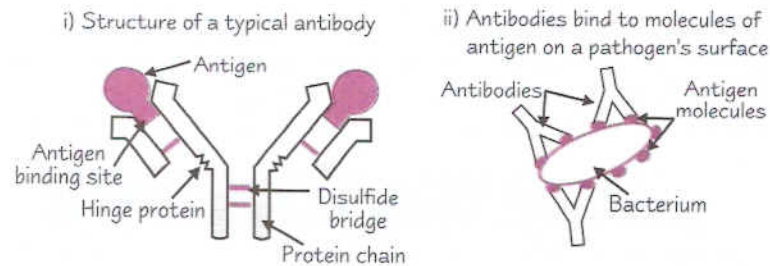


The Immune System

The immune system protects the body from pathogens (organisms that cause disease). It helps the body recognize them as foreign, and destroys them.

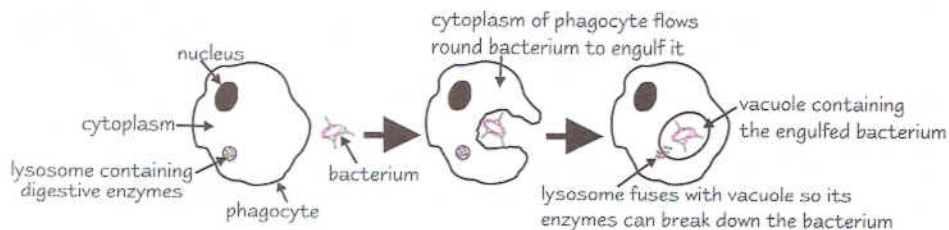
Lymphocytes and antibodies recognize foreign invaders

- 1) **Antigens** are substances that the immune system identifies as potential pathogens. Each antigen molecule has a unique structure, which matches receptor proteins on immune system cells called **lymphocytes**. So when a pathogen like a bacterium invades the body, the antigens on its cell surface are **identified as foreign** by the immune system. Lymphocytes bind to the antigens and attack the pathogen.
- 2) When the body **detects** foreign antigens, it also makes **antibodies** — protein molecules that **bind** to specific antigens, giving an **antigen-antibody complex**.
- 3) Antibodies have **two binding sites**, so they can attach to two antigen molecules. They deal with pathogens by clumping or **linking** them together to make it easier for them to be engulfed by **phagocytes**. They can also **rupture** foreign cells, (which **kills them**) and inactivate any toxins they produce.



Phagocytes get rid of cell debris and bacteria

- 1) **Phagocytes** are large **white blood cells** that encircle and engulf pathogens. They **clear away** the antigen-antibody complexes formed in an **immune response**.
- 2) Phagocytes are made in the **bone marrow** and then spend their lifetime hanging about in **blood and tissues**.



Phagocyte engulfing a bacterium

It's a war in there...

There are some important facts on this page that you will need to understand before going into your Regents exam. Make sure you know by heart the processes at work during an immune response...

The Immune System

Once pathogens have entered our bodies they will **reproduce rapidly** unless they are destroyed. Your "**immune system**" does just that, and **lymphocytes** are the most important part of it.

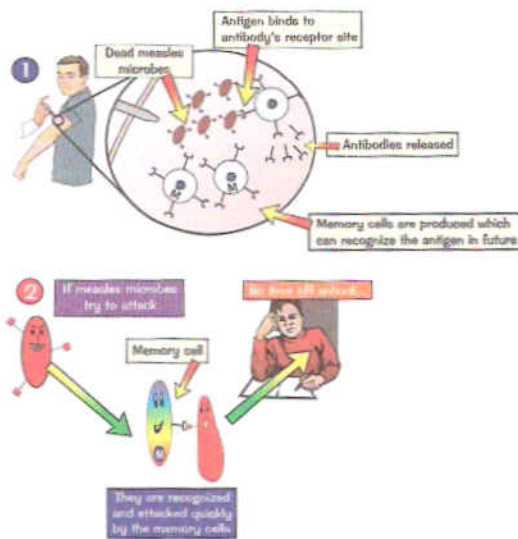
Lymphocytes control our immune response

Lymphocytes are white blood cells with **proteins** on their surface to recognize **foreign antigens**. Our bodies carry out two types of **immune response**:

- 1) The **CELLULAR RESPONSE** — This uses **lymphocytes** that **attach to foreign antigens** and **attack pathogens directly**. These cells can;
 - **kill** the pathogens
 - **recognize** antigens that might invade the body in the future. Cells which do this are called **memory cells**. They keep the ability to recognize a particular antigen. This allows the immune system to respond very quickly to a future attack.
 - **stop** the action of other white blood cells when the pathogen has been destroyed.
- 2) The **HUMORAL RESPONSE** — This uses **lymphocytes** to release antibodies. Each lymphocyte has a **specific antibody** on its membrane. When a lymphocyte meets a complementary foreign antigen, the antigen **binds** to the antibody's **receptor site**. This stimulates the lymphocyte to release the antibody into the blood. These lymphocytes divide by **mitosis** to produce many clones which release the same antibody, **killing the pathogen**. Some **clones** remain as memory cells that can recognize the antigen and protect the body from future attacks.

Immunization — Getting white blood cells ready for attack

- 1) Once your body produces cells that can recognize the antigens on a new strain of bacteria or virus, you are said to have developed a "**natural immunity**" to it.
- 2) This means if the **same pathogens** attack again they'll be killed by the **memory cells** you already have waiting for them, and you **won't get sick**.
- 3) The trouble is when a **new** pathogen appears, it takes your white blood cells a few days to produce a defensive response to deal with them, and in that time you can get **very sick**.
- 4) There are plenty of diseases which can make you very sick indeed (for example, polio, tetanus, measles) and only **immunization** can stop you from getting them.
- 5) Immunization involves injecting **dead** pathogens into you. This causes your body to produce **an immune response** to attack them, even though they're dead. They can do no **harm** to you because they don't work any more.
- 6) If **live** pathogens of the same type appeared after that, they'd be **killed immediately** by the memory cells which you have already developed against them. Cool.



It's grisly stuff, but worth learning just the same...

This stuff is definitely "mini-essay" material. There are two main sections, with lots of important facts in each. Do a **mini-essay** on each subsection and then **check** what you forgot.