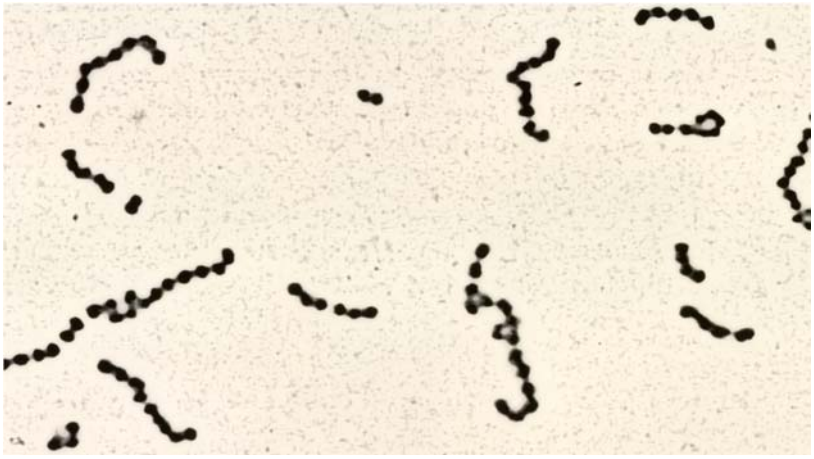
STREPTOCOCCACEAE



SPECIAL MICROBIOLOGY

Instructor

Dr. Maytham Ihsan

Ph.D Vet Microbiology

STREPTOCOCCACEAE

Genus: *Streptococcus and Enterocccus*

Streptococcus and Enterocccus genera, are Gram-positive ovoid (**lanceolate**) cocci, approximately 1 µm in diameter, that tend to occur in singles, pairs & chains (rosary-like) may be long or short. ***Streptococcus*** species occur as commensals on skin, upper & lower respiratory tract and mucous membranes; some may act as opportunistic pathogens causing pyogenic infections.

Enteroccci spp. are enteric opportunistic & can be found in the intestinal tract of many animlas & humans.

Growth & Culture Characteristics

- Most streptococci are facultative anaerobes and catalase-negative.
- They are non-motile and oxidase-negative and do not form spores & susceptible to desiccation.
- They are fastidious bacteria and require the addition of blood or serum to culture media. They grow at temperature ranging from 37°C to 42°C. Group D (Enterocooci), are considered thermophilic & can gorw at 45°C or even higher.
- Colonies are small about 1 mm in size, smooth, translucent & may be greyish.
- *Streptococcus pneumoniae* (pneumococcus or diplococcus) occurs as slightly pear-shaped cocci in pairs. Pathogenic strains have thick capsules and produce mucoid colonies or flat colonies with smooth borders & a central concavity "**draughtsman** colonies" after 48-72 hrs on blood agar. These bacteria cause pneumonia in humans and rats.

- Some of streptococci grow on MacConkey like: *Enterococcus faecalis*, *Strept. bovis*, *Sterpt. uberis* & *strept. lactis* producing very tiny colonies like pin-point appearance after 48 hrs of incubation at 37°C.
- Streptococci genera grow slowly in broth media, sometimes forming faint opacity; whereas others with a fluffy deposit adherent to the side of the tube. A clear supernatant is a feature of long chains streotococci like *Strept. equi* & *Strept. agalactiae*.
- Produce a wide range of enzymes & extracellular toxins playing an important role in their virulence & pathogensity.
- Produce variable types of haemolysis which used for their classification.

Classification of Streptococci

- **Haemolysis** on blood agar.
- **Lancefield's Grouping**: Is a serological method of classification based on group-specific (C-substance) polysaccharide in the cell wall. Two methods used: 1- Ring precipitation 2- Slide agglutination. **A-H & K-U**.
- **Capsular Polysaccharide**: For typing of *Strept. pneumoniae* & Group B (*Strept. agalactiae*).
- **Biochemical Tests**, which includes: Tests for Sugar fermentation, production of enzymes as well as to susceptibility or resistance to certain chemical agents.

- Another Classification, as follows:

1- **Pyogenic Streptococci**: Group A, *Strept. pyogenes*, include the majority of disease-producing strains.

2- **Viridans Streptococci**: Produce greenish discoloration on blood agar (alpha haemolysis) (Group B; *Strept. agalactiae*).

3- **Lactic Streptococci**: Usually recovered from milk esp. (Group C; *Strept. equi* & *Strept. zooepidemicus*).

4- **Enterococci**: Are mainly intestinal (Group D; *Enterococcus faecalis, Sterpt. bovis* & *Strept. uberis*).

Antigenic Structure

- M protein , Is a major virulent factor of *Strept. pyogenes*. Play an important role in the pathogenesis of Rheumatic Fever.

- T Substance, which is not related to the virulence otherwise used for differentiation of certain types of Streptococci.

- R Protein , is a surface antigen.

- Nucleoproteins (P substances), make up most of streptococci cell body.

Toxins and Enzymes

A. Streptokinase (Fibrinolysin)

Is produced by many strains of group A β-hemolytic streptococci. It transforms the plasminogen of human plasma into plasmin, an active proteolytic enzyme that digests fibrin and other proteins.

B. Deoxyribonucleases (A, B, C & D) Degrade host tissue DNA (Dnases).

C. Hyaluronidase (Spreading Factor)

Aids in spreading infecting microorganisms by splits hyaluronic acid, an important component of the ground substance of connective tissue.

E. Hemolysins (Streptolysins) , The **β-hemolytic group A *S pyogenes*** elaborates two hemolysins :

1- Streptolysin O , perform **ASOT** (Anti Streptolysin O Test) 160-200 units (HI).

2- Streptolysin S

D. Pyrogenic Exotoxins (Erythrogenic Toxin) (A , B & C).

Streptococcal pyrogenic exotoxin (Spe) produced by group A *S pyogenes, are associated with Scarelt fever &* streptococcal toxic shock syndrome**.**

Streptococcal Diseases

S. equi

- **Strangles (Equine Distemper) –** infection of upper respiratory tract. ***S. equi*** *not* normal flora. Outbreaks, highly contagious

- Complications are: Bastard strangles & Purpura haemorrhagica.

Streptococcus zooepidemicus

- True commensal of horses, cause opportunistic disease:
  - Pneumonia , Wound infections & Mastitis.
  - Cross-species transmission, Haemorrhagic pneumonia in dogs.

Streptococcus canis

Are Commensal & can induce: Otitis, Cystitis & Wound infection (necrotizing fasciitis) as well as to Fading puppy syndrome.

Enterococci

Are gastrointestinal flora, Opportunists infections: Mastitis, Cystitis & Otitis.

Streptococci of Bovine Mastitis

- *Strept. agalactiae*
- *Strept. dysagalactiae*
- *Strept. Uberis*
- *Enterococcus facecalis* (**Only grow on MacConkey Agar**)

-Edwards Medium used for isolation & differentiation.

Pathogenic streptococci, their habitats, hosts and consequences of infection

Species	Lancefield group	Haemolysis on blood agar	Hosts	Consequences of infection	Usual habitat
S. pyogenes	A	β	Humans	Scarlet fever, septic sore throat, rheumatic fever	Mainly upper respiratory tract
S. agalactiae	B	β (α, γ)	Cattle, sheep, goats	Chronic mastitis	Milk ducts
			Humans, dogs	Neonatal septicaemia	Vagina
S. dysgalactiae	C	α (β, γ)	Cattle	Acute mastitis	Buccal cavity, vagina, environment
			Lambs	Polyarthritis	
S. equi (*S. equi* subsp. *equi*)	C	β	Horses	Strangles, suppurative conditions, purpura haemorrhagica	Upper respiratory tract, guttural pouch
S. zooepidemicus (*S. equi* subsp. *zooepidemicus*)	C	β	Horses	Mastitis, pneumonia, navel infections	Mucous membranes
			Cattle, lambs, pigs, poultry	Suppurative conditions, septicaemia	Skin, mucous membranes
S. suis	D	α (β)	Pigs	Septicaemia, meningitis, arthritis, bronchopneumonia	Tonsils, nasal cavity
			Humans	Septicaemia, meningitis	
S. canis	G	β	Carnivores	Neonatal septicaemia, suppurative conditions, toxic shock syndrome	Vagina, anal mucosa
S. uberis	Not assigned	α (γ)	Cattle	Mastitis	Skin, vagina, tonsils

Diagnosis

- **Specimens:** Pus, blood, urine, exudates & mastatic milk .
- **Direct Microscopy**: Specimens to be stained by Gram's stain.
- **Culture of specimens**: Specimens are cultured on :

- Ox or sheep blood agar
- Edward's medium with Aesculin (*Enterococcus faecalis /* Positive black colonies)
- MacConkey agar (*Enterococcus faecalis*)

- **Identification:**

- Lancefield's grouping
- Quellung reaction (capsular swelling) for *Strept. pneumoniae*.
- Fluorescent antibody technique against *Strept. pneumoniae* capsular material.

- **Biochemical profile:**

- **Sugar fermentation**
- **Catalase (Negative)**
- **Haemolysis on blood agar** (α, β & γ). Group β haemolytic are more pathogenic than Group α haemolytic.
- Ready to use kits called biochemical identification system like: RapID STR & API STREP.
- **Hydrolysis of Sodium hippurate**. Group B Streptococci (GBS) are Positive.
- **Bile Solubility**. *Strept. pneumoniae* suspension is hydrolyzed.
- **Susceptibility to Optochin**. *Strept. pneumoniae* is sensitive.
- **Susceptibility to Bacitracin.** Group A Streptococci (GAS) are Sensitive.

- **Carotenoid Pigment Production**. GBS produce orange to red pigment on GBS media.
- **Molecular tests:** PCR-based techniques used widely recently for detection & genotyping of Streptococci with gene sequencing for genetic barcoding.

Differentiation of equine group C streptococci by sugar fermentation

	Trehalose	Sorbitol	Lactose	Maltose
S. equi	–	–	–	+
S. zooepidemicus	–	+	+	+(–)
S. equisimilis	+	–	v	+

GOOD LUCK