistently** to epithelium
- *Ex. Attachment of Leptotrichia buccalis* to cheek mucosa
- Attachment of M protein of A group Streptocci to pharynx and tonsils mucosas

Non Specific Attachment

"İf bacteria do not have a specific receptor on tooth or mouth mocosa surfaces, 2 phases recognised in adhesion"

- First phase (adsorption phase):
  - Between bakteria and host surface , week electric charges, van der Waals ,and first contact with surface tension force
  - Hydrogen ion concentration (pH), temperature enhance this relation
  - Ex. *Streptococcus miteor* attach to tooth in acidic environment (pH<6)
- Second phase (adehesion phase):
  - Extracellular polymeric material synthesis by bacteria

  "**Mucinous Glycoproteins**"
  - This phase is adehesion phase
  - Similar to adherence of two substances with glue

Specific – Direct attachment

- Do not require any material between bacteria and host tissue
- Bacteria-host contact with **pili**
- Ex. Between Actinomyces's Tip-1 fimbria and tooth enamel tissues
  - This attachment is both selective and insistent

Specific - Indirect Attachment

- Agent is required for attachment to host tissu
- Incompability between host receptor and bacteria surface molecules
- Lack of complementary

- Adhesion only occured;
  - İf there is a bacteria or chemical material between them that act as an adaptor

These adaptors can be:

- **Adhesion**
- **Kriptitop**
- **Glucan**
- **Coaggregation bridges**

Adhesion

- **Neutral hexoses** like levan, dextran, glucose, mannose or
- Methyl pentoses like fucose, rhamnose or
- **Resin like structures**
  - Extracellular materials that make attachment of bacteria to host tissues
  - These are generally called **adhesions**

- Oral pathogens produce adhesions that can attach to enamel and dentin tissues
- Some oral bacteria *(A. viscosus, A. naeslundii, Leptotrichia buccalis, F. nucleatum, Eikenella corrodens, Prevotella intermedia)*
  - GBA (Galactosyl-Binding-Adhesin) on their surfaces
  - Weak attachment to erythrocytes, epithelia and saliva musins with this receptors

Kriptitop

- There are many proteins and only 2 phosphoprotein in saliva
- These are **PRP** (acidic-Proline-Riched-Protein) and **statherin**
- These two proteins is 30-40% of all proteins
- All Phosphoproteins are (PRP and statherin) **histatin**
  - Strongly attach to outer surfaces

- 3 functions on histatin layer:
- 1) Forming non immune defence mechanism by producing biofilm
- 2) Block lipid A thgat is found antimicrobial and Gram negative bakteria outer surfaces

3) Decrease signal levels of mast cells and other immune cells

Kriptitop

- Target of bacteria (histatin biofilm)
- Protease and neurodimidases produced by oral pathogens break down histatin
- Histatin forming aminoacids seperate from each other and attach to host tissues producing tips
  - These tips are called **kriptitop** (kriptic, secret)
- **Kriptitops** are hook like structures that attach to oral pathogens surfaces

Kriptitop

- Histatins (Mouth defense components) ;
- Transform to centers where bacterial colonisation is possible with bacterial enzymatic bakterilerin enzimatik activity

- *A, israelii, A. odontolyticus* and *A. viscosus* only attach to tooth with their Tip-1 fimbrias, after appearing of **kriptitops,** they also attach with Tip-2 fimbrias

- Breaking down of periodontal tissue and tooth hard tissue's organic matrix collagen;
- Non specific kriptops appear
- *Streptococcus rattus* and *Streptococcus cricetus* capable to attach collagen kriptitops

Glucan

- **Glukan** is a special adhesion molecule
- Synthesised from **sucrose** by bactreia and released to environment
- Differences from other adhesions:
  - Streptococcus with GBP (glukan-binding-protein) on their surfaces provide adhesion
  - *S. mutans* both synthesise **glucan** and have **GBP** on their surfaces
- These synthesised glucan attached to tooth tissues, bacteria attach to thier own syntheisıed glucan with GBP

Coaggregation Bridges

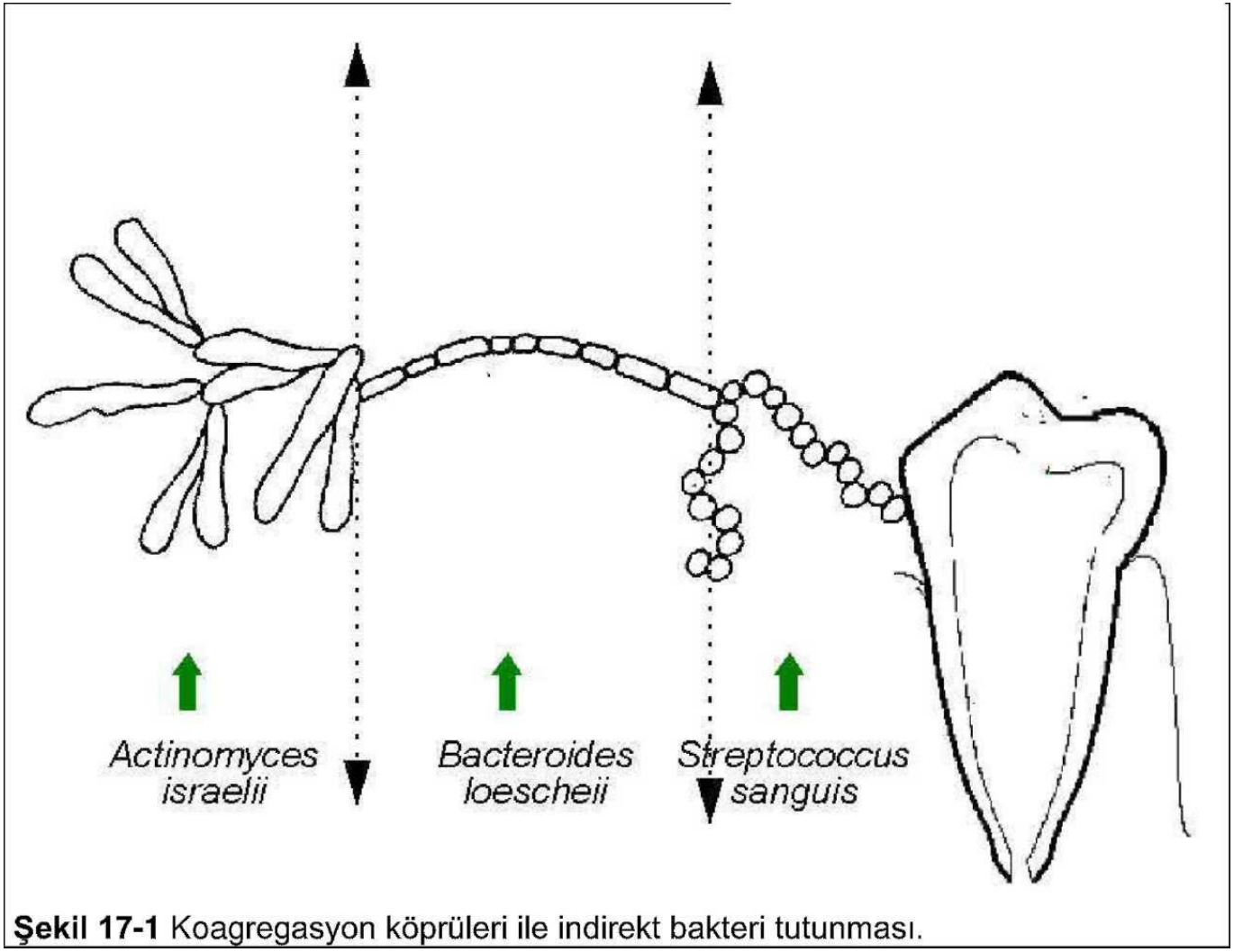
- Sometimes bacteria
  - Can attact to tongue, cheek and mouth mucose and tooth hard tissues with another bacteria

  Ex. *S. mutans* attach to tooth hard tissue with glucan and adhere to *Porphyromonas gingivalis*
- In this case pathogen bacteria,
  - First Bakterum on the chain
- Agent bacteria
  - symbiyont

Koaggregation Bridges

- Sometimes compose of 3 Bazen bu zincir 3 circles
- Ex. *Streptococcus sanguis attach to tooth surfaces and connect A. İsraeli by taking Bacteroides loeschei between them*
- Probably bacterial surface electric charges play a role in bacteria-bacteria attachment
- These chains help plaque formation
- Most pathogen is the one on tip of chain

Koaggregation Bridges



Şekil 17-1 Koagregasyon köprüleri ile indirekt bakteri tutunması.