STAPHYLOCOCCI

By

Prof. Dr. Batool Hassan Al-Ghueabi

STAPHYLOCOCCI

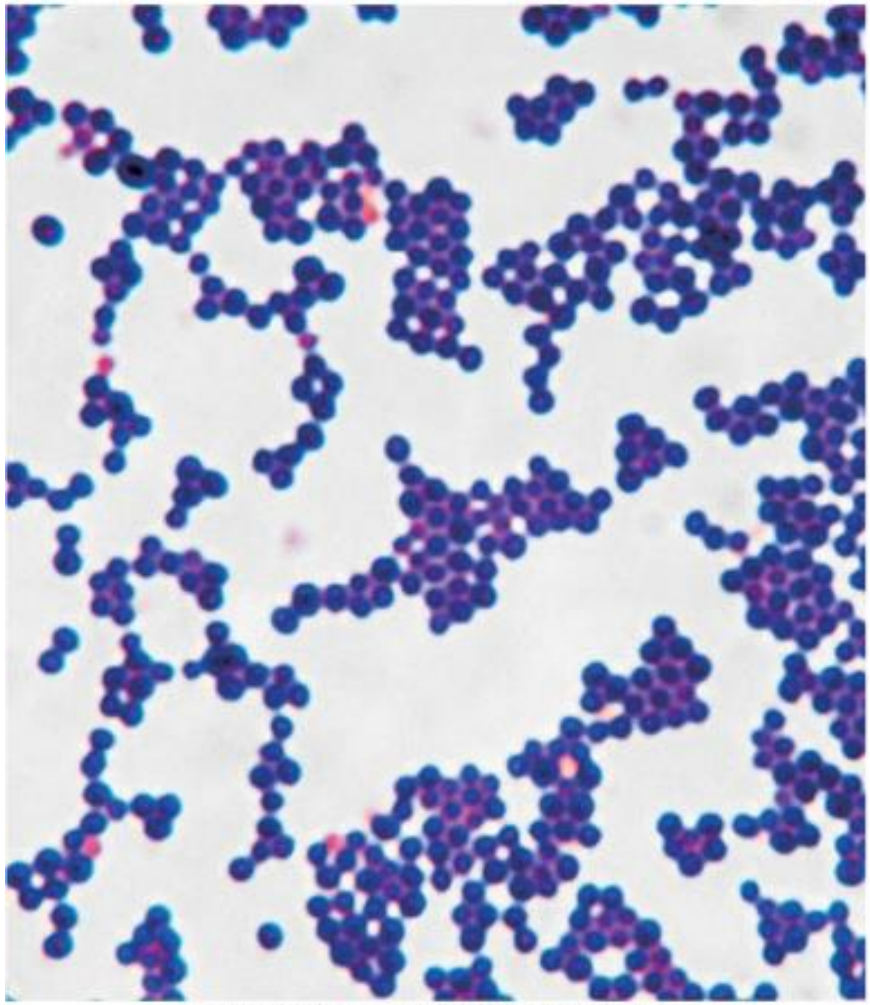
-Staphyloccocci - derived from Greek word: staphylē,

"bunch of grapes" and kókkos, "granule“.

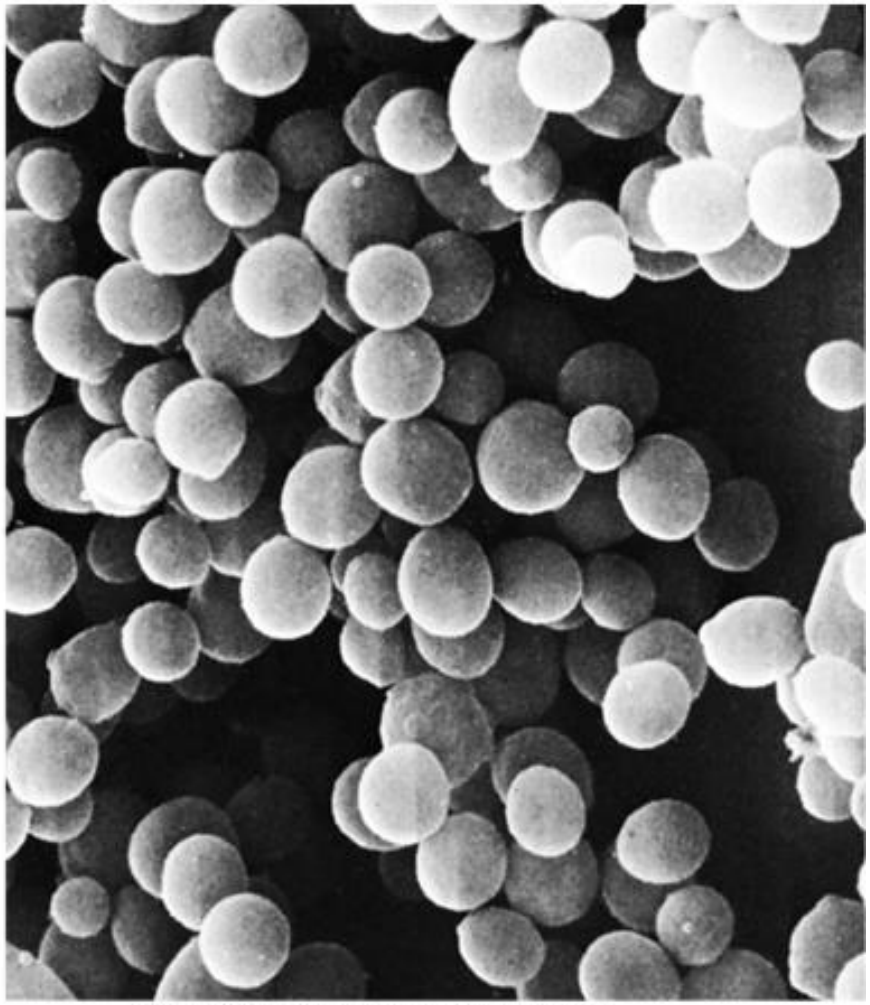
- Staphyloccocci is a genus of Gram-positive bacteria.

Under the microscope they appear round (cocci), and form in

grape-like clusters.



© Eye of Science/Photo Researchers



© David M. Phillips/Visuals Unlimited


Staphylococcus Bacteria

Scientific Classification

Kingdom: Bacteria

Phylum: Firmicutes

(Latin: firmus ‘strong’ and cutis ‘skin’ referring to the cell wall)

Class: Bacill**ales**

Order: Bacilli

Family: Staphylococc**acea**

Genus: Staphylococcus

The Staphylococcus **genus** includes at least forty species.

Each species contain strains

- ***Staphylococcus aureus***
- ***Staphylococcus epidermidis***
- Most of these species are harmless and reside normally on the skin and mucous membranes of humans and other organisms.

-They are ubiquitous.

Characters of Staphylococci •

- Gram-positive cocci, arranged in grape-like • clusters
- Non motile •
- Non spore forming •
- Facultative anaerobe •
- Ferment glucose and produces lactic acid •

- Catalase positive (meaning it can produce the enzyme catalase), so is able to convert hydrogen peroxide **(H2O2)** to **water H2O** and **oxygen O2**, the catalase test useful to distinguish staphylococci from streptococci.

- Coagulase positive (some species negative)

- Oxidase-negative

- Normal flora of humans found on nasal passages, skin and mucous membranes.

Grouping of Staphylococci

- Staphylococci are divided in to two groups based on the presence or absence of the enzyme coagulase. This enzyme converts fibrinogen into fibrin causing blood plasma to clot.

1. Coagulase positive Staphylococci (pathogenic)

- ***Staphylococcus aureus***

2. Coagulase negative Staphylococci (non pathogenic)

- ***Staphylococcus epidermidis***
- ***Staphylococcus saprophyticus***

S. aureus infections

S. aureus causes a variety of infections from pus-forming infections and toxinoses in humans.

- Presence of pus is characteristic of skin infections caused by *S. aureus,* so it is called Suppurative or pyogenic infections.

It causes **skin infections, pneumonia, meningitis, urinary tract infection**; and deep-seated infection such as **osteomyelitis and endocarditis.**

S. aureus infections

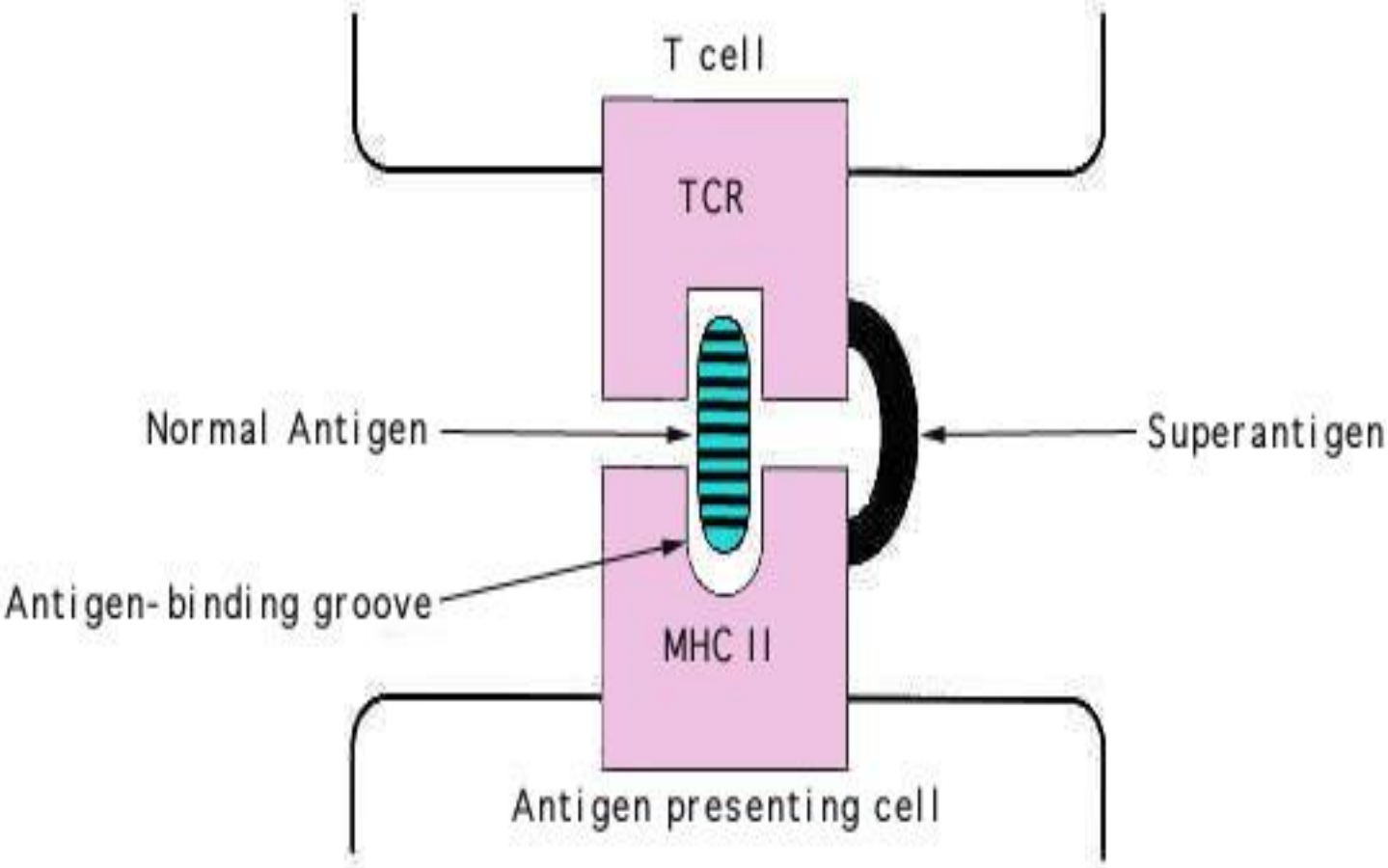
- *S. aureus* is a major cause of **hospital acquired infection** of surgical wounds (nosocomial infection) and infections associated with medical devices (Catheters).
- Catheters :are medical devices that can be inserted in the body to treat diseases or perform a surgical procedure .

S. aureus infections

- *S. aureus* causes **food poisoning** by releasing enterotoxins into food, and **toxic shock syndrome** by release of toxic shock syndrome toxin (superantigens) into blood stream.

Superantigens: are antigens that stimulate T cells non-specifically without normal antigenic recognition. Up to one in five T cells may be activated, whereas only 1 in 10,000 is stimulated during a usual antigen presentation.

Cytokines are released in large amounts, causing the symptoms of toxic shock syndrome.


T cell
TCR
Normal Antigen
Superantigen
Antigen-binding groove
MHC II
Antigen presenting cell

Virulence factors •

A-Cell-Associated Virulence Factors •

1. Capsule or slime layer •

2. Teichoic acid •

3. Protein A: •

4. Clumping factor (bound coagulase)

B-Extracellular Enzymes

1. Catalase
2. Coagulase (bound or free):
2. Hyaluronidase
3. Nuclease
4. Protease
5. Lipases
6. Beta-lactamase or Penicillinase: confers antibiotic resistance

C-Exotoxins

1-Cytolytic (cytotoxins; cytolysins), they cause cytolysis as a result of plasma membrane damage.

a. Alpha toxin

b. Beta toxin

c. Gamma toxin

d. Delta toxin: Cytopathic for RBCs, macrophages, lymphocytes, neutrophils and platelets.

e. Leukocidin: Kills neutrophils

2-Enterotoxin

3-Exfoliative toxin (epidermolytic toxin)

4-Pyrogenic exotoxins