

Vaccines

A vaccine is a biological preparation, usually given by injection, which improves or conveys immunity to a particular disease. Most vaccines are made from dead or weakened viruses or bacteria, from fragments of these micro-organisms or from the toxins they produce. Vaccines are quite different from chemical medicines; they usually have much more complex molecular structures than chemical medicines because they are produced through natural processes. In contrast to most chemical medicines, they are frequently given to healthy individuals and normally aim to prevent rather than cure disease. Therefore, it is important to ensure that any risks of side effects are minimal.

A global vaccination plan was implemented in the 20th century, which eradicated smallpox. Vaccines are now available for preventing many previously devastating diseases, such as polio, typhoid, measles and tuberculosis, and have saved millions of lives worldwide. Indeed, today, vaccines are being used not only to prevent diseases, but also to treat diseases such as cancer.

Vaccine immunity

During vaccination, a vaccine with modified forms of viruses or bacteria is injected into the body (left). The vaccine stimulates the immune system to produce antibodies against the microorganism (centre). The immune system learns to recognise the microorganism, so that if the body is later infected with the live disease it will produce antibodies to attach to the microorganisms and stop the infection (right).

The first step in vaccine development is to grow a modified version of the micro-organism that causes the disease. It is modified so that the immune system can still recognise it, but so that it no longer causes harm. There are three main types of vaccines: live-attenuated, inactivated, and sub-unit.

Vaccines must be tested in clinical trials to demonstrate whether they are effective and to assess side effects. This process can be longer than for other medicines because they are tested in healthy people who are at particular risk of infection.