

Microbiology - Topic 1 - General Principles of Microbiology

- Micro = small
- Bio = life
- Logy = study of

Immunology - study of our protection from foreign macromolecules or invading organism and our responses to them

Different Classes of Organisms:

- Viruses/chlamydia (grow only in living cells)
- Mycoplasma (grown on non-living media)
- Bacteria (no separate nucleus, unicellular)
- Parasites
- Small (microscopic, 1-2 microns)
- Named by first name genus, second name species

What Are They Made Of?:

Viruses:

- Nucleic acid (RNA or DNA)
- Surrounded by protein shell (capsid)
- Attach, inject nucleic acid (penetration), hijack synthetic processes inside cells to make more viruses, package, get out while going good
- Simple but dangerous

Bacteria:

- Rigid cell wall to keep things in place
- Genetic material, circular chromosome
- No nucleus (nucleoid)
- Both DNA and RNA
- Binary fission (grow twice its length and split into 2)
- Some bacteria don't have a rigid cell wall and are more fragile

Eukaryotes:

- Unicellular and multicellular animals and plants
- Genetic material is organized into a nucleus

Are all bacteria bad?

- No. Biotechnology, spoilage of foods, bioremediation, functional foods, etc.

Can we live without bacteria?

- No.

Normal Flora The Good Guys:

- Always want GI tract full so bad can't get it
- Resident (ones that stay forever) vs. transient (get in when vacant)
- At about 8 months you have your flora
- Skin is mostly coagulase negative staphylococci

Where should there be NO bacteria?

- CNS, bloodstream, respiratory system, private parts (male), eyes but there is some. **

What can they do for us?

- Protection from invasive bacteria by taking up space, metabolism (vitamin K), immune stimulation.

Protection From The Bad Guys:

- Mechanical barriers - skin (dry, acidic, sweat), saliva, mucous, tears, hair, etc
- Antibodies
- Complement
- Immune cells (T-cells, NK cells, macrophages)
- Immune system (cell mediated, humoral)

How Bad Guys Get In:

- Adherence
- Toxin production (destroys some defences)
- Opportunism
- Compromised host (through sleep, exercise, age, stress, cold)
- Septicaemia (blood poisoning) vs. bacteraemia (bacteria in blood, type of septicaemia)

Microbial Disease:

- Interaction between microorganisms and the host is a continuous battle
- They need to enter-live-multiply
- In order to enter they need to colonize in/on body
- Clinical infection can result when damage occurs to host

Contamination - deposition without multiplication

- Clinical disease is easy to recognize, symptoms: chest pain, HR, respiration, BP, acidic, rashes, etc.
- Sub-clinical infection is hard to diagnose because no symptoms

Measuring How Dangerous A Virus/Parasite/Bacteria Is:

Pathogenicity - ability to produce disease (pathogenic/non-pathogenic)

Virulence - relative capacity to cause damage (More virulent/less virulent)

Opportunistic - don't normally cause disease but can do so when defence mechanisms are breached or compromised

Pathogenesis of Infectious Diseases:

- A pathogenic microorganism enters your body and two things happen:
 1. Microorganism tries to multiply/invade and cause disease
 2. Host tries to prevent this
- Whether the invader wins or not is dependent on several factors
- Transmission:
 - Inhalation, ingestion (most common 2), break in protective barrier, direct deposit **

- Pathogenicity
- Invasiveness (adherence, persistence, avoidance of immune system)
- Toxigenicity (ability to make toxins)

How A Pathogen Adheres To Us:

- A bacteria needs to adhere, evade and invade the host
- Tools used to achieve these objectives are: surface structures, capsules and enzymes

Toxigenicity:

- Toxins are substances (usually proteins) secreted by bacteria with the hope to cause damage
- Two classes:

Exotoxins:

- Excreted by living cells
- Specific affinities
- thermolabile (sensitive)
- Potent

Endotoxins:

- Liberated when cell wall disintegrates
- Less specific, causes fever, malaise, shock
- Thermostable
- Less potent than exotoxins