

# Major Histocompatibility Complex (MHC)

**Suman Kumar Meikap**

**Asst. Professor (Pharmacology)**

**CUTM, Bhubaneswar**



# Introduction

- Major Histocompatibility complex (MHC) is set of surface proteins located on the cell membrane of nucleated cells.
- It plays more important work to identify 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 in to 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 except nervous tissue 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.



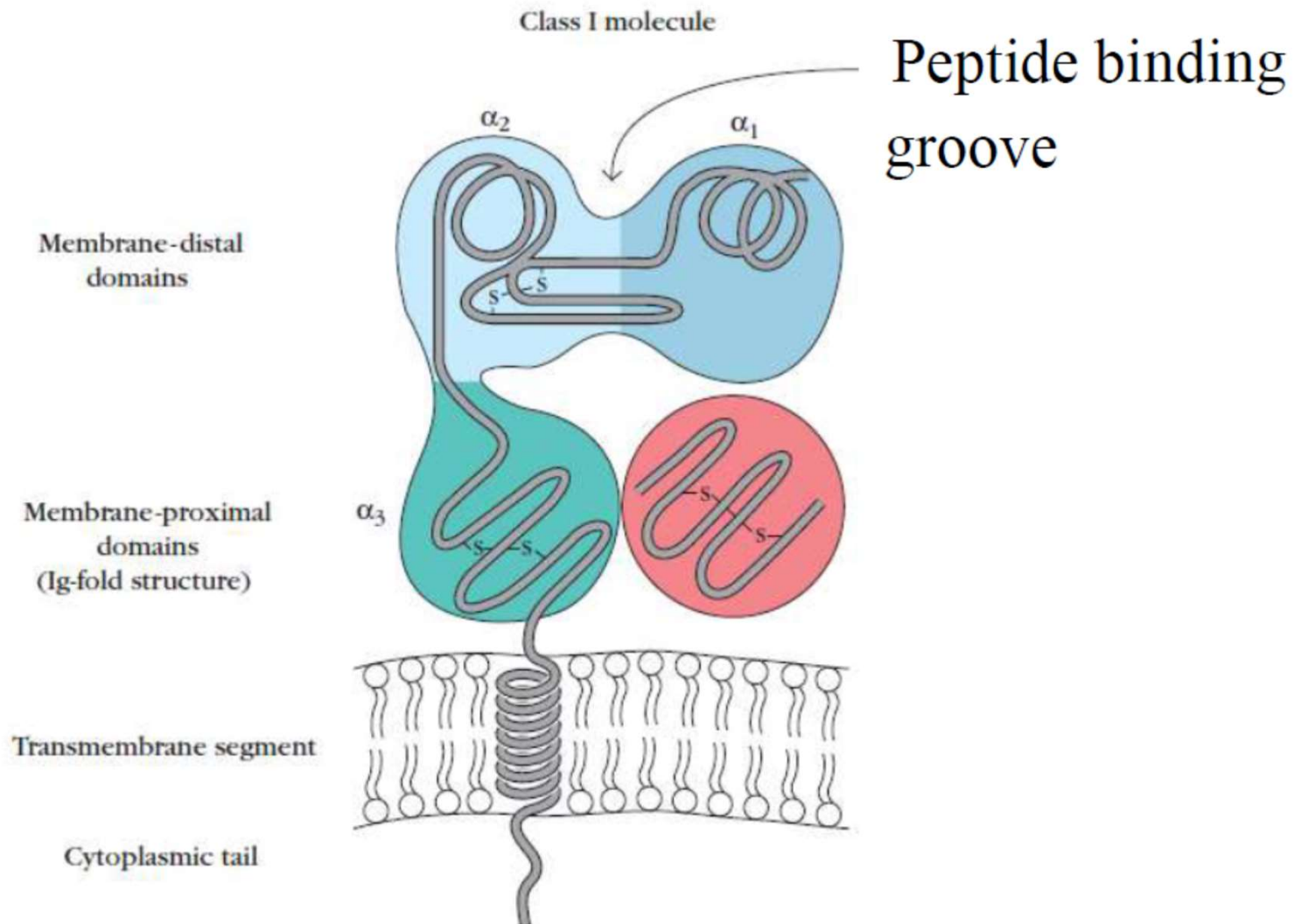


Fig:- Class I MHC antigen



# 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 TH 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 kD) and  $\beta$  (28 kD) 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

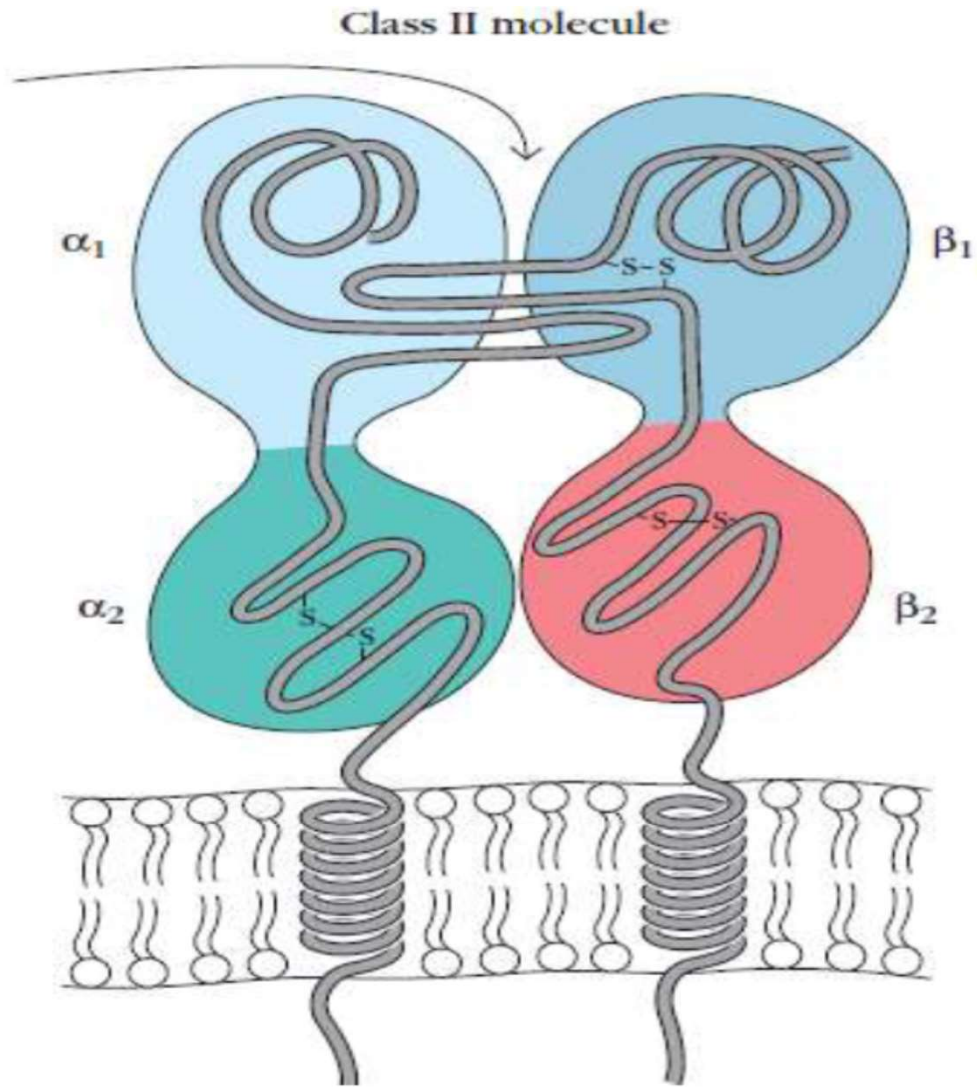


Fig:- Class II MHC molecule

## 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

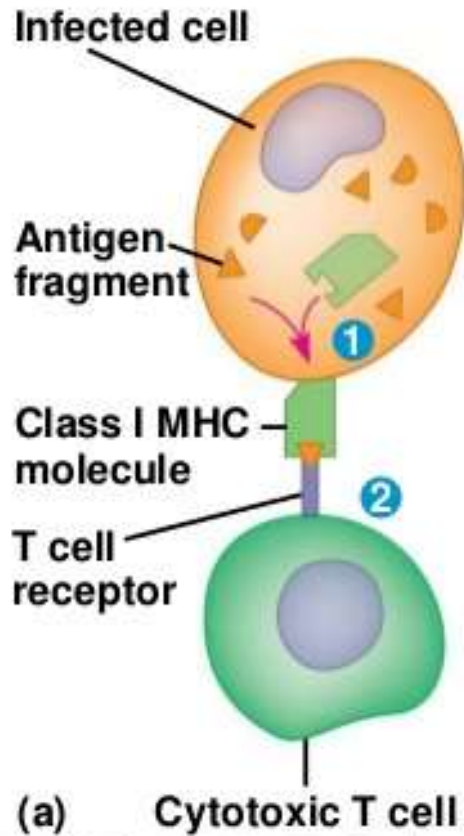
- The major histocompatibility complex (MHC) of mouse is called ***H-2* complex**.
- *H-2* complex is a **cluster of genes** responsible for the production of **antigens located of nucleated cells** and complement components.
- This complex is located in the **short arm** of the chromosome number 17.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



# Function of MHC Molecules

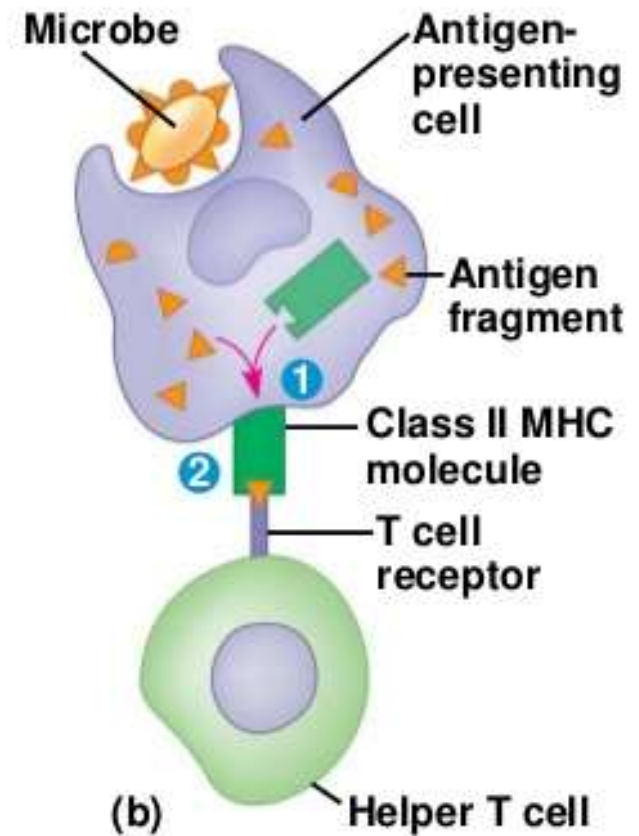
- MHC molecules are loaded with a bit of sample peptide fragment derived from the **degradation of proteins** present inside the cell. This peptide is the **mirror image** of proteins present inside the cell.
- MHC molecules contain **self** as well as **nonself (foreign)** antigen.
- They bring about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





1 Antigen associates with MHC molecule

2 T cell recognizes combination



Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.



# 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

