

- Toxins and diagnostic microbiology
- Brock 21.10-21.12 and Chapter 24
- Toxin
  - The latin root applies to a bow (like a bow and arrow) – the idea is that it kills like an arrow
  - Endotoxin – lipopolysaccharide
  - Exotoxins
    - Proteins
    - Mostly enzymes
    - Three broad types:
      - Cytolysins
      - A-B toxins
      - Superantigens
- Cytolysins
  - Example: streptococcus pyrogenes
    - This is what gives you strep throat
    - Hemolysin – produces a toxin that lyses the cells around it
    - You can see this happening to cells if you plate this bacteria on agar
    - This used to be used to diagnose strep throat, before a quicker test was developed
    - Why does this toxin exist? It doesn't lyse red blood cells in your blood stream. It's there to fight the neutrophils that your body sends to kill the streptococcus
    - If you stay sick with strep throat for very long, it can cause an autoimmune disorder where your own immune system attacks and damages the endothelial lining of your heart valve
- A-B Toxin
  - Example: Corynebacterium diphtheriae
    - Diphtheria used to be a major public health concern
    - Antitoxin – you develop a toxoid (antigenic, but not toxic)
      - If you immunize people with this toxoid, you develop an antitoxin (antibody that will neutralize the toxin)
      - Emil Adolf von Behring
    - In Boston there's a statue of the husky dog that brought the precious load of antitoxin on a sled across Alaska when there was a big outbreak of diphtheria

- It's not clear if it gains benefit from killing the epithelial cells in the throat, or if its some innate response...
    - Some of these bacteria have the phage and make the toxin, but others don't.
      - The ones that don't produce the toxin cause a more minor sore throat
    - We're vaccinated against the toxin – DPT
  - Example: Clostridium toxins
    - Tetanus toxin
      - Used to be used as a bioweapon – fear that it could be used that way again
      - Neural toxin
      - Causes muscle contraction
      - Spastic paralysis
      - There's an inhibition of the inhibitory muscle contractors, so that people are unable to relax their muscles – they just continue to clench and clench, sometimes so severely that their bones break
      - Causes lockjaw
      - Important to stay immunized against this with regular boosters
    - Botulism toxin
      - Causes flaccid paralysis
      - It works in the same way on a different neural group, so that instead it inhibits muscle contraction
      - Muscles can't contract
      - Used cosmetically because it inhibits the contraction of the muscles under your face
      - Also used to treat lazy eye, by injecting it into the muscles of the eye.
      - Infant botulism – caused by honey contaminated with botulism spores. The honey won't hurt us, because the biota in our gut can take care of it, but infants can't fight it off, and they can die.
- Enterotoxin
  - Example: Cholera
    - Causes rice water diarrhea
    - Normally our body prevents constipation and diarrhea by regulating the secretion of ions to maintain the right amount of moisture
    - Nonstop chlorine secretion and all of the moisture leaves your system
    - People actually die of cardiovascular collapse due to dehydration
    - In a modern hospital, you treat this with liquids provided through IV



- The only way to get more antibody is to inject another rabbit
- To make a monoclonal antibody, you can actually kill the animal (usually a mouse) and create a cell line that you can culture, that will still continue to produce the antibody
  - To use these antibodies in people, you have to use recombinant DNA technology, so that it's a humanized antibody instead of a mouse one, thus preventing an immune rejection response
  - This kind of technology is also used in transplants today
- Serological tests
  - Blood tests – figure out your blood type
    - You simply mix the antiserum with the blood and see if it agglutinates
    - Natural antibodies