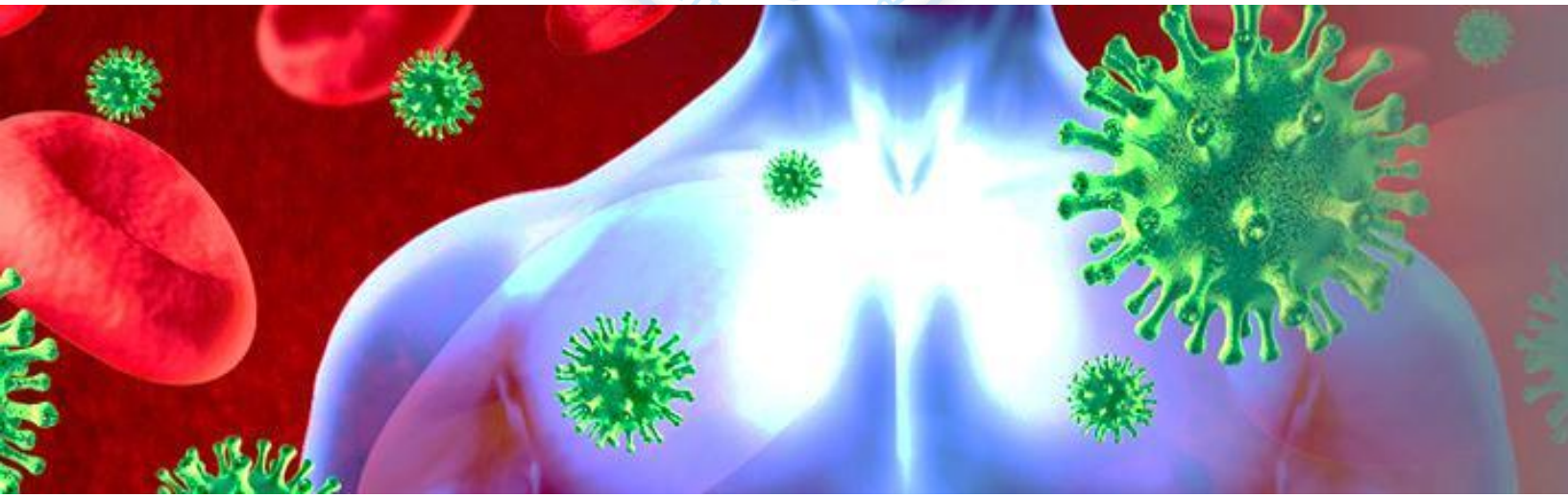
Dr. Adel AlMogren

Introduction To Immunology & The Lymphoid System

Lecture 1



Objectives:

1. Know the historical perspective of immunology.
2. Be familiar with the terminology and definitions.
3. Know the cells of immune response.
4. Understand types of immune responses.
5. Know about the lymphoid system.
6. Understand T & B cell functions.

Videos to Watch:

Immunology Overview (watch before you start)

www.youtube.com/watch?v=LSYED-7riNY

Immunology Course Videos

www.khanacademy.org/science/biology/immunology

Origin

- **In 1798 Edward Jenner began the science of Immunology.**
- ***Louis Pasteur* Introduced Weakened Virulence** (*attenuated*: weakened, non-virulent strain whose exposure can confer resistance to disease.)

Basic Terminology & Definitions

Immunity: **The state of protection from infectious disease.**

Immunology: **The study of mechanisms that humans and other animals use to defend their bodies from invading organisms.**

Cluster of Differentiation (CD): **Molecule with a CD designation has a characteristic cell surface protein are often associated with the cell's function** (used for identification).

Antigen (Ag): **Any substance** (usually foreign) **that binds specifically to a component of adaptive immunity.**

Allergen: **Non-infectious Antigens** (that induce hypersensitivity reactions, most commonly IgE mediated type I reactions).

Antibodies/Immunoglobulin (Ig): **Consists of heavy and light polypeptide chain, it's secreted from plasma cells.**

Adaptive Immunity: **Specific host defenses that are mediated by T & B cells *following* exposure to Ag.**

Innate Immunity: **Nonspecific host defenses that exist *prior* to exposure to Ag.**

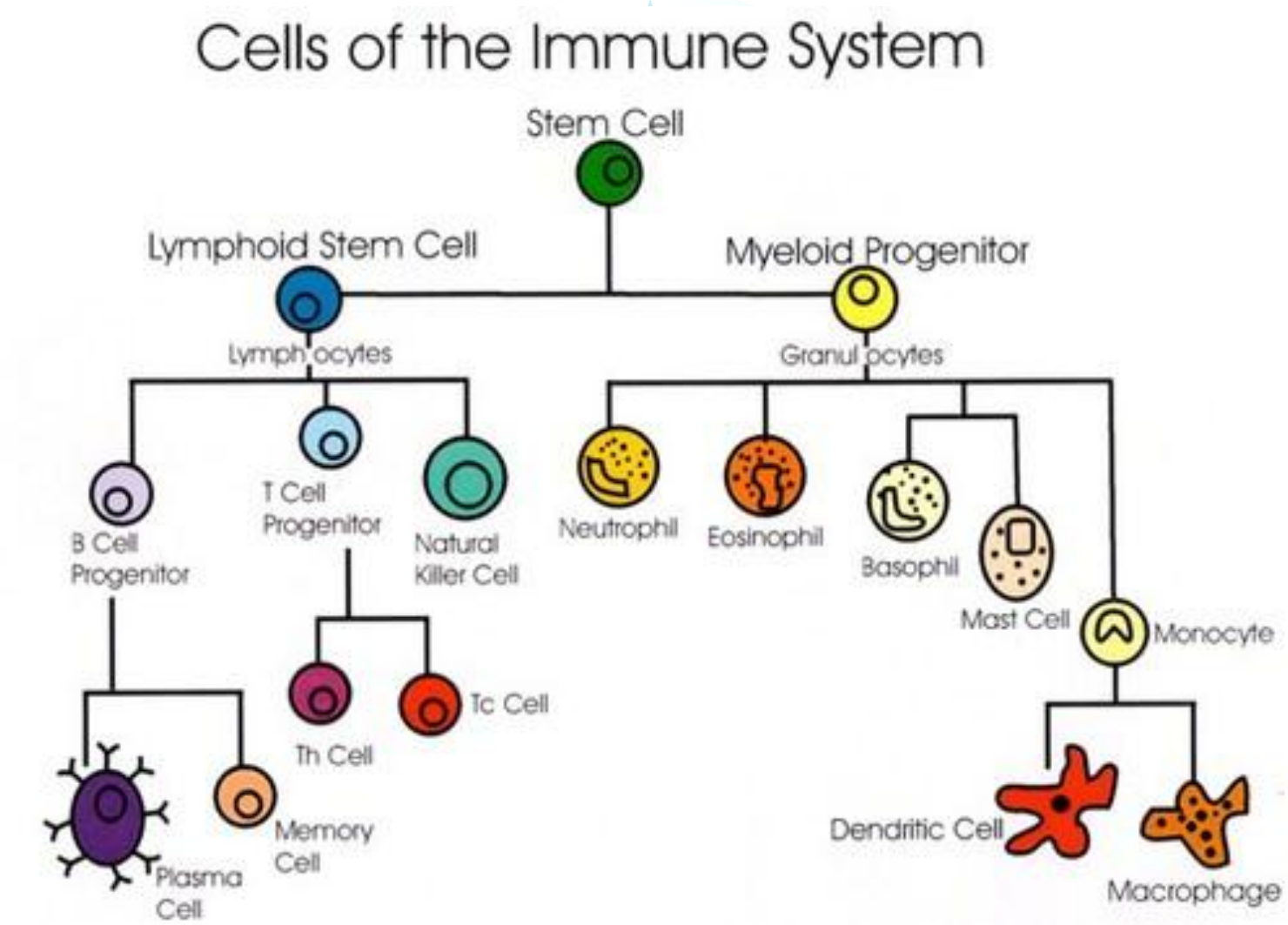
Pathogen: **A disease causing organism.**

Vaccination: **deliberate induction of *protective* immunity to a pathogen.**

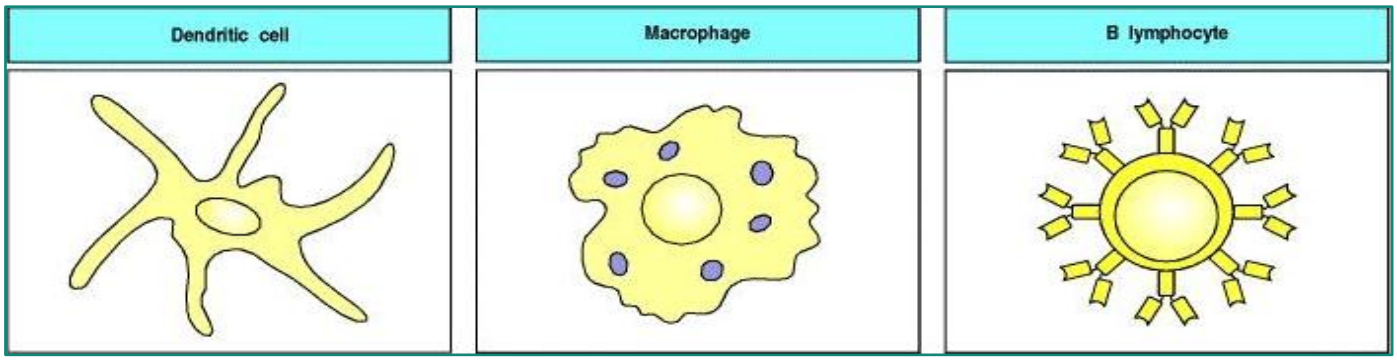
Where & What Are Antigens?

- **Microorganisms** (bacteria, viruses) **& their related products** (proteins, lipids).
- **Environmental substances**
- **Drugs**
- **Organs** (liver transplant)**, tissues, cells**

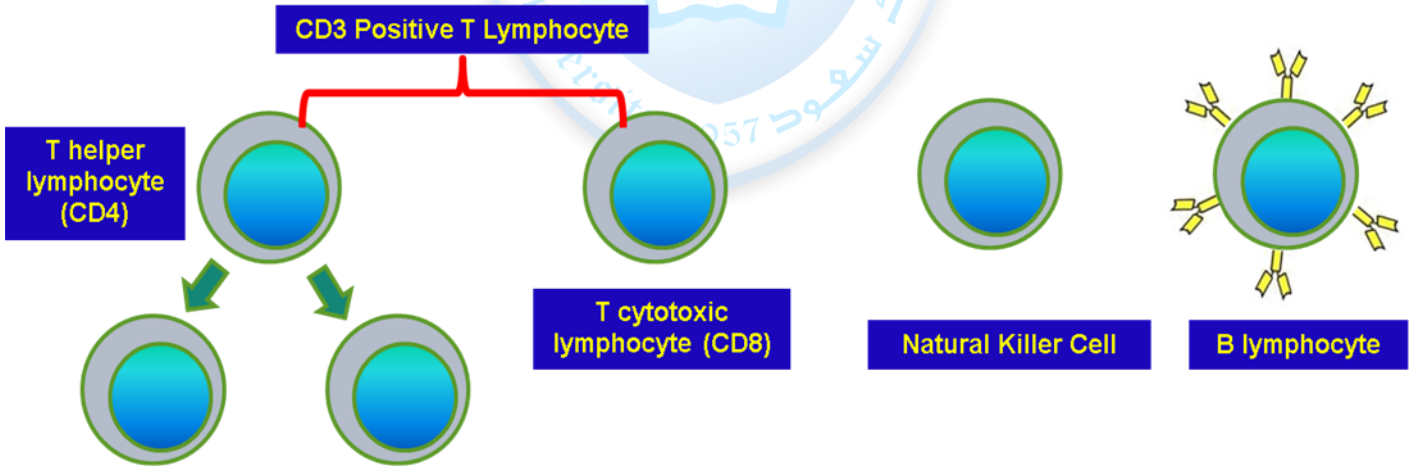
Responding Cells



Antigen Presenting Cells

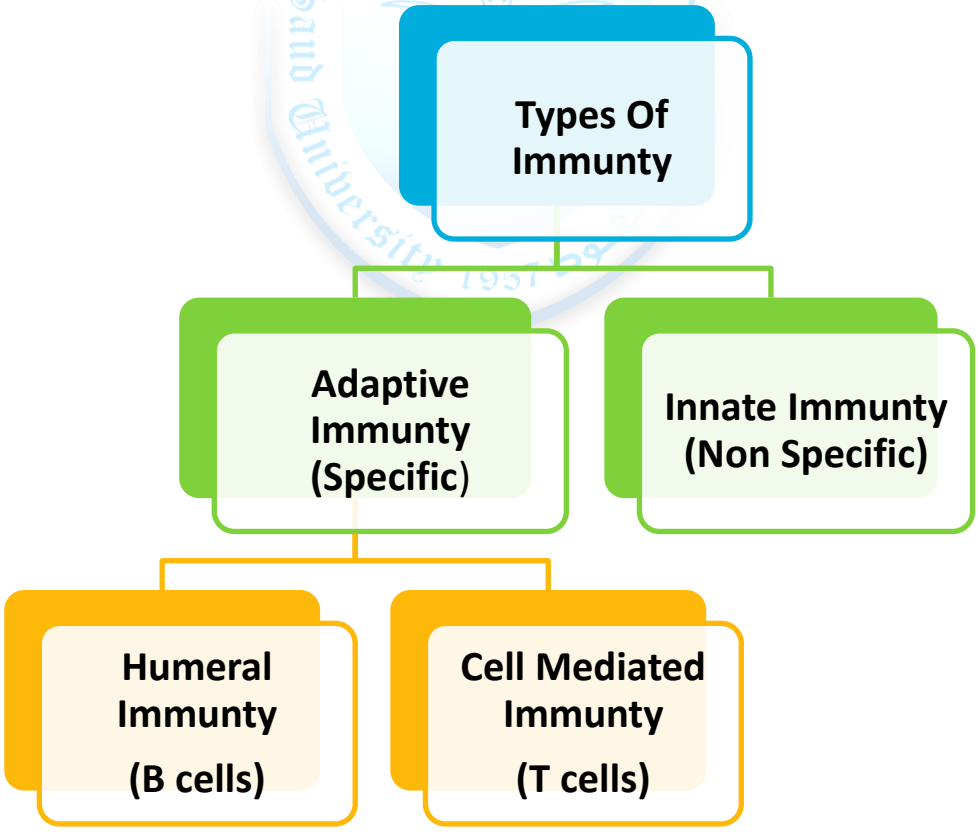


Responding Cells



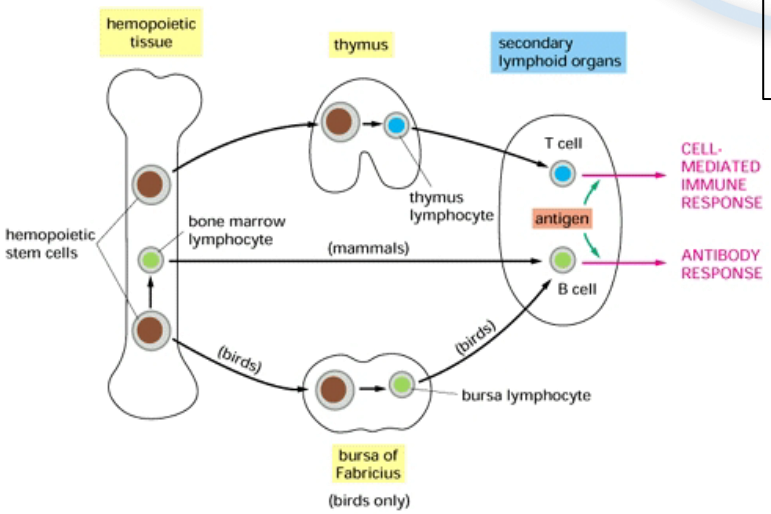
Types of Immunity

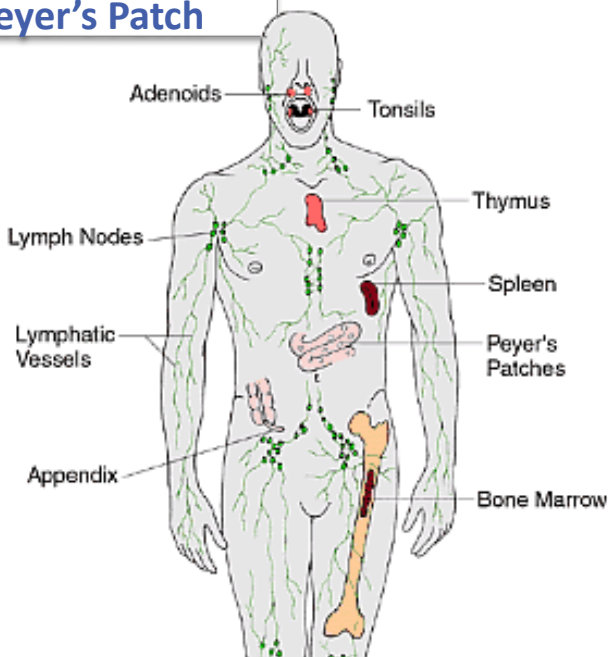
Adaptive	Innate
Specific	Non-specific
Immunological memory (recognition)	No memory
Response of an antigen specific B and T lymphocytes to an antigen	Shorter duration



The Lymphoid System

- **Lymphatic System**
  - **Lymphoid Organs**
    - **Primary**
      - **Thymus**
      - **Hemopoietic Cells** (Bone Marrow)
      - **Bursa Of Fabricius** (Birds Only)
    - **Secondary**
      - **Spleen**
      - **Lymph Nodes**
      - **Appendix**
      - **Tonsils**
      - ***MALT*** (Mucosa Associated Lymphoid Tissue)
        - **Peyer's Patch**
  - **Lympatic Vessels**





T Cells

T-Cells Differentiation:

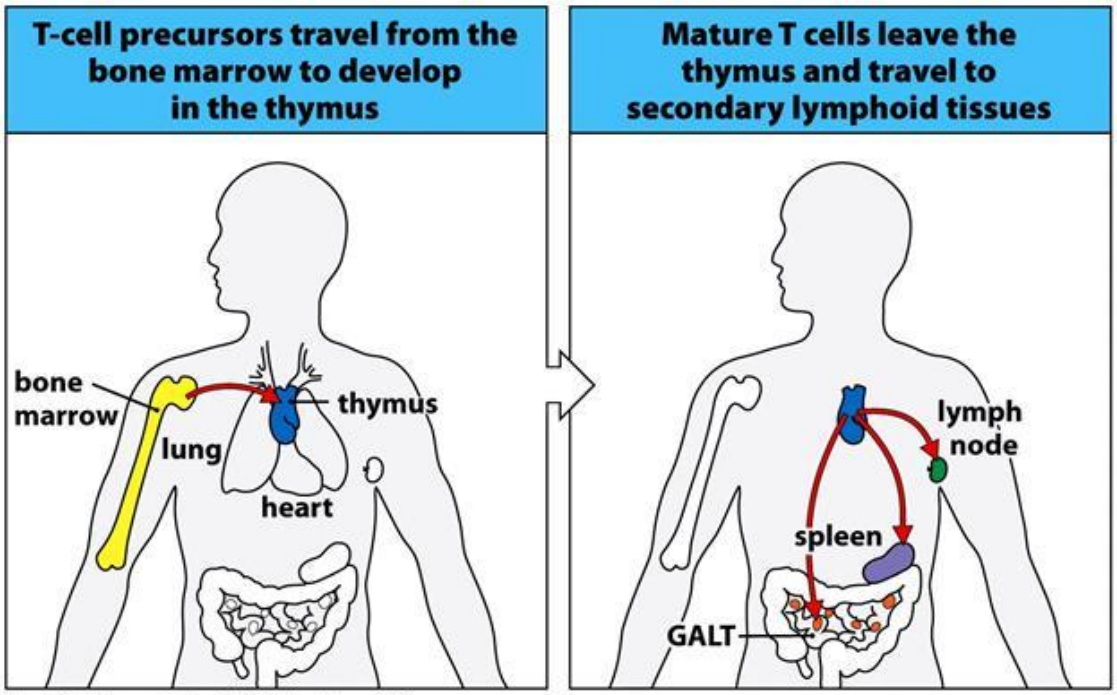


Figure 7.1 The Immune System, 3ed. (© Garland Science 2009)

- **Stem cells lack antigen receptors and *CD3, CD4, CD8* surface markers.**
- **During their passage through *thymus* they differentiate into T cells expressing either markers (*CD4* or *CD8*).**

T-Lymphocytes:

- **All T cells have *CD3* proteins on their cell surface.**
- **Mature T cells have either *CD4* or *CD8* proteins <u>but not both.</u>**

Functions of T helper *CD4* Lymphocytes:

Th 2	Th 1	
Help B cells to develop into antibody producing plasma cells *Th2*	Help CD8 cells to become activated cytotoxic T cells Th1	Help macrophages in cell mediated immunity *Th1* during inflammatory response.

Functions of *CD8* Positive Cells:

They are about 35% of peripheral blood T cells.	They perform cytotoxic functions.	They kill virus-infected cells, tumors and allograft cells (transplant).

B-cells

During embryogenisis **Pre B cells** are produced in the *fetal liver*

Pre B cells are found in the *bone marrow*.

Mature B cells are found circulating in the *bloodstream*.

- **They do not require the *Thymus* for maturation.**

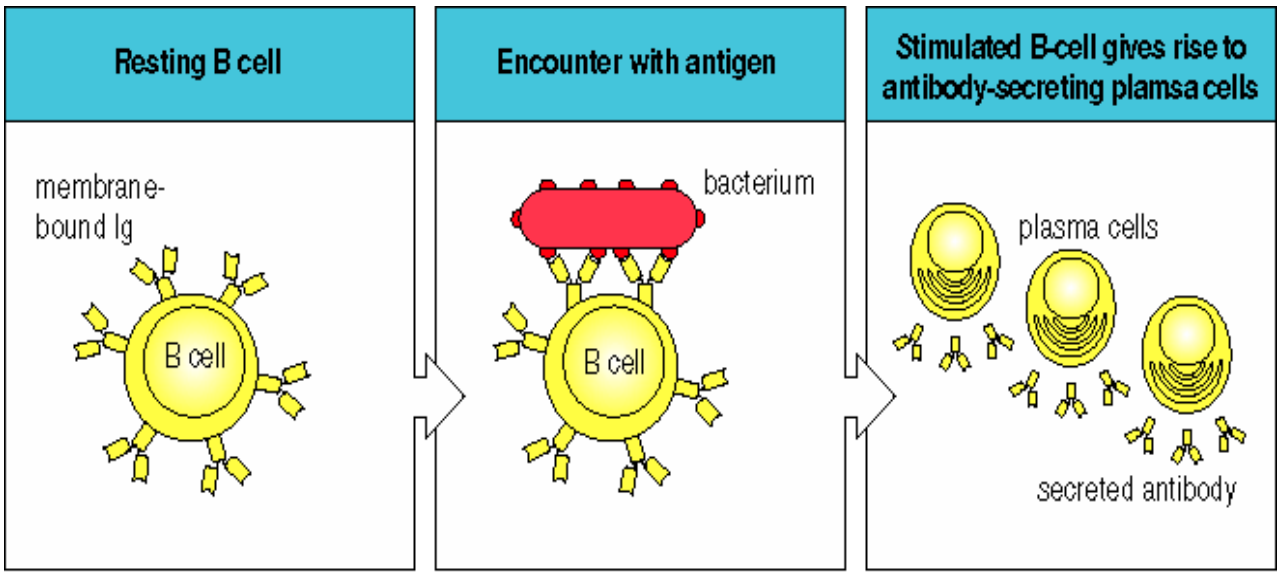
T & B Cells Functions

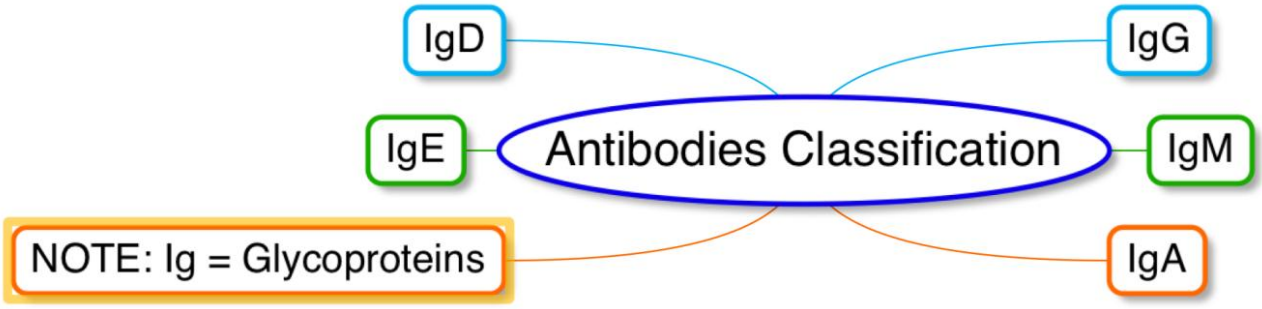
	T cells	B cells
Origin	**Originate in the *Bone Marrow***	**1. During Embryogenesis** (fetal liver) **2. Pre B cells** (bone marrow) **3. Mature** (the blood)
Maturation	**Maturate in the *Thymus***	**Do not need Thymus for maturation**
Antigen Receptors	• **Lack Antigen Receptors** • **Mature T Cells have *CD4* protein** (T helper lymphocytes) **or *CD8* protein** (T cytotoxic lymphocytes) ***but not both.***	**They display IgD *and\or* IgM** (serve as antigen receptors)

Antibodies (Immunoglobulin)

1. **They are glycoprotiens.**
2. **After binging to specific *antigens* they differ in:**

- **size**
- **amount of CHO**
- **biological fuctions**

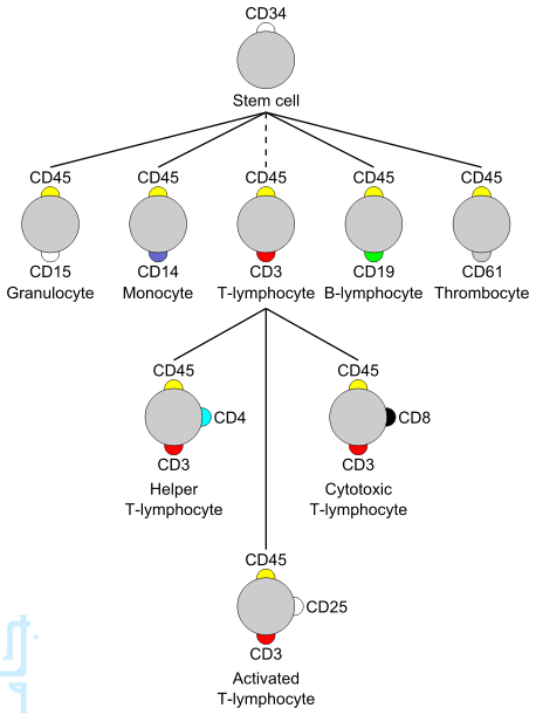




Summary

CD: is used for identification

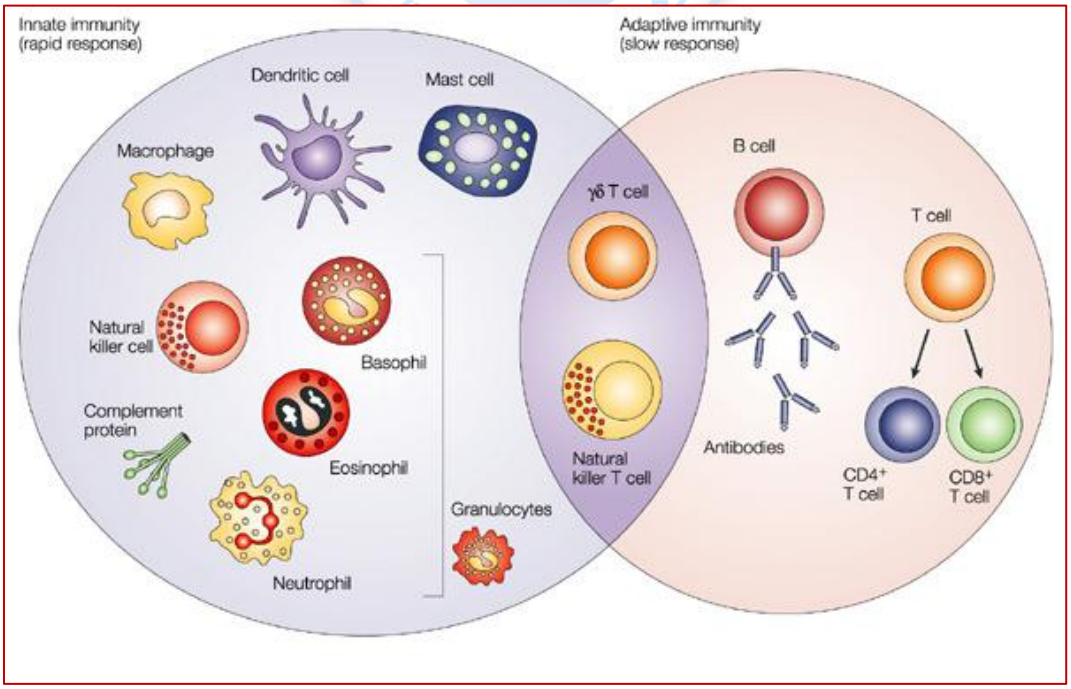
- Stem cells lack antigen receptors
- CD3 in T lymphocyte
- CD4 in helper T lymphocyte
- CD8 in cytotoxic T lymphocyte



Types of Immunity:

1. Adaptive (Specific) Immunity
   - Humoral Immunity (B-cells)
   - Cell Mediated (T-cells)
2. Innate (Non Specific) Immunity

   No memory, Natural



MCQs :

1) Innate immunity is all of following except:

a. Has no memory
b. Natural immunity
c. Acquired immunity
d. Prior to antigen

2) Immunoglobulin (Ig) is secreted from:

a. Stem cells
b. Plasma cells
c. Monocytes
d. Dendrite cells

3) One of the following is NOT a secondary lymphoid organ:

a. Thymus
b. Spleen
c. Tonsils
d. Appendix

4) Which of the following helps B cells to develop into antibody producing plasma cells?

a. CD4
b. CD8
c. CD3
d. CD4 and CD8

5) What is the final destination of B cells?

a. Thymus
b. Bone marrow
c. Fetal liver
d. Tonsils

Answers: 1. c , 2. b , 3. a , 4. a , 5. d