

# Medical Bacteriology- Lecture 6

## *Streptococci*



# Classification of Streptococci

- **1 - Hemolysis on blood agar**
- **alpha-hemolysis**
- partial hemolysis (Greenish Discoloration)

• *S. pneumoniae*

- **Beta -hemolysis**
- complete lysis of red cells (Clear zone)
- *Streptococcus pyogenes*

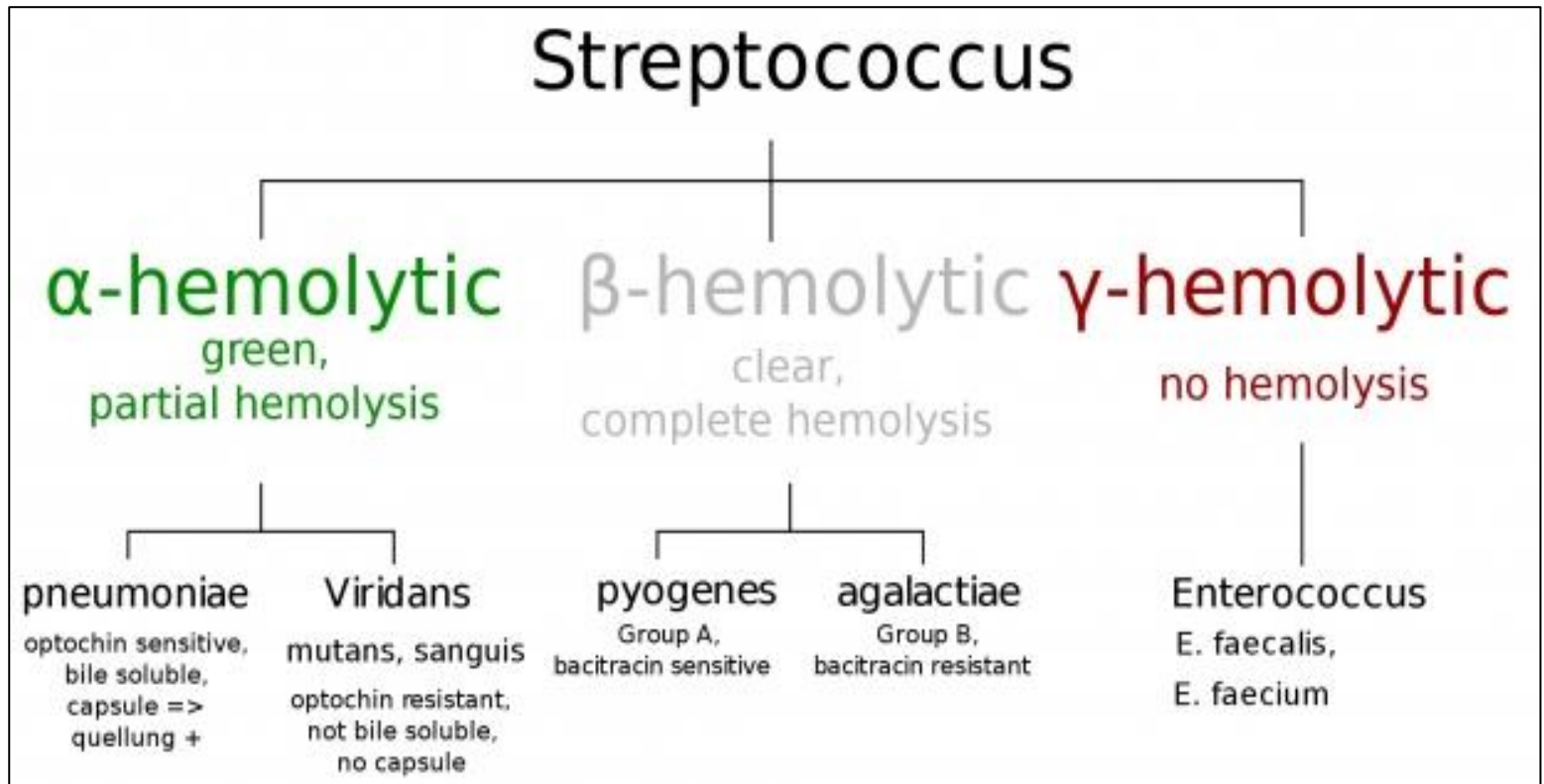
**gamma-hemolysis**

- Non hemolytic colonies.
- *Enterococcus faecales*



# Classification of Streptococci

## Hemolysis on blood agar



# Classification of Streptococci

- (2) - Antigenic types of carbohydrate (Serology)
- **Lancefield Classification**
- based on the antigenic composition of  
**specific cell wall carbohydrates (C- Substrate)**

The classification system for  
**beta-hemolytic streptococci or gamma**

**Alpha-hemolytic Streptococci** are **not grouped** under classification (no antigen).

- **The main species and groups of medical importance:**  

<i>Streptococcus pyogenes</i>	(Group A Streptococci) (GAS)
<i>Strep. agalactiae</i>	( Group B Streptococci ( GBS)
<i>Enterococcus faecales</i>	( Group D Streptococci)

# Classification of Streptococci

- (3)- Biochemical /Physiological properties
- Bergeys manual of bacteriology, classified Streptococci based on
- growth at 6.5 % NaCl, 10 and 45 °C.

Growth in 6.5% NaCl	Temperature		Group
	45 °C	10° C	
-	-	-	<i>Strep. pyogenes</i>
-	+	-	<i>Strep. Viridans</i>
+	+	+	Enterococcus
-	-	+	Lactic acid bacteria

# *Streptococcus pyogenes*

- **General characteristics**
- **Gram-positive**
- **Coccus, occurs in chains**
- **Catalase negative**
- **Facultative anaerobic (the metabolism of *S. pyogenes* is fermentative )**
- **Fastidious**
- **hyaluronic acid capsule**
- **Beta hemolytic**
- **an exogenous secondary invader**

# Pathogenesis of *Strep. pyogenes*

- **1- Suppurative infections: (Acute diseases)**
- **Respiratory tract infections**
- **Throat:** *S. pyogenes* is the leading cause of **pharyngitis**
- **sinusitis, otitis, and pneumonia.**
- **Skin**
- **Impetigo**
- **Cellulitis Necrotizing fasciitis "flesh eating bacteria".**
- **Systemic**
- **Scarlet fever** (rash)
- **Toxic shock;** caused by a few strains that produce a toxic shock toxin
- **joint infections, myositis, meningitis and endocarditis, Bacteremia.**
- **2- Non-suppurative Sequelae:**
- may follow streptococcal disease, and occur in 1-3% of untreated infections.
- **rheumatic fever**
- **glomerulonephritis**

# Virulence factors of *Strep. pyogenes*

- (1) **Protein M (major virulence factor)** , (Protein F) , lipoteichoic acid (adherence)
- (2) **hyaluronic acid capsule (non antigenic)** as an immunological disguise
- (3) **invasins (Haemolysins, streptokinase, hyaluronidase streptolysin)** (ASO test)

Hemolysin	Streptolysin O	Streptolysin S
Stability of Oxygen	No	yes
Antigenic	Yes	No ( small)

- (4) **Exotoxins**
- **pyrogenic (erythrogenic) toxin**; causes rash in **scarlet fever** and **toxic shock syndrome**.
- **5-DNAase (streptodornase- 4 types)**
- 6-Protease
- 7- Amylase
- 8- **C5a peptidase (evasion of phagocytosis)**

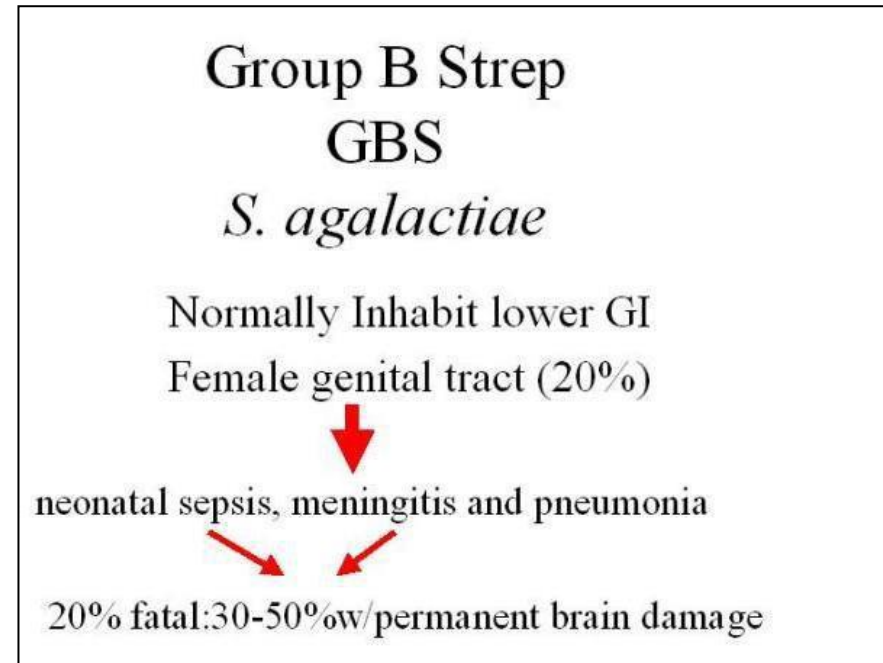


# Host defenses against *Strep. pyogenes* infections

- **Non specific defenses**
  - (intact skin, respiratory tract barriers such as cilia, coughing, sneezing and epiglottal reflexes)
- **Phagocytic system**
- **Complement**
- **Specific antibodies**
- **Treatment and prevention**
  - **Penicillin**
  - No effective vaccine has been produced

# *Streptococcus agalactiae*

- **Beat hemolytic**
- **Lancefield group B**
- Colonize human **vagina, pharynx and large intestine**
- **Causes; Puerperal sepsis**
  - Neonatal sepsis
  - pneumonia
  - meningitis
  - **Septic abortion**
- **Groups A & B Streptococci are treated with penicillin/ Erythromycin.**
- No vaccines available



# ***Enterococcus faecales***

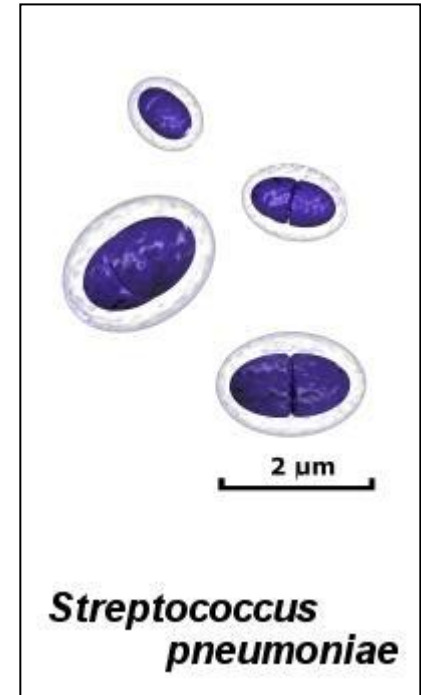
- **Lancefield Group D**
- Usually non-hemolytic or  $\alpha$  hemolytic
- normal colonists of human large intestine
- Causes; **Nosocomial Infections, opportunistic urinary**, wound infections
- **Grow on MacConkey agar**
- **Naturally high levels of antibiotic resistance**
- Treatment ( Penicillin+ Gentamycin)
- No vaccines available

# Viridians streptococci

- **They possess no Lancefield antigens.**
- Non haemolytic- alpha haemolytic.
- **Optochin resistant.**
- **Not soluble in bile salts**
- Heterogeneous group of organisms ( normal flora, pathogenic)
- Causes; endocarditis, bacteremia
- **eg. *Streptococcus mutans* (dental caries)**
- ***Streptococcus salivarius***

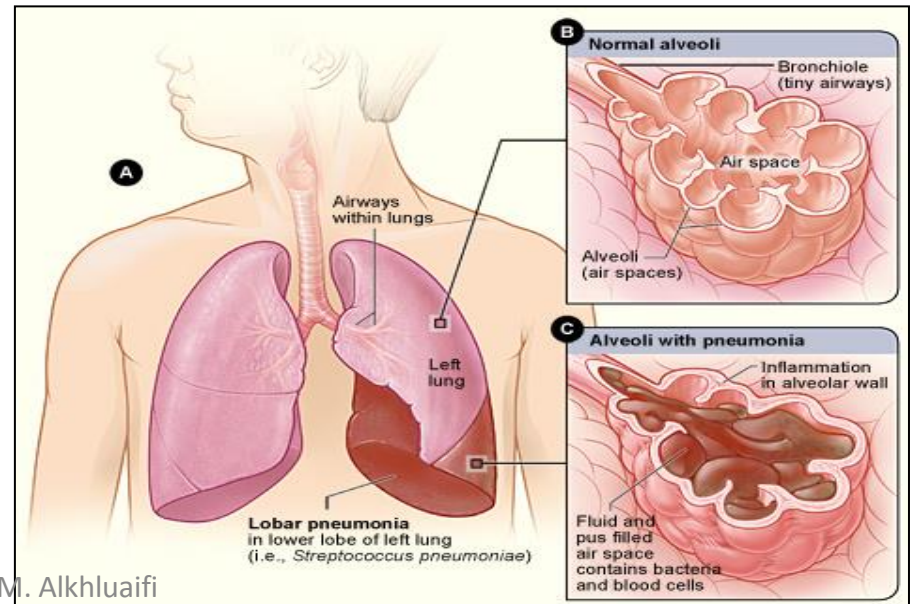
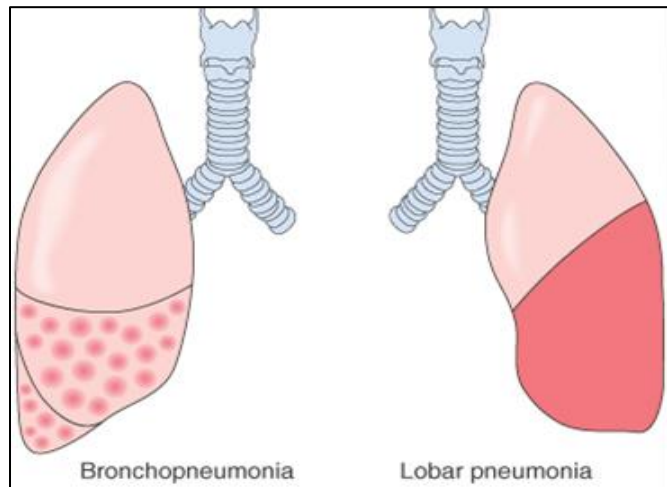
# ***Streptococcus pneumoniae*** ***(Diplococcus pneumoniae)***

- Gram-positive, cocci. Usually, pairs of cocci (diplococci)
- alpha hemolytic
- fastidious
- Poly saccharide capsule
- Fermentative aerotolerant anaerobe
- lack catalase and ferment glucose to lactic acid.
- Do not display C- substrate of cell wall composition.
- normal inhabitant of the human upper respiratory tract
- ***Strep. pneumoniae* is the leading cause of pneumonia**
- usually secondary to one of the former infections.



# Types of Pneumonia

Bronchial pneumonia	Lobar pneumonia
infants, young children and aged adults.	younger adults
It is caused by various bacteria, including <i>Strep. pneumoniae</i> .	A majority of the cases are caused by <i>Strep. pneumoniae</i> .
produces Patchy Pneumonic Consolidation	causes consolidation of whole lobe..



# Virulence factors of *Strep. pneumoniae*

- **1- Capsule (polysaccharide)**
- **An essential virulence factor.**
- Prevent phagocytosis
- **2- IgA protease**
- **Treatment and vaccination**
- Amoxicillin
- Chloramphenicol
- Third generation Cephalosporins
- **Anti-pneumococcal vaccines** (various capsular polysaccharide antigens)