Pyogenic cocci.....
Pyogenic means “pus forming”
Cocci means “spherical bacteria”
  - Genus Staphylococcus.
  - Genus Streptococcus.
  - Genus Neisseriae.

**Genus staphylococcus.**
Gram's positive, spherical, arranged in grape like clusters non motile, non spore forming, occasionally capsulated and most are catalase positive.
This microorganism is widely distributed in our environment some of them are members of the normal flora of humans, others are important human pathogens.
Staphylococcus contains more than 30 spp. but only 3 are of medical importance:
  1. Staphylococcus aureus (Coagulase positive staph.)
  2. Staphylococcus epidermidis (coagulase negative staph. as normal flora).
  3. free living Staphylococcus saprophyticus.
Cultural characteristics of S. aureus:
Aerobic, grow on ordinary media can tolerate (9% NaCl) and (50°C for 1/2 hr.), colonics are smooth low convex, glistening, densely opaque and surrounded by a clear narrow zone of hemolysis on blood agar, pigmented (yellow → gold). The most important biochemical character is manitol fermentation.

Enzymes and Toxins

1. Catalase: Is an enzyme that breaks hydrogen peroxide into $O_2$ and $H_2O$ which is toxic to bacteria.
2. Coagulase (free & bound): It’s an enzyme like protein; it clots citrated or oxalated human or rabbit plasma. The serum factor reacts with coagulase, which converts fibrinogen (soluble) into fibrin (insoluble), fibrin can be deposited on the surface of bacteria forming a wall around the bacteria which has an important role in:
   A) Protection of bacteria from phagocytosis.
   B) Preventing the action of antibiotics.
3. Protease
4. Lipase: breaks down lipid in the skin, lipoprotein in blood.
5. Hyaluronidase enzyme breaks down hyaluronic acid which is important substance in binding tissue cells together therefore it is called (spreading factor).
6. Hemolytic toxins A&B as exotoxins can lyse RBC, damage platelets and has a powerful action on vascular smooth muscle.
7. Leucocidin → death of leukocytes → necrosis of tissues.
8. Enterotoxin (A-F) are super antigen bind + MHC class II molecules → stimulation of T-lymphocyte and induce
release of IL₁ 2IL₂ can cause food poisoning (I.P 8 hr.) and induce vomiting and water non-bloody diarrhea and can not be inactivated by heat.

9. Exfoliative toxin: also super antigen produced only by certain strains of Staphylococcus aureus includes at least 2 proteins that yield the generalized desquamation resulted in scalded skin appearance.


**Sensitivity to antibiotics:**
- Most clinical isolate resist benzyl penicillin due to production of B.lactamase this criteria controlled by plasmid.
- Resistance of some isolates to broad spectrum penicillin due to lack of gene coding for penicillin binding protein or PB receptor.
- Some strains of S.aureus are resistant to the B.lactamase resistant penicillin, such as MRSA Methicillin resistant Staphylococcus aureus (MRSA) is a bacterium responsible for several difficult to treat infections in humans. The evolution of such resistance does not cause the organism to be more intrinsically virulent than strains of Staphylococcus aureus that have no antibiotic resistance, but resistance does make MRSA infection more difficult to treat with standard types of antibiotics and thus more dangerous.
MRSA is especially troublesome in hospitals, prisons, schools, and nursing homes, where patients with open wounds, invasive devices, and weakened immune systems are at greater risk of infection than the general public.

**Antigenic structure**

1. Protein A: is a major protein of the cell wall and an important virulence factor (binds to Fc of IgG).
2. Peptidoglycan: a polysaccharide polymer provides rigid exoskeleton of the cell wall that can be destroyed by exposure to strong acids and lysozymes, can elicit production of IL-1 and opsonic antibodies and endotoxin-like activity also activate complement directly.
3. Teichoic acid: polymers of ribitol phosphate, Ab (anti-teichoic acid) can be detected in patient with endocarditis.
4. Surface receptors for specific staphylococcal bacteriophages. Phage typing used to detect the source of infection when there is outbreak of food poisoning.
5. Most strains of S.aureus are coated with a small amount of polysaccharide capsule (microcapsule) that is antiphagocytic, there are 11 serotypes based on antigenicity of the capsular polysaccharide.

**Pathogenesis of S.aureus:**

Some healthy individuals carry microorganisms in their nose with no harm but generally S.aureus causes wide range of disease by producing toxins or by multiplying in the tissues causing inflammation.
1. pyogenic infection: folliculitis, impetigo, carbuncles, breast abscess, osteomyelitis or empyema.
2. disseminated infection: bacteremia, septicemia.
3. toxin mediated illness: food poisoning, TSS and scalded skin syndrome.

**Laboratory diagnosis of S.aureus**

1. Specimen collection.
2. Stained slide → G+ve.
3. Culture → manitol salt agar selective media.
4. Biochemical tests: including catalase, coagulase and API staph.
5. Serology: - detection of enterotxin 2 TSST-1 by latex agglutination microtiter plate.
   - detection of protein A by ELISA method.

**Infections with coagulase negative Staphylococci**

- community acquired urinary tract infection in young women caused by S.saprophyticus.

- Staphylococcus epidermidis: members of normal flora of skin deep layer and mucous membrane (S.albicans), can cause infection if accidently introduced into blood stream with vascular catheters or implanted prostheses. Virulence factors is production of an exopolysaccharide “slime” forming a layer around the bacterial cell wall:
  - promotes adherence to plastic surfaces
  - increase resistance to phagocytosis
  - inhibits entrance of antibiotics to the cell.