

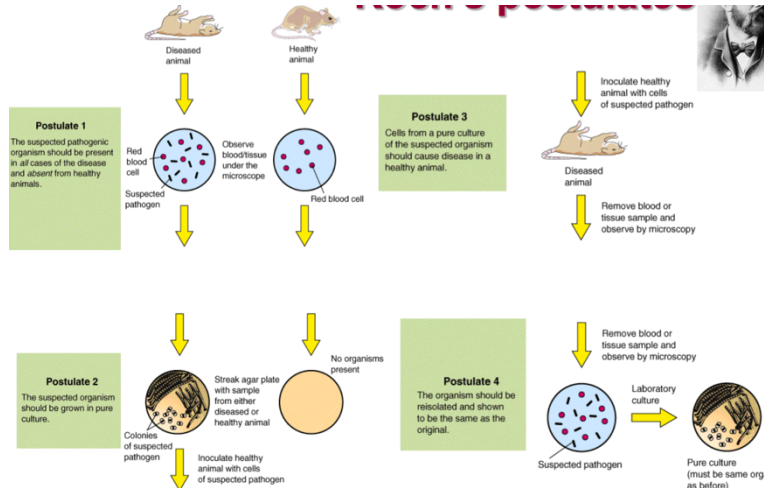
MIC2022 Notes

Lecture 1: Host-Pathogen Interactions I

Koch's Postulates

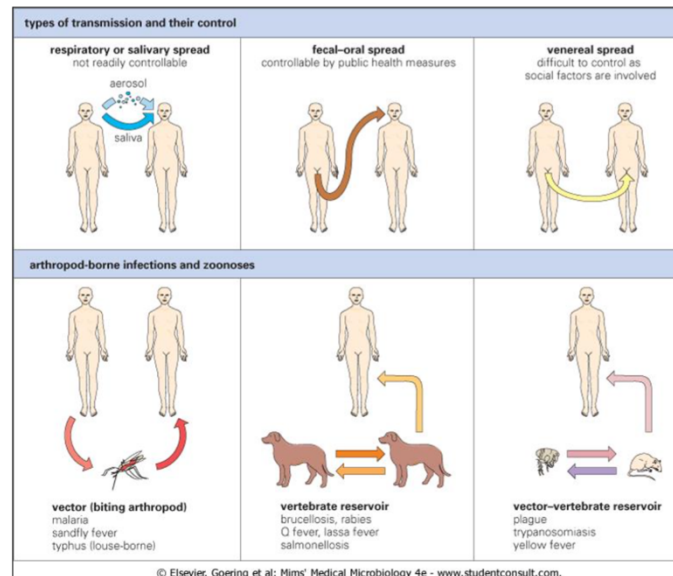
- Used to see if a specific microorganism is the cause of a disease

1. Association of **causative agent with disease lesions**
2. Isolation of **agent in pure culture**
3. Isolated agent must then be able to **cause disease in humans**
4. Must **reisolate the same agent from diseased animal**



How Pathogens Cause Disease

- Predisposing factors** lead to infection via endogenous agents
- Transmission from exogenous sources or **infected individuals (epidemiology)**
- Entry** into the human body
- Overcome** host defences
- Growth** and spread within body
- Cause cell and tissue **damage**
- Spread** to other individuals



Bacterial-Human Relationships

- Mutualism**
 - Two independent organisms living together to their mutual benefit
 - ❖ *Escherichia coli* in the colon
 - ❖ They produce vitamin K and some B vitamins
 - ❖ Bacteria break down waste products

- **Commensalism**
 - Normal flora that neither hurt nor benefit the host
- **Parasitism**
 - One organism benefits at the expense of the other
 - Range from slight harm to death

Lecture 2: Host-Pathogen Interactions II

Normal Microbiota

- Usually considered to be commensalistic or mutualistic
- Only considered to be in a parasitic relationship when they cause infection
 - **Opportunistic Pathogens**: Cause disease only under **predisposing circumstances** that compromise host defences
 - **Primary Pathogens**: Cause disease in the **normal healthy host**, no requirement for predisposing conditions
- Can be transient or resident
- Usually beneficial for **metabolism, growth factors, protection of infection** and **stimulation of the immune response**

Carriers

- Infected individuals who are not obviously diseased
- **Acute Carriers**
 - **Incubatory**: Incubating pathogen, not yet ill
 - **Convalescent**: Recovered, still have large numbers of pathogen
- **Chronic Carriers**
 - Harbor the pathogen for long periods
 - Multiplication and shedding occur at low levels
 - Capable of transmitting infection
- **Asymptomatic Carriers**
 - Harbor the pathogen for long periods
 - Multiplication and shedding occur at low levels
 - Capable of transmitting infection
 - Absence of any symptoms of disease

Skin - Microbiota

- **Best protection** against pathogens
- Contains epidermis, dermis, subcutis and muscle
- **Inhospitable environment** (slightly acidic pH; high concentration of NaCl; low moisture)
- Inhibitory substances
- Gram positive bacteria

Upper Respiratory Tract - Microbiota

- **Mouth** (500-600 different bacteria; saliva protects)
- **Nose** (mucus, hair, aerobic, *Staphylococcus* spp.)
- **Throat** (pharynx and larynx)
- Many species as part of normal microbiota
- Gram positive bacteria

Lower Respiratory Tract - Microbiota

- Trachea, bronchi, bronchioles and alveoli (lungs) **do not normally have microbiota**
- Microorganisms **removed by continuous stream of mucus** generated by ciliated epithelial cells or **alveolar macrophages**

Gastrointestinal Tract - Microbiota

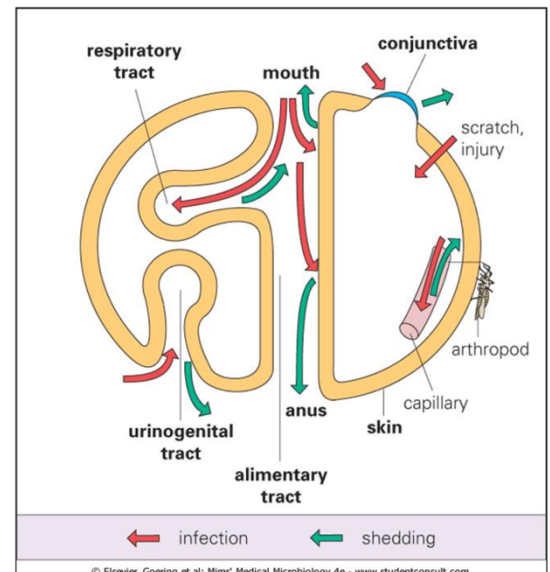
- **Stomach** (pH 2.0; gastric mucosa; *Helicobacter pylori*)
- **Duodenum** (pH increases; bacterial number increases)
- **Jejunum**
- **Ileum**
- **Colon** (anaerobic fermentation tank, largest number of bacteria)

Urogenital Tract - Microbiota

- **Upper areas** (kidneys, bladder, upper urethra) are **usually sterile**
- **Lower urethra** is often colonised but **flushed out by urine**
- **UTIs are more common in females** due to a shorter urethra

Entry of Pathogens (Exogenous)

- Cedric Mims' model (picture) follows the notion that the 'tube' is the GI tract (indentations are susceptible)
- Physical Barriers
 - High salt, fatty acids (skin)
 - Acid (stomach)
 - Mucous (LRT)
 - Peristalsis (GI tract)
- Innate Immunity
 - Complement
 - Phagocytosis
- Adaptive Immunity
 - Antibodies
 - Cell-mediated immunity (CD4/CD8)



Immunity

- Passive Immunisation: Transfer of performed antibodies or immune cells to a recipient
- Active Immunisation: Acquisition of specific immunity by injection or vaccination

Lecture 3: Host-Pathogen Interactions III

Staphylococcus spp.

- Gram positive cocci
- Irregular "grape-like" clusters
- Non-motile
- Facultative anaerobes
- Catalase positive
- *S. aureus*
 - Coagulase positive
 - Pathogenic
 - Often pigmented (golden staph)