مقدمة في علم المناعة الطبّي

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Medical Committee
The University of Jordan

IMMUNOLOGY

Lec# 2 **,Date(** 26/6/2014 **)**

Subject:

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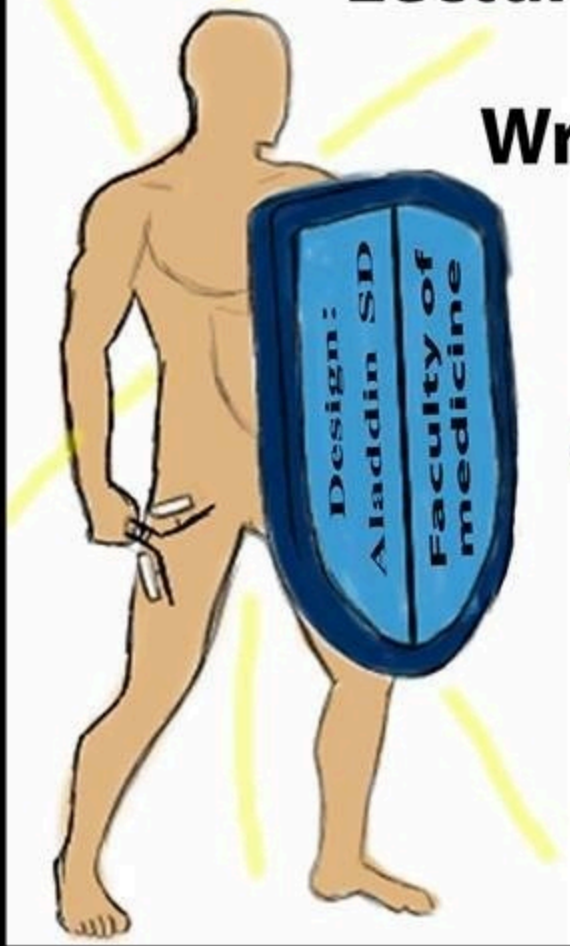
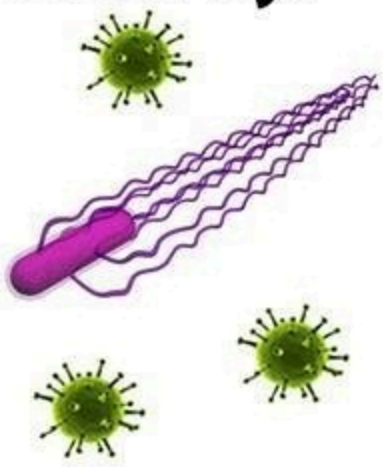
Written by:





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Introduction to Immunology.

The main function of the immune system is to recognize self from non-self, in order to get rid of foreign material and maintain the organism in good health.

There are two mechanisms by which the immune system can effect this function :

I- Innate immunity : this is natural, present from birth, non-specific, available immediately. No memory is involved.

a)- Physiological barriers and their secretions : Skin (acid pH of sweat and sebaceous secretions). Mucous membranes (mucus and cilia, gastric juices, proteolytic enzymes of GIT, acid pH of vagina, lysozyme in saliva, tears.). Flushing action like urine.
Normal flora (bacteriocins) antibiotics can have a detrimental effect on the normal flora.

b)- Phagocytosis : phagocytic cells comprise PMN and macrophages. These engulf foreign matter and destroy it in lysosomes.
Macrophage mannose receptor, LPS receptor (and other surface lectins) : these are non-specific receptors (pattern recognition receptors – PRR, also called Toll like receptors) that recognize non-mammalian molecules present on the surface of foreign particles (PAMP pathogen associated molecular patterns) e.g. bacteria. LPS, Flagellin, Lipoteichoic acid, dsRNA, Peptidoglycan.
Some of these proteins are secreted e.g. mannose binding protein, ficolin.
Opsonins greatly enhances phagocytosis (as the number of "natural" recognition molecules is limited) :
zippering effect with actin filament formation in the cytoplasm at the site of contact of plasma membrane with particle.
Phagosome, phagolysosome, respiratory burst, for killing of bacteria.
There are also natural killer cells which are large lymphocytes that can attack and kill foreign cells. Eosinophils also play a role.
Chemotaxis.

c)- Complement : plays an important role in the elimination of foreign material or antigen; it acts as an opsonin for phagocytosis, and also in the lysis of cells. Also acts as chemotactic agent (C5a) hence the inflammatory function of complement.

d)- Fever : high temp. unfavourable for growth of pathogens. It also interferes with the availability of iron required for bacterial growth (interferes with siderophores).
The inflammatory process is a natural means of immunity. Histamine and related agents ECF-A and NCF-A.

e)- The body produces chemicals e.g. interferons that result in anti-viral state (the metabolism of the cell is arrested, thus no new virus can be synthesized), cytokines that

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promote the process of inflammation. Inflammation in general is an innate mechanism, also effector part of acquired immunity.

f)- Acute phase proteins e.g. C-reactive protein (C-polysaccharide on pneumococcus). Mannose binding protein (binds to bacterial saccharides) , this is bound to MASP (mannan associated serine protease which cleaves C4 thus activating the mannan complement pathway).
Both activate complement.

g)- Defensins : these are short peptides that act as "antibiotics"
that produce lysis in pathogens. Believed to act on membranes that lack sterols.

II- Acquired immunity :

Active and passive immunity.
This is specialised, recent in evolution, only present in vertebrates. It is specific. The individual is endowed with the capability to mount an immune response to any antigen from birth, but has to be exposed to the antigen before mounting such a response (a process called immunization), the response results in the production of certain lymphocytes and antibodies that are specific to that antigen.

Three types of cells are usually involved in acquired immunity : T-lymphocytes, B-lymphocytes and macrophages.

Another feature of acquired immunity is Memory. On a second exposure, there is a rapid response which is larger, quicker and of better quality.

There are two types of Acquired immunity :

I- Humoral : antibodies are produced by B-lymphocytes, these are serum globulins, also known as immunoglobulins or Ig for short. An Ig combines with an antigen leading to its neutralization and elimination., or to a cell wall leading to its lysis. Complement plays an important role in Humoral immunity.

II- Cell-mediated immunity : Lymphocytes that bear specific surface receptors, can recognize and bind specific antigens resulting in an immune response. These cells are T-lymphocytes and can be helper, cytotoxic, suppresser T-cells.

The specificity is to a certain molecular structure on the antigen, called determinant or epitope. One cell clone responds to one epitope : the clonal selection theory. The repertoire (diversity of specificity to different antigens) is of the order of 10^9 in the human body.

The specific immune response has three phases :
I- Recognition : through receptors.
II- Activation : proliferation and differentiation, increase in numbers of a clone, B-cells become plasma cells.
III- Effector phase : enhancing natural immunity mechanisms.

The ability of the immune system to recognise self from non-self is of paramount importance for the survival of the organism. This is apparent in :

I- Infection. II- Cancer. III- { Transplantation }.

Malfunction of the immune system may occur leading to pathology :
I- The immune response leads to local damage that eventually stops, occasionally there may an abnormal or prolonged response that may lead to extensive tissue damage.
This is hypersensitivity reaction.
II- Inadequate immune response (deficiency) leads to repeated infection and increased tumour incidence. Young and aged.
III- Failure to differentiate between self and non-self leads to auto-immune disease.