Microbiology Lecture 5
2020-2021
3rd year

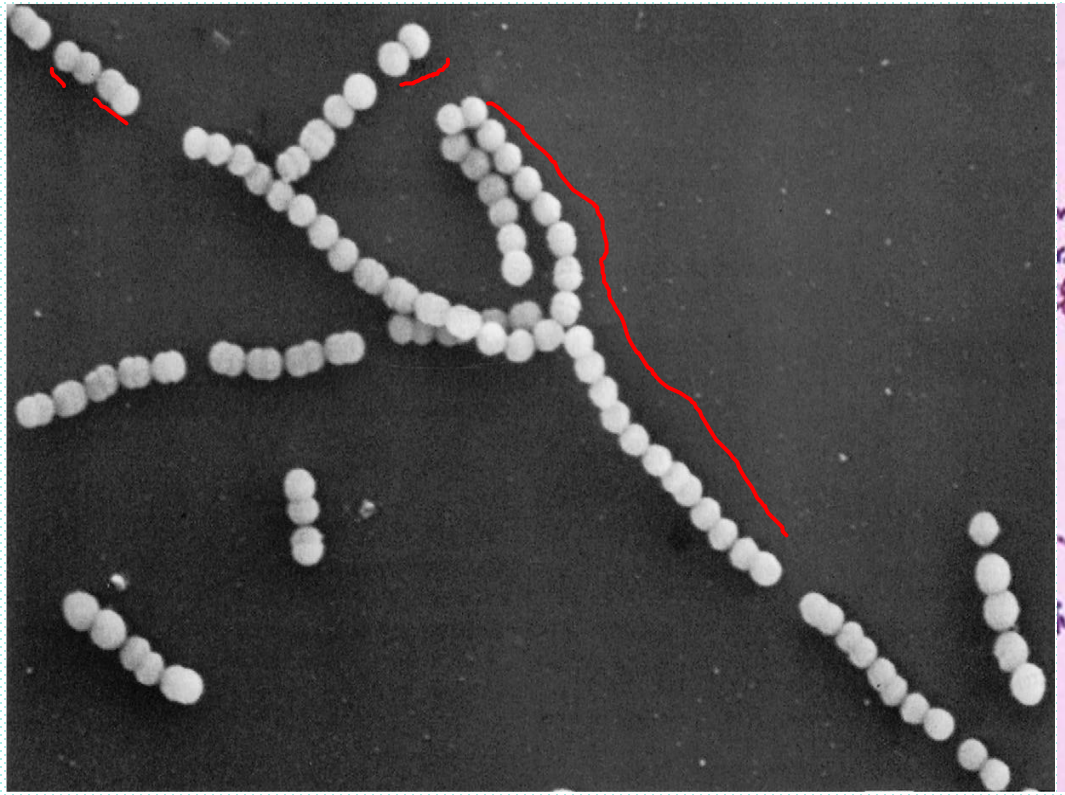
DR. ALI AL-FENDI

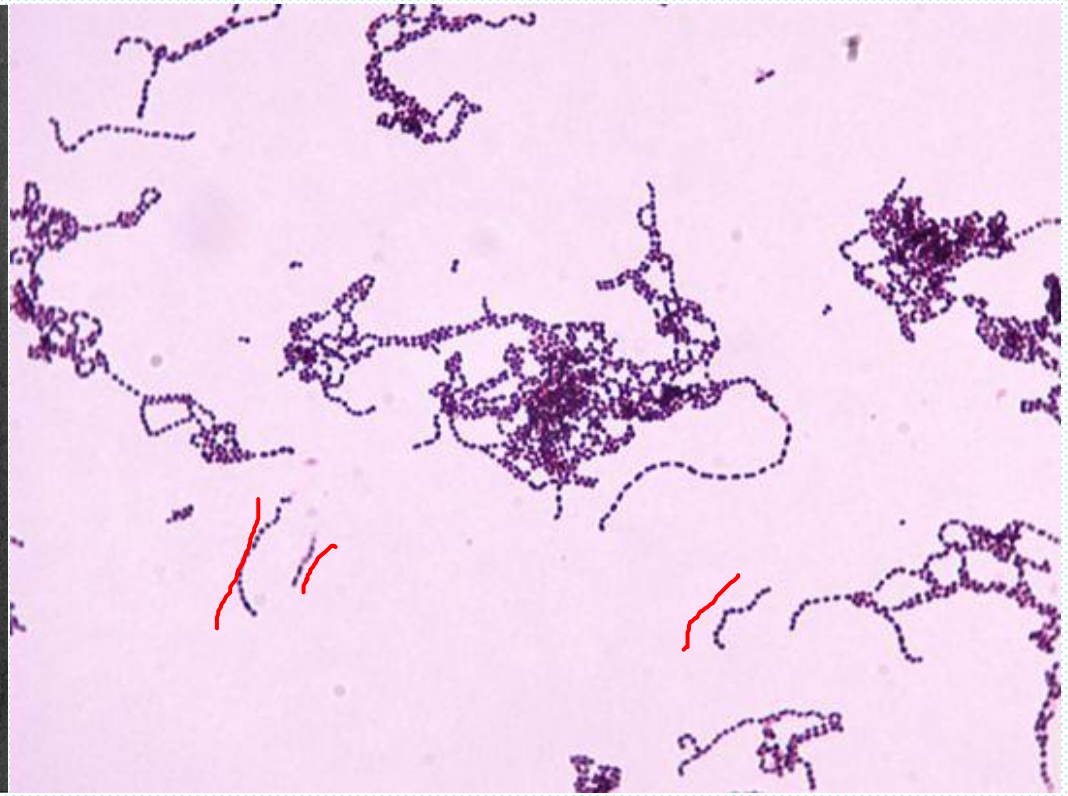
PhD Medical Microbiology

Streptococci

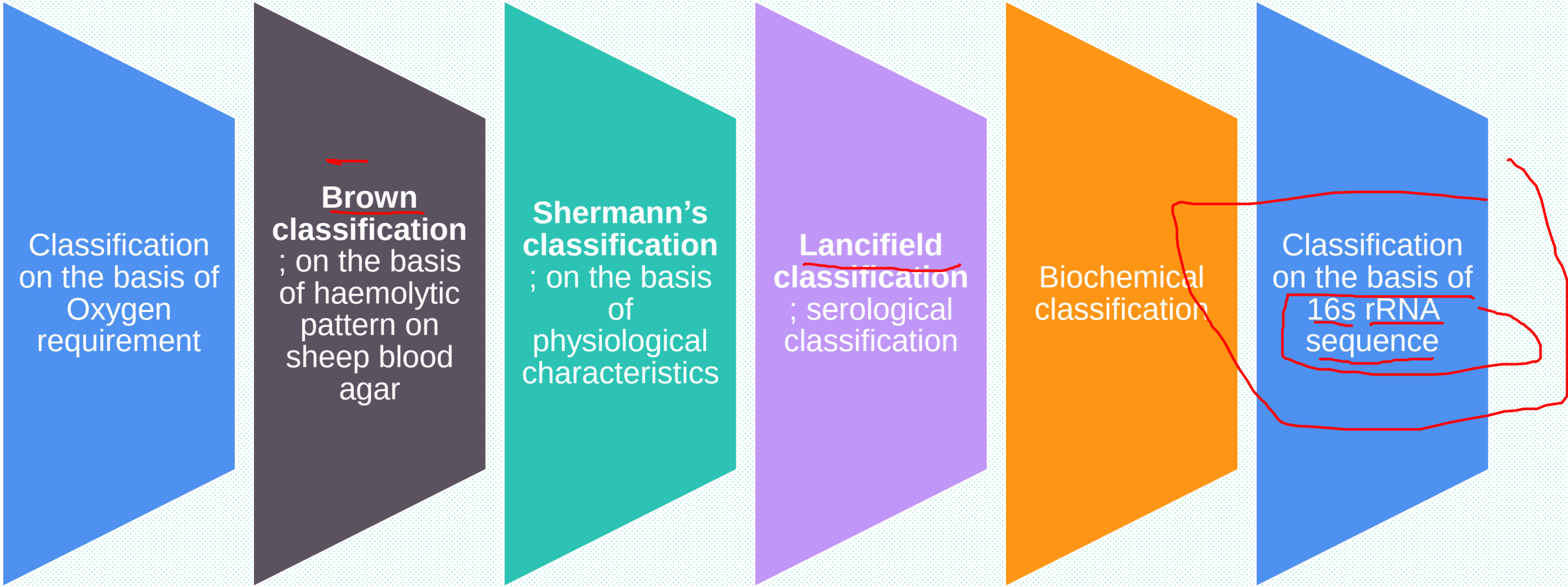
General properties :
Streptococci comprise a diverse group of Gram-positive cocci.

- Spherical or oval cocci in pairs and chains; 0.7–0.9 µm in diameter.
- They are distributed widely in humans and animals, mostly forming part of their normal flora.
- A few species cause significant human morbidity.
- The oral streptococci, which include the cariogenic *mutans* group, are important members of the genus.
- Most streptococci are facultative anaerobes, and some are obligate (*Peptostreptococcus*) anaerobes. Most require enriched media (blood agar).
- They are catalase-negative.

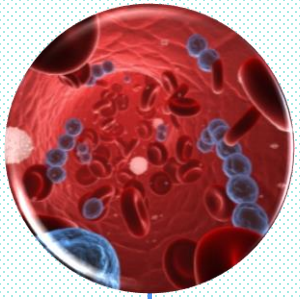




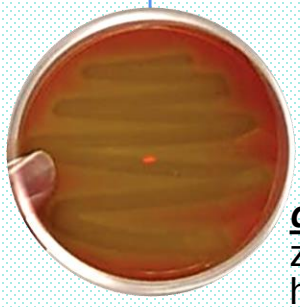
Classification of *Streptococcus*



Culture

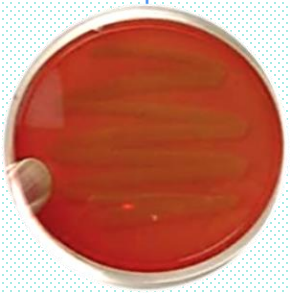


These cocci grow well on blood agar, although enrichment of media with glucose and serum may be necessary. Typical haemolytic reactions are produced on blood agar.



<u>*α*-haemolysis:</u> narrow zone of partial haemolysis and green (*viridans*) discolouration around the colony, e.g. *viridans streptococci.*

<u>*β*-haemolysis:</u> wide, clear, translucent zone of complete haemolysis around the colony, e.g. *Streptococcus pyogenes*



<u>no haemolysis</u> (***γ***-haemolysis), e.g. *non-haemolytic streptococci*.

Serology (Lancefield grouping)

- The carbohydrate antigens found on the cell walls of the organisms are related to their virulence;

1. This classification is based on the difference in the structure of cell wall carbohydrate ie. group specific polysaccharide antigen. Most strain of *β*-haemolytic group and some strain of α- hemolytic and non-haemolytic group are classified on the basis of cell wall polysaccharide.
2. Currently, 20 Lancefield groups are recognized (A–H and K–V) but not all are equally important as human pathogens.

Serology (Lancefield grouping)

Group A

- includes the important human pathogen *Streptococcus pyogenes*

Group B

- contains one species, *Streptococcus agalactiae*, an inhabitant of the female genital tract; it causes infection in neonates

Group C

- mainly causes diseases in animals

Group D

- includes the enterococci (*Enterococcus faecalis*, etc.) and ranks next to group A in causing human disease

Streptococcus pyogenes (group A)

❖ Habitat and transmission:

- The normal habitat of this species is the human upper respiratory tract and skin; it may survive in dust for some time. Spread is by airborne droplets and by contact.

❖ Characteristics:

- ❖ It is found as a commensal in the nasopharynx of a minority of healthy adults, but more commonly in children.
- ❖ It grows well on blood agar, with a characteristic halo of β-haemolysis. Some strains produce mucoid colonies as a result of having a hyaluronic acid capsule.
- ❖ This may contribute to virulence by offering resistance to phagocytosis.

Exotoxins and enzymes

Streptokinase: a proteolytic enzyme that lyses fibrin

hyaluronidase: attacks the material that binds the connective tissue, thereby causing increasing permeability (hence called the 'spreading factor')

Produces a large number of biologically active substances, such as:

DNAases (streptodornases): destroy cellular DNA

haemolysins (streptolysins, leukocidins): phage mediated and are responsible for the characteristic erythematous rash in scarlet fever.

Pathogenicity

- Streptococcus pyogenes causes a number of infections; the most notable are:
  1. Tonsillitis and pharyngitis
  2. Scarlet fever
  3. Mastoiditis and sinusitis
  4. Otitis media (middle-ear infection)
  5. Wound infections leading to cellulitis and lymphangitis
  6. Impetigo (a skin infection).

- After an episode of infection, some patients develop complications, such as rheumatic fever is caused by immunological cross-reaction between bacterial antigen and human heart tissue.
- As treatment, Penicillin is the drug of choice; erythromycin is suitable for patients hypersensitive to penicillin.

Streptococcus agalactiae (group B)

- This species is increasingly recognized as a human pathogen, especially as a cause of neonatal meningitis and sepsis.
- **Habitat and transmission:**
  - Found in the human vagina; sometimes anorectal carriage occurs. Babies acquire infection from the colonized mother during delivery or during nursing.
- **Characteristics:**
  - Gram-positive cocci in chains.
  - Gram-stained smear and culture yielding *β*-haemolytic colonies on blood agar; colonies on blood agar are generally larger than *Streptococcus pyogenes*.

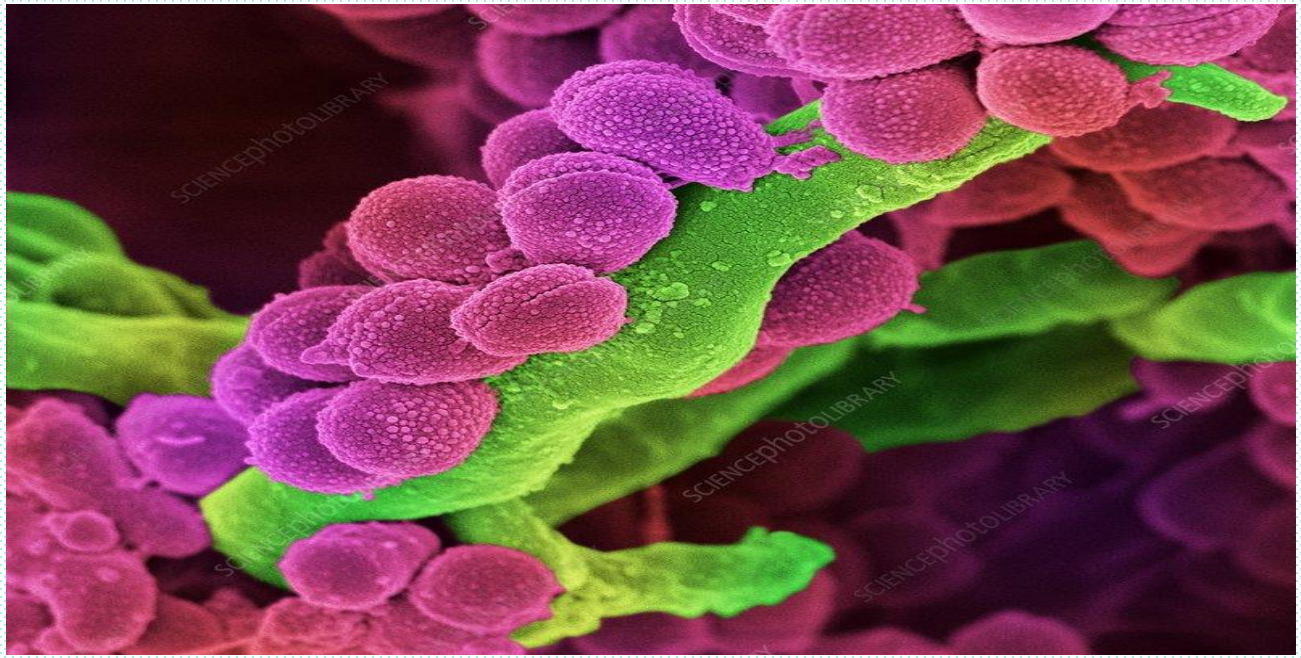
Pathogenicity

- No toxins or virulence factors have been identified:
  - Penicillin is the drug of choice; erythromycin is suitable for patients hypersensitive to penicillin.
  - Prophylactic antibiotics may be given to neonates if the mother is culture-positive.

Oral streptococci

Oral streptococci, which live principally in the oropharynx, are a mixed group of organisms with variable characteristics.

They typically show α-haemolysis on blood agar, but this is not a constant feature as some strains are non-haemolytic and others β-haemolytic.



Oral streptococci can be divided into four main species groups as follows:

1.mutans group
2.salivarius group
3.anginosus group
4.mitis group.

Oral *streptococci*

❖ Habitat and transmission:

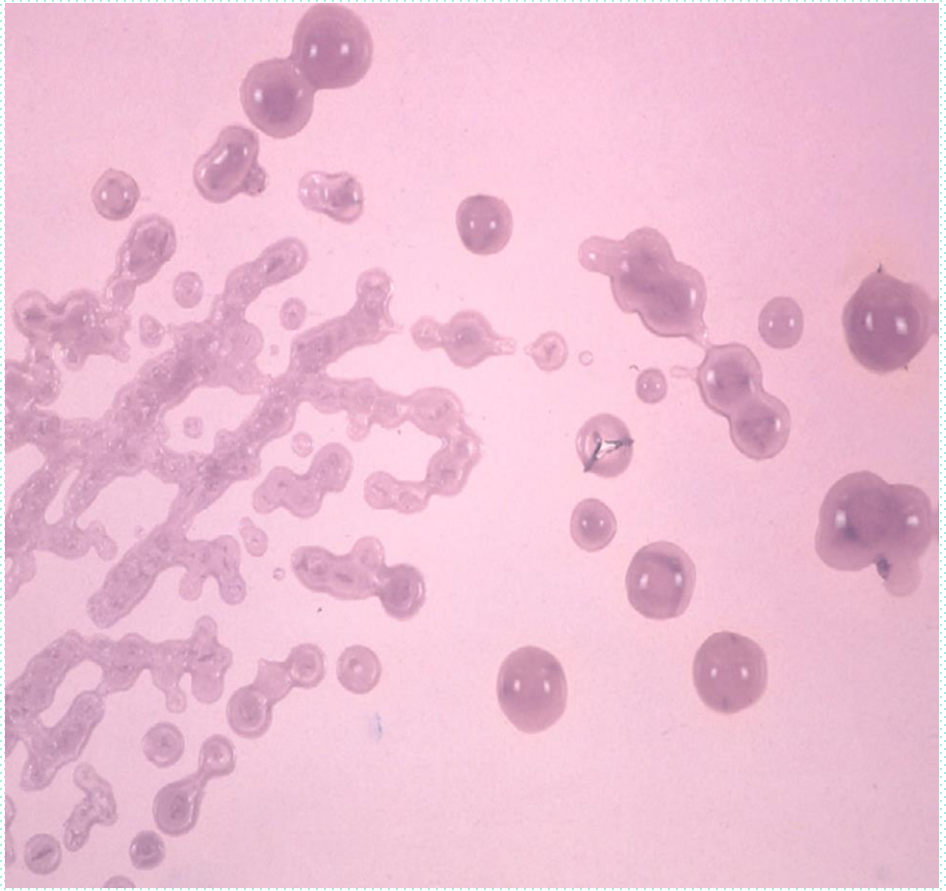
- *Streptococci* make up a large proportion of the resident oral flora. It is known that roughly one-quarter of the total cultivable flora from supragingival and gingival plaque and half of the isolates from the tongue and saliva are streptococci.
- They are vertically transmitted from mother to child.
- Infective endocarditis caused by these organisms (viridans streptococci) is generally a result of their entry into the blood stream during intraoral surgical procedures (e.g. tooth extraction), and sometimes even during tooth-brushing.

❖ Characteristics:

- Gram-positive cocci in chains; *α*-haemolytic; catalase negative.

Pathogenicity

- The mutans group of streptococci are the major agents of dental caries (but in the absence of predisposing factors, such as sucrose, they cannot cause caries).
  - They have a characteristic ability to produce voluminous amounts of sticky, extracellular polysaccharides in the presence of dietary carbohydrates; these help tenacious binding of the organisms to enamel and to each other.
  - They are also important agents of infective endocarditis, and some 60% of cases are due to this organism.
  - In patients at risk of infective endocarditis, prophylactic antibiotic cover should always be given before dental procedures.



Streptococcus mutans

- *Streptococcus mutans* gained notoriety in the 1960s when it was demonstrated that caries could be experimentally induced and transmitted in animals by oral inoculation with the organism.
- The name ‘mutans’ results from its frequent transition from coccal phase to coccobacillary phase.
- Currently, seven distinct species of human and animal *mutans streptococci* and eight serotypes (a–h) are recognized, based on the antigenic specificity of cell wall carbohydrates.
- The term *Streptococcus mutans* is limited to human isolates belonging to three serotypes (*c*, *e* and *f*).