

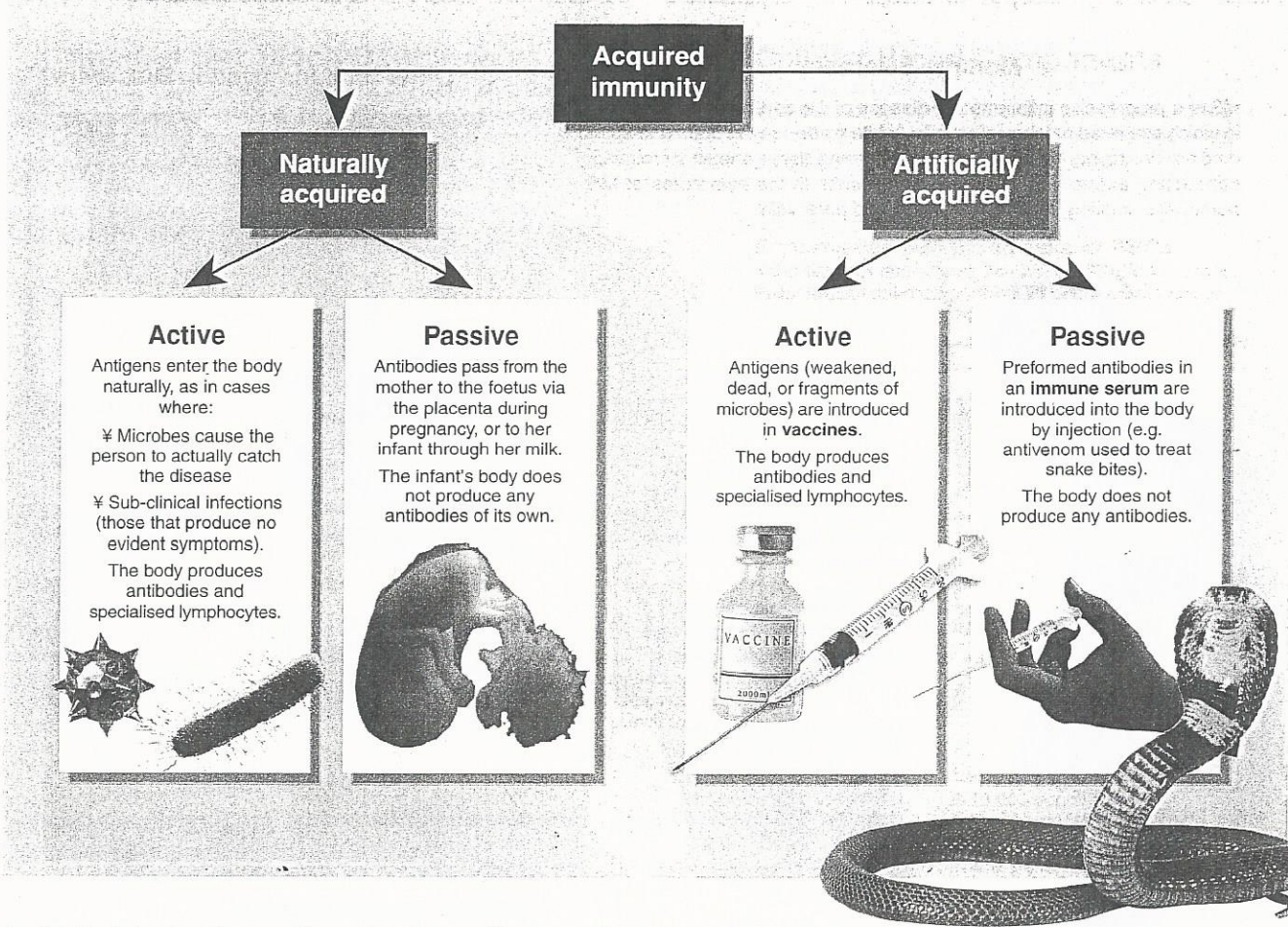


2. Distinguish between specific and non-specific resistance: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Discuss the features of the different types of white blood cells, explaining how these relate to their role in defence:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Describe the functional role of each of the following defence mechanisms (the first one has been completed for you):
- (a) Skin (including sweat and sebum production): Skin helps to prevent direct entry of pathogens into the body. Sebum slows growth of bacteria and fungi.
- (b) Phagocytosis by white blood cells: \_\_\_\_\_  
\_\_\_\_\_
- (c) Mucus-secreting and ciliated membranes: \_\_\_\_\_  
\_\_\_\_\_
- (d) Body secretions: tears, urine, saliva, gastric juice: \_\_\_\_\_  
\_\_\_\_\_
- (e) Natural antimicrobial proteins (e.g. interferon): \_\_\_\_\_  
\_\_\_\_\_
- (f) Antibody production: \_\_\_\_\_  
\_\_\_\_\_
- (g) Fever: \_\_\_\_\_  
\_\_\_\_\_
- (h) Cell-mediated immunity: \_\_\_\_\_  
\_\_\_\_\_
- (i) The inflammatory response: \_\_\_\_\_  
\_\_\_\_\_
5. Infection with HIV results in the progressive destruction of T lymphocytes. Suggest why this leads to an increasing number of opportunistic infections in AIDS sufferers:  
\_\_\_\_\_  
\_\_\_\_\_

# Acquired Immunity

We have natural or **innate resistance** to certain illnesses; examples include most diseases of other animal species. **Acquired immunity** refers to the protection an animal develops against certain types of microbes or foreign substances. Immunity can be acquired either passively or actively and is developed during an individual's lifetime. **Active immunity** develops when a person is exposed to microorganisms or foreign substances and

the immune system responds. **Passive immunity** is acquired when antibodies are transferred from one person to another. Recipients do not make the antibodies themselves and the effect lasts only as long as the antibodies are present, usually several weeks or months. Immunity may also be **naturally acquired**, through natural exposure to microbes, or **artificially acquired** as a result of medical treatment.



Defence & the Immune System

- (a) Explain what is meant by **active immunity**: \_\_\_\_\_

\_\_\_\_\_

(b) Distinguish between naturally and artificially acquired active immunity and give an example of each:

\_\_\_\_\_

\_\_\_\_\_
- (a) Explain what is meant by **passive immunity**: \_\_\_\_\_

\_\_\_\_\_

(b) Distinguish between naturally and artificially acquired passive immunity and give an example of each:

\_\_\_\_\_

\_\_\_\_\_
- Prior to birth, a baby receives antibodies across the placenta from its mother.

(a) Explain why a newborn baby needs to have had a supply of maternal antibodies: \_\_\_\_\_

\_\_\_\_\_

(b) Explain why this supply is supplemented by antibodies provided in breast milk: \_\_\_\_\_

\_\_\_\_\_

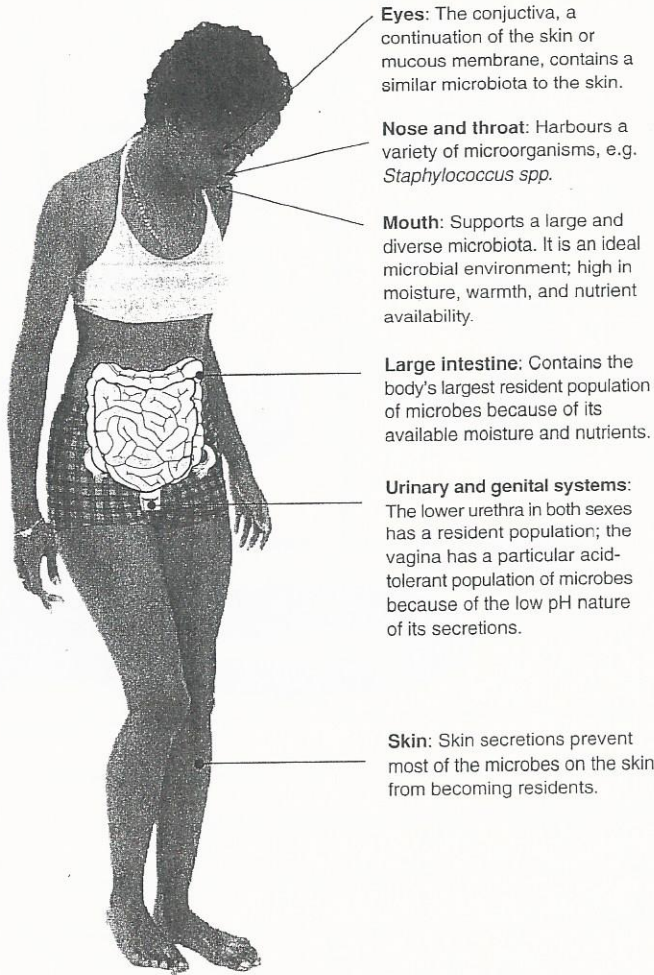
# Targets for Defence

In order for the body to present an effective defence against pathogens, it must first be able to recognise its own tissues (self). It must also ignore the normal microflora inhabiting our bodies and be able to deal with abnormal cells which periodically appear in the body and might develop into cancer. Failure of self/non-self recognition can lead to autoimmune disorders, in which the immune system mistakenly destroys its own tissues. The ability

of the body to recognise its own molecules has implications for medical techniques such as tissue grafts, organ transplants, and blood transfusions. Incompatible tissues (correctly identified as foreign) are attacked by the body's immune system (rejection). Even a healthy pregnancy involves suppression of specific features of the self recognition system, allowing the mother to tolerate a nine month relationship with a foreign body (a foetus).

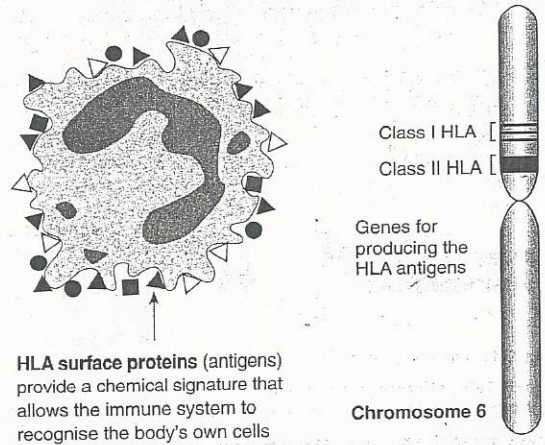
## The Body's Natural Microbiota

After birth, normal and characteristic microbial populations begin to establish themselves on and in the body. A typical human body contains  $1 \times 10^{13}$  body cells, yet harbours  $1 \times 10^{14}$  bacterial cells. These microorganisms establish more or less permanent residence but, under normal conditions, do not cause disease. In fact, this normal microflora can benefit the host by preventing the overgrowth of harmful pathogens. They are not found throughout the entire body, but are located in certain regions.



## Distinguishing Self from Non-Self

The human immune system achieves self-recognition through the **major histocompatibility complex (MHC)**. This is a cluster of tightly linked genes on chromosome 6 in humans. These genes code for protein molecules (MHC antigens) that are attached to the surface of body cells. They are used by the immune system to recognise its own or foreign material. **Class I MHC** antigens are located on the surface of virtually all human cells, but **Class II MHC** antigens are restricted to macrophages and the antibody-producing B-lymphocytes.



## Tissue Transplants

The MHC is responsible for the rejection of tissue grafts and organ transplants. Foreign MHC molecules are antigenic, causing the immune system to respond in the following way:

- T cells directly lyse the foreign cells
- Macrophages are activated by T cells and engulf foreign cells
- Antibodies are released that attack the foreign cell
- The complement system injures blood vessels supplying the graft or transplanted organ

To minimise this rejection, attempts are made to match the MHC of the organ donor to that of the recipient as closely as possible.

1. Explain why it is healthy to have a natural population of microbes on and inside the body: \_\_\_\_\_  
\_\_\_\_\_
2. (a) Explain the nature and purpose of the major histocompatibility complex (MHC): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(b) Explain the importance of such a self-recognition system: \_\_\_\_\_  
\_\_\_\_\_
3. Name two situations when the body's recognition of 'self' is undesirable: \_\_\_\_\_