Smart Pals

Study Sharp. Stay Smart.

Infection and Response

GCSE AQA BIOLOGY: TOPIC 3

Smart Pals
Study Sharp. Stay Smart.

Communicable disease

Communicable disease → disease can spread from one organism to another.

Caused by pathogens: (microorganisms that cause disease).

There are 4 types of pathogens:

Bacteria

- Bacteria are very small cells (1/100size of your body cell), they reproduce rapidly in the body
- spreads through food, water, contact.
- make you feel ill by producing toxins, damages cells.
- examples → salmonella, gonorrhoea

Viruses

- Viruses are not cells. They are very small (about 1/100 the size of the bacteria)
- Spreads through air, contact,bodily fluids
- they invade host cells and reproduce, causing cell damage.
- examples → measles, HIV, TMV

Fungi

- Fungi have different shapes, they are single- celled or have body made of hyphae (thread like structures)
- spreads through air and water
- make you feel ill by growing on surfaces, damaging tissues.
- Produce spores, can be spread to other plants and animals.
- examples → rose black spot

Protists

- Protists are single - celled, all eukaryotic cells
- spreads through mosquito vector
- makes you feel ill as they live inside organisms, damaging cells
- examples → malaria

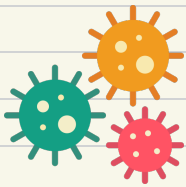
Pathogens spread by:

- Air → pathogens travel through air, carried in droplets produced when you cough or sneeze
- water → drinking contaminated water
- direct contact → touching contaminated surfaces, skin and sexual contact

Smart Pals
Study Sharp. Stay Smart.

Viral diseases

3 main viral diseases:



Measles

- Spread by inhalation of droplets like cough and sneeze.
- symptoms - red skin rash and signs of fever (high temperature)
- can be serious and fatal
- complications - can lead to pneumonia or brain infection (encephalitis)
- prevention - vaccination

HIV (human immunodeficiency virus)

- Spread by sexual contact, blood (eg. Sharing needles), from mother to baby (during birth or breastfeeding)
- symptoms - flu-like illness at first then no symptoms for years
- attacks the immune system, if untreated, it leads to AIDS, body can't fight other infections or cancers
- treatment- antiretroviral drugs prevent virus from replicating
- prevention - safe sex, screening blood

TMV (tobacco mosaic virus)

- Affects plants for example tomatoes
- spreads by direct contact between plants and through contaminated tools or insects
- symptoms - mosaic pattern of discolouration on leaves
- can have an impact on photosynthesis, as it reduce the photosynthesis rate
- prevention - remove infected plants, disinfect tools or insects

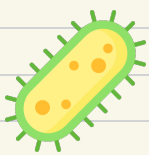
Smart Pals
Study Sharp. Stay Smart.

Bacterial diseases

2 main bacterial diseases :

Salmonella:

- caused by bacteria found in contaminated food (eg. Undercooked meat, eggs)
- symptoms - fever, stomach cramps, vomiting and diarrhoea
- happens because bacteria release toxins that irritate the gut lining
- prevention - in the UK, poultry are vaccinated against salmonella. Cook food properly. Practice good food hygiene.



Gonorrhoea:

- Sexually transmitted bacterial infection
- symptoms - thick yellow or green discharge from genitals. Pain when urinating. Can lead to infertility if untreated
- used to be easily treated with penicillin. Now, many strains have become resistant
- prevention - use barrier methods of contraception, such as condoms, treat infected individuals quickly.

Smart Pals
Study Sharp. Stay Smart.

Fungal & protist diseases

Fungal disease:

Rose black Spot:

- Plant disease
- spread easily in warm and wet conditions
- symptoms - purple or black spots develop on leaves. Leaves turn yellow and full off early. Photosynthesis is reduced, so the plant grows poorly and fewer flowers are produced
- prevention - remove infected leaves, treat using fungicides

Disease caused by protist:

Malaria:

- The protist is a parasite that lives part of its life inside another organism
- spreads to humans by a vector
- Mosquitos pick up the malarial protist when they feed on an infected animal
- symptoms - repeating episodes of fever
- can be life threatening and causes: chills, sweating, headache and muscle pain
- prevention - mosquito nets and use insecticides

Preventing diseases

Prevention stops communicable diseases from spreading, it is cheaper and more effective then treatment. Ways to prevent diseases:

- Hygiene - washing hands before eating, using tissues when sneezing and cleaning surfaces.
- vaccination - through this infection can't be developed and so will not spread.
- isolating infected individuals - stops pathogens from spreading
- destroying vectors - getting rid of organisms that spread disease prevents disease to be passed on.

Smart Pals
Study Sharp. Stay Smart.

Human defence system

Human defence system → protects the body from pathogens. The body has two main lines of defence against pathogens:

- non- specific defence system - the first barrier, acts against all pathogens.
- specific immune response - the second line, involving white blood cells, targets specific pathogens.

Non-specific defence (first line of defence)

DEFENCE	HOW IT PROTECTS
Skin	Acts as a physical barrier; secretes antimicrobial substances to kill pathogens
Nose	Has hair and mucus that traps particles and pathogens
Trachea & bronchi	Lined with cilia (hair-like structures) that wafts mucus up to the throat where it's swallowed
Stomach	Produces hydrochloric acids that kills pathogens

Specific immune system (second line of defence)

When pathogens get past the first line of defence, the immune system (mainly white blood cells) takes over. White blood cells defend the body in 3 main ways:

- Phagocytosis - when certain white blood cells called phagocytes engulf and digest pathogens. They surround the pathogen and break it down with enzymes.
- antibody production- white blood cells called lymphocytes detect antigens on pathogens. They produce antibodies that are specific to that pathogen's antigens. Antibodies lock onto the pathogen, destroying it. If some pathogen tries to infect again, the body responds faster and stronger, creating immunity.
- Antitoxin production- some white blood cells produce antitoxins to neutralise toxins released by bacteria.

Smart Pals
Study Sharp. Stay Smart.

Vaccination

Vaccination involves injecting a dead or inactive form of a pathogen into the body. This stimulates the immune system to respond without causing disease. The goal is to train the body to fight the pathogen if it ever shows up later.

How vaccination work:

1. Vaccine contains antigens from the pathogens (dead or inactive)
2. White blood cells (specifically lymphocytes) detect the antigens
3. The body produces antibodies specific to those antigens
4. Some white blood cells become memory cells
5. If the real pathogen enters the body later, the immune system recognises it immediately. It rapidly produces antibodies to destroy it. This prevents illness, creating immunity.

Advantages of vaccination

- Helps control lots of communicable disease
- epidemics (big outbreaks of disease) can be prevented if a large percentage of the population is vaccinated (herd immunity)

Disadvantages of vaccination

- Side effects
- don't always work

Key vocabulary:

- antigen - unique molecule on the surface of a pathogen
- antibody- protein made by white blood cells, binds to antigens
- Memory cells - special white blood cells that remember the pathogens
- herd immunity - reducing spread of disease, as most of the population is vaccinated

Smart Pals
Study Sharp. Stay Smart.

Drugs

Drugs → substances used to treat or prevent diseases. In this topic the main focus is on medical drugs.

Types of medical drugs

Painkillers

- Relieve symptoms (like pain or fever) but don't kill pathogens
- painkillers don't cure the diseases, they only make you feel better, giving you pain relief.
- examples - paracetamol, aspirin

Antibiotics

- Kill or prevent the growth of bacteria, without harming body cells.
- do not work on viruses (viruses reproduce inside cells)
- examples - penicillin

Antibiotic resistance

- Bacteria con mutate (change) which can lead to resistance. This means that when antibiotic are given, only bacteria that is not resistant will be killed. The resistant bacteria will survive and reproduce, passing on resistance. This is a major concern in medicine.
- To slow down the rate of resistant strains from developing, doctors must avoid over- prescribing antibiotics. When patients are given antibiotics, they must ensure to finish the whole course so that all the bacteria is killed.

Drug origins (required examples)

- aspirin - originated from willow and used as painkillers
- digitalis - originated from fox glove and used to treat heart conditions
- penicillin - originated from mould (Alexander Fleming noticed that mould kills bacteria) and used as antibiotic

Smart Pals
Study Sharp. Stay Smart.

Drug Development

Purpose of developing drugs → used to treat symptoms, cure diseases and prevent diseases.

Drug development process:

Drug development is carefully controlled to make sure drugs are effective, safe, and have the right dose.

Stage 1 - preclinical testing (cells and tissues)

- The drug gets tested in the lab on human cells and tissues.
- if the drug is designed to affect the whole body, human cells and tissues can't be used as it would produce inaccurate results.

Stage 2 - preclinical testing (animals)

- The drug gets tested on live animals.
- The test is for: toxicity (is it safe?), efficacy (does it work?), dose (how much to give).
- some individual believe it is ruthless to test on animals, but others think it is the safest way to ensure the drug isn't toxic.

Stage 3 - clinical trials

- When the drug passes the test on animals, it's then tested on healthy human volunteers first at a low dose, in-order to check the safety and the side effects.
- then gets tested on patients with disease, this is to test for efficacy and and optimum dosage.
- next is the double- blind trial. Patients are split into two groups: one group gets the real drug and one gets a placebo (non active drug) - neither the patient nor the doctor knows who gets which until after the trial, preventing bias results and allows for the placebo effect (when patient feels better when they have been given a dummy form of the drug)
- lastly, before the test gets published, there is another step called peer review. This ensures the results are valid, reliable and high quality.