TOPIC : HUMORAL AND CELLULAR IMMUNE RESPONSES.

P. G. Sem -III, zoology,
CC-10, vertebrate immunology
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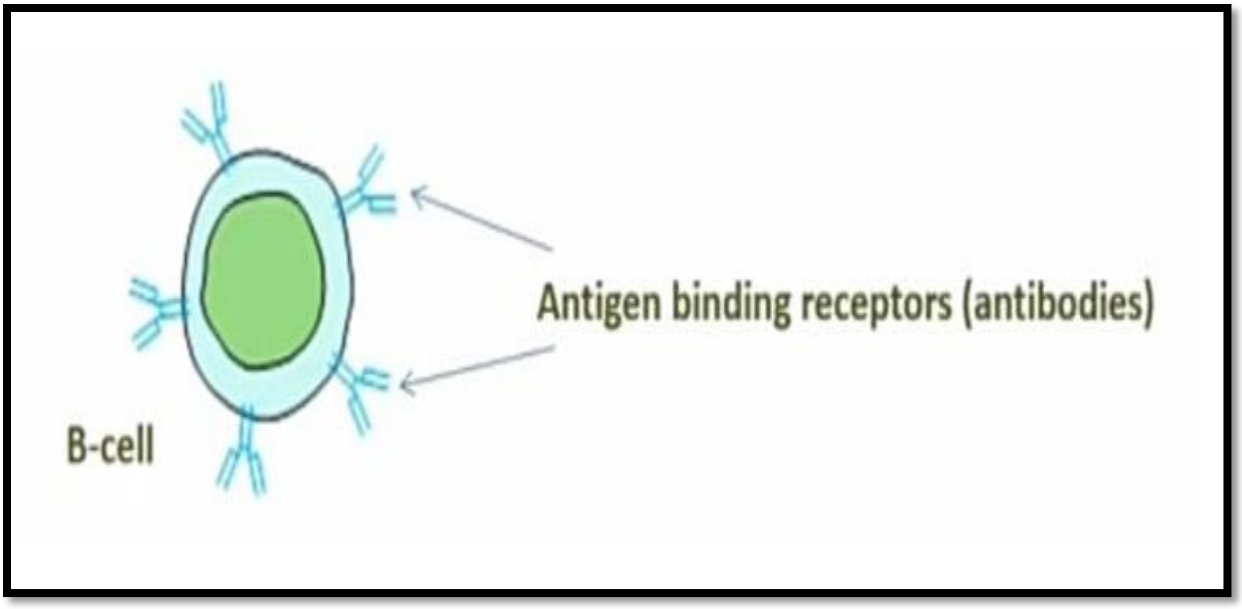
1. HUMORAL IMMUNITY : (Introduction & Definition)

The term humoral derived from the latin word "humor" means from the body fluid. This immunity is mediated by macromolecules found in extracellular fluids such as secreted antibodies, complement proteins, and certain antimicrobial peptides.

The humoral immunity refers to the interaction of **B-Cells** with antigens and their subsequent proliferation and differentiation into antibody secreting plasma cells and memory cells for later secondary responses.

Antibodies produced and secreted from activated plasma cells, binds with antigens to make them neutralize and get them eliminated.



1. **CELLULAR IMMUNITY (Cell mediated Immune Response)**

   Introduction & Definition :

This type of immunity is mediated by T-cells. T-cells are named so because these lymphocytes gets maturation in thymus gland.

This immunity is respond to extra cellular and intracellular antigens in different ways. The mechanism is different from humoral immunity as in humoral immunity antigen directly

binds with B-cells, but in Cellular immunity, antigen first binds with Antigen Presenting Cells (APC) and then brought to T-cells. The two types of T-cells (T-helper and T-cytotoxic) participate in cellular immunity. These T-cells differentiate on the basis of molecules found on their surface. These molecules are CD4 and CD8 type. T-helper (TH) cells represent CD4 molecules, where as most of the Tcytotoxic (Tc) cells represent CD8 molecules.

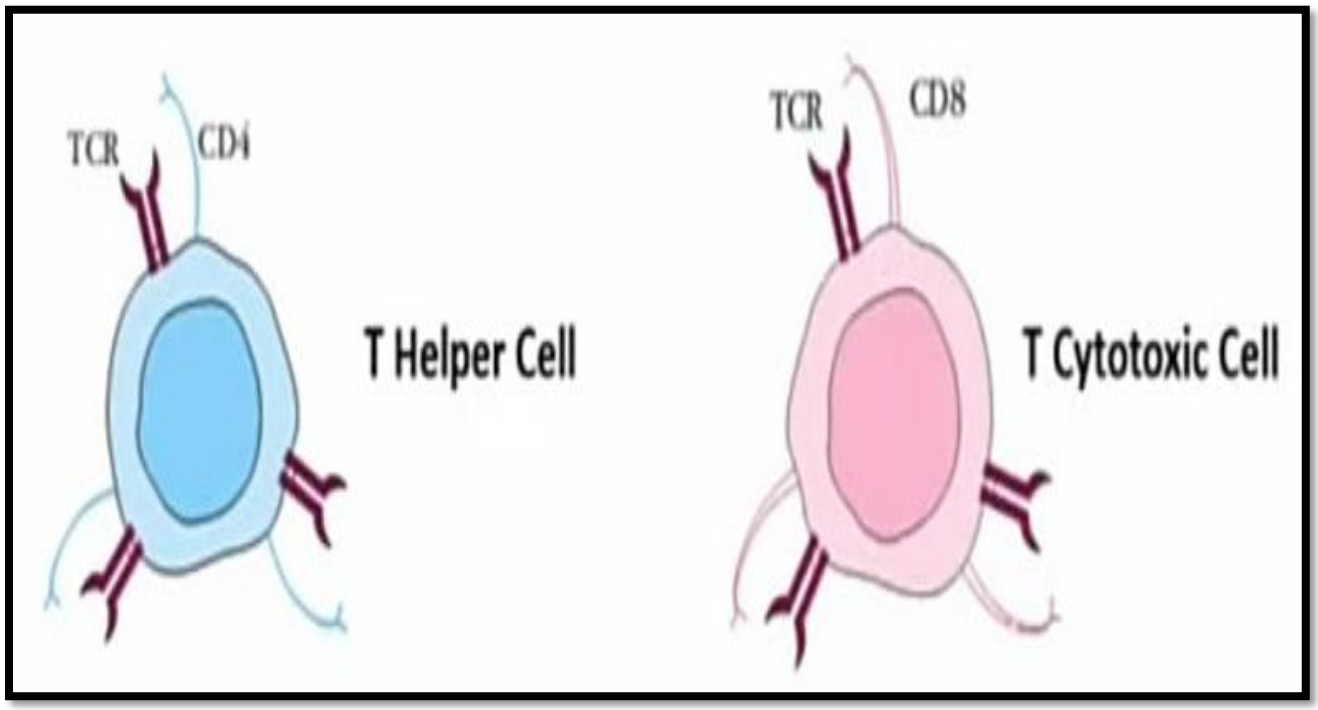


Fig : T Helper cell & T cytotoxic cell.

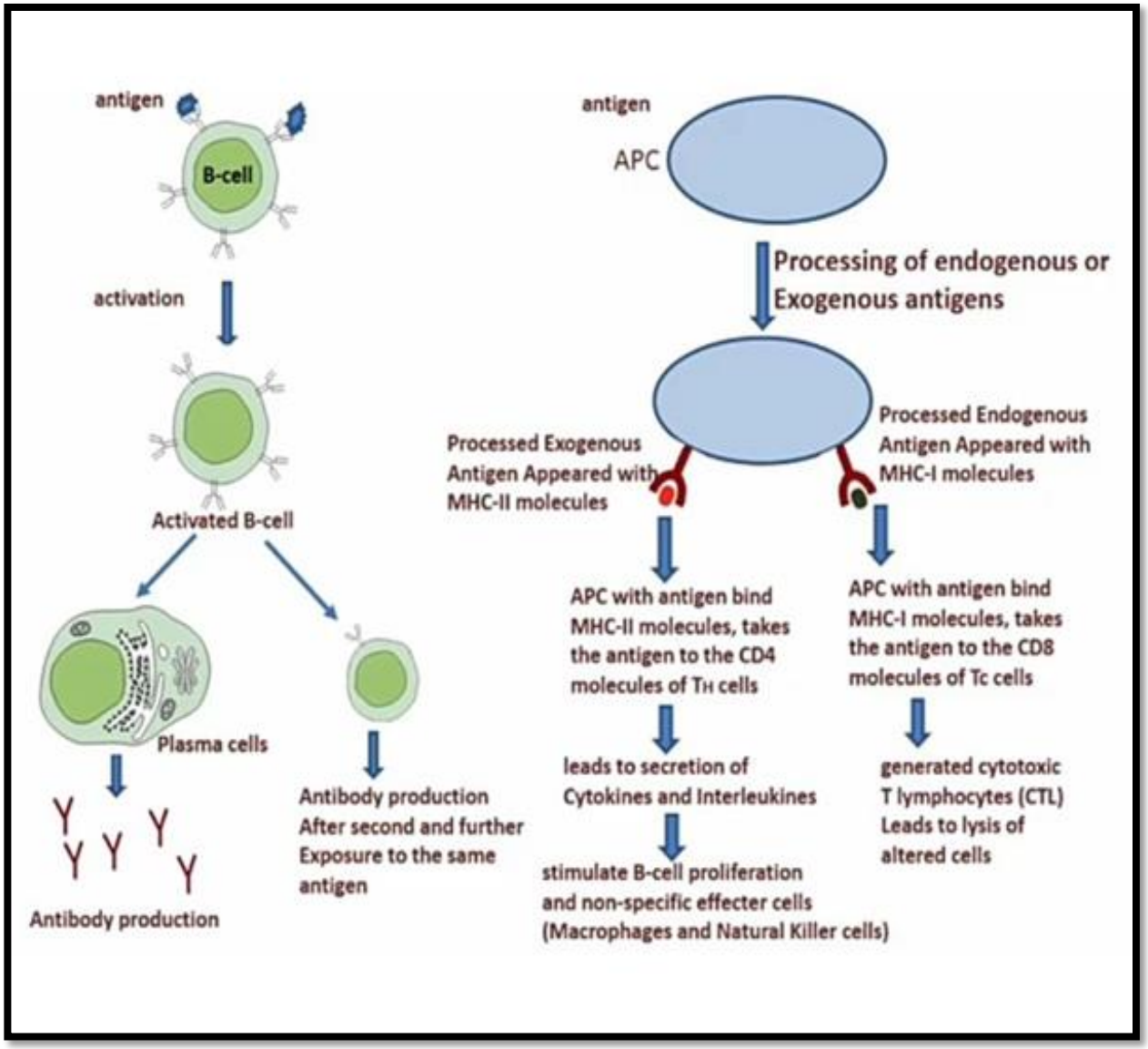


Fig : Diagram showing Humoral & Cell mediated immune response.

These activated B-cells divide into two types of cells. One is antibody producing plasma cells and second is memory cells.

Antibody secreting cells have no membrane bound antibodies, can secrete one of the five types of antibodies, which have affinity to that antigen, from which the gets activated or stimulated.

Memory cells are smaller in size as compared to plasma cells and carries antibody on their cell surface. Memory cells have longer life span (even for years) and high sensitivity towards antigens.

During the secondary exposure (second or more time exposure) of antigen (but the antigen should be the same which activated the B-cells in first response). These memory B-Cells proliferate and rapidly differentiate into plasma cells and produce high affinity antibodies through secondary response.

PROCESS OF DEVELOPMENT OF HUMORAL IMMUNITY :

Humoral immunity is generated and mediated through **B-Cells**

The antibodies present on immune competent B-cells, can recognize different epitopes. Epitopes are the discrete sites

present on antigens and are responsible for binding with antibodies

Appropriate interaction between antigen and B-cells membrane bound antibodies occurs.

This interaction activates B-cells and induce clonal selection of B-cells in which the B-cells divides repeatedly, differentiate and generates a population of activated B-CelIs or the effecter cells. This activation takes 4-5 days.

Extra cellular or exogenous antigens (which are found outside of the cell) internalize first through APCs via endocytosis.

These internalize antigens exposed to lysosomes. Due to Iytic activity enzymes,

these antigens get fragmented. These fragments then attached with Class Il Major Histocompatibility Complex (MHC) molecules (MHC-Il). After binding with MHC-Il, these bind antigen fragments again comes to the surface of APCs.

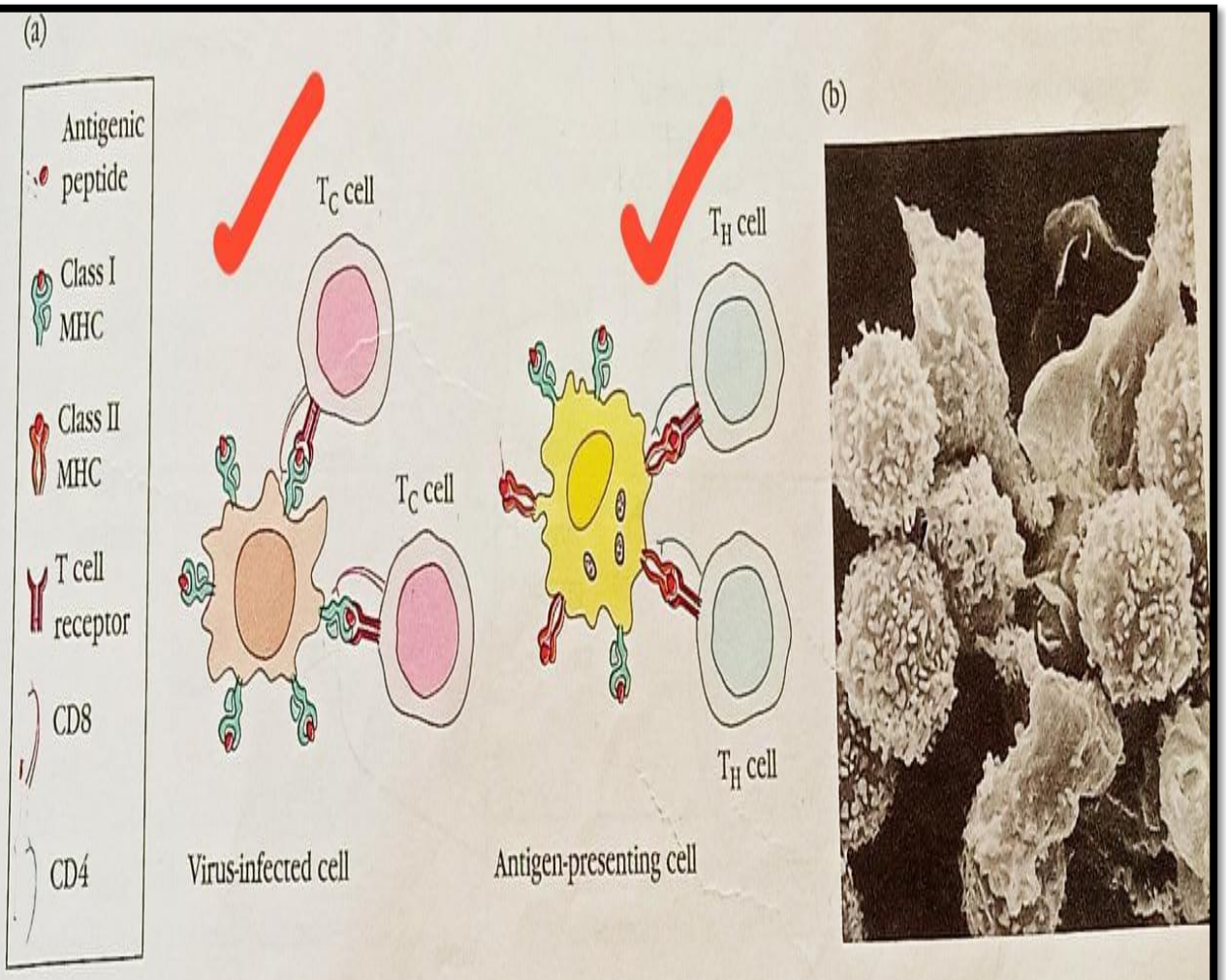
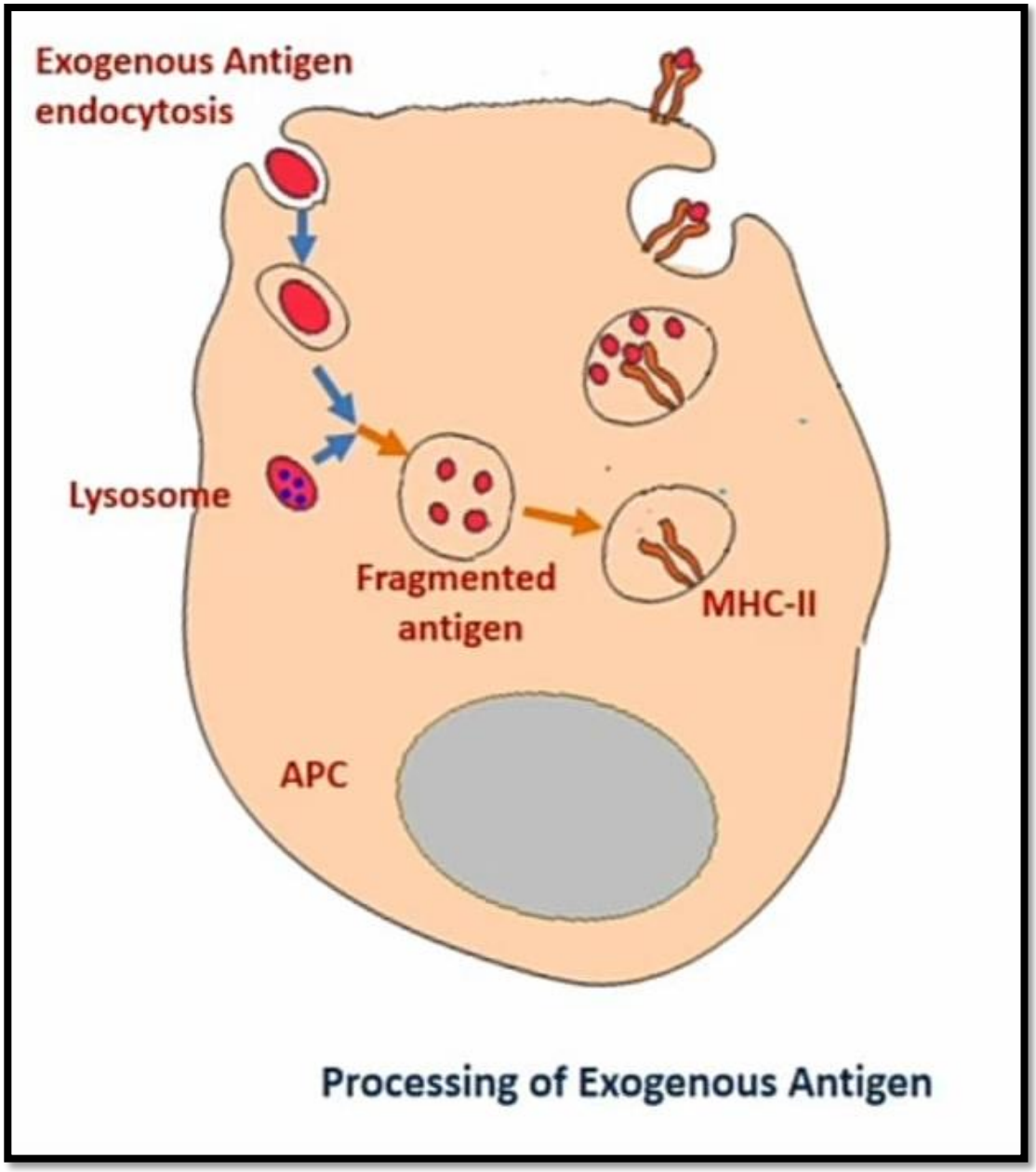
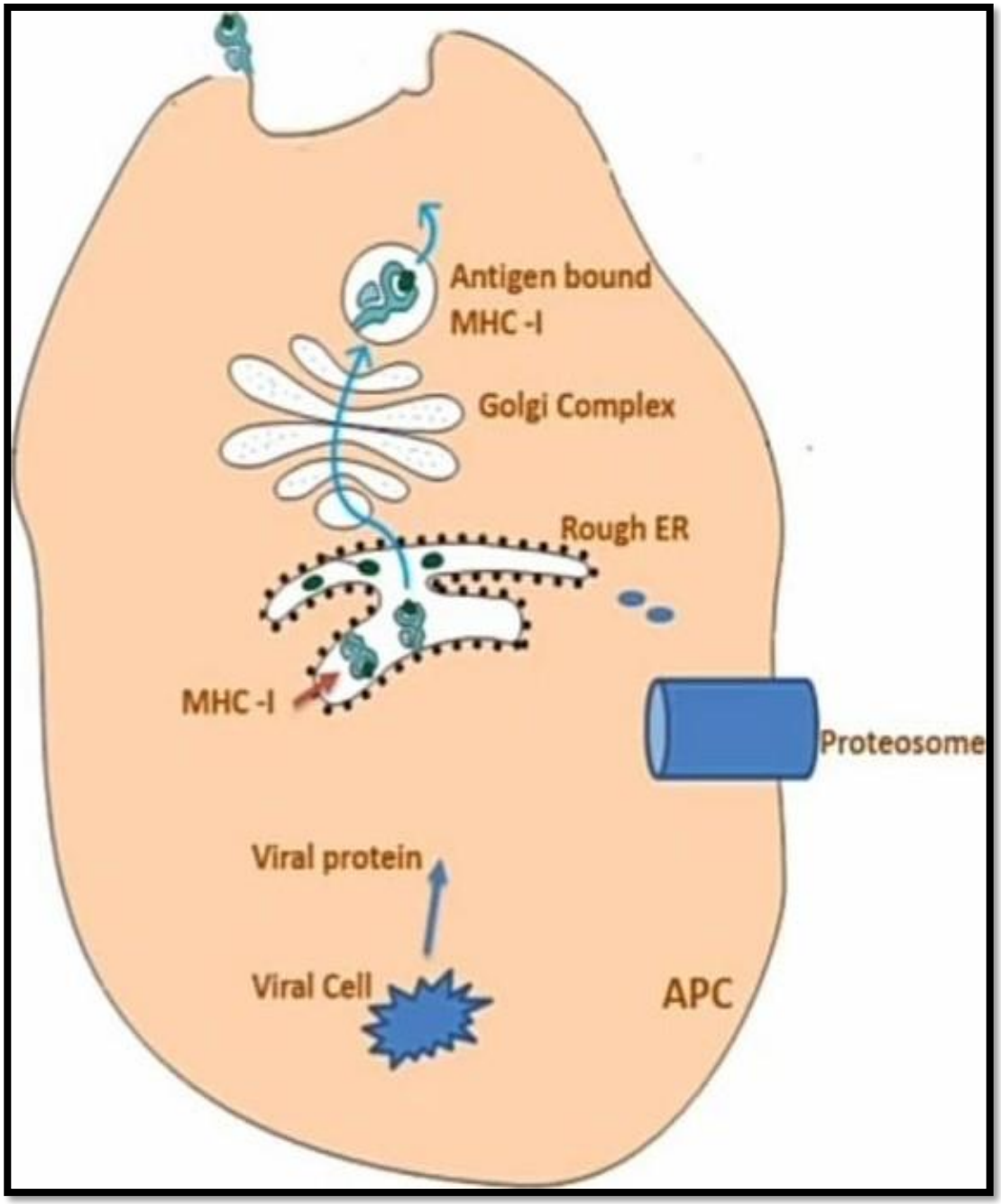


FIGURE 1-8 The role of MHC molecules in antigen recognition by T cells. (a) Class I MHC molecules are expressed on nearly all nucleated cells. Class II MHC molecules are expressed only on antigen-presenting cells. T cells that recognize only antigenic peptides displayed with a class II MHC molecule generally function as T helper (T_H) cells. T cells that recognize only antigenic peptides displayed with a class I MHC molecule generally function as T cytotoxic (T_C) cells. (b) This scanning electron micrograph reveals numerous lymphocytes interacting with a single macrophage. The macropha presents processed antigen combined with class II MHC molecu to the T cells. [*Photograph from W. E. Paul (ed.), 1991,* Immunolo Recognition and Response, *W. H. Freeman and Company, New Y micrograph courtesy of M. H. Nielsen and O. Werdelin.*]



Endogenous antigens get fragmented through proteosomes,and the fragmented antigen binds with MHC-I molecules and this assembly again comes to the surface of APCs.

Antigenic fragments attached with MHC-I and MHC -11 of APCs are exported to t-cells.



Components

Intracellular Fluid: The intracellular fluid comprises the cytosol.

Extracellular Fluid: The extracellular fluid comprises blood plasma, tissue fluid, and transcellular fluid.

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