CIE Biology GCSE

10: Diseases and Immunity

Notes

(Content in **bold** is for Extended students only)

A **pathogen** is an **organism that causes disease**. Pathogens include **bacteria and viruses**. Organisms which harbour these pathogens are referred to as **hosts**. Pathogens can be spread from host to host through contact with an infected organism, or through other mediums such as food, water, waste and bodily fluids, and are thus called **transmissible diseases.** It is therefore important to make sure that food is prepared **hygienically**, waste and sewage are treated, and good personal hygiene is maintained to **prevent the spread of disease**.

Defences against infection:
The body's first line of defense attempts to prevent pathogens from entering the body, and includes:

- **Mechanical barriers** - this includes hairs in the nose and skin.
- **Chemical barriers** - includes mucus, stomach acid and tears.

Once the pathogen has infected the body, an **immune response** occurs to kill it. This involves **phagocytosis and antibody production** by white blood cells.

Antibodies and antigens:
Pathogens can be detected by white blood cells and are destroyed in an immune response. Each pathogen has a specific antigen protein on the cell membrane. In the immune response, lymphocytes produce specific antibodies, which bind to the antigens to produce an antibody-antigen complex. As each type of pathogen has different antigens, a specific antibody which is complementary to this antigen must be made for each disease. Once the antibody binds to the antigens, the pathogens clump together making them harmless. They can then either be killed directly or marked for destruction by phagocytes.

Autoimmune diseases:
Some diseases can be caused by an immune response on healthy body cells, where they are targeted and destroyed by the immune system. An example of this is type 1 diabetes, where the body targets cells in the pancreas, thus insulin can no longer be produced.

Immunity

Active immunity:
Active immunity can be gained after an infection, or through vaccination.

Infection:
After the pathogen has been killed, some of the lymphocytes remain as memory cells. This means that if the same pathogen ever enters the body again, the lymphocyte would recognize the antigens and be able to produce new antibodies more quickly than the first time. Memory cells stay in the body for years, thus giving long-term immunity.

Vaccination:

1. **A dead or attenuated version of a pathogen is given to the patient**
2. **The antigens evoke an immune response, in which antibodies are produced**
3. **Memory cells are produced which stay in the body, giving long-term immunity**

Vaccination can be used to control the spread of disease by providing herd immunity. This is where a large amount of the population is vaccinated and are thus immune to the pathogen, so the disease cannot spread as there are only a few people left who can still become infected. The few that cannot be vaccinated, for example due to medical reasons, are therefore protected against the disease.

Passive immunity:
Passive immunity is a short-term defense against a pathogen and can be gained through acquiring antibodies from another individual. One example of passive immunity is antibodies being passed to a baby through the mother's milk, thus it is important for babies to be breastfed to reduce the risk of diseases. It can also be gained through injections of antibodies from a donor.

Passive immunity is short-term as memory cells are not produced.