Corynebacterium, Bacillus

A mixed bag of some serious pathogens
**Corynebacterium diphtheriae**

- Club-shaped “V” or “L” bacteria
  - Koryne=club in Gr.
- Gram + rods
- Normal flora of skin & mucus membranes
- *C. diphtheriae* only medically important
  - pathogenes due to diphtheria toxin, a potent exotoxin
  - lysogenized *B*-corynephage
Historical Considerations

• Hippocrates, 300BC
  sore throats with throat-membranes & suffocation

• Loeffler in Koch’s lab:
  – noted pseudomembrane
  – bacteria did not invade other tissues
  – cardiac & CNS lesions predicted a toxin
  – toxin discovered Pasteur Institute
  – Von Behring made toxoid
  – “Diphtheroids” incapable of toxin are common in normal flora

• World-wide
  – before vaccine, the major killer
    2-14 yr olds in Canada & U.S.--1922>200,000 cases
  – Today rare in U.S.
    • less than 5 per year
  – Annually kills millions elsewhere
    • former USSR
  – Humans only infected
    • droplet & skin**
  – Vaccine against toxin, not bacteria (toxoid)
Incidence and Case Fatality Rates for Diphtheria. Figure 19.12 (T)

Antitoxin first used for general passive immunization

Incidence in cases/million population

Case fatality rate (%)

Toxoid used for general active immunization

Year

Diphtheria in the former Soviet Union, after vaccination ceased
Pathogenesis of diphtheria

- Diphtheria toxin:
  - lysogenic phage
  - Classical A/B toxin
    - binds to epidermal growth factors
    - blocks protein synthesis
    - mostly in heart, nerves & kidneys
  - Pseudomembrane
    - respiratory collapse
  - Myocarditis
  - Renal Failure
  - Suffocation
Clinical features of diphtheria

• Respiratory:
  – sore throat, malaise,
  – Pseudomembrane:
    • White/gray membrane
    • fibrin-rich exudate and necrotic tissue
    • cervical nodes greatly enlarged (bull-neck)
  • Labored breathing
    – dyspnea
    – accessory muscles
    – cyanosis
    – anxiety
  • suffocation without tracheostomy or intubation

“Bull neck” lymphadenopathy and tracheal intubation
Clinical features of diphtheria

- **Extra-Respiratory:**
  - Pseudomembrane of eyes (bloody tears)

- **Toxemia:**
  - Cardiac & Neural
  - 10-25% cardiac like congestive heart failure
  - Neuropathy--paralysis of pharynx
    - affects breathing
  - Mortality due to myocarditis and asphyxia

- DPT vaccine & Penicillin

Myocardio-necrosis from D-toxin
Anthrax

*Bacillus anthracis*
**Bacillus anthracis**

- **Gram +, spore-former**
- **Zoonotic disease (cattle, mostly)**
- **Noted in anciently**
  - Hebrew, Roman & Greek literature
- **Koch’s work**
- **Common in farm workers**
  - Woolsorter’s disease
- **Disease produced by a variety of toxins**

- **Cutaneous lesions**
  - eschar, black leathery necrotic lesions
  - Pulmonary *(highly fatal)*
    - capillary thrombosis
    - cardiovascular shock
  - Intestinal lesions
    - from meat
    - rare, but serious
  - Germ Warfare weapon
    - Desert Storm and Inspection problems
    - spores in warheads
Figure 19-8  Three forms of anthrax that might be contracted by exposure to infected animal products.

- Cutaneous
- Pulmonary
- Intestinal
Cutaneous Anthrax lesions

Early skin lesion, on neck (hide porters)

Central area of necrosis (eschar) slow to heal

Wrist & hand lesions common in butchers

Patient worked in a paint-brush factory
Hemorrhagic monkey brain after experimental inhalation of anthrax spores
Hemorrhagic human brain after the inhalation of Anthrax spores