

I. Non-specific Immunity

[division 1] (7 Regiments w/ Battalions)

A. **PHYSICAL BARRIERS** - [*Prevent Access and initiate defenses*] Integument & Accessory structures (hair, nails, glands)

B. **INFLAMMATION** - via Mast cells and Basophils

- ↑ blood flow; ↑ capillary permeability, ↑ phagocytic activities,
- ◇ activates complement, ◇ walls off injury site, ◇ activates Division II

C. **FEVER** - via pyrogens

- ◇ Mobilizes defenses, ◇ accelerates repair, ◇ inhibits pathogens

D. **COMPLEMENT** [tagging] - 11 plasma 'C' proteins attacks & breaks down cell walls via **MAC** (membrane attack complex) pore formation, attracts phagocytes

E. **CYTOKINES** [chemical warfare] Lymph Hormones or Chemotaxic Factors

(Direct attacks and stimulates Division II) (except Suppressor T-cell inhibitory cytokines)

1. INTERFERONS - proteins increase resistance to viral infections & stimulate Macrophages & NKCs (alpha, beta & gamma) α & δ stim. NKCells β slow viral inflam.
2. INTERLEUKINS - IL1- 7 membrane glycoproteins via CDMs (cluster designated markers) called MHCs (major histocompatibility complex) or Cluster Designated Markers HLAs (human leukocyte antigens)
3. MONOKINES - via monocyte-macrophages {IL-12, IL-18 and IL-15}
4. LYMPHOTOXIN - toxic substances to pathogens via B & T cells
5. TNF - Tumor Necrosis Factor via Macrophages; slow & kill tumor growth; activate T-cells & Eosinophils; inhibit parasites & viruses
6. LYMPHOKINES - chemicals (double stranded RNA) secreted by t-lymphocytes activated by antigens stimulating the production of nonsensitized lymphocytes and activating macrophages
7. LEUKOTRIENES - lipid compounds that contain 20 carbon atoms, are related to prostaglandins, and mediate the inflammatory response
8. COLONY STIMULATING FACTORS - via macrophages, fibroblasts, & T-cells G, M, GM, Multi formed element factors
9. PROSTAGLANDINS - *local hormones* - alter the metabolism & sensitivities of other cells

F. **LEUKOCYTES** [WBCs] *Myeloid derived*

1. Monocyte-Macrophages - fixed and free big eaters [*Reticuloendothelial System*]
Fixed: *Langerhan Cells, Kupffer Cells, Microglia, Osteoclasts etc.*
Present antigens; Clean up after microphage battles
2. **Microphages** - kamikaze little eaters
 - a. Neutrophils - invading bacteria & cellular debris
 - b. Eosinophils - target foreign cpds or pathogens coated with antibodies
3. Basophils and Mast Cells - Inflammatory response
Histamine, Heparin, Prostaglandins

G. Natural Killer Cells - *Lymphoid Leukocytes* [lymphocytes] [*special forces* unit used by both divisions] activated by double-stranded RNA or lymphokines and fights off viral infections and tumors without evident antigenic specificity

immunological surveillance

ADCC - Antibody Dependant Cell Mediated Cytotoxicity

II. Specific Immunity [Precise, Definitive] [division 2] (three Regiments w/ Battalions)

LYMPHOID LEUKOCYTES [lymphocytes]

A. **Natural Killer Cells** – [*immunological surveillance*]
[special forces unit used by both divisions]
(ADCC) -Antibody Dependant Cell Mediated Cytotoxicity

B. T- CELLS (fort Thymus) [*tissue mediated immunity*]
Presentation / MHC proteins / Antigen Recognition / Costimulation

1. **Cytotoxic T- cells** [Killer T- cells] cell-to-cell combat
(CD8 markers) >found on Cytotoxic T-cells & suppressor T-cells <
>activated by Class I MHC proteins<
release chemotaxic factors that act as flares
2. **Helper T- cells** - stimulate activation of specific defenses >T, B and NK<
(CD4 markers) >found on Helper T-cells<
>Respond to Class II MHC proteins<
3. **Memory T- cells** – I.D. specific invaders
4. **Suppressor T- cells** – Inhibit T& B Cells via inhibitory Cytokines

C. B CELLS [*humoral immunity*]

1. **Plasma Cells** (antibodies or immunoglobulins)
IgM – 1st response to new antigen (anti-A, anti-B agglutinins)
IgA – exocrine secretions (tears, mucus, sweat, etc.) skin, respiratory, G.I.
IgD – extracellular fluids (ISF, CSF, Plasma, etc.) surface of B cells for activation
IgE – Allergic response (mast cells & basophils)
IgG – 2nd response ("anamnestic" without forgetting) crosses placenta
2. **Memory B- cells** – vary even in clones (Identical Twins)