



**WEAPONS OF
MICROSCOPIC
DESTRUCTION**

HOW YOUR IMMUNE SYSTEM KEEPS YOU SAFE FROM ATTACK



Haematopoietic Stem Cells



Truly flexible, the stem cell is what all our immune cells start off life as. These 'jack of all trades' are found in the bone marrow. Here they renew themselves throughout our lives and occasionally decide to become any one of our many immune cells.

This is a very flexible path, and the cells do not decide which immune cell to become until they reach specific checkpoints. The decision at each of these 'checkpoints' is influenced by many things; location in the body, infection, and what cells need to be replaced at the time.



Neutrophils

The most abundant white blood cell in your body and the first cells on the scene when you graze your knee or cut your finger. They are the body's rapid response force, being highly mobile and able to quickly congregate at the site of an infection or cut.

Neutrophils are also known as **granulocytes** because of the 'granules' which can be seen inside the cells, they contain in these granules highly toxic and reactive oxygen to kill engulfed pathogens.

To be recognised and engulfed, the pathogen must be coated in antibodies by a process called **opsonisation**. Neutrophils can also 'degranulate' to release their reactive oxygen-filled granules at a site of inflammation to aid the killing of pathogens. They are the most abundant cells in pus, giving it its yellow/white appearance.

This image shows a neutrophil – check out our video of it moving!



Dendritic Cells



The intelligence officers of the immune system, found in every part of the body, including our skin, gut and immune organs (thymus and bone marrow, where our immune cells develop).

Dendritic cells 'collect' parts of pathogens from around the body and take them to the lymph nodes, where many immune system cells can be found.

The dendritic cells show T cells and B cells the pathogen parts and stimulate them to multiply and attack the pathogen. Dendritic cells are also essential in the development of T and B cells.

This image shows dendritic cells (red) with blood vessels (green) in the lymph node.





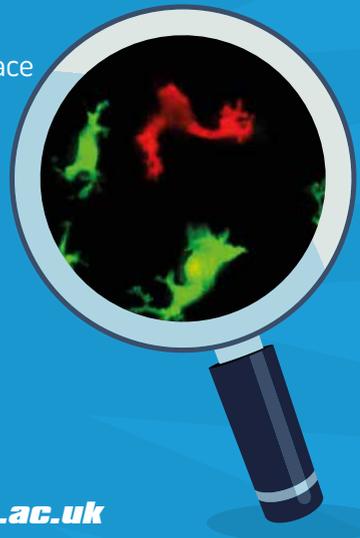
T Cells

T cells come in various guises. One type of T cell, known as **helper T cells** can be seen as the generals of the immune system; they regulate and control the responses of B cells in the **germinal centre**. Here they test and help those B cells trying to make their antibodies better and stand out from the crowd.

Killer T cells are the soldiers; they patrol the body checking our own cells for invaders. Viruses are unable to live alone; they rely on our cells to survive and grow. This means that they are hidden and cannot be directly detected by our immune system.

Killer T cells look for “help signs” on the surface of our cells which are shown when they are infected. These “help signs” are a mix of bits of the virus itself and special parts of our own cells.

These cells (red and green) are T cells that are found on our skin – check out our video to see how they move around!





B Cells

B cells are the engineers of the immune system, as one of their main jobs is to make **antibodies**. Antibodies are 'Y' shaped proteins; each one is slightly different so that many germs – or **pathogens** – can be identified.

Antibodies can also be made in various forms depending on where in the body they need to be, for example in our blood or on our skin. When B cells first develop they produce simple antibodies which respond initially to invading pathogens, but later these antibodies can be improved.

When a virus or bacteria attacks your body, the simple stock of antibodies produced by B cells respond. Then special command units are formed called germinal centres, where defence attack is planned and co-ordinated. From here improved invader-specific antibodies and immune cells are sent out to join the battle.

Using a powerful microscope we can see B cells (blue) in the lymph node.





Macrophages

Macrophages are the immune system's clean-up crew. They 'eat' anything foreign, such as bacteria. Additionally, these cells dispose of pollen and bits of our own cells.

At sites of infection and inflammation (where you see weeping and pus) these cells "mop-up" the debris left over from battles fought between immune system cells and pathogens.

Macrophages are also supported by the antibodies produced by B cells. Antibodies cover a pathogen, like tomato ketchup, making it irresistible to a macrophage.

Here we are able to see macrophages (red/green) moving around under the microscope.

