

The Streptococci

- Diverse collection of cocci.
- Gram-positive
- Chains or pairs
- significant pathogens

- Strong fermenters
- Facultative anaerobes
- Non-motile
- Catalase Negative

Classification 1

Table 16.1 <i>Streptococcus</i> species of clinical importance			
Phylogenetic group	Species	Lancefield group	Type of haemolysis ^a
Pyogenic group	<i>Str. pyogenes</i>	A	β
	<i>Str. agalactiae</i>	B	β
	<i>Str. equisimilis</i>	C	β
Mitis group	<i>Str. pneumoniae</i>	O	α
	<i>Str. mitis</i>	O	α
	<i>Str. oralis</i>	Not identified	α
	<i>Str. sanguis</i>	H	α
	<i>Str. gordonii</i>	H	α
Anginosus group	<i>Str. anginosus</i>	G, F (and A)	α
	<i>Str. intermedius</i>		α
Salivarius group	<i>Str. salivarius</i>	K	None
Bovis group	<i>Str. bovis</i>	D	α or none
Mutans group	<i>Str. mutans</i>	Not designated	None
	<i>Str. sobrinus</i>	Not designated	None

^aOn horse blood agar.

Genus: *Streptococcus* and
Enterococcus

Classification 2

- The pyogenic group
- The mitis group
- The anginosus group
- The salivarius group
- The bovis group
- The mutans group

Haemolytic activity

- β -haemolysis

<http://medicine.ucsd.edu/NizetLab/streptococpage/Hemolysis.jpg>

- α -haemolysis

<http://www.kcom.edu/faculty/chamberlain/Website/lab/idlab/hemo.jpg>

- Another useful site:

<http://www.aic.cuhk.edu.hk/web8/Strep.htm>

Lancefield Grouping

- Serological classification
 - Means of distinguishing PYOGENIC Streps
- Differences in cell wall polysaccharides

Streptococcus pyogenes

- Lancefield Group A
- Most prevalent
- Exclusively human pathogens
- Infection Types
 - Suppurative
 - Toxin related
 - Non-suppurative

***Str. pyogenes* - suppurative**

- **non-invasive**
 - pharyngitis skin infection, impetigo
- **invasive bacteremia**
 - toxic shock-like syndrome
 - "flesh eating" bacteria
- **pyrogenic toxin**

Suppurative (continued 1)

- **Pyrogenic toxin**
 - **superantigen**
 - **T cell mitogen**
 - **activates immune system**

Suppurative (continued 2)

- **Scarlet fever**
 - **rash**
 - **erythrogenic toxin**

Non-suppurative

- rheumatic fever
 - inflammatory disease
 - life threatening
 - chronic sequelae
 - fever
 - heart
 - joints
- rheumatic NOT rheumatoid arthritis

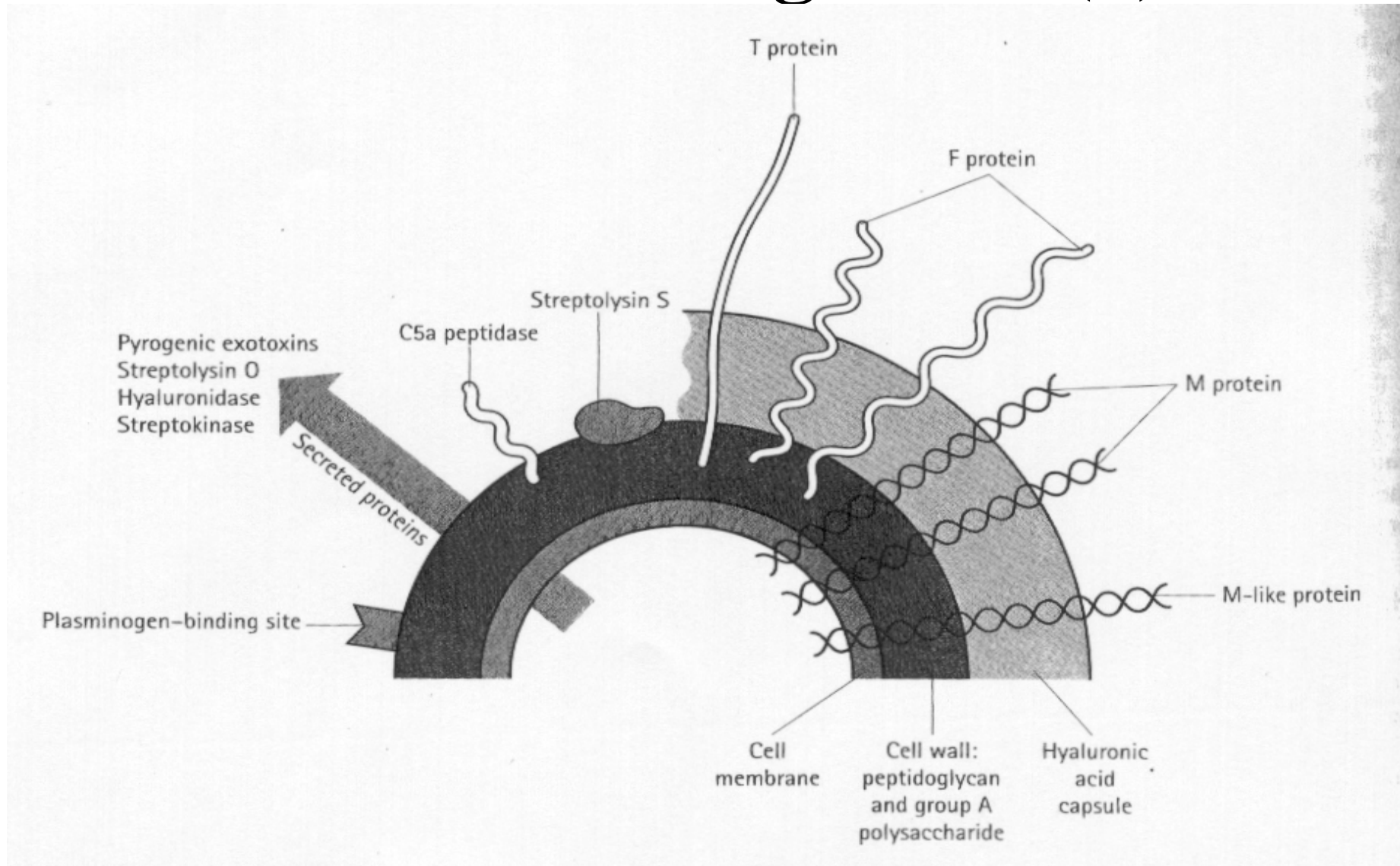
Non-suppurative 2

- Rheumatic fever
- (penicillin: terminates pharyngitis & decreases carditis)
- Acute glomerulonephritis (immune complex disease of kidney)
- Rheumatic fever –etiology
- M protein (cross-reacts heart myosin; autoimmunity)
- cell wall antigens (poorly digested in vivo persist indefinitely)

Str. pyogenes: Pathogenesis (1)

- Lancefield Group A
- Human pathogen
- Suppurative infections
 - Respiratory tract
 - Soft tissue infections
(<http://www.4um.com/tutorial/icm/softiss.htm>)
 - Toxin associated infections
- **Spectrum of infection resembles that of Staph. aureus BUT virulence characteristics DIFFER**

Location of virulence associated factors Pathogenesis (2)

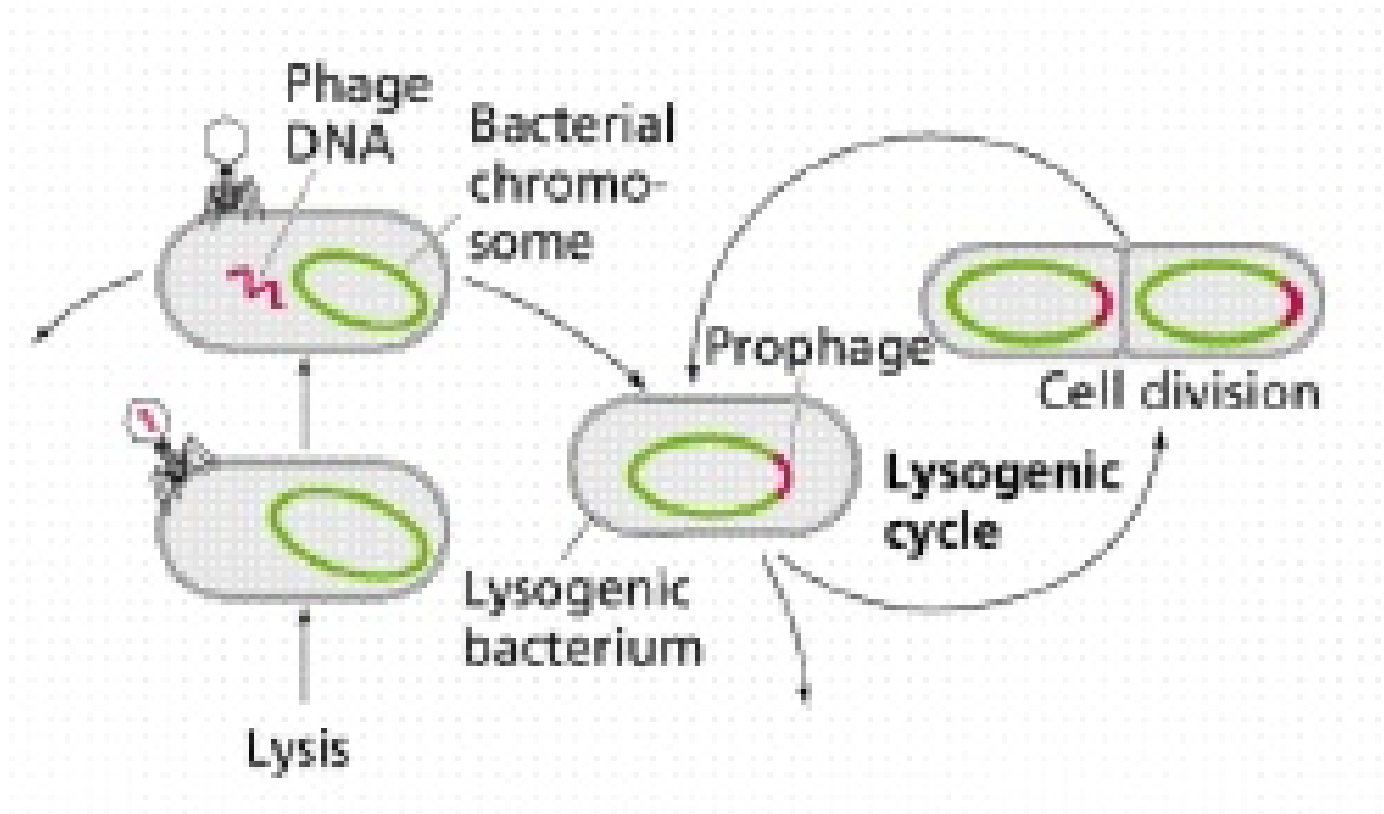


Genus: Streptococcus and
Enterococcus

Virulence factors: Pathogenesis (3)

- Any attributes that are conducive to the process of infection
 - adherence,
 - evasion of the host immune system and
 - tissue damage
- Variability
 - Genetic info transfer via “transduction”

Transduction



www.panspermia.org/transduction.jpg

Virulence factors: adhesion

- Principal mechanism
 - F protein===fibronectin
 - Adherence
 - Entry of the organism INTO the cell
 - Lipoteichoic acid
 - M protein

Virulence factors: M protein

- Resistance to phagocytosis
- Fibril
 - Cytoplasmic membrane
 - Cell wall
- Polymorphism in gene encoding → variability
 - >80 forms
- Strains may have :
 - More than 1 type on their surface and
 - M-like
- Bind to host serum proteins

Virulence factors: Capsule

- Hyaluronic acid capsule
 - Some strains
- Severe infections
- Muroid colonies on blood agar
- Anti-phagocytic effect
 - Variable significance

Streptococcus agalactiae

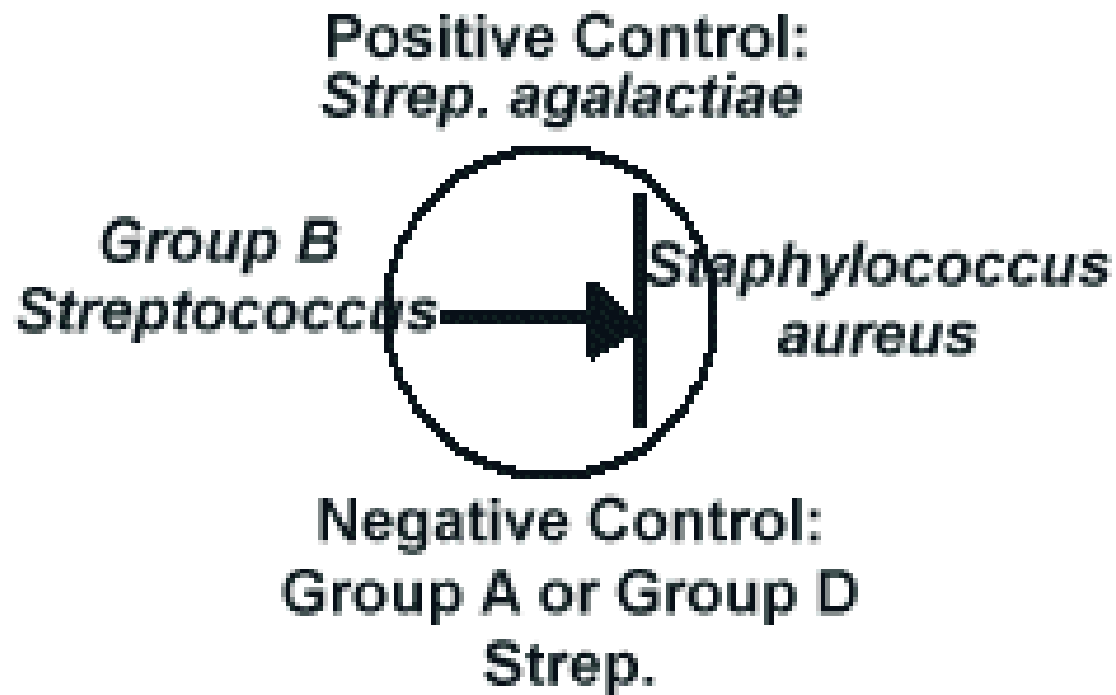
- Lancefield Group B
- Primary habitat is the human colon; other areas include
 - throat
 - vagina (10-40 %)
- Bovine mastitis

Str. agalactiae: Pathogenesis

- virulence factors
 - haemolysins,
 - capsule polysaccharide; (9 different types)
 - C5a peptidase (only the human pathogenic strains),
 - hyaluronidase (not all strains) ,
 - various surface proteins

Str. agalactiae: Pathogenesis 2

- CAMP
 - Means of lab recognition of *Str. Agalactiae*



<http://gold.aecom.yu.edu/id/micro/camp.htm>

Str. agalactiae: Features

- Infections in Neonates
 - Early onset (at or $T < 12$ h of birth)
 - Late onset ($T > 7$ days but $T < 3$ months)
- Newborn babies become infected in three ways:
 - before birth
 - during birth
 - after birth

Early onset disease

- Risk factors for early onset disease include:
- Premature delivery;
- Multiple births;
- Premature rupture of membranes before the onset of labour;
- Prolonged rupture of membranes lasting more than 18 hours before delivery;
- Urinary tract infection in mother caused by Group B Strep;
- Lack of antibody in mother against type of Group B Strep carried in birth canal;
- Fever in mother during labour;
- History of previous newborn with Group B Strep disease.

Late onset disease

- Bacteraemia alone or in conjunction with other conditions
 - purulent meningitis
 - pneumonia,
 - septic arthritis,
 - osteomyelitis
 - conjunctivitis
 - sinusitis
 - otitis media
 - endocarditis
 - peritonitis

Infection in the adult

- Pregnancy / recent post partum
 - Ascending spread
 - Abortion, chorioamnionitis, post partum sepsis,
 - other infections
 - e.g. pneumonia in the post partum period
- Non pregnant adults
 - sepsis, pneumonia, soft tissue infections, and UTI
 - complicated by bacteraemia.
- Elderly

Str. suis (Group R streptococcus)

- septicaemia and meningitis in pigs.
- occasionally infect people
 - Through contaminated pork or infected pigs, and
 - cause septicaemia, meningitis, and respiratory tract infections.

Streptococcus pneumoniae

- *pneumococcus*
 - oropharyngeal flora of 5-70% of the population
 - highest isolation rate in children during the winter months.
- diplococcus
- an important pathogen
 - polysaccharide capsule
- genetically very flexible

Streptococcus pneumoniae: *Pathogenesis 1*

- Capsule

<http://www.indstate.edu/thcme/micro/s-pneum2.html>

- Antiphagocytic

<http://www.medschool.lsumc.edu/Micr/COURSES/DMIP/opson.htm>

<http://medtech.cls.msu.edu/ISL/immunology/opsonize.htm>

Streptococcus pneumoniae: *Pathogenesis 2*

- IgA1 protease
- Pneumolysin
 - Neutrophil chemotaxis
 - Phagocytosis and the respiratory burst
<http://www.cellsalive.com/nbt.htm>
- Autolysin

Clinical features: pneumonia

- Predisposing conditions
- Person-to-person spread is uncommon.
- Possible causes include:
 - Aspiration into the lower respiratory tract
 - Terminal events
 - Immune deficiencies

The Commensal Streptococci: Viridians Streptococci

- Viridans group dominant resident oral flora
 - Mitis
 - Salivarius
- Inhibit colonization of many pathogens
 - Bacteriocins
 - H₂O₂

Viridans streptococci

- ill defined group of species
- α - haemolysis on blood agar,
- may have a variety or no Lancefield antigens.
- The most common are *Str. sanguis*, *mitis*, *mutans* and *salivarius*.
- Most are commensals of the mouth and upper respiratory tract.

Bacteriocins

- <http://www.biochem.ucl.ac.uk/bsm/PLASMID/Bacteriocins.htm>
- Agents
- Encoded in the genetic material carried by plasmids
- Their purpose is to kill or inhibit closely related species or even different strains of the same species
- Specific
- Survival in an overpopulated environment

Mitis group

- *Str. mitis*, *Str. oralis*, *Str. sanguis* and *Str. gordonii*
- Colonize tooth surfaces & mucosal membranes
- May enter the bloodstream
- In healthy individuals,
 - ➔ cleared from circulation within 1 h
- Not so with other predisposing factors present
 - ➔ post-streptococcal rheumatic fever
- were the primary cause of infective endocarditis

Mutans group

- *Str. mutans* and *Str. sobrinus*
 - Exclusively colonize tooth enamel
 - Only after eruption
- Lactic acid producers
- may cause subacute bacterial endocarditis.

Anginosus Group

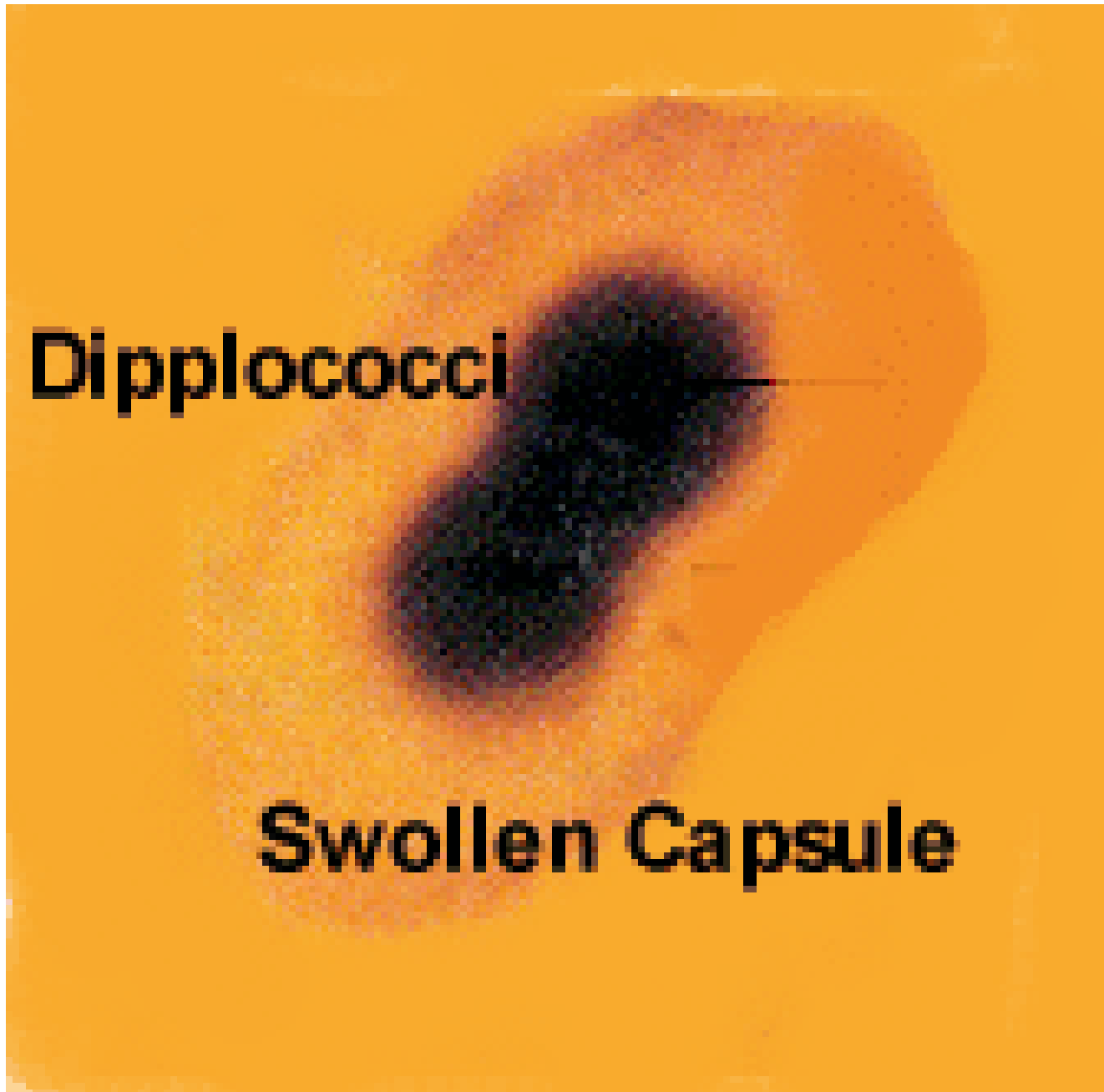
- *Str. anginosus* , *Str. intermedius* & others
- regular commensals
 - tooth surfaces
 - gingival crevices.
- isolated from abscesses and other purulent opportunistic infections

Bovis Group

- Str. Bovis
- Various animal species
- Human gut
- Occasionally causes
 - Bacteraemia
 - Subacute endocarditis
- Associated with colon carcinoma

Enterococcus

- natural habitat in the human intestines
 - **E. faecalis**
 - **E. faecium**
- Associated diseases
 - Urinary tract infection (in hospitals, sporadic outbreaks)
 - Infective endocarditis
 - Biliary tract infections
 - Suppurative abdominal lesions
 - Peritonitis
- Poor prognosis



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