



## 10 DISEASES &amp; IMMUNITY

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[VIEW EXAM QUESTIONS](#)

YOUR NOTES



## 10.1 SPREAD OF DISEASE

## Pathogens

- A pathogen is a **disease-causing organism**
- Pathogens are passed on from one host to another and therefore the diseases they cause are known as **transmissible diseases**
- Pathogens can be passed on from host to host in different ways, including:
  - **Direct contact** – the pathogen is passed directly from one host to another by transfer of body fluids such as blood or semen (eg HIV, gonorrhoea, hepatitis B & C)
  - **Indirect contact** – the pathogen leaves the host and is carried in some way to another, uninfected individual

METHOD OF TRANSMISSION	EXAMPLES OF DISEASES SPREAD IN THIS WAY
DROPLETS IN AIR	COMMON COLD, INFLUENZA
FOOD OR WATER	CHOLERA, TYPHOID, DYSENTERY
TOUCHING CONTAMINATED SURFACES	ATHLETES FOOT, SALMONELLA (CAN BE TRANSMITTED ON THE FEET OF FLIES WHO LAND ON FOOD THAT IS THEN EATEN)
INSECT BITES	MALARIA, DENGUE FEVER



## 10 DISEASES &amp; IMMUNITY

## 10.1 SPREAD OF DISEASE cont...

YOUR NOTES



## Defences Against Pathogens

There are **three** main ways in which the body defends itself against disease:

- Mechanical barriers** – structures that make it difficult for pathogens to get past them and into the body
  - Skin** – covers almost all parts of your body to prevent infection from pathogens. If it is cut or grazed, it immediately begins to heal itself, often by forming a scab.
  - Hairs in the nose** – these make it difficult for pathogens to get past them further up the nose so they are not inhaled into the lungs
- Chemical barriers** – substances produced by the body cells that trap / kill pathogens before they can get further into the body and cause disease
  - Mucus** – made in various places in the body, pathogens get trapped in the mucus and can then be removed from the body (by coughing, blowing the nose, swallowing etc)
  - Stomach acid** – contains hydrochloric acid which is strong enough to kill any pathogens that have been caught in mucus in the airways and then swallowed or have been consumed in food or water
- Cells** – different types of **white blood cell** work to prevent pathogens reaching areas of the body they can replicate in
  - By **phagocytosis** – engulfing and digesting pathogenic cells
  - By producing **antibodies** – which clump pathogenic cells together so they can't move as easily (known as **agglutination**) and releasing chemicals that signal to other cells that they must be destroyed

## 10.2 IMMUNITY



EXTENDED ONLY

## Antigens &amp; Antibodies

- All cells have proteins and other substances projecting from their cell membrane
- These are known as **antigens** and are **specific** to that type of cell
- Lymphocytes have the ability to 'read' the antigens on the surfaces of cells and recognise any that are foreign
- They then make **antibodies** which are a **complementary shape to the antigens** on the surface of the pathogenic cell

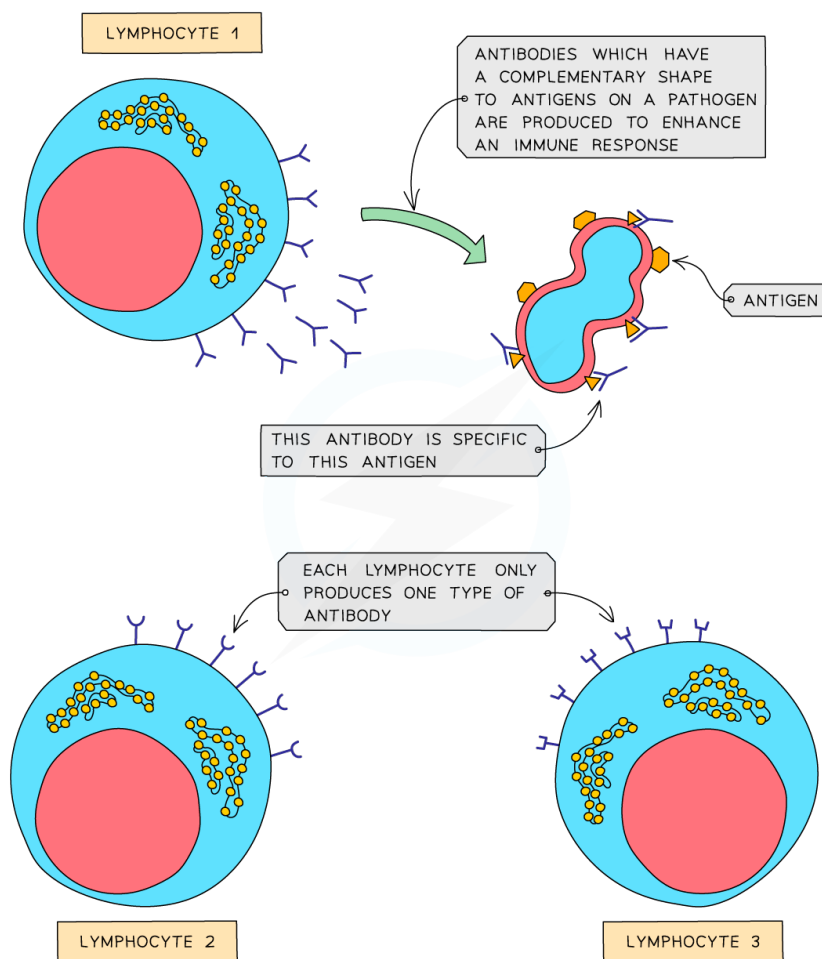
## 10 DISEASES &amp; IMMUNITY

## 10.2 IMMUNITY cont...

YOUR NOTES



EXTENDED ONLY cont...



## Antigens and antibodies

- The antibodies attach to the antigens and cause **agglutination** (clumping together)
- This means the pathogenic cells cannot move very easily
- At the same time, **chemicals** are released that signal to **phagocytes** that there are cells present that need to be destroyed



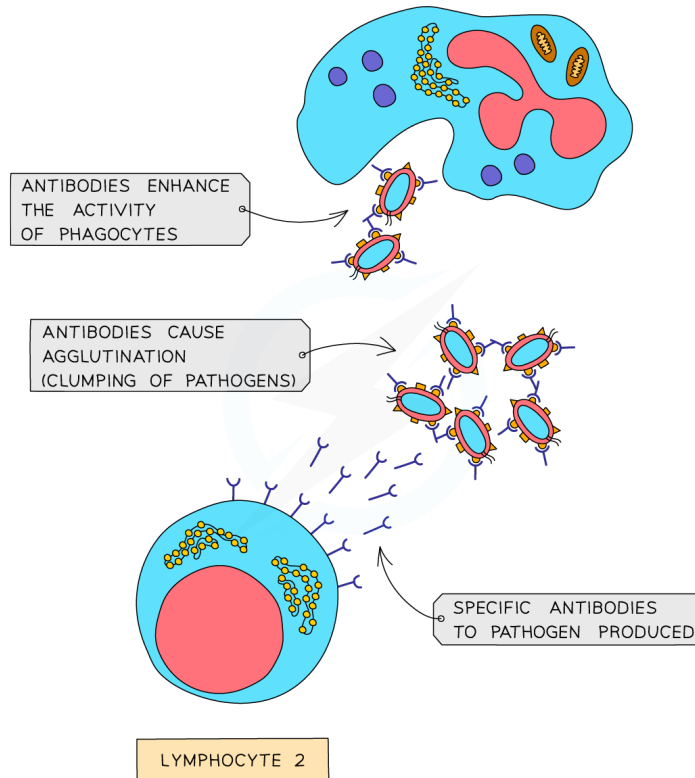
## 10 DISEASES &amp; IMMUNITY

## 10.2 IMMUNITY cont...

YOUR NOTES



EXTENDED ONLY cont...



Agglutinated pathogens cannot move easily

- The **initial response** of a lymphocyte encountering a pathogen for the first time and making specific antibodies for its antigens can take **a few days**, during which time an individual may get sick
- Lymphocytes that have made antibodies for a specific pathogen for the first time will then make '**memory cells**' that retain the instructions for making those specific antibodies for that type of pathogen
- This means that, in the case of reinfection by the same type of pathogen, **antibodies can very quickly be made** in greater quantities and the pathogens destroyed before they are able to multiply and cause illness
- This is how people can become **immune** to certain diseases after only having them once
- It does not work with all disease-causing microorganisms as some of them **mutate** fairly quickly and change the antigens on their cell surfaces
- Therefore, if they invade the body for a second time, the memory cells made in the first infection will not recall them as they now have slightly different antigens on their surfaces (e.g. the cold virus)



## 10 DISEASES &amp; IMMUNITY

## 10.2 IMMUNITY cont...

YOUR NOTES



EXTENDED ONLY cont...

### Active & Passive Immunity

#### Active Immunity

- Making antibodies and developing memory cells for future response to infection is known as **active immunity**
- There are **two ways** in which this active immune response happens:
  - The body has become **infected with a pathogen** and so the lymphocytes go through the process of making antibodies specific to that pathogen
  - **Vaccination**
- Active immunity is **slow-acting** and **provides long-lasting immunity**

#### Passive Immunity

- This is when **ready-made antibodies**, from another source, are introduced to the body
- Passive immunity is a **fast-acting, short-term defence** against a pathogen by antibodies acquired from another individual, eg:
  - From **mother to infant** via **breast milk** – this is important as it helps the very young to fight off infections until they are **older and stronger** and their immune system is more responsive
  - **Injected antibodies** for certain diseases where the individual is already infected and a fast response is required, like **rabies** or **tetanus**
- The body **does not make its own antibodies or memory cells** in passive immunity, hence the name

### Diseases Caused by the Immune System

- Occasionally, the cells of the immune system start to **attack the body's own cells**
- This is rare as lymphocytes usually **recognise** their own body cells by the **antigens** on the cell surfaces and do not respond to them
- In this situation, **specific body cells are targeted by lymphocytes** and antibodies are made against them, destroying them
- One example of this type of disease is **Type 1 diabetes**
- People who suffer from this disease no longer make their own insulin and so are unable to regulate their blood glucose levels
- This is because their immune system is **targeting and destroying the pancreatic cells which are responsible for making the insulin**, eventually leading to dangerously high glucose levels in the blood



## 10 DISEASES &amp; IMMUNITY

## 10.2 IMMUNITY cont...

YOUR NOTES



## EXAM TIP

There is often a lot of confusion amongst students regarding the terms antigen, antibody and antibiotic:

- An **antigen** is a chemical found on the surface of a cell
- An **antibody** is a chemical made by lymphocytes that is complementary to an antigen and, when attached, clumps them together and signals the cells they are on for destruction
- An **antibiotic** is a drug that slows down or stops the growth of bacteria

## 10.3 VACCINATION

## What is Vaccination?

- Vaccinations give **protection against specific diseases** and **boost the body's defence against infection** from pathogens without the need to be exposed to dangerous diseases that can lead to death
- The level of protection in a population depends on the **proportion of people vaccinated**



## EXTENDED ONLY

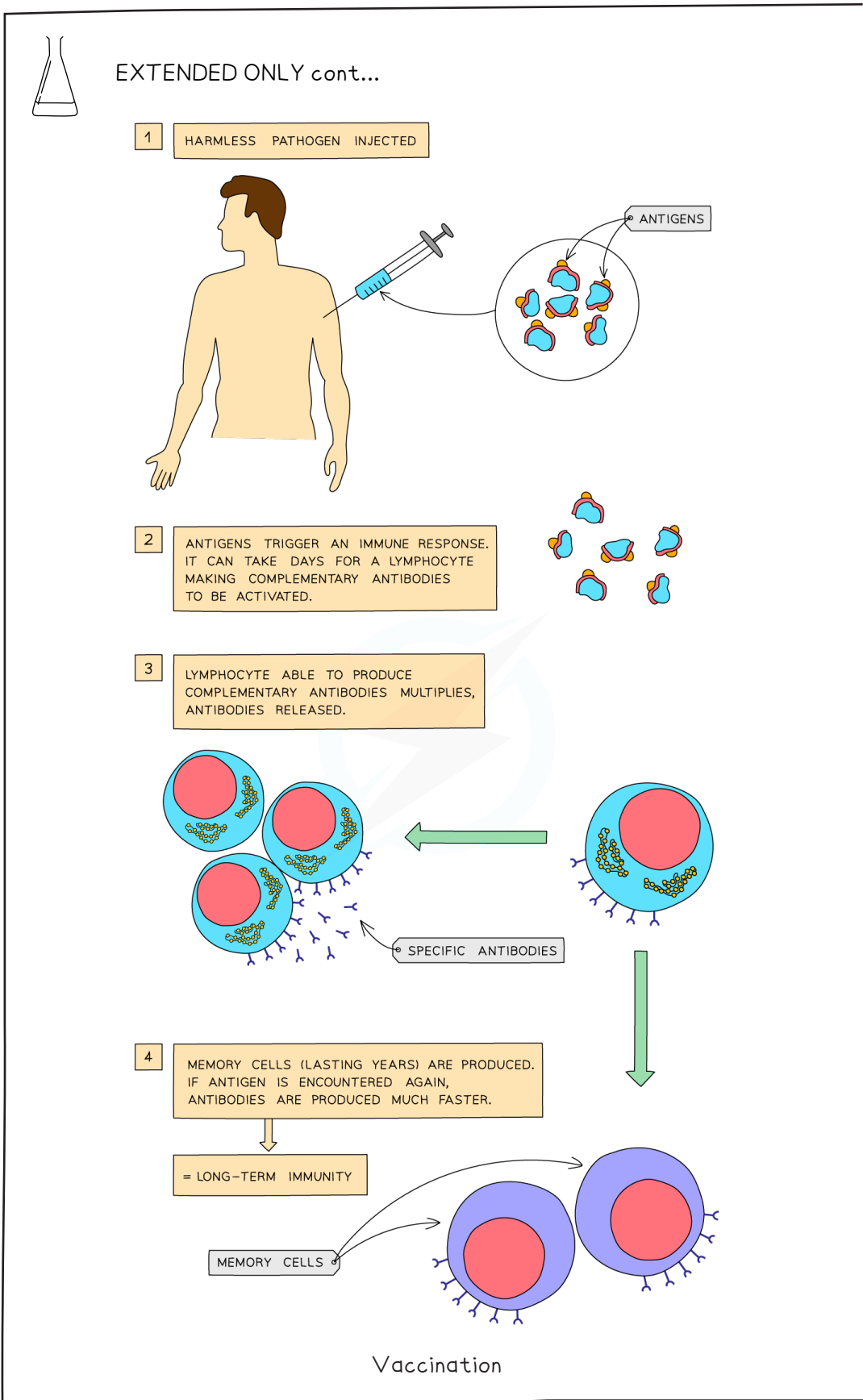
## How does Vaccination Work?

- Vaccines allow a **dead or altered form** of the disease-causing pathogen, which contains specific antigens, to be introduced into the body
- In this weakened state, the pathogen **cannot cause illness** but can **provoke an immune response**
- Lymphocytes produce **complementary antibodies** for the antigens
- The antibodies target the antigen and attach themselves to it in order to create **memory cells**
- The memory cells remain in the blood and will **quickly respond** to the antigen if it is encountered again in an infection by a 'live' pathogen
- As memory cells have been produced, this immunity is **long-lasting**

10 DISEASES & IMMUNITY

10.3 VACCINATION cont...

YOUR NOTES



10 DISEASES & IMMUNITY

10.3 VACCINATION cont...

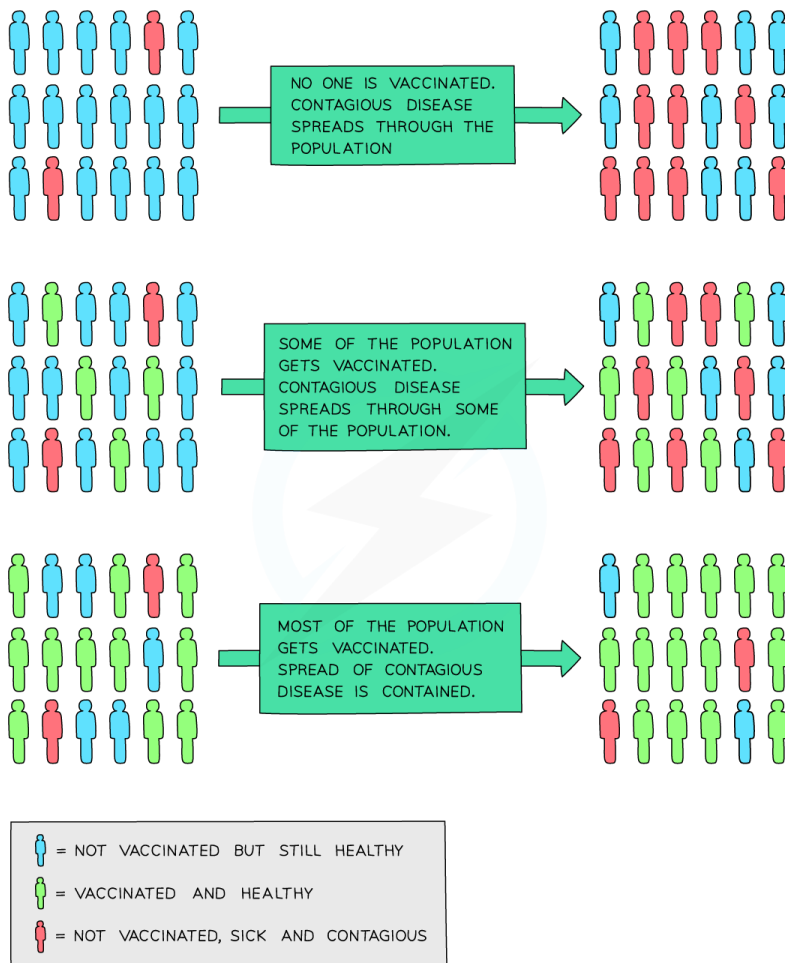
YOUR NOTES



EXTENDED ONLY cont...

How Does Vaccination Control the Spread of Disease?

- If a **large enough percentage** of the population is vaccinated, it **provides protection for the entire population** because there are **very few places for the pathogen to breed** – it can only do so if it enters the body of an unvaccinated person
- This is known as **herd immunity**
- If the number of people vaccinated against a specific disease **drops** in a population, it leaves the rest of the population at risk of **mass infection**, as they are more likely to come across people who are infected and contagious
- This **increases the number of infections**, as well as the number of people who could die from a specific infectious disease



Herd immunity





## 10 DISEASES &amp; IMMUNITY

## 10.3 VACCINATION cont...



## EXTENDED ONLY cont...

**Herd immunity prevents epidemics and pandemics from occurring in populations**

- This is the reason that many vaccinations are given to **children**, as they are regularly seen by medical practitioners and can be vaccinated early to ensure the entire vaccinated population remains at a high level
- In certain instances, vaccination programmes are run with the aim of **eradicating** certain dangerous diseases, as opposed to controlling them at low levels
- An example of a disease which has been eradicated as a result of a successful vaccination programme is **smallpox**, which was officially eradicated in 1980 after a vaccination programme run by the World Health Organisation since the mid-1950s

YOUR NOTES



## 10.4 CONTROLLING SPREAD OF DISEASE

**Ways to Prevent Transfer of Pathogens**

- The simplest way to prevent disease is to **stop pathogens from spreading**
- This means using simple measures such as **good hygiene and effective sanitation and waste disposal** to contain pathogens and dispose of them safely



## 10 DISEASES &amp; IMMUNITY

## 10.4 CONTROLLING SPREAD OF DISEASE cont...

YOUR NOTES



MEASURE TO PREVENT SPREAD	HOW IT WORKS
HYGIENIC FOOD PREPARATION	<ul style="list-style-type: none"> <li>- KEEP FOOD COLD SO BACTERIA AND FUNGI REPRODUCE MORE SLOWLY</li> <li>- PREPARE FOOD HYGIENICALLY TO AVOID CONTAMINATION FROM PATHOGENS BY WASHING HANDS WELL WITH SOAP AND CLEANING WORK SURFACES WITH PRODUCTS SUCH AS BLEACH TO KILL PATHOGENS</li> <li>- COOK FOOD WELL (LONG ENOUGH AT HIGH TEMPERATURE) TO KILL BACTERIA AND FUNGI</li> <li>- COVER FOOD TO PREVENT FLIES LANDING ON IT BEFORE EATING</li> <li>- USE SEPARATE CHOPPING BOARDS/UTENSILS FOR CUTTING UNCOOKED MEAT</li> <li>- WASH HANDS AFTER USING THE BATHROOM BEFORE HANDLING FOOD</li> </ul>
PERSONAL HYGIENE	<ul style="list-style-type: none"> <li>- WASHING WITH SOAP REMOVES SUBSTANCES WHICH TRAP PATHOGENS AS WELL AS PATHOGENS THEMSELVES FROM THE SKIN</li> <li>- USE TISSUES TO CATCH SNEEZES AND COUGHS</li> <li>- DISPOSE OF USED TISSUES AS SOON AS POSSIBLE AS PATHOGENS CAN STILL BE ALIVE</li> <li>- WASH HANDS AFTER USING THE BATHROOM</li> </ul>
WASTE DISPOSAL	<ul style="list-style-type: none"> <li>- WASTE FOOD IS A FOOD SOURCE FOR FLIES THAT CAN ACT AS VECTORS FOR TRANSMISSIBLE DISEASES AND SO SHOULD BE DISPOSED OF IN A SEALED CONTAINER</li> <li>- RUBBISH BINS SHOULD BE COVERED AND REMOVED TO THE LANDFILL FOR DISPOSAL OR BURNING REGULARLY</li> <li>- ALL RUBBISH SHOULD BE STORED BEFORE COLLECTION AWAY FROM HUMAN HABITATION</li> </ul>
SANITATION	<ul style="list-style-type: none"> <li>- HOMES AND PUBLIC PLACES SHOULD HAVE PLUMBING AND DRAINS TO SAFELY REMOVE FAECES AND WASTE WHICH CAN CARRY PATHOGENS</li> <li>- RAW SEWAGE SHOULD BE TREATED TO REMOVE SOLID WASTE AND KILL PATHOGENS BEFORE BEING RELEASED INTO THE ENVIRONMENT</li> </ul>

> NOW TRY SOME EXAM QUESTIONS



## 10 DISEASES &amp; IMMUNITY

## EXAM QUESTIONS

YOUR NOTES

**? QUESTION 1**

The blood contains lymphocytes. What is their purpose?

- A Transport of hormones
- B Phagocytosis
- C Antibody production
- D Sensitivity

**? QUESTION 2**

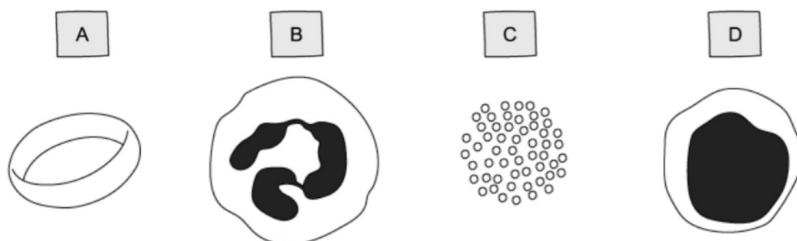
The immune system recognises which part of a pathogen?

- A Antibiotic
- B Antigen
- C Active site
- D Antibody

**? QUESTION 3**

Components of the blood from a mammal are shown in the diagram below.

In which component would you expect to find the remains of the breakdown of bacterial cells.





## 10 DISEASES &amp; IMMUNITY

## EXAM QUESTIONS cont...

YOUR NOTES

**? QUESTION 4**

The body has a number of barriers to prevent infection by pathogens.

Which of the options below are both chemical barriers?

- A Skin and hairs in the nose
- B Mucus and antibodies
- C Skin and stomach acid
- D Mucus and stomach acid

**? QUESTION 5**

Which of the following diseases listed below are not caused by infectious pathogens?

- 1 Coronary Heart Disease
- 2 Cholera
- 3 AIDs
- 4 Scurvy

A 2 only    B 1 and 4    C 2 and 3    D 2, 3 and 4

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