Genus Staphylococcus

General characters: Staphylococci generally stain darkly **gram positive** (Figure 6.1). They are round rather than oval and tend to occur **in bunches like grapes.**

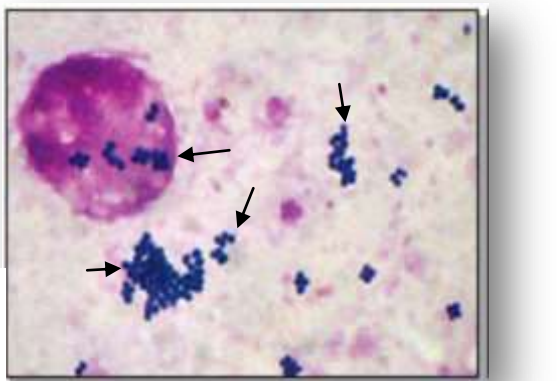


Figure 6.1
Gram stain of *Staphylococcus aureus*.

Growth of staphylococci requires supplementation with various **amino acids and** other **growth factors**, they are routinely cultured on enriched media containing nutrient broth and/or blood.

Staphylococci are **facultatively anaerobic** organisms. They produce **Catalase**, which is one feature that distinguishes them from the **catalase-negative streptococci**.

The most virulent species of staphylococcus is ***S. aureus***, almost all isolates of which secrete coagulase, an enzyme that causes citrated plasma to clot.

The most virulent of the genus , ***S.aureus*** is one of the most common causes of bacterial infections, and is also an important cause of food poisoning and toxic shock syndrome. Among less virulent staphylococcal species, ***S.epidermidis*** is an important cause of prosthetic implant infections, whereas ***S.saprophyticus*** causes urinary tract infections, especially cystitis in women.

Staphylococci are hardy, being resistant to heat and drying, and thus can persist for long periods on fomites (inanimate objects), which can then serve as sources of infection.

Toxin production

Protein A: Protein A is a major component of the *S. aureus* cell wall. It **binds to the Fc region of IgG**, exerting an anti-opsonin (and therefore strongly antiphagocytic) effect.
Cytolytic exotoxins: α, β, γ, and δ Toxins attack mammalian cell (including red blood cell) membranes, and are often referred to as hemolysins.

Panton-Valentine leukocidin: This **pore-forming toxin** lyses PMNs. Production of this toxin makes strains more virulent.

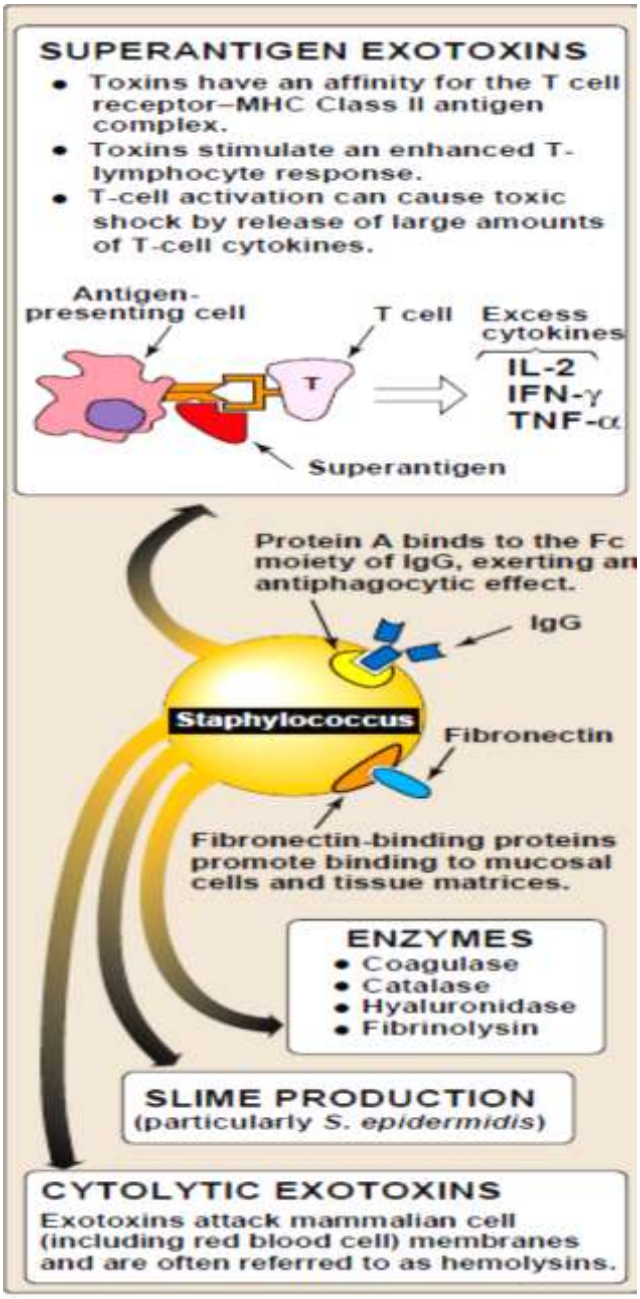
Superantigen exotoxins: These toxins have an affinity for the T-cell receptor–major histocompatibility complex Class II antigen complex. This major T-cell activation can cause toxic shock syndrome, primarily by release into the circulation of inordinately large amounts of T-cell cytokines, such as interleukin-2 (IL-2), interferon-γ (IFN-γ), and tumor necrosis factor-α (TNF-α).

Enterotoxins: (**six major antigenic types: A, B, C, D, E, and G**) are produced by approximately half of all *S.aureus* isolates. When these bacteria contaminate food and are allowed to grow, they secrete enterotoxin, ingestion of which can cause food poisoning. Enterotoxins are superantigens that are even more heat-stable than *S. aureus*. Therefore, organisms are not always recovered from incriminated food but the toxin may be recovered.

Toxic shock syndrome toxin (TSST –1): This is the classic cause of toxic shock syndrome (TSS). Because of similarities in molecular structure, it is sometimes referred to as staphylococcal **enterotoxin F**, although it does not cause food poisoning when ingested.

Exfoliatin (exfoliative toxin, ET) is also a superantigen. It causes scalded skin syndrome in children. The toxin cleaves desmoglein 1, which is a component of desmosomes (cell structures specialized for cell to-cell adhesion). Cleavage results in loss of the superficial skin layer.

Enzymes produce by staphylococcus
1-Coagulase
2-Catalase
3- Hyaluronidase
4- Fibrinolysin



Immunity

S. aureus infections do not elicit strong or long-lasting immunity, as demonstrated by the continuing susceptibility of individuals to S. aureus infections throughout life.

Sensitivity test

1-Nafcillin/oxacillin are drugs of choice because of widespread penicillinase-producing stains.
2-Mupirocin for topical treatment.
3-For methicillin-resistant *Staphylococcus aureus* (MRSA):
4-Vancomycin For vancomycin-resistant *Staphylococcus aureus* (VRSA) or Vancomycin-intermediate *S. aureus* (VISA).