

HOW THE BODY DEFENDS ITSELF

Humans and other multicellular organisms have an immune system to prevent pathogens from entering the body and to identify and destroy any invaders that make it inside. If the immune system fails to do its job, medicine may help the body fight disease.

This illustration shows white blood cells flowing through red blood to seek out and destroy pathogens.

The body's lines of defence

1 Barriers

Preventing pathogens from entering the body is your first line of defence against disease.

The skin, a waterproof physical barrier to invasion, carries out this defence. It is supported by mucus, sweat and other secretions like earwax and tears where there are openings in the skin, such as the ears, nose and eyes. Secretions may trap pathogens, or contain chemicals that can deactivate them.

Our skin is home to many 'good' bacteria, which make it more difficult for foreign bacteria to colonise and survive. However, when the barrier of your skin is broken, such as when cut, pathogens can make it through this line of defence.

2 Body responses

The body's second line of defence includes the clotting of blood to help form a barrier when a blood vessel is broken, and a fever to increase the body's temperature to make conditions more difficult for heat-sensitive pathogens. The site of infection attracts increased blood flow, causing redness, heat and inflammation. More blood carries more white blood cells, which recognise that the pathogens do not belong to your body. White blood cells destroy the pathogens by enveloping and digesting them. Finally, the pain and swelling associated with injury prevents you from using the affected area, giving it the best chance of healing.

Skin is an effective barrier to pathogens, unless it is broken.



Vaccination prevents many diseases that were once common. It has even resulted in some diseases, such as smallpox, completely disappearing.

3 Immunity

The body's third line of defence involves targeting any remaining foreign bodies using an immune response that is specific to the pathogen. When infected, the body takes about a week to produce enough **antibodies** to fight the infection. Antibodies are protein molecules that target specific protein molecules on the surface of the pathogen cell, called **antigens**.

Antibodies remain in the body long after the disease has been defeated. This means that the next time your body is infected by the same disease, you already have antibodies ready to recognise and fight it. This process of getting a disease and making antibodies that protect you from the same infection in the future is called having natural immunity to the disease.

Immunity to certain diseases can be passed from a mother to a baby in the womb and via breast milk.

However, this immunity does not last more than a few months. This type of immunity is called passive immunity, because your body does not make the antibodies itself.

Another way to obtain immunity to disease is through **vaccination**. Vaccination involves being injected with or swallowing weakened or inactive antigens that prompt antibody production without the person becoming sick. The vaccine may be a dead pathogen, a live but non-infectious pathogen, the antigens with the pathogen removed, or weak toxins from bacteria. Getting a vaccination is like having a 'dress rehearsal' for your immune system so that it knows how to respond quickly if you ever get infected with the real pathogen.

LOOK IT UP

antibiotics medicines that fight bacteria
antibodies protein molecules that target specific parts of a pathogen cell
antigens protein molecules on the surface of pathogen cells
vaccination being injected with or swallowing weakened or inactive antigens that prompt antibody production without the person becoming sick

CHECK IT OUT

- 1 What are the body's three lines of defence?
- 2 Why does the skin around infections appear red and warm?
- 3 Which of the following are foreign bodies? Antigens, pathogens, antibodies, viruses
- 4 List three ways your body could acquire immunity to a disease.
- 5 Explain how vaccination can help your body fight disease.

Medicine

Medicines are drugs that can be taken to help the body's immune system fight disease and its symptoms. Medicines can work in a number of ways, such as replacing substances missing from your body, destroying microorganisms and foreign cells, changing how cells function, or reducing the symptoms of illness.

Antibiotics are medicines that fight bacteria. They do not work against viruses. Some antiviral medicines exist, but often the best way to fight viruses is to rest and allow your body's immune system to control the infection.

Penicillin: a life saver!

Penicillin is an antibiotic that is produced by some species of *Penicillium* fungus. In 1928, Scottish scientist Alexander Fleming discovered that *Penicillium* mould kills bacteria. During the Second World War, Australian scientist Howard Florey and his team developed *Penicillium* into a wonder drug that has saved many lives. Penicillin works by breaking down the cell walls of bacteria without harming human cell walls. If you've ever had a sore throat, your doctor may have given you penicillin to kill the bacteria making you sick.



As the developer of penicillin, Adelaide-born Howard Florey is credited with saving at least 50 million lives since 1941.