



MEDICINE
KING SAUD UNIVERSITY

Foundation Block

Lecture one

Introduction to Immunology & the lymphoid system

IMMUNOLOGY

4 3 6 ' s T E A M W O R K

Objectives:

- To know the historical perspective of immunology
- To be familiar with the basic terminology and definitions of immunology
- To recognize immune response cells
- To understand types of immune response
- To know about the lymphoid system
- To understand T and B cell functions

- **Important.**
- Extra notes.
- **Females notes**
- **Males notes.**

Introductory video

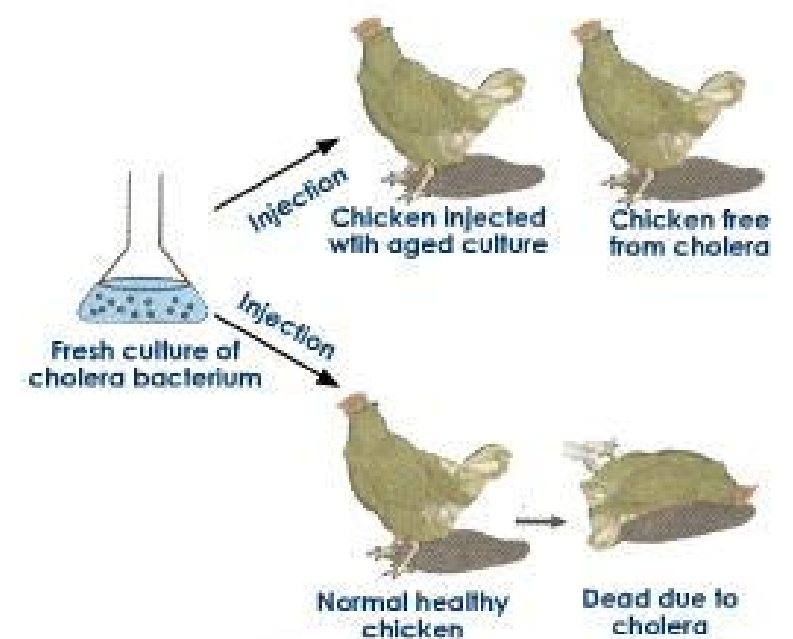
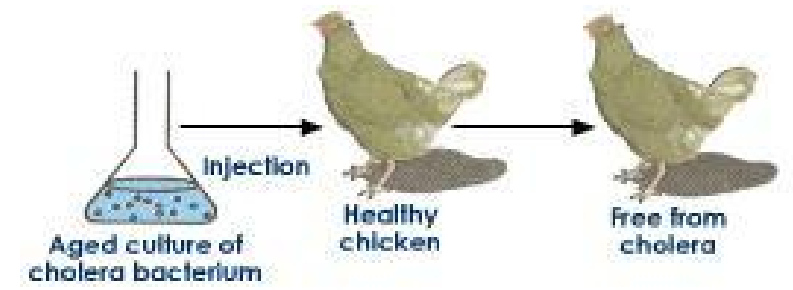
A great overview of the lecture

Edward Jenner:

- ◆ In 1798 Edward Jenner began the science of Immunology (the study of the body's response to foreign substances).
- ◆ Observation: Milkmaids who contracted cowpox (a mild disease) were subsequently immune to small pox¹.

Louis Pasteur:

- ◆ The virulence of pathogen weakens with **age**
- ◆ Chickens inoculated with old strains not only survive but become **resistant**
- ◆ Observation: check the diagram.



The classic experiment of Pasteur with chicken (fowl) cholera

Terminology:

- **Immune** (Latin: immunus): To be free, exempt.
People survived ravages of **epidemic diseases** when faced with the same disease again.
- **Immunity**: The state of **protection** from infectious disease
The study of mechanisms that humans and other animals use to defend their bodies from invading organisms such as bacteria, viruses, fungi, parasites and toxins
- **(CD) Cluster of Differentiation**: Molecule with a CD designation is a characteristic cell surface protein often associated with the cell's function.
- **Antigen (Ag)**: Any substance (usually foreign) that binds specifically to a component of the adaptive immunity (T and B lymphocytes).
- **Allergen**: Noninfectious antigens (that are from environment but not derived from microorganism) that induce **hypersensitivity reactions**, most commonly IgE- mediated type I reactions.
- **Immunoglobulin (Ig) or Antibodies**: Secreted from plasma cell (B cell).
Consists of a heavy and light polypeptide chains linked to each other via **disulfide bonds**.
- **Adaptive Immunity**: **Specific** host defenses that are mediated by T & B cells following exposure to Ag (takes time).
- **Innate immunity**: **Nonspecific** host defenses that exist prior to exposure to Ag (very quickly).

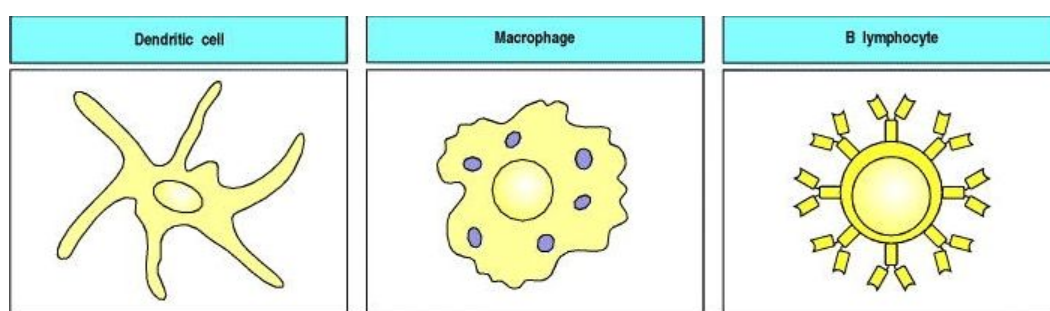
- **Pathogen:** a disease causing organism.
- **Vaccination:** deliberate induction of protective immunity to a pathogen. (comes from Vacca “cow in latin”)

Where & what are antigens?

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

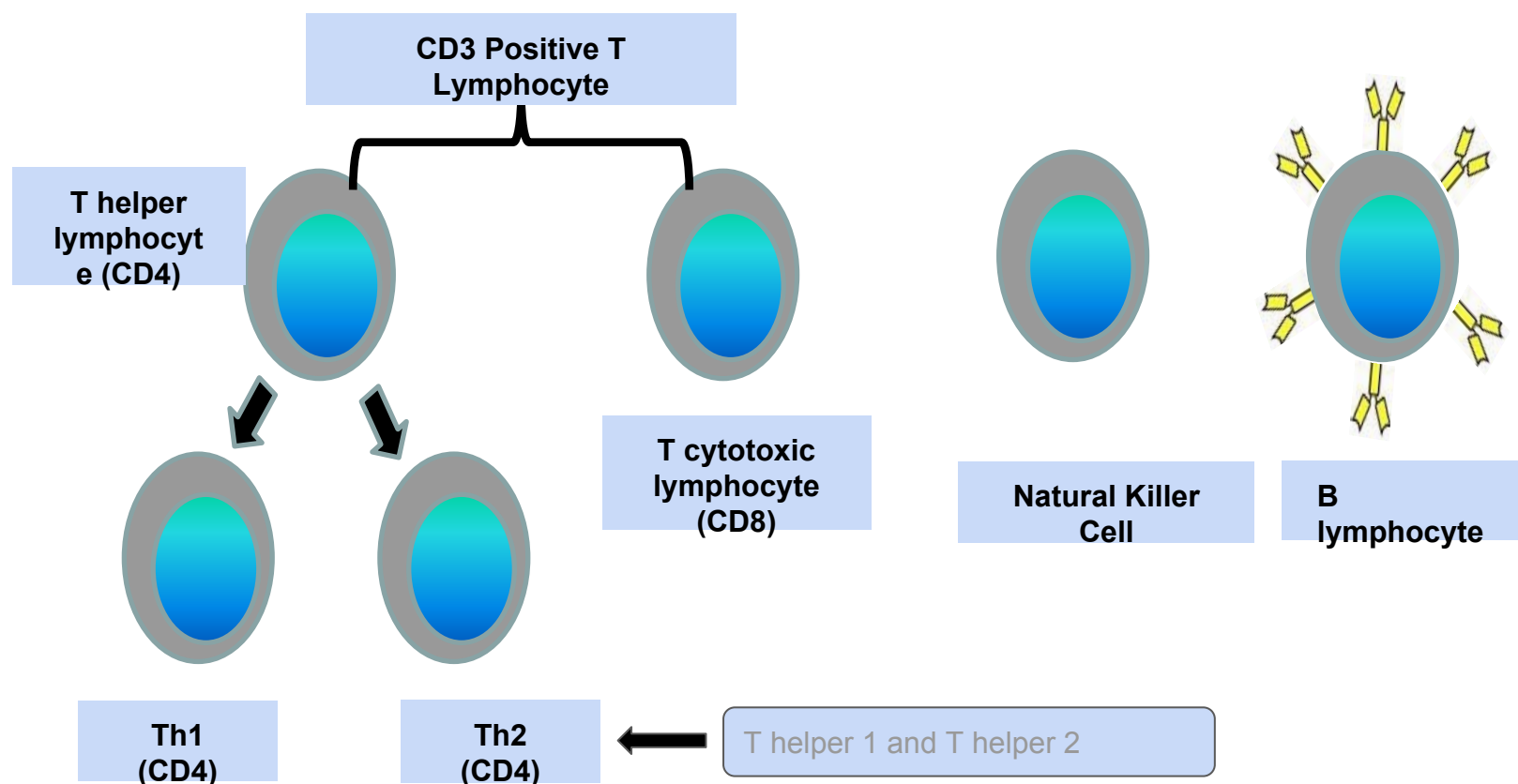
Antigen presenting cells:

T-lymphocytes are unable to recognize antigen they need to be presented by antigen presenting cells

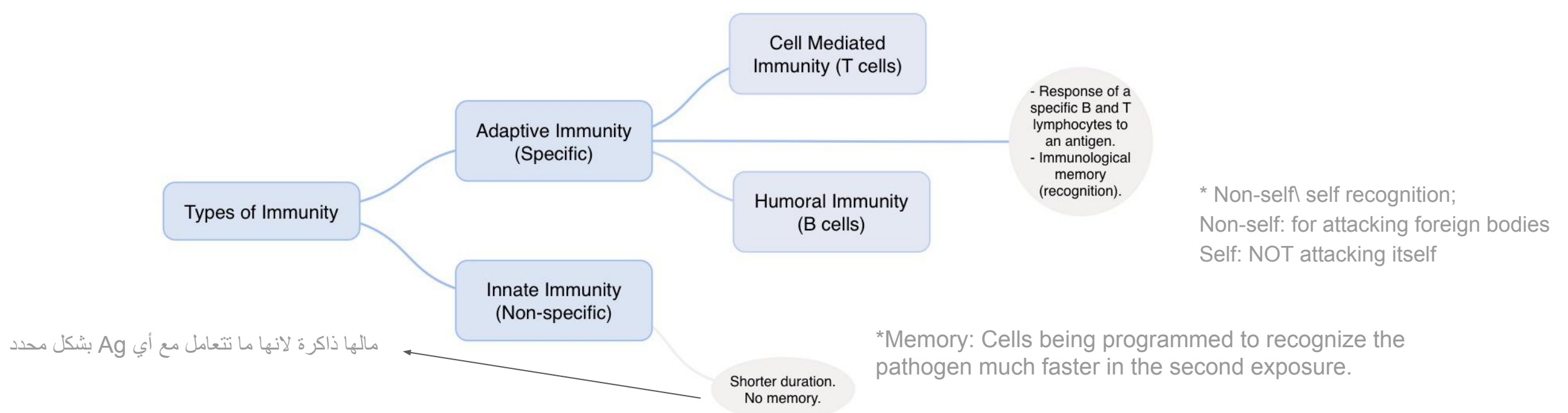


Macrophages:
Macro means big and phages means to eat

Responding cells:



Types of Immunity:

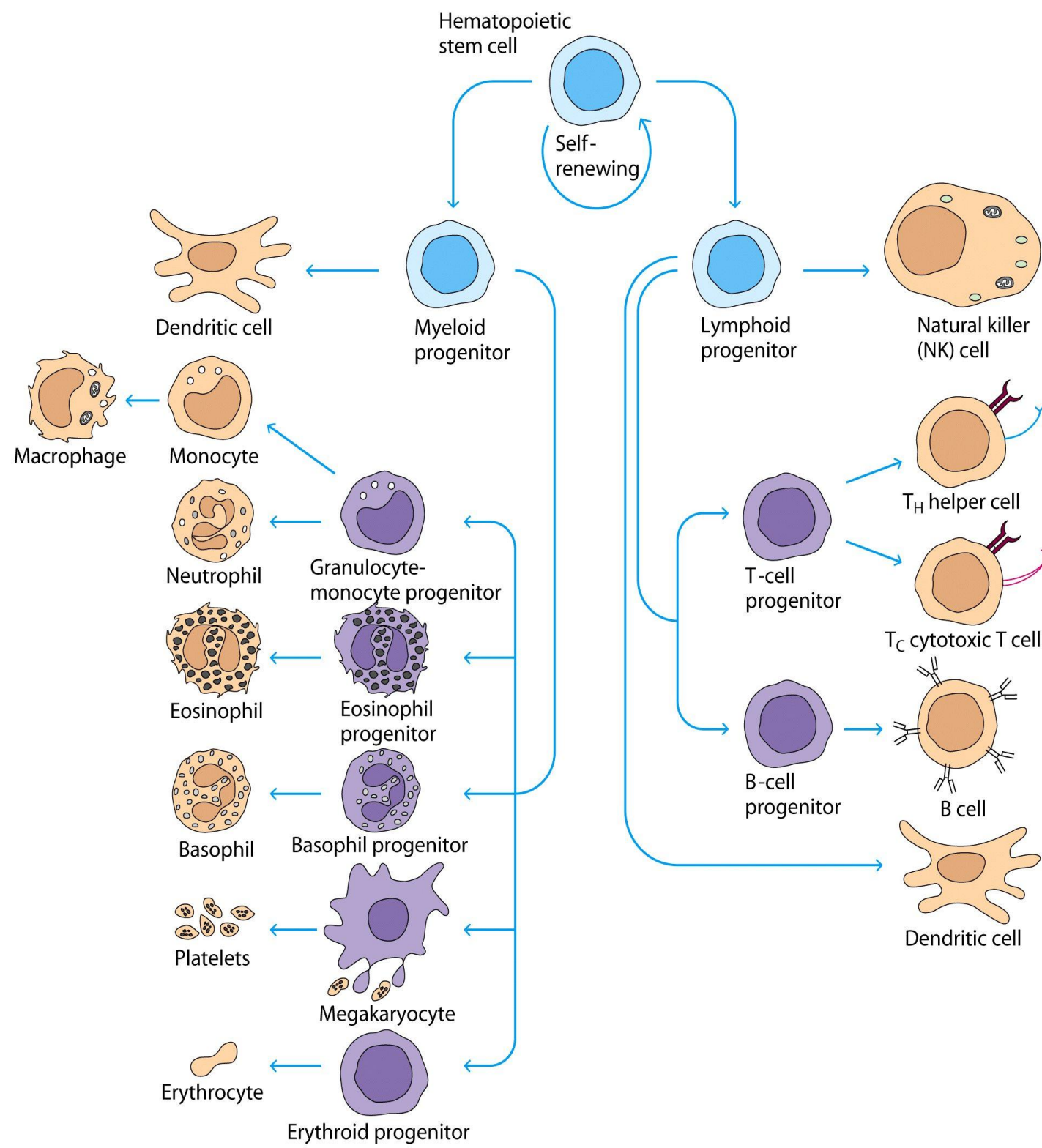


[Video about antigens](#)

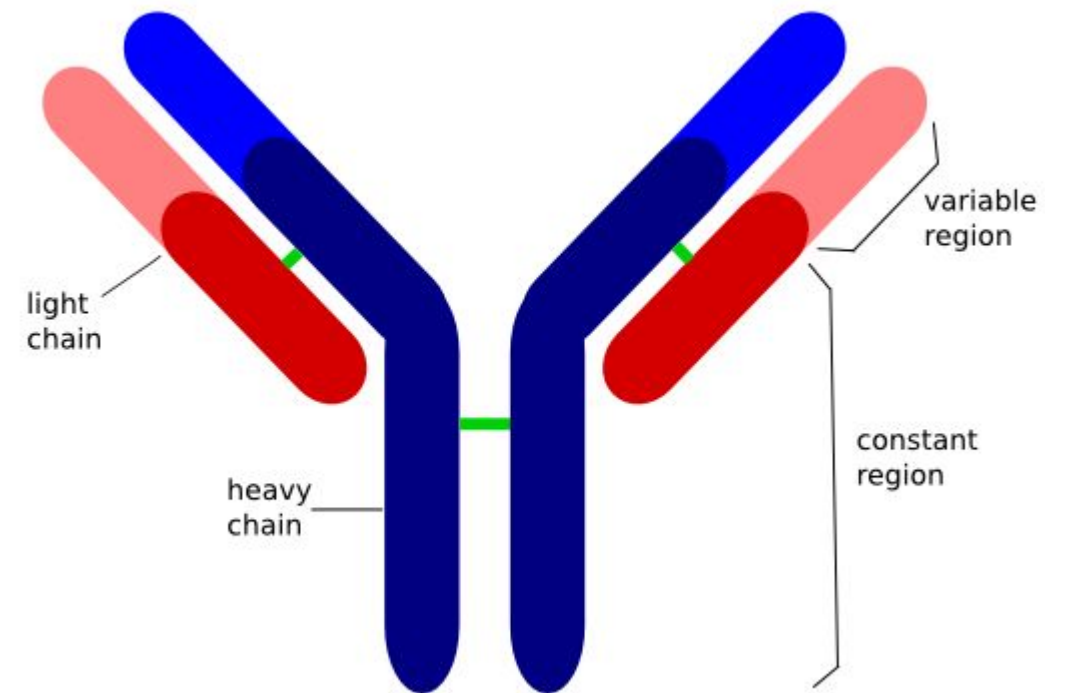
[Video about antibodies](#)

[Video about types of Immunity](#)

Cells of Immune system:

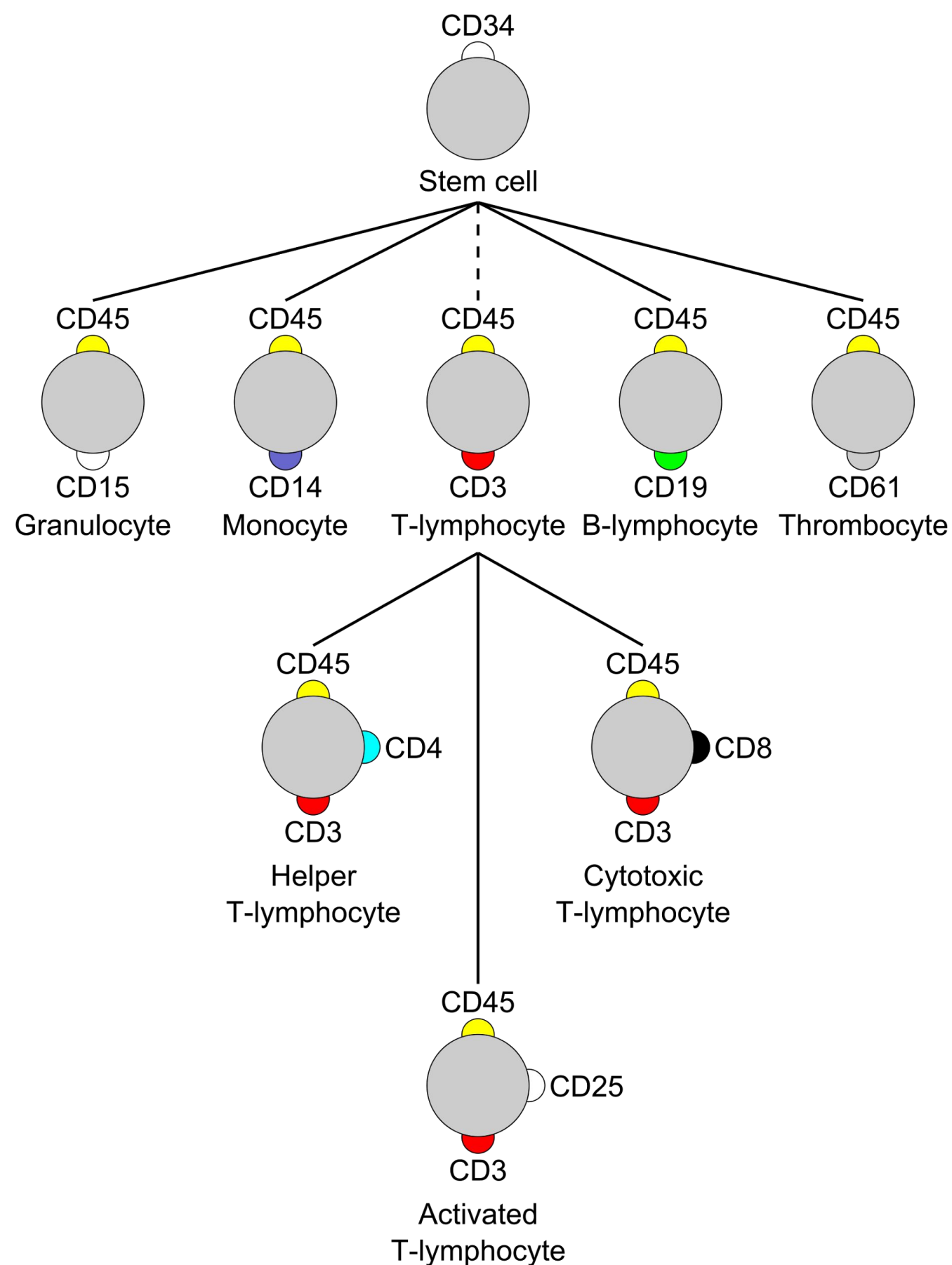


Structure of antibodies:



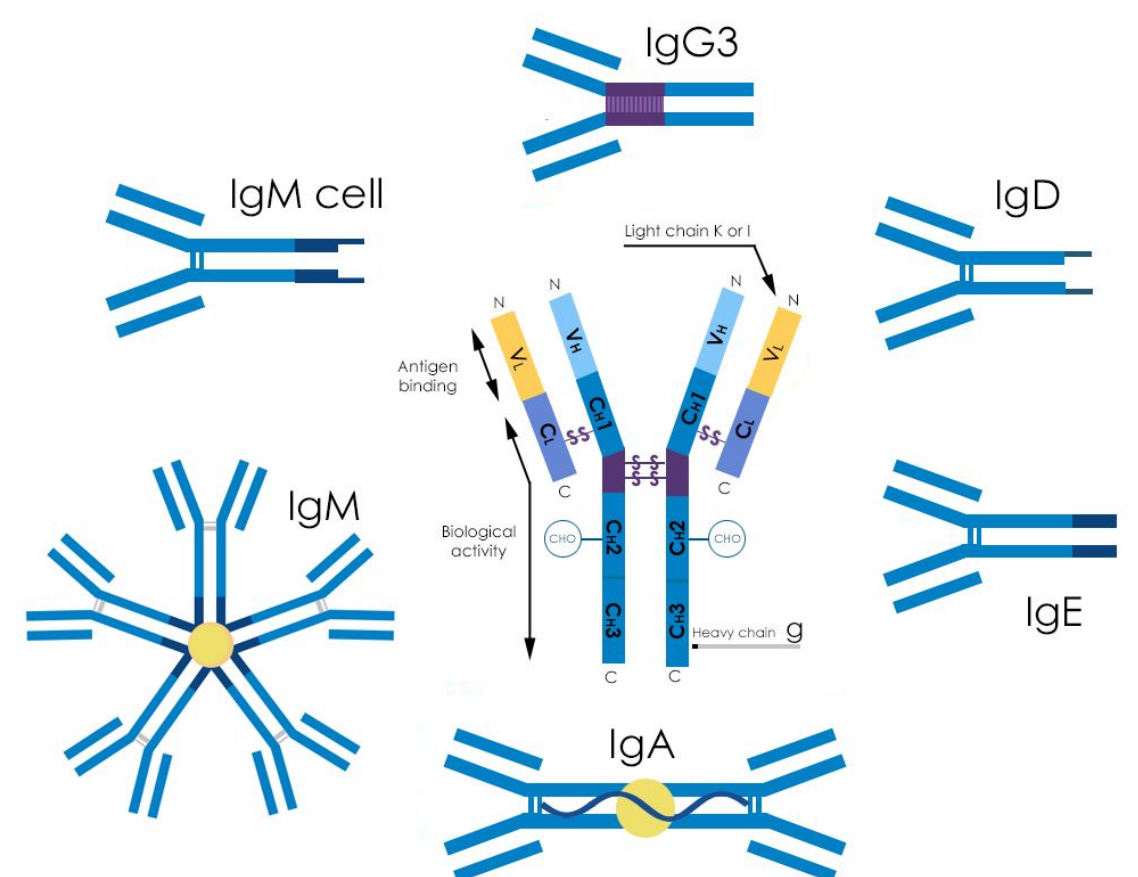
Cluster of differentiation (CD):

[Video about CD](#)



Extra explanation: Structure of different antibodies

غير مطالبين فيها فقط للتوضيح



Lymphoid system:

- Lymphatic vessels.
- Circulating lymph
- Primary lymphoid organs:
 - ★ Thymus
 - ★ Bone marrow
- Secondary lymphoid tissues:
 - ★ Spleen
 - ★ Lymph nodes
 - ★ Tonsils
 - ★ MALT (Mucosa Associated Lymphoid Tissue)
 - ★ Peyer's patches

Lymphoid series comprise of two main lymphocyte populations:

- T cells
- B cells

T-Lymphocyte Differentiation:

- T cells originate in Bone Marrow then migrate to **Thymus** for development.
- T cell precursors differentiate into mature T cells in thymus
- Stem cells **lack** antigen receptors and **CD3, CD4, CD8** surface marker
- During their passage through thymus they differentiate into T cells expressing either markers (**CD4 or CD8**)
- **All** T cells have **CD3** proteins on their cell surface
- **Mature** T cells have **either CD4 or CD8** proteins but not both

Functions of T Helper Lymphocytes:

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

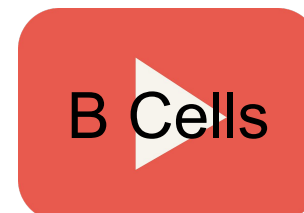
CD8 positive cells Cytotoxic T Cells:

- About 35% of peripheral blood T cells
- Perform cytotoxic functions
- They kill virus-infected cells, tumors and allograft cells (transplant)

B lymphocyte:

Origin:

- During embryogenesis – **fetal liver**
- Migrate to **bone marrow** – final destination
- They **do not** require thymus for maturation



Display:

They display Surface:

- IgM
- IgD

They both serve as an antigen receptor

Found:

Pre B cells:

found in Bone Marrow

- Mature B cells:

found circulating bloodstream

Antibodies (Immunoglobulins):

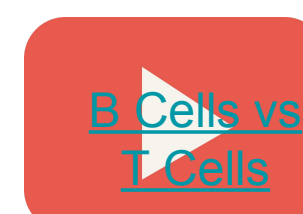
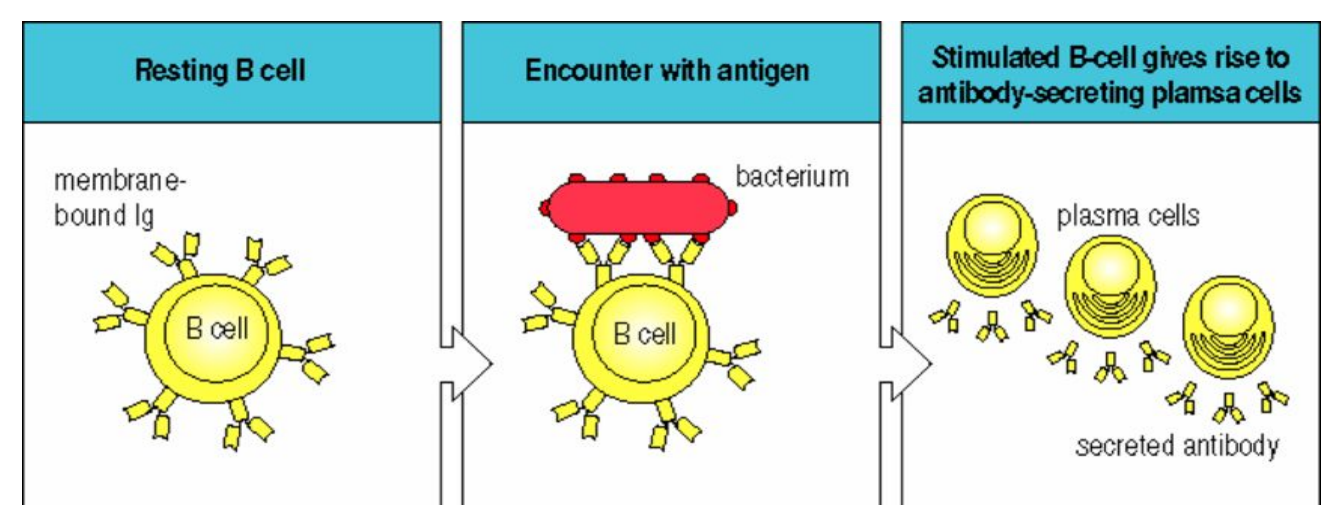
Immunoglobulins (Ig) are grouped into 5 classes:

- IgG
- IgM
- IgA
- IgD
- IgE

Remember:
GAMED

- Ig are **glycoproteins**

- They differ in **size, amount of CHO** and **biologic functions** after binding to specific antigens.



MCQs:

1- Humoral immunity is mediated by:

- A. T cells
- B. Macrophages
- C. B cells
- D. Phagocytes

2- Primary lymphoid organs include:

- A. Thymus and spleen
- B. Thymus, bone marrow, and spleen
- C. Thymus and bone marrow
- D. Thymus, bone marrow, spleen, and lymph nodes

3- Which of the following is the site of T cell maturation?

- A. Bone marrow
- B. Thymus
- C. Spleen
- D. Lymph nodes

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

- A. CD8
- B. CD3
- C. CD4
- D. non of the above

5- Origin and maturation of B cells takes place at:

- A. Bone marrow
- B. Thymus
- C. Spleen
- D. Lymph nodes

6- Antibodies are:

- A. Polysaccharides
- B. Glycoproteins
- C. Lipoglycans
- D. Glycerol

7- Non-specific host defences that exist prior to exposure to an antigen is called:

- A. Innate immunity
- B. Adaptive immunity
- C. Acquired immunity
- D. All the above

8- Which of the following is not an antigen presenting cell?

- A. B-lymphocytes
- B. T-lymphocytes
- C. Dendritic cells
- D. Macrophages

Answers:

- 1. C
- 2. C
- 3. B
- 4. C
- 5. A
- 6. B
- 7. A
- 8. B



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Contact us

Email: Immunology436@gmail.com

Twitter: [Immunology436](https://twitter.com/Immunology436)

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4 3 6 ' s T E A M W O R K

Team Leaders

Ghaida Alsaeed

Basel almeflh

Team members

Aroob Alhuthail

Abdullah alharbi

aldorah Alhamdi

Abdulmajeed almutairi

Ghada Alskait

Abdulmajeed alammarr

Hanin Bashaikh

Basel alanazi

Lara Alsaleem

Moayed Ahmed

Rawan Alwadee

Mohammed alhammad