BMED2404

Historical Perspective of Disease

Global Disease trends

- Infectious diseases have been decreasing in developed countries
- Infectious diseases are very prevalent in developing countries
- TB and AIDS are deadlier in adults while Measles and Diarrhoea are deadlier in children

Definitions

- Mortality involves the **causes of death** (primary such as influenza or secondary such as AIDS and Diarrhoea)
- Morbidity is the **impact and prevalence of a disease** (Measured as the productivity lost due to sick days and inability to contribute)
- Emerging Infections are new infections that previously did not exist in an area
    - Can be due to **changes and evolution** of pre-existing diseases
    - **Re-emergence** of older diseases
    - **Migration of disease**

Immunisation

- Aims to produce immunity or eliminate pathogens
- Successes include **Polio** and **Smallpox**
    - Smallpox was targeted in 1967 and **declared extinct in 1979**
    - Samples kept in USA and Russia
- Difficulties include TB, Whooping Cough and HIV

Microbial Relations

Definitions

- Normal Flora are residents associated with **healthy individual function**
    - Out compete pathogens, produce anti-microbials, aid digestion, supply growth requirements, stimulate immune system

- Commensalism is when **one partner is benefited** and the **other is unaffected**
- Mutualism is when **both partners benefit** (Gut Flora)
- Parasitism is when **one partner benefits but the other is harmed**

Organisms can move between these stages

- Pathogen is an organism that invades the body and causes tissue damage
- **Virulence is the degree/intensity of pathogenicity (ability to cause disease)**

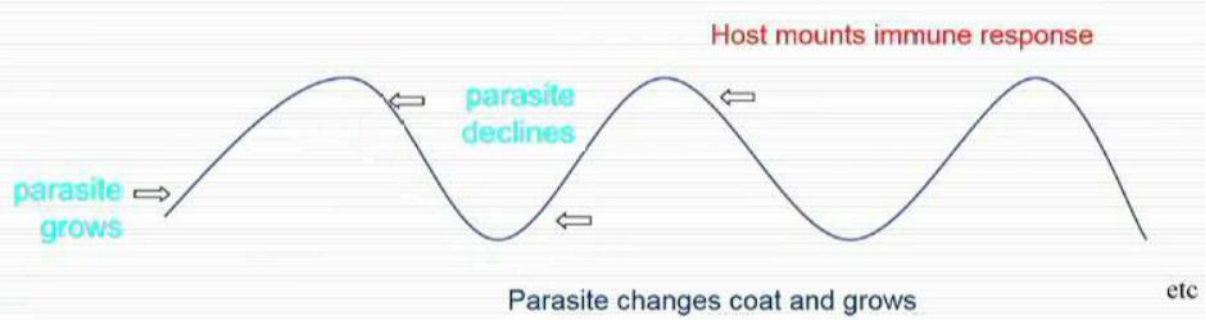
Examples of "healthy microbes"

- **E. Coli is found in the gut** and helps out-compete pathogens
- **Staphylococci is found in the oral cavity** and helps out-compete invading pathogens (can be dangerous itself if it gets into lower respiratory passages)
- **Lactobacilli is found in the stomach and small intestine** and helps with digestion of food (also available as probiotics!)

Organisms can become more/less dangerous at different times. They could develop new dangers (SARS Epidemic 2003) or they could move to different areas of the body (Staphylococci).

Factors affecting relations

- Increasing the number of organisms will make it more dangerous (poor hygiene)
- Increasing virulence of an organism will move it towards parasitism
- The health of host will determine the ease of infection



Epidemiology

Definitions

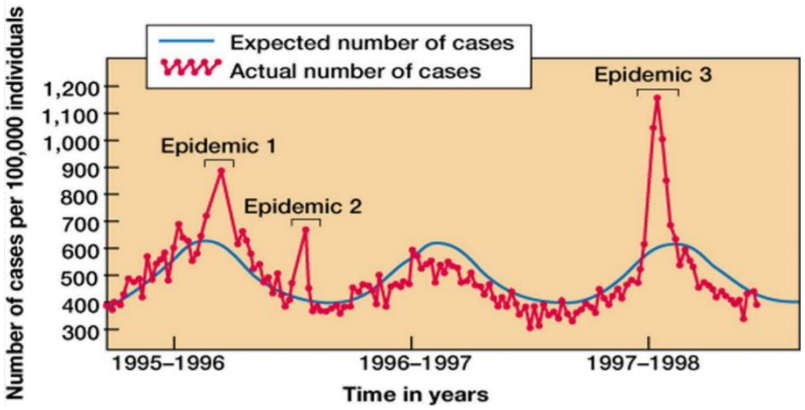
- Koch's Postulates
  - The same pathogen must be present in every case
  - Pathogen can be isolated and grown in a culture
  - Pathogen must cause the disease in another healthy organism
  - The same pathogen must be isolated from the infected organism

These **postulates don't support viruses** because you can't culture the pathogens and grow them on a plate!

- Sporadic diseases are those that **spring up at different times at different intensities**
  - Occasional and irregular diseases
  - Example is **typhoid** caused by salmonella food poisoning
- Outbreak is a new and sudden **unexpected spike in disease in a new area**
  - Represented by a single sudden spike in occurrence
  - Example is the **zika virus**
- Epidemic is when a disease suddenly increases above the endemic baseline
  - Example is **influenza**

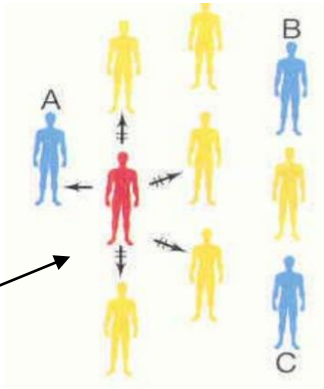
- Common source epidemics occur over a short time frame from a common source such as food poisoning or Legionnaires' (from air vents) and diminish as common source disappears
- Propagated Epidemics occur over a longer period and occur from person to person such as Influenza and Chickenpox. Has a **lower peak but longer period**

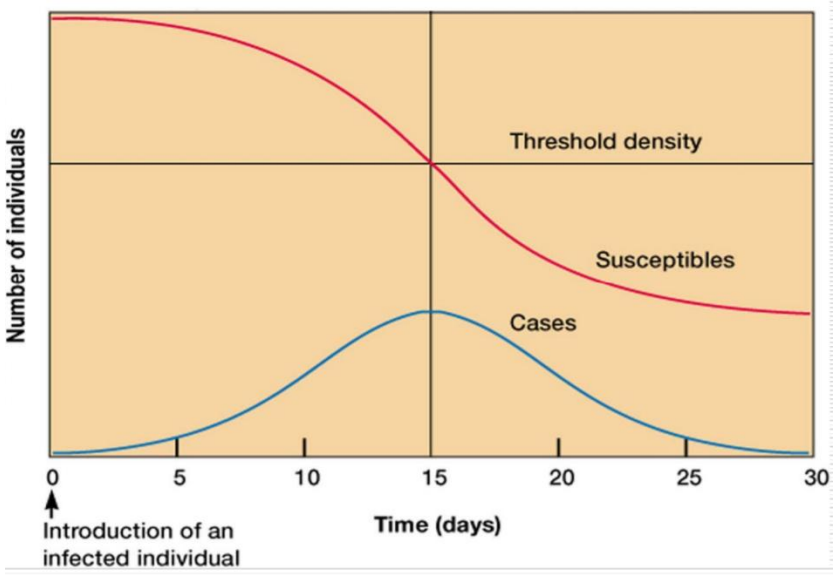
- Endemic is when a disease is constantly present in a population at low frequency
  - Example is **tuberculosis**, **malaria and yellow fever**



The blue line represents the endemic line whereas the red line shows the spikes of epidemics

- Pandemic is when a disease increases within **large widespread populations**
  - Example is **SARS**
- Herd Immunity is when **infected and immune people prevent the transmission to susceptible people**
  - An infected person first entering a population will infect very easily
  - After people become immune from vaccines or having already overcome disease, they **become a "blocker"** from the disease transferring to a healthy individual
    - A is susceptible but B and C are protected by the yellow people via herd immunity





The threshold density is where the number of susceptible people reaches a low enough point that the number of people infected begins to decrease

Influenza Virus

- Structure
  - **Humans mainly infected by Influenza A**
  - Has a large, enveloped viral centre
  - Has 2 projections on the outer wall
    - **HA protein** is used to **attach the virus to cell walls** in respiratory tract
    - **NA protein** punches a **hole in the cell that allows the virus to enter** and begin replicating
  - The projections can change type which creates new strains and overcomes immunity
    - Can change the amino acid sequence or protein folding
    - **Drifts are small antigenic changes** that alter the proteins and make them **difficult to recognise**
    - **Shifts are drastic antigenic changes** that alter the proteins and make them **completely unrecognisable**

HA and NA antigenic shift in 1918 led to the "Spanish Flu". Created an epidemic far above the normal influenza endemic level

- Transmission
  - Mainly spread by **aerosol droplets**
  - Spread to people who have no immunity to the specific strain (HA and NA types)
  - Children and elderly more susceptible