

4.6 VACCINATION

Using vaccination as a means of preventing and controlling disease by giving immunity

A **vaccination** is a deliberate exposure to antigenic material in order to provide immunity to a specific disease. A vaccine will introduce antigens to the immune system in a harmless form in order to provoke an immune response. This leads to the production of antibodies, and memory cells, which gives a person long-term immunity, which can last for decades.

The antigenic material used for a vaccine can come in a variety of forms, depending on the disease:

- a dead version of the pathogen (e.g. the cholera vaccine)
- a harmless (or **attenuated**) version of the pathogen (e.g. the tuberculosis vaccine)
- a **toxoid** (a harmless, or deactivated, version of the toxin) (e.g. the tetanus vaccine)
- isolated **antigens** – a preparation of the antigens from a pathogen (e.g. the hepatitis B vaccine)

Active and passive immunity

When immunity arrives from a response of the immune system, it is called **active immunity**. This involves producing the antibodies yourself due to your own immune response to an exposure of the pathogenic organism. The lymphocytes manufacture the antibodies, releasing them into the blood which provides long-term immunity.

Passive immunity is provided by antibodies that have not been produced in the person's own immune system as a result of an immune response to a pathogen. Passive immunity is the form of immunity where no immune response is involved.

Natural and artificial immunity

When immunity is obtained due to getting a disease naturally, due to regular living processes, it is known as **natural immunity**. When immunity is gained by deliberate exposure to antibodies or antigens, it is **artificial immunity**.

- **natural, active immunity** – after having been infected by the pathogen and your immune system responds; a person is infected by the disease once and then the production of antibodies grants future immunity
- **artificial, active immunity** – e.g. after having been given a vaccination of a small, harmless version of a disease so that the immune system is triggered to develop appropriate antibodies, giving immunity
- **natural, passive immunity** – receiving antibodies not from your own immune system, but not artificially, so for example from breast milk or across the placenta during pregnancy
- **artificial, passive immunity** – receiving the antibodies again not from your own immune system, e.g. from an injection of the direct antibodies, rather than the disease, so the immune system does not need to respond

Vaccinations are used as a means of *controlling* disease by giving immunity to all of those at risk, or at least as many as possible. When a new disease, or new strain of an existing disease, breaks out, it is necessary that a procedure is in place so a response can be put into practice swiftly. There are two main types of vaccination procedure.

Herd vaccination is used to try and vaccinate the majority of the population in order to prevent a disease from spreading. In order to be realistic, this needs to vaccinate at least 85 to 90 per cent of the population. This is why young children are given a range of vaccinations to prevent them from developing diseases, as it automatically gives immunity to the majority of people who are born in this country. In the UK, vaccination programmes include those for tuberculosis, tetanus, polio, meningitis and MMR (measles, mumps and rubella).

Ring vaccination is used whenever a new disease does break out. When a new case of a disease is reported, all of the people in an immediate vicinity of the case(s) are vaccinated. This can also be used to stop the spread of disease amongst livestock.