

Outlines:

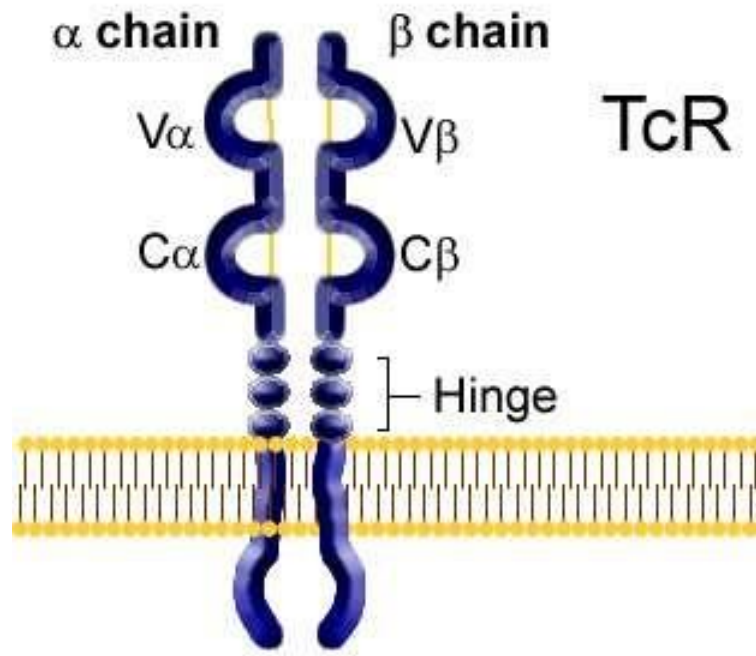
- I. Antigen receptors.
- II. Antigen recognition by lymphocytes.
- III. The role of MHC in antigen recognition.

Antigen receptors.

- The antigen receptors on B cells (the **B-cell receptor** or **BCR**) and T cells (the T-cell receptor or **TCR**) are multiprotein complexes made up of clonally variable antigen-binding chains.
- The **B-cell receptor** or **BCR** is a transmembrane receptor protein located on the outer surface of B-cells.
- The **T cell receptor** or **TCR** is a molecule found on the surface of T lymphocytes (or T cells) that is responsible for recognizing antigens bound to major histocompatibility complex (MHC) molecules

The T-cell Receptor

T-cells (CD3): Their antigen receptor is surface bound.



<http://bioweb.wku.edu/courses/biol328/TcR.png>

The T-cell Receptor

- The **Tcell receptor** or **TCR** is a molecule found on the surface of Tlymphocytes (or Tcells) that is responsible for recognizing antigens bound to major histocompatibility complex (MHC) molecules.
- The binding between TCR and antigen is of relatively low affinity and is degenerate: that is, many TCR recognize the same antigen and many antigens are recognized by the same TCR.
- The TCR is composed of two different protein chains (that is, it is a heterodimer). In 95% of Tcells, this consists of an alpha (α) and beta (β) chain, whereas in 5% of Tcells this consists of gamma and delta (γ/δ) chains. This ratio changes during ontogeny and in diseased states.

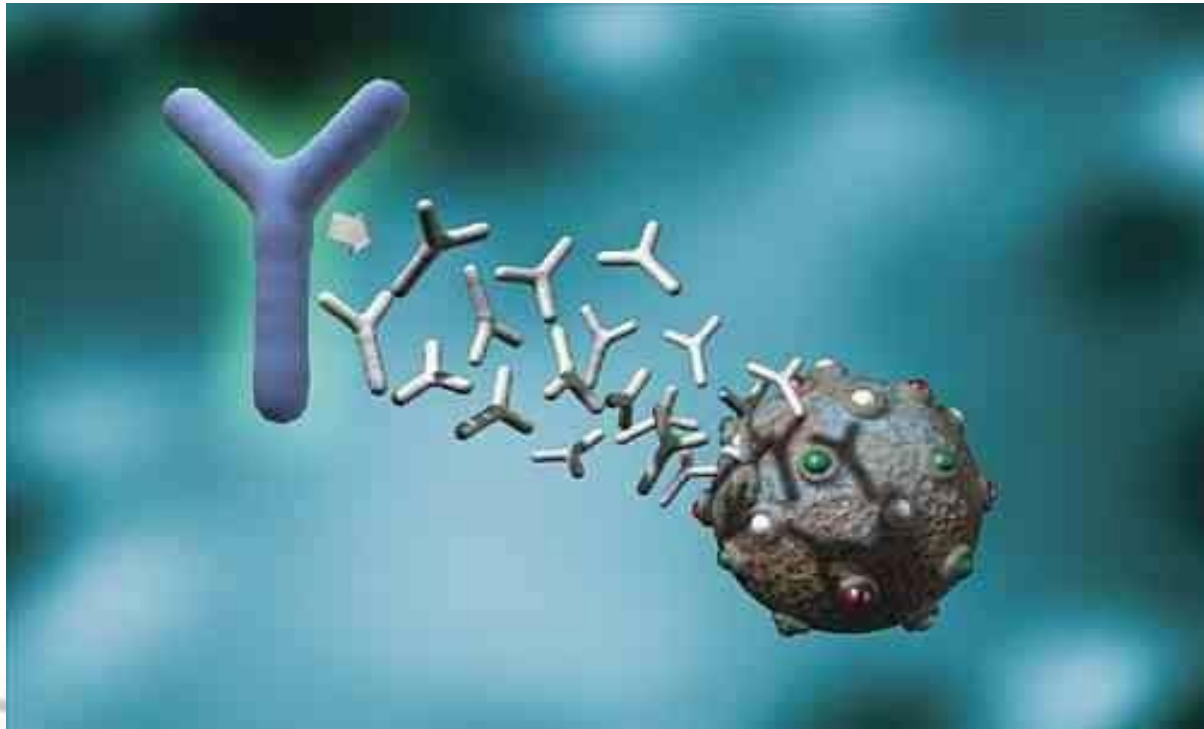
The T-cell Receptor

- The TCR is composed of two different protein chains (that is, it is a heterodimer).
- In 95% of T cells, this consists of an alpha (α) and beta (β) chain.
- In 5% of T cells this consists of gamma and delta (γ/δ) chains. This ratio changes during ontogeny and in diseased states.

B-cell Receptors

B-cells (CD19 and CD20):

- B cells secrete their antigen receptors: *antibodies*.



B-cell Receptors

- The **B-cell receptor** or **BCR** is a transmembrane receptor protein located on the outer surface of B-cells.
- The receptor's binding moiety is composed of a membrane-bound antibody that, like all antibodies, has a unique and randomly determined antigen-binding site.
- When a B-cell is activated by its first encounter with an antigen that binds to its receptor (its "cognate antigen"), the cell proliferates and differentiates to generate a population of antibody-secreting plasma B cells and memory B cells.

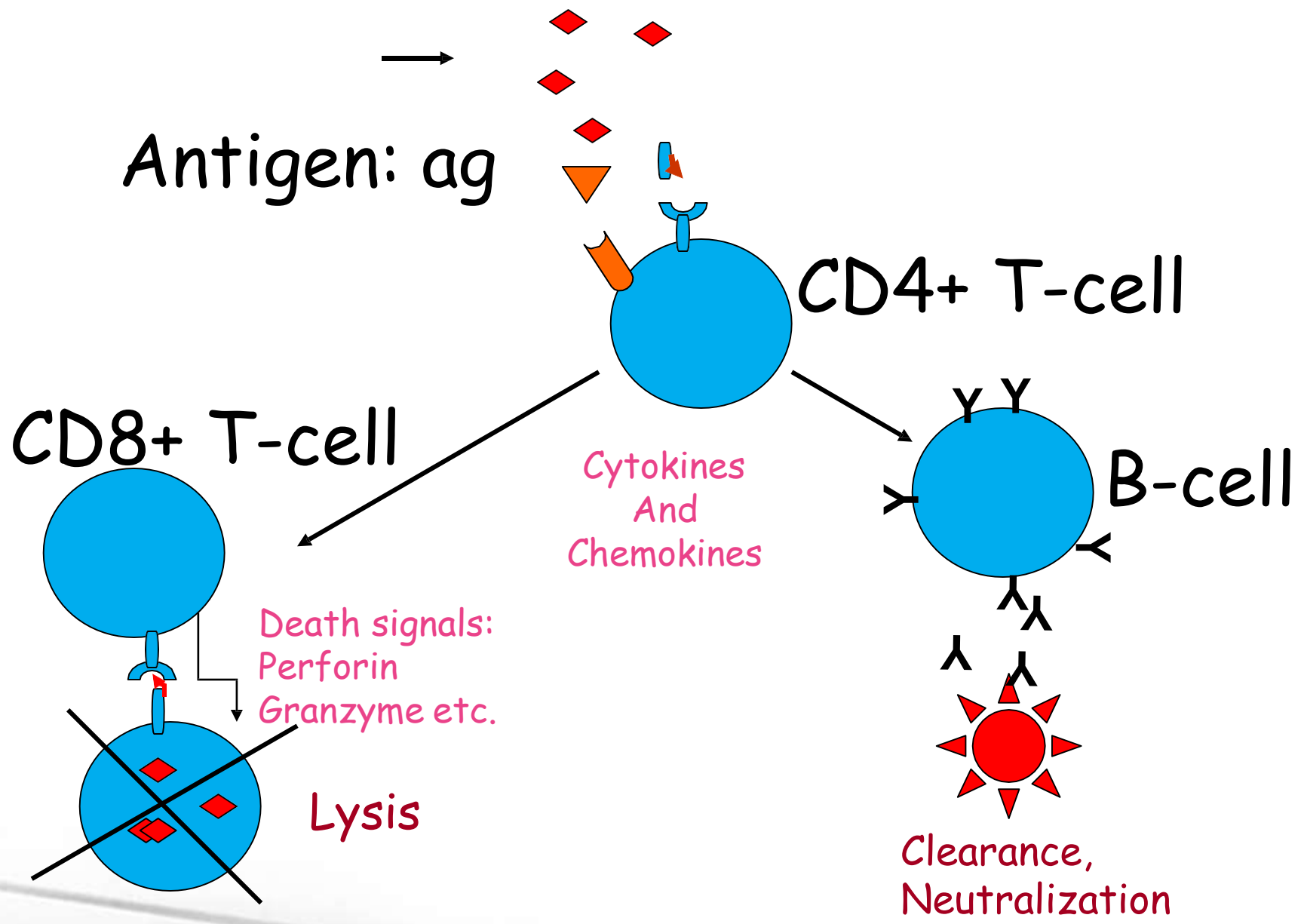
B-cell Receptors

- The B cell receptor (BCR) has two crucial functions upon interaction with Ag. One function is signal transduction, involving changes in receptor oligomerization.
- The second function is to mediate internalization for subsequent processing of Ag and presentation of peptides to helper T cells.

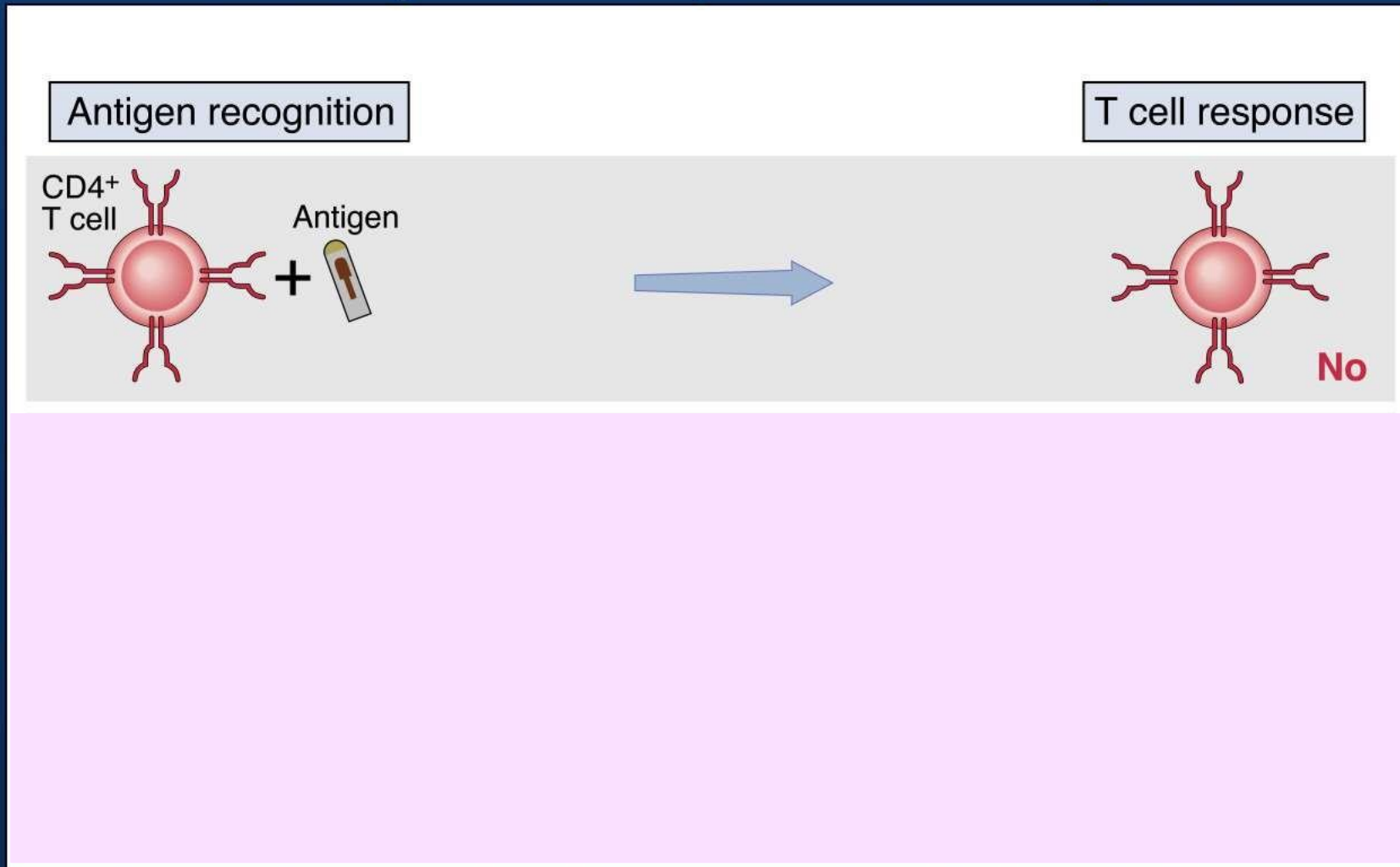
Antigen Recognition by Lymphocytes

- An antigen is any foreign molecule to which a lymphocyte responds
- A single B cell or T cell has about 100,000 identical antigen receptors

APC

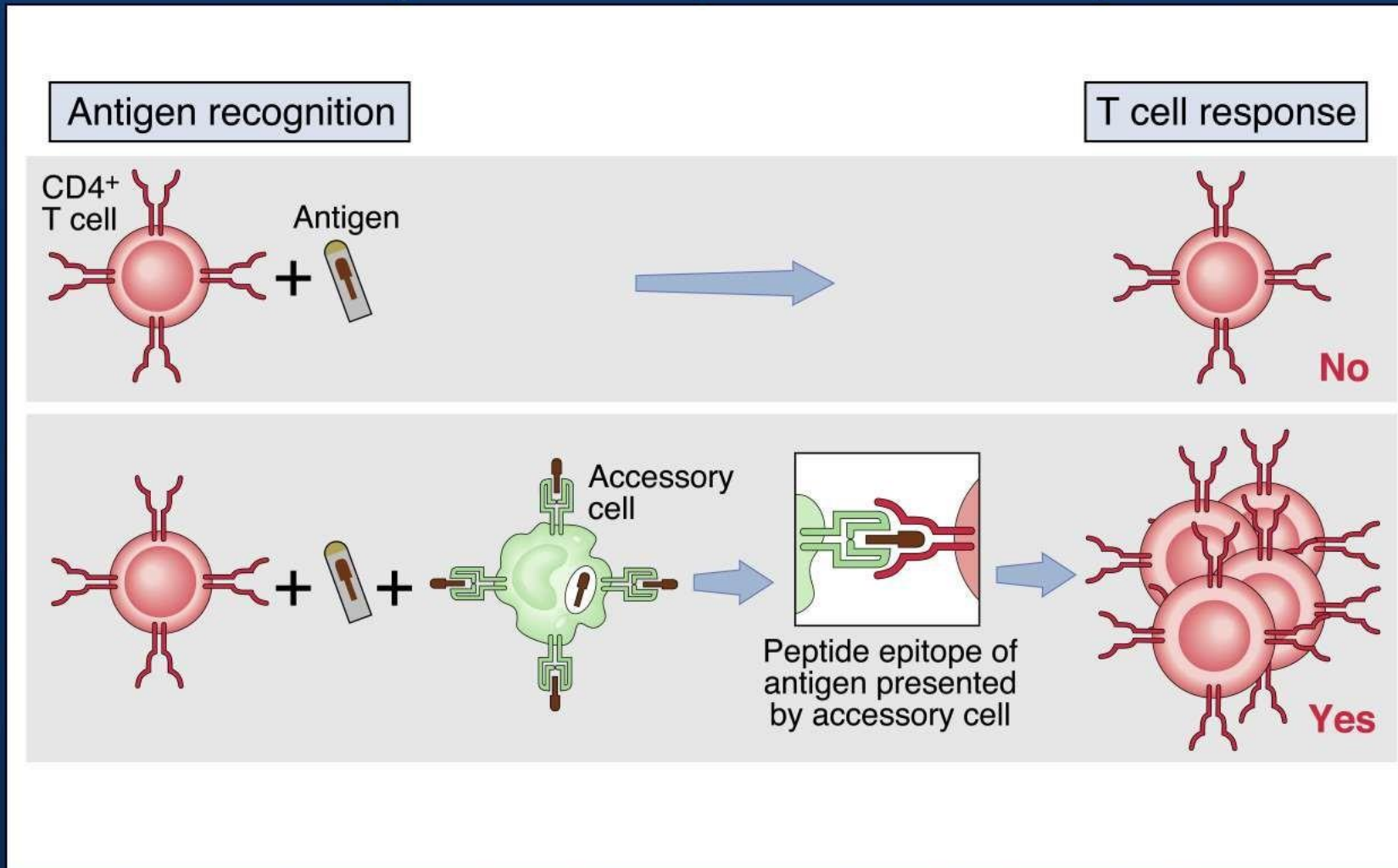


T cell responses require accessory cells



From Abbas, Lichtman, & Pober: Cellular and Molecular Immunology. W.B. Saunders, 1999, Fig. 5-2

T cell responses require accessory cells



From Abbas, Lichtman, & Pober: Cellular and Molecular Immunology. W.B. Saunders, 1999, Fig. 5-2

Antigen Presenting Cell

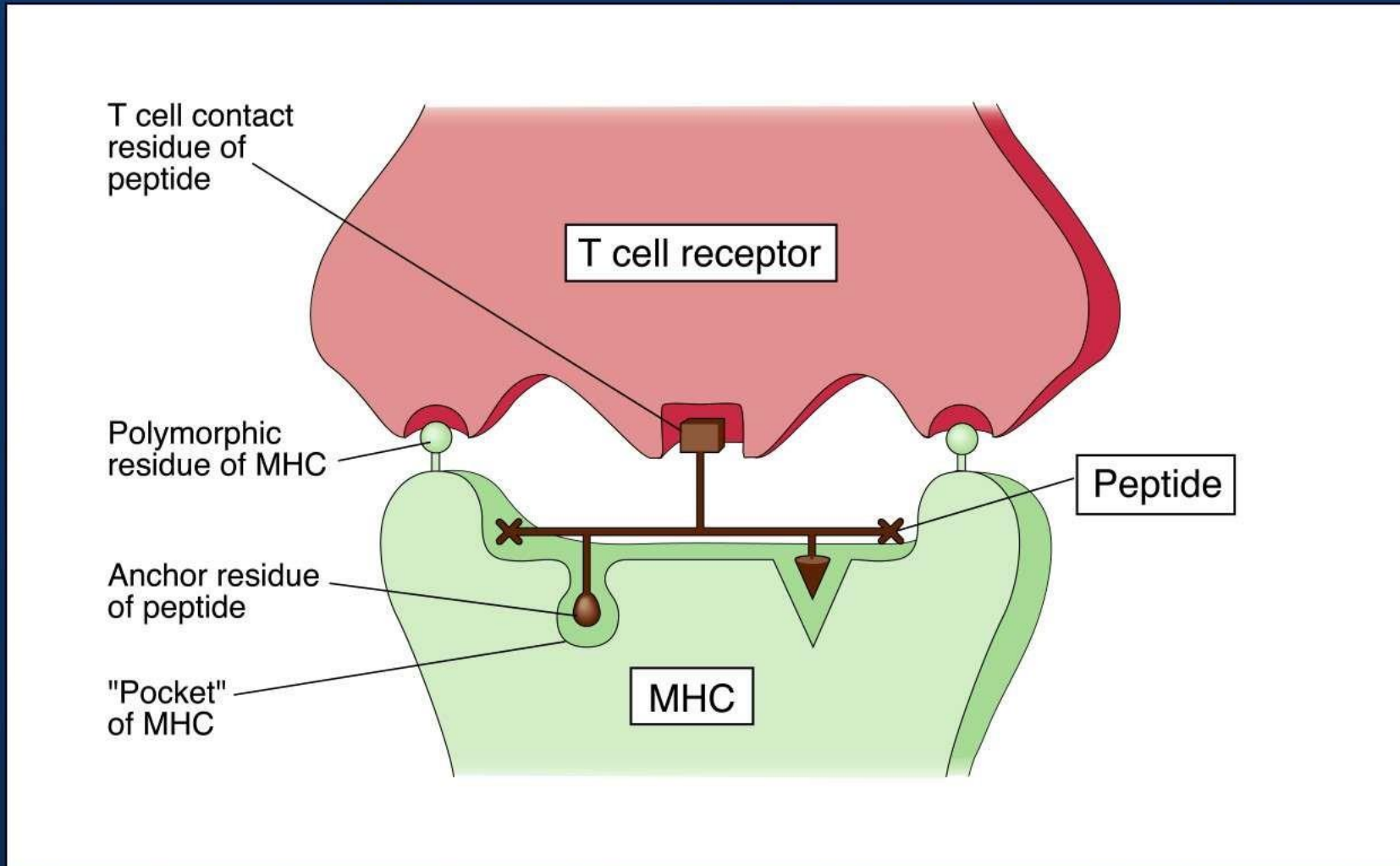
MHC role in antigen recognition

- MHC molecules are so named because they are encoded by a family of genes called the major histocompatibility complex.
- Class I MHC molecules are found on almost all nucleated cells of the body
- They display peptide antigens to cytotoxic T cells.
- In infected cells, MHC molecules bind and transport antigen fragments to the cell surface, a process called antigen presentation.

T Cell-Antigen Recognition

- Respond to contiguous short amino acid sequences in proteins-*T Cell Epitopes*
 - Peptides
 - **Not** Native Protein
- Tcells do not bind free peptides
- TCells Recognize a complex of a *peptide* fragment bound to the membrane proteins of cells- *Major histocompatibility complex (MHC) molecules*

T Cell recognition of a peptide-MHC complex



From Abbas, Lichtman, & Pober: Cellular and Molecular Immunology. W.B. Saunders, 1999, Fig. 4-1

MHC Molecules

- MHC I
- MHC II
- Physiological function is to present peptides to Tcells

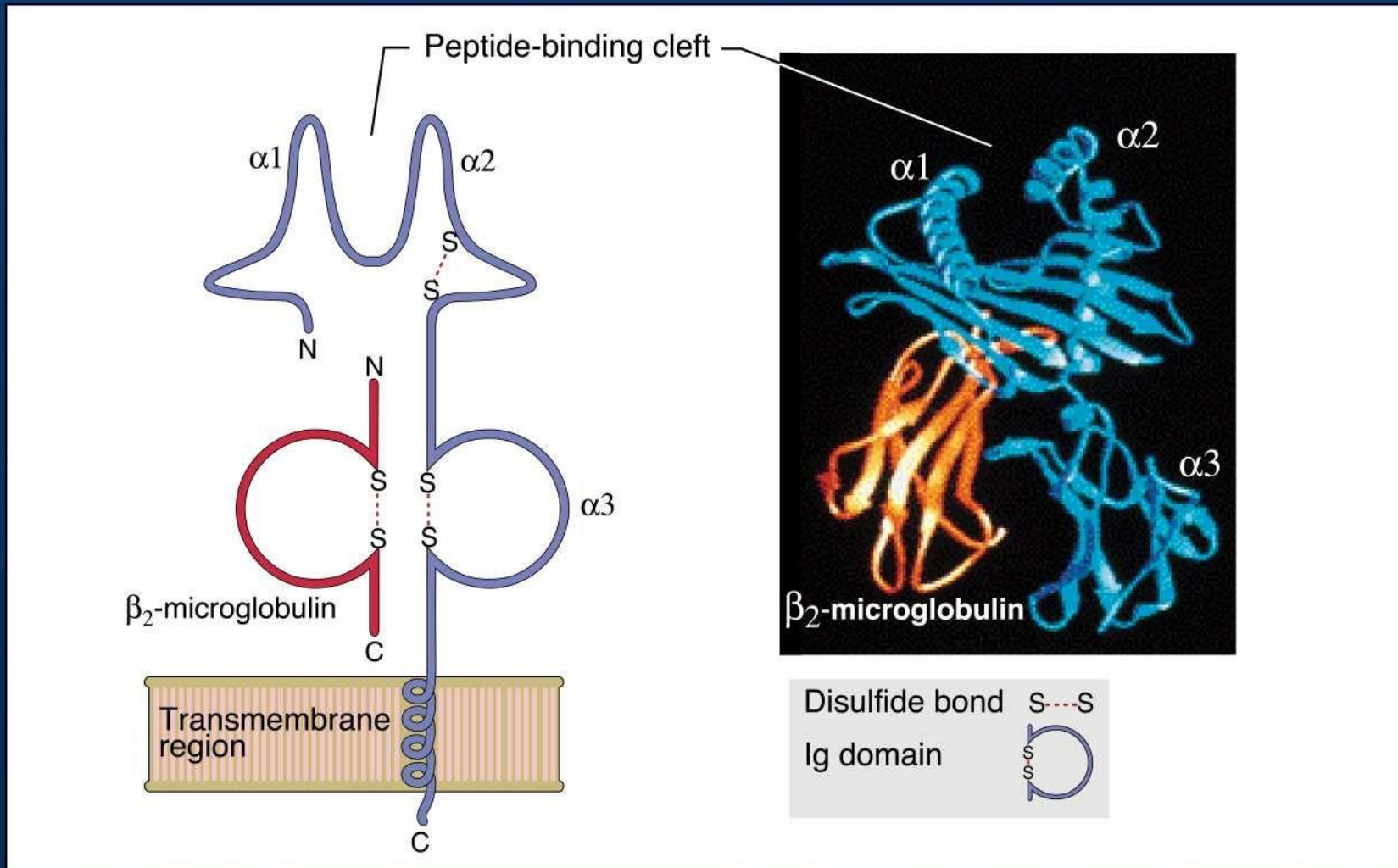
Major Histocompatibility Complex Proteins

- Human-HLA (human leukocyte antigen)
- Mouse: H-2
- Bovines: BoLA
- Equines: ELA
- Swine: SLA
- OLA, CLA, DLA, FLA

MHC Class I Molecules

- Present Peptides to *CD8+* TCells
- Expressed on *ALL Nucleated Cells* of the Body

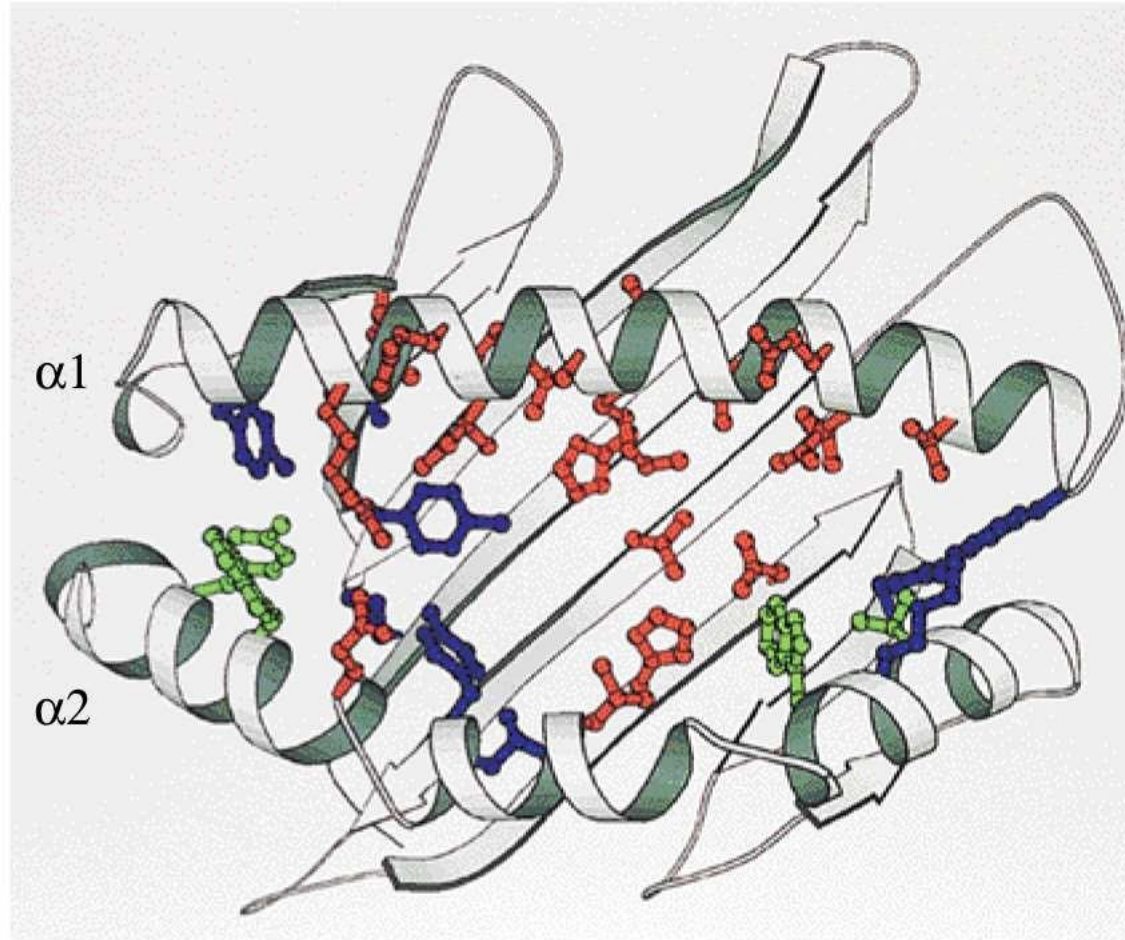
Structure of a Class I MHC molecule



From Abbas, Lichtman, & Pober: Cellular and Molecular Immunology. W.B. Saunders, 1999, Fig. 4-4

Slide 4-6

Polymorphic residues of a class I MHC molecule



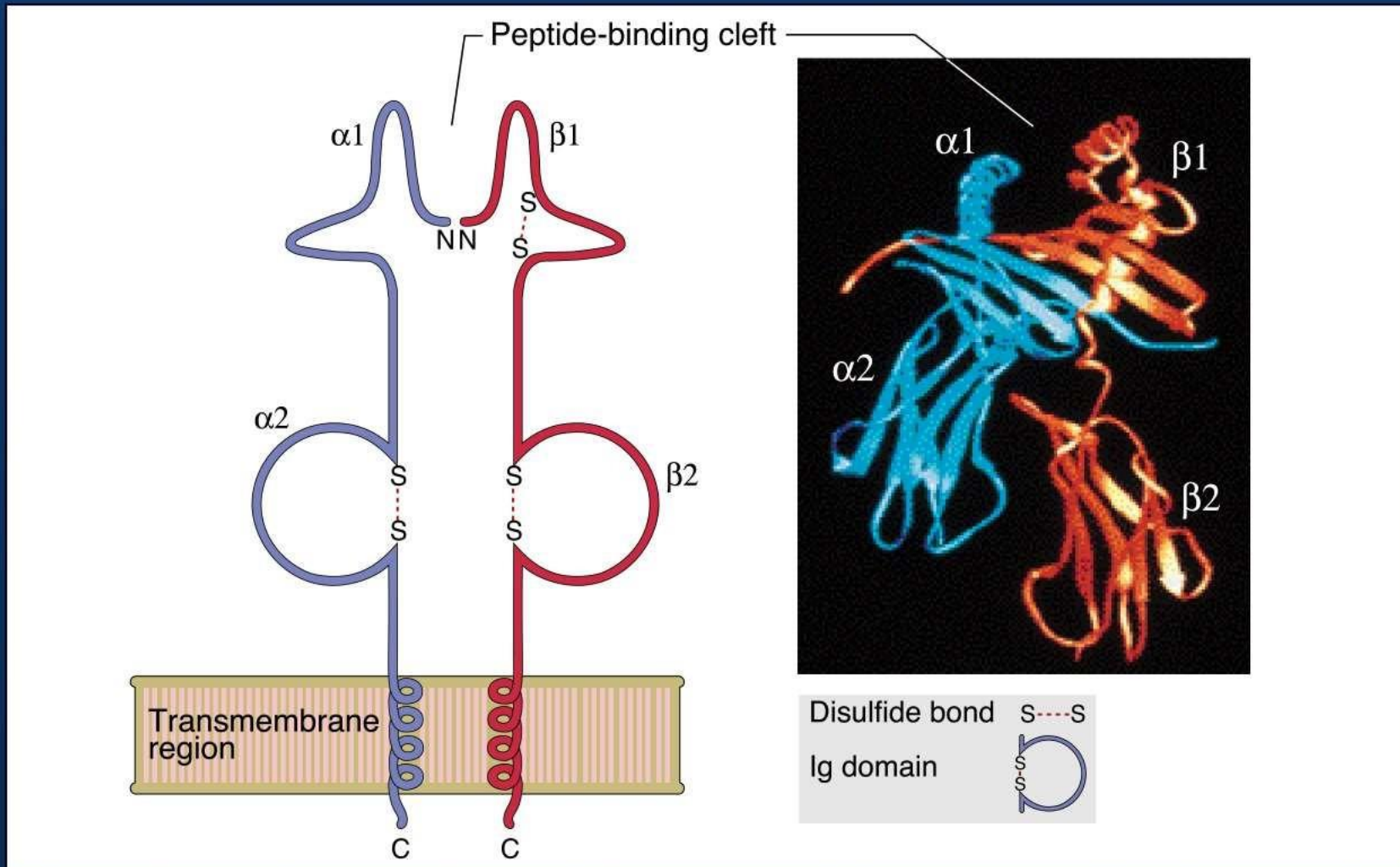
From Abbas, Lichtman, & Pober: Cellular and Molecular Immunology. W.B. Saunders, 1999, Fig. 4-5

***Recognition of
Peptide/MHC I Complex
By the T Cell Antigen
Receptor***

MHC Class II Molecules

- Present Peptides to *CD4+* TCells
- Expressed on *Dendritic Cells, B Cells, Macrophages*-Professional Antigen Presenting Cells

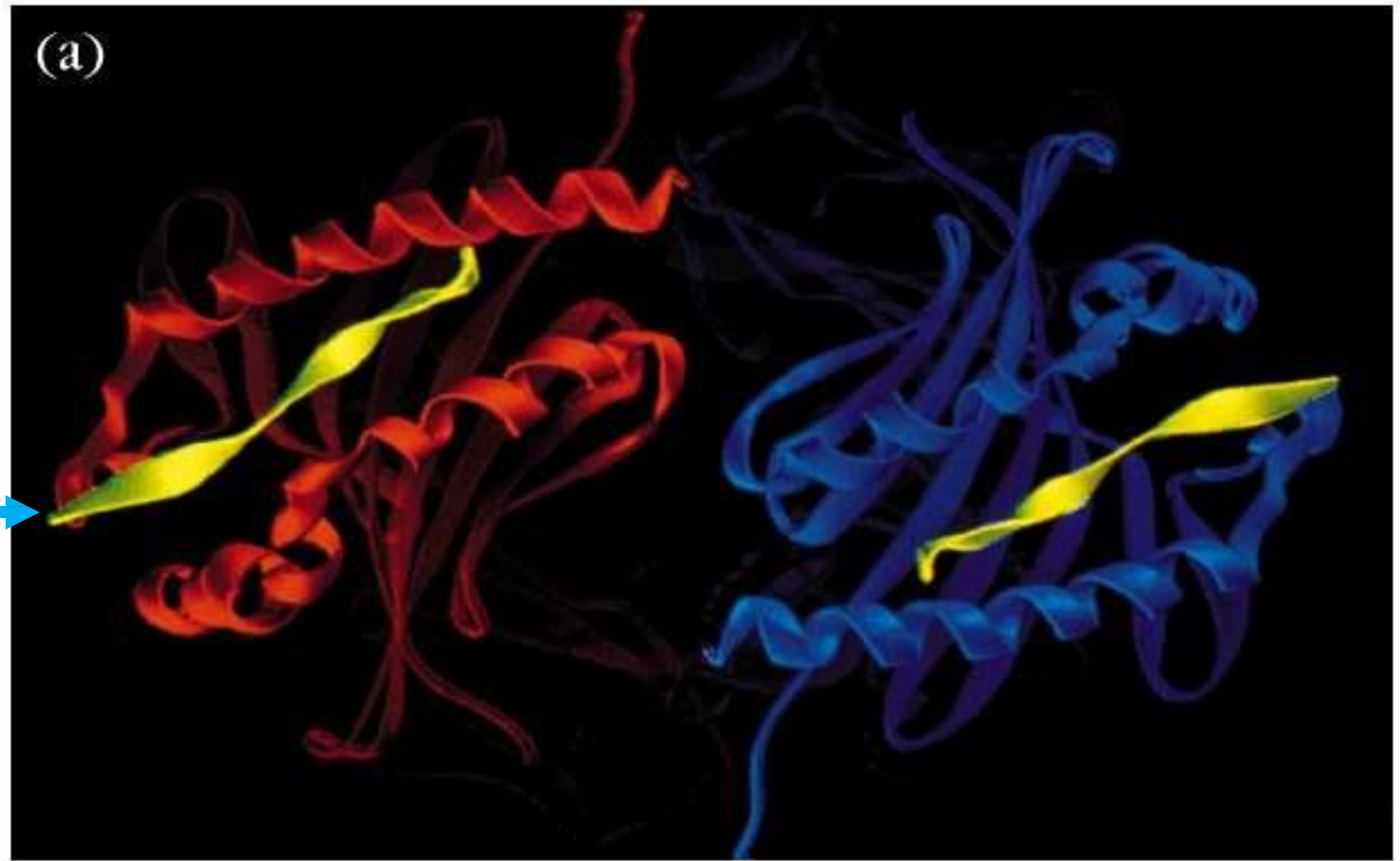
Structure of a Class II MHC molecule

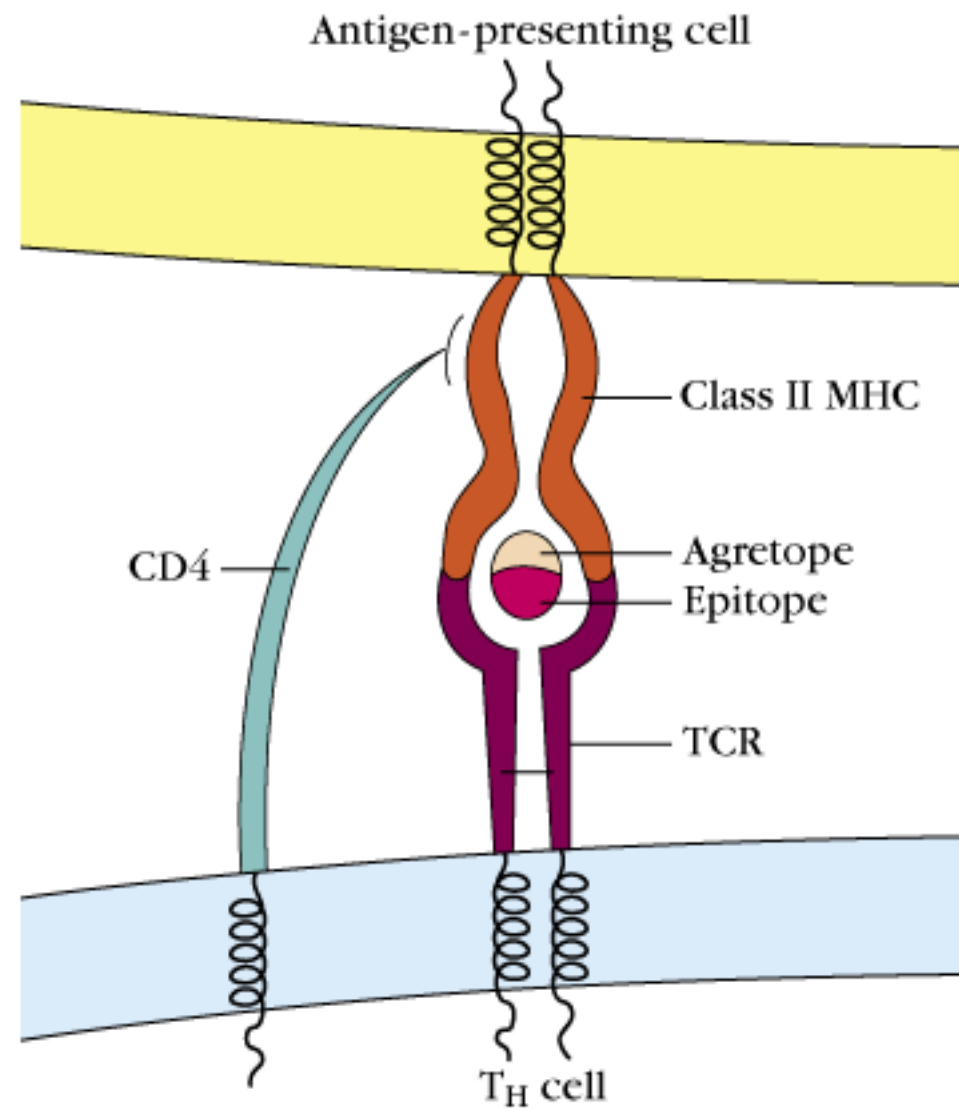


From Abbas, Lichtman, & Pober: Cellular and Molecular Immunology. W.B. Saunders, 1999, Fig. 4-6

Crystal Structure of MHC Class II Molecules

Peptide





References:

- <http://www.ncbi.nlm.nih.gov/books/NBK27130/>.
- <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/A/AntigenReceptors.html>.
- <http://www.britannica.com/EBchecked/topic/702522/antigen-receptor>.

James
York

