Principles of Disease

Principles of Disease and Epidemiology

- Pathology:
- Etiology: The study of the cause of a disease
- Pathogenesis: The development of disease
- Infection:
- Disease: An abnormal state in which the body is not functioning normally

Normal Microbiota and the Host

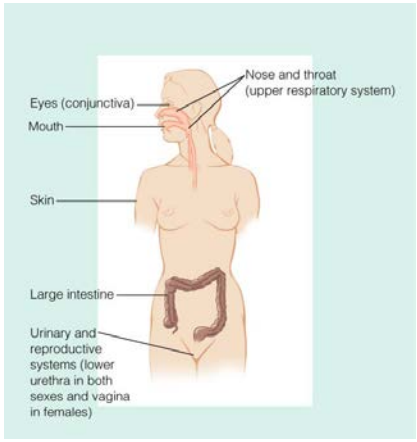
- Transient microbiota may be present for days, weeks, or months.
- Normal microbiota permanently colonize the host.
- Symbiosis is the relationship between normal microbiota and the host.

Symbiosis

- In commensalism, one organism is benefited and the other is unaffected.
- In mutualism, _____
- In parasitism, one organism is benefited at the expense of the other.
- Some normal microbiota are opportunistic pathogens

Normal Microbiota and the Host

- Locations of normal microbiota on and in the human body.



- Microbial antagonism is a competition between microbes.
- Normal microbiota protect the host by:
  - Occupying niches that pathogens might occupy
  -
  -
- Probiotics are live microbes applied to or ingested into the body, intended to exert a beneficial effect.

Koch's Postulates

- Koch's postulates are used to prove the cause of an infectious disease.
- 1. suspect microbe always found in diseased individual never in healthy one.
  - (exceptions -_____)
- 2. be able to culture microbe on artificial medium in lab (_____)
- 3. pure cultures of microbe must be able to cause the disease in test animals
- 4. reisolate same microbe from experimentally infected animal

Classifying Infectious Diseases

- Communicable disease: A disease that is spread from one host to another.
- Contagious disease: A disease that is easily spread from one host to another.
- Noncommunicable disease: A disease that is not transmitted from one host to another.

Occurrence of Disease

- **Incidence**: Fraction of a population that <u>contracts</u> a disease during a specific time (

  .)
- Incidence conveys information about the <u>risk</u> of contracting the disease
- Incidence Rate =

- **Prevalence**: Fraction of a population having a specific disease at a given time
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- It is a measure of the burden of the disease on society
- Prevalence =

    - "Old" cases and "new" cases are counted in the numerator

- Flint, Michigan
    - Water supply contaminated with lead
    -
    - In 2016, bottled water distributed, water supply changed and treated so no more lead contamination
    - In 2015, the incidence of lead poisoning would be:
        - High or Low?
    - In 2015, the prevalence of lead poisoning would be:
        - High or Low?
    - In 2016, the incidence of lead poisoning would be:
        - High or Low?
    - In 2016, the prevalence of lead poisoning would be:
        - High or Low?

- This is an example of a disease that takes a long time to cure (if possible) and was widespread in 2015 but dissipated in 2016. This disease will have both high incidence and high prevalence in 2015, but in 2016 it will have a low incidence yet will continue to have a high prevalence (because it takes a long time to cure, so the fraction of individuals that are affected remains high).
- Consider influenza in the United States:

    - How would you describe the incidence and prevalence of a flu epidemic during the winter vs. the flu in summer? (high or low)
        - <u>Incidence</u> <u>Prevalence</u>
    - Winter
    - Summer

- Endemic disease:
- Epidemic disease: Disease acquired by many hosts in a given area in a short time.
- Pandemic disease:
- Sporadic disease: Disease that occurs occasionally in a population
- Herd immunity:

Severity or Duration of a Disease

- Acute disease:
- Chronic disease:
- Latent disease: Disease with a period of no symptoms when the patient is inactive.

Extent of Host Involvement

- Local infection: Pathogens are limited to a small area of the body.
- Systemic infection:
- Focal infection: Systemic infection that began as a local infection.
- Bacteremia:
- Septicemia: Growth of bacteria in the blood

- Toxemia:
- Viremia:
- Primary infection: Acute infection that causes the initial illness.
- Secondary infection: Opportunistic infection after a primary (_____) infection.
- Subclinical disease: No noticeable signs or symptoms (inapparent infection, asymptomatic).

Reservoirs of Infection

- Reservoirs of infection are continual sources of infection.
    - Human —
        - Carriers may have inapparent infections or latent diseases.
    - Animal — Rabies, Lyme disease
        - Some zoonoses may be transmitted to humans.
    - Nonliving — Botulism, tetanus
        -

Transmission of Disease

- Contact
    - Direct: Requires close association between infected and susceptible host.
    - Indirect: Spread by fomites (_____).
    - Droplet: Transmission via airborne droplets.

- Vehicle: Transmission by an inanimate reservoir (_____).
- Vectors: Arthropods, especially fleas, ticks, and mosquitoes.
- Mechanical: Arthropod carries pathogen on feet.
- Biological: Pathogen reproduces in vector.

Nosocomial (_____) Infections

- Are acquired as a result of a hospital stay.
- 5-15% of all hospital patients acquire nosocomial infections.

Common Causes of Nosocomial Infections

	Percentage of Nosocomial Infections	Percentage Resistant to Antibiotics
Gram (+) cocci	51%	29%-89%
Gram (–) rods	30%	3-32%
Clostridium difficile	13%	
Fungi	6%	

How can nosocomial infections be reduced?

Study Objectives

1. Define: Pathology, Etiology, Pathogenesis, Infection, and Disease.

2. Explain the relationship between transient microbiota, normal microbiota and the host including symbiotic relationships.

3. Describe Koch's postulates.

4. Define: Communicable disease, Contagious disease and Noncommunicable disease.

5. Define: endemic, epidemic, and pandemic disease.

6. Describe the extent of host involvement in terms of local, systemic, primary and secondary infection.

7. Define: bacteriemia, septicemia, toxemia, viremia, and subclinical disease.

8. Describe the ways in which infectious diseases are transmitted.

9. What is a nosocomial infection?

10. How can nososcomial infections be reduced?

11. Define incidence and prevalence. What does each one tell us about disease?

12. Calculate incidence and prevalence.