20.106J – Systems Microbiology
Lecture 24
Prof. Schauer

- Final Exam next week
- The main focus of the final exam is going to be our last eight lectures: the topics listed below
    - The format will be similar to the format of the tests
    - Open-ended questions
    - You need to know the concepts – you do not need to memorize specific details
    - There will also probably be a couple of questions about the lectures from earlier in the course, given by Prof. DeLong

- Topics:
    - 1: Growth Control
        - Physical growth control
            - Heat and autoclaving
            - The kind of cell death that occurs with heat
        - Chemical growth control
            - Outside of the body
            - Strategies of controlling microbes on surfaces, etc.
        - Antibiotics
            - Inhibition of cell wall synthesis, ribosomes
            - Beta-lactam antibiotics
            - Know why these don't interfere with protein synthesis in our own cells
            - Antibiotic design requires targeting a feature that is unique to bacterial cells, and not human ones. Asking you to formulate a hypothetical new antibiotic would a be a reasonable question on the test.
        - Antibiotic resistance
            - Know that the existence of antimicrobial resistance predated our own medical use of antibiotics. Why is that?
    - 2: Microbe-host Interactions
        - Healthcare-associated infections (HAI)
            - Know about the acquisition of drug resistance by some of these microbes in people
            - VRE, MSRA
            - The fear of developing a superbug that we have to drug to treat
        - Commensal microbiota (ecology, models)
            - You should be familiar with the concept that there are microbes that live in every living thing on earth

- Know about the development of a climax community of microbiota in the human gut as people grow up from infants to adults
- Gnotobiotic animals: in the lab, people can create rabbits, mice, or pigs grown in a sterile environment so that they have no microbiota inside them.
- You might be able to make some comparisons between our endosymbionts and those of aphids

- 3.4: Immunology I and II
  - Immune cells
    - Be familiar with the main components of the immune system
    - Know the main components of lymphocytes
    - Know what B and T cells do once they become activated, what they secrete
  - Inflammation, phagocytosis
    - Natural immunity
    - Getting microbes out of the injured site
  - Adaptive immunity (Ag, MHC, T, B)
    - Know the way that antibodies recognize antigens, as compared to the way that T cells can recognize them
    - B cells bind to conformational antigens
    - Affinity maturation
      - Creates a little extra diversity in a B cell response
      - However, this does not happen in T cells, because it would be catastrophic to have T cells that recognize different things – you don't want them to start attacking your own cells. They need to recognize your own MHC
  - Vaccines (types)
    - Know about the general types of vaccines
    - You won't have to name specific vaccines
    - Understand the range of successful vaccines that have been used
    - For example, there's the TB vaccine, which only protects against childhood TB. You can't give a vaccine like that to immuno-suppressed people – it could kill them
    - Anergy (tolerance)
  - Hypersensitivity
    - Type I: IGE
    - Type IV: TB test is an example
- 5: Diagnostic Microbiology
  - Exotoxins: A-B toxins, SAg (Super antigens)
    - Super antigens bind to the conserved parts of the TCR and the APC

        - They stimulate large numbers of T cells that share common variable regions of the Beta chain
        - Whole sale stimulation, release of large quantities of cytokines
    - Selective, differential media
        - Selective media to inhibit growth of commensals
        - You can also make differential media, such as adding sugars or pH sensitive dyes
    - MAb, serology
- 6: Person-to-person Transmission
    - TB (risk factors, pathogenesis)
        - Many people get exposed, many people develop latent infections
        - If they become immuno-suppressed, they can develop active TB
    - Influenza
        - Antigenic shift
            - Large, sudden changes
        - Antigenic drift
            - Small changes in the proteins compromise the ability of your system to protect you from the virus
    - Hp
        - Only a small proportion actually develop peptic ulcer disease
- 7: Epidemiology
    - Terms
        - Incidence, prevalence, control, transmission
    - Emerging infectious diseases
- 8: Arthropod-borne and Zoonotic Diseases
    - Plague (epidemiology, pathogenesis)
        - Wild rodents, transmission through fleas on a sporadic basis
        - Be familiar with how plague affects the flea life cycle, causing it to bite more people
        - Bubonic, Systemic, and Pneumonic forms of plague