

Lec.1 :Introduction to immunology

Immunology

Immunology is a branch of medical science that study immune systems in all organisms.

Immunity : is the ability of an organism to resist a particular disease especially through preventing development of a pathogenic microorganism or by counteracting the effects of its products by the action of specific antibodies or sensitized cells.

History of theories of immunity

The concept of immunity has intrigued mankind for thousands of years. The prehistoric view of disease was that it was caused by supernatural forces, and that illness was a form of theurgic punishment for "bad deeds" or "evil thoughts" visited upon the soul by the gods or by one's enemies. Between the time of Hippocrates and the 19th century, when the foundations of the scientific methods were laid, diseases were attributed to an alteration or imbalance in one of the four humors (blood, phlegm, yellow bile or black bile). Also popular during this time before learning that communicable diseases came from germs/microbes was the miasma theory, which held that diseases such as cholera or the Black Plague were caused by a miasma, a noxious form of "bad air". If someone were exposed to the miasma in a swamp, in evening air, or breathing air in a sickroom or hospital ward, they could get a disease.

The modern word "immunity" derives from the Latin *immunis*, meaning exemption from military service, tax payments or other public services. The first written descriptions of the concept of immunity may have been made by the Athenian Thucydides who, in 430 BC, described that when the plague hit Athens: "the sick and the dying were tended by the pitying care of those who had recovered, because they knew the course of the disease and were themselves free from apprehensions. For no one was ever attacked a second time, or not with a fatal result". The term "immunes", is also found in the epic poem "Pharsalia" written around 60 B.C. by the poet Marcus Annaeus Lucanus to describe a North African tribe's resistance to snake venom. The first clinical description of

immunity which arose from a specific disease causing organism is probably *Kitab fi al-jadari wa-al-hasbah* ('A Treatise on Smallpox and Measles', translated 1848) written by the Islamic physician Al-Razi in the 9th century. In the treatise, Al Razi describes the clinical presentation of smallpox and measles and goes on to indicate that that exposure to these specific agents confers lasting immunity (although he does not use this term). The first scientist who developed full theory of immunity was Ilya Mechnikov after he revealed phagocytosis in 1882. With Louis Pasteur's germ theory of disease, the fledgling science of immunology began to explain how bacteria caused disease, and how, following infection, the human body gained the ability to resist further infections.

The birth of active immunotherapy may have begun with Mithridates VI of Pontus. To induce active immunity for snake venom, he recommended using a method similar to modern toxoid serum therapy, by drinking the blood of animals which fed on venomous snakes. According to Jean de Maleissye, Mithridates assumed that animals feeding on venomous snakes acquired some detoxifying property in their bodies, and their blood must contain attenuated or transformed components of the snake venom. The action of those components might be strengthening the body to resist against the venom instead of exerting toxic effect. Mithridates reasoned that, by drinking the blood of these animals, he could acquire the similar resistance to the snake venom as the animals feeding on the snakes. Similarly, he sought to harden himself against poison, and took daily sub-lethal to build tolerance. Mithridates is also said to have fashioned a 'universal antidote' to protect him from all earthly poisons. For nearly 2000 years, poisons were thought to be the proximate cause of disease, and a complicated mixture of ingredients, called Mithridate, was used to cure poisoning during the Renaissance. An updated version of this cure, Theriacum Andromachi, was used well into the 19th century. In 1888 Emile Roux and Alexandre Yersin isolated diphtheria toxin, and following the 1890 discovery by Behring and Kitasato of antitoxin based immunity to diphtheria and tetanus, the antitoxin became the first major success of modern therapeutic Immunology.

In Europe, the induction of active immunity emerged in an attempt to contain smallpox. Immunization, however, had existed in various forms for at least a thousand years. The earliest use of immunization is unknown, however, around 1000 A.D. the Chinese began practicing a form of immunization by drying and inhaling powders derived from the crusts of smallpox lesions. Around the fifteenth century in India, the Ottoman Empire, and east Africa, the practice

of inoculation (poking the skin with powdered material derived from smallpox crusts) became quite common. This practice was first introduced into the west in 1721 by Lady Mary Wortley Montagu. In 1798, Edward Jenner introduced the far safer method of deliberate infection with cowpox virus, (smallpox vaccine), which caused a mild infection that also induced immunity to smallpox. By 1800 the procedure was referred to as vaccination. To avoid confusion, smallpox inoculation was increasingly referred to as variolation, and it became common practice to use this term without regard for chronology. The success and general acceptance of Jenner's procedure would later drive the general nature of *vaccination* developed by Pasteur and others towards the end of the 19th century. In 1891, Pasteur widened the definition of vaccine in honor of Jenner and it then became essential to qualify the term, by referring to polio vaccine, measles vaccine etc.

Immunology branches :

- **Classical immunology:** It studies the relationship between the body systems, pathogens, and immunity. The earliest written mention of immunity can be traced back to the plague of Athens in 430 BCE, ties in with the fields of epidemiology and medicine.

-**Clinical immunology** is the study of diseases caused by disorders of the immune system (failure, aberrant action, and malignant growth of the cellular elements of the system). It also involves diseases of other systems, where immune reactions play a part in the pathology and clinical features.

-**Immunotherapy** :the use of immune system components to treat a disease or disorder is known as immunotherapy. Immunotherapy is most commonly used in the context of the treatment of cancers together with chemotherapy (drugs) and radiotherapy (radiation). However, immunotherapy is also often used in the immunosuppressed (such as HIV patients) and people suffering from other immune deficiencies or autoimmune diseases.

-**Diagnostic immunology:** the specificity of the bond between antibody and antigen has made it an excellent tool in the detection of substances in a variety of diagnostic techniques. Antibodies specific for a desired antigen can be conjugated with an isotopic (radio) or fluorescent label or with a color-forming enzyme in order to detect it. However, the similarity between some antigens can lead to false

positives and other errors in such tests by antibodies cross-reacting with antigens that aren't exact matches.

-Cancer immunology:the study of the interaction of the immune system with cancer cells can lead to diagnostic tests and therapies with which to find and fight cancer.

-Reproductive immunology:this area of the immunology is devoted to the study of immunological aspects of the reproductive process including fetus acceptance. The term has also been used by fertility clinics to address fertility problems, recurrent miscarriages, premature deliveries and dangerous complications such as pre-eclampsia.

-Theoretical immunology : immunology is strongly experimental in everyday practice but is also characterized by an ongoing theoretical attitude. Many theories have been suggested in immunology from the end of the nineteenth century up to the present time. The end of the 19th century and the beginning of the 20th century saw a battle between "cellular" and "humoral" theories of immunity.