Mechanisms of Human Disease
Streptococci and Enterococci
Amanda Harrington, Ph.D.

1. Streptococcus - Key Characteristics
   a. Lancefield Typing
   b. Hemolytic properties
   c. Biochemical properties

2. Streptococcus - Enterococcus
   a. Beta Streptococci
      i. S. pyogenes (Group A Strep)
         1. Serious Infections
            a. Acute Pharyngitis
            b. Impetigo
            c. Erysipelas
            d. Scarlet Fever
            e. Necrotizing Fasciitis
            f. Toxic Shock-like Syndrome
         2. Post-Streptococcal Sequelae
            a. Rheumatic Fever
            b. Acute Glomerulonephritis
      3. Virulence Factors
         a. Capsular Polysaccharide
         b. Hemolysins
         c. Enzymes
            i. Streptokinase
            ii. Streptolysin
         d. M protein
         e. Superantigens
      ii. S. agalactiae (Group B Strep)
         1. Serious Infections
            a. Neonatal infections
               i. Early Onset
               ii. Late Onset
            b. Skin and Soft Tissue infections
            c. Endocarditis
         2. Virulence Factors
            a. Capsule
         3. Prevention of perinatal GBS disease
      iii. Other Beta Hemolytic Strep
         1. Group C
         2. Group F
         3. Group G
   b. Streptococcus pneumoniae
      i. Virulence Factor
Mechanisms of Human Disease  
Streptococci and Enterococci  
Tuesday August 28, 2018, 10:30-11:30 am  
Amanda Harrington, PhD

ii. Epidemiology
iii. Pneumococcal Disease
   1. Community Acquired Pneumonia
   2. Bacteremia
   3. Meningitis
c. Viridans Streptococci
   i. Sanguis Group
   ii. Mitis Group
   iii. Mutans Group
   iv. Salivarius Group
   v. Bovis Group
   vi. Anginosus Group
d. Enterococcus
   i. Important Species
   ii. E. faecalis
   iii. E. faecium
   iv. VRE

3. Laboratory Identification
   a. Comparison of Staphylococci and Streptococci
   b. Key Characteristics
   c. Gram Stain Morphology
   d. Colonial Morphology
      i. Hemolysis
      ii. Lancefield typing
e. Key biochemical tests
      i. Optichin
      ii. Bile solubility
      iii. PYR
      iv. ASO

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**Lab Test Spotlight: Latex Agglutination**

Latex agglutination is a laboratory method that can be used to identify the presence of a specific molecule or analyte. A 'sample' containing the suspected antigen (or antibody) is mixed with latex particles that contain an antibody (or antigen) that are coated onto the surface of latex particles. The sample may be a bacterial colony or a specimen taken directly from a patient (stool, serum, cerebral spinal fluid, etc.). The reaction between an antigen and an antibody results in visible clumping called agglutination.

The following video provides a good visual example of how latex agglutination works for the detection of *Staphylococcus aureus* via protein A on the surface of the bacteria.

[https://www.youtube.com/watch?v=7R9og3HuAAU](https://www.youtube.com/watch?v=7R9og3HuAAU)

In class we discussed several uses of latex agglutination.

1. Coagulase test—detects free or bound coagulase, also known as clumping factor.
   a. Bacterial colony is mixed with latex particles
   b. Latex particles are coated with fibrinogen and IgG
c. Agglutination occurs if the organism produces coagulase, which converts fibrinogen to fibrin = clot and protein A, which binds to Fc portion of IgG molecule
d. Agglutination = identification of *Staphylococcus aureus*

2. Lancefield typing—separates streptococci into groups by detection of specific carbohydrate antigens
   a. Bacterial colony is mixed with latex particles
   b. Latex particles are coated with antibodies to different streptococcal grouping antigens
c. Agglutination occurs if the organism contains an antigen in its cell wall
d. Nearly all beta hemolytic streptococci contain a streptococcal grouping antigen
e. Some alpha hemolytic streptococci (and Enterococcus) contain a streptococcal grouping antigen (this test is not routinely performed on alpha hemolytic organisms in the clinical laboratory)
f. Agglutination = grouping/identification of Lancefield group A, B, C, D, F, or G

3. Antistreptolysin O—detects antibodies to Streptolysin O to aid in the diagnosis of rheumatic fever
   a. Patient serum is mixed with latex particles
   b. Latex particles are coated with Streptolysin O
c. Agglutination occurs if patient has made antibodies to Streptolysin O
d. Agglutination = the patient has been recently exposed to *Streptococcus pyogenes*