**Epidemiology**
Microbes and Disease

Pathogens -- disease causing organisms

Disease -- in a state of not being healthy, change from health

Pathology -- study of disease

   Etiology -- the cause of disease

   Pathogenesis -- how disease progresses

Infection -- colonization or invasion of pathogenic microbes
   may be that organism in the wrong place E. coli in urinary tract

Normal Flora -- the normal bacteria in you and on you -- good
   transient versus resident flora -- stay for short periods or permanent residents
   10^{13} eucaryotic versus 10^{14} prokaryotic cells
Microbial antagonism -- overwhelms potential pathogens no place to colonize intestines and vagina -- excessive antimicrobial activity disrupts balance vagina normally pH ~ 4 with normal flora of lactobacilli w/out lactobacilli can lead to Candida albicans infection

Symbiosis -- living together

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Host</th>
<th>Symbiote</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commensalism</td>
<td>Ø</td>
<td>+</td>
<td>Corynebacteria &amp; eye</td>
</tr>
<tr>
<td>Mutualism</td>
<td>+</td>
<td></td>
<td>E. coli and intestines</td>
</tr>
<tr>
<td>Parasitism</td>
<td>—</td>
<td>+</td>
<td>pathogens</td>
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</tbody>
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Know some examples of mutualistic bacteria

Opportunistic -- normally non-pathogenic
- E. coli and urinary tract
- Pneumocystis carinii and respiratory system
- Streptococcus pneumoniae and pneumonia

Etiology in Infectious Diseases
- not all infectious
- genetic -- inherited
degenerative
congenital
• Koch’s Postulates •

Robert Koch ~ 1877 working on Anthrax a disease in Cattle developed framework for study of the etiology of disease

1) same pathogen present in every case of the disease
2) isolate and grow in pure culture
3) cause disease in healthy animal
4) re-isolated and shown to be the same as original

Exceptions:
not cultured or culturable
Treponema pallidum
Rickettsia
Chlamydia
viruses
Legionella

some pathogens cause many different diseases -- Streptococcus pyogenes
• Classifying Infectious Diseases •

Symptoms -- a change in body function i.e. pain and malaise
Syndrome -- group of symptoms

1) Diseases may be group by how spread:
   Communicable -- spread host ----------------------> host
   also indirectly
   Contagious -- easily spread
   non communicable -- not spread Clostridium tetani and C. botulinum

2) By incidence --prevalence
   sporadic -- occasionally
   endemic -- locally common
   epidemic -- widespread outbreak
   pandemic -- worldwide outbreak AIDS??

3) Severity
   acute -- rapid and short duration
   chronic -- slow and long term
   subacute -- intermediate
   latent - shingles AIDS??
4) Extent of host involvement
   local -- small area -- boil
   systemic -- throughout body
   focal -- localized to certain places -- tonsils

   Bacteremia -- bacteria in blood
   Septicemia -- multiply in blood
   Toxemia -- toxins in blood
   Viremia -- ???

1° infection -- acute infection that causes the initial illness
2° infection -- caused by opportunist microbe in now weakened host --
   Pneumocystis pneumonia and AIDS
subclinical (in apparent) -- no symptoms -- Hepatitis A and Polio
• Spread of Infection •
Reservoirs -- a place for a pathogen to reside - a person or a thing

Human reservoirs may or may not have symptoms -- carriers like Typhoid Mary carry latent diseases or are in pre symptom or convalescent stages

Animal reservoirs -- if an animal carries a disease to a human -- Zoonoses
examples -- swine flu, rabies, Rocky Mt. spotted fever
yellow fever, Psittacosis, Tularemia -- wild rabbits
Salmonellosis, plague

~150 -- Zoonoses

Non living reservoirs -- soil --> fungi, Clostridium
water --> fecal contamination -- bacterial, protozoa
and helminthes
• Transmission of Disease •

3 principle routes

1) contact -- direct or indirect  
   - Direct contact -- person to person
     - touching
     - kissing
     - sex

2) vehicle
   - Indirect contact -- via non living object -- fomite
     - handkerchiefs
     - towels
     - bedding
     - diapers
     - drinking cups
     - toys
     - money?
     - syringes

3) vectors
   - Droplet -- in mucus droplets that travel only short distances ~ 3’
     - by sneezing, coughing, laughing, talking

   examples: influenza, pneumonia and whooping cough
2) Vehicle by common inanimate reservoir

- food
- water
- airborne
- drugs
- blood

- water examples: -- sewage -- cholera, shigellosis
- food examples: -- food poisoning - E. coli, tapeworm, Salmonella
- airborne example: via air >3’ on dust aerosol form sneeze or cough like
  Staphylococci, Streptococci, tuberculosis, fungal spores --
  histoplasmosis, coccidiodomycosis

3) Vectors - 1° Arthropods and insects

- Mechanical by landing on food and passing
- Biological by biting and passing from person to person
  - tsetse fly - Trypanosoma flagellate
  - mosquitoes - yellow fever, encephalitis and malaria
  - flea - plague
  - ticks -- Lyme, RMSF

√ **Table 14.2 for Zoonoses**
• Portals of Exit •

for spread of disease

Respiratory -- oral and nasal discharge during coughing and sneezing
  examples: TB, whooping cough, pneumonia, scarlet fever, meningitis, measles, mumps, smallpox, and influenza

GI tract -- fecal contamination -- Salmonellosis, cholera, typhoid fever, shigellosis, amoebic dysentery, and poliomyelitis

Urogenital tract -- sexually transmitted disease

• Nosocomial Infections •

Hospital acquired 5 - 15% acquire >20,000 per year die
  why?
    a) microbes in environment -- (lots of sick people)
    b) already sick or wounded -- compromised host
    c) close to people - chain of transmission

Also resistant strains - E. coli, Pseudomonas, enterics like Serratia
Control by aseptic techniques
Antibiotic abuse
- Patterns of Disease -

Reservoir ----> Transmission ----> Host ---->
vector etc

invasion and colonization ---->pathogenesis (development of disease)

Predisposing factors:
leads to increased susceptibility male versus female
genetics like Sickle cell anemia climate -- cold weather inside
nutrition fatigue age
life style like working at a hospital

Development of Disease

Incubation -- infection up to first symptoms
may or may not be variable

Prodromal -- short period of early mild symptoms -- malaise

Period of Illness -- overt signs -- fever and chills, swollen lymph nodes
GI disturbance increase in WBC's
Period of Decline -- signs and symptoms subside - susceptible to 2° infections

Period of Convalescence -- regain strength and recovery
BUT - reservoir

Epidemiology -- Science of where diseases occur and how they are transmitted
See charts

Case reporting -- certain diseases must be reported to health officials
follow outbreaks and chain of transmission

CDC - Center for Disease control
publishes MMWR - Morbidity and Mortality Weekly Report

Morbidity - notifiable diseases

Mortality - deaths from these diseases