



# **Major Histocompatibility Complex**

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# Introduction

- Major Histocompatibility complex (MHC) is set of surface proteins located on the cell membrane of nucleated cells.
- It plays more important work to indentify the antigen between self and non self body, intracellular recognition and responsible for antigen presentation.
- **Histo** refers to tissues. **Compatibility** refers to living together harmoniously.
- MHC molecules always recognize only T lymphocytes. The two types of MHC are worked in immunity. T helper (Th) cell recognized by MHC molecules II, and T cytotoxic (Tc) cells are recognized by MHC I molecules.

# Definition

- *“Major Histocompatibility complex is membrane attached protein which work on recognition of antigen between self and non self body and antigen presentation”.*

# History

- **Peter Gorer (1930)** found that four group of MHC molecules he used the blood sample of mice to identified the blood group antigen which designated by I to IV group of MHC.
- **Georg Snell, Jean Dausset and Bariy** received noble prize in 1980 for their contribution to the discovery of MHC molecule.

# Classes of MHC Molecules

□ The MHC molecules are classified into four classes namely :-

1. Class I MHC molecules
2. Class II MHC molecules
3. Class III MHC molecules
4. Class IV MHC molecules

# Class I MHC Molecules

- Class I MHC(45 KD) molecule are a group of major histocompatibility antigen.
- They are present on the surface of all nucleated cells and platelets.
- It present antigen to **Tc** cells.
- It bind with **CD-8** adhesion molecules of **Tc** cells.
- It brings about **cell mediated immune response**.

# Structure of Class I MHC Molecule

- It consists two polypeptide chains namely  **$\alpha$  chain and  $\beta$ 2 – micro globulin.**
- $\alpha$  chain which is non covalently attached with  $\beta$ 2 microglobuline .  $\alpha$  chain contain a transmembrane glycoprotein which is encoded by A,B and C gene of grouped HLA.
- $\alpha$  chain is organized by three domains such as  $\alpha$  1,  $\alpha$  2 and  $\alpha$  3 each domain containing 90 amino acids sequences .
- $\beta$ 2 microglobuline is similar in size of  $\alpha$  3 and it dose not contain trans membrane proteins .
- When the antigen is internalized and processed inside by proteosome (Ubiquitin, cytosolic degradation), the peptides are produced .
- Peptide is further loaded on the groove of MHC I molecules from endoplasmic reticulum.



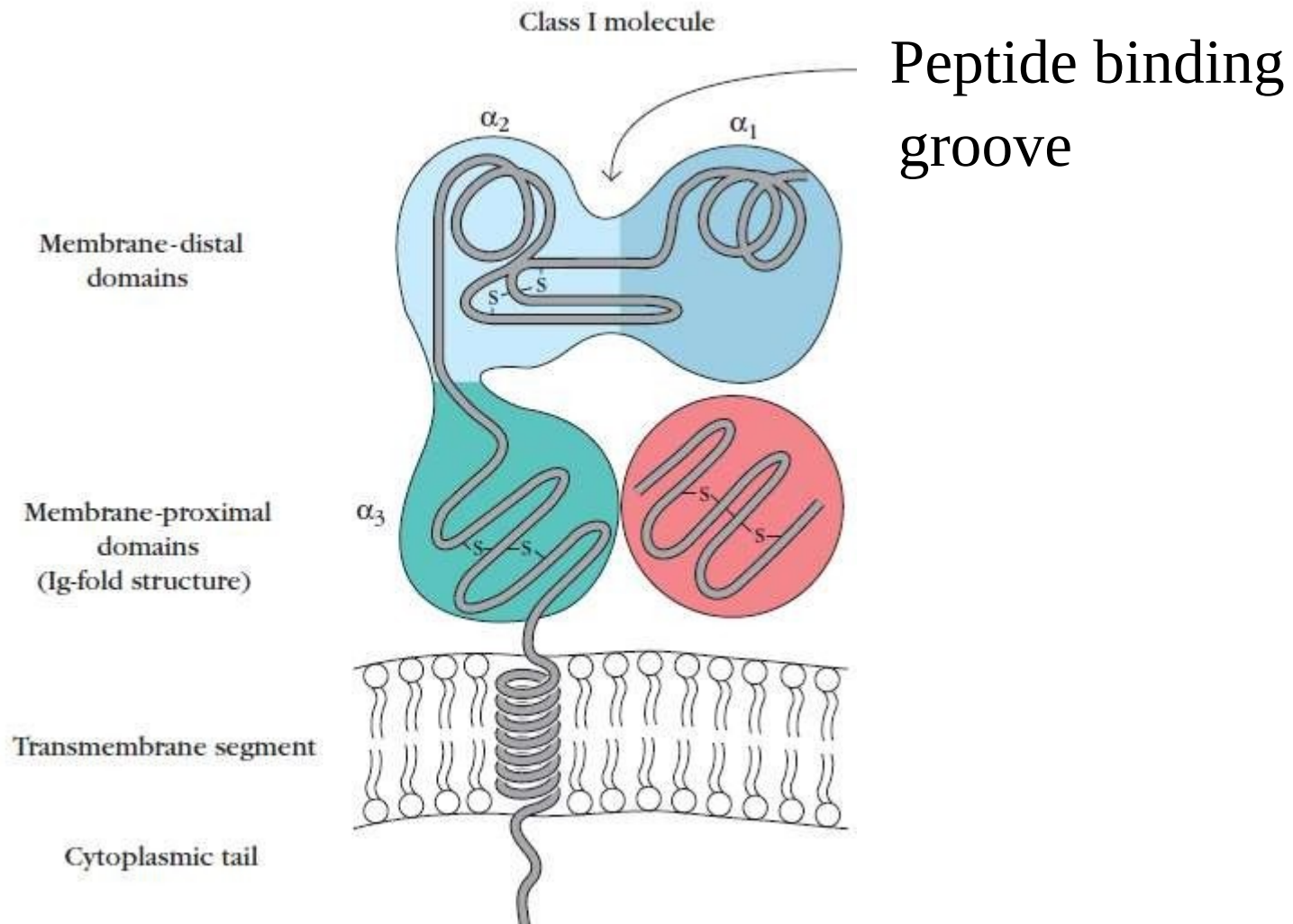


Fig:- Class I MHC antigen

# Class II MHC Molecule

- Class II MHC molecule are present on the surface of antigen presenting cell and cell which engulfed the foreign antigen.
- It binds with the exogenous(endocytic degradation ) antigens.
- It binds with CD4 adhesion molecules T<sub>H</sub> cells.
- It also consist of two polypeptide chains namely  $\alpha$  chain and  $\beta$  chain.
- Antigen is processed inside the **endosome** and peptide is further loaded on groove of MHC II molecules.

# Structure of MHC II Molecule

- The class II MHC Molecule consists of two polypeptide chain namely  $\alpha$  chain (33 kDa) and  $\beta$  (28kDa) chain.
- The both chain are attached noncovalently.
- Each chain contains two units. The two units of  $\alpha$  chain are called  $\alpha 1$  and  $\alpha 2$ . The two domains of  $\beta$  chains are called  $\beta 1$  and  $\beta 2$ .
- $\beta 2$  and  $\alpha 2$  are **transmembrane** domains anchoring the MHC to plasma membrane.
- The  $\alpha 1$  and  $\beta 1$  domains jointly bear a **peptide binding groove**.

Peptide binding  
groove

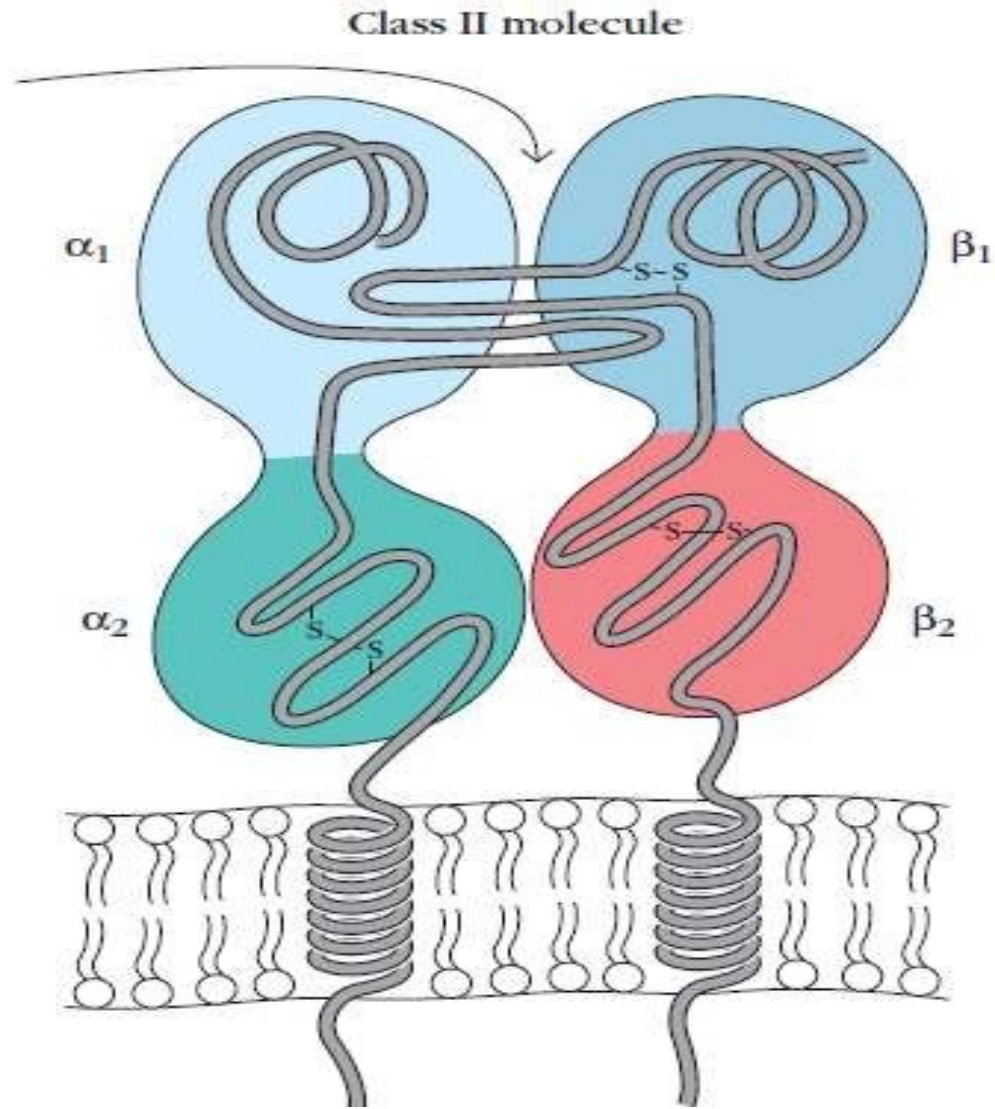


Fig:- Class II MHC molecule

## Class III MHC molecule

- The molecules include complements like C2 and C4 and Bf (factor B).

## Class IV MHC molecule

- These molecule is present on T cells of leukemia(T1a) as well as on immature thymocytes .

# HLA - Human Leukocyte

## Antigen

- **HLA is the human leukocyte antigen.**
- HLA is the MHC molecules present in human beings.
- HLA is a set of surface protein present on the surface of all nucleated cells. They are responsible for **graft rejection, adaptive immunity, defense against infection, some time it is expressed on cancer cell destruction, certain autoimmune diseases** and certain complements.
- MHC is the general term referring to the cell surface antigen of vertebrates.

# H-2 Complex Of Mouse

- The major histocompatibility complex (MHC) of mouse is called ***H-2*** complex.
- *H-2* complex is a **cluster of genes** responsible for the production of **antigens located of nucleated cells** and complement components.
- This complex is located in the **short arm** of the chromosome number **17**.
- It consists of a **set of structural genes** .
- The genes, that make up a given histocompatibility complex, are called **halotypes**.

# Function of MHC Molecules

- MHC molecules are loaded with a bit of sample peptide fragment derived from the **degradation of proteins** present inside the cell. This peptide is the **mirror image** of proteins present inside the cell.
- MHC molecules contain **self** as well as **nonself (foreign)** antigen.
- They bring about **defense against infections and diseases**.
- They mediate certain **autoimmune diseases**.



# Summary

- The both MHC I and II molecule are responsible for antigen presentation and it has application of antigen recognition between self and nonself recognition, mostly they are located on T lymphocytes encoded by chromosome 6 of the human. The two types of antigen degraded peptides (exogenous and endogenous) are involved to complete these process of antigen neutralization.



**Thank you**