Infection and Response

Below is a checklist of everything you need to know for this topic:

	Explain how diseases caused by viruses, bacteria, protists and fungi spread in animals and plants
	Explain how the spread of diseases can be reduced or prevented
	Give a definition for pathogen and state how pathogens spread
	Describe how bacteria and viruses make us feel ill
	Describe symptoms of bacterial, viral, fungal and protist caused diseases in plants and animals, their treatment and spread
	Describe how the skin, nose, trachea and bronchi, and stomach defend against pathogens
	Explain how white blood cells fight off pathogens
	Define what a vaccine is
	Explain how vaccinations prevent illness
	Describe why herd immunity is beneficial
	Describe the difference between antibiotics and painkillers
	Give advantages and disadvantages of antibiotic use
	Explain why it is difficult to kill viruses
	Give examples of drugs extracted from natural sources
	Describe the stages of drug testing
	Describe how monoclonal antibodies are produced
	Give uses of monoclonal antibodies
	Suggest why monoclonal antibodies are not widely used
	Describe ways plant disease can be identified
	Describe the effect of ion deficiency on plants
	Give examples of physical and chemical plant defence responses
	Give examples of mechanical adaptations plants have

A pathogen is a **micro-organism** that spreads disease.

A **communicable disease** is a disease that can **spread from one person to another** because it is caused by a pathogen

Bacteria and Viruses

Bacteria and viruses are the two most common types of pathogens.

Bacteria make us feel ill by **producing toxins** that damage tissue.

Viruses live and reproduce inside cells causing **cell damage.**

Bacterial Diseases

Illness	Symptoms	Treatment
Salmonella (food poisoning)	Fever, cramps, vomiting, diarrhoea	Fluids Vaccinate poultry
Gonorrhoea	Thick green or yellow discharge, pain when urinating	Antibiotics (most strains now resistant), use a condom

Protist Disease

Malaria is caused by protists that is spread by mosquitoes

It causes **repeating episodes of fever** which can be fatal. The spread can be controlled by:

- Stopping the vectors (mosquitoes) breeding
- Using mosquito nets
- Vaccination
- Insect repellents

Viral Diseases

Measles

Symptoms: Fever, red skin rash

Fatal if complications arrive

Most children are **vaccinated** at a young age

Spread by inhalation of **droplets** from coughs and sneezes.

HIV

Attacks the body's immune system. **Develops in to AIDS** where the **immune system is so badly damaged** it cannot deal with other infections.

Spread by exchange of bodily fluids.

Controlled using **antiretroviral drugs**

Tobacco Mosaic Virus

Affects **tomato plants.**

Gives a **mosaic pattern of discolouration** on the leaves.

The plant growth is affected because of a **lack of photosynthesis.**

Control the spread by **destroying affected plants.**

Fungal Disease

Rose Black Spot is a fungal disease that affects plants.

Purple or black spots develop on the leaves which then **turn yellow** and fall off early as there is **reduced photosynthesis**.

It is **spread by water and the wind.**

It can be **treated using fungicides** and by **removing/destroying** the affected leaves.

Spread of pathogens

Pathogens can be spread through:

1. The air
2. Contact with animals
3. Through water
4. Uncooked food
5. Other people

Reducing the spread of disease

The spread of pathogens can be prevented by::

- Cooking food properly
- Coughing/sneezing in to a tissue
- Good hygiene and sanitation
- Using clean water systems

Human Defence Systems

Skin	Acts as a barrier to stop pathogens entering
Nose	Contains little hairs to trap pathogens
Trachea and bronchi	Contain ciliated cells to trap pathogens. Cells also produced mucus.
Stomach	Contains acid to destroy pathogens that enter

White Blood Cells

White blood cells fight pathogens by:

- Producing antibodies
- Producing antitoxins
- Phagocytosis

Vaccinations

A **vaccine** is a **dead or inactive** pathogen.

A **small amount of pathogen** is injected in to the body.

White blood cells recognise the pathogen as foreign and produce a **small amount of antibodies** to fight the pathogen.

If a **live pathogen re-enters** the body, white blood cells produce **more antibodies in a shorter period of time.**

Antibiotic Use

Antibiotics kill infective bacteria inside the body.

The antibiotic is **specific** to the bacteria.

The use of antibiotics has **reduced deaths from infectious diseases** but there are more strains become **resistant** to bacteria.

Antibiotics **do not kill viruses**

Painkillers

Painkillers **treat the symptoms** of a disease but not the cause.

It is **difficult to kill viruses** without also damaging the tissues of the body.

Sources of medicine

- The heart drug **digitalis** was extracted from the **foxglove plant**
- The **painkiller aspirin** is extracted from the **willow bark tree**
- The **antibiotic Penicillin** was discovered by Alexander Fleming from the ***Penicillium mould***

Most new drugs are synthesised by chemist in the pharmaceutical industry.

The **starting point** for a new drug can often be a **chemical extracted from a plant.**

Infection and Response

Developing a new drug

Preclinical Testing: The drug is tested on **cells, tissues and animals** for **toxicity**.

Stage One: The drug is tested on **healthy volunteers** to test for **toxicity.**

Stage Two: The drug is tested on a **small group of patients** with the illness to test for **toxicity and efficacy.**

Stage Three: The drug is tested on a **bigger group of patients** with the illness to test for **efficacy and dosage.**

Before the drug can be licensed for use, the research has to be **peer-reviewed** in order to **prevent bias.**

Drugs are tested for:

- **Toxicity** (to make sure they are safe)
- **Efficacy** (to make sure they work)
- **Dosage** (to find out the **optimum** dose)

Most drug trials are **double-blind**,

This means the **patient and the doctor are not aware** of who is getting the drug or placebo.

A **placebo** is a fake drug or sugar pill.

It is used as a **control** to compare results to.

Detecting Plant Diseases

Plant diseases can be detected by:

- **Stunted** growth
- **Spots** on leaves
- Areas of **decay**
- Growths or **tumours**
- **Malformed** stems or leaves
- **Discolouration**
- The presence of **pests**

Identifying Plant Diseases

Plant diseases can be identified by:

- Reference to a gardening **manual or website**
- Taking infected plants to a **laboratory** to identify the pathogen
- Using **testing kits** that contain monoclonal antibodies

Plant Defence Responses

Physical Defence Responses

- Cellulose **cell walls**
- Tough **waxy cuticle** on leaves
- Layers of **dead cells** around the stem or bark which fall off

Chemical Plant Defence Responses

- **Antibacterial chemicals**
- Secrete **poisons** to deter herbivores

Mechanical Adaptations

- **Thorns and hairs** to deter animals
- **Leaves** which **droop or curl** when touched
- **Mimicry** to trick animals

Aphids are **little insects** which destroy the plant.

They can be killed using **insecticides.**

Detecting Plant Diseases

Stunted growth can be caused by **nitrate deficiency.** Nitrates are important for protein synthesis.

Chlorosis (leaves turning yellow) is caused by a **magnesium deficiency.** Magnesium ions are needed to make chlorophyll for photosynthesis

Uses of monoclonal antibodies

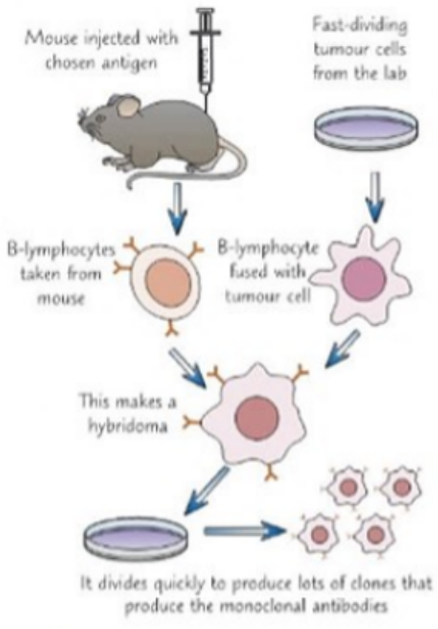
Monoclonal antibodies can be used:

- For **diagnosis** (e.g. in pregnancy tests)
- In laboratories **to measure levels of chemicals** (e.g. hormones) in the blood or to detect levels of a certain pathogen
- In **research** to locate or identify specific molecules in a cell or tissue. The monoclonal antibody **binds with a fluorescent dye.**
- To **treat diseases** (e.g. cancer)
  - The monoclonal antibody binds to a radioactive substance (e.g. drug)
  - It stops cancer cells growing and dividing
  - It does not harm the other cells in the body

Monoclonal antibodies have **more side effects** than first expected.

This means they are **not as widely used** as hoped when they were originally developed

Producing Monoclonal Antibodies



Monoclonal antibodies are produced from **clones of a single white blood cell.** This means that all the antibodies are **identical** and only target **one specific antigen.**

A **hybridoma cell** is a mouse B-lymphocyte fused with a **tumour cell** – this means that there is a cell that **grows easily** and produces **lots of antibodies.**

These antibodies can then be **collected and purified.**

Monoclonal antibodies are useful as they only bind to **the target molecule** on **one type of cell.**