

Infectious Disease

Keywords

Communicable disease - disease caused by pathogens that can be passed from one organism to another.

Pathogens - microorganisms that cause disease.

Non - communicable disease - are not infectious and cannot be passed from one organism to another.

Types of pathogen that make us ill

Bacteria – reproduce and release toxins

Virus – invade our cells, reproduce and cause the cell to burst

Fungi – grow and penetrate our skin, causing disease

Protists – single cell eukaryotes (no nucleus)

How pathogens cause disease

Bacteria – reproduce rapidly by splitting in two (binary fission). May produce toxins or damage cells directly.

Viruses – live and reproduce inside host cells, damaging and destroying them.

Common symptoms – high temperature, headache, rash.

How pathogens are spread

Water – drinking contaminated water, e.g. water infected with cholera (a bacterial infection) or fungal spores in splashes of water spread plant diseases.

Direct contact – transfer of pathogens by touching an infected organism.

Air – pathogens transferred through the air, often in droplets in humans from sneezing or coughing. Fungal spores also spread through the air.

Examples of Diseases

| Disease | Caused by | Symptoms | Treatment/Prevention |
|----------------------------|--------------|---|----------------------|
| Measles | <u>Virus</u> | Red skin rash & fever | Vaccination |
| HIV | <u>Virus</u> | Flu-like symptoms. Long term the body cannot fight other infections. | Antiretroviral drugs |
| Tobacco mosaic virus (TMV) | <u>Virus</u> | Mosaic pattern on plant leaves. Photosynthesis is inhibited. | |

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| Rose black spot | <u>Fungus</u> | Purple or black spots on rose plant leaves. Photosynthesis is inhibited. | Fungicides. Cutting off the infected leaves. |
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| Malaria | <u>Protist</u> Spread by mosquitos | Fever. | Protection from mosquito bites (nets and insecticides). |
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| Salmonella | <u>Bacteria</u> from contaminated food. | Fever, stomach cramps, vomiting, diarrhoea | Poultry is vaccinated against Salmonella. Cook food properly. |
| Gonorrhoea | <u>Bacteria</u> A STD. | Pain when urinating. Discharge from penis or vagina. | Antibiotics. Using barrier methods of contraception. |

Reducing Spread of Disease

Hygiene – washing hands before cooking and after sneezing.

Killing vectors – Insects that carry diseases are called vectors. Killing them or destroying their habitats can prevent the spread of disease.

Isolating infected people – prevents them passing the disease to anyone else.

Vaccination – the person cannot become infected and pass it on. Animals can also be vaccinated.

Fighting Disease

Non-specific defences

Skin - physical barrier. It also secretes antimicrobial substances to kill pathogenic bacteria. If you cut or damage skin, platelets help form a clot that dries to form a scab.

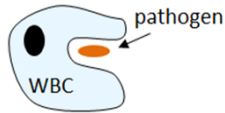
Nose hairs & mucus – traps pathogens

Trachea and bronchi – secrete mucus to trap pathogens. Cilia lining the tubes beat to waft the mucus up to the back of the throat.

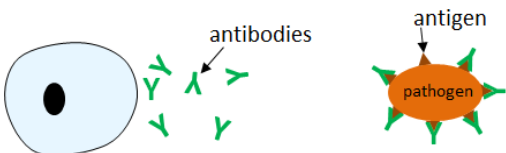
Stomach acid - (hydrochloric) acid kills pathogens in mucus you swallow or take in through food and drink.

Immune System

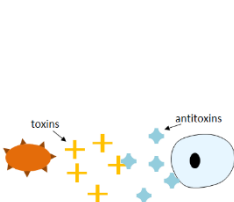
1. White blood cells **engulf** pathogens and digest them.



2. White blood cells **produce specific antibodies** that bind to antigens on a pathogen. If the person gets infected with the same pathogen in the future, WBCs produce the antibodies rapidly and in larger quantities so the person does not feel ill – they are immune.



3. White blood cells release **antitoxins** to destroy toxins released by pathogens.



Vaccination

- An inactive or dead pathogen is injected into a person's bloodstream.
- This stimulates their white blood cells to release specifically shaped antibodies that lock on to the antigen and destroy the pathogen.
- If the person is infected with the real pathogen in the future, memory cells rapidly release antibodies in much larger quantities so the person does not feel ill.

Herd immunity

If a large proportion of the population is immune to a disease, the spread of the pathogen in the population is very much reduced and the disease may even disappear. The WHO want 95% of children to have two doses of measles vaccine to give global herd immunity. Current global figures show that 85% of children get the first dose and 56% get the second.

Antibiotic Resistance

1. You start taking an antibiotic.
2. Some bacteria are susceptible to the antibiotic (killed by it).
3. Some bacteria have a random **mutation** (change in the DNA), that makes them **resistant** to an antibiotic.
4. The antibiotics kill the susceptible bacteria but not the mutated resistant strain.
- At this point, you may start to feel better and stop taking the antibiotic.
5. The **resistant bacteria will reproduce** as they have less competition for resources, increasing their population.
6. A resistant strain emerges that is very difficult to treat.

To help prevent the development of antibiotic resistant bacteria doctors should **not over-prescribe** antibiotics and we should **finish the whole course**.

MRSA is an example of an antibiotic resistant bacteria.

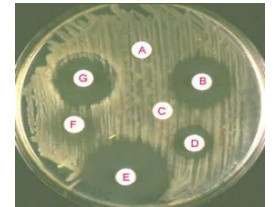
Drugs

Painkillers reduce symptoms of a disease – aspirin, paracetamol

Antibiotics work inside your body to kill bacteria – penicillin.

Antibiotics **do not kill viruses** as they reproduce inside body cells.

Some antibiotics kill a wide range of bacteria whilst others are very specific.



Discovering drugs

Traditionally drugs were extracted from plants and microorganisms.

- The heart drug digitalis originates from foxgloves.
- The painkiller aspirin originates from willow.
- Penicillin was discovered by Alexander Fleming from the *Penicillium* mould.

Developing new drugs

New drugs must be:

1. Effective
2. Safe
3. Stable
4. Successfully taken into and removed from your body.

Stages of Drug Development

1. Research

- researchers target a disease and make many possible new drugs.

2. Preclinical testing

- test drugs on **human cell & tissues** in a lab for toxicity and efficacy. Many drugs fail at this stage.
- Test on **live animals** to check the drug works on a whole living organism to predict how they may behave in humans.
- Gain information about doses and side effects.