بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

IMMUNOLOGY

Professor Dr. Batool Mutar Mahdi

M.B.Ch.B., M.Sc., FICMS

Clinical Immunology

REFRENCES:

-Medical Microbiology by Jawetz

-Immunology by Roitt

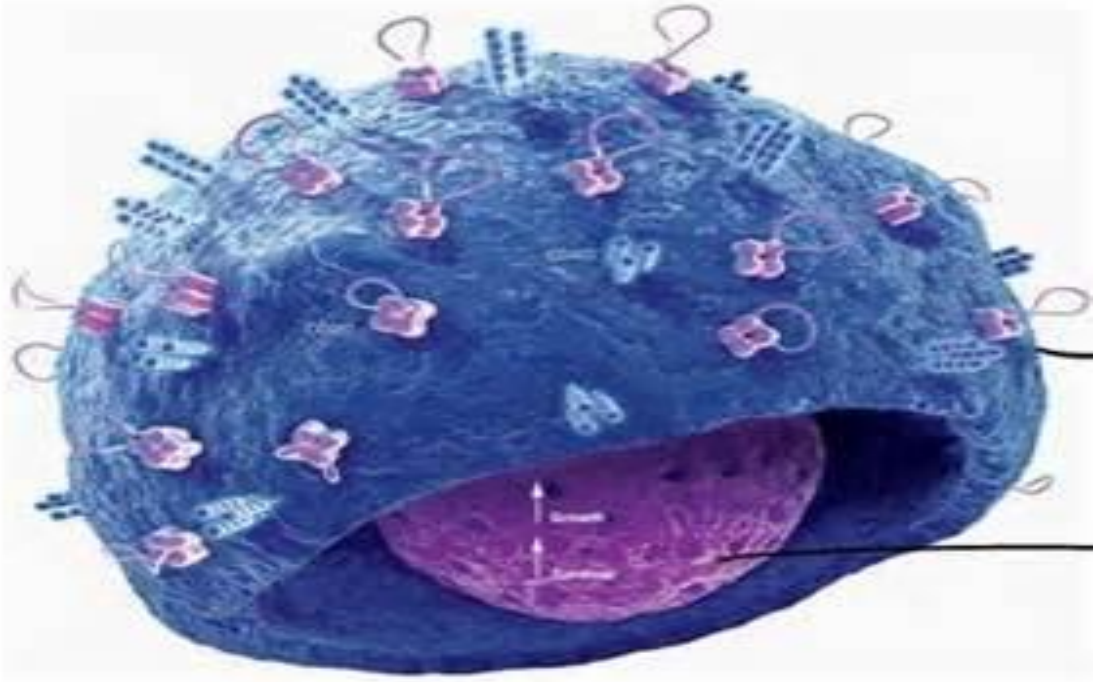
-Immunology by kuby

Objectives:

- Antigen
- Types
- Characteristics
- Factors determine antigen effectiveness
- Cytokines
- chemokines

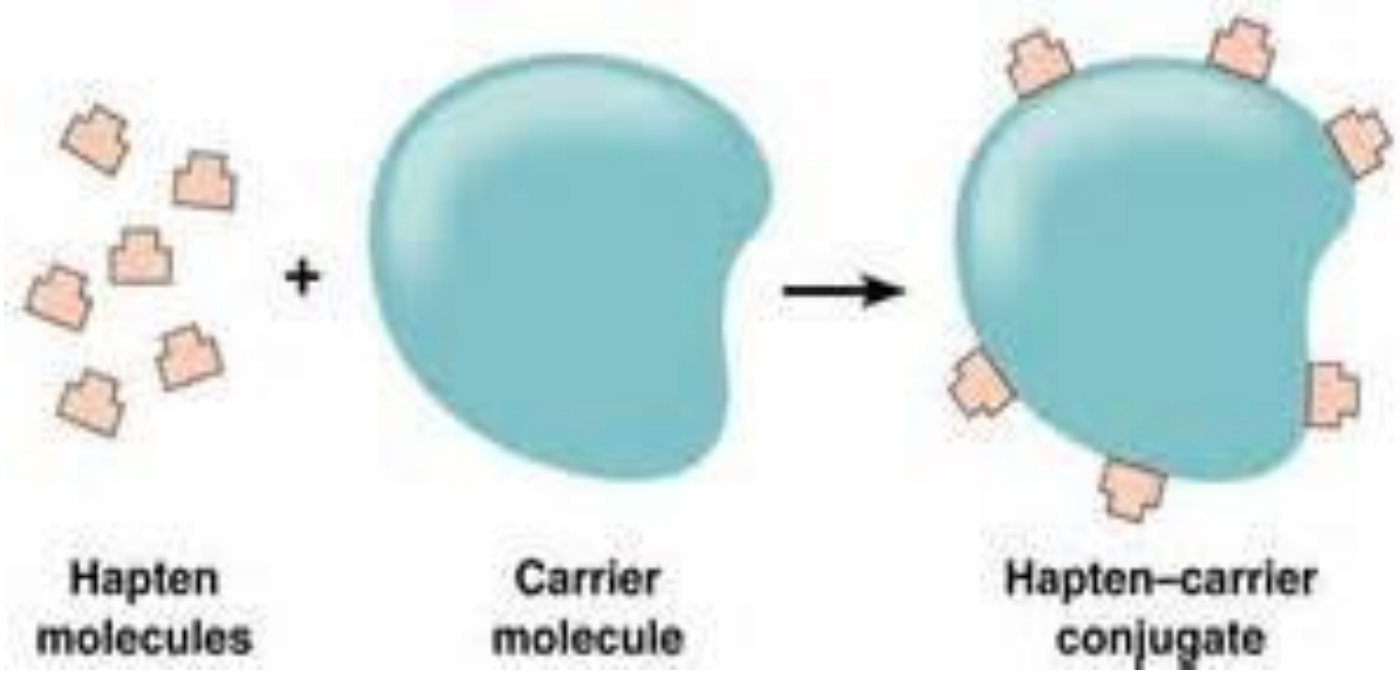
ANTIGEN

Antigens (Ag): any molecule that can be specifically recognized by the adaptive immune system



2- Epitope: is a restricted part of Ag (short sequence of sugars , a.a. , that bind with antibodies (Abs).

3-**Hapten**: a small molecule had a low molecular weight that can not initiate an immune response unless its coupled with a large carrier molecule



MAJOR HISTOCOMPATIBILITY COMPLEX *(MHC)*

- Each mammalian species possesses a tightly linked **cluster of genes** **(MHC),** their products play a major role in :
- cellular recognition
- determining the transplanted tissue is accepted or rejected.

- The product of these genes were expressed as

  antigens
- on the cell surface of the cells.
- its also called

  human leukocyte antigens (HLA).

MHC (major histocompatibility complex)

- Consisted of three classes:

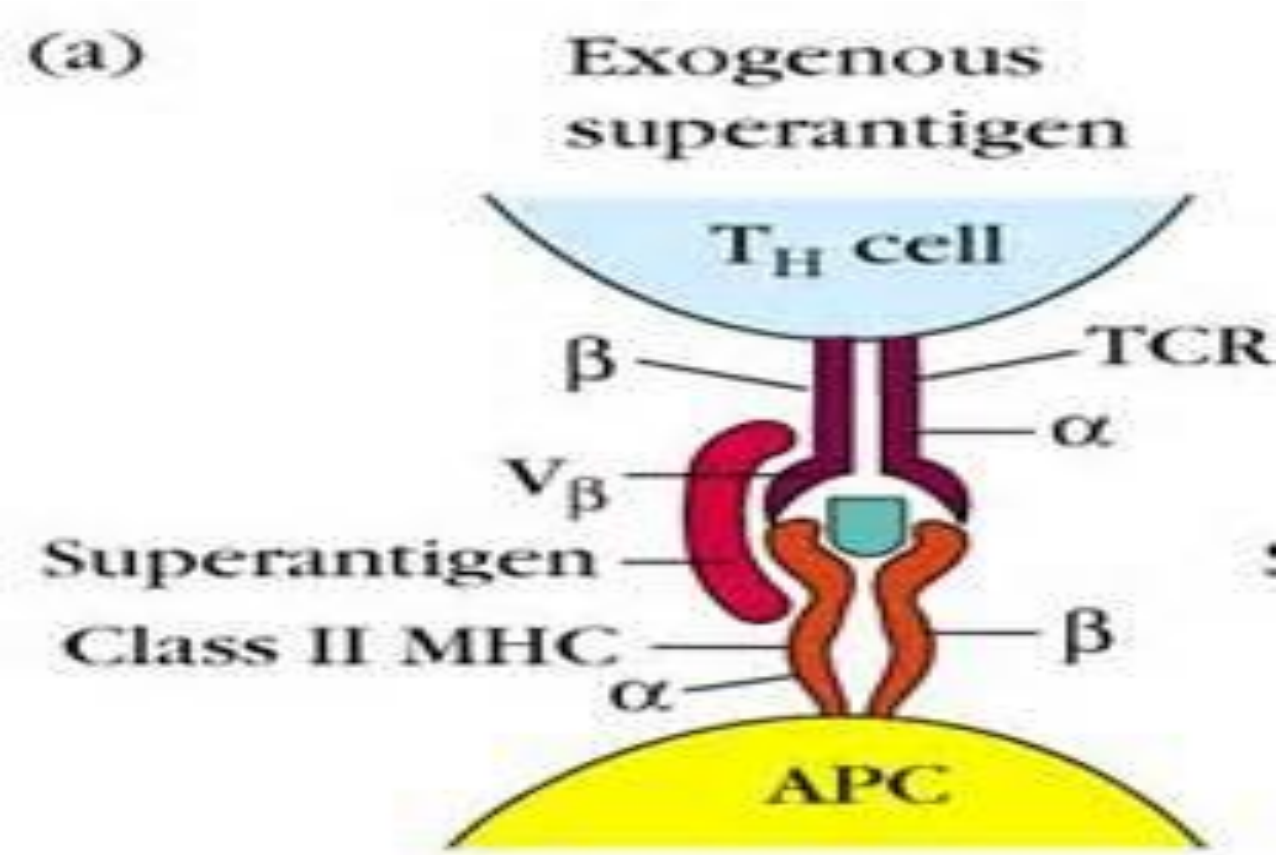
1- class I

2-class II

3-class III

Super antigen:

Is an antigen like Staphylococcal enterotoxins that binds Tcell receptor variable beta regions to alpha chain of class II major histocompatibility complex on antigen presenting cells. This leads to stimulation multiple T cells



Factors determining antigenicity

1. Degree of foreignness
2. Molecular size:100000 Dalton
3. Chemical compositions: proteins-polysaccharide-lipid-nucleic acids
4. Susceptibility to antigen processing
5. Genotype
6. Dose of immunogens
7. Route of administration
8. Adjuvant: substance mix with Ag to enhance immunogenicity (Alum-Aluminum potassium sulfate)

Cytokines

Are regulatory proteins or glycoproteins of low molecular weight secreted by white blood cells and other cells in response to a number of stimuli.

Function as intercellular messenger that evoke particular biological activity after binding to a specific receptor.

-They are either soluble or membrane bound form

Nomenclature

- Interlukines: cytokines are secreted by some leukocytes and act upon other leukocytes(communicates between white blood cells).
- Chemokines: are molecules that communicate among immune cells that mobilize them from one organ or from one part of organ to other
- Chemoattractants:molecules that attract the cells by expression of cell surface adhesion molecules

- IL-1
- Secreted by macrophages
- Act on lymphocytes Induce lymphocytes maturation , activation and clonal expansion
- Acts on hypothalamus inducing fever
- Acts on liver induce acute phase protein synthesis

IL-2

- Secreted from Th1
- Acts on Ag specific T-cell supporting its growth
- Acts on NK cell increasing activity
- Acts on Tc cell increasing cytotoxicity
- Leads to development cell mediated immunity
- Suppress cytokines secreted from Th2 cells.

IL-3

- Secreted from Th2
- Supports growth and differentiation of hematopoietic cells

IL4 and IL-5

- **Secreted from TH2**
- **Its up-regulate classII MHC expression**
- **Stimulate growth of mast cell**
- **Stimulate proliferation of activated B-cell**
- **Stimulate Abs secretions from plasma cell**
- **Stimulates humoral immune response**
- **Down regulates Th1**
- **IL-4 promotes class switch to IgE**
- **IL-5 promotes Eosinophil activation and generation**

IL-6

- **Secreted by macrophages and endothelial cells and TH2 cells.**
- **Effect liver induces acute phase protein synthesis and proliferation and antibody secretion of B-cells.**

IL-10

- **Secreted from Th2**
- **Antagonizes generation of Th1 subsets and cytokines production by TH1**
- **Anti-inflammatory cytokine**
- **Mediate regulation of the immune system**

IL-17

-secreted from TH17

-promotes inflammation and increase production of proinflammatory cytokines

-Family of IL-17 include (A,B,C,D,E,F)

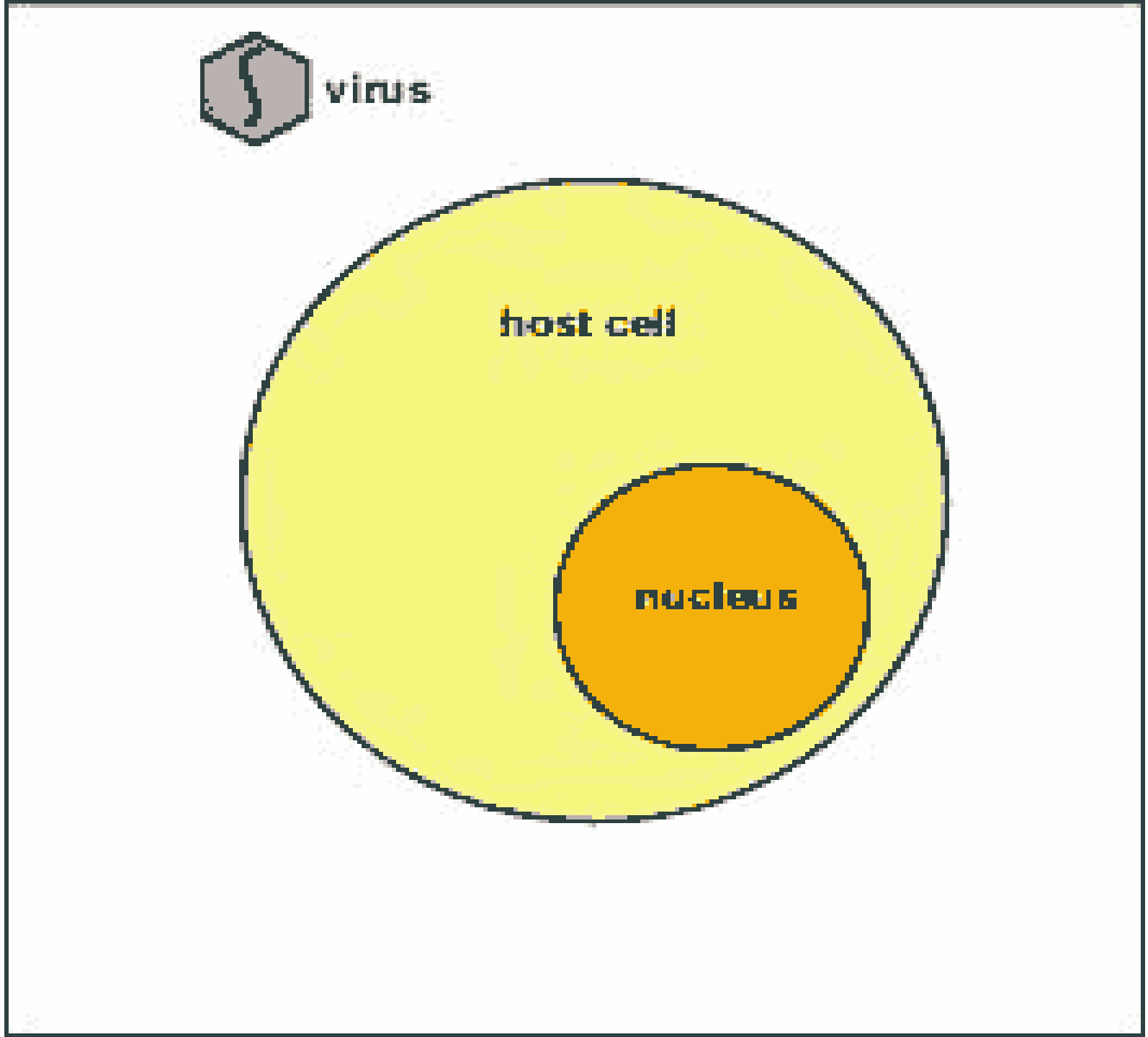
_It binds to specific receptors

-Type I Interferon (IFN) consisted from:

- **IFN α and IFN β:secreted by activated macrophages, dendritic cells and viral infected cell and inhibit viral replication**
- **Type II interferon include IFN γ:secreted from Th1, Tc, NK cell and inhibit viral replication,**

  enhance activity of macrophages, increase MHC class-II expression, inhibits Th2 proliferation

-Type III interferon include IFNλ : It is up-regulates the expression of genes controlling viral replication and host cell proliferation

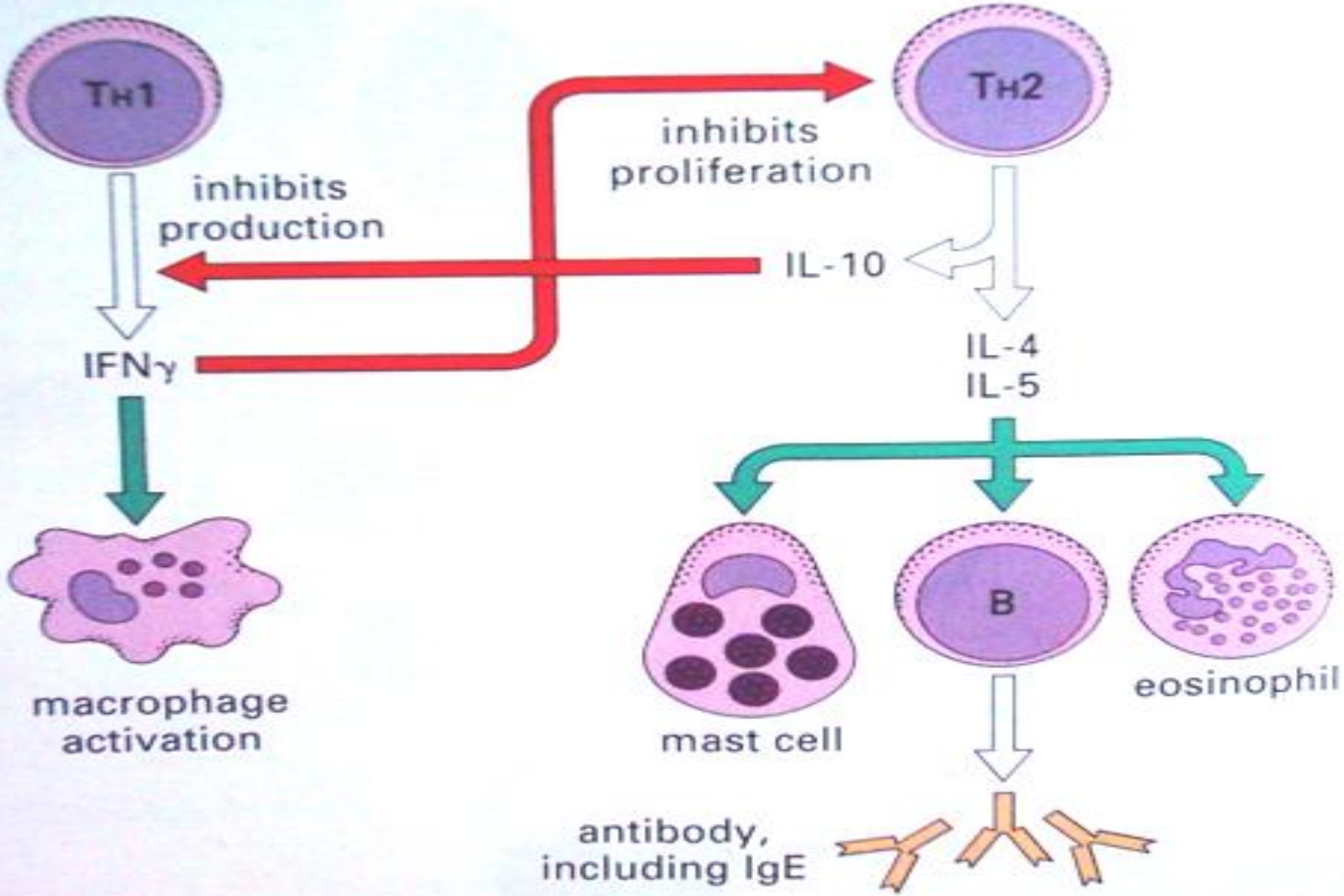

virus
host cell
nucleus

Tumor necrosis factor (TNF)

- TNF :secreted from macrophages NK cell and act on tumor cells
- Had direct cytotoxic effect on tumor cells and tumor undergoes visible hemorrhagic necrosis and regression by inhibition angiogenesis, there by decreasing the flow of blood that is necessary for progressive tumor growth.
- Causes extensive loss weight, loss

of muscle and body fat (cachexia) by suppression lipogenetic metabolism

Selection of effector mechanisms by TH1 and TH2 cells



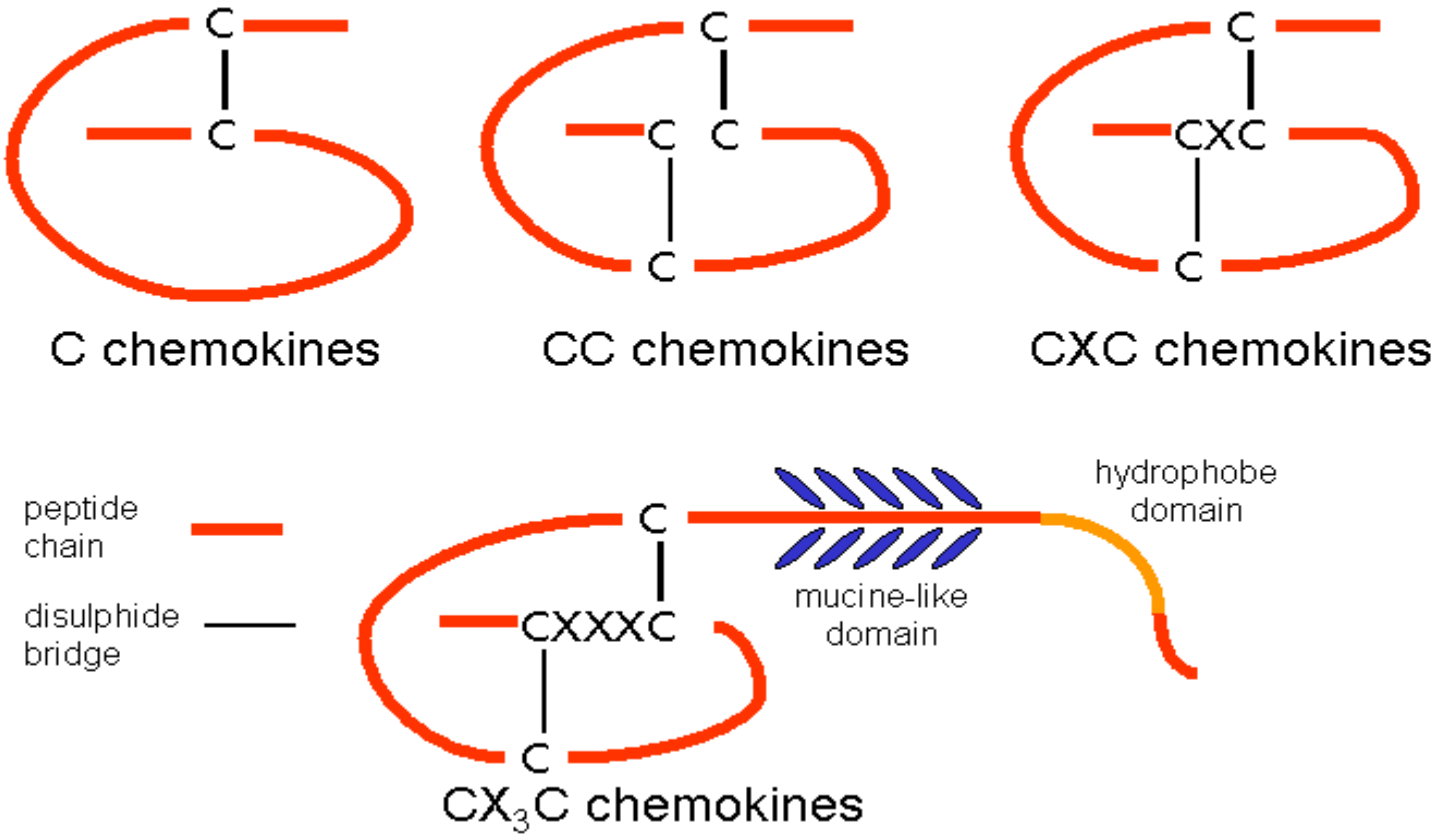
Chemokines

- **Chemokines** are a family of small cytokines, or signaling proteins secreted by cells. Their name is derived from their ability to induce directed chemotaxis in nearby responsive cells; they are **chemo**tactic cyto**kines**
- Some chemokines are considered pro-inflammatory and can be induced during an immune response to recruit cells of the immune system to a site of infection, while others are considered homeostatic and are involved in controlling the migration of cells during normal processes of tissue maintenance or development.

- Chemokines have been classified into four main subfamilies based on their structural characteristics, : CXC, CC, CX3C and XC. All of these proteins exert their biological effects by interacting with transmembrane receptors called chemokine receptors, that are selectively found on the surfaces of their target cells.

- Members of the chemokine family are divided into four groups depending on the spacing of their first two cysteine residues. Thus the nomenclature for chemokines is, e.g.: CCL1 for the ligand 1 of the CC-family of chemokines, and CCR1 for its respective receptor.
- three amino acids between the two cysteines and is termed CXXXC

Structure of chemokine classes



THANK YOU