ARCHBISHOP ILSLEY CATHOLIC SCHOOL

Justus et Tenax Propositi - Just and Firm of Purpose

AQA GCSE Combined Science

Biology

B3 Infection and Response

Knowledge and Mastery Book

Do not write in this booklet

ALL answers to be written in your exercise book

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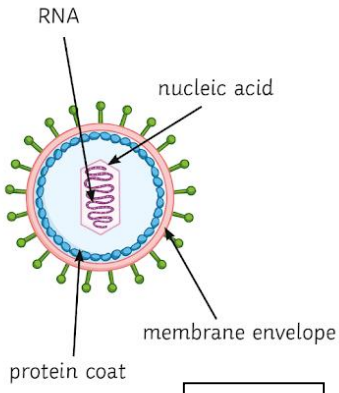
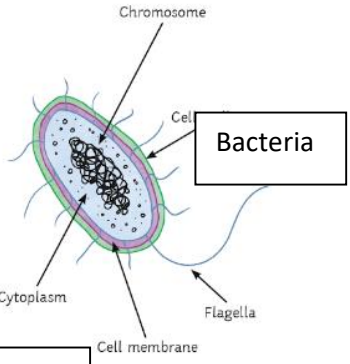
Lesson 1 Types of Pathogens

Communicable diseases are ones that can be spread between individuals. Some examples include tuberculosis, measles and flu. Communicable diseases are caused by pathogens which are disease causing micro-organisms. Pathogens can be bacteria, viruses and fungi. Non –communicable diseases cannot be transmitted between individuals. Some examples include arthritis and heart attacks. Both communicable and non-communicable diseases cause ill health. Other factors like diet, stress and age can affect chances of being ill. Pathogens are micro-organisms that cause disease. There can be many types of pathogens including **bacteria**, **viruses**, **protists** or **fungi**. Pathogens enter the body through where there are gaps in the body's defences i.e. mouth, nose, cuts. The diseases caused by pathogens are known as communicable diseases as they can be spread between individuals. Pathogens can be spread in different ways. Some pathogens can be spread through the air by coughing, sneezing and even talking (droplet infection). Examples include flu (caused by a virus) and tuberculosis (caused by a bacteria). Some pathogens are spread by direct contact. For example, sexually transmitted diseases such as gonorrhoea (caused by a bacteria) and HIV/AIDS (caused by a virus). Other pathogens can be spread through water, for example, cholera or salmonella. These diseases often cause diarrhoea. Diseases often spread quicker through crowded city centres.

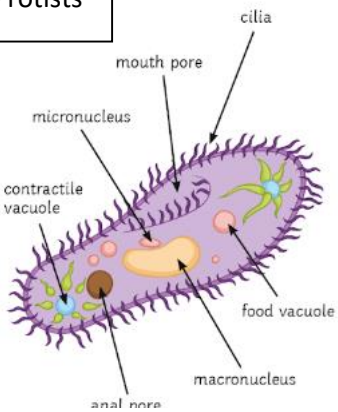


Virus

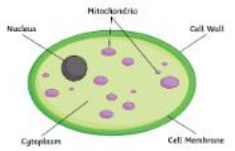


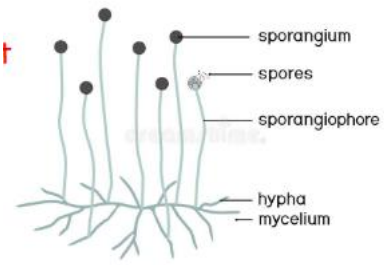
Bacteria

Protists



The two main types of pathogens that cause disease are bacteria and viruses. Bacterial pathogens are prokaryotic cells that cause disease by releasing toxins that make you feel ill. Once inside our body bacteria cells divide by binary fission. Viruses invade our cells, they then reproduce inside the cells (not by binary fission) and continue to do so until the cell bursts. This can create direct symptoms, or you might experience symptoms as a result of your immune system fighting off the infection. Viruses are not cells and need to invade cells in order to reproduce. They are also incredibly small, about 100 times smaller than bacteria.

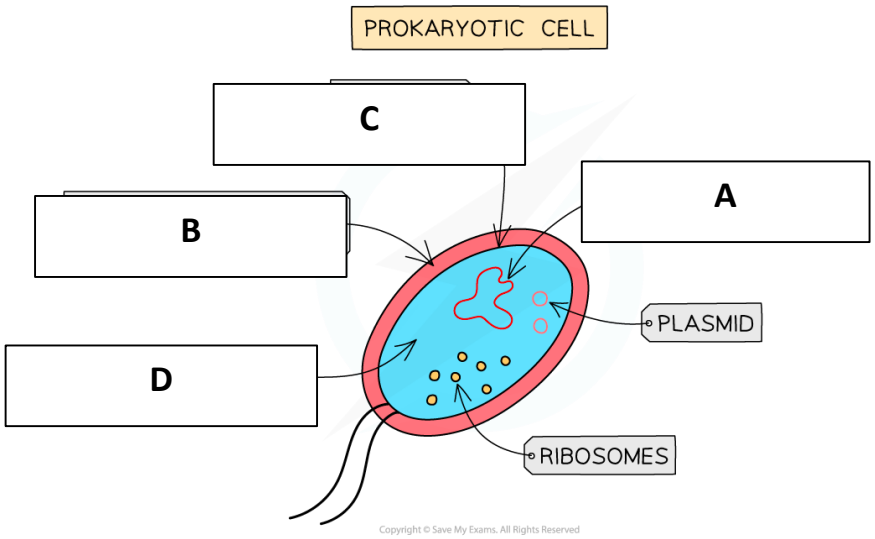




Fungi

Mastery Questions

1. What is a pathogen?
2. Clive says "Bacteria and Viruses are both prokaryotic cells" explain the common mistake he has made
3. List the 4 different types of pathogens.
4. State two diseases caused by bacteria.
5. State two diseases caused by viruses.
6. What are three ways pathogens can be spread?
7. What do bacteria release to make us ill?
8. How do bacteria divide?
9. Label the prokaryotic cell.



10. How do viruses make us ill?
11. Suggest the ways that pathogens could enter your body.
12. Suggest why pathogens/diseases that spread through water often cause diarrhoea
13. Suggest ways that the spread of diseases in air droplets could be prevented
14. Suggest why diseases spread faster in city centres
15. Complete a Venn diagram to compare the similarities of bacteria and virus pathogens
16. Compare bacterial and virus pathogens use the sentence starters below to help
    Both viruses and bacteria are examples of…
    An example of a viral disease is…. Whereas….
17. Describe how diseases can be spread.
18. Compare bacterial and viral diseases making sure to include examples
19. Suggest what safety measures you could incorporate around the school to prevent the spread of disease.
20. The school wants to bring in a rule where students must shake a teachers hand before entering the classroom. Explain why this is a bad idea.

Exam Questions

Q1. Pathogens cause infectious diseases.

(a) Write the disease in your books, with the type of pathogen that causes it near.

Disease		Type of pathogen
		Bacterium
Gonorrhoea		
		Fungus
		Protist
Measles		
		Virus

Q2. Bacteria and viruses can cause communicable diseases.

(a) Bacterial cells are different from animal cells.
Which structure is found in bacterial cells and **not** in animal cells?
Copy out **one** correct answer

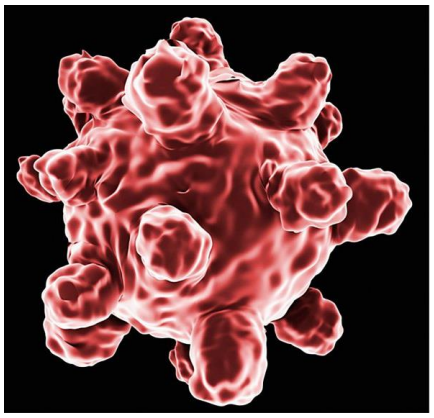
(b) The table below lists four communicable diseases.
Which diseases are caused by a bacterium and which are caused by a virus?
Copy and complete the table, putting **one** tick in each **row** (line going across)
One row has been completed for you.

Disease	Caused by a bacterium	Caused by a virus
Measles		✓
Gonorrhoea		
AIDS		
Salmonella		

Lesson 2 Diseases

Pathogens that cause disease come in 4 main categories: virus, bacteria, protists and fungi.

Viral diseases



Measles is a viral disease showing symptoms of fever and a red skin rash. Measles is a serious illness that can be fatal if complications arise. For this reason, most young children are vaccinated against measles. The measles virus is spread by inhalation of droplets from sneezes and coughs.

HIV initially causes a flu-like illness. Unless successfully controlled with antiretroviral drugs the virus attacks the body's immune cells. Late stage HIV infection, or AIDS, occurs when the body's immune system becomes so badly damaged it can no longer deal with other infections or cancers. HIV is spread by sexual contact or exchange of body fluids such as blood which occurs when drug users share needles.

Tobacco mosaic virus (TMV) is a widespread plant pathogen affecting many species of plants including tomatoes. It gives a distinctive 'mosaic' pattern of discolouration on the leaves which affects the growth of the plant due to lack of photosynthesis.

Bacterial diseases

Salmonella food poisoning is spread by bacteria ingested in food, or on food prepared in unhygienic conditions. In the UK, poultry are vaccinated against salmonella to control the spread. Fever, abdominal cramps, vomiting and diarrhoea are caused by the bacteria and the toxins they secrete.

Gonorrhoea is a sexually transmitted disease (STD) with symptoms of a thick yellow or green discharge from the vagina or penis and pain on urinating. It is caused by a bacterium and was easily treated with the antibiotic penicillin until many resistant strains appeared.

Gonorrhoea is spread by sexual contact. The spread can be controlled by treatment with antibiotics or the use of a barrier method of contraception such as a condom.

Fungal diseases

Fungi are living organisms. They are eukaryotic organisms and include: mushrooms, toadstools, moulds and yeast. They produce spores (for reproduction) and digest organic matter. They do not photosynthesise so in some ways are more closely linked to animals than plants.

Rose black spot is a fungal disease where purple or black spots develop on leaves. It affects the growth of the plant as photosynthesis is reduced. It is spread in the environment by water or wind. Rose black spot can be treated by using fungicides and/or removing and destroying the affected leaves.

Protist diseases

Protists are microscopic and unicellular. They are Eukaryotes. The parasitic diseases that they cause can be life threatening. Malaria is an example of a disease caused by a protist. The parasite spends some of its time living inside mosquitoes and the rest inside humans. The mosquito spread the protists from one human to another. They are said to be the vector of transmission for the disease. When in the body the protist can damage the liver and the red blood cells. Malaria is widespread in tropical areas and kills 660,000 people per year. Treatment for malaria involves taking a combination of drugs however it is becoming less effective. The best strategies involve preventing the spread by targeting the mosquito vectors.

This is achieved by:

- Using mosquito nets to prevent human being bitten
- Using insecticides to kill mosquitoes
- Preventing the breeding of mosquitoes by removing their breeding habitats like standing water
- Providing people with antimalaria drugs which kill the parasites if they get bitten

Lesson 2 Mastery Questions

1. How is measles spread?
2. Name 2 symptoms of measles?
3. What does the HIV attack?
4. How is HIV spread?
5. Is Salmonella a bacteria or virus?
6. Name 2 symptoms of food poisoning.
7. What is gonorrhoea?
8. How can gonorrhoea be prevented and treated?
9. What is the difference between eukaryotic and prokaryotic organisms
10. What is a vector?
11. What is the meaning of unicellular?
12. What causes the spread of malaria?
13. Why is the chance of getting malaria in the UK very low?
14. Why would leaving black spotted leaves on the ground cause the spread of rose black spot disease?
15. Give 2 examples of how a disease is spread by droplet infection
16. How can we prevent the spread of sexually transmitted infections?
17. Why did Semmelweis' suggestion of washing between patients prevent the spread of disease?
18. What precautions could nurses take to prevent the spread of infections at hospitals?
19. What are communicable diseases?
20. What is a pathogen?
21. Name four microorganisms that can be pathogens (give the broad group names, rather than specific examples).
22. What chemicals can pathogens produce that cause disease symptoms?
23. Where in organisms do viruses reproduce?
24. How does this cause symptoms?
25. State three general ways that pathogens can be spread from animal to animal (including humans).
26. Describe five general methods that humans can adopt to reduce the spread of pathogens.
27. State how pathogens can spread from plant to plant.

Lesson 2 Exam Questions

Q1. (a) Copy out each disease and copy the description that matches it.

HIV	Can be spread by not washing hands thoroughly.
	Can increase the chance of infection such as pneumonia.
Malaria	Part of the life cycle includes an insect.
	spread by cough and sneezes.
Salmonella	Treated with stem cell.
	Treated with fungicides.

(b) Gonorrhea is a sexually transmitted disease. A bacterium causes gonorrhea.

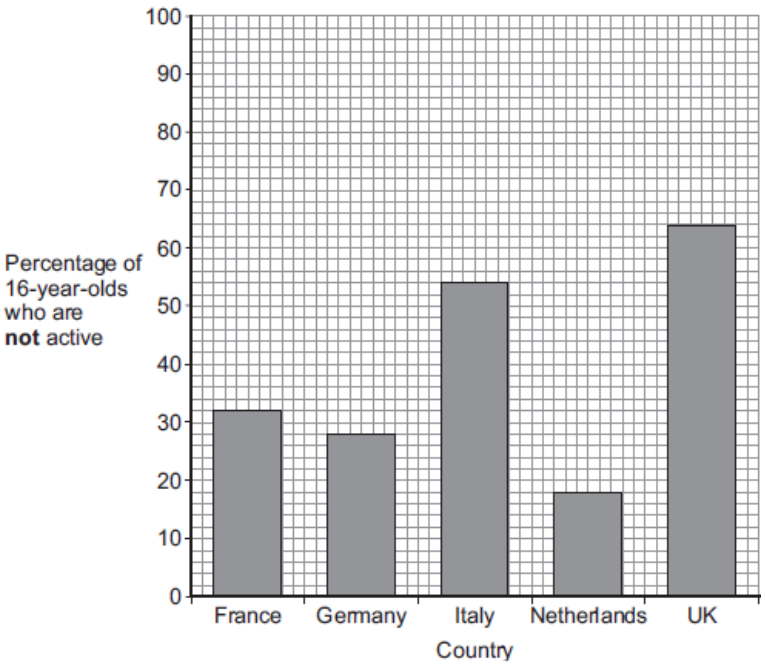
What are the symptoms of gonorrhea? Copy the **two** correct answers:

Headache Pain when urinating Rash Vomiting

Yellow Discharge

2. Scientists investigated the effect of different factors on health.

(a) People who are **not** active may have health problems.



The graph shows the percentage of 16-year-olds in some countries who are **not** active.

(i) What percentage of 16-year-olds in the UK are **not** active?

(ii) What percentage of 16-year-olds in the UK are **active**?

(iii) A newspaper headline states:

People in the UK are the laziest in the world.

Information in **Figure 1** does **not** support the newspaper headline.

Suggest **one** reason why the newspaper headline may be wrong.

(b) Doctors gave a percentage rating to the health of 16-year-olds.
100% is perfect health.

The table shows the amount of exercise 16-year-olds do and their health rating.

Amount of exercise done in minutes every week	**Health rating as %**
Less than 30	72
90	76
180	82
300	92

What conclusion can be made about the effect of exercise on health?

Use information from the table.

(c) Inherited factors can also affect health.

Give **one** health problem that may be affected by the genes someone inherits.

Draw a ring around the correct answer.

being malnourished	**having a high cholesterol level**	**having a deficiency disease**

(1)

Lesson 3 Human Defence Systems

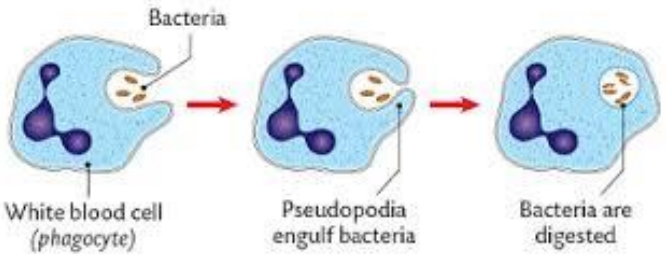
Humans live in a world surrounded by potential pathogens. Like all other organisms we have evolved several defence systems to prevent us from getting ill.

Non-specific defence systems: these are working all the time to prevent us from pathogens.

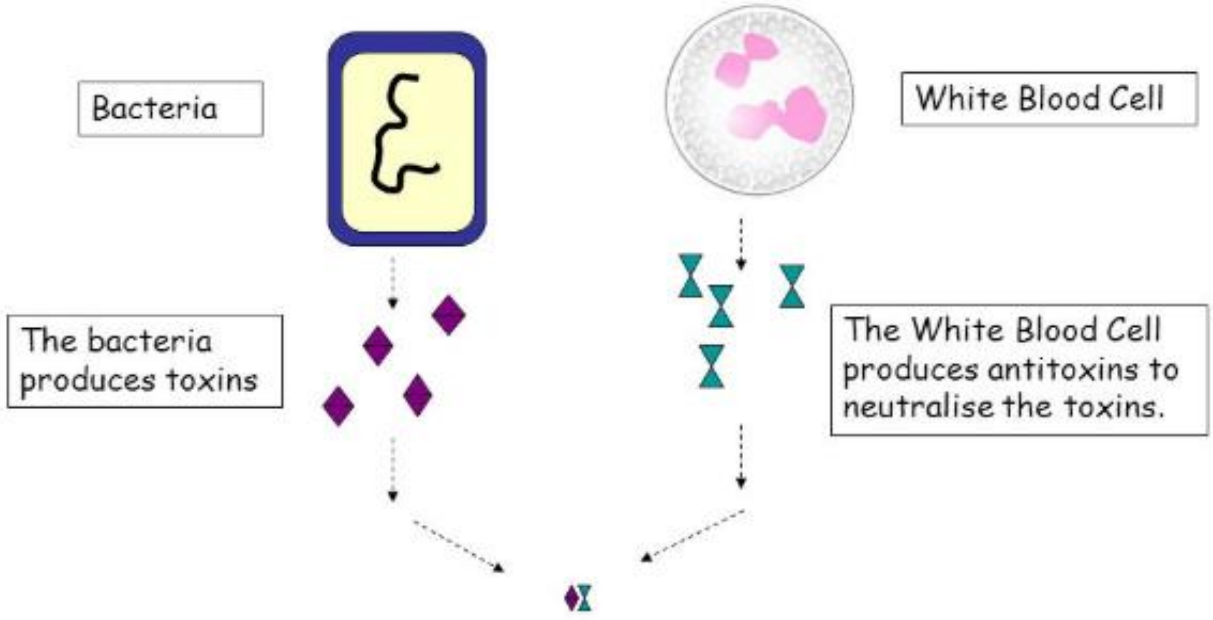
- **Skin**: Provides a protective barrier that prevents pathogens entering the body
- **Nose**: Contains tiny hairs that trap pathogens
- **Trachea and bronchi**: Contain ciliated epithelial cells which move mucus up to the nose. The mucus traps pathogens.
- **Stomach**: Contains acid. The acid destroys pathogens that are eaten

Specific defence systems: different cells and chemicals of the immune system aimed at destroying specific invaders

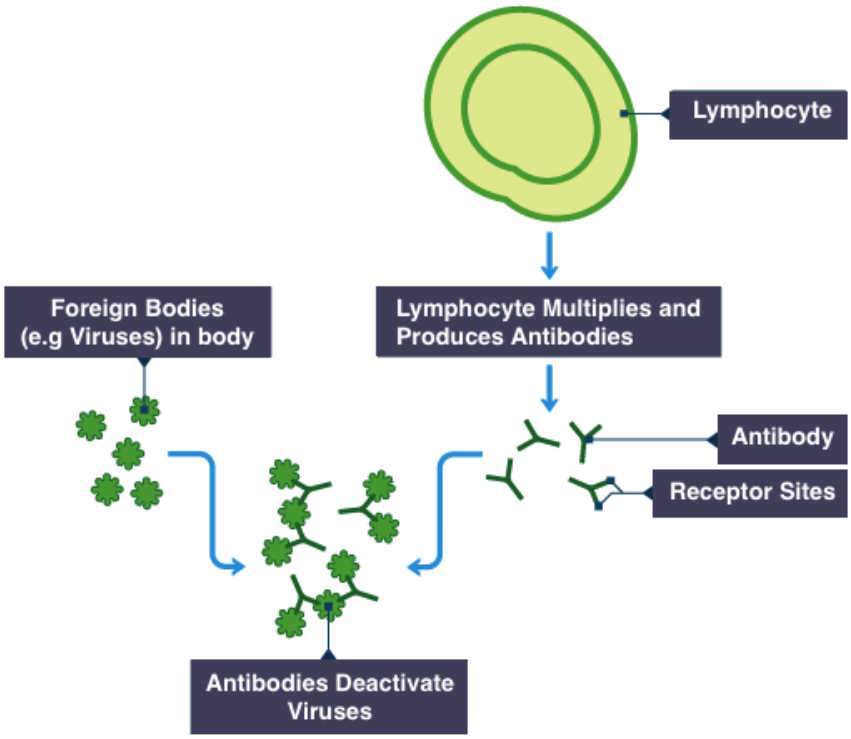
- **Phagocytosis**: White blood cells ingest (take in) pathogens, digesting them with enzymes so they cannot make you ill. Once the phagocytes have ingested as many pathogens as possible they die. Their dead cells form around a cut as pus.



- **Antitoxin production**: White blood cells can also produce antitoxins. These bind to the toxins made by bacteria and prevent them hurting your cells.



- **Antibody production**: While blood cells called lymphocytes produce antibodies. These target specific pathogens by sticking to complementary molecules found on the surface of all cells, called antigens. This then prevents them spreading and targets them for destruction by the immune system. Antibodies are specific to a particular pathogen and can be rapidly made again should re-infection happen with the same pathogen.



Once some of the lymphocytes have begun producing specific antibodies and antitoxins they stay primed as memory cells. This means they can respond quickly if they are introduced to the same pathogen again. The immune system is able to adapt over time and build up a 'memory' of past infections. This means that over time you become more resistant to a wider range of pathogens.

A Bug's Life…

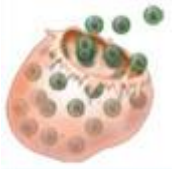
Hi. I'm *Staphylococcus aureus*, but you can call me Staffy for short and this is the story of how my mates and I went on a rampage… and how we died.

Well it all started with us living happily in the nose. It's warm, it's moist and there's a good supply of oxygen- it's a 5* joint for us bacteria! We were living in the nose of a young lad called George. George fell over one day, cut his knee up real bad. George wasn't bothered; infact whilst his mum washed his wound, he picked his nose [filthy habit]. Anyway, we ended up being transferred to his fingertips and that little beggar- well, straight after his mum was done washing his cut, he was poking it and touching it- that's when we made our move! We hopped straight into that cut and got the direct line to his nice open skin. Hmmm… heaven!

As we got comfy, we started multiplying, we make exact copies of ourselves- some species of bacteria can do this in as little as 20 minutes- most Staphylococcus strains can double our number in under an hour. Sometimes you humans don't even realise you're infected until you start to feel ill a few days later- this is usually because we need time to multiply enough to get the numbers needed to cause problems. Well anyway, as we start to multiply, we make **toxins**. These are chemicals that are harmful to other organisms and for you humans. They make you feel ILL!!!

We're different to those other microbes' "viruses" because we can survive all by ourselves- we don't have to go crawling into a body cell in order to reproduce! Although seeing how the viruses burst the cells open when they've finished multiplying [releasing lots more viruses into the bloodstream] maybe we shouldn't make fun of them!

1. The cell ignores its own needs and switches to making new viruses.

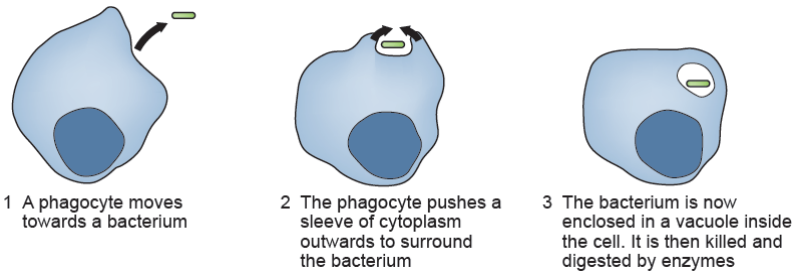


2. As the viruses leave the cell it is sometimes destroyed. The new viruses go on to infect other cells.

So anyway, there I was with my mates, happily **secreting** [releasing] those toxins when disaster struck! A **phagocyte** was on its way. They're scary gits for us pathogens- they actually engulf us whole! This type of white blood cell basically traps us in a little pocket of their membrane then release enzymes that… destroy us! You guys call this process

phagocytosis- we call it SCARY!!! Those phagocytes ingest and digest all cells that don't belong to your body but luckily, they're small in number so a lot of us survived 💻

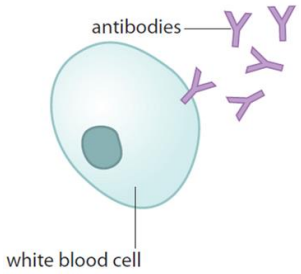
Oh BTW- if your other bacterial mates tell you that a macrophage is on the way then be scared- it's another name for a phagocyte!

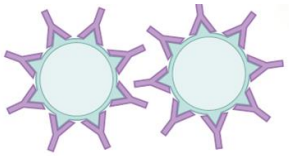


Our joy at surviving was short lived… other white blood cells had been notified of our presence and had been busy with their own types of torture. The white bloods in question release two nasty devilish things that cause us to quake in our cell walls… **antibodies** and **antitoxins**.

Antitoxins make us feel weak because they counteract all of those toxins that we release. Good thing for you is that it makes you feel better and less ill- bad thing for us- all our hard work has been for nothing!

The real hazard is the antibodies. These are Y shaped chemicals that can kill us directly or cause us to clump together to make it easier for the phagocytes to get us. Each type of antibody attacks only one type of pathogen so they take some time to make… but that's where the good news ends- after the antibody's been made special memory white blood cells store the design for quick production later.





The antibodies attach to the pathogen and destroy it

So, once the entire immune system was in full swing, my mates and I didn't stand a chance. One by one we were killed off… worse thing is we can't even pretend we caused the swelling and the pus in George's leg; the swelling was from the increased blood flow bringing all the white blood cells to the site of infection and the pus was dead white blood cells and bacteria. It was a good ride but once again the immune system has us beat. We'll get you back- just show us the antibiotics… but that's a different story!

A Bug's Life Comprehension Questions:

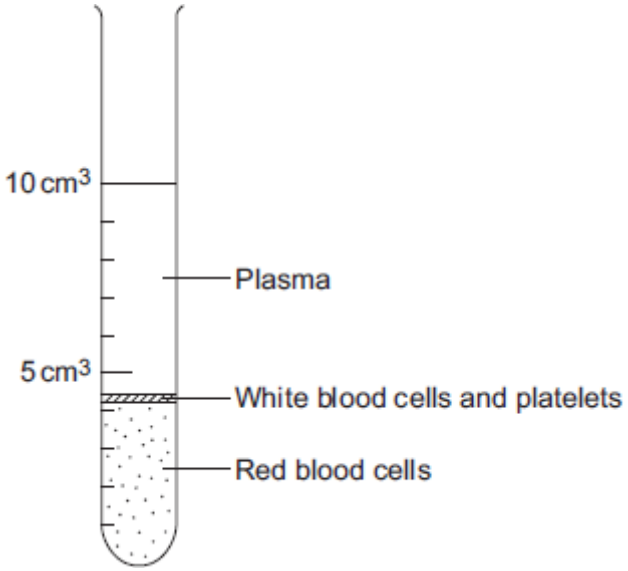
1. **What type of blood cells are involved in the immune response?**
2. **Why is there a delay between being infected and feeling the symptoms?**
3. **How do viruses make you feel ill?**
4. **How do bacteria make you feel ill?**
5. **What's the difference between bacteria and viruses in how they replicate [make copies]?**
6. **Explain how phagocytes work.**
7. **Explain the difference between antibodies and antitoxins.**
8. **Why do you think skin is classed as a non-specific response whereas antibodies are a specific response?**

Lesson 3 Mastery Questions

1. What is a pathogen?
2. List 3 non-specific defence systems the body has.
3. What is Phagocytosis?
4. What type of cells produce antibodies?
5. Where do we find antigens?
6. What type of cells produce antitoxins?
7. What do antibodies bind to?
8. What type of cells remember antibodies that have been made before?
9. Do antitoxins prevent against viral or bacterial infections. Why?
10. What type of cells engulf and digest pathogens?
11. What three ways can white blood cells protect us from invading pathogens?
12. How does the skin protect against pathogens entering the body?
13. What is it called when cells engulf and digest pathogens?
14. What property of the stomach helps to stop food poisoning?
15. Why are bacteria known as prokaryotic cells but fungi are eukaryotic cells?
16. Hugh says "I've already had chicken pox so I can't get it again." Is Hugh right or wrong? Give a reason
17. A child falls over in the mud and cuts their knee. After a few days yellow puss has formed around the cut and it is sore to touch. Explain how the cut became infected. Keywords: skin, pathogen, white blood cell, ingest, phagocytosis, puss, infection
18. There is an outbreak of a common pathogen. Who will be more likely to fight it off before getting sick, a child or an adult? Why?

Lesson 3 Exam Questions

Q1. The parts of the blood can be separated from each other by spinning the blood in a centrifuge.The image below shows the separated parts of a 10 cm^3 blood sample.



(a) Calculate the percentage of the blood that is made up of plasma.

(2)

(b) Name **three** chemical substances transported by the plasma.

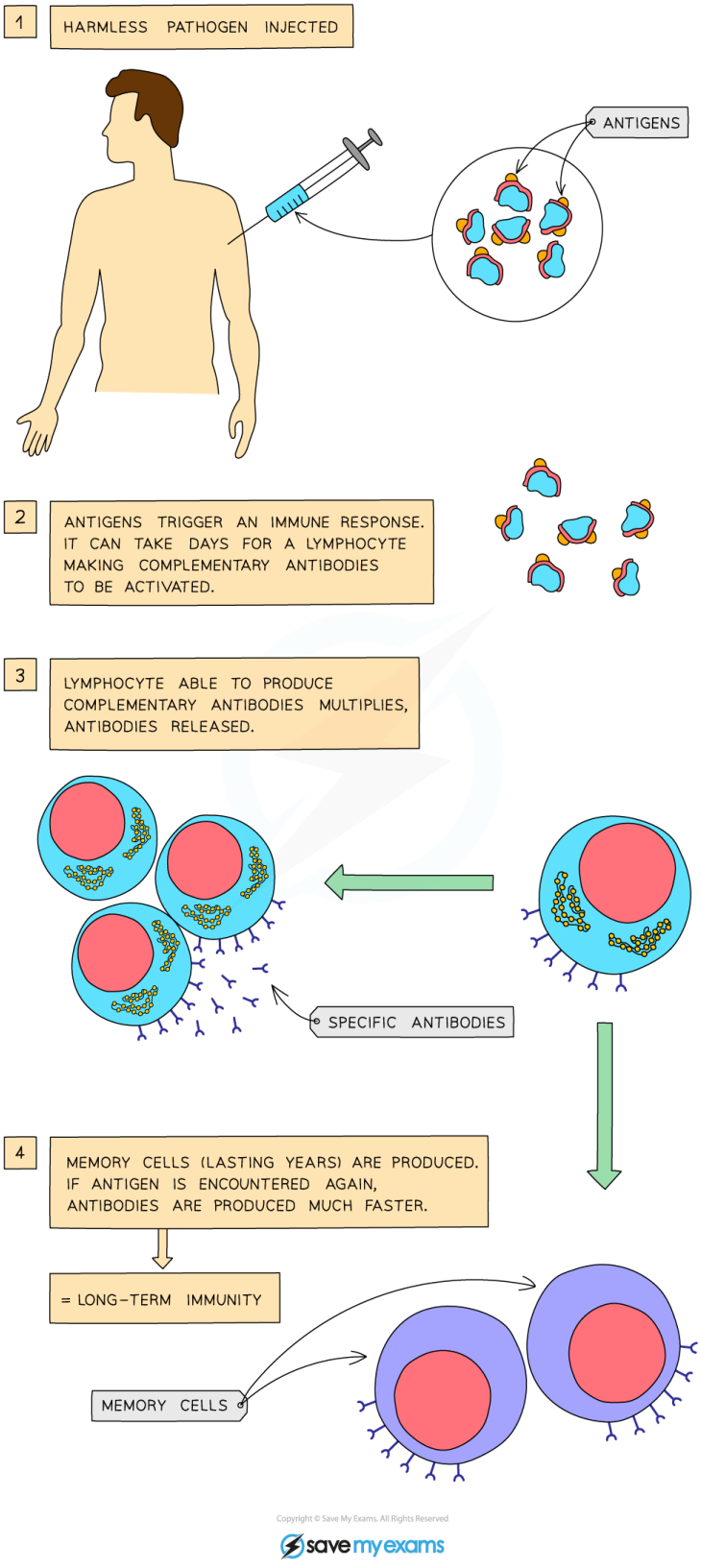
(3)

(C) Describe how pathogens cause infections **and** describe how the immune system defends the body against these pathogens.

Lesson 4 Vaccinations

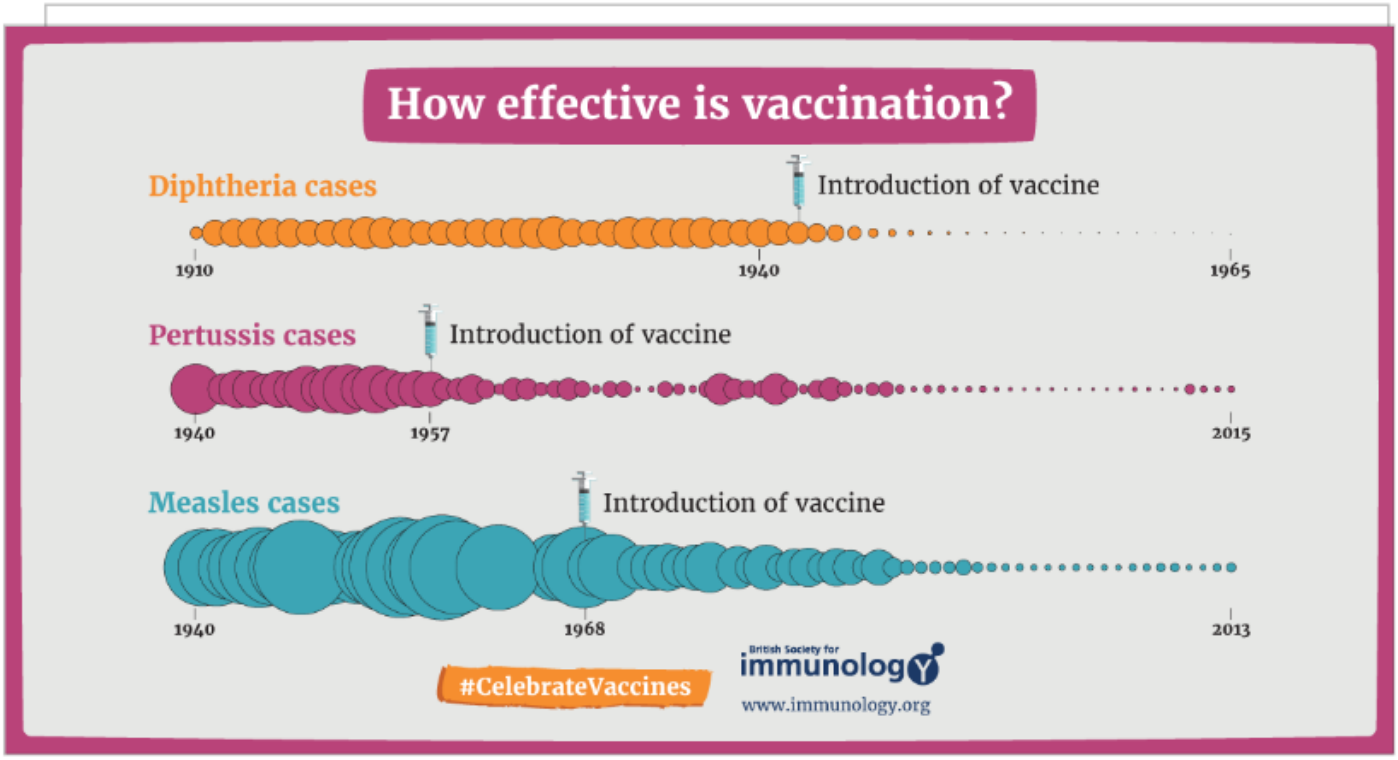
Vaccinations allow people to become immune without being infected by a dangerous pathogen.

1. A vaccine is an injection of a dead or inactivated form of a pathogen which means it can't make us ill.
2. When injected into our bodies it stimulates our white blood cells to form the correct antibodies.
3. The antibodies then bind to the vaccine and destroy it.
4. Some of these white blood cells become memory cells. As previously mentioned, these memory cells remember how to make the antibodies required to destroy a particular pathogen.
5. If the patient is infected by that pathogen in the future the memory cells rapidly make lots of antibodies before the pathogen can make the patient ill. This process is so rapid the person will not even be aware that they have been infected!



Herd Immunity

The most well know vaccine is the MMR which protects us from Measles, Mumps and Rubella. Many vulnerable people cannot get vaccinated, notably the elderly and those with immune system deficiencies. In order to protect them a system known as herd immunity is used. Herd immunity is when the majority of people in a population are immune to a disease. This prevents the spread of diseases as there are not enough hosts to carry the disease to the vulnerable people. This involves vaccinating the majority of the population. Recently some parents have been deciding against vaccinating their children with MMR. Some people have based their decision on falsified scientific data. The MMR was first introduced in 1971 and there is no evidence to suggest that vaccines are harmful to short-term or long-term health. This has caused an increase in the number of deaths from diseases that were previously under control, like measles.



Lesson 4 Mastery Questions

1. What is an antigen?
2. What is an antibody?
3. What cells produce antibodies?
4. What is the benefit of memory cells?
5. What happens the second time your body meets the same pathogen?
6. What is a vaccine?
7. After an infection with a vaccine what do some white blood cells become?
8. What is the advantage of vaccinations?
9. What is herd immunity?
10. Who is herd immunity of most benefit too?
11. Roy is an anti-vaxer. He doesn't want to give his child the vaccine for measles. Explain why Roy is endangering both his child's life and the life of his elderly neighbour.
12. What are antibodies?
13. Antibodies are specific to particular antigens, use the diagram to explain what this means.
14. How do antibodies destroy pathogens?
15. How do these white blood cells protect against future infections?
16. Why is it useful to vaccinate large proportions of population?
17. What is in a vaccine?
18. What makes vaccines safe to take?
19. How do vaccines activate white blood cells?
20. What happens the white blood cells once they have been activated?
21. How does this prevent future infection?

Lesson 4 Exam Questions

Q1 The MMR vaccine is used to protect against measles.

(a) Apart from measles, which **two** other diseases does the MMR vaccine protect against?

(b) Read the information.

> Measles is a dangerous disease caused by a virus.
> Normally, MMR vaccinations are given at 1 year old and again at 4 years old.
> Each vaccination is 90% effective in protecting against the measles virus.
>
> In April 2013, there were 630 cases of measles in children aged 4 and over in a small area of the UK. Of these cases, 504 children had not been vaccinated against MMR at all and only a few had been given a second vaccination.

(i) Calculate the percentage of the children who caught measles in April 2013 who had **not** been vaccinated against MMR.

(ii) Suggest **one** advantage to the population as a whole of children having the second MMR vaccination.

(c) (i) What does a vaccine contain?

(ii) Explain how a vaccination prevents infection.

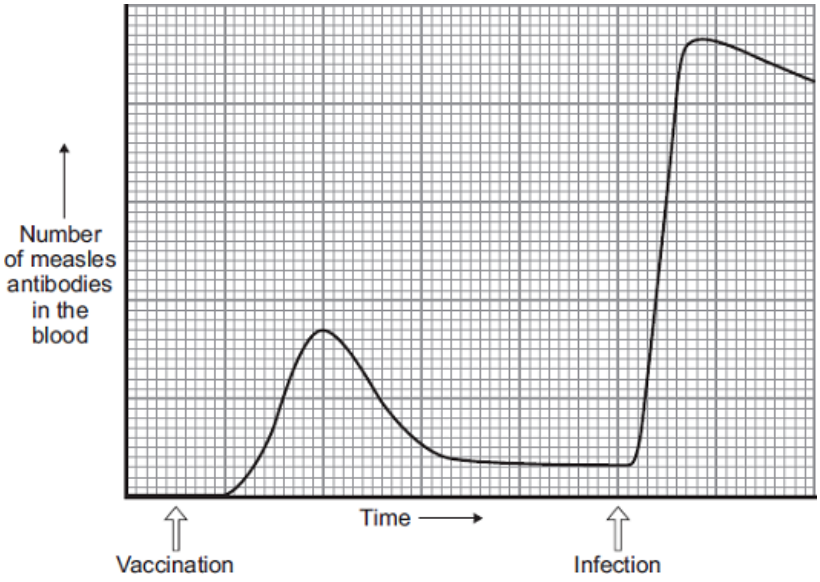
Q2. Vaccination can protect us from the diseases pathogens cause.

One type of virus causes measles. A doctor vaccinates a child against measles.

a) What does the doctor inject into the child to make the child immune to measles?

b) A few weeks after the vaccination, the child becomes infected with measles viruses from another person.

The graph shows the number of measles antibodies in the child's blood from before the vaccination until after the infection. More measles antibodies are produced after the infection than after the vaccination.



c) Describe other differences in antibody production after infection compared with after vaccination.

d) Vaccination against the measles virus will **not** protect the child against the rubella virus. Why?

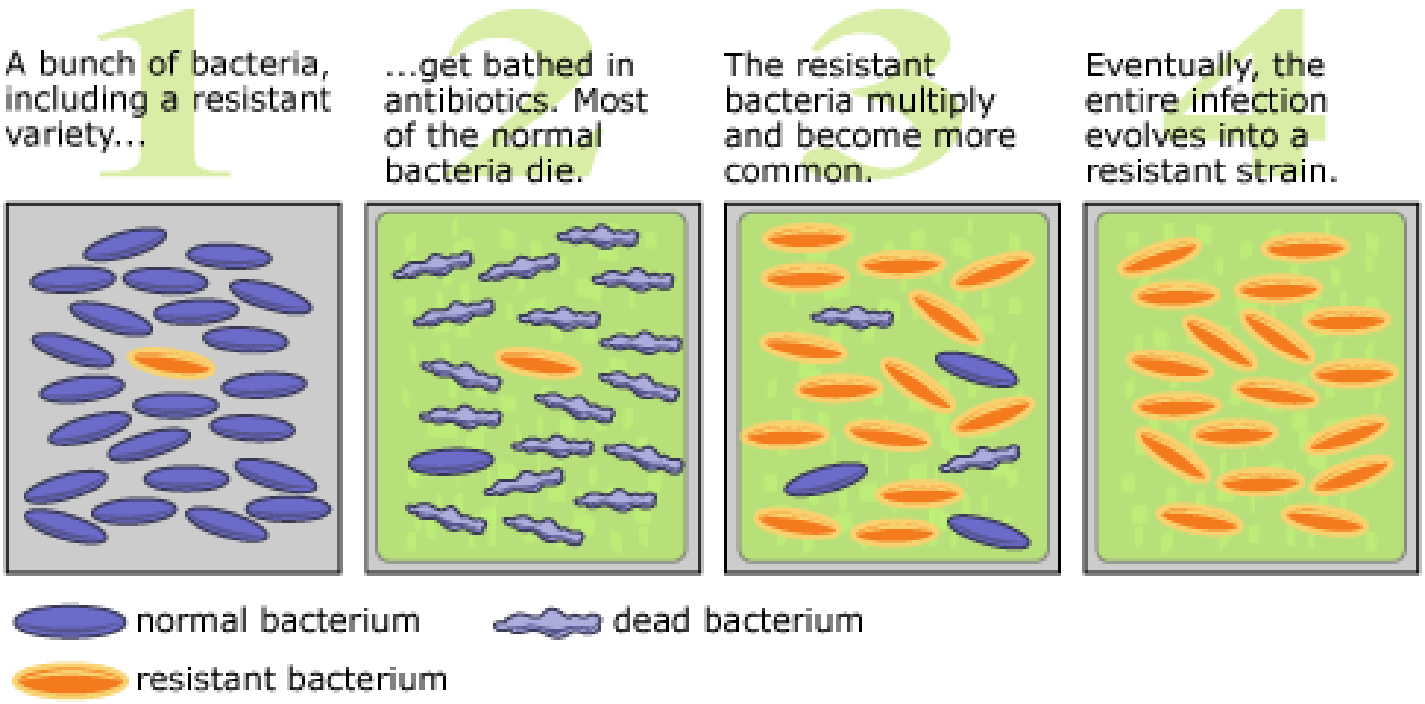
e) What is the advantage of vaccinating a large proportion of the population against measles?

Lesson 5 Drugs

Some medicines can be used to treat the pathogen but others can be used to relieve the symptoms such as pain or fever. Aspirin and paracetamol are painkillers that can be used to relieve pain but do not combat the pathogen itself. Conversely, drugs like amoxicillin and penicillin are examples of antibiotics that can be used to kill bacteria that are causing disease. Antiseptics and disinfectants can be used to kill bacteria outside the body but are too dangerous to be used inside the body as they are harmful to our own cells,

However, antibiotics cannot completely eradicate disease for 2 reasons.

1. Antibiotics work by killing the bacteria that make us ill however not all diseases are caused by bacteria. For example antibiotics cannot be used to treat diseases caused by viruses. This is because viruses invade our cells and antibiotics don't harm human cells.
2. The second reason that antibiotics cannot completely eradicate disease is the evolution of antibiotic resistant bacteria. These bacteria are no longer killed by an antibiotic. Bacteria evolve antibiotic resistance at an alarming rate. This is because as prokaryotes, they contain DNA plasmids which can be quickly transferred between bacteria. MRSA is a type of bacteria that is resitant to many antibiotics.



Drug Development

There are a number of useful drugs in use today that were isolated from plants and fungi.

- Digitalis is extracted from foxglove and is used to treat heart problems.
- Aspirin (a painkiller) was originally extracted from the bark of willow trees.
- Penicillin (the first antibiotic) is isolated from the mould that grows on your bread.

Today most new drugs are synthesised by Pharmacist working in a lab but may still originate from a plant or microorganisms. They then undergo extensive and rigorous testing through clinical trials.

The aims of drug testing at to check:

1. **Toxicity**: Will it kill humans?
2. **Efficacy**: Will it work?
3. **Dosage**: How much and how often will you need to take?

There are 3 stages to clinical trials

1. **Preclinical trials:** The drug is tested on isolated cells and tissues to check it is not toxic to cells. It is then checked on animals. This checks again for toxicity to the whole organism and possibly also efficacy.
2. **Clinical trials 1:** The drug is tested on healthy volunteers in a very low dose to confirm it is not toxic to humans.
3. **Clinical trials 2:** Then the drug is given to volunteers suffering from the disease to determine the dosage required and efficacy.

Clinical trials are double blind trials. This means that some of the volunteers are given the real drug and others are given a placebo. A placebo is a fake medicine. This way, scientists can be sure that it is the actual drug making people better and not just the thought of taking medicine. The placebo effect describes someone experiencing a relief in symptoms because they believe they have been given a cure.

After the clinical trials are completed they are verified by peer review. Other scientists scrutinise the results and repeat some of the trials to confirm the results. Only when all steps have been passed will the drug be allowed to be prescribed to the public.

When a trail is not conducted properly the consequences can be devastating. In the 1950's a drug called Thalidomide was given to pregnant women as a cure for morning sickness. It had never been tested on pregnant animals during trials. The women gave birth to babies with severe limb deformations.

Lesson 5 Mastery Questions

1. What are antibiotics?
2. Name an antibiotic.
3. How do antibiotics work against bacteria?
4. Which pathogens are antibiotics not effective against?
5. Which specific named pathogens are antibiotics effective against?
6. How do these pathogens reproduce?
7. Why is it difficult to kill these pathogens?
8. What are painkillers?
9. What effect do painkillers have on pathogens?
10. Why can't measles be treated with antibiotics?
11. How has the use of antibiotics helped?
12. What is antibiotic resistance?
13. What are the implications of antibiotic resistance spreading?
14. What can be done to reduce the spread of antibiotic resistance?
15. Which form of DNA in prokaryotic cells increases the spread of antibiotic resistance?
16. What drug is extracted from foxglove?
17. What is digitalis used to treat?
18. Where was aspirin originally extracted from?
19. What improved version of aspirin was created?
20. What was the advantage of this drug?
21. What scientist discovered penicillin?
22. What scientists mass produced penicillin?
23. What observation did Fleming make on his return after his holiday?
24. Who discovered penicillin?
25. What is the source of most new drugs?
26. What are new drugs tested for?
27. What things are drugs tested on before human trials begin?
28. Why must new drugs be trialled on people?
29. How do human trials begin?
30. What is being tested for at this stage?
31. Why is it possible to test on volunteers at this stage?
32. What is the drug tested for in the second phase of human trials?
33. Why must patients with the disease be tested during later stages?
34. What is a placebo?

Lesson 5 Exam Questions

Q1. Bacteria and viruses can reproduce quickly inside the body and make people feel ill.

(a) Use the correct answer from the box to complete the sentence.

antibodies	**antitoxins**	**toxins**

Bacteria and viruses make us feel ill because they produce _____ .

(1)

(b) (i) Antibiotics can be used to treat some infections.
Use the correct answer from the box to complete the sentence.

bacteria	**bacteria and viruses**	**viruses**

Antibiotics are medicines that kill _____ .

(1)

(ii) New strains of pathogens have developed which are resistant to antibiotics.
Use the correct answer from the box to complete the sentence.

are short of food	**invade body cells**	**mutate**

New strains are produced when pathogens _____ .

(1)

(iii) What will scientists have to develop to kill these new resistant strains?

(1)

(Total 4 marks)

Q2. Antibiotics are used to treat bacterial infections, but not viral infections.

(a) Explain why antibiotics are **not** effective against viral infections.

(2)

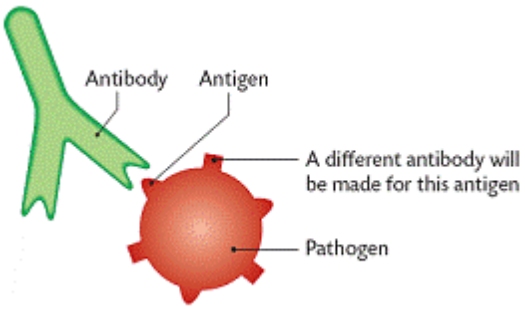
(b) New strains of bacteria have developed that are resistant to antibiotics. There is no effective treatment against these resistant strains.

What must be done to make sure we will be able to treat bacterial infections in the future?

(2)

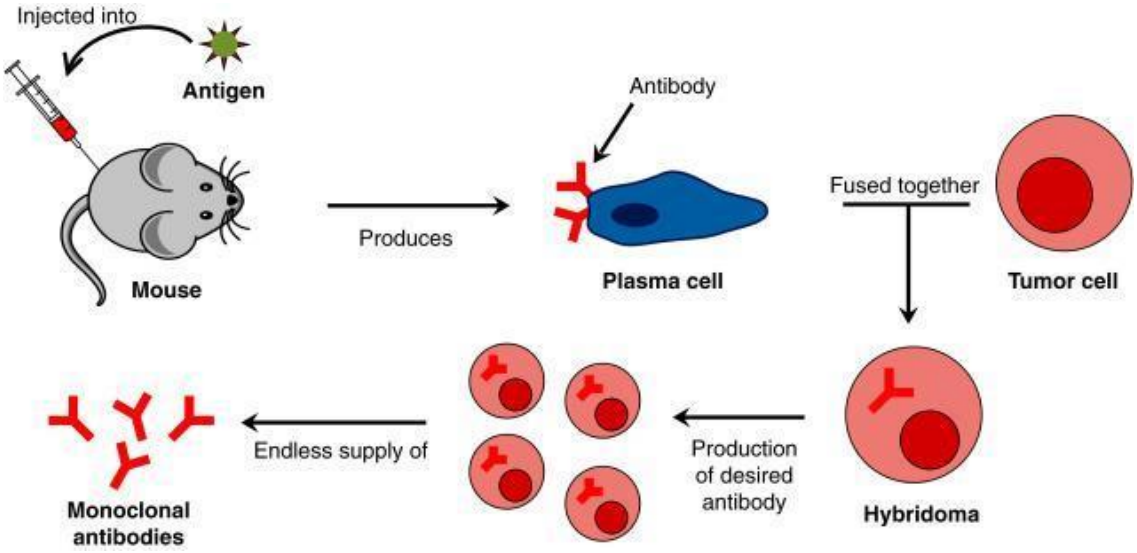
Lesson 6 Monoclonal antibodies TRIPLE ONLY

Mono means 'one' so monoclonal means 'cloned from one'. In a normal immune response there will be thousands of different antibodies that attack different antigens on the same pathogen. Monoclonal antibodies target 1 molecule only.



Monoclonal antibodies are produced from a single clone of cells. The antibodies are specific to one binding site and so are able to 'stick to' a specific chemical or specific cells in the body.

They are produced by stimulating mouse lymphocytes to make a particular antibody. The lymphocytes are combined with a particular kind of tumour cell to make a cell called a hybridoma cell. The hybridoma cell can both divide and make the antibody. Single hybridoma cells are cloned to produce many identical cells that all produce the same antibody. A large amount of the antibody can be collected and purified.



Uses of monoclonal antibodies

- for diagnosis such as in pregnancy tests
- in laboratories to measure the levels of hormones and other chemicals in blood, or to detect pathogens
- in research to locate or identify specific molecules in a cell or tissue by binding to them with a fluorescent dye
- to treat some diseases: for cancer the monoclonal antibody can be bound to a radioactive substance, a toxic drug or a chemical which stops cells growing and dividing. It delivers the substance to the cancer cells without harming other cells in the body

Lesson 6 Mastery Questions

1. What is an antigen? (See Page 12)
2. What is a clone?
3. What are the three ways lymphocytes fight pathogens? (See Page 12)
4. Why is a tumour cell used to form a hybridoma?
5. Why are monoclonal antibodies all the same?
6. Erica says "monoclonal antibodies are used to fight infection" Is she correct? Give a reason.
7. Why is penicillin not prescribed for a common cold? (See Page 18)
8. Will taking paracetamol speed up recovery from tonsillitis? Explain why. (See Page 18)
9. Name the identical structures in all the nuclei of the hybridoma
10. What type of reproduction is occurring when the hybridoma divides, mitosis or meiosis?

A virus called RSV causes severe respiratory disease. **This question will require the first 2 topics in this booklet as well as the one currently being done, and the drug section.**

11. Suggest two precautions that a person with RSV could take to reduce the spread of the virus to other people.
12. One treatment for RSV uses monoclonal antibodies which can be injected into the patient. Scientists can produce monoclonal antibodies using mice. The first step is to inject the virus into a mouse. Describe the remaining steps in the procedure to produce monoclonal antibodies.
13. Describe how injecting a monoclonal antibody for RSV helps to treat a patient suffering with the disease.
14. A trial was carried out to assess the effectiveness of using monoclonal antibodies to treat patients with RSV. Some patients were given a placebo. Why were some patients given a placebo?

Lesson 6 Exam Questions

Q1 A number of patients had to be admitted to hospital as they became so ill with RSV.

The results are shown in the table below.

Treatment received by patient	**% of patients within each group admitted to hospital with RSV**
Group **A**: Monoclonal antibody for RSV	4.8
Group **B**: Placebo	10.4

The trial involved 1 500 patients.

- Half of the patients (group **A**) were given the monoclonal antibodies.
- Half of the patients (group **B**) were given the placebo.

a) Calculate the total number of patients admitted to hospital with RSV during the trial.
b) Evaluate how well the data in the table above supports the conclusion:

'monoclonal antibodies are more effective at treating RSV than a placebo'.

Lesson 7 Plant disease and defence TRIPLE ONLY

Plants get ill just like animals. We have already seen examples of tobacco mosaic virus and rose black spot. Aphids are insects which suck the sap of plants from the phloem. By doing this they are reducing the plants nutrients water and sugar. Aphids feeding can also introduce various pathogens into the phloem which can travel around the plant.

Symptoms of plant diseases are:

- stunted growth
- spots on leaves
- areas of decay (rot)
- growths
- malformed stems or leaves
- discolouration
- the presence of pests.

Aphids feed by piercing the stem with their adapted mouthparts and sucking up cell sap from the vacuole of phloem cells.

Many plant diseases reduce the amount of photosynthesis a plant can perform. This leads to less glucose being produced which means less respiration and therefore less energy for the plant to grow.

Due to the variety of species of plants the average person might have in their garden we often have to look up symptoms in a book or online. If we are concerned it is an aggressive pathogen then we might buy a testing kit, which uses monoclonal antibodies to detect a specific pathogen, or send it to a lab for testing. Preventing the spread of infections through crops is vital to ensure we have enough food to eat.

To prevent spread of these pathogens may involve drugs such as antivirals, antifungals or pesticides. Removing infected leaves, stems or whole plants can also prevent the spread.

Mineral deficiencies can also present symptoms similar to those above a reduce crop yields. If a plant is lacking in nitrates it will not be able to make enough protein so its growth will be stunted. If a plant is lacking magnesium it will not be able to make enough chlorophyll. This will turn the leaves yellow (called chlorosis) and reduce the rate of photosynthesis. This therefore also reduces plant growth as there is not enough glucose for respiration.

Lesson 7 Mastery Questions

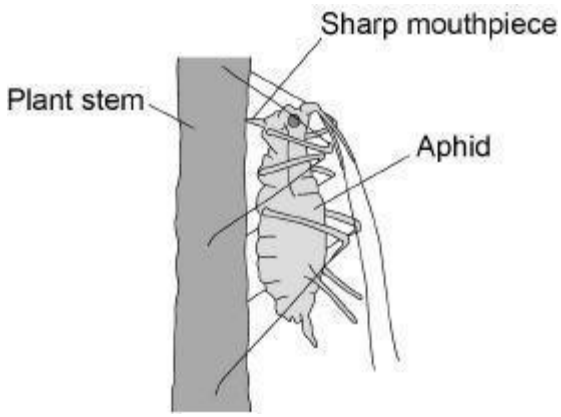
1. Name two plant diseases
2. Why does an aphid puncture the phloem?
3. Give 4 symptoms of possible plant disease.
4. What is chlorosis and what is it caused by?
5. Why does a farmer ensure his fields are rich in magnesium?
6. Rob says "Plants need lots of nitrates so they can eat more protein for growth and repair" He is wrong. Write the correct sentence in your book.
7. What should a gardener do to rose leaves infected with rose black spot to prevent the infection spreading?
8. Dutch elm disease is a fungal infection spread by a beetle vector. It has destroyed 25 million elm trees in the UK alone. Suggest 2 different ways we could prevent the spread of Dutch elm disease. (See chapter 1 and 2 if unsure)
9. What causes rose black spot?
10. What are the symptoms of rose black spot?
11. What causes tobacco mosaic virus?
12. What are the symptoms of tobacco mosaic virus?
13. What are aphids?
14. What are the symptoms of aphids?
15. What is a nitrate deficiency?
16. What are the symptoms of a nitrate deficiency?
17. What is chlorosis?
18. What are the symptoms of chlorosis?

Lesson 7 Exam Questions

Q1 Plants can be infected by fungi, viruses and insects. Aphids are small insects that carry pathogens. The diagram below shows an aphid feeding from a plant stem.

(a) An aphid feeds by inserting its sharp mouthpiece into the stem of a plant.

Give the reason why the mouthpiece of an aphid contains a high concentration of dissolved sugars after feeding.



(b) Plants infected with aphids may show symptoms of magnesium deficiency.

Magnesium deficiency symptoms include:

- yellow leaves
- stunted growth.

Explain how a deficiency of magnesium could cause these symptoms.

(c) A farmer thinks a potato crop is infected with potato virus Y (PVY).

The farmer obtains a monoclonal antibody test kit for PVY.

To make the monoclonal antibodies a scientist first isolates the PVY protein from the virus.

Describe how the scientist would use the protein to produce the PVY monoclonal antibody.