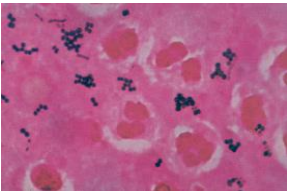



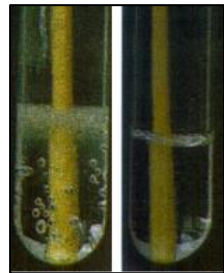


Differentiation between staphylococcus and streptococcus:

	Staphylococcus	Streptococcus
Catalase test	+	-
Gram stained smears	Gram + cocci, non-motile, non-capsulated, uniform size, occur single or in pairs or clusters, some strains are β-hemolytic on blood agar 	Gram + cocci, non-motile, some are capsulated, forming long chains in fluid cultures, but found single or in pairs on forming short chains on solid media 

Catalase test:

- Used to differentiate between bacteria producing catalase enzyme (staphylococcus) and those which don't (streptococcus).
- A colony of the tested bacteria is added to 2-3ml of 3% hydrogen peroxide in a test tube. If the bacteria is catalase-positive, hydrogen peroxide will be broken down to water and oxygen (which will appear as bubbles in the solution).

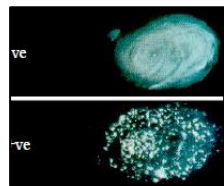


Differentiation between the species of staphylococcus:

Species	Coagulase test	DNase test	MSA
S.aureus	+	+	+ (mannitol utilized = yellow)
S.epidermidis & species other than S.aureus	-	-	- (mannitol not utilized = pinkish)

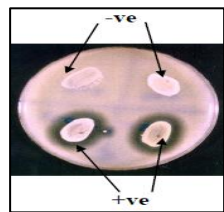
Coagulase test:

- Differentiating between coagulase positive staphylococcus such as S.aureus and CoNS such as S.epidermidis.
- A drop of physiological saline is added to a slide → a colony of bacteria will be emulsified in it → a drop of undiluted human plasma is added → look for clumping within 10 sec.



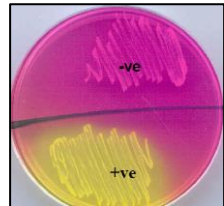
DNase test (it confirms coagulase test):

- Differentiating S.aureus from other species of Staphylococci which do not produce DNase.
- The organism which will be tested is culture on a medium containing DNA → weak HCl is added after overnight incubation → unhydrolyzed DNA will precipitate & DNase producing colonies will be surrounded by clear areas.



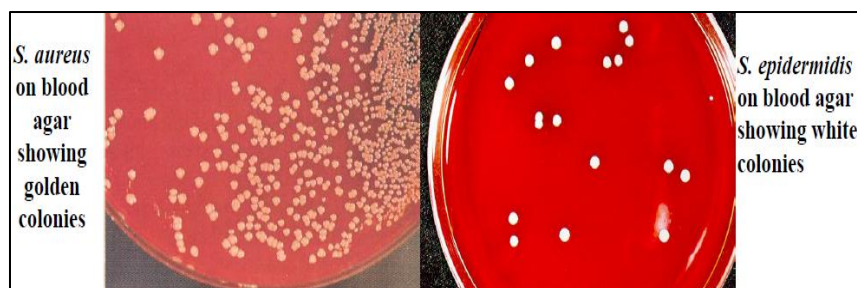
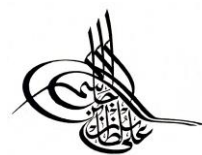
Mannitol Salt Agar:

- Useful with fecal specimens when investigating staphylococcal food-poisoning.
- S.aureus colonies will grow and produce yellow zones around them.
- S.epidermidis colonies will grow and produce red or purple zones around them.



Staphylococcus aureus:

- Gram (+) cocci occurring mostly in clusters (grape-like groups) and has all the characteristics of staphylococcus genus mentioned in the first table above.
- Some strains produce a high heat-stable protein toxin causing illness in humans.
- On blood or chocolate agars, they produce yellow creamy colonies (1-2mm in diameter).



- **Coagulase-negative staphylococcus (CoNS):**

- **Constituent of normal human microbiota but cause infections with:**

- ✓ Indwelling catheters.
- ✓ Cardiac valves.
- ✓ Cerebrospinal fluid shunts.
- ✓ Prosthetic devices.

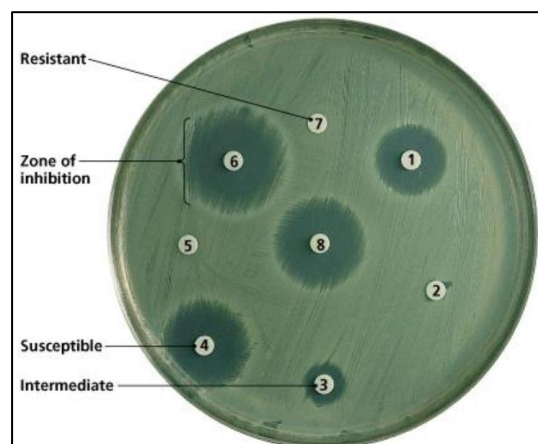
- **They include:**

S.epidermidis	74%-92% of all hospital acquired CoNS infections
S.hemolyticus	Relevant in endocarditis, sepsis, peritonitis, urinary tract infections, osteomyelitis & wound infections
S.saprophyticus	Urinary tract infection in young females
S.lugdunensis	Native valve endocarditis

- 50% of CoNS are resistant to methicillin (80% of S.epidermidis is resistant to it).

- **Antibiotic disk sensitivity test:**

- Determines susceptibility of microorganisms to antimicrobial agents.
- For an organism which is sensitive to an antimicrobial agent, the colonies will be surrounded by zones of inhibition around the disc impregnated with the antimicrobial agent.
- Accurate measurement of zone diameter (using a ruler or a caliper) is necessary to properly interpret this test.
- Take a specimen from a culture using swab → spread it on Penassay Agar plate → let the plate dry at room temp. for several minutes → apply your antibiotic disks using a disk dispenser → incubate the plates for 1-2 days at 37



- **Mechanisms of resistance to beta-lactam antibiotics:**

- Gram (+) bacteria have peptidoglycan which contains penicillin-binding proteins facilitating the entry of penicillins to the bacteria.
- **Resistance develops when beta-lactam antibiotics:**
 - ✓ Fail to bind to altered penicillin-binding proteins.
 - ✓ Or when they are hydrolyzed by beta-lactamases produced by the bacteria itself.

- **Clinical relevance:**

S.aureus	* Non-pyogenic infections (infections with no pus production) * Pyogenic infections in many areas of the body: staphylococcal skin scalded syndrome, toxic shock syndrome, food-poisoning (enterotoxins)
S.epidermidis	* In pace makers. * Prosthetic devices. * Central venous catheters.
S.saprophyticus	* Urinary tract infections in females