Innate and Acquired Immunity.

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Immunology is defined as the science which deals in the study of defence mechanisms against the effect of parasites and diseases produced by them. Every organisms have a well developed immunity properties against many diseases specially infecious diseases. The system is our body which helps to developed immunity against such diseases is called as Immune System.

Immunity is classified in to two groups—
(A) Innate Immunity (B) Acquired Immunity.

(A) Innate or Natural Immunity : →

Innate immunity is the summation of all the naturally occuring defence mechanisms that protect an individual from infectious diseases. These physiological mechanisms are present throughout the animal kingdom as inherent or innate, qualities of the species. They donot exibibit specificity. So it is also known as non-specific immunity. A single defence barries will afford protection against many different potential pathogens.

The natural immunity differs in different organisms. eg: Man gets mumps easily but Dogs and cattles have natural immunity against mumps. The natural immunity of an organism depends upon Nutrition, amount of hormones produced as many other environmental factors.

Body's innate immunity act as a first line of defence against invaders. Recall that non specific defences are uniform response to all threats, they donot discriminate between kinds of threats. These defences react to invading bacteria in the same way they react to invading viruses or fungi and there is no lasting memory of a particular infection.

(I) Innate immunity out side the Lymphatic system—

(i) Species barriers → Humans are against most of the disease of other animals and all the diseases of plants. Indeed most

Pathogens are quite specific for the kinds of the cells they can infect. They bind only the certain receptor sites on plasma memb.

(A) Physical barriers :- The keratinized epithelium of skin provides a protective outer envelope for the body. It is difficult for pathogen to move between the tightly packed epithelium cells. Also, the high level of cells division in the epidermis causes surface cells of the skin to flake away continually, carrying off attached microbes.

(B) Secretions → In addition to mucus, secretions such as saliva, tears, ear wax, sweat and stomach acid all play roles in trapping and destroying invaders.

(C) Body process → Co ordinated body processes such as urination, defecation, vomiting, coughing and sneezing are other non specific defence that help the body remove dangerous substances and pathogens.

(D) Innate immunity of the Lymphatic System —

(i) Phagocytic cells :- Micro organism that successfully invade the body may encounter a second line of defence that involves cells which can engulf and destroy them.

Using the process of phagocytosis these cells —

- engulf foreign cells and debris
- contain them within cytoplasmic vesicles and
- digest them with enzyme of lysosomes.

The body's most numerous phagocytes are the white blood cells called neutrophiles and macrophages. These cells are capable of amoeba like movement and can migrate out of blood vessels into tissues. In the tissue space, they are attracted the site of an infection by chemicals released from damaged and infected cells. Although some phagocytes move around through body tissues, others are more permanently attached to connective tissues in the spleen, lymph nodes, lungs, liver and brain.

In the absence of infections, these cells

normally live for a few days. However, during an infection, when phagocytes engulf and digest quantity of pathogens and cell debris, these cells survive for only a few hours. The dead phagocytes, debris from damaged body cells and the tissue fluid that collects at an infection site.

(b) Natural Killer cells :→ It is a modified WBC that attack abnormal body cells rather than invading microbes. They are able to recognize of virus-infected cells and tumour cells because of changes in the plasma membrane proteins.

(c) Interferons :→ Lymphocytes – macrophages and fibroblasts that have been infected by viruses are capable of producing and secreting a special group of proteins called Interferons. Several different types of interferons are made by different body cells. In addition to their antiviral action, some interferons enhance the activity of phagocytes and inhibit the development of transformed cells into tumours.

Several interferons, designated α, β and γ.

In lymphomas, interferon often produces sharp clinical improvement.

(d) The complement system → It is highly specialised plasma proteins. They are not antibodies, but as a rule, a complement must be present, during an agent antigen antibody action invitro and invivo. They are activated to accomplish four fundamental goals—

(i) They create holes in the plasma membranes of bacteria, allowing the cell contents to spill out, killing the cell.

(ii) They stimulate the release of histamine from mast cells.

(iii) They create a ~~third~~ trail of chemical signals that attract phagocytes to an infected site.

(iv) They attach to pathogens in ways that help phagocytes recognise and engulf the pathogens.

Phagocyte migration involves neutrophiles and macrophages that collected at the scence of an infection, typically within an hour after inflammation starts. They find the sites of infection by following a trail of minin chemical signals.

Summary of Innate Immunity :-

Defense	Functions :-
① Species barrier	— The unique structure of human cells protect the body against the diseases.
② Physical barriers (Skin and mucous memb.)	— Provide a mechanical barrier to most microbes.
③ Secretions Mucus, Saliva, Earwax, Tears, Sweat, Sebum, Gastric juice	— Trap microbes and prevent penetration into body. Hcl kill microbes. Salt of sweat is hipertonic and inhibits microbial growth.
④ Body processes	
(a) Urination, defecation, vomiting, coughing, sneezing	— Coordinated body actions that periodically or occasionally remove microbes.
(b) Fever	— Increase metabolism, inhibits microbial growth.
⑤ Inflammation	— Dilates blood vessels and increases their permeability to enhance blood flow.
⑤ Phagocytic cells	— Neutrophiles, monocytes, macrophages engulf and destroy invading microbes.
⑥ Natural killer cells	— Destroy virus-infected cells and tumour cells.
⑦ Interferons	— Secreted by virus-infected cells and prevents viral replication in unifected cells.
⑧ Complement	— Kills microbial cells, enhances phagocytosis, stimulates inflamations

(B) Acquired Immunity :-

It is also known as Adaptive or Specific Immunity. It occurs following exposure to a particular infectious agent, either deliberate (Vaccination) or accidental (infection). Increased resistance to the particular agent usually occurs as a result of the production of antibodies or Sensitized lymphocytes specific for the microbes.

When infectious agents overwhen the non-specific defenses, the body is further protected by a series of responses collectively called specific defences or the immune responses.

Acquired immunity can distinguish between different foreign materials and use a slightly different response to combat each pathogens or foreign substances. eg:- after recovering from measles, human retain an immune memory of the measles virus and thus acquire a life long protection or immunity against this specific pathogens and diseases.

The extraordinary feats of the acquired immunity are accomplished by the integrated functioning of the lymphatic, circulatory and endocrine systems. However the most active in this process are lymphocytes.

(1) Lymphocytes :-

There are 2 types of lymphocytes

(i) B-lymphocytes — It is antibody mediated immunity
- Produced and mature and bone marrow.
- Undergo clonal selection in spleen and lymph node.
- Direct recognition of antigen.
- clonal expansion produces antibody-secreting plasma cells as well as memory B-cells.
- B-cells are named for a lymphatic organ in chickens.

(b) T- lymphocytes :-

- cell mediated immunity.
- = Produced in bone marrow, mature in thymus.
- = Antigen must be presented, usually by macrophages.
- = cytotoxic T cells search and destroy antigen-bearing cells.
- - Helper T- cells Secretes lymphokines and stimulate other immune cells.

An essential common feature of both T cells and B cells is their ability to recognised foreign cells and cell products as being distinct from human cells. This is the capacity to distinguish the self from the non self. This recognition is based on antigens found on the surface of cells, among other places:

(i) Lymphoid Organs and tissues :-

(a) Primary and Secondary lymphoid organs :-

Thymus and bone marrow are the primary lymphoid organs in mammals. Secondary lymphoid tissues are lymph nodes, spleen and the mucosa associated lymphoid tissue.

- Bone marrow is composed of hematopoietic cells of various lineage and maturity packed between fat cells which gives ~~not~~ rise not only to all of the lymphoid cells found in the lymphoid tissue. During early fetal stage all these are done by mesenchyme of the yolk sac.
- It is a lymphocyte rich, bilobed encapsulated organ located behind the sternum, above and infront of heart. It is essential for the maturation of T cells and development of cell-mediated immunity. In fact the term T-cells means thymus derived cell and should only be ... for T-