

# Major Histocompatibility Complex

## PART-1

**Course Code: ZOOL-2023; Course Title: Immunology**  
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# Introduction

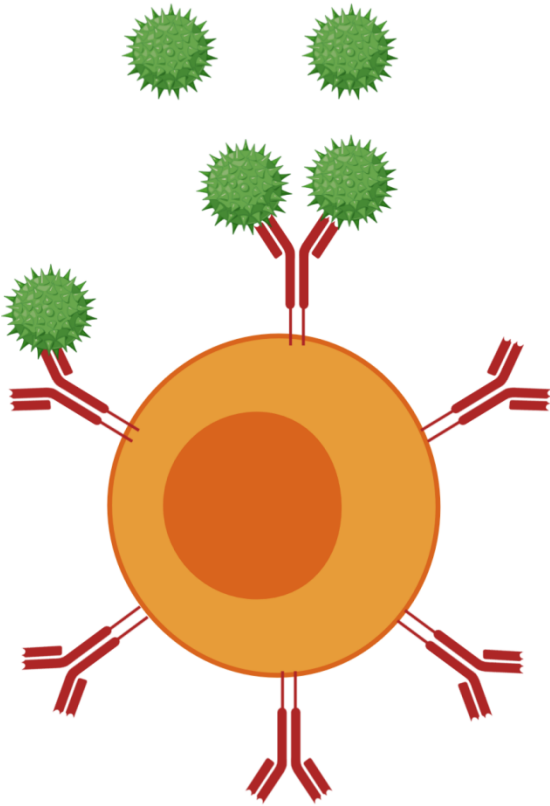
- MHC is stand for **Major Histocompatibility Complex**.
- MHC is a cluster of gene that encode MHC molecules.
- In human, MHC genes are located on the **chromosome number 6**, know as **Human Leukocyte Antigen (HLA) complex** .
- In mice, MHC genes are located on the **chromosome number 17**, know as **H-2 complex** .
- B-lymphocyte recognize free antigens, while T-Lymphocyte does not recognize free antigen.
- T-lymphocyte recognize only membrane bound antigens.
- Antigen presenting cells (APC) engulf and degrade the antigen and finally displayed the antigenic peptides on the surface of APC with the help of MHC molecule.

## Introduction cont...

- T-Cell recognize the antigenic peptide when it bound with the MHC mol. and cell mediated immunity occurs.
- Thus, MHC mol. hold and display the antigenic peptides on the surface of APC so that the T-lymphocytes can be able to recognize the antigen and for a complex between TCR-Ag-MHC mol.
- Major class of MHC molecules are-
  - MHC class I molecule
  - MHC class II molecule
- All nucleated cell have class I molecule, present interior antigen. MHC class I molecule interact with CD8<sup>+</sup> T Cells.
- Antigen presenting cells are expressed class II MHC molecule which interact with CD4<sup>+</sup> T cells and induce cellular immunity against exterior antigen.

## Introduction Cont...

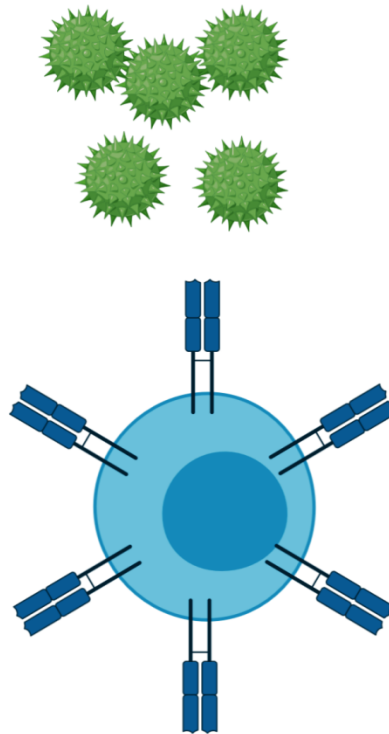
Free Antigen



B-Lymphocyte

B-Lymphocyte  
recognize free antigen

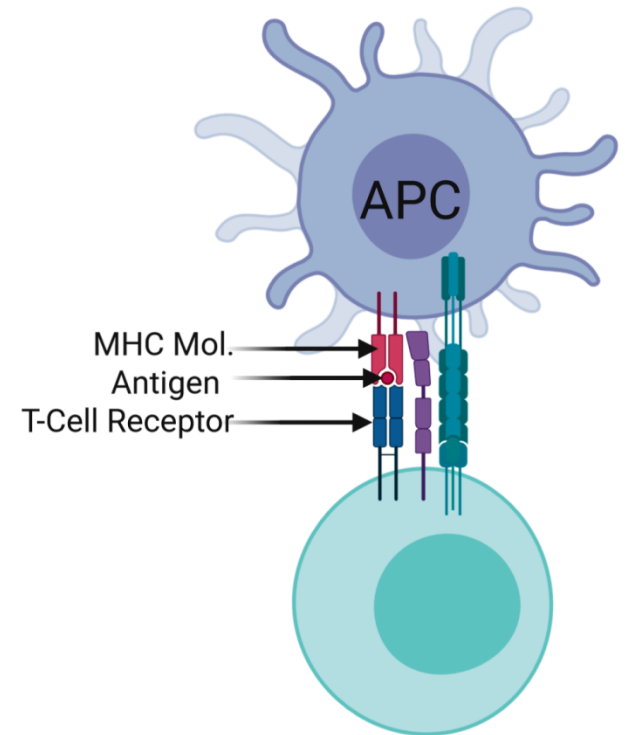
Free Antigen



T-Lymphocyte

T-Lymphocyte does  
not recognize free  
antigen

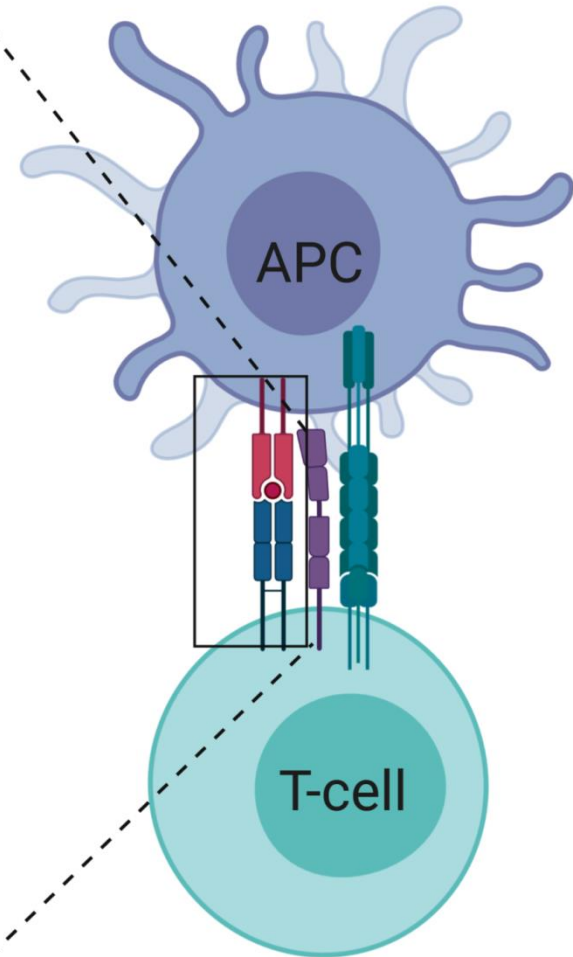
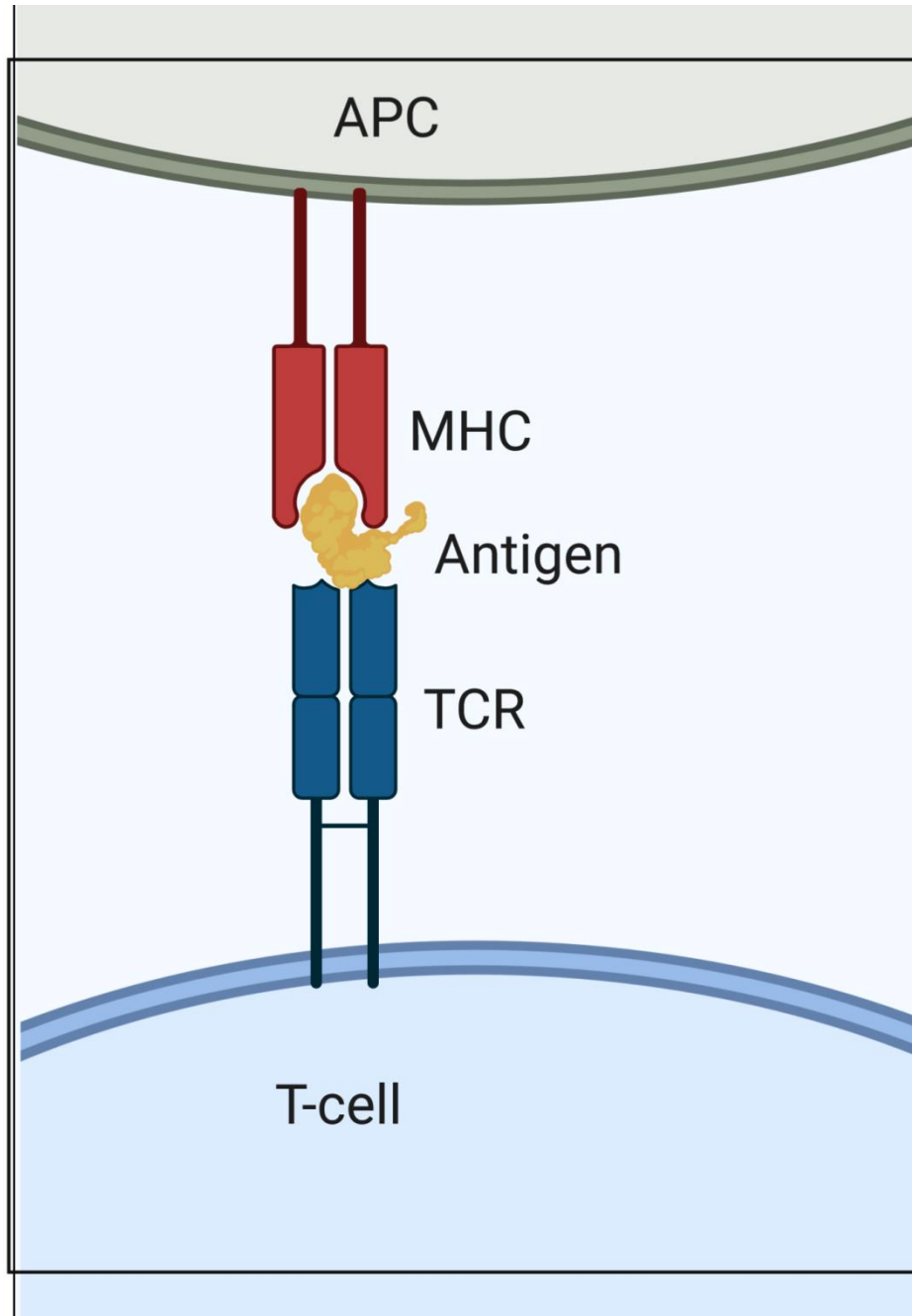
Membrane bound Antigen



T-Lymphocyte

T-Lymphocyte recognize  
only membrane bound  
antigen

## Introduction Cont...

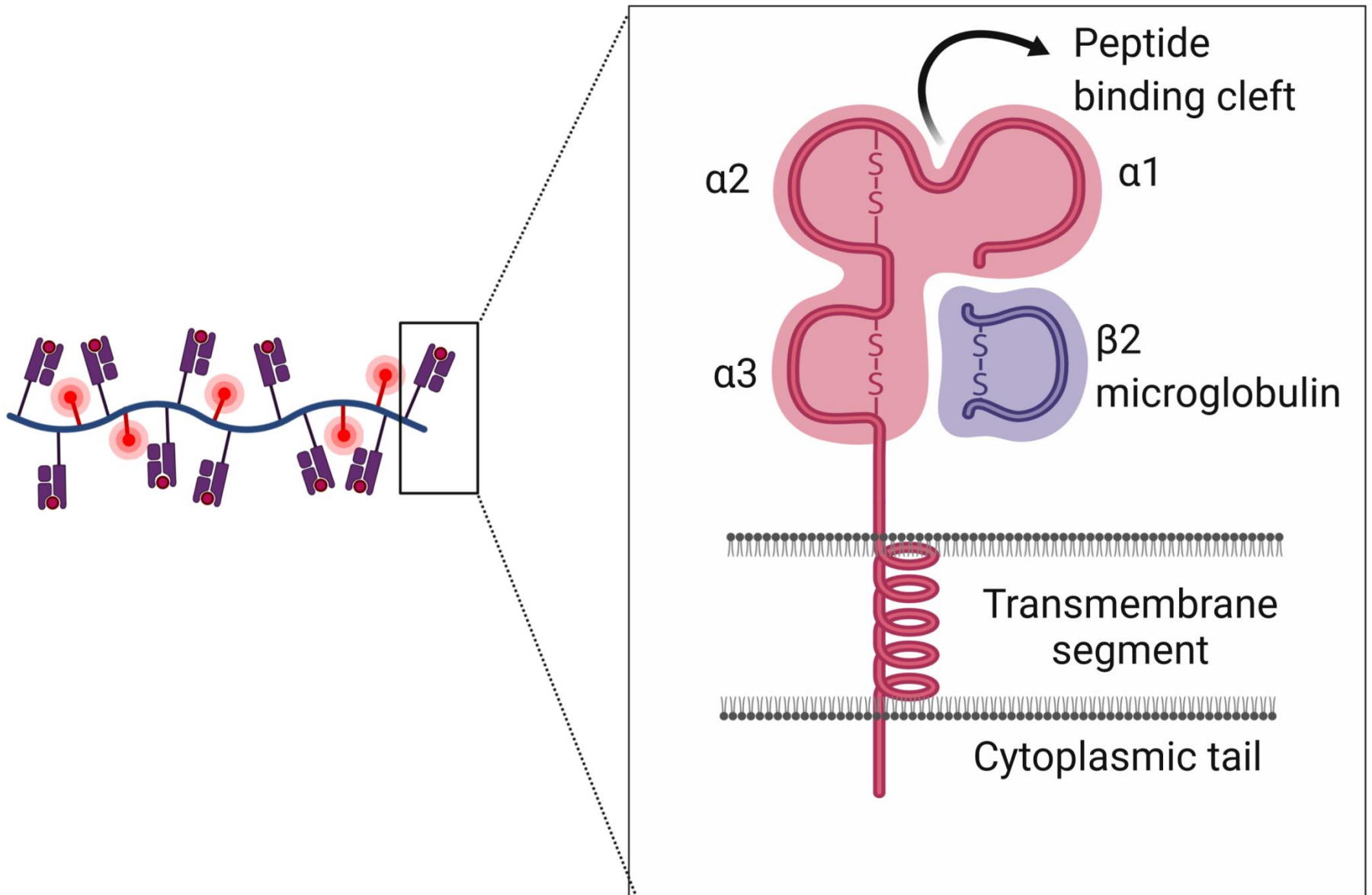


## History

- Transplantation immunology gave the birth of Major Histocompatibility complex (MHC).
- For the discovery MHC and their role in immune rejection and acceptance during transplantation of tissue, three scientists namely **Baruj Benacerraf, Jean Dausset** and **George D. Snell** jointly awarded **Nobel Prize** in physiology or medicine **in 1980**.
- They found that genetically determined molecules present on the cell surface that control the immune reactions in transplantation of tissue. And finally the cell surface molecule recognized as MHC.

# Structure of Class I MHC molecule

- Made up of two polypeptide chains-
  - One is  **$\alpha$  chain** having three extracellular domain i.e.,  $\alpha 1$ ,  $\alpha 2$  and  $\alpha 3$  with a transmembrane domain and a cytoplasmic domain. Molecular weight is approx. 44kD . The  $\alpha 1$  and  $\alpha 2$  is approx. 90 amino acids long. The antigen binding cleft of  $\alpha 1$ , and  $\alpha 2$  domain can accommodate 8-11 amino acids long antigenic peptide.  $\alpha 3$  domain recognized by CD8<sup>+</sup> co-receptor of T cells.
  - Another is **extracellular  $\beta 2$ -microglobulin domain**, approx. 12 kD

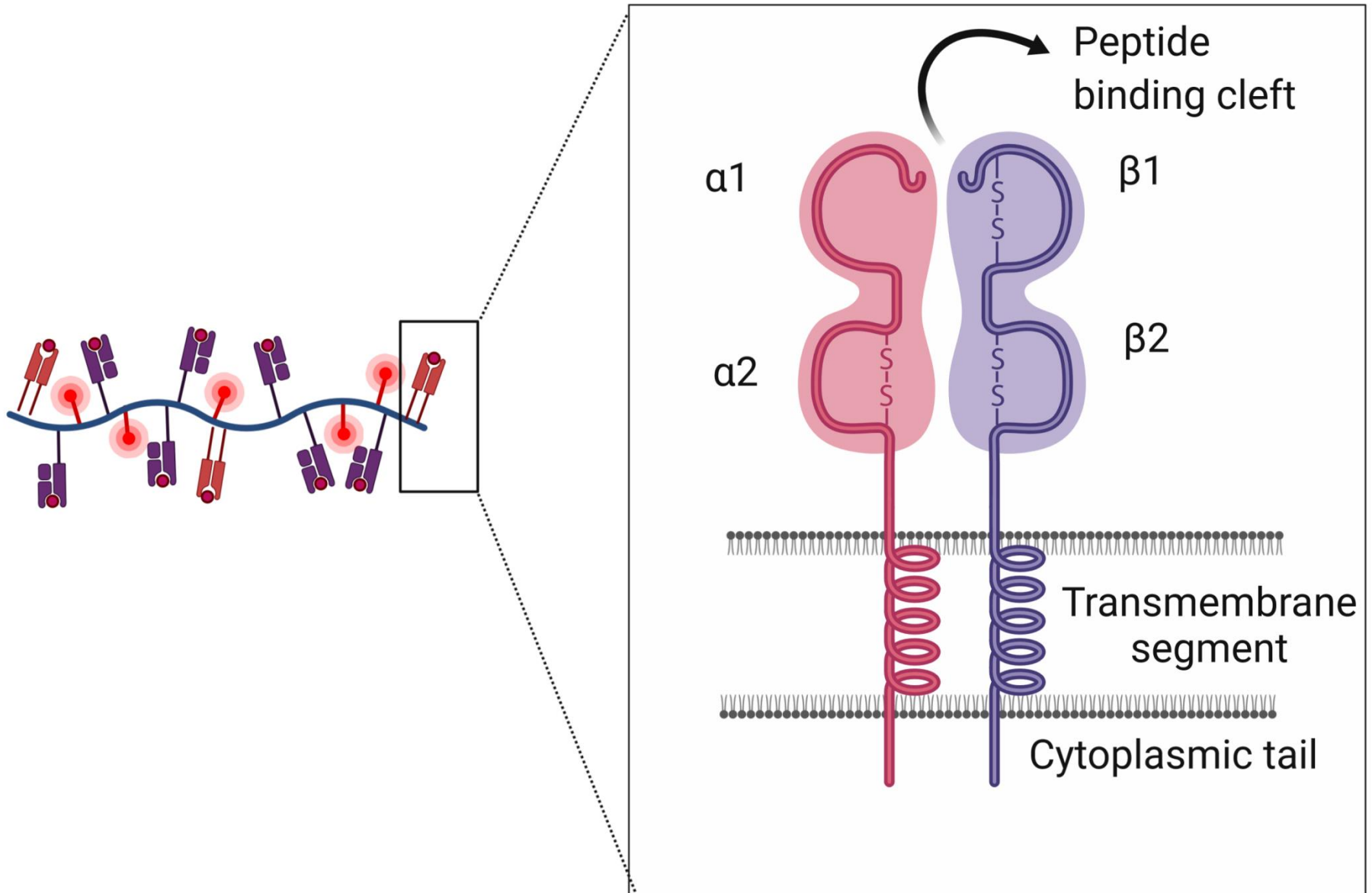


**Diagram of Class I MHC Molecule**



## Structure of Class II MHC molecule

- Made up of two polypeptide chains-
  - One is  **$\alpha$  chain** having two extracellular domain i.e.,  $\alpha 1$  and  $\alpha 2$  with a transmembrane domain and a cytoplasmic domain. Molecular weight is approx. 33kD. The antigen binding cleft i.e.,  $\alpha 1$ , and  $\beta 1$  domain can accommodate 13-18 amino acids long antigenic peptide.
  - Another is  **$\beta$  chain** also have two extracellular domain i.e.,  $\beta 1$  and  $\beta 2$  with a transmembrane domain and a cytoplasmic domain. Molecular weight is approx. 31kD. Further, the  $\beta 2$  domain for  $CD4^{+}$  co-receptor of T cells.



**Diagram of Class II MHC Molecule**

S. No.	Features	MHC Class I	MHC Class II
1.	Polypeptide chains	<ul style="list-style-type: none"> <li>▪ <math>\alpha 1</math>, <math>\alpha 2</math> and <math>\alpha 3</math> (Have extracellular domain, Transmembrane domain and cytoplasmic domain).</li> <li>▪ <math>\beta</math> microglobulin (only extracellular domain)</li> </ul>	$\alpha 1$ , $\alpha 2$ , $\beta 1$ and $\beta 2$ (All have extracellular domain, Transmembrane domain and cytoplasmic domain).
2.	Antigen (peptide) binding site	Cleft between $\alpha 1$ , and $\alpha 2$ domain	Cleft between $\alpha 1$ , and $\beta 1$ domain
3.	Size of antigenic peptide	8-11 amino acids	13-18 amino acids
4.	CD4 <sup>+</sup> and CD8 <sup>+</sup> binding site	$\alpha 3$ domain for CD8 <sup>+</sup>	$\beta 2$ domain for CD4 <sup>+</sup>

**Thanks**