Pathology, Infection, and Disease

- **Pathology** deals with the scientific study of disease
- **Etiology** refers to the “cause” of a disease
  - We are most concerned with diseases having an *infectious* etiology
  - Establishing etiology is critical to being able to provide effective therapy
- **Pathogenesis** is the “course” of a disease

What is *Infection*?

- It cannot just be the presence of microorganisms
  - We possess an abundant normal *microbiota*
  - Disease-causing microorganisms may *colonize* tissues without causing disease symptoms
- Colonization of normally sterile tissues is usually thought of as infection
- Colonization with *pathogenic* microorganisms certainly increases risk for infection
- In the end, it is difficult to disengage *infection* and *disease* - damage, or improper functioning of, tissues
The Normal Microbiota

- Microorganisms in permanent residence without causing disease
- Mostly bacterial
- Abundant microflora found on
  - Skin
  - Gastrointestinal tract
  - Upper respiratory tract
  - Outer genitourinary tract (vagina, distal urethra)
- No microflora in
  - Lower respiratory tract
  - Peritoneal cavity
  - Musculature
  - Circulation

Significance of the Normal Microbiota

- The normal microbiota may antagonize colonization by pathogenic microorganisms
  - Damage to the normal microbiota by antimicrobial drugs may lead to secondary infections - “Superinfections”
    - Candida albicans vulvovaginitis following treatment of urinary tract infection
    - Clostridium difficile colitis in a hospital setting
  - Probiotic therapy is based on maintaining a healthy normal microbiota
- The normal microbiota may become opportunistic pathogens
  - Opportunists do not usually cause disease, but may infect compromised hosts
    - This may involve another disease
    - Therapy (for cancer, transplants) may also make someone compromised
  - The distinction between opportunistic and “true” pathogens is not always easy to make

Koch’s Postulates

- These establish infectious etiology
  - The same microorganism must be present in every case of a disease
  - The microorganism must be isolated from the diseased host and grown in pure culture
  - It must be possible to cause the disease by inoculating healthy animals with the pure culture of the suspected pathogen
  - The pathogen must be isolated from the experimentally infected animals
- It is not always possible to meet these criteria unambiguously
Classifying Infectious Diseases

• Signs and symptoms
  – Signs are objective changes that can be observed or measured
  – Symptoms are subjective changes noticed only by the person suffering the infection

• Communicability
  – A communicable disease can be transmitted from an infected to a susceptible host
  – A noncommunicable disease is not usually transmitted
    • Many opportunistic infections are endogenous
    • Some infections (Legiella pneumonia, tetanus) are acquired from the environment

Classifying Infectious Disease (continued)

• Patterns of occurrence
  – The incidence of a disease is the fraction of a population that acquires it during a given period of time
  – The prevalence of a disease is the fraction of a population affected by the disease at a particular time

• Frequency of occurrence
  – Incidence of endemic diseases does not vary over time (although they may be seasonal)
  – Some infections occur in sporadic outbreaks
  – An infection becomes epidemic if incidence is increasing over time; rare infections with increasing incidence are sometimes said to be emerging
  – Pandemic refers to worldwide epidemic

Reported AIDS Cases in the United States

(Source: CDC)
### Classifying Infectious Disease (continued)

- **By severity or duration**
  - *Acute* infections develop rapidly and last a short time. Example: Influenza
  - *Chronic* infections continue or recur over extended periods. Example: Serum hepatitis
  - *Latent* infections may remain inactive, with periodic recurrence. Example: Genital herpes

- **By extent of host involvement**
  - In *localized* infections, the microorganism is confined to a particular tissue
  - In *systemic* infections, the circulation carries the microorganism or its products to different tissues
    - *Bacteremia* - presence of bacteria in the blood
    - *Fungemia* 
    - *Viremia* 
    - *Toxemia* - presence of microbial toxins in the blood

  *Systemic infection can lead to sepsis, an uncontrolled systemic inflammatory state, leading to hypovolemia and organ failure*