Fundamentals of Immunology Notes

1.3 Pathogen Varieties

- Different types of pathogens:
  - Virus: Unstructured DNA, Protein Coating.
  - Bacteria.
  - Fungus.
  - Unicellular Eukaryotes.
  - Multicellular Worm.

1.4 Pathogen Recognition

- Neutrophils attach to bacteria prior to phagocytizing them.
- Lysozyme, an enzyme that cuts up bacterial cell wall peptidoglycan.
- Pore in pathogenic membrane constructed by complement MAC.
- Leucine-rich hook domain found in many pattern recognition receptors.
- Properties of Innate vs Adaptive Defenses:

Innate	Fast:Minutes after exposure	Always there	Recognizes patterns: types of molecules that a pathogen might have and you would not have	Neutrophils, macrophages, NK cells, proteins, barriers
Adaptive	Slower: approximately two weeks after first exposure and three days after subsequent exposure	requires gene rearrange-ment	recognizes specific parts of proteins characteristic of a pathogen	B cells, antibodies, T_C cells, T_H cells.

1.7 Innate vs Defensive Responses

- Responding to foreign antigen:

Responding Cell	T_H (Helper)	T_C (Cytotoxic)
Response	Coordinates immune response	Attacks and kills cell
Binds antigen with	$\alpha\beta$ T-cell receptor	$\alpha\beta$ T-cell receptor
Co-receptor	CD4	CD8
Antigen presented/displayed on	Class II MHC	Class I MHC
Cells presenting/displaying	Sentinel dendritic, macrophages, B cells	All nucleated cells except sperm
Source of antige	phagocytosis	synthesized in cell
Antigen hydrolyzed in	phagolysosome	proteosome

2.1 Terminology

- The primary organs are where the genes rearrange to make various recognition molecules. They include:
  - Bone marrow for B cells.
  - Myeloid cell.
  - Thymus for T cells.
- The secondary organs are where the immune cells are activated and counter-antigen. They include:
  - Lymph nodes.
  - Spleen.
  - Regions of the gut.
- Myeloid and lymphoid cells:
  - Myeloid cells are all innate and are found everywhere.
  - Lymphoid cells are only present in lymphs, including B cells, T cells, NK cells, and sentinel dendritic cells.
- Cluster of Differentiation (CD) refers to how cells come out of various separation procedures that involve cytometry. Hence, CDx cells are only informative in the chronological order they were discovered.

2.2 Hematopoiesis

- Pluripotent stem cell has many possible developmental phase.
- Different blood cells:
  - Erythrocytes or red blood cells:
    - Makes up the majority of the cells.
    - Minor cooperation with the immune system.

    - Maintain oxygen supply and pH in blood.
  - Thrombocytes or platelets:
    - Little fragments cells.
    - Pinched off from megakaryocytes.
    - Help stimulate the immune system but not considered part of the white blood cells.
  - Megakaryocytes:
    - Produce platelets to repair blood vessels.
    - Has thrombopoietin receptors, whose activation urges the up-regulation of platelets.

- Workflow of a hematopoietic stem cell: