Pathogens

Pathogens are disease-causing agents that disrupt the normal physiology of infected organisms (i.e. homeostatic imbalance).

Pathogens may be species-specific or cross species barriers:
- Diseases that can be naturally transmitted between animals and humans are called **zoonotic** diseases.

**LIVING (CELLULAR)**
- Parasite
- Protozoa
- Fungi
- Bacteria
- Virus
- Prion

**NON-LIVING**

Antibiotics

Antibiotics are compounds that target prokaryotic features but don’t harm eukaryotic cells (i.e. don’t affect host organism):
- May target structures (e.g. cell wall) or metabolic processes.

Some strains of bacteria have evolved with genes that confer resistance to antibiotics (some even have multiple resistance):
- Antibiotics can’t be used to treat viruses (no metabolism).

The first antibiotic identified was penicillin (Fleming – 1928):
- Its treatment use was demonstrated by Florey and Chain.

**Experiment**: Mice infected with pathogenic bacteria

<table>
<thead>
<tr>
<th>Control: No treatment</th>
<th>Treatment: Penicillin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result: All mice died</td>
<td>Result: All survived</td>
</tr>
</tbody>
</table>

Conclusion: Penicillin has antibiotic properties.

Lines of Defense

Immune system can be divided into three lines of defense:
- 1st line of defense – Surface barriers (skin / mucus)
- 2nd line of defense – Innate immunity (non-specific)
- 3rd line of defense – Adaptive immunity (specific)

Surface Barriers

The first line of defense against infectious disease is the surface barriers that function to prevent pathogenic entry.

**Skin**
- Protects external structures (i.e. outside the body)
- Thick, dry and composed predominantly of dead cells
- Glands secrete chemicals to restrict bacterial growth

**Mucous Membranes**
- Protects internal structures and cavities (inside body)
- Thin region composed of living cells that secrete fluid (mucus) to trap pathogens (which may then be removed)

Clotting

Clotting seals damaged vessels to prevent pathogenic entry:
- Injured cells and platelets release clotting factors
- These factors convert prothrombin into thrombin
- Thrombin converts fibrinogen (soluble) into fibrin (insoluble)
- Fibrin forms a mesh of fibres that block the injured site
- Clotting factors also cause platelets to become sticky and form a solid plug (called a clot), sealing the wound
- This process of events is called a coagulation cascade
- Clot formation in coronary arteries lead to heart attacks.

**Clotting Factors**

- Prothrombin
- Thrombin
- Fibrinogen
- Fibrin

**Damaged Vessel**

**Clot Formation**