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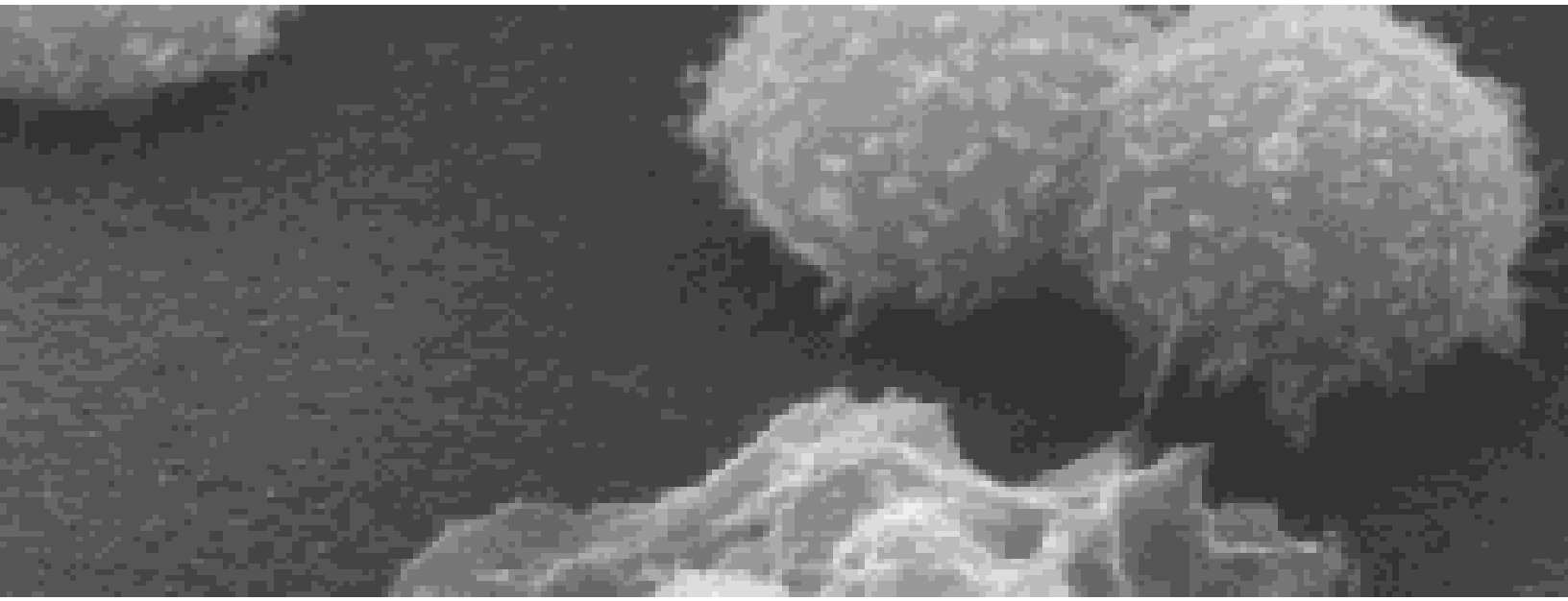
Cell Mediated Immunity

Lecture 3



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Objectives:

1. To describe antigen recognition by T cells.
2. To describe the pathways involved in processing endogenous and exogenous antigens.
3. To discuss self MHC restriction in Ag presentation to T cells.
4. To describe the induction of cell meditated immunity (Chronic Inflammation).

Videos to Watch:

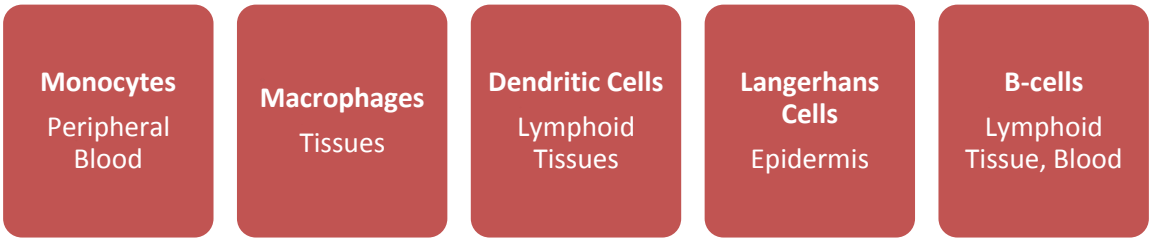
The Cellular Immune Response

http://www.youtube.com/watch?v=oUpcRfpEh3c

Cell Mediated Immunity

- T cells (lymphocytes) bind to the surface of other cells (Antigen Presenting Cells) that display the antigen and trigger a response.
- Mononuclear cell inflammatory process usually associated with *chronic inflammations.*

Antigen Presenting Cells

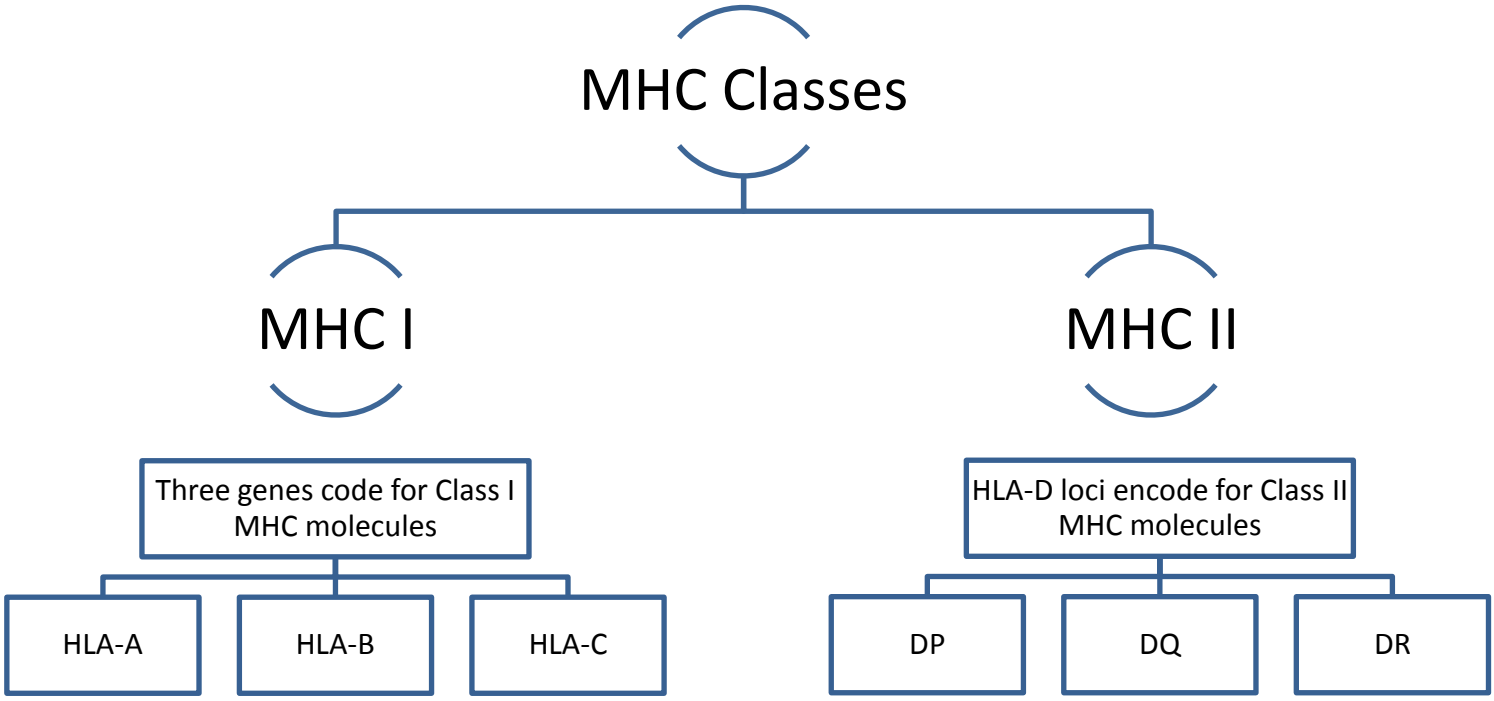


Major Histocompatibility Complex (MHC)

- MHC proteins were discovered for the first time with when tissue transplantation started.
- The success of tissue and organ transplantation depends upon the match of donor's and recipient's **"*human leukocyte antigens*" (HLA)** encoded by HLA genes.
- Genes for HLA proteins are clustered in the MHC complex located on *the short arm of chromosome 6.*

MHC Classes

- Each group of MHC consists of several *glycoproteins*.
- Each individual has two "*haplotypes*" **i.e.** two sets of these genes: one paternal and one maternal.



- MHC Class I molecules are found on the surface of virtually all nucleated cells.
- Presents ***endogenous*** antigens (bacteria).
- Associates with **T-cytotoxic cells (CD8).**

- MHC Class II molecules are normally present of the surface of antigen presenting cells.
- Presents ***exogenous*** antigens (viruses).
- Associates with **T-helper cells (CD4).**

Biologic Importance of MHC

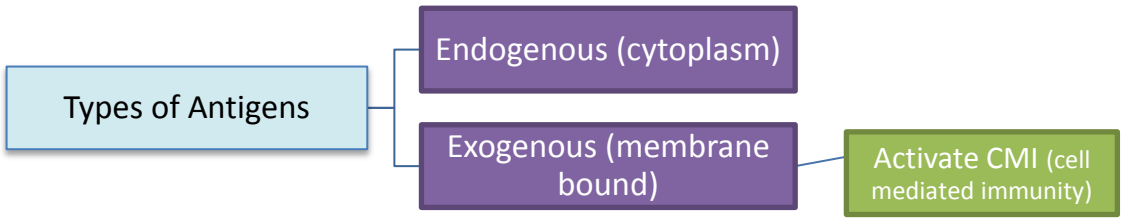
Antigen Recognition (MHC Restriction)

- **T cytotoxic (CD8)** cells kill virus infected cells in association with **class I MHC** proteins.
- **Helper T (CD4)** cells recognize antigen in association with **class II MHC** proteins.

This is called MHC restriction

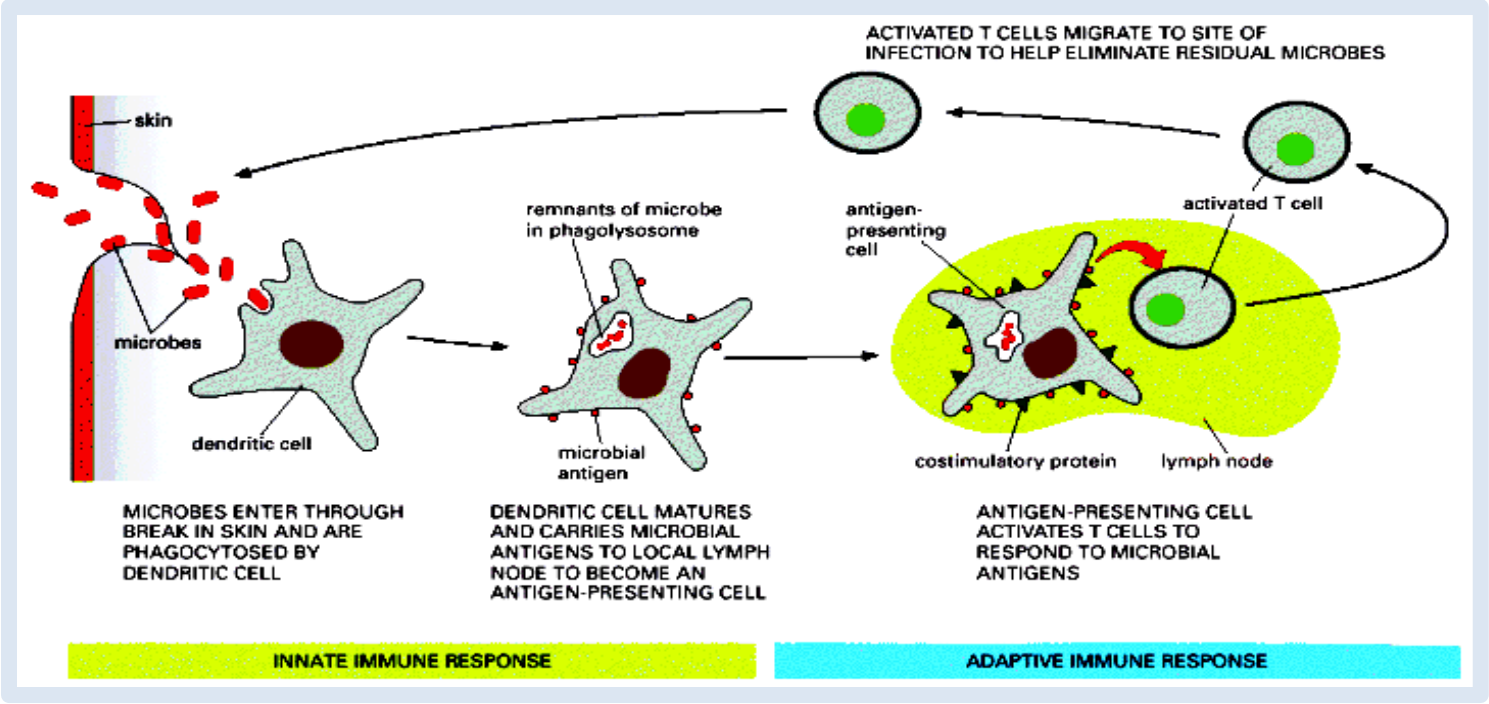
Transplantation

- Success of organ transplant is determined by compatibility of the MHC genes.



Antigen Presenting Cells (Again!)

Dendritic cells and **macrophages** digest invading microbe and then present the antigen of the microbe to lymphocytes **in lymphoid organs**.



T cells Activation

Two signals are required to activate T cells

First Signal

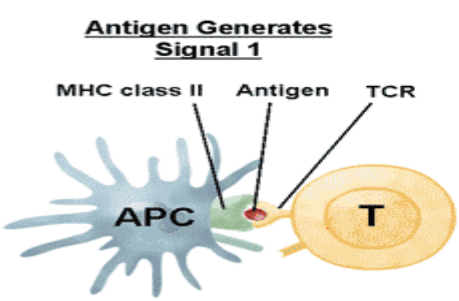
Class II MHC with **Antigen** binds to **TCR(T cell receptor)**

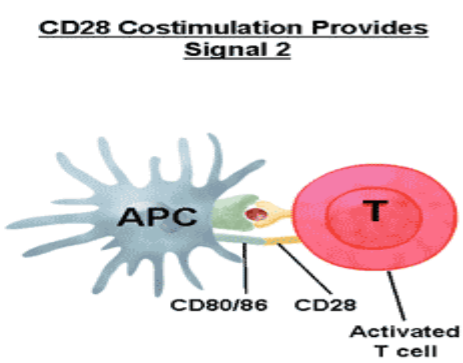
IL-1, LFA-1 with ICAM

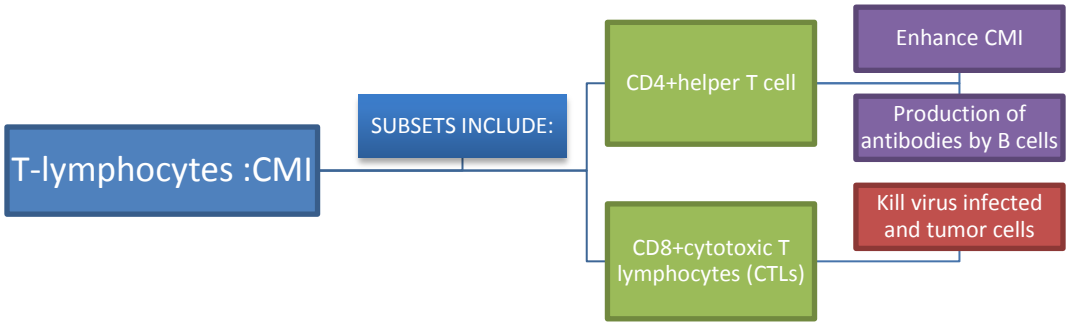
Second Signal

B7 on APC interacts with **CD28 on lymphocyte**

(Co-stimulatory Signal)







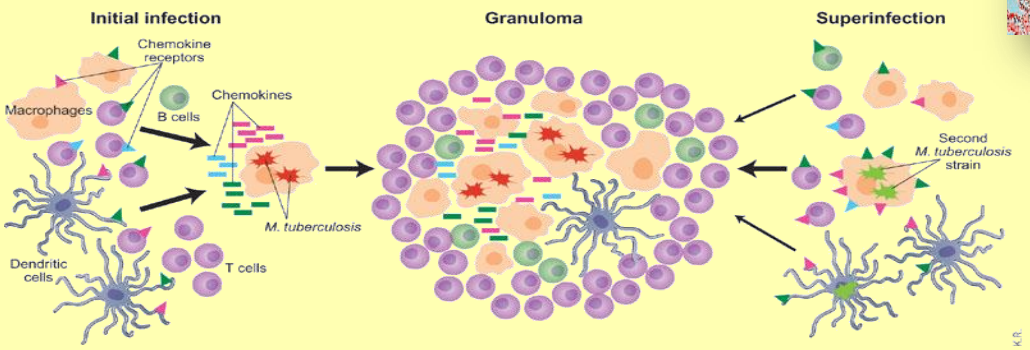
Outcome of T Helper Cells Activation

1- Production of IL-2 and its Receptor

- IL-2 is also known as T cell growth factor.
- Proliferation of antigen specific T cells.
- Effector and regulatory cells are produced along with *memory* cells.
- IL-2 stimulates CD8 cytotoxic cells.

2- Production of Interferons

- Enhances anti-microbial activity of macrophages.
- Granuloma Formation in Chronic Inflammation. **e.g.** TB **g**



3- Memory T cells

- Respond **rapidly** for many years after initial exposure to antigen.
- The **secondary response** is greater than the primary:
- A large number of memory cells are produced.
- Memory cells live for many years and have the capacity **to multiply**.
- They are activated by **smaller amount of antigen**.
- They produce **greater** amounts of interleukins.

Examples of Cell Mediated Immunity

1. **Delayed Type of Hypersensitivity (DTH) Reaction:**

- **The Tuberculin Test**
  Mediated by CD4+ T cells and takes about **72 hours** to develop.

2. **Contact Sensitivity:**

- **Rashes on skin following contact with certain chemicals such as nickel, dyes, and poison ivy plant.**
  The response takes some **24 hours** to occur and like DTH, is triggered by CD4+ T cells.



Remember

- Cell mediated adaptive immune response is **specific** and develops after exposure to a pathogen (antigen).
- Initial antigen exposure results in generation of **memory cells** for a **stronger** and a **quicker response** against future exposures to the same pathogen.
- It is usually associated with **chronic infections**.
- **Antibodies** are not involved.

MCQs :

1) MHC class I molecules are NOT found on the surfaces of:

a. RBCs
b. B cells
c. Macrophages
d. Dendritic Cells

2) The secondary response according to memory cells is:

a. Less than the primary response
b. More than the primary response
c. Equal to the primary response

3) The tuberculin test is mediated by:

a. CD4+
b. CD2+
c. CD28+
d. CD5+

Answers: 1. a , 2. b , 3. a