

Difference Between HLA and MHC

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Key Difference - HLA vs MHC

The immune responses are generated as a result to the invasion of the host cells by a pathogen. Different cells and molecules present in the immune system are involved in this process. Human Leukocyte Antigen (HLA) and Major Histocompatibility Complex (MHC) molecules are two important aspects of the immunity system. They involve in the recognition of pathogenic antigens and coordinating with other immune cells to generate an immunological response. **MHC molecules are often present in different types of vertebrates whilst HLA is present only in humans.** This is the **key difference** between HLA and MHC.

What is HLA?

The MHC molecules of humans are encoded by the gene complex known as Human Leukocyte Antigen (HLA) which is present on chromosome 06. It is considered to be polymorphic which consists of different forms of alleles. This polymorphic nature of HLA gene complex provides fine tuning of the adaptive immune system which consists of specialized cells that perform the elimination process of pathogens and cease their growth. MHC molecules can be classified into two major classes, MHC Class I and MHC Class II. HLAs correspond to both MHC classes in different forms, providing different functions for each type of class.

HLA - A, HLA – B and HLA – C encode for MHC Class I molecules. This basically involves in cell mediated immunity which presents protein particles (peptides) from the interior of the cell. During the invasion of the cell by viruses and other intracellular pathogens, the fragments of the pathogens are taken up by the HLA system and are brought to the surface of the cell. This initiates an immune response where the infected cell is recognized by Tc cells and eventually destroyed.

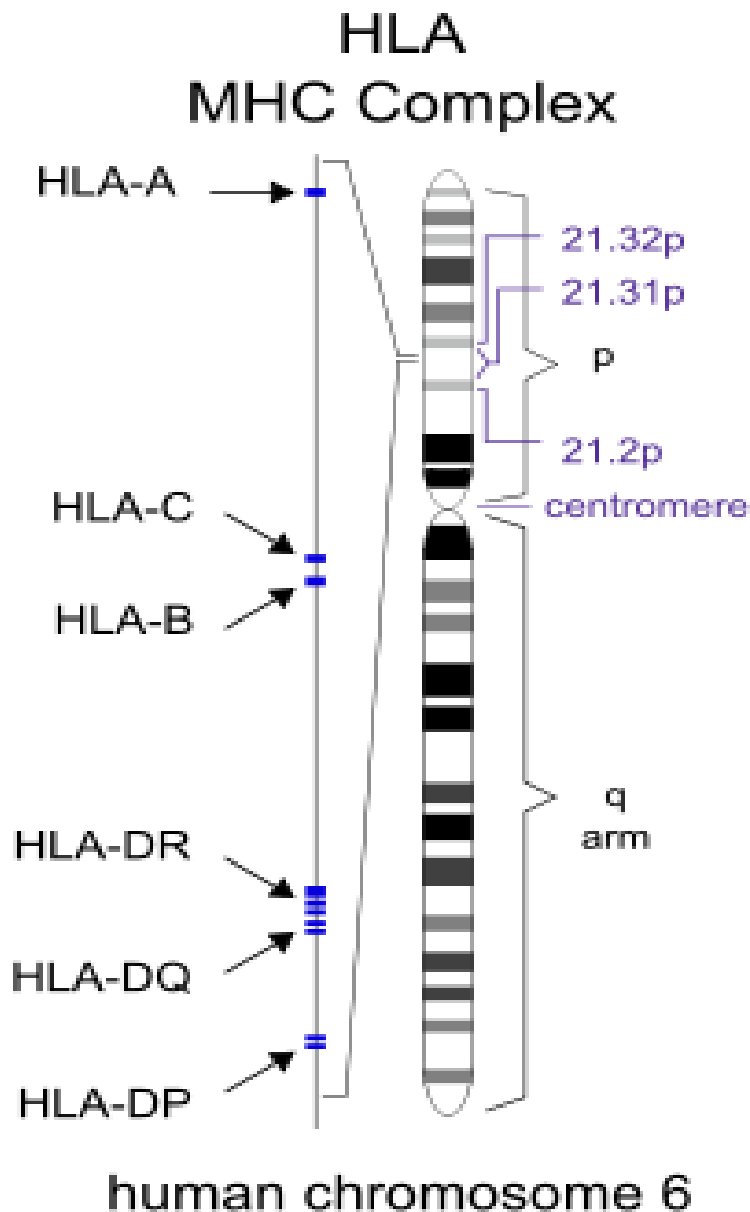


Figure 01: Human HLA complex

HLA - DP, HLA - DR, HLA - DQ, HLA - DOA, HLA - DOB encode for MHC Class II molecules. These HLA gene complex present antigens to the T lymphocytes that have derived from the exterior of the cell. The presentation of antigens by the gene complex initiates the rapid multiplication of Th cells. This causes the stimulation of B cells in the production of antibodies to the specific antigen presented.

Other than encoding MHC molecules, HLA gene complex consist of other roles within the cells. They are considered as the major cause for transplant rejection. If a mutation is present in the HLA gene complex, it leads to autoimmune diseases. The diversity of HLA gene complex within a population determines the different responses to infectious diseases.

What is MHC?

Major Histocompatibility Complex (MHC) molecules play a major role in the recognition of foreign substances or antigens which disrupt the normal functioning of the cells. They are cell surface proteins which involve in the binding of antigens. These antigens are derived from different types of invading pathogens from both intracellular and extracellular ways. Once bound to the MHC molecules the antigens are presented to T cells which include T helper cells (T_H) and cytotoxic T cells (T_C). MHC molecules have a special mechanism to prevent the initiation of the immune responses against hosts own antigens. During the degradation of cell proteins, the peptide particles of each protein are taken to onto the cell surface of MHC molecules. These peptide particles are known as epitopes. They provide information to the MHC molecules to distinguish between self and nonself antigens and act accordingly. MHC molecules are of two main categories; MHC Class I and MHC Class II.

All nucleated cells possess MHC Class I molecules on their cell surfaces. They function to detect nonself antigens from self-antigens present within the cell and on Tc cells to initiate an immune response. The Tc cells especially possess co-receptor molecule CD8. MHC Class I molecules causes the initiation of direct cell lysis by Tc cells through the presentation of antigens on CD8 co-receptor molecules. The antigen presentation pathway in MHC Class I molecules is known as endogenous pathway since peptides which are derived from cytosolic proteins are present on MHC Class I molecules. MHC Class I molecules are encoded by HLA gene complex (HLA-A, HLA-B and HLA- C) that are present on Chromosome 6 and also by the beta subunits that are present on chromosome 15.

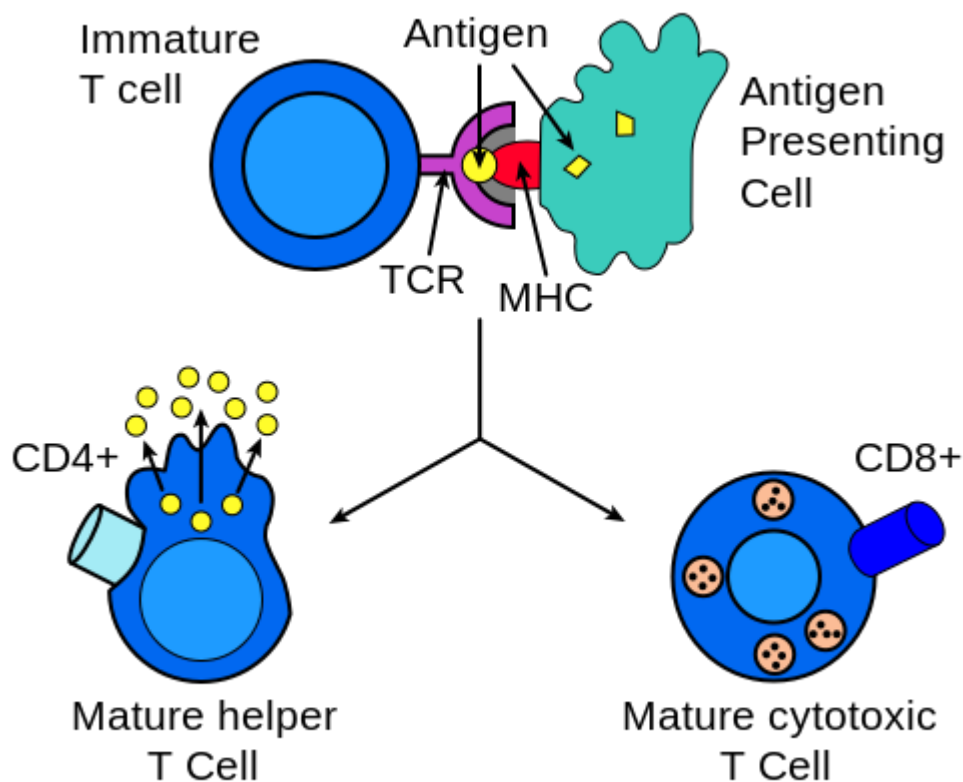


Figure 02: MHC

Antigen Presenting cells (APC) which includes B cells, dendritic cells and macrophages express MHC Class II molecules on their cell surfaces. The presentation of antigens by MHC Class II molecules differ to that of MHC Class I antigen presentation. Once the MHC Class II molecules encounter an antigen, the antigen is taken up into the cell in which the antigen undergoes processing. Afterwards, an epitope that is a fraction of an antigen is taken to the surface of the cell. This epitope recognizes complementary particles, self or nonself antigen known as paratope and binds to it. The MHC Class II molecules present antigens to initiate immune responses by other cells in the immunity system. T helper (Th) cells with co-receptor molecule CD4 involve in the initiation of immunological responses. MHC Class II molecules are encoded by HLA-D gene complexes that possess two identical alpha and beta chains.

What are the Similarities Between HLA and MHC?

- Both types are antigens that are present on cell surfaces and on the genetic material of cells.
- Both involve in a common function that is, assisting the immune system of the body to recognize invading pathogens and to prevent its multiplication within the body.
- Both involve in the regulation of immune system and immune responses.

What is the Difference Between HLA and MHC?

HLA vs MHC	
HLA is a gene complex present in humans which encode for MHC molecules.	MHC are the molecules which play a major role in recognition of foreign substances; antigens which disrupt the normal functioning of the cells.
Occurrence	
HLA is present only in humans.	MHC molecules are commonly present in vertebrates.
Function	
HLA encode for MHC Class I and MHC Class II molecules.	MHC involves in recognition of foreign substances; antigens.

Summary - HLA vs MHC

HLA and MHC molecules are important aspects of the immunity system. The difference between HLA and MHC is that, MHC molecules are commonly found in many vertebrates whilst HLA is found only in humans. HLA is a gene complex present in chromosome 06 which encodes for both classes of MHC molecules. MHC molecules involve in the recognition of antigens and displaying the antigens to other immune cells to initiate an immunological response. MHC molecules are of two main classes. MHC Class I molecules are encoded by HLA gene complex (HLA-A, HLA-B and HLA- C) present on Chromosome 6 and also by the beta subunits present on chromosome 15. MHC Class II molecules are encoded by HLA-D gene complex.

Reference:

1. "Human leukocyte antigens - Genetics Home Reference." U.S. National Library of Medicine, National Institutes of Health.
2. Janeway, Charles A, and Jr. "The major histocompatibility complex and its functions." Immunobiology: The Immune System in Health and Disease. 5th edition., U.S. National Library of Medicine, 1 Jan. 1970. [Available here](#)

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