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Short Communication

Acquired immunity: Mechanisms, types and importance in disease prevention

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DESCRIPTION

Acquired immunity, also known as adaptive immunity, is a specialized and sophisticated defense mechanism developed by the body to protect against specific pathogens. Unlike innate immunity, which provides a general defense against a wide range of invaders, acquired immunity is customized to recognize and eliminate particular pathogens that the body has encountered previously. This article examines the mechanisms of acquired immunity, its types, and its significance in disease prevention and management (Bakker et al., 2005).

Mechanisms of acquired immunity

Acquired immunity involves a complex interaction between various components of the immune system, primarily mediated by lymphocytes-T cells and B cells.

Antigen recognition: The first step in acquired immunity is the recognition of specific antigens, which are molecules or fragments of pathogens that provoke an immune response. Antigens are recognized by specialized receptors on the surface of T cells and B cells (Chelbi-Alix et al., 2006).

Activation of lymphocytes: Upon encountering an antigen, T cells and B cells are activated. This process involves antigen presentation by Antigen-Presenting Cells (APCs), such as dendritic cells and macrophages, which process and display antigens to lymphocytes.

Clonal expansion: Once activated, lymphocytes undergo clonal expansion, a process in which they rapidly multiply to produce a large number of cells that are specific to the encountered antigen (Finke et al., 2005).

Effector response: The expanded population of lymphocytes then works to eliminate the antigen. B cells differentiate into plasma cells that produce antibodies, which bind to and neutralize the antigen. T cells can directly kill infected cells or help coordinate the overall immune response.

Memory formation: After the antigen is cleared, some of the activated lymphocytes persist as memory cells. These cells "remember" the specific antigen and provide a more rapid and robust response upon subsequent exposure to the same pathogen (Garcia et al., 1999).

Types of acquired immunity

Acquired immunity, also known as adaptive immunity, examines over time and is specific to particular pathogens or foreign substances.

Active immunity: Active immunity refers to the process by which the immune system produces its own antibodies and memory cells in response to exposure to a specific antigen, such as a pathogen or a vaccine. This type of immunity can be acquired naturally, through infection, or artificially, through vaccination (Marissen et al., 2005).

Natural active immunity: This occurs when an individual is exposed to a pathogen in the course of natural infection, leading to the development of an immune response and the formation of memory cells. For example, recovering from a bacterial or viral infection typically provides long-lasting protection against reinfection with the same pathogen.

Artificial active immunity: This is achieved through vaccination. Vaccines contain antigens or antigenic components of pathogens that stimulate an immune response without causing the disease. The immune system generates memory cells, providing protection against future infections with the pathogen. Vaccines have been instrumental in controlling and eradicating infectious diseases (Morin et al., 2017).

Passive immunity: Passive immunity refers to the protection against disease that is provided when a person receives antibodies from another source rather than producing them through their own immune system. This form of immunity is typically immediate but temporary, as the body does not generate memory cells for long-term protection.

Natural passive immunity: This type of immunity is acquired through the transfer of antibodies from another individual, such as from mother to infant through the placenta or breast milk. This provides temporary protection to the infant during the early months of life (Nadin-Davis et al., 2011).

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Artificial passive immunity: This involves the administration of pre-formed antibodies, known as immunoglobulins, to provide immediate but short-term protection against specific diseases. This approach is used in situations such as post-exposure prophylaxis for rabies or tetanus.

Significance in disease prevention and management

Acquired immunity plays an important role in protecting individuals and populations from infectious diseases and managing public health.

Disease prevention: Vaccination programs harness artificial active immunity to prevent outbreaks of infectious diseases. Vaccines have led to significant reductions in diseases such as measles, polio, and influenza. Immunization also contributes to herd immunity, reducing the overall prevalence of disease in the community and protecting those who cannot be vaccinated (Ogino et al., 2016).

Treatment of infectious diseases: Passive immunity can be used therapeutically to provide immediate protection or treatment. For example, monoclonal antibodies are used to treat various viral infections and some cancers. They offer targeted treatment by binding to specific antigens on pathogens or tumour cells.

Management of autoimmune diseases: Understanding acquired immunity helps in managing autoimmune diseases, where the immune system mistakenly targets the body's own tissues. Immunomodulatory therapies aim to regulate or suppress the immune response to alleviate symptoms and prevent tissue damage (Qureshi et al., 2023).

Transplantation and immunotherapy: In organ transplantation, acquired immunity plays a role in graft acceptance or rejection. Immunosuppressive drugs are used to prevent rejection of transplanted organs. Additionally, immunotherapy is a growing field in cancer treatment, using the body's own immune system to target and destroy cancer cells.

Challenges and future firections

While acquired immunity is a powerful defense mechanism, there are ongoing challenges and areas of research.

Vaccine development and efficacy: Ensuring the effectiveness and safety of vaccines, especially in the face of evolving pathogens and emerging variants, remains a critical focus. Research continues to develop vaccines for diseases with limited preventive options.

Antibiotic resistance: The emergence of antibiotic-resistant strains of pathogens necessitates ongoing efforts to understand and enhance acquired immunity to combat these resistant organisms.

Personalized medicine: Advances in genomics and immunology are paving the way for personalized approaches to vaccine development and immunotherapy, tailoring treatments to individual immune profiles and genetic backgrounds (Rieder et al., 2011).

Acquired immunity is a sophisticated and essential component of the immune system, providing targeted protection against specific pathogens and contributing to long-term immunity through memory cells. Its mechanisms and types-active and passive-play a vital role in disease prevention, treatment and public health management. Continued research and advancements in immunology will further enhance our understanding and application of acquired immunity, ultimately improving health outcomes and combating infectious diseases.

REFRENCES

1. Bakker AB, Marissen WE, Kramer RA, Rice AB, Weldon WC, Niezgoda M, Hanlon CA. et al. (2005). Novel human monoclonal antibody combination effectively neutralizing natural rabies virus variants and individual *in vitro* escape mutants. J Virol;79(14): 9062-9068.
2. Chelbi-Alix MK, Vidy A, Bougrini JE, Blondel D. (2006). Rabies viral mechanisms to escape the IFN system: The viral protein P interferes with IRF-3, Stat1, and PML nuclear bodies. J Interferon Cytokine Res. 26(5):271-280.
3. Finke S, Conzelmann KK. (2005). Replication strategies of rabies virus. Virus Res. 111(2):120-131.
4. Garcia LS. (1999). Classification of human parasites, vectors and similar organisms. Clin Infect Dis. 29(4): 734-736.
5. Marissen WE, Kramer RA, Rice A, Weldon WC, Niezgoda M, Faber M, Slootstra JW. et al. (2005). Novel rabies virus-neutralizing epitope recognized by human monoclonal antibody: Fine mapping and escape mutant analysis. J Virol;79(8):4672-4678.
6. Morin B, Liang B, Gardner E, Ross RA, Whelan SP. (2017) . An *in vitro* RNA synthesis assay for rabies virus defines ribonucleoprotein interactions critical for polymerase activity. J Virol.91(1):10-128.
7. Nadin-Davis SA, Real LA. (2011). Molecular Phylogenetics of the Lyssaviruses-Insights from a Coalescent Approach. Adv Virus Res. 79:203-38.
8. Ogino M, Ito N, Sugiyama M, Ogino T. (2016). The rabies virus L protein catalyzes mRNA capping with GDP polyribonucleotidyltransferase activity. Viruses. 8(5):144.
9. Qureshi YM, Voloshin V, Facchinelli L, McCall PJ, Chervova O, Towers CE, Covington JA. (2023). Finding a husband: Using explainable AI to define male mosquito flight differences . Biology. 12(4):496.
10. Rieder M, Brzózka K, Pfaller CK, Cox JH, Stitz L, Conzelmann KK. (2011). Genetic dissection of interferon-antagonistic functions of rabies virus phosphoprotein: Inhibition of interferon regulatory factor 3 activation is important for pathogenicity. J Virol. 85(2):842-852.