

Human defences and immunity

Revision notes · Barriers and chemical defences, the specific immune response, how immunisation works, and the pros and cons of vaccination including herd immunity.

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Human defences and immunity **Spec 5.12-5.15B**

Physical barriers and chemical defences **Spec 5.12**

The body has first lines of defence that try to stop pathogens getting in or kill them before they can cause harm.

Human physical barriers and chemical defences		
Defence	Type	How it protects
Skin	Physical barrier	Forms a barrier that pathogens cannot easily pass through
Mucus	Physical barrier	A sticky liquid in the nose and airways that traps pathogens
Cilia	Physical barrier	Tiny hairs on the cells lining the airways that move the trapped mucus up and away from the lungs
Lysozymes	Chemical defence	Enzymes in tears and other secretions that break down the cell walls of bacteria
Hydrochloric acid	Chemical defence	Acid in the stomach that kills pathogens swallowed with food and drink

Common mistake: Cilia do not trap pathogens; mucus does. Cilia move the mucus.

The specific immune system **Spec 5.13**

If a pathogen gets past the first defences, the **specific immune system** responds. It is called specific because the response is aimed at one particular pathogen.

Antigen	A molecule, usually on the surface of a pathogen, that the immune system recognises as foreign and that triggers an immune response.
Antibody	A protein made by white blood cells (lymphocytes) that binds to a specific antigen.
Memory lymphocyte	A white blood cell that stays in the body after an infection and can respond quickly if the same antigen returns.

The primary response

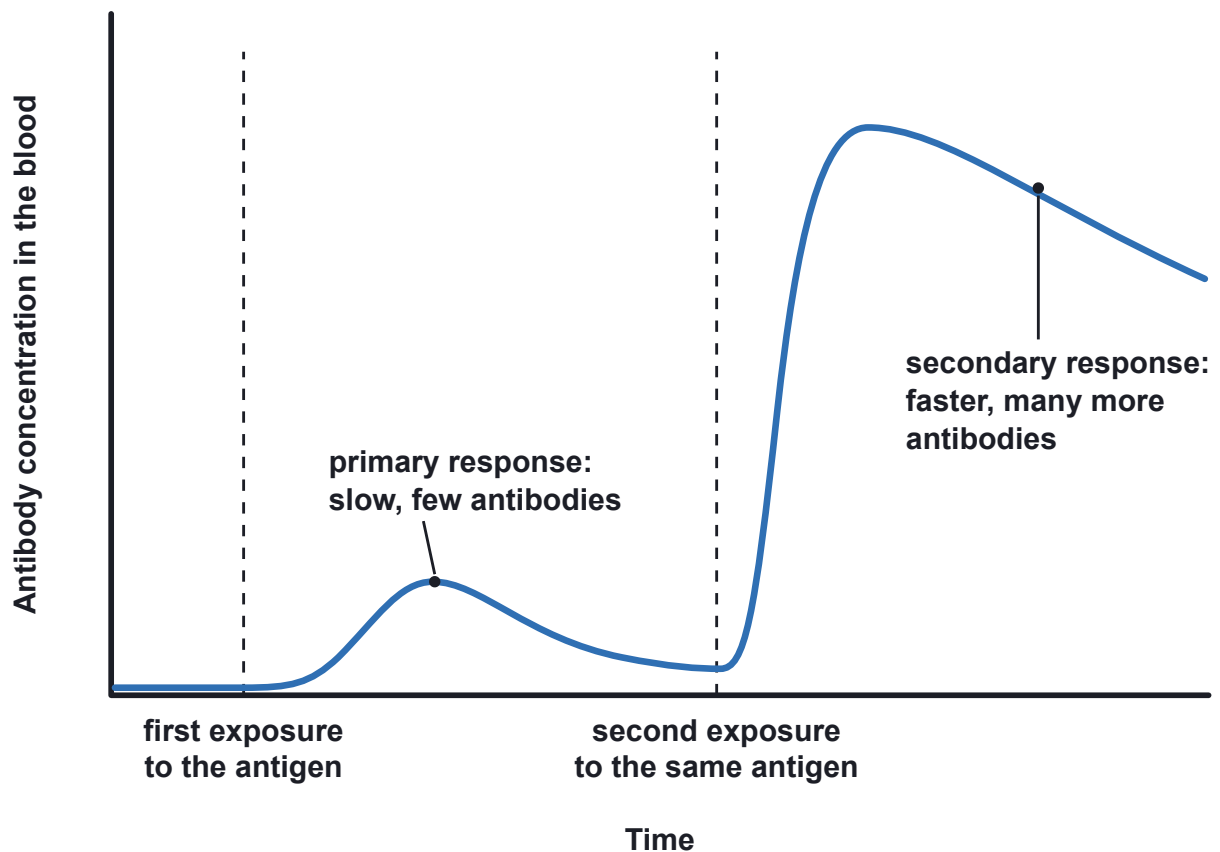
1. The body is exposed to a pathogen.
2. The **antigens** on the pathogen trigger an immune response.
3. Lymphocytes with antibodies that fit the antigen divide, and the response causes the production of **antibodies**.
4. The antibodies bind to the antigens on the pathogen and help to destroy it.

5. The antigens also trigger production of **memory lymphocytes**.

The secondary response

If the same pathogen enters the body again, the memory lymphocytes recognise its antigens. They respond **faster** and make more antibodies than the first time, so the pathogen is destroyed before it can make the person ill. The person is now immune to that pathogen.

Exam tip: For the secondary response, write three things: it is quicker, more antibodies are made, and memory lymphocytes are responsible.



Memory lymphocytes make the **secondary response** faster and bigger than the primary response.

Immunisation Spec 5.14

Immunisation gives protection from a disease without having to catch it. A person is given an **inactive** form of the pathogen, for example a dead or weakened one, usually by injection.

1. The inactive pathogen is put into the body. It cannot cause the disease, but its antigens are still present.
2. The antigens trigger an immune response and antibodies are made.
3. Memory lymphocytes are produced.
4. If the live pathogen enters later, the memory lymphocytes carry out a fast secondary response. Large numbers of antibodies are made quickly and the person does not become ill.

Immunisation and the immune response		
	Natural infection	After immunisation
Pathogen present	Live pathogen	Inactive pathogen, which cannot cause the disease
Memory lymphocytes made?	Yes	Yes
Person becomes ill?	Yes, during the first (primary) response	No

Doctors sometimes give a second injection, called a booster, to increase the number of memory lymphocytes made.

Common mistake: Immunisation does not put antibodies into the body. It makes your own body produce antibodies and memory lymphocytes.

Advantages and disadvantages of immunisation Spec 5.15B Triple only

In a **discuss** question you must give both sides. Use the ideas below.

Immunisation: for and against	
Advantages	Disadvantages
Protects the person from serious diseases	Some people have side effects, such as a sore arm or fever; very rarely, serious reactions happen
Reduces the spread of disease, so epidemics can be prevented	It does not always work, and some people are still infected
Some diseases have been almost wiped out	Boosters may be needed to keep protection high
Protects people who cannot be vaccinated, through herd immunity	Some pathogens change often, so new vaccines are needed

Herd immunity

Herd immunity happens when a large proportion of a population is immune to a disease. The pathogen finds it hard to spread because most people it reaches are immune. This also protects the few who are not immune, such as babies who are too young to be vaccinated or people whose immune system is weak.

If fewer people are vaccinated, herd immunity is lost and the disease can spread through the population again.

Exam tip: End a discuss answer with a short judgement, for example that the benefits outweigh the risks for most people, and say why.

Quick check

1. Name two physical barriers in the human body.
2. What do lysozymes do?
3. What is an antigen?
4. Why is the secondary response better than the primary response?
5. Triple only: what is herd immunity?

Quick check answers

Human defences and immunity

1. Any two of: skin, mucus, cilia.
2. They are enzymes that break down the cell walls of bacteria.
3. A molecule, usually on the surface of a pathogen, that triggers an immune response.
4. Memory lymphocytes make it faster and produce more antibodies.
5. When a large proportion of the population is immune, so the pathogen cannot spread easily and non-immune people are protected.