

The **initial response of the body to infection is non-specific**. The next phase is the **primary immune response that confers immunity**. This is the ability of **organisms to resist infection by protecting against disease-causing microorganisms or their toxins that invade their bodies**.

Antigens:

This is **any part of an organism or substance that is recognised as non-self (foreign) by the immune system and stimulates an immune response**.

These are **usually proteins that are part of the cell-surface membrane or cell walls of invading cells**.

The presence of an antigen triggers the production of an antibody as a part of the body's defence system.

Lymphocytes:

Immune responses such as phagocytosis are non-specific and occur whatever the infection. The body also has **specific responses that react to specific antigens**. Specific immunity depends on a type of white blood cell—Lymphocyte. These are produced by stem cells in bone marrow.

T-Lymphocytes (T cells) = mature in the thymus gland. They are associated with cell-mediated immunity = immunity involving body cells.

B-Lymphocytes (B cells) = mature in bone marrow. Associated with humoral immunity = immunity involving antibodies that are present in the body fluids or 'humour' such as blood plasma.

T-lymphocytes and cell mediated immunity

Cell-mediated immunity:

Lymphocytes respond to an organism's own cells that have been infected by non-self material from a different species (like a virus). They also respond to cells from individuals of the same species because they are genetically different.

They have different antigens on their cell-surface membrane from the antigens on the organism's own cell. = T-Lymphocytes can distinguish these invader cells because:

- Body cells invaded by a virus present some of the viral antigens on their own cell-surface membrane
- **Phagocytes that have engulfed and hydrolysed a pathogen present some of a pathogen's antigens on their own cell-surface membrane.**
- Transplanted cells from individuals of the same species have different antigens on their cell-surface membrane
- **Cancer cells are different from normal body cells and present antigens on their cell-surface membrane.**

Cells that display foreign antigens on their surface are called antigen-presenting cells.

T-Lymphocytes will only respond to antigens that are presented on a body cell. This response is the cell-mediated immunity. The role of the receptors on T cells is important. These respond to a single antigen. There is a vast number of different types of T cell, each one responding to a different antigen.

T-Lymphocytes response to infection:

1. pathogens invade body cells or are taken in by phagocytes.
2. The phagocyte places antigens from the pathogen on its cell-surface membrane.
3. Receptors on a specific helper T cell fit exactly onto these antigens.
4. This attachment activates the T cell to divide rapidly by mitosis and form a clone of genetically identical cells.

5. The cloned T cells:

- Develop into memory cells that enable a rapid response to future infections by the same pathogen.
- Stimulate phagocytes to engulf pathogens by phagocytosis
- Stimulate B cells to divide and secrete their antibody
- Activate cytotoxic T cells.

How cytotoxic T cells kill infected cells:

These kill abnormal cells and body cells that are infected by pathogens by producing a protein (perforin) that makes holes in the cell-surface membrane. These mean the membrane becomes **freely permeable** to all substances and the cell dies as a result. Action of T cells is most effective against viruses because these replicate inside cells.