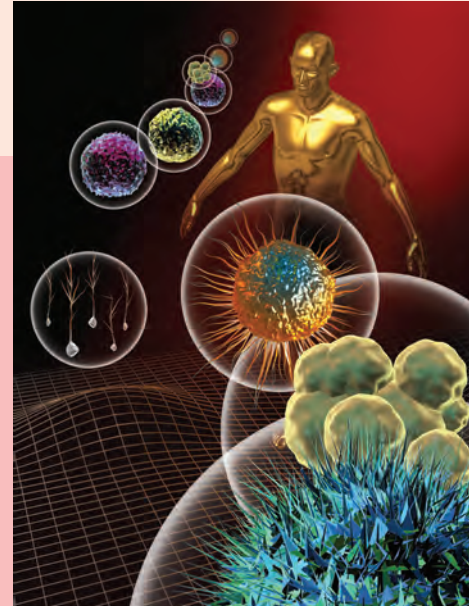


The Immune System



Germs, diseases, bacteria, viruses, microorganisms, bugs... All of these things can be grouped under the single term 'antigens'. Antigens are any substance (living like bacteria or non-living like dust) that causes your immune system to react. The immune system within your body includes different organs, cells and tissues that fight to keep you healthy. Even though we are exposed to millions of disease-causing and harmful antigens each day, we don't get sick from most of them. This is because our immune system is effective at defending our bodies and remembering how to fight a disease we may have encountered before.



The first step is to try and keep out the antigens – it is best and easiest to prevent any infection. Our bodies are covered in skin which acts as a physical barrier. This barrier prevents these germs from getting into the important and susceptible organs inside the body. However, if the skin is cut or grazed then these antigens are able to enter. In order to live, we also have specially designed holes that can let these 'nasties' in. They include the nose, eyes and mouth. Luckily within these holes we have slimy, snotty, sticky mucus that traps foreign particles and invaders and gives an impenetrable barrier to our internal blood supply. The acid in our stomach kills any bacteria from our food that we might have eaten. Our tears and saliva wash away and break down the antigens on the surface of the eye and in the mouth.

If the antigens are really determined and make their way past these initial defences, they will encounter our body's mega high-alert find-and-destroy system. Much like our circulatory system, there is another fluid circulating the body through special vessels, called lymph. Lymph contains special cells (called white blood cells) that fight infections. If you have swollen lymph nodes or glands (found in your neck, armpits and groin – as well as many other places) then it means that your body is busy fighting an infection.

The cells that act like the body's weapons system by seeking and destroying antigens are:

- **Neutrophils:** These are general in their actions and target any invaders. They are the first responders to an infection, wound or other damage. They call other immune cells to the site of infection. Neutrophils are also able to attack and destroy harmful microbes. Dead neutrophils are the main component of pus.
- **Macrophages:** These also behave in a general fashion. They engulf and destroy any antigens including cell debris, old organelles, microorganisms and foreign matter. They also remove used neutrophils.
- **Lymphocytes:** This group is very specific. A different lymphocyte is created for each different disease and infection. There are three main types:
 - **B-lymphocytes** or B-cells (made and matured in the bone marrow): These produce antibodies* that bind to the antigen and either identifies them as bad so others will eradicate them or neutralises them and makes them inactive.
 - **T-lymphocytes** or T-cells (matured in the thymus gland): Find and destroy body cells that have been infected with antigens.
 - **T-Helper cells:** Instruct T-killer cells to attack, stimulate macrophages to engulf, get B-cells to make antibodies and some become memory cells.
 - **T-Killer cells:** Destroy cells infected by invaders. They can scan the inside of cells to identify infections.
 - **Memory cells:** Remember antigens from previous attacks, which speeds up the immune response so antibodies are made much faster and the infection is stopped sooner. This is what we refer to as building our immunity and it is how immunisation works.
 - **Natural Killer cells:** These don't need cells to have any prior activation; there is no need for antibodies. They can detect cells that are under attack quickly before a full scale immune system response is launched and destroy them immediately.

* Large Y-shaped proteins that can bind to the surface of antigens. The tips of the Y are different depending on the type of antigen.