

How do vaccines work?

Script from the animation by the Vaccine Knowledge Project, Oxford Vaccine Group, University of Oxford: <http://vk.ovg.ox.ac.uk/how-do-vaccines-work>

To understand how vaccines work, it helps to look first at how the immune system works, because vaccines harness the natural activity of your immune system.

There are about a hundred trillion bacteria and viruses on your body. Not all of them cause disease. But some are able to get inside our bodies to multiply, and this can make us ill.

There are barriers to stop this happening. But suppose some disease-causing bacteria do get through. Your immune system is quick to recognise them as invaders. This is because the proteins or sugars on the bacteria's surface have different shapes to any of the ones in the human body. They trigger a complex chain of events involving many different types of white blood cells working together.

One type of white blood cell is able to make antibodies to fight the invaders. Antibodies can stick to the proteins or sugars on the bacteria's surface, and this kills the bacteria or disables them.

However, not all antibodies will work against these bacteria. They have to be exactly the right shape – a bit like a key fitting a lock.

Our bodies have a library of billions of white blood cells, each of which can make just one shape of antibody. Only a few of these antibodies will match the invading bacteria.

Producing antibodies of the right shape can take several days. By this time there could be billions of disease-causing bacteria in your body.

Once the right cells are activated they quickly divide and turn into a production line, making masses of antibodies that stick to the bacteria. Eventually your body gets rid of all the bacteria and you recover.

Antibodies remain in the blood, and some white blood cells may also become 'memory cells'. If those specific bacteria invade the body again, the immune system will respond so quickly that you won't get ill.

Vaccines work in the same way. They contain weakened or dead bacteria or viruses, or even just a few proteins or sugars from the surface. This is enough to convince the immune system that a real invader has got in.

The same process takes place as when real bacteria or viruses invade our bodies – except you don't get ill.

Afterwards, if your body ever meets the real thing, your immune system will remember it and get rid of it before you even know it's there.