

## STAPHYLOCOCCI

Facultative anaerobes, Gram positive, occur in grape like-clusters and are catalase positive. Major components of the normal flora of skin and nose.

### *Staphylococcus aureus*

- (i) One of the commoner causes of opportunistic infections in the hospital and community; including pneumonia, osteomyelitis, septic arthritis, bacteremia, endocarditis, abscesses/boils and other skin infections.
- (ii) Food poisoning. The food becomes contaminated with the organism from human contact, grows and produces enterotoxin.
- (iii) Healthy people: boils.
- (iv) Toxic shock syndrome particularly after tampon.
- (v) Exfoliative toxin causes scalded skin syndrome in babies.

### *Staphylococcus epidermidis*

*Staphylococcus epidermidis* is a less common cause of opportunistic infections than *S. aureus*, but is still significant. It is a mediator of nosocomial infections (e.g. catheters, surgery [e.g. heart valves]). It is a major component of the skin flora and thus commonly a contaminant of cultures.

### *Staphylococcus saprophyticus*

This organism is a significant cause of urinary tract infections. It is also coagulase-negative and is not usually differentiated from *S. epidermidis* clinically.

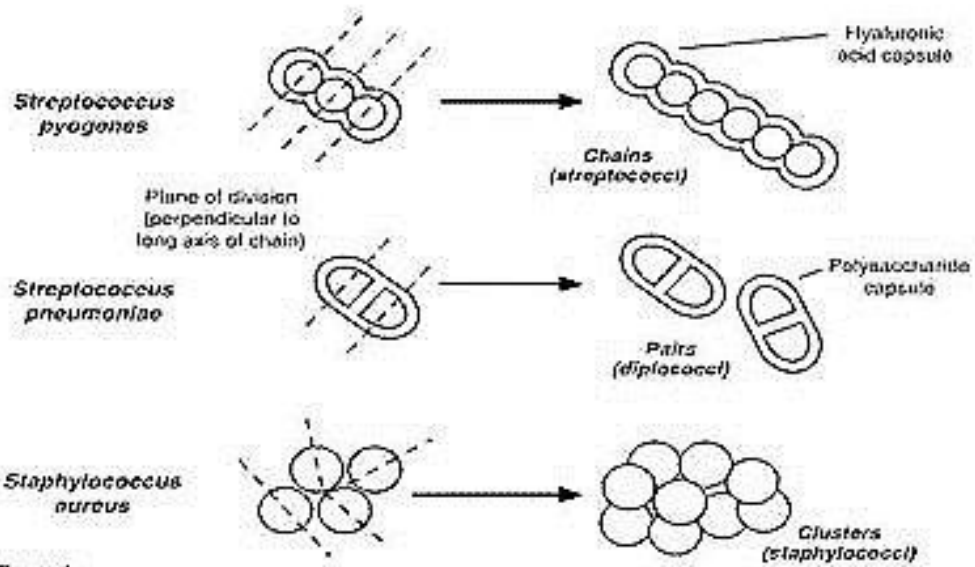


Figure 1.

Test	<i>Staphylococcus aureus</i>	<i>Staphylococcus epidermidis</i>	<i>Staphylococcus saprophyticus</i>
Catalase test	+	+	+
Coagulase test	+	-	-
Colour differences in colonies	Gold – yellow	White	White to yellow
Hemolysis test	Beta	None	None
Reaction to Novobiocin	Sensitive	Sensitive	Resistant



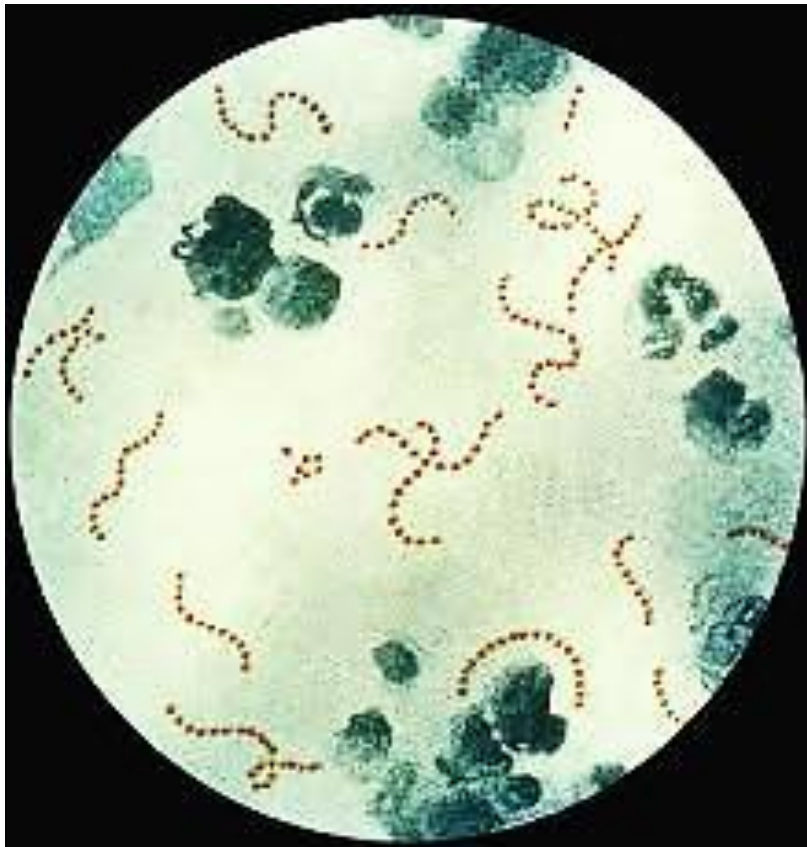
## Streptococci

They are facultative anaerobic, Gram-positive organisms that often occur as chains or pairs and are catalase-negative (staphylococci are catalase positive). Streptococci are subdivided into groups by antibodies that recognize surface antigens. These groups may include one or more species. The most important groupable streptococci are A, B and D. Among the groupable streptococci, infectious disease (particularly **pharyngitis**) is caused by **group A** which is thus emphasized here.

The *Streptococcus pneumoniae* (a major cause of human **pneumonia**) and *Streptococcus mutans* and other so-called **viridans** streptococci (among the causes of dental caries) do not possess group antigens.



Bacteria	Lancefield group	Hemolysis	Diagnostic features
<i>S. pyogenes</i>	A	Beta	Bacitracin sensitive
<i>S. agalactiae</i>	B	Beta	Bacitracin resistant Hippurate hydrolyzed
<i>S. faecalis</i> ( <i>Enterococcus</i> )	D	Alpha or Beta or none	Growth in 6.5% NaCl
<i>S. bovis</i>	D	Alpha or none	No Growth in 6.5% NaCl
<i>S. pneumoniae</i>	Not applicable	Alpha	Bile soluble Inhibited by optochin
Viridans group	Not applicable	Alpha	Not bile soluble Not inhibited by optochin



Three types of hemolysis reaction are seen after growth of streptococci on sheep blood agar (alpha, beta, gamma). **Alpha** refers to **partial hemolysis** with a green coloration (from production of an unidentified product of hemoglobin) seen around the colonies; **beta** refers to **complete clearing** and **gamma** means there is **no lysis**.

Both groups **A** and **B** streptococci are beta hemolytic, whilst **D** are usually **alpha** or **gamma**. *Streptococcus pneumoniae* and viridans ("green") streptococci are  $\alpha$  hemolytic. Thus the hemolysis reaction is important in grouping streptococci. The hemolysis reaction along with one physiologic characteristic is sufficient for a presumptive clinical identification.

### **Group A streptococcus (*S. pyogenes*)**

This organism traditionally causes suppurative, but non-invasive pharyngitis, and less frequently the skin infection, impetigo. In the middle part of the 1900's, the serious complications of group A streptococcal infections began to decline dramatically and had greatly decreased by the 70's. Thus, interest in this organism waned. In the 80's and 90's, there has been an rapid raise in classical "rheumatic fever" (a non-suppurative disease of the heart) but also new forms of streptococcal disease which includes both "invasive" bacteremia, a toxic shock-like syndrome (as seen with *S. aureus*) and so-called "flesh eating" bacteria.

Rheumatic fever. Rheumatic fever, is an inflammatory disease affecting primarily the heart and joints.

Acute glomerulonephritis. This is an immune complex disease of the kidney.

Scarlet fever. The characteristic rash is caused by erythrogenic (pyrogenic) toxins which are phage encoded.

Bacteremia and toxic-shock. The newly described invasive (and sometimes fatal) forms of the disease with a toxic shock-like disease (including rash, fever and shifting of fluid from the bloodstream to peripheral tissues with resulting edema) and/or necrotizing myositis and fasciitis.

### **Group B streptococcus (*S. agalactiae*)**

These organisms cause **neonatal meningitis** and **septicemia** after transmission from the normal vaginal flora of the mother.

### **Group D streptococcus**

Group D streptococci are divided into those that will grow in 6.5% saline (**enterococci**) and those that will not (**non-enterococci**). Enterococci much more commonly cause human disease than non-enterococci.

## **Other beta hemolytic groups**

Groups **C** and **G** (and rarely group **F**) occasionally cause human disease (particularly **pharyngitis**).

## **Viridans streptococci**

These are a diverse group of species commonly found orally (including **S. mutans**) and cause endocarditis after release into the bloodstream from tooth extraction . They are also involved in dental caries (**tooth decay**). They are alpha hemolytic and negative for other tests described above.

They are non-groupable.

## ***STREPTOCOCCUS PNEUMONIAE***

*S. pneumoniae* is a leading cause of pneumonia in all ages (particularly the young and old), often after "damage" to the upper respiratory tract (e.g. following viral infection). It also causes middle ear infections (otitis media). The organism often spreads causing bacteremia and meningitis. *S. pneumoniae* is  $\alpha$  hemolytic and there is no group antigen.

Direct Gram staining or detection of capsular antigen in sputum can be diagnostic. The organism grows well on sheep blood agar.