# Path 203 – Principles of Immunology
# Lecture for undergraduate studies - Week 1

**Immunology**

Is a branch of biomedical science that covers the study of all aspects of the immune system in all organisms. It deals with:

- The physical, chemical and physiological characteristics of the components of the immune system in vitro, in vivo and in situ.
- The physiological functioning of the immune system in both health and disease.
- Malfunctions of the immune system in immunological disorders (autoimmune diseases, hypersensitivities, immune deficiency, transplant rejection).

Immunology has applications in several disciplines of science and as such is further divided into:

1. **Immunity** (the ability to resist infection)
2. **Serology** (is the use of antibodies to detect and measure antigens using **serological assays**, so called because these assays were originally carried out with serum, the fluid component of clotted blood, from immunize individuals)
3. **Immunobiology** (is the study of the biological basis for host defense against infection).
4. **Immunogenetics** ( which was originally the analysis of genetic traits by means of antibodies against genetically polymorphic molecules such as blood group antigens or MHC proteins. Immunogenetics now refers to the genetic analysis, by any technique, of molecules important in immunology)
5. **Immunochemistry** (which link immunology and the chemical bases of the immune response elements).
6. **Clinical Immunology** (Immune disorder such as autoimmune diseases, hypersensitivities, immune deficiency, transplant rejection).

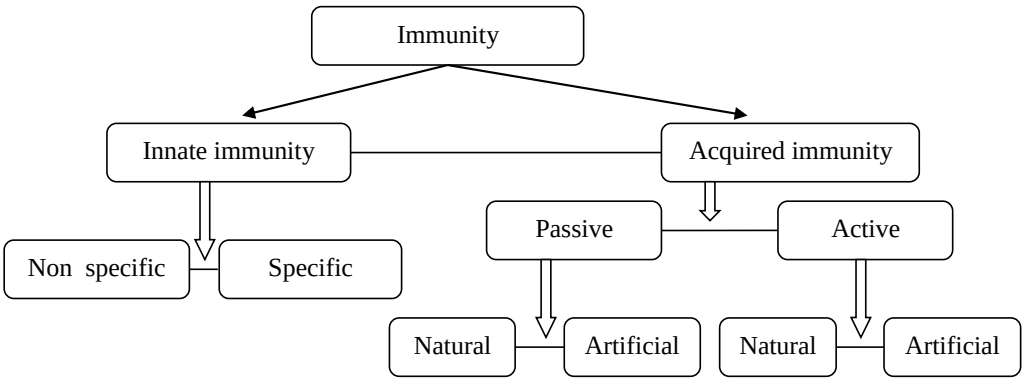
- **Innate immune response or Innate immunity** is the early phases of the host response to infection, in which a variety of innate resistance mechanisms recognize and respond to the presence of a pathogen. Innate immunity is present in all individuals at all times, does not increase with repeated exposure to a given pathogen, and discriminates between a group of related pathogens.

- **Acquired immune response or acquired immunity** (**adaptive immune response** or **adaptive immunity)** is the response of antigen-specific lymphocytes to antigen, including the development of immunological memory. Adaptive immune responses are generated by clonal selection of lymphocytes and distinct from innate and non adaptive phases of immunity, which are not mediate by clonal selection of antigen-specific lymphocytes.

**Immunity**

The resistance offered by the host to harmful effect of pathogenic microbial infection is called immunity

Immunity against infections disease is of different types




**What is Innate Immunity?**

The term 'innate immune system' is used to describe pre-existing defense mechanisms that are designed to prevent infection by pathogens or to mount an immediate defense against the infectious agent. The physical, chemical and biochemical barriers to infection are part of the innate immune system. They are called 'innate' or 'natural' because they are present before infection, although the amount of some components may increase following infection.

The Innate Immunity is basic immunity which may be genetically passed on from one generation to other generation. It does not depend on prior contacts with microorganism it may be nonspecific when it indicates a degree of resistance to all infection e.g plant pathogen, rinderpest, distemper. It is specific when it shows resistance to particular pathogens.

**Characteristic features of Innate immunity:**

1. 1st line of defense
2. Rapid defense
3. The same response on re-exposure to antigens
4. Generally lacks memory and lacks specificity
5. Recognize and react against microbes only
6. Block the entry of microbes and eliminate succeeded microbes which entered the host.
7. Dendritic cells, mast cells, monocytes/macrophages, natural killer (NK) cells, polymorphonuclear leukocytes (PMNL) and γδT cells are primarily involve

**Innate Immunity can be divided into following type:**

**1. Species Immunity**

Individual of the same species show uniform pattern of susceptibility to different bacterial infection. The mechanism of species immunity may be due to physiological and biochemical differences between tissue of host species which determine whether or not pathogen can multiply in them. For example:

1. Poliomyelitis
2. Measles causing measle
3. *Tryponema palladium* causing syphilis
4. *Mycobacterium leprea* causing leprosy
5. *Niesseria gonorrhea* causing gonorrhea which occur only in man

Many a time same species of bacteria produce different types of infection in different animals e.g. *Salmonella typhi* produces typhoid fever in man whereas mice it is resistant (no disease).

**2. Racial immunity**

Within a species different races show different in susceptibility to infection. Such racial differences are known to be genetic in origin for example:

1. Negroes are resistant to yellow fever and malaria
2. Algerian sheep high resistance to anthrax

**3. Individual immunity**

Individual in population shows variation in their response to microbial infection e.g. Homozygous twins exhibit similar degree of resistance or susceptibility to lepromatous leprosy and tuberculosis such as correlation is not seen heterozygous twins.

**Factors influencing level of innate immunity in individuals**

**1. Age**

Two extremes of life carry high susceptibility to infection disease e.g. The susceptibility of fetus to infection is related to immaturity of its immune apparatus such as coxsackic viruses cause fatal infection in suckling mice but not in adults. On the other hand old person are highly susceptibility to gradual waning of their immune response.

**2. Hormonal Influence**

Hormones affect innate immunity (increase or decrease):

A. The person who suffers from endocrine disorders e.g. diabetes mellitus is related to susceptibility to infection because of increased carbohydrate levels in tissue.
B. The person who treated with corticosteroid. Corticosteroids decrease hosts resistance by acting as anti-inflammatory, antiphagocytic agents and by suppression of antibody formation and hypersensitivity.

**3. Women pregnancy**

The elevated steroid levels during pregnancy may have relation to heightened susceptibility of pregnant women to many infection.

**4. Nutrition**

Defective nutrition depresses all type of immune response and thus increasing the risk of infection.

**Immune Surveillance**

Immune surveillance is a theory that the immune system patrols the body not only to recognize and destroy invading pathogens but also host cells that become cancerous. Perhaps potential cancer cells arise frequently throughout life, but the immune system usually destroys them as fast as they appear. There is some evidence for this attractive notion. There is also evidence that the immune system mounts an attack against established cancers although it often fails. For immune surveillance to work, cancer cells must express antigens that are not found on normal cells.