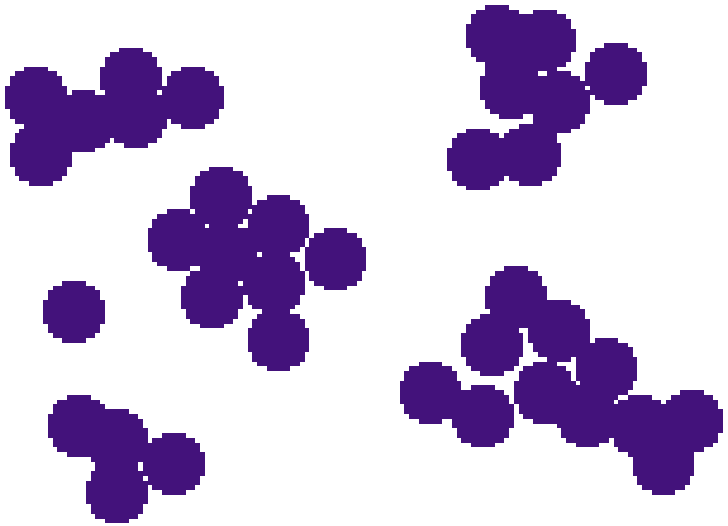
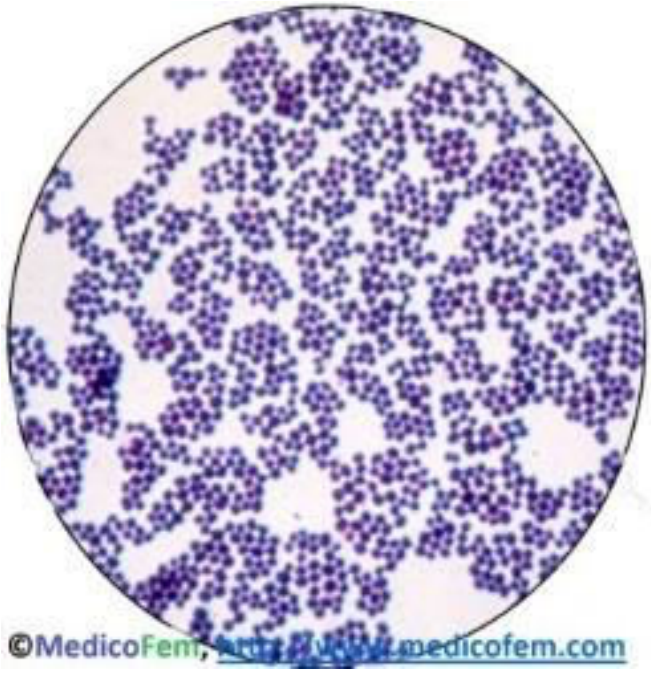
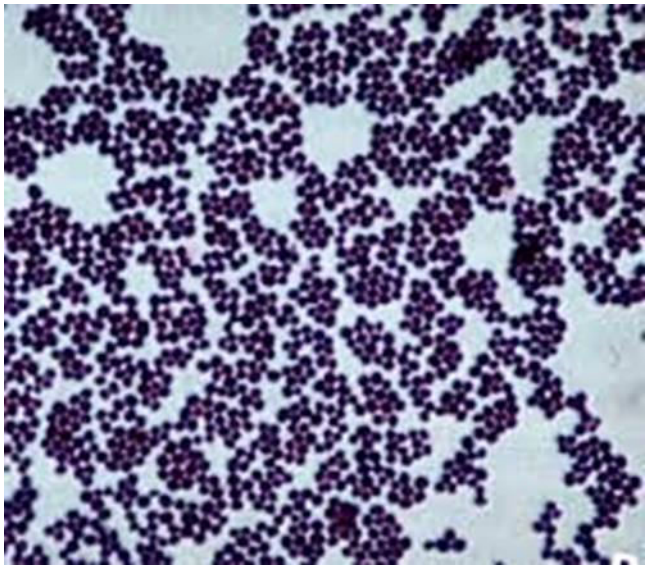
Gram Positive Cocci (Staphylococci)





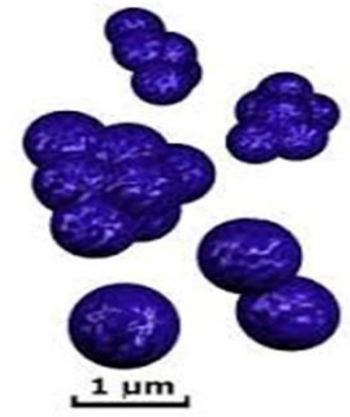
Staphylococci

- **Staphyle:** Derived from Greek “stapyle” which means bunch of grapes.
- **Cocci:** spherical



Morphology:

Gram positive, cocci in groups



Staphylococcus aureus

Staphylococci spp.

The most important spp. are:

Staphylococcus aureus (The most virulent one)

S. epidermidis

S. saprophyticus

Characteristics of Staphylococci

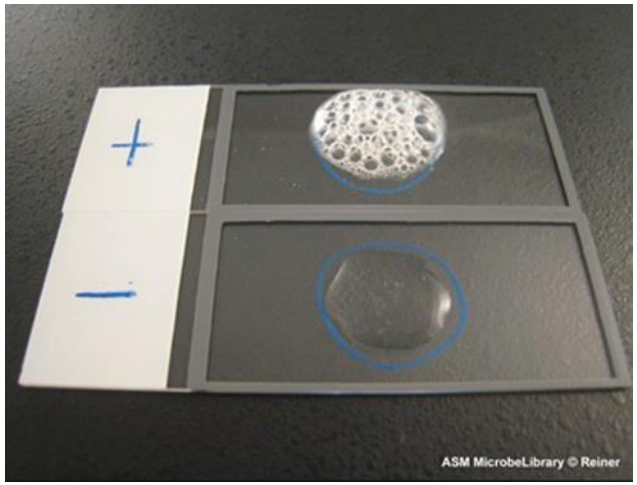
1. Morphology>>
- Gram positive cocci.
- Arranged in grape like clusters.

2. Habitat>>
- They are ubiquitous in nature (found on any inanimate surface).
- About a dozen species occurring as part of human flora on the skin, in the nose, throat, and in the stool.

3. Culture>>

They are Facultative anaerobic (Can live with or without Oxygen).

4. Biochemical Reactions>>
Produce Catalase enzyme
(give positive catalase test
in the lab).



5. Non-sporulating.

6. Resistant to heat, drying and high salt concentration.

7. Staphlyococcus can easily spread from person to person via hand to hand contact

Note: **areas at highest risk for severe staphylococcal infections:**

- New born nursery
- ICU
- Operating rooms and
- Cancer chemotherapy wards

Staphylococci are Calcified into:

➢ Coagulase Positive Staphylococci:

- Can produce Coagulase enzyme.
- The most virulent

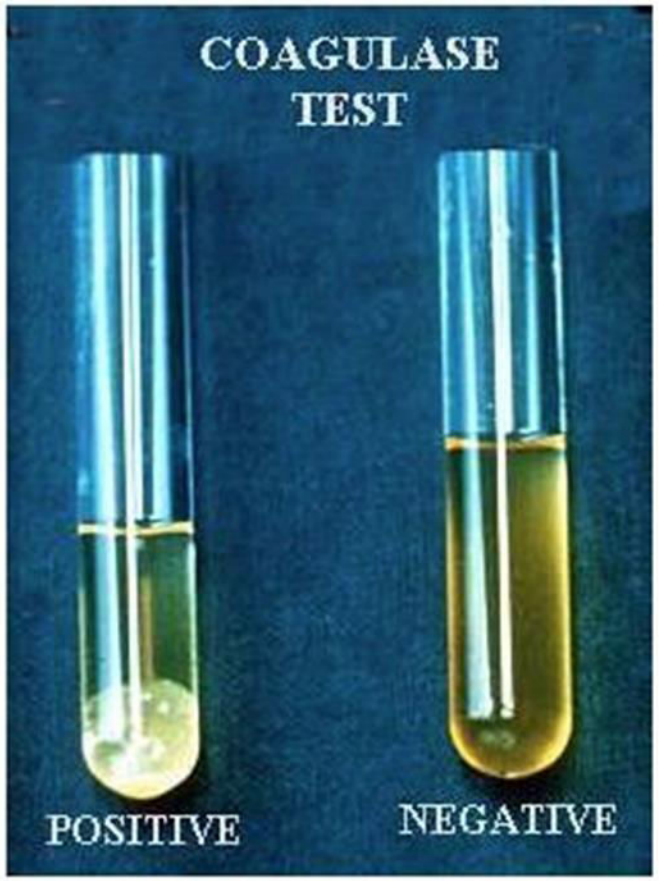
Staphylococcus aureus

➢ Coagulase Negative Staphylococci:

- Do not produce Coagulase enzyme.
- Occasionally cause disease.
- Mainly:

Staphylococcus epidermidis

Staphylococcus sparophyticus



S. aureus

S.aureus Virulence factors:

1. Cell wall Virulence factors:

- **Capsule:** very thin, resist phagocytosis.
- **Protien A:** anti-phagocytic (bind to Fc region of IgG).
- **Fibronectin-binding protein (FnBP):** promote binding to mucosal cells.
- **Clumping factor:** enhance clumping of the organisms in the presence of plasma.

2. Cytolytic toxine (hemolysins): attack mammalian cell membranes and leads to lysis.

3. Panton-Valentine leukocidin: it lyses PMNs. Predominantly produced by MRSA.

4. Enterotoxins: produced by ½ of *S.aureus*, it's toxin to the intestine. Ingestion of enterotoxin in contaminated food cause food poisoning.

S. aureus Infections:

- **Localized skin infections:** the most common *S.aureus* infections , small superficial abscesses involving hair follicles or sweat or sebaceous glands. Example of it is Blepharitis.

- **Deep , localized infections:** these are usually metastatic from superficial infections. The most common is chronic infection of bone marrow and septic joint in children.

- **Acute endocarditis:** generally associated with intravenous drug abuse.

- **Septicemia:** blood poisoning.

- **Pneumonia:** it cause sever necrotizing pneumonia.

- **Nosocomial infections:** often related to wound infection or bacteremia associated with catheters.

- **Toxinosis:** Toxic shock syndrome, Staphylococcual gastroenteritis, Scalded skin syndrome.

How do Staphylococcus aureus cause the infection??

- Penetrate the deep tissues of skin damaged by:

burns, cuts, insect bites, skin diseases.

- Insertion of a foreign body.
- Obstructed hair follicle.
- Compromised immune system.

Treatment of S.aureus infections in general

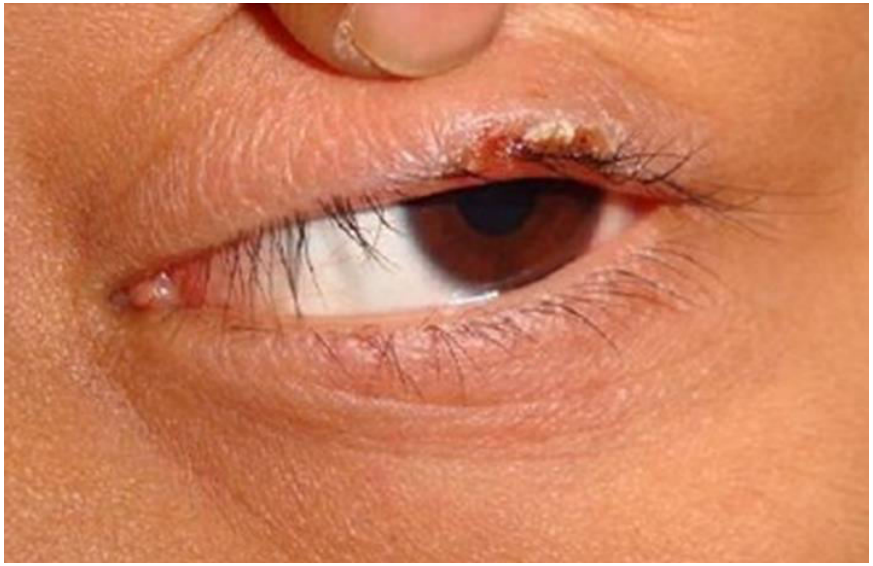
- Usually require incision & drainage of localized lesions, as well as systemic antibiotic.
- Nowadays all community and hospital acquired S. aureus infection as are resistant to penicillin G.
- Currently the drug in serious infections is β-lactamase-resistant penicillin such as methicillin or oxacillin.
- The increased use of these antibiotics resulted in the evolving of a S.aureus that is resistant to a number of β-lactam antibiotics such as methicillin , oxacillin and amoxicillin. Those strains are called **Methicillin Resistant Staphylococus aureus (MRSA).**
- Vancomycins resistance: vancomycin has been the agent of choice for empiric treatment of life-threatening MRSA . Since 1997 low level resistance to vancomycin has been observed and it has been in the rise since then.

Blepharitis

Blepharitis: Inflammation of the base of the eyelid.

Ulcerative Blepharitis:

- Characterized by the deposition of yellow crusts at the roots of eyelashes.
- Presence of ulcer under the crusts.
- Bleeding on crust removal
- Swelling of the lid margins and falling of the eyelashes.

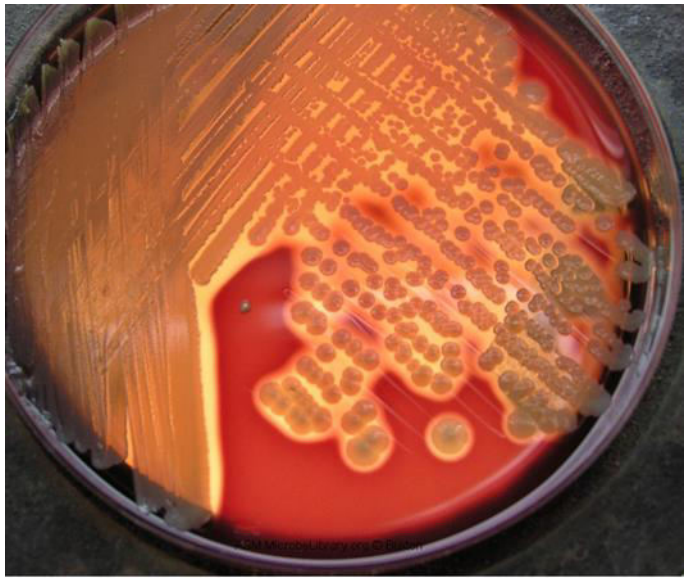


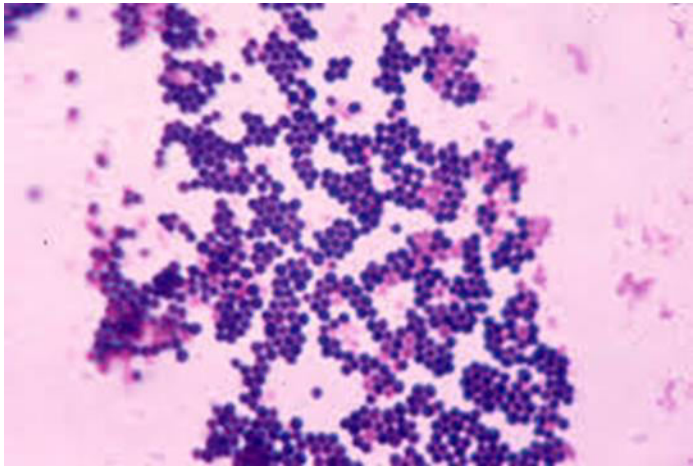
Etiologic Agent of Ulcerative Blepharitis

- Most common is

Staphylococcus aureus

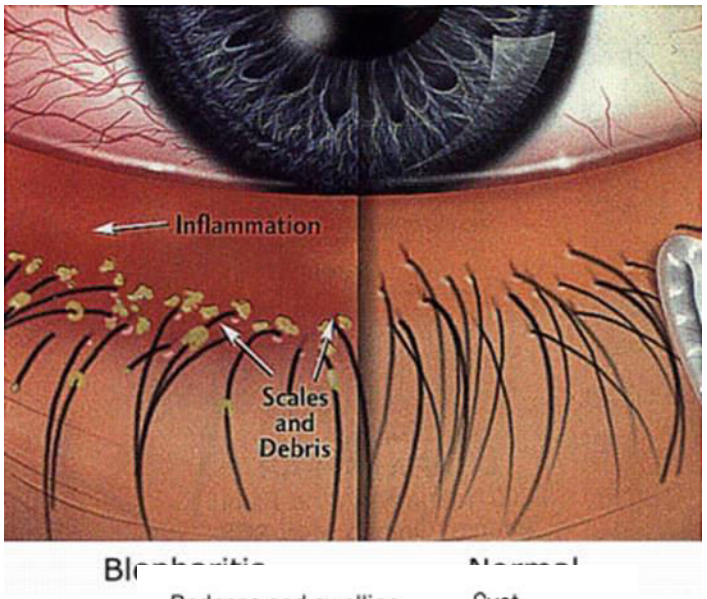
(Coagulase Positive Staphylococci).

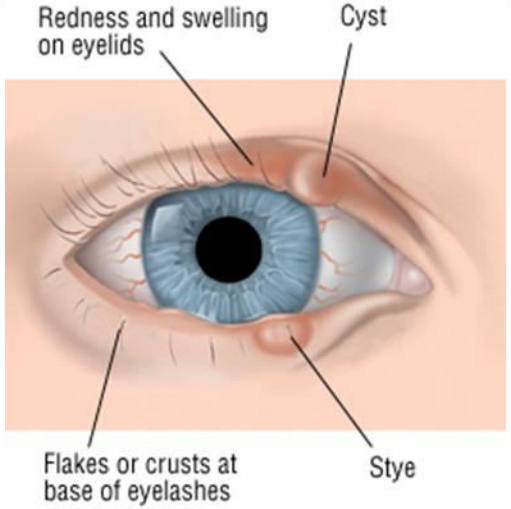




General Signs & Symptoms

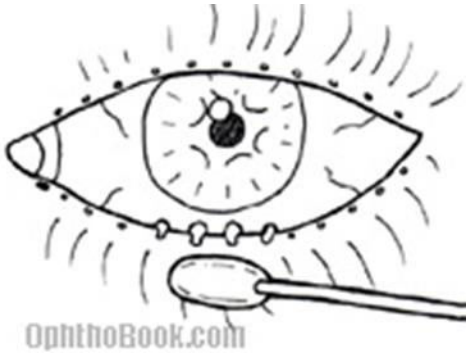
- Foreign-body sensation.
- Dryness.
- Tearing.
- Itching.
- Burning.
- Crusting around the eyes.
- Eyelid swelling.
- Mild discharge.
- Sticking of eyelids mostly upon waking.





Diagnosis

- The clinical appearance of the eyelids is virtually diagnostic.
- Scraping or swabbing can be sent for culture in severe or recurrent cases.



Treatment

- Lid hygiene
- Warm compresses for 20 minutes 2 to 4 times a day on the eyes.
- Mechanical removal of crusts by scrubbing.
- Scrub the eyelid margins with mild shampoo (Johnson’s baby shampoo) .
- Artificial tears 4 to 6 times a day.
- Application of antibiotic eye ointment e.g. Erythromycin ointment at bedtime.

Other eye infections that can be caused by S.aureus

- **Conjunctivitis>>** mostly acute purulent conjunctivitis

✓ Conjunctiva becomes red.
✓ Lids are slightly edematous.
✓ Mucopurulent discharge.
✓ Glueing of the eyelashes after night sleep.
✓ Photophobia.
✓ Commonly seen in children but can affect any age group.
✓ Short incubation period.
✓ Bacterial conjunctivitis is bilateral.
✓ May manifest either in mild or severe form.

- **Bacterial corneal ulcer (=bacterial keratitis)**

MRSA

- MRSA is a type of Staphylococcus, sometimes called “superbug” that is resistant to most of the antibiotics.
- It is hard to treat.
- They are resistant to most other drugs including tetracyclines, erythromycins, aminoglycosides.
- Vancomycin has been the drug of choice for MRSA infections.
- 1997 several MRSA’s were isolated that had also acquired low-level vacomycin resistance.

- Methicillin-resistant *Staphylococcus aureus* is one of the most common causes of postoperative ophthalmic infections.
- Hence infectious blepharitis , if present, should be treated prior to surgery.

Coagulase Negative Staphylococci

- Around 12 different coagulase negative staphylococcl species have been recovered as normal flora of human skin and anterior nares.

- The most abundant and important species are:

✓ *Staphylococcus epidermidis.*

✓ *Staphylococcus saprophyticus.*

- Coagulase negative stpahylococci are important agents of hospital-acquired infections associated with the use of implanted prosthetic devices and catheters.

The Difference

Staphylocuccus aureus

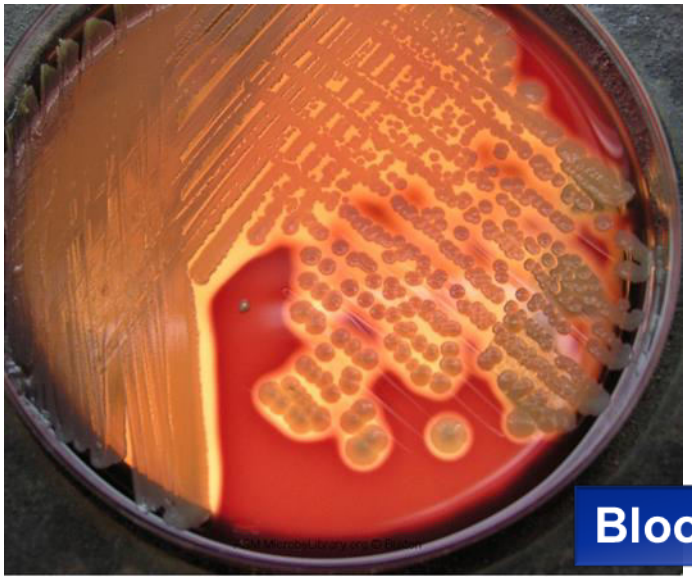
- Gram positive cocci in clusters
- Catalase +ve.
- Coagulase +ve.
- Blood agar>> βhemolysis , creamy yellowesh colonies.
- Mannitol salt agar>> ferment mannitol and give yellow colonies

Coagulase Negative Staphylococci

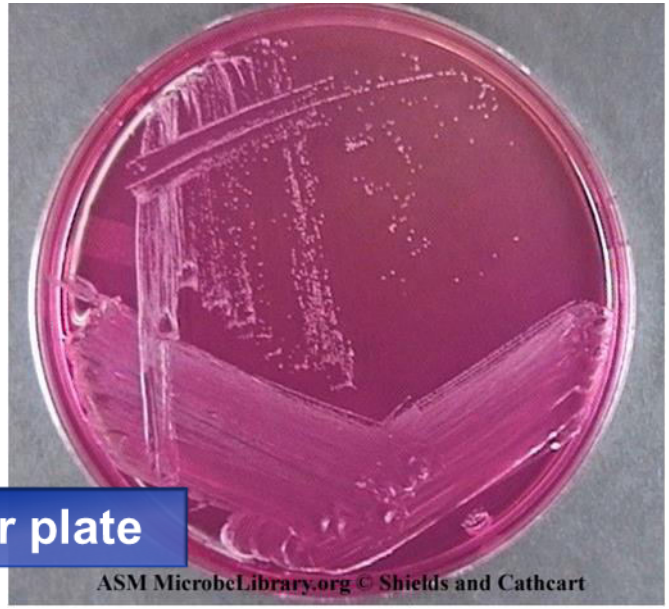
- Gram positive cocci in clusters.
- Catalase +ve.
- Coagulase –ve.
- Blood agar>> No hemolysis , gray colonies.
- Mannitol salt agar>> dose not fermint manitol and no yellow colonies.

Staphylococcus aureus

Coagulase Negative Staphylococci



Blood Agar plate



Mannitol Salt Agar plate