# B3: Infection and Response

AQA · GCSE Biology · Revision Notes

*Specification reference: 4.3*

**Note:** Sections marked ★ HIGHER TIER ONLY are for Higher tier students only. Foundation tier students should focus on the unmarked sections.

## 4.3.1 Communicable Diseases

### 4.3.1.1 How Disease Spreads

Communicable diseases are caused by microorganisms called pathogens that can be passed from person to person.

- **Bacteria** — reproduce rapidly inside the body and produce toxins (e.g. salmonella, gonorrhoea).
- **Viruses** — invade host cells and use them to replicate; damage or destroy cells (e.g. HIV, measles, tobacco mosaic virus).
- **Fungi** — can infect skin and plants (e.g. rose black spot, athlete's foot).
- **Protists** — some cause disease via insect vectors (e.g. malaria spread by mosquitoes).
- Spread by: contaminated water/food, air (droplets), direct contact, sexual contact, vectors (animals carrying pathogens).

#### Key Terms

**Pathogen:** A microorganism that causes disease

**Toxin:** A poison produced by bacteria that causes symptoms

**Vector:** An organism that carries and transmits a pathogen (e.g. mosquito)

### 4.3.1.2–5 Specific Diseases

- **Measles** (virus) — spread by droplets; causes fever and red rash; dangerous for young children. Prevented by MMR vaccine.
- **HIV/AIDS** (virus) — spread by sexual contact or blood; attacks white blood cells; weakens immune system. Treated with antiretrovirals.
- **Tobacco mosaic virus** — infects plants; causes mosaic pattern on leaves; destroys chloroplasts, reducing photosynthesis.
- **Salmonella** (bacteria) — spread by contaminated food; causes food poisoning (fever, stomach cramps, vomiting).
- **Gonorrhoea** (bacteria) — sexually transmitted; causes discharge and pain. Treated with antibiotics (though resistant strains exist).
- **Rose black spot** (fungus) — spreads in water on roses; black spots on leaves; treated with fungicide.
- **Malaria** (protist) — spread by female Anopheles mosquitoes; causes fever and can be fatal. Prevented using mosquito nets and antimalarial drugs.

**Exam Tip:** For each disease, learn: the pathogen type, how it spreads, its symptoms, and how it is treated or prevented.

### 4.3.1.6 Human Defence Systems

The body has non-specific (physical and chemical) defences as well as specific immune responses.

- **Skin** — a physical barrier; prevents most pathogens entering.
- **Mucus** — in nose and airways; traps pathogens.
- **Cilia** — sweep mucus (with trapped pathogens) away from the lungs.
- **Stomach acid** — kills most pathogens swallowed with food.
- **Phagocytes** — white blood cells that engulf and destroy pathogens (phagocytosis).
- **Lymphocytes** — white blood cells that produce antibodies specific to a pathogen's antigens.
- Memory lymphocytes remain after infection — enabling a faster response if the same pathogen is encountered again (immunity).

**Key Terms**

**Antigen:** A protein on the surface of a pathogen that triggers an immune response
**Antibody:** A protein produced by lymphocytes that binds to a specific antigen
**Phagocytosis:** The process by which phagocytes engulf and digest pathogens

### 4.3.1.7 Vaccination

Vaccines contain dead, weakened or harmless fragments of pathogens. They stimulate the immune system to produce antibodies and memory cells without causing disease.

- If vaccinated, the body responds quickly to real infection — before symptoms develop.
- Herd immunity: if enough people are vaccinated, even unvaccinated people are protected because the disease cannot spread easily.

**Exam Tip:** Vaccines do NOT contain the live, active pathogen — they contain a harmless version that "trains" your immune system.

### 4.3.1.8 Antibiotics and Painkillers

Antibiotics kill bacteria inside the body without harming body cells. They do NOT work against viruses.

- Antibiotic resistance: bacteria can evolve resistance through natural selection. MRSA is a well-known resistant bacterium.
- Painkillers (e.g. paracetamol, ibuprofen) treat symptoms but do not kill pathogens.

**Exam Tip:** Antibiotics only kill bacteria — viruses like flu and COVID are not affected. This is a common exam question!

### 4.3.1.9 Drug Development

New drugs must be discovered and then tested before they can be used on patients.

- 1. **Discovery** — from plants (e.g. aspirin from willow bark, penicillin from mould), microorganisms, or chemical synthesis.
- 2. **Preclinical testing** — tested on cells in the lab and on animals to check safety and effectiveness.
- 3. **Clinical trials** — tested on human volunteers. Low doses first; if safe, more people tested. Double-blind trials use placebos.

### Key Terms

**Placebo:** A dummy treatment with no active ingredient — used as a comparison in clinical trials

**Double-blind trial:** Neither patients nor doctors know who has the real drug, reducing bias

**★ HIGHER TIER ONLY — Monoclonal Antibodies**

• Monoclonal antibodies are identical antibodies produced from a single clone of B-lymphocytes.

• They are made by fusing a lymphocyte with a tumour cell to make a hybridoma cell that divides rapidly.

• Uses: pregnancy tests, detecting cancer antigens, delivering cancer drugs directly to tumour cells (magic bullets), treating autoimmune diseases.