# STREPTOCOCCUS

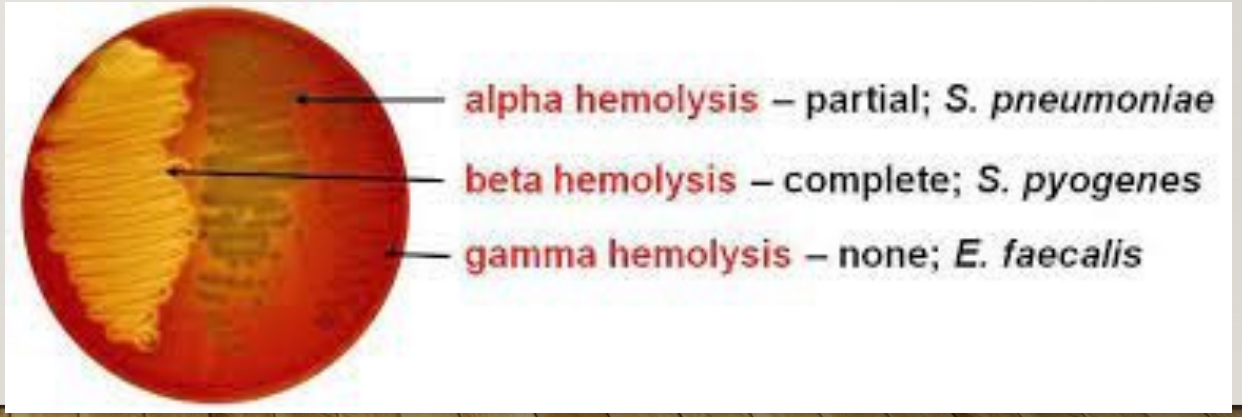
# *Streptococcus*

- Is a genus of Gram-positive *coccus* or spherical bacteria that belongs to the family Streptococcaceae. Cell division in **streptococci** occurs along single axis, so as they grow, and tend to form pairs or chains that may appear bent or twisted. (Contrast with that of staphylococci, which divide along multiple axis, thereby generating irregular, grape-like clusters of cells.)

- Certain Streptococcus species are responsible for many cases of pink eye, meningitis, bacterial pneumonia, endocarditis, erysipelas, and necrotizing fasciitis (the 'flesh-eating' bacterial infections).
- However, many streptococcal species are not pathogenic, and form part of the commensal human microbiota of the mouth, skin, intestine, and upper respiratory tract.

**Species of *Streptococcus* are classified based on their hemolytic properties to:**

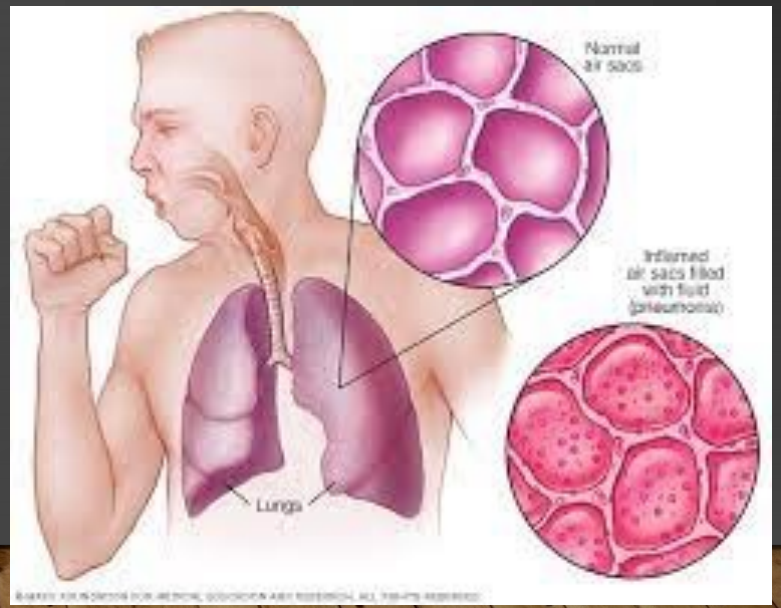
- Alpha-hemolytic: species cause oxidization of iron in hemoglobin molecules within red blood cells, giving it a greenish color on blood agar.
- Beta-hemolytic: species cause complete rupture of red blood cells. On blood agar, this appears as wide areas clear of blood cells surrounding bacterial colonies.
- Gamma-hemolytic: species cause no hemolysis.



- Beta-hemolytic streptococci are further classified by a serotype classification (that is, describing specific carbohydrates present on the bacterial cell wall)
- In the medical setting, the most important groups are the alpha-hemolytic streptococci *S. pneumoniae* and *Streptococcus viridans* group, and the beta-hemolytic streptococci of groups A and B *S. pyogenes* (also known as “group A strep” and “group B strep”).

# Pneumococci

- *S. pneumoniae* (sometimes called pneumococcus), is a leading cause of bacterial pneumonia and occasional etiology of otitis media, sinusitis, meningitis, and peritonitis. Inflammation is thought to be the major cause of how pneumococci cause disease.



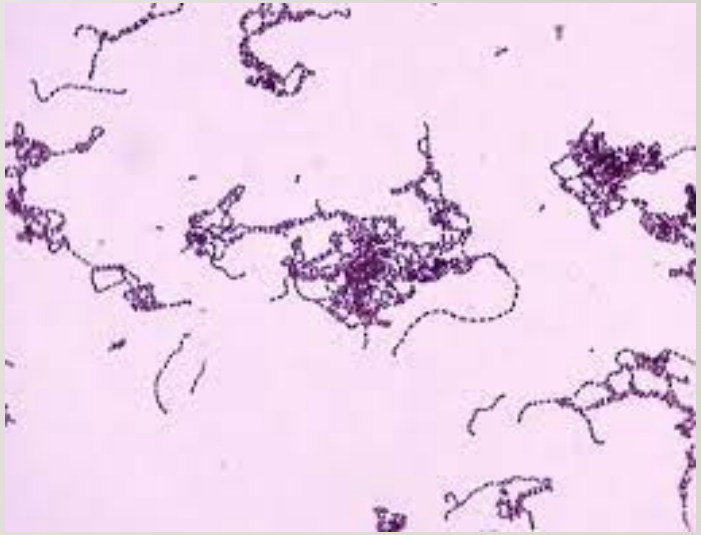
# THE VIRIDANS GROUP

- The viridans streptococci are a large group of commensal bacteria that are either alpha-hemolytic, producing a green coloration on blood agar plates , or nonhemolytic.
- Viridans streptococci can be differentiated from *Streptococcus pneumoniae* using an optochin test, as viridans streptococci are optochin-resistant; they also lack either the polysaccharide-based capsule typical of *S. pneumoniae*or the Lancefield antigens of the pyogenic members of the genus

alpha-hemolytic *s. viridans* (right) and beta-hemolytic Group A *s. pyogenes* (left) streptococci growing on blood agar

# ***S. PYOGENES***

- ***Streptococcus pyogenes*** is a species of Gram-positive, aerotolerant bacterium .
- These bacteria are extracellular, and made up of non-motile and non-sporing cocci.
- It is clinically important for humans. It is usually pathogenic, but can be part of the skin microbiota.



- *S. pyogenes* (Group A streptococcus ) is the causative agent in a wide range of group A streptococcal infections (GAS). These infections may be noninvasive or invasive. The noninvasive infections tend to be more common and less severe. The most common of these infections include streptococcal pharyngitis (strep throat) and impetigo. Scarlet fever is also a noninvasive infection, but has not been as common in recent years.

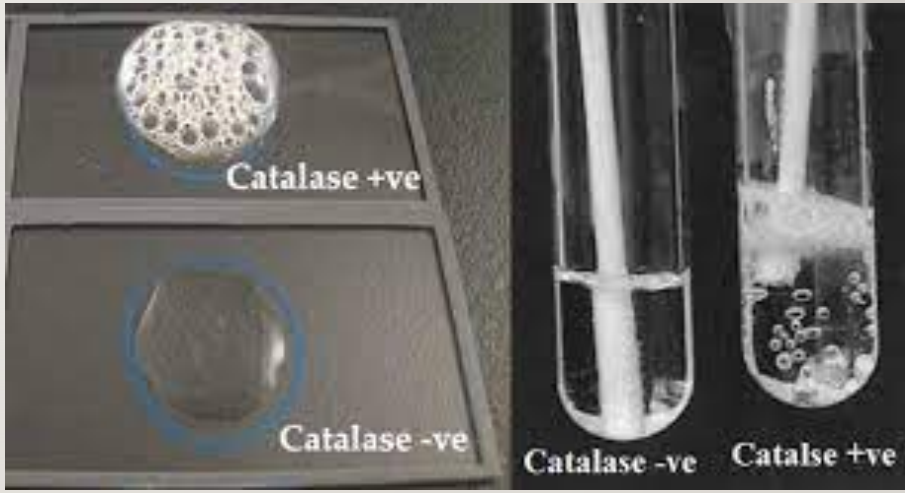
- The invasive infections caused by *S. pyogenes* as one of group A beta-hemolytic streptococci tend to be more severe and less common.

- This occurs when the bacterium is able to infect areas where it is not usually found, such as the blood and the organs.

- The diseases that may be caused include streptococcal toxic shock syndrome, necrotizing fasciitis, pneumonia, and bacteremia. Globally, GAS has been estimated to cause more than 500,000 deaths every year, making it one of the world's leading pathogens.

- Additional complications may be caused by GAS, namely acute rheumatic fever and acute glomerulonephritis.

- *S. pyogenes* can be cultured on fresh blood agar plates. Under ideal conditions, it has an incubation period of 1 to 3 days.
- *S. pyogenes* is catalase negative. This is the main criterion for differentiation between *Staphylococcus* spp. and *Streptococcus* spp. As Staphylococci are catalase positive whereas streptococci are catalase-negative.



- Of healthy individuals, 1% to 5% have throat, vaginal, or rectal carriage. In healthy children, such carriage rate varies from 2% to 17%.
- There are four methods for the transmission of this bacterium: inhalation of respiratory droplets, skin contact, contact with objects, surface, or dust that is contaminated with bacteria or, less commonly, transmission through food.
- The number of pharyngitis cases is higher in children when compared with adults due to exposures in schools, nurseries, and as a consequence of lower host immunity.
- Such cases Streptococcal pharyngitis occurs more frequently from December to April (later winter to early spring) in seasonal countries.

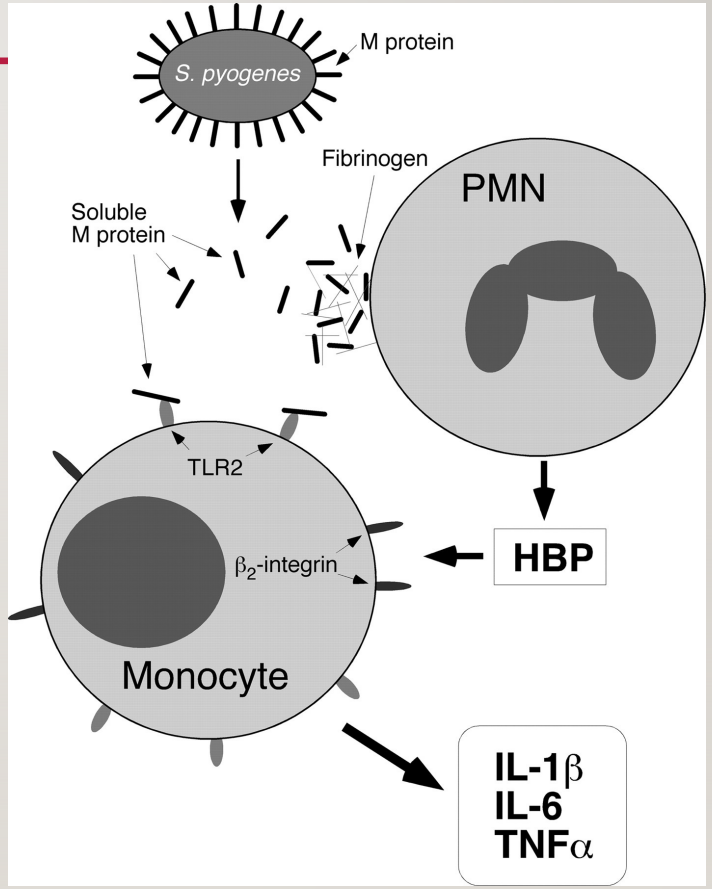
# Virulence factors

- ***S. pyogenes*** **has several virulence factors that enable it to attach to host tissues, evade the immune response, and spread by penetrating host tissue layers.**

**1- A carbohydrate-based bacterial capsule composed of hyaluronic acid surrounds the bacterium, protecting it from phagocytosis by neutrophils.**

# Virulence factors

- **2- M protein** also inhibits opsonization by the alternative complement pathway by binding to host complement regulators.
- The M protein is also able to prevent opsonization by binding to fibrinogen.
- However, the M protein is also the weakest point in this pathogen's defence , as antibodies produced by the immune system against M protein target the bacteria for engulfment by phagocytes. M proteins are unique to each strain.



# Virulence factors

- **3- Streptolysin O** :it is an exotoxin, one of the bases of the organism's beta-hemolytic property. Streptolysin O causes an immune response and detection of antibodies to it
- 4- Exotoxin A and C: Superantigens secreted by many strains of *S. pyogenes*: This pyogenic exotoxin is responsible for the rash of scarlet fever and many of the symptoms of streptococcal toxic shock syndrome.

# Virulence factors

- 5- Exotoxin B : Cysteine protease and the predominant secreted proteins. These exotoxins have multiple actions, including degrading the extracellular matrix, cytokines, complement components, and immunoglobulins. Also called streptopain
- 6-Streptokinase : Enzymatically activates plasminogen, a proteolytic enzyme, into plasmin, which in turn digests fibrin and other proteins

# Virulence factors

- 6-Hyaluronidase Hyaluronidase is widely assumed to facilitate the spread of the bacteria through tissues by breaking down hyaluronic acid, an important component of connective tissue.
- 8-Streptodornase: Most strains of *S. pyogenes* secrete up to four different DNases, which are sometimes called streptodornase.

# Virulence factors

- 9-C5a peptidase: C5a peptidase cleaves a potent neutrophil chemotaxin called C5a, which is produced by the complement system

- 10-Streptococcal chemokine protease: degrades the chemokine IL-8, which would otherwise attract neutrophils to the site of infection

# Disease caused by *S. pyogenes*

- *S. pyogenes* is the cause of many human diseases, ranging from mild superficial skin infections to life-threatening systemic diseases.
- Infections typically begin in the throat or skin. The most striking sign is a strawberry-like rash.
- Examples of mild *S. pyogenes* infections include pharyngitis (strep throat) and localized skin infection (impetigo).
- Erysipelas and cellulitis are characterized by multiplication and lateral spread of *S. pyogenes* in deep layers of the skin.

# Disease caused by *S. pyogenes*

- *S. pyogenes* invasion and multiplication in the fascia can lead to necrotizing fasciitis, a life-threatening condition requiring surgery. The bacterium is found in neonatal infections.
- Infections due to certain strains of *S. pyogenes* can be associated with the release of bacterial toxins. Throat infections associated with release of certain toxins lead to scarlet fever. Other toxigenic *S. pyogenes* infections may lead to streptococcal toxic shock syndrome, which can be life-threatening

# TREATMENT

- This bacterium remains acutely sensitive to penicillin. Failure of treatment with penicillin is generally attributed to other local commensal organisms producing β-lactamase. Certain strains have developed resistance to macrolides, tetracyclines, and clindamycin.