

# **CIE Biology GCSE**

## 10: Diseases and immunity

### Notes

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**.

### **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**.