PHYSIOLOGY

Q8 – Cell Mediated Immunity

Ans : 8 – Answer

Introduction

Cell mediated immunity is a major arm of the adaptive immune system that provides protection against intracellular pathogens such as viruses, certain bacteria, fungi, protozoa, and malignant cells. It also plays an important role in transplant rejection and immune regulation. Unlike humoral immunity, cell mediated immunity does not involve antibodies and is mediated primarily by T lymphocytes and their cytokines.

Definition

Cell mediated immunity is defined as the immune response mediated by T lymphocytes in which immune protection is achieved by direct cell-to-cell contact or by release of cytokines, without the involvement of circulating antibodies.

Cells Involved in Cell Mediated Immunity

The cells involved include helper T cells (CD4+), cytotoxic T cells (CD8+), regulatory T cells, and memory T cells. Antigen presenting cells such as macrophages, dendritic cells, and B lymphocytes process antigens and present them to T cells using major histocompatibility complex (MHC) molecules.

Types of T Cells and Their Functions

Helper T cells recognize antigens presented with MHC class II molecules and secrete cytokines that activate cytotoxic T cells, macrophages, and B cells. Cytotoxic T cells recognize antigens presented with MHC class I molecules and directly kill infected, malignant, or transplanted cells by releasing perforin and granzymes, which induce apoptosis. Regulatory T cells suppress excessive immune responses and help maintain immune tolerance.

Mechanism of Cell Mediated Immunity

The process begins with antigen processing and presentation by antigen presenting cells. Recognition of antigen by T cell receptors along with co-stimulatory signals leads to activation and clonal expansion of T cells. Activated T cells differentiate into effector and memory cells. Effector cells carry out immune functions through cytokine release or direct cytotoxic action.

Delayed Type Hypersensitivity

Delayed type hypersensitivity is a classic manifestation of cell mediated immunity. It develops 24 to 72 hours after antigen exposure and is mediated by sensitized T lymphocytes and macrophages. The tuberculin skin test is a commonly used example of delayed type hypersensitivity.

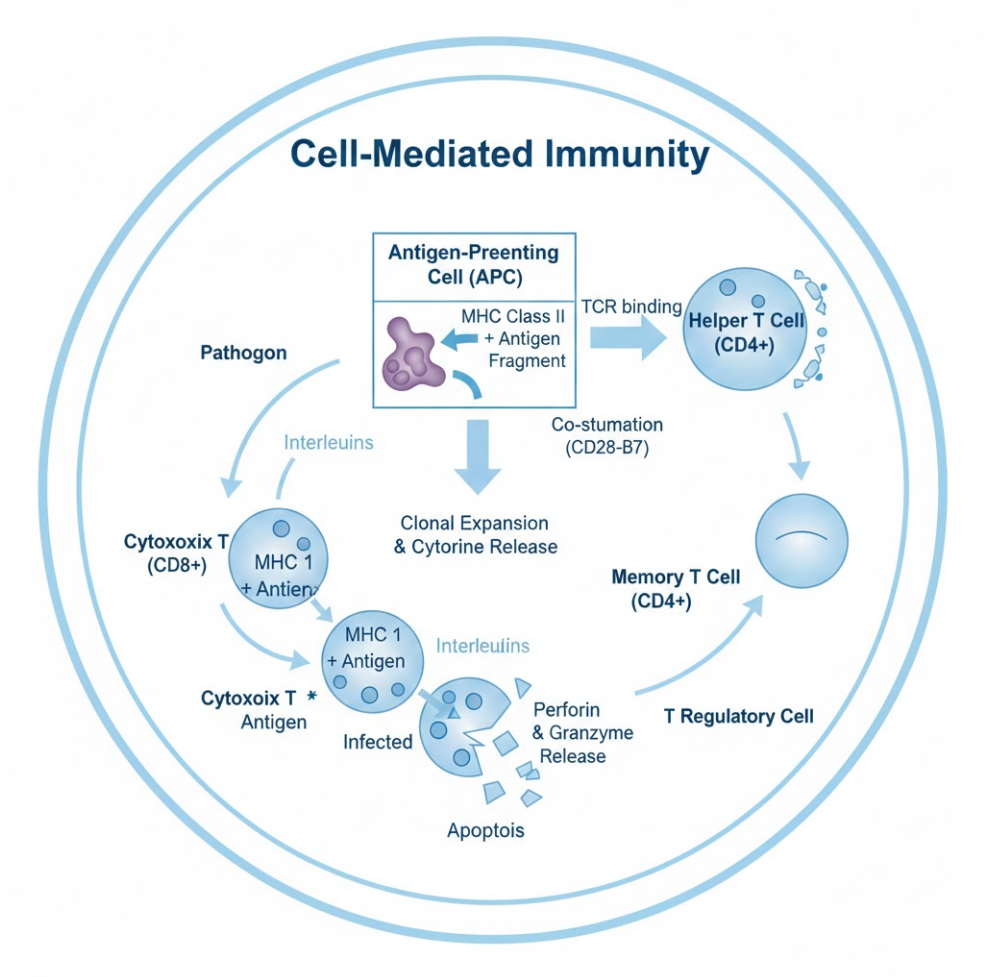
Functions of Cell Mediated Immunity

Cell mediated immunity is responsible for defense against intracellular pathogens, tumor surveillance, rejection of transplanted organs, regulation of immune responses, and maintenance of immunological memory.

Clinical Importance

Deficiency of cell mediated immunity results in severe and recurrent infections, as seen in conditions such as AIDS. It is important in the pathogenesis and defense against diseases like tuberculosis and leprosy, and forms the basis of immunotherapy and transplant rejection.

Diagram – Cell Mediated Immunity



Conclusion

Cell mediated immunity is a vital component of the immune system that protects the body against intracellular infections, malignant cells, and foreign tissues. Through coordinated actions of T lymphocytes, antigen presenting cells, and cytokines, it provides effective immune defense and maintains immune balance.