Foundation block

Introduction to Immunology and the lymphoid system

Lecture 1

432 Immunology team

Objectives:

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

What do we mean by Immunology?

Immunology is the science concerned with the study of structure and function of immune system (protection).

Observation:

-Milkmaids who contracted cowpox (a mild disease caused by a virus) were subsequently immune to small pox (fatal disease caused by a virus).

In other words, getting cowpox (less dangerous) used to protect (immune) people from getting small pox (more dangerous).

Small pox was an infectious disease until it was eradicated

○ Louis Pasteur's Contributions:

- Determined through studies of cholera in chickens that the virulence of a pathogen weakens with age.

- Attenuated: weakened, non-virulent strain whose exposure can confer resistance to disease.

Attenuated vaccines are vaccines created in labs (kept there for few months in a certain medium or culture) until they lose their capability of causing a disease (harmless or less virulent). After you have been vaccinated the body will be protected from that certain virus (increase in immunity).

○ Classical experiment :

Heat attenuated anthrax bacillus (Anthrax was used before as biological weapon- sent via mail- people died from inhalational of anthrax) and subsequent challenge with virulent Bacillus anthracis in sheep.

○ Observation : Cholera:

Cholera

Explanation of observation:

لدينا انبوبين، انبوب عرف بإنه(aged bacterial culture) رقم 1

وانبوب آخر (fresh bacterial culture) رقم 2

"Age bacterial culture "

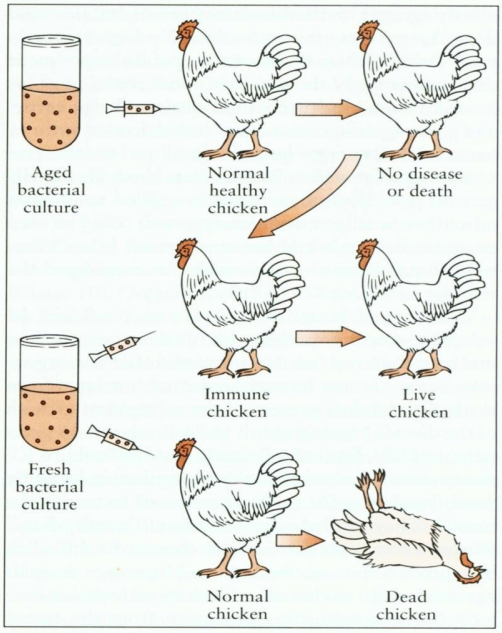
وهنا تم حقن الدجاجه رقم 1 بالبكتيريا بعد ما أصبحت ضعيفه مع الوقت

و كان الناتج عدم وجود مرض ولا موت

"Fresh bacterial culture "

الدجاجه رقم 1 لم تتعرض لأي مرض بسبب حقنها من الانبوب رقم 1
وتكون المناعه لديها من البكتيريا في الإنبوب رقم 2

وفي المقابل الدجاجة رقم (2) قد ماتت بعد إعطائها من البكتيرايا في الأنبوب رقم (2) وذلك لعدم تعريضها للبكتيريا الضعيفة من قبل.



○ Definitions:

1. **(CD) Cluster of Differentiation**
   - We have 279 CDs.
   - We recognize people by their features, the cells are the same. We recognize a certain cell (type and function) by the protein attached to it.
   - CD 8 = cytotoxic.
   - CD 4 = helper cells. (divide into (Th1) and (Th2))
2. **Antigen (Ag):**
   - Antigens are proteins that may or may not belong to your body.
   - They are usually recognized as foreign substance.
3. **Allergen**:
   - Same idea of antigen but it causes allergy.
4. **Immunogen:**

   -They are foreign bodies that stimulate the immune system to provide antibodies (like vaccine of hepatitis B).
5. **Antibody (Ab):**
   - They bind to destroy foreign bodies.
6. **Immunoglobulin (Ig)**
7. **Epitope (antigenic determinant):**
   - Antibodies bind to a specific area in the organism called (epitope).
8. **Adaptive Immunity**
9. **Innate immunity**

   - born with.

   - When babies are 6 months old they start to form their own immune system.

10.Pathogen

11.Vaccination

- Where & what are antigens?

Myeloid cells

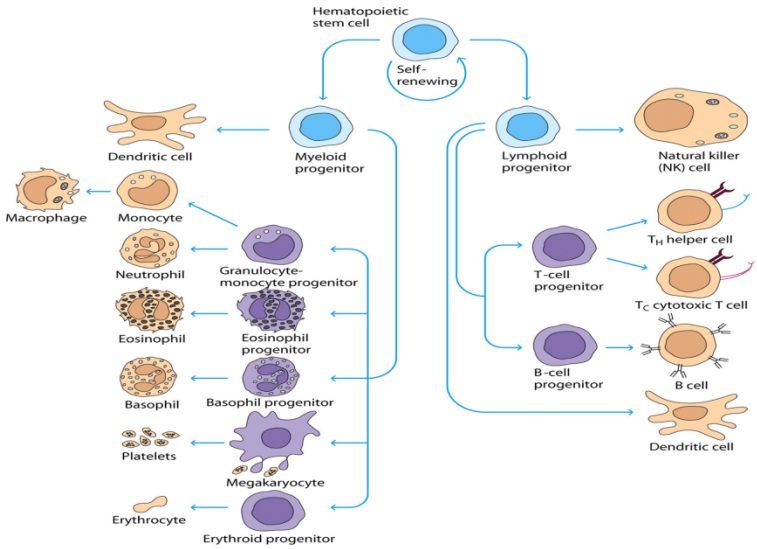
-Granular

-Have more than one nucleus (PMN)

Lymphoid cells

-A granular

-One nucleus



- Types of immunity:

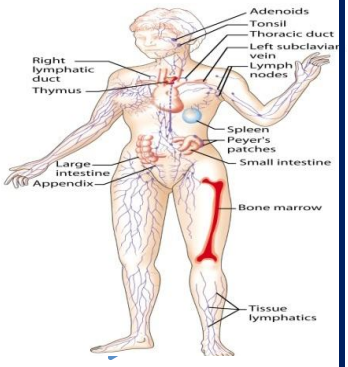
Innate (nonspecific) Immunity	Adaptive (specific) Immunity
-Shorter duration -No memory	-Response of an antigen specific B and T lymphocytes to an antigen. -Exhibit immunological memory, specificity and self/nonself recognition.

○ Types of adaptive immunity:

Humoral immunity	Cell Mediated Immunity
Immunity that is mediated by antibodies (B cells) (anti bodies production)	Immune response in which antigen specific T cells dominate (produce cells to kill organism)

○ Lymphoid System

- Primary lymphoid organ: Bone marrow, thymus
- Secondary lymphoid organs : spleen, lymph nodes, tonsils, appendix



Most of immune reactions happen in lymph nodes.

- We have 2 types of lymphocytes:
  1. B-lymphocytes come from bone marrow.
  2. T-lymphocytes come also from bone marrow and become mature in thymus.

- All T cells have CD3 proteins on their cell surface
- Mature T cells have either CD4 or CD8 proteins but not both

Functions of Helper Lymphocytes (CD4 Lymphocytes)

Th1	Th2
*Help CD8 cells to become activated cytotoxic T cells *Help macrophages in cell mediated immunity	*Help B cells to develop into antibody producing plasma cells

CD8 positive cells

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

B cells

- During embryogenesis – fetal liver
- Migrate to bone marrow – final destination
- They do not require thymus for maturation
- B cells display surface IgM which serves as antigen receptor
- Surface IgD on some B cells also serves as an antigen receptor
- Pre B cells are found in bone marrow and mature B cells are found circulating in bloodstream.

- The anti-bodies

  -Anti bodies are also called Immunoglobulins (Ig) are grouped into 5 classes: (remember (G then MADE)).

- Random notes :

  - We have different types of vaccines.
  - The more you get injections (vaccinations) the better your immunity will become.
  - Some viruses affect you only once like measles.
  - Immunity in our bodies differs from one organism to another.
  - Influenza (flu) is caused by different types of virus.
  - Tuberculosis (TB) vaccine is usually given first days after birth.
  - Why we get 3 doses of hepatitis B vaccine? To enhance immunity in our body (protects you for 3 to 4 years).

We are not perfect, but with your help, our work can be flawless..

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