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THE INNATE AND ADAPTIVE IMMUNE RESPONSE: UNDERSTANDING THE BODY'S DEFENSE MECHANISMS AGAINST PATHOGENS

Mette Baier
Department of Microbiology, Damascus University, Damascus, Syria
Email: mette.b@outlook.com

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ABOUT THE STUDY

An immunological response is a physiological process that happens within an organism during inflammation to fight against foreign stimuli. These include a wide range of toxins, viruses, intra and extracellular bacteria, parasites, and fungus that, if not eliminated from the body, can have major consequences for the host's health.

In general, the immune response is divided into two parts; innate and adaptive, which act together to protect against infections. Both branches involve humoral and cellular elements (Kurros et al.1988).

The innate branch is noted for being a non-specific and fast response to any type of pathogen. Physical barriers such as the skin and mucous membranes, immune cells such as neutrophils, macrophages, and monocytes, and soluble substances such as cytokines and complement are all components of the innate immune response. The adaptive branch, on the other hand, is the body's immune response that is directed against particular antigens and consequently takes longer to activate the components involved. Cells in the adaptive branch include dendritic cells, T cells and B cells, as well as antibodies also known as immunoglobulins, which interact directly with antigen and are a critical component of a powerful reaction against an intruder. The first time an organism comes in contact with a specific antigen, it produces effector T and B cells, which are activated cells that protect against the pathogen. An initial immune response is the creation of these effector cells as a result of the first encounter. When the same pathogen enters the organism again, memory T and memory B cells are created. If the organism is re-exposed to the same pathogen, a secondary immune response will enter in, and the immune system will be able to respond quickly and strongly due to the memory cells from the original exposure. In order to elicit an initial immune response, vaccines inject a weakened, dead, or fragmented microbe. This is done to ensure if the body is exposed to the infection, it can immediately protect itself *via* the secondary immune response (Arese et al. 2005).

Innate immune response

The innate immune response is the body's initial reaction to external intruders. This immunological response has been evolutionarily conserved across many different species, with all multicellular creatures having some form of innate response. Physical barriers such as skin and mucous membranes, diverse cell types such as neutrophils, macrophages, and monocytes, and soluble substances such as cytokines and complement comprise the innate immune system. The innate immune response, in contrast to the adaptive immune response, is not specific to any one foreign invader and, as a result, works fast to clear the body of infections (Williams et al. 2005).

Pattern Recognition Receptors (PRR) recognise and identify pathogens. These receptors are structures on the surface of macrophages that may bind external invaders and initiate cell signalling within the immune cell. PRRs specifically recognise Pathogen Associated Molecular Patterns (PAMPs), which are structural components of pathogens. PAMPs include the peptidoglycan cell wall and Lipopolysaccharides (LPS), which are both fundamental components of bacteria and hence evolutionarily conserved across many different bacterial species (Schofield et al. 2005).

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Adaptive immune response

The adaptive immune response is the second line of defence for the body. Because B and T cells generate antigen receptors that are specific to just particular antigens during early embryonic stages, the cells of the adaptive immune system are exceedingly specialised. This is critical for B and T cell activation. B and T cells are very hazardous cells, and if they can attack without being activated, a defective B or T cell can begin exterminating the host's own healthy cells. When Antigen Presenting Cells (APCs) express foreign antigen on their cell surface *via* MHC class II molecules, naive helper T cells are activated. Dendritic cells, B cells, and macrophages are examples of APCs that are endowed not only with MHC class II but also with co-stimulatory ligands that are recognised by co-stimulatory receptors on helper T cells. The adaptive immune response would be ineffective without co-stimulatory chemicals, and T cells would become energy. Specific APCs can activate many T cell subgroups, and each T cell is uniquely adapted to cope with each distinct microbial infection. The kind of T cell activated and the response produced are influenced by the situation in which the APC initially met the antigen. Once activated, helper T cells can activate naive B cells in the lymph node. B cell activation, on the other hand, is a two-step procedure. To begin, B cell receptors, which are simply Immunoglobulin M (IgM) and Immunoglobulin D (IgD) antibodies unique to the individual B cell, must attach to the antigen, which results in internal processing so that it may be displayed on the B cell's MHC class II molecules. When this occurs, a T helper cell that recognises the antigen attached to the MHC binds with its co-stimulatory molecule, activating the B cell. As a result, the B cell transforms into a plasma cell, secreting antibodies that function as opsonins against intruders (Flajnik et al. 2010).

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