IMMUNOLOGY

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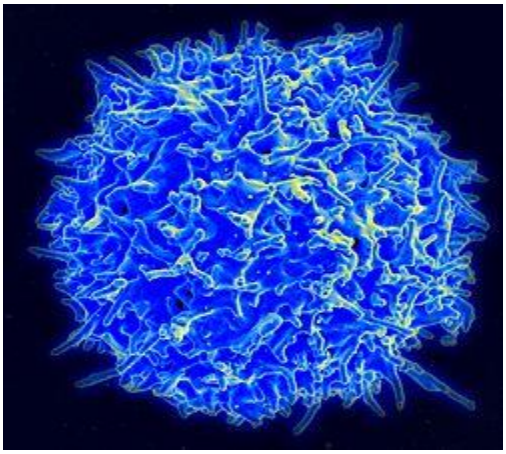
Lac.No. 6

The role of lymphocytes in specific immunity

Lymphocytes are the cells responsible for specific immune response. Most lymphocytes are either T cells or B cells . T cells (thymus cells) and B cells (bone marrow) are the major cellular components of the adaptive immune response. T cells are involved in cell-mediated immunity the direct distraction of body cells that have been involved by parasites or that undergo degeneration. T cells also play a significant regulatory role in the development and activation of all types of immune responses, whereas B cells are primarily responsible for humoral immunity (relating to antibodies) also can be antigen presenting cells. T cells can be distinguished from other lymphocytes, such as B cells and natural killer cells, by the presence of a T-cell receptor on the cell surface.



T and B lymphocytes cannot be distinguished by a Appearance . lymphocytes can see by scanning Electron microscopy .

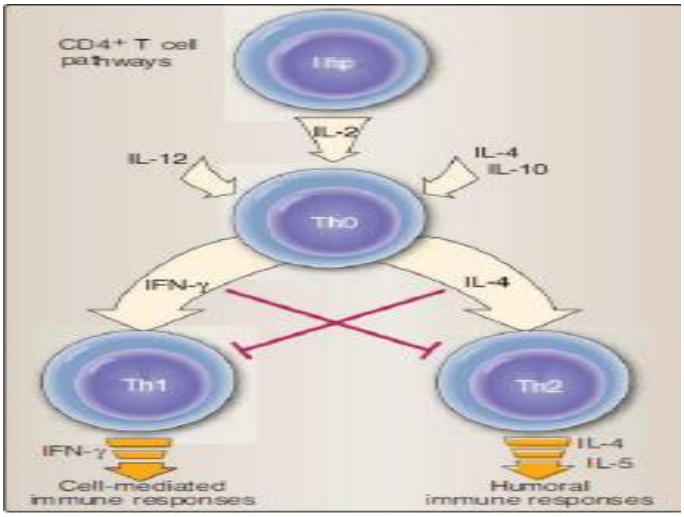
B and T cells recognize antigen in different way.

B and T cells recognize antigen in different ways. All lymphocytes are identified by protein on the surfaces of cells; B cells are identified by presence of immunoglobulin on their surfaces. T cells express unique T-cell receptors for antigen on their surfaces. During maturation a variety of **cluster of differentiation** or **CD** protein molecules (or markers) are expressed on the cell membranes of subpopulations of cells enabling them to be identified. CD molecules are especially useful in identifying lymphocytes . The category of effector T cell is a broad one that includes various T cell types that actively respond to a stimulus, such as co-stimulation. This includes helper, killer, regulatory, and potentially other T cell types. All T cells carry CD3 molecules which are associated with the T-cell receptors for antigen. The subgroups of T cell that can be farther

identified by other CD molecules. Most of the mature T cells are either CD4 cells bearing the CD4 protein or CD8 cells with CD8 protein.

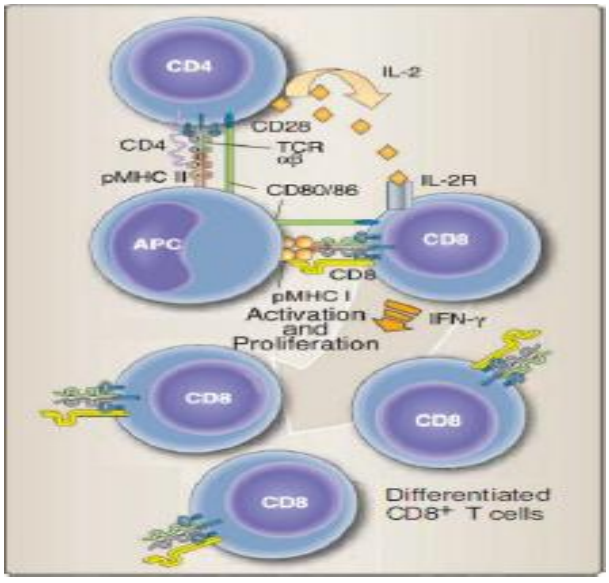
-Helper CD4+ T cells

T helper cells (TH cells) assist other white blood cells in immunologic processes, These cells are also known as CD4+ T cells, there are two functional subsets of CD4 lymphocytes , **Th1 cells** produce cytokines that drive the development of CD8 cytotoxic cells and activate macrophages. **Th2 cells** produce cytokines that stimulate B cells to produce antibodies. (Helper T cells become activated when they are presented with peptide antigens by MHC class II molecules, which are expressed on the surface of antigen-presenting cells (APCs).

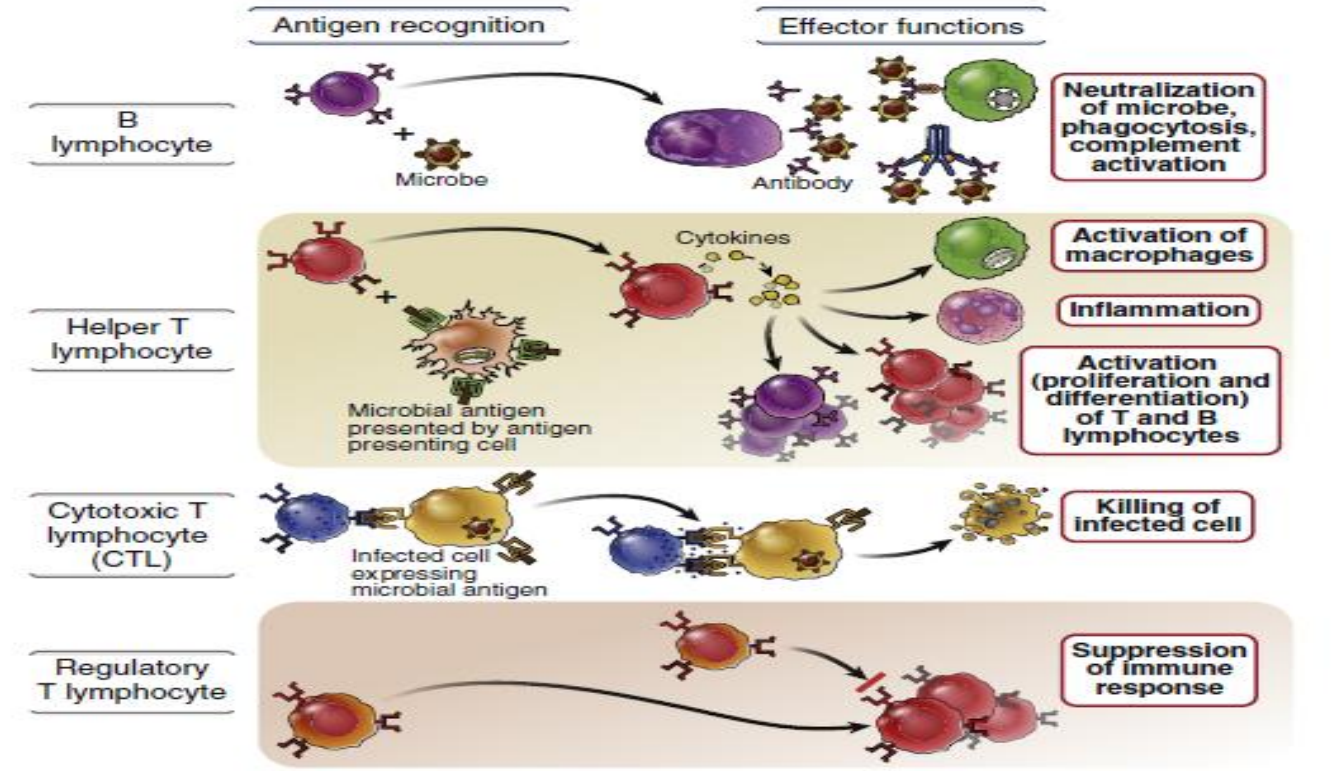


- Cytotoxic (killer) CD8+ T cells

Cytotoxic T cells (TC cells, T-killer cells,) destroy virus-infected cells and tumor cells, and are also implicated in transplant rejection. These cells are also known as CD8+ T cells since they express the CD8 glycoprotein at their surfaces. These cells recognize their targets by binding to antigen associated with MHC class I molecules, which are present on the surface of all nucleated cells. Through IL-10, adenosine, and other molecules secreted by regulatory T cells, the CD8+ cells can be inactivated to an anergic state, which prevents autoimmune diseases.



Some other lymphocytes act as suppressor (Ts) cells or T-regulatory cells to suppress immune responses, probably by means of secreted factors (Their major role is to shut down T cell-mediated immunity toward the end of an immune reaction and to suppress autoreactive T cells that escaped the process of negative selection in the thymus.) This is an important "self-check" built into the immune system to prevent excessive reactions. Regulatory T cells come in many forms with the most well-understood being those that express CD4, CD25.



Major histocompatibility complex (MHC)

In addition to CD markers and immunoglobulins, many other recognition molecules are found in the cell surfaces. One interesting group is **Major histocompatibility complex (MHC) is** a set of molecules displayed on cell surfaces that are responsible lymphocytes recognition and antigen presentation. The MHC molecules control the immune response through recognition of self and non-self and consequently serves as targets in translation rejection. In humans the major gene complex is composed of closely linked genes located on chromosome 6 Human MHC proteins are called **human leukocyte antigens (HLAs)** because they were discovered as antigens of leukocytes.in individual who are genetically the same, such as identical twins have the same MHC molecules on their when transplant is made between identical twins the immune system fails to recognize the MHC molecules on the transplanted cells as foreign and the transplant is accepted. When cells are transplanted between nonidentical people the immune system recognizes

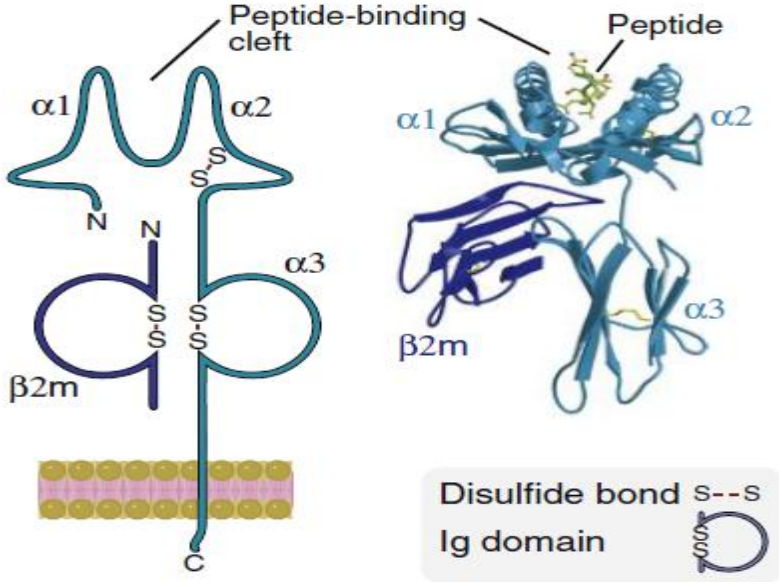
the MHC molecules on the transplanted cells and makes a vigorous immune response leading to rejection of the tissue. In all mammals, the MHC locus contains two sets of highly polymorphic genes, called the class I and class II MHC genes. Both class I and class II MHC have a peptide-binding groove or cleft where peptide antigen fragment can be inserted.

MHC class I

found on the cell surface of all nucleated cells in the bodies of jawed vertebrates, They also occur on platelets, but not on red blood cells. the CD8(cytotoxic T cells) bind to MHC class I molecules.

Structure

MHC class I molecules are heterodimers that consist of two polypeptide chains, α and β2-microglobulin (b2m). The two chains are linked noncovalently via interaction of b2m and the α3 domain. Only the α chain is polymorphic and encoded by a HLA gene, while the b2m subunit is not polymorphic and encoded by the Beta-2 microglobulin gene. The α3 domain is plasma membrane-spanning and interacts with the CD8 co-receptor of T-cells. The α3-CD8 interaction holds the MHC I molecule in place while the T cell receptor (TCR) on the surface of the cytotoxic T cell binds its α1-α2 heterodimer ligand, and checks the coupled peptide for antigenicity. The α1 and α2 domains fold to make up a groove for peptides to bind. MHC class I molecules bind peptides that are 8-10 amino acid in length.



Antigen activate T cytotoxic cells only when they are presented as peptides complexed with MHC class I molecules in this manner and in conjunction with a signal given by antigen presenting cells . if the peptides are nonself such as those produced by

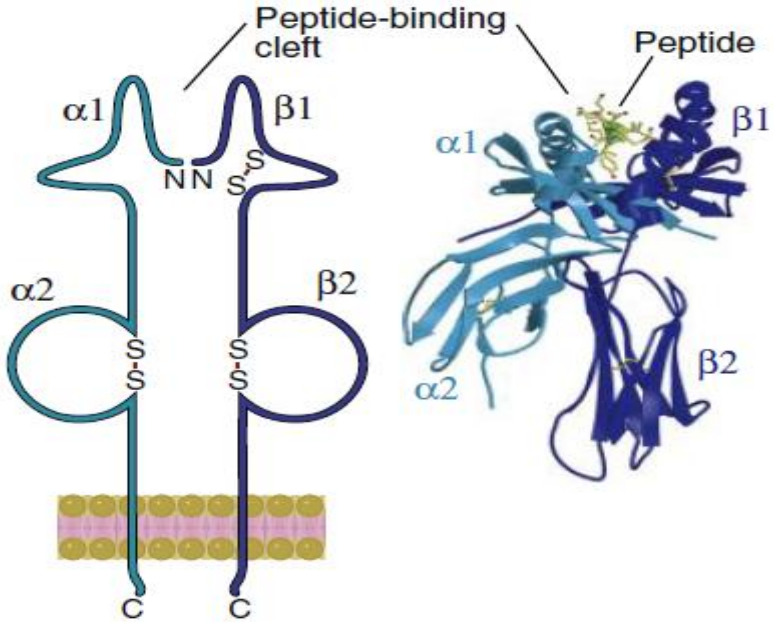
intracellular pathogens Tc cells can identify and destroy the infection cell . so class I present endogenous antigen like fragment of viral proteins or tumor proteins.

MHC class II

Are found principally on macrophages and dendritic cells ,antigen presenting cells and B cells with can also presenting antigen. CD4 helper T-lymphocytes bind to MHC class II

Structure

Like MHC class I molecules, class II molecules are also heterodimers, but in this case consist of two homogenous peptides, an α and β chain, both of which are encoded in the MHC. The subdesignation α1, α2, etc. refers to separate domains within the HLA gene; each domain is usually encoded by a different exon within the gene, and some genes have further domains that encode leader sequences, transmembrane sequences, etc. Because the antigen-binding groove of MHC class II molecules is open at both ends while the corresponding groove on class I molecules is closed at each end, the antigens presented by MHC class II molecules are longer, generally between 15 and 24 amino acid residues long.



Because class II MHC is loaded with extracellular proteins, it is mainly concerned with presentation of extracellular pathogens (for example, bacteria that might be infecting a wound or the blood). Class II molecules interact mainly with immune cells, like the T helper cell (TCD4+) . The helper T cells then help to trigger an appropriate immune response which may include localized inflammation and swelling due to recruitment of phagocytes or may lead to a full-force antibody immune response due to activation of B cells