

IMMUNOLOGY

Unit I : Overview of the Immune system

- ① Introduction to basic concept in immunology
- ② principles of innate and adaptive immune system.

Introduction :-

The immune system is a complex system of structure and processes that has evolved to protect us from disease. Immunity is a defensive mechanism which is not only complicated but also fascinating. Molecular and cellular components make up the immune system. The functions of these components divided into non-specific mechanisms, those which are innate to an organism, and responsive responses, which are adaptive to specific pathogens. Immunology is the study of immune system & is very important branch of medical & biological sciences.

① Immunology is a relatively new science. Its origin is usually attributed to Edward Jenner, who discovered in 1796 that cowpox, or vaccina, induced protection against human smallpox, an often fatal disease. Jenner called this procedure vaccination, & this term is still used to describe the inoculation of healthy individuals with weakened or attenuated strains of disease-causing agents to provide protection from disease.

Although Jenner's experiment was successful, it took almost two centuries for smallpox vaccination to become universal, an advance WHO to announce in 1979 that smallpox has been eradicated.

When Jenner introduced vaccination he knew nothing of the infectious agents that cause disease.

In 19th century Robert Koch proved that infectious diseases are caused by microorganisms, each one responsible for a particular disease, or pathology.

The disease causing microorganisms or pathogens are categorized into four groups. These are viruses, bacteria, pathogenic fungi and other relatively large & complex eukaryotic organisms are collectively termed parasites.

In 1880, Louis Pasteur devised a vaccine against cholera in chickens, & developed a rabies vaccine that proved a success upon its first trial in a boy bitten by a rabid dog. These practical triumphs led to a search for the mechanism of protection and to the development of the science of immunology.

In 1890 Emil von Behring & Shibasaburo Kitasato discovered that the serum of vaccinated individuals contained substances which they called antibodies. That specifically bound to relevant pathogen.

A specific immune response such as the production of antibodies against a particular pathogen is known as an adaptive immune response. because it occurs during the lifetime of an individual as an adaptation to infection with that pathogen. In many cases adaptive immune response confers lifelong protective immunity to reinfection with the same pathogen. This distinguishes such responses from innate immunity.

Metchnikoff discovered that many microorganisms could be engulfed & digested by phagocytic cells, which he called macrophages.

These cells are immediately available to combat a wide range of pathogens without requiring prior exposure and are a key component of the innate immune system.

Antibodies are produced only after infection, and are specific for the infecting pathogen. The antibodies present in a given person therefore directly reflect the infections to which he or she has been exposed.

It is clear that specific antibodies can be induced against a vast range of substances. Such substances are known as antigens because they can stimulate the generation of antibodies.

However not all adaptive immune response entail the production of antibodies, & the term antigen is now used in a broader sense to describe any substance that can be recognized by the adaptive immune system.

Both innate immunity and adaptive immune responses depend upon the activities of white blood cells or leucocytes. The innate & adaptive immune systems together provide a remarkably effective defense system. It ensures that although we spend our lives surrounded by potentially pathogenic microorganisms, we become ill only relatively rarely. Many infections are handled successfully by the innate immune system & cause no disease, others that cannot be resolved by innate immunity trigger adaptive immunity & are then overcome successfully, followed by lasting immunological memory.

② Principles of innate and adaptive immune system

Healthy immunity accomplishes four essential principles:

1. Ability to detect and fight off infection
2. Ability to recognize a host's own cells as "self" thereby protecting them from attack.
3. A memory from previous foreign infections.
4. Ability to limit the response after the pathogen has been removed.

The macrophages and neutrophils of the innate immune system provide a first line of defense against many common microorganisms and are essential for the control of common bacterial infections. However, they cannot always eliminate infectious organisms, and there are some pathogens that they cannot recognize.

The lymphocytes of the adaptive immune system have evolved to provide a more versatile means of defense which in addition, provides increased protection against subsequent reinfection with the same pathogen. The cells of the innate immune system, however play a crucial part in the initiation and subsequent direction of a adaptive immune responses, as well as participating in the removal of pathogens that have been targeted by an adaptive immune response.