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Commentary

Genes of major histocompatibility complex and its functions

Izmily Tiya *

Department of Immunology, Université de Moncton, New Brunswick, Canada.

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DESCRIPTION

A sizable region of vertebrate Deoxyribonucleic acid (DNA) called the Major Histocompatibility Complex (MHC) contains a group of closely related polymorphic genes that code for cell surface proteins necessary for the adaptive immune system. These MHC molecules are cell surface proteins. Because it was found through the investigation of the compatibility of transplanted tissues, this locus received its name. Subsequent research showed that the role of MHC molecules, which also includes binding an antigen originating from pathogens or self-proteins and bringing the antigen presentation to the cell surface for detection by the proper T cells, goes far beyond tissue rejection caused by incompatibility. Leukocytes, commonly known as White Blood Cells (WBCs), connect with other leukocytes or with bodily cells through the mediation of MHC molecules. The MHC determines a person's vulnerability to autoimmune illnesses as well as donor compatibility for organ transplants.

Genes

All jawed vertebrates have the MHC locus, which is thought to have developed around 450 million years ago. The overall structure of the locus is somewhat consistent despite the variation in the amount of genes present in the MHC of various animals. About a hundred genes and pseudogenes make up the typical MHC, but not all of them are involved in immunity. In humans, the MHC region is located on chromosome 6 (from 6p22.1 to 6p21.3, or 29Mb to 33Mb on the hg38 assembly), and it comprises 224 genes spread across 3.6 megabase pairs (3 600 000 bases). Roughly half have immune systems that are well-known to work. The HLA (human leukocyte antigen) complex is another name for the human MHC (often just the HLA). The same is true for BoLA (bovine leukocyte antigens), DLA (dog leukocyte antigens), and SLA (swine leukocyte antigens). Yet, traditionally, the MHC has been referred to as the Histocompatibility system 2 (H-2) in mice, the RT1 in rats, and the B-locus in chicken.

Functions

The immune system's ability to bind to, recognise, and tolerate itself (more precisely, T cells) depends on the tissue-antigen known as MHC (autorecognition). Moreover, MHC functions as a chaperone for intracellular peptides that combine with MHCs and are then presented as potential foreign antigens by T Cell Receptors (TCRs). To improve the affinity and specificity of the antigen-TCR interaction as well as the efficiency of signal transduction, MHC interacts with TCR and its co-receptors. The MHC-peptide complex is essentially an auto-antigen/allo-antigen complex. In theory, T cells should be able to tolerate the auto-antigen after binding but become active in response to the allo-antigen. The breakdown of this concept results in disease states.

Antigen presentation: MHC molecules connect to the CD4/CD8 co-receptors on T lymphocytes as well as the T cell receptor, and the antigen epitope contained in the MHC molecule's peptide-binding groove interacts with the TCR's variable Ig-Like domain to cause T-cell activation.

Autoimmune response: Certain MHC molecules are associated with a higher risk of developing autoimmune illnesses than others. HLA-B27 is an example. Although processes involving improper antigen presentation or T cell activation have been proposed, it is still unknown how exactly possessing the HLA-B27 tissue type raises the risk of ankylosing spondylitis and other related inflammatory illnesses. Allorecognition of tissue In essence, MHC molecules act as TCR ligands when they are in complex with peptide epitopes. Any MHC molecule that T cells were not conditioned to recognise during positive selection in the thymus must bind to the peptide-binding grooves in order to activate them.

*Corresponding author: Izmily Tiya, Email: Izmilytiya@c.ca