

## **Communicable and non-communicable diseases:**

Communicable diseases spread from person to person by pathogens (bacteria, viruses)

Non communicable diseases cannot be passed on from person to person

Health is the state of physical and mental well-being

## **Pathogens:**

Pathogens are microorganisms that cause infectious diseases

Pathogens can include:

- Viruses
- Bacteria
- Fungi
- Protists

Bacteria reproduce in the body and release harmful chemicals called toxins which damages tissues

Viruses take control of the ribosome and reproduce uncontrollably and when they leave, they can burst the cell open and cause the cell to die

Pathogens can be spread through:

- Air
- Water
- Direct contact

How to reduce spread of pathogens:

- Drinking clean water
- Basic hygiene
- Reducing direct contact
- Vaccination
- Isolation

## **Measles and HIV (viruses):**

Viruses cannot be killed by antibiotics

### **Measles:**

- Primarily characterised as a red skin rash
- Spread by droplets in the air (cough, sneeze)
- People are vaccinated against measles when they are young

### **HIV/AIDS:**

- Damages immune system over time
- Causes immune system to be very weak and unable to fight off other diseases
- This can be stopped using antiretroviral drugs which stops the virus from multiplying but the patient has to take it for the rest of their life
- Transmitted through fluids such as sexual intercourse or between drug users using infected needles (spread through blood)
- Person with HIV may take longer to recover because they are immunocompromised so white blood cells cannot kill bacteria as effectively

*Note: HIV is the virus and AIDS is the effect of the virus*

## **Salmonella and Gonorrhea:**

Bacteria can be killed using antibiotics

### **Salmonella food poisoning:**

- Spreads by ingesting infected food
- Symptoms can include (fever, abdominal cramps, vomiting and diarrhoea)
- Usually found in poultry such as chicken (chicken are usually vaccinated)
- To stop salmonella:
  - Wash hands after using the toilet
  - Isolate yourself
  - Don't share utensils
- Ways farmers can prevent transmission of salmonella:
  - Don't sell infected chickens/eggs
  - Keep infected chickens isolated
  - Slaughter infected chickens

### **Gonorrhea:**

- Sexually transmitted disease (STD)
- Symptoms can include a thick yellow/green discharge from the private part and also pain when urinating
- To stop gonorrhea:
  - Wash hands after urinating
  - Use condoms
  - Abstain from sex

Bacteria is grown at 25°C to stop the growth of harmful bacteria

## **Malaria:**

Malaria pathogen is an example of a protist

People with malaria can experience bouts of fever

### **Lifestyle of malaria protist:**

1. Person infected with malaria is bitten by mosquito
2. Malaria pathogen passes into the mosquito and does sexual reproduction
3. The mosquito bites another person and passes the malaria pathogen to them

4. The malaria pathogen does asexual reproduction

*Note: The mosquito is called a vector because it transports the malaria pathogen*

### **How to stop spread:**

- Drain areas with still water
- Sleep under a mosquito net
- Spray insecticide to kill vector
- Cover skin and body

### **Non specific defense systems in the human body:**

The job of the non specific defense system is to prevent pathogens from entering the body

The skin consists of dead cells and is difficult for pathogens to penetrate so **the skin is a barrier**

The skin produces sebum which kills bacteria

The skin scabs over when injured

The nose contains hair and mucus which traps pathogens

The trachea and bronchi have cilia which has mucus which traps the pathogens and wafts it upwards out of the body

The stomach has hydrochloric acid which can kill pathogens inside of food

### **The immune system:**

#### **White Blood Cells (WBC) perform phagocytosis:**

- 1.WBC detects chemicals released from the pathogen and moves towards it
- 2.WBC engulfs the pathogen
- 3.WBC breaks down pathogen using enzymes

Another way WBCs stop pathogens from harming the immune system is by releasing antibodies which bind to the antigen on the pathogen which is complimentary which immobilises the pathogen

Antibodies are specific so they cannot protect against other pathogens but they stay in the blood for a long time so they help prevent against the same pathogen if it invades again

Another way is by releasing antitoxins which binds to the toxins preventing them from damaging cells

### **Infectious diseases in plants:**

#### **Tobacco mosaic virus (TMV):**

- Virus
- Infects over 250+ plant species
- Causes the discolouration of leaves
  - >This causes reduced photosynthesis which means reduced respiration and less energy for the plant to grow and repair

#### **Rose black spot:**

- Caused by a fungus
- Causes leaves to develop purple or black spots
- Leaves often fall off

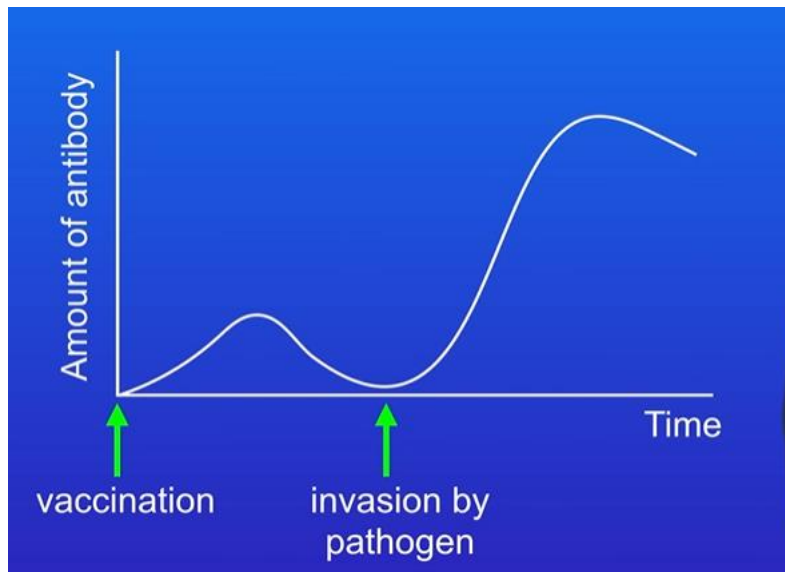


- Reduces photosynthesis meaning less growth for the plant
- Fungus is spread by water/wind
- Two ways to treat it:
  - Spray fungicides
  - Remove infected leaves and then destroy them

## **Vaccination:**

### **How vaccines work:**

- 1.The vaccine consists of a dead/inactive pathogen which cannot harm a person
- 2.When injected, the patients immune system reacts normally
- 3.The WBCs release antibodies which bind to the antigen
- 4.The antibodies are stored in the memory cell in the blood
- 5.Antibodies are produced quickly upon reinfection in larger quantities which kills the pathogen



If many people are vaccinated, then this would protect the unvaccinated people (herd immunity)

### **Antibiotics:**

Antibiotics kill the infective bacteria without harming the body

Antibiotics don't work on viruses because they are only effective against bacteria and do not kill viruses

Antibiotic resistance – When antibiotics become overused and ineffective against the bacteria because they have evolved

Doctors use specific antibiotics to treat specific bacteria

Antibiotics cannot kill viruses because viruses hide inside the cells and bacteria are on the outside of the cell

Pain killers treat the symptoms of a disease by relieving pain but doesn't kill the pathogen

### **Testing medicines:**

Aspirin (painkillers) comes from willow trees

Penicillin comes from penicillium

017	It is important for drugs to be tested in clinical trials before the drugs are approved for use by the public.
	Give <b>two</b> reasons why. <span style="float: right;">[2 marks]</span>
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Question	Answers	Extra information	Mark
01.7	any <b>two</b> from: <ul style="list-style-type: none"> <li>• to check toxicity</li> <li>• to check dosage</li> <li>• to check its efficacy</li> </ul>	allow to check it is safe allow to check for side effects allow to check it is not poisonous / dangerous / harmful  allow to check how much is needed  allow to check it works allow to check it does not interact with other drugs	2

## Developing new drugs:

### Preclinical testing:

- Tested on live animals, cells, tissues
- Tested for safety, efficacy and danger

### Phase 1 clinical testing:

- Tested on healthy volunteers
- Tested for toxicity

### Phase 2 clinical testing:

- Tested on small number of unhealthy volunteers
- Tested for dosage, efficacy and toxicity

### Phase 3 clinical testing:

- Tested on large number of unhealthy volunteers
- Tested for dosage, efficacy and toxicity

### Phase 4 testing:

- Anyone who is in need of it (able to buy)
- Tested for toxicity, dosage and efficacy

A placebo is a tablet or injection with no active drug in it but may make a person think they will get better

Some patients may get better because they think they are being treated with the actual drug even though it is a placebo

Patients are given a placebo as a control

### **Double-blind trial:**

- Some patients will receive the active drug
- Other patients will receive the placebo which looks exactly like the actual drug but has nothing inside
- The doctors and the patients don't know which people will get the drug or the placebo. This is done to stop bias from the doctors

Bacteria is grown at 25°C to stop the growth of harmful bacteria

However, companies grow it at a higher temperature to make bacteria grow faster and 37°C is normal human body temperature

## **Monoclonal antibodies:**

### **How they are produced:**

1. First we inject the mouse with an antigen
2. Then lymphocytes (White Blood Cell) will produce antibodies against antigens
3. We collect the lymphocytes and join tumour cells to allow the lymphocytes to divide by mitosis
4. The cell we produced when adding a tumour cell is called a hybridoma cell which can produce antibodies and divide by mitosis
5. We select a single hybridoma cell which is producing the antibodies we want and allow it to clone itself by mitosis to produce identical hybridoma cells
6. The antibodies produced are all identical and we collect these and purify them

## **Uses of monoclonal antibodies:**

One use of these are pregnancy tests which detect specific hormone. This is cheap and easy to use and highly accurate

We can also use them to measure the levels of hormones in the blood

We can also use them to detect pathogens in the blood to protect us against them by attaching something to it

It also allows us to identify and locate specific molecules in a cell/tissue

It can protect against cancer cells by having antibodies with toxic drugs and then the toxic drugs can stop the cancer cells from dividing

However, monoclonal antibodies have very harmful side effects for some drugs

## **Plant diseases:**

Plants can be attacked by insects called aphids which bite into the phloem and extract sugars and

other minerals from the plant making the plant unable to grow

### **To diagnose plant diseases, look for:**

- Discolouration
- Decay/rot
- Spots on leaves
- Abnormal growths
- Stunted growth
- Malformed leaves/stems

### **To identify plant diseases:**

- We can use a garden manual or website
- We can take the plant to the lab to test it for the pathogen
- We can use testing kits containing monoclonal antibodies

### **Plant ion deficiencies:**

- Lack of nitrate ions causes stunted growth because nitrates are needed for protein synthesis and therefore growth
- Lack of magnesium ions causes chlorosis (lack of chlorophyll) because magnesium ions are needed for chlorophyll production



## **Plant defence responses:**

### **Physical responses:**

- Plant cells have cellulose cell wall which makes it difficult for microorganisms to penetrate
- Leaves are covered with waxy cuticle which makes it difficult for microorganisms to penetrate
- Trees have bark which protects them from microorganisms

### **Chemical responses:**

- Plants release antibacterial chemicals which kills bacteria and prevents them from attacking the plant
- Plants also release poisons to deter herbivores (animals that eat plants) from eating the plant

### **Mechanical responses:**

- Plants have sharp thorns which protect them from herbivores eating them

- Plants have hairs which irritate herbivores mouths making the plant difficult to eat
- Plants have leaves which can droop or curl when touched which scares the herbivores (mimosa)
- Plants such as white dead nettles could look exactly like real nettles or other plants but they don't sting but have the aim of deterring herbivores (mimicry)