

# PATHOGENIC GRAM POSITIVE COCCI

29 July 1991, rvsd 24 Feb 1993, 12 August 1993, 21 Fe 00, 6 Aug 01, 28 Feb 02, 1 Aug 03, 9 Aug 04, 15 Aug 07, 9 Aug 08, 28 July 09, 28 July 10, 27 July 11, 21 Feb 13  
 See also Jensen & Wright, pp 202-228, TFC 7<sup>th</sup>: 582-586 (staph), 658-660 (strep), 690-691 (staph food poisoning), Bauman 2<sup>nd</sup>: 530-542, 4<sup>th</sup>: 539-571

**LOW G+C GRAM POSITIVE COCCI:** *Staphylococcus*, *Streptococcus*, *Enterococcus*

**STAPHYLOCOCCUS:** (p. 540) Ubiquitous. Aerobic or facultatively anaerobic:

V. strong cell wall, resists 10% salt: in cured meats, drying.

*Staphylococcus epidermidis* common on skin (90% of flora) and nares, in rectum. **Opportunistic pathogen.**

*Staphylococcus aureus* (yellow colonies on agar): the most virulent of Staph species

**MECHANISM OF PATHOGENICITY:** due to toxins and enzymes (p 531).

**ENZYMES:**

- catalase** "Catalase positive" indicates pathogenicity. (Strep is catalase neg.)
- coagulase** "Coagulase positive" indicates pathogenic: fibrinogen to fibrin, walls off site of infection, protects from phagocytosis, (*S. epidermidis*: coagulase neg.)
- hyaluronidase** spreading factor, hydrolyzes hyaluronic acid, a C.T. polysaccharide
- β lactamase** inactivates penicillin (95% *S. aureus* carries it now...) See above.

**TOXINS:** (p 540)

- enterotoxin** **food poisoning intoxication:** heat resistant, a superantigen, triggers T cell inflammatory response: nausea, vomiting, sweating, diarrhea. **Rapid onset:** 1-6 hrs after eating meats, **lasts only 24 hrs**, custard pastries, potato salad.
- exfoliative toxin** "scalded skin syndrome," dissolves desmosomes, epidermis sloughed off
- TSS Toxic shock syndrome** fever, vomiting, sunburn-like rash, shock (grph: 542)
- leukocidin** disrupts lysosomes: neutrophils & macrophages. Causes lysis, tissue damage

**Diseases:** transmitted by direct contact or **fomites** (**thorough hand washing** prevents transmission)

- Skin: folliculitis** pimple, no scar (**sty** = folliculitis of eyelash),
- boil** invades dermis, leaves scar
- carbuncle** underlying tissue cavity, necrosis, suppuration [from under, pus]

- Prevent wound infection:**
- 1) scrub wound thoroughly
  - 2) flood with 70% EtOH
  - 3) cover with sterile bandage
  - 4) replace bandage when soiled

Treatment of infection: drain abscess, break up niche, remove dormant bacteria.

**Impetigo** mixed infection of Staph and Strep (page 541) (direct contact, fomites)

Staph develops resistance to drugs faster than any other bacterium (a problem with antibiotic abuse)

**MRSA: Methicillin Resistant Staph Aureus:** formerly nosocomial, now common in community

**STREPTOCOCCUS: cause more disease than any other group of bacteria.** (P 543)(But most members are not pathogens)

Distinguish pathogenic species of Strep by two traits: (note Rebecca Lancefield's Serology Groups A - O)

**Traits of pathogenic strep** (notably *Streptococcus pyogenes*): **Group A, beta hemolytic strep**

- 1) **Group A** **M protein, in the cell wall, makes it "group A":** it retards phagocytosis
- 2) **Hemolysis:**
  - alpha:** partial clearing, green cast (*Strep. pneumoniae*)
  - beta:** **complete clearing, yellow cast** (the hemolysin is inhibited by O<sub>2</sub>)
  - gamma:** no clearing

**Can be spread by aerosol:** Strep carriers: summer: 5% of pop., winter: 10%. Esp in elementary schools.

**MECHANISM OF PATHOGENICITY:** Act extracellularly, esp. **necrotizing exoenzymes:**

- M protein** cell wall attachment protein, inhibits opsonization, (makes it "group A")
- streptolysin** lyse RBC, WBC, platelets, etc (accounts for beta hemolysis)
- hyaluronic acid** contained in its capsule, body ignores (it is part of connective tissue)
- streptokinase** fibrolysin, digests fibrin in inflamed barrier (therapeutic for MI, stroke)
- erythrogenic toxin** pyrogenic toxin (fr lysogenic virus): fever and rash = **scarlet fever.**

**DISEASES:** Spread mostly by respiratory droplets, normal flora missing, compromised barriers

**Strep throat** (p 544) [10% of sore throats are Strep...] beefy red purulent pharynx, fever, malaise, SORE throat. 15% of children are asymptomatic carriers. (50-90% "pharyngitis" = viral...) children <15 avg 1 inf<sup>n</sup>/yr.

**Scarlet fever** "scarletina." Erythrogenic factor, causes vasodilation

**necrotizing fasciitis** "**Flesh eating**" **bacteria:** effective at invading (causing cellulitis, myositis) (p 545)

**SEQUELAE:** **Rheumatic fever** in 3% of untreated children 1-5 wks later, **rheumatoid arthritis**

- glomerulonephritis:** filtering basement membrane scarred
- Puerperal fever** *S. agalactiae* infection of uterus following childbirth
- tooth decay** *S. mutans* (cariogenic) make dextran fr sugar, biofilm = plaque, lactic H<sup>+</sup>
- pneumonia** *S. pneumoniae* (p 541) formerly "*Diplococcus pneumoniae*" also causes otitis media, sinusitis

leading cause of community acquired pneumonia (85% of pneumonia), due to compromise: flu, alcoholism, diabetes, CHF etc.

**ENTEROCOCCUS** p 541 *E. faecalis*, non-pathogenic in GI, but nosocomial: UTI, lungs, bl<sup>d</sup>, intestinal laceration. lack capsule, can grow at 45 C, pH 9.6, 6.5% NaCl, 40% bile salt broth.

