Topic Page: Immunity

Definition: **immunity** from *Dictionary of Virology*

The condition of a living organism whereby it resists and overcomes an infection or disease (protective immunity). Active immunity occurs in response to stimulation with antigen (e.g. vaccine) during infection. Passive immunity is due to antibody or primed lymphocytes derived from another immune individual (e.g. maternal immunity).

Image from: **Immunizations stimulate body tissues to form...** in *Encyclopedia of Global Health*

Summary Article: **Immunity**
From *Black's Medical Dictionary, 43rd Edition*

The body's defence against foreign substances such as bacteria, viruses and parasites. Immunity also protects against drugs, toxins and cancer cells. It is partly non-specific – that is, it does not depend on previous exposure to the foreign substance. For example, micro-organisms are engulfed and inactivated by polymorphonuclear LEUCOCYTES as a first line of defence before specific immunity has developed.

Acquired immunity depends upon the immune system recognising a substance as foreign the first time it is encountered, storing this information within selected lymphocytes, which then mount a reaction the next time the substance enters the body. This is the usual outcome of natural infection or prophylactic IMMUNISATION. A foreign substance which can provoke an immune response is termed an ANTIGEN. These are usually proteins but smaller molecules such as drugs and chemicals can also induce an immune response. The antigenic material is taken up and processed by specialised cells called 'antigen-presenting cells', strategically sited where microbial infection may enter the body, for example the tonsils at the entrance to the throat. The complex protein molecules are broken down into short amino-acid chains (peptides – see PEPTIDE) and transported to the cell surface where they are presented by structures called HLA antigens (see HLA SYSTEM).

Foreign peptides presented by human leucocyte antigen (HLA) molecules (see HLA SYSTEM) are recognised by cells called T-lymphocytes. These originate in the bone marrow and migrate to the THYMUS where they are educated to distinguish between foreign material, which provokes an immune response, and self-antigens (that is, constituents of the person themselves), which do not. Non-responsiveness to self-antigens is termed 'tolerance' (see AUTOIMMUNITY). Each population or clone of T-cells is uniquely responsive to a single PEPTIDE sequence because it expresses a surface molecule ('receptor') which fits only that peptide. The responsive T-cell clone induces a specific response in other T- and B-lymphocyte populations. For example, CYTOTOXIC T-cells penetrate infected tissues and kill cells which express peptides derived from invading micro-organisms, thereby helping to eliminate the infection.

B-lymphocytes secrete ANTIBODIES which are collectively termed IMMUNOGLOBULINS (Ig) – GAMMA-GLOBULIN. Each B-cell population (clone) secretes antibody uniquely specific for antigens encountered in the blood, extracellular space, and the LUMEN of organs such as the respiratory passages and gastrointestinal tract.

Antibodies belong to different Ig classes; IgM antibodies are synthesised initially, followed by smaller and therefore more penetrative IgG molecules. IgA antibodies are adapted to cross the surfaces of mucosal tissues so that they can adhere to organisms in the gut, upper and lower respiratory passages, thereby preventing their attachment to the mucosal surface. IgE antibodies also contribute to mucosal defence but are implicated in many allergic reactions (see ALLERGY).

Antibodies are composed of constant portions, which distinguish antibodies of different class; and variable portions, which confer unique antigen-binding properties on the product of each B-cell clone. In order to match the vast range of antigens that the immune system has to combat, the variable portions are synthesised under the instructions of a large number of encoding GENES whose products are assembled to make the final antibody. The antibody produced by a single B-cell clone is called a MONOCLONAL ANTIBODY; monoclonal antibodies are now synthesised and used for diagnostic tests and in treating certain diseases.

Populations of lymphocytes with different functions, and other cells engaged in immune responses, carry distinctive protein markers. By convention these are classified and enumerated by their 'CD' markers, for example CD4cells are reduced in AIDS and are used as a guide to the need for treatment.

Immune responses are influenced by CYTOKINES which function as HORMONES, acting over a short range to accelerate the activation and proliferation of other cell populations contributing to the immune response. Specific immune responses collaborate with non-specific defence mechanisms. These include the COMPLEMENT SYSTEM, a protein-cascade reaction designed to eliminate antigens neutralised by antibodies and to recruit cell populations which kill micro-organisms.

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