

Staphylococcus spp.

By: Hadeel Luay

1. Species

The genus *Staphylococcus* includes several species, but the most important ones in medical microbiology are:

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

***Staphylococcus aureus* is the most pathogenic species and causes many infections in humans.**

2. Morphology and Staining

Staphylococci are Gram-positive spherical bacteria (cocci). They appear in clusters resembling grapes when viewed under the microscope. They are non-motile, non-spore forming, and facultative anaerobes.



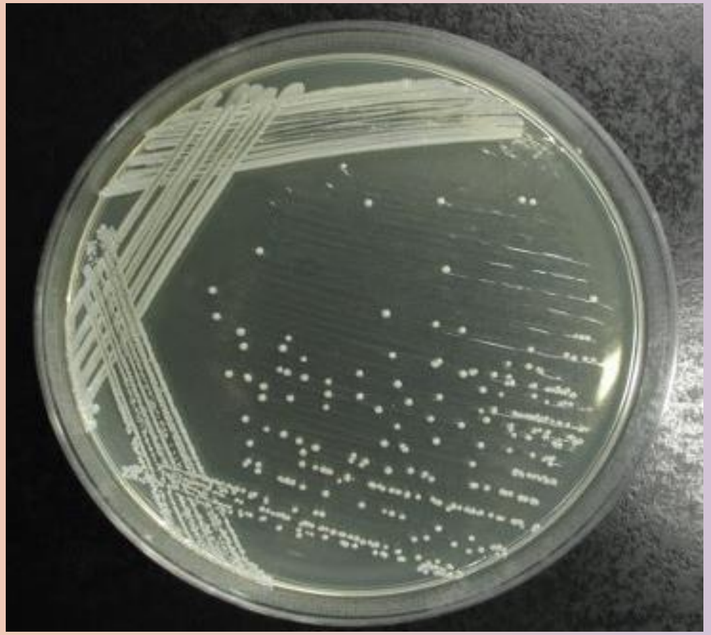
3. Cultural Characteristics

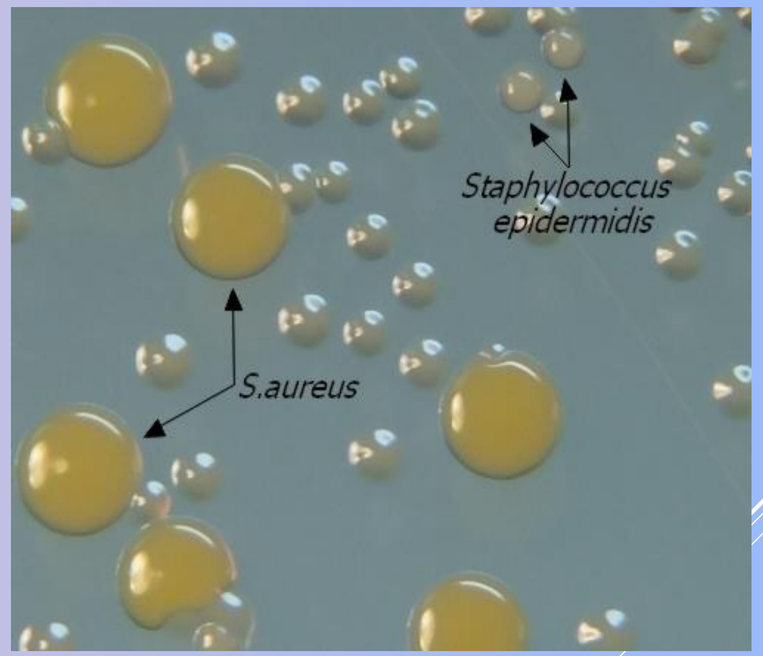
Staphylococci **grow well on ordinary culture media such as nutrient agar, blood agar, milk agar and Mannitol slat agar. The colonies are usually round, smooth, and opaque.**

- ***Staphylococcus aureus*** **produces golden-yellow colonies after 18-24 hours and often shows beta-hemolysis on blood agar.**
- ***Staphylococcus epidermidis*** **forms white colonies after 18-24 hours in the incubator and usually does not cause hemolysis on blood agar.**
- ***Staphylococcus saprophyticus*** **forms creamy colonies after 18-24 hours in the incubator and usually does not cause hemolysis on blood agar.**

1. Nutrient agar

The colonies are pigmented golden yellow, circular 1 to 2 mm. in diameter, convex , opaque, glistering, with entire edges





2. Blood agar

Staphylococcus aureus	***Staphylococcus epidermidis***	***Staphylococcus saprophyticus***
Shows golden-yellow colonies and often shows beta-hemolysis on blood agar.	**Shows white colonies and does not cause hemolysis on blood agar.**	**Shows creamy colonies and does not cause hemolysis on blood agar.**
		

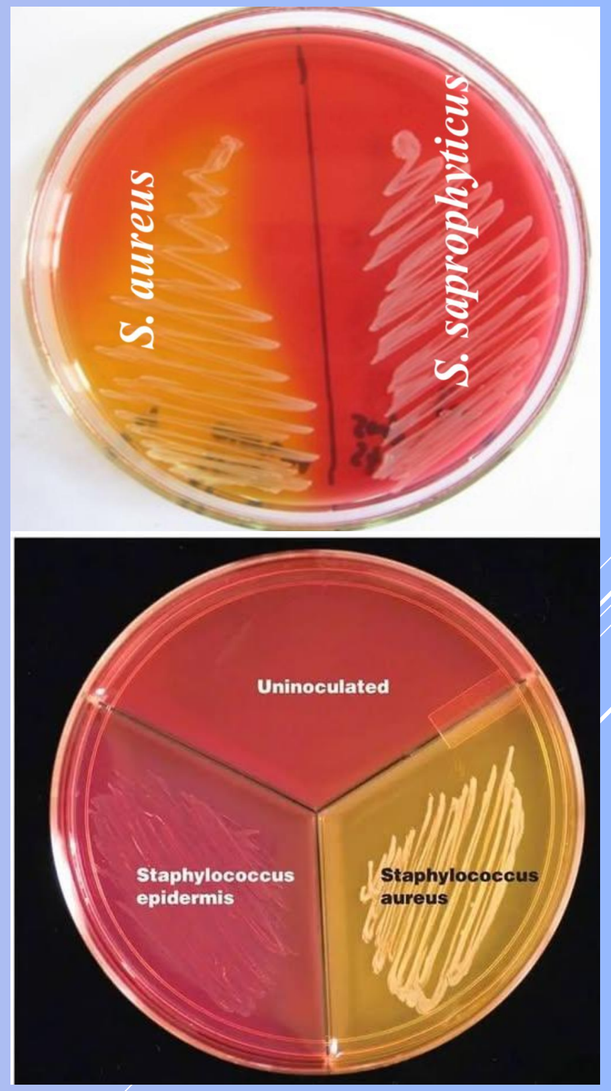
3. Mannitol Salt Agar (MSA)

• **Because of *Staphylococci* tolerance to high salt concentration the MSA act as highly selective media for them. It contains 7.5–10% of NaCl (sodium chloride).**

• **This medium could be used for growth on the MSA isolation of pathogenic *staphylococci* from specimen (pus, feces).**

• ***Staphylococcus aureus* on MSA is capable of fermenting the (sugar) mannitol in the medium to acid and causes the medium to change color to yellow because of the presence of phenol red indicator.**

• **MSA able to differentiate between bacteria that can ferment mannitol and those that cannot ferment mannitol.**



Mannitol salt agar (selective and differential) for isolation of staphylococci.

4. Biochemical Tests

Several biochemical tests are used to identify Staphylococcus species:

- **Catalase test: Positive in all Staphylococcus species.**
- **Coagulase test: Positive in Staphylococcus aureus and negative in most other species.**
- **Mannitol fermentation: Staphylococcus aureus ferments mannitol on Mannitol Salt Agar.**

Feature	Staphylococcus aureus	Staphylococcus *epidermidis*	Staphylococcus *saprophyticus*
Gram stain	Gram positive cocci	Gram positive cocci	Gram positive cocci
Catalase	Positive	Positive	Positive
Blood agar	Beta hemolysis	Non hemolytic	Non hemolytic
Mannitol fermentation (MSA)	Ferments mannitol	Does not ferment	Does not ferment
Coagulase	Positive	Negative	Negative

Differentiation of Gram-positive cocci

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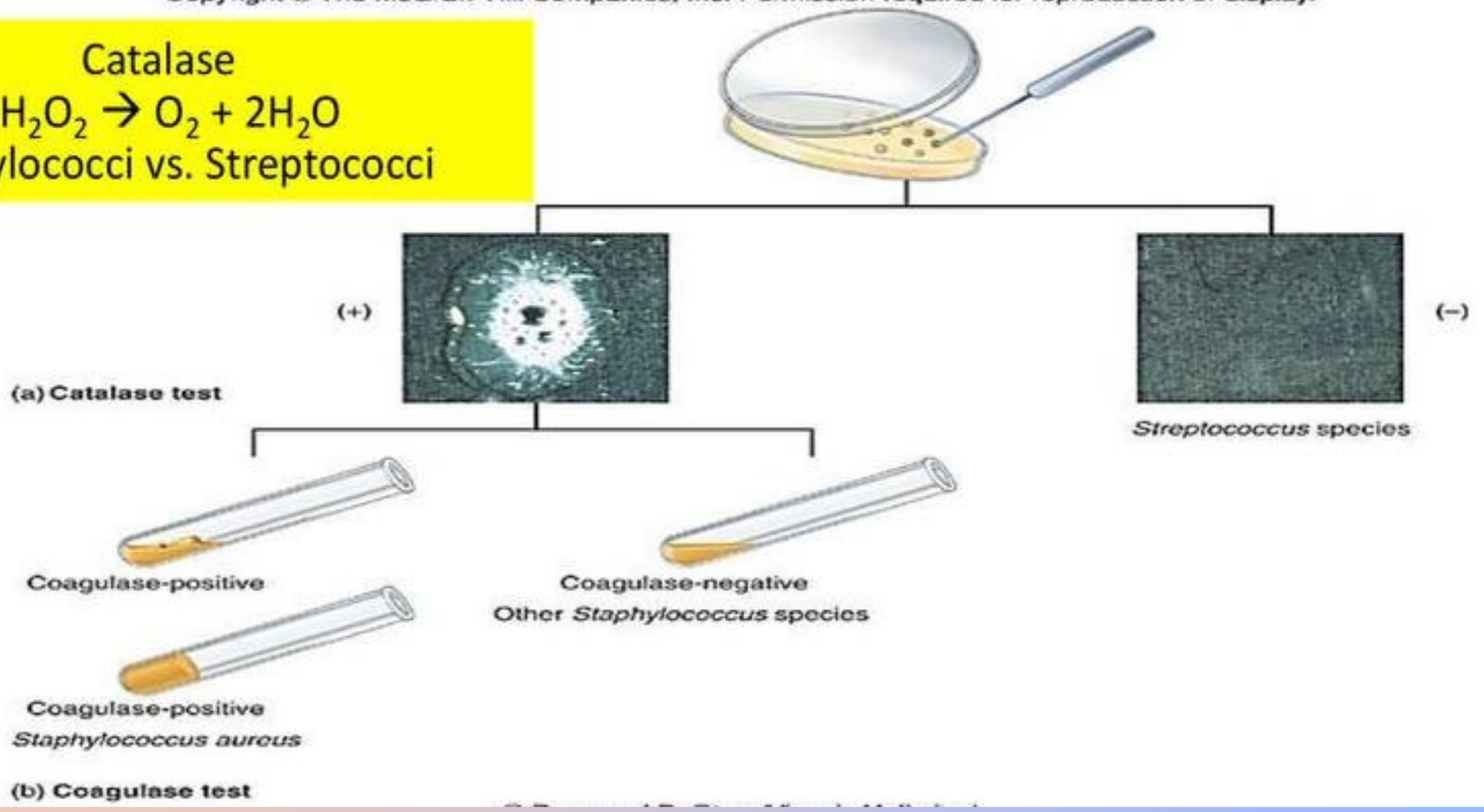
Catalase

$2H_2O_2 \rightarrow O_2 + 2H_2O$

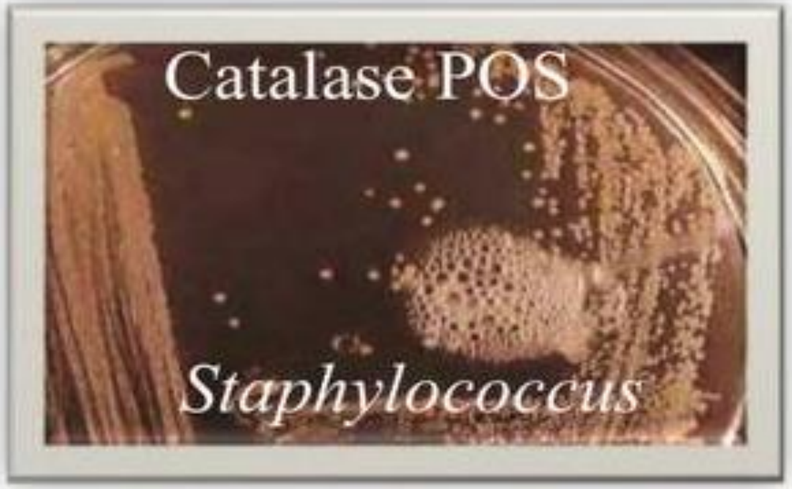
Staphylococci vs. Streptococci



1. Catalase Test



Catalase
$2H_2O_2 \rightarrow O_2 + 2H_2O$
Staphylococci vs. Streptococci



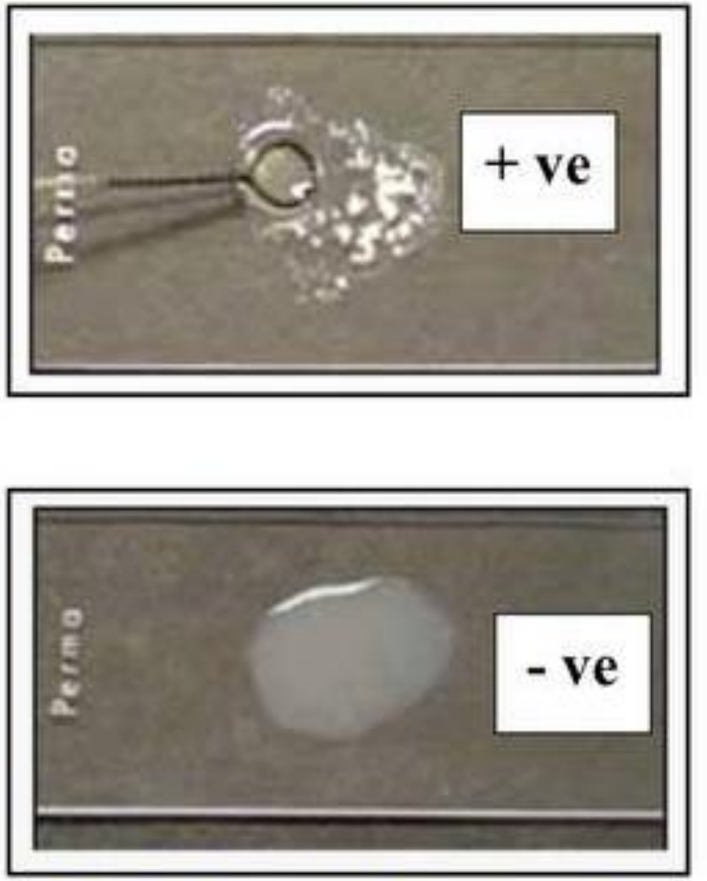


2. Coagulase Test

Most strain of *S. aureus* produce bound Coagulase or clumping factor which is detected by slide Coagulase test.

Procedure:

A loop full of the Staphylococcal culture is emulsified in a drop of water on a microscopic slide then anther loop full of rabbit plasma is added and mixed well with the bacterial suspension . Positive reaction is indicated by clumping within one or two minute .



Positive and negative reaction for slide test

4. Diagnosis

1. In suppurative conditions, the likelihood of staphylococcal infection must be considered and appropriate specimens such as pus exudates collected for laboratory procedures.

2. Gram-stained smears of pus or other suitable specimens may reveal typical staphylococcal clusters.

3. Specimens are cultured on blood agar, selective blood agar and incubated aerobically at 37°C for 24 hour

5. Diseases

1.Staphylococcus aureus can cause a wide range of diseases, including:

- Skin infections (boils, abscesses, impetigo)
- Food poisoning
- Pneumonia
- Endocarditis
- Toxic shock syndrome

2. Staphylococcus epidermidis is commonly associated with infections related to medical devices such as catheters and prosthetic implants.



Environmental Decontamination



Need adequate surface disinfection