

Unit 8- Immune response

Introduction

The reaction of an organism to a foreign substance is called immune response.

Primary immune response

When a new pathogen enters in to the body, specific immune system is activated and mounts an immune response against that pathogen, this immune response to the new antigens is known as primary response. Primary immune response results in a proliferation of B-cells that were stimulated by pathogens. If the antigen is given as vaccine then the the first injection of the antigen producing primary immune response is called priming dose.

The period between the invasion of pathogen and expression of immune response is known as "latent period" which can vary from several hours to days. This latent period depends on the factors like type of antigen, amount of antigen entered, rout of entry, health status of the individual etc. In this latent period the immune system prepares to activate and proliferate the lymphocytes which produce plasma cells and memory cells.

Plasma cells secrete antibodies and memory cells store memory of the pathogen. During primary response IgM type of antibodies are produced with a half life of 5 days. Secreted antibodies are different at different stages of latent period.

The amount of antibodies produced by the immune response to antigen is called antibody titre. The antibody titre plotted against time gives a sigmoid curve called immune response curve. The curve obtained for primary immune response is called primary immune response curve.

In the initial phase of infection non specific immune response activates followed by specific immune response and that's the reason in initial stage antibodies against the antigens are almost absent, and this period is known as "Lag phase". Later the concentration of antibodies rises and this raising period is referred as "Log phase". Once the antibody level attains maximum it remains constant for some period called as "plateau phase". If the level of antibody remains constant for several days indicates that the antibodies are produced and replaced the antibodies that were lost. After plateau phase the level of antibodies starts to decrease called decline phase.

The antigen is necessary to stimulate immune response which intern produce antibodies from plasma cells. After the removal of antigens by the antibodies, B-cells are not stimulated which intern stops producing plasma cells. Some of the B-cells are stored as memory cells.

Secondary immune response

During vaccine, the injection of the same antigen for the second time is called secondary dose or booster dose.

When the animal is invaded by the same pathogen that caused primary response, the immune system responds very quickly because of the presence of memory cells. Secondary immune response differ both qualitatively and quantitatively from primary response. In the case of secondary response the log phase is very short because of the presence of memory B cells specific for antigen induce the production of antibody with the level of antibody peaking up in a short time. The rise of antibody is around 100 to 1000 times higher than the primary

response.

The antibodies formed in response to the secondary antibody is IgG type. IgG type of antibodies have a life span of around 3 weeks so the duration of plateau phase is much extended in the secondary response, and the antibodies decline very steadily even if the plasma cells does not produce antibody.

Difference between Primary and Secondary Immune Responses

| Primary immune response | Secondary immune response |
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| 1. This occurs as a result of primary contact with an antigen. | This occurs as a result of second and subsequent exposure of the same antigen |
| 2. Responding cell is naïve B-cell and T-cell. | Responding cell is memory cell. |
| 3. Lag phase is often longer (4-7 days), sometimes as long as weeks or months. | Lag phase is shorter (1-4 days) due to the presence of memory cell. |
| 4. Level of antibody reaches peak in 7 to 10 days. | Level of antibody reaches peak in 3 to 5 days. |
| 5. It takes longer time to establish immunity. | Takes shorter time to establish immunity. |
| 6. First antibody produced is mainly IgM. Although small amount of IgG are also produced. | Mainly IgG antibody is produced. Although sometimes small amount of IgM are produced. Other immunoglobulins such as IgA and in the case of allergy IgE are produced. |
| 7. Amount of antibody produced depends on nature of antigen. Usually | Usually 100-1000 times more antibodies are produced. |

produced in low amount.

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| 8 | Antibody level declines rapidly. | Antibody level remain high for longer period. |
| 9. | Affinity of antibody is lower for its antigen. | Antibodies have greater affinity for antigen. |
| 10 | Primary response appears mainly in the lymph nodes and spleen. | Secondary response appears mainly in the bone marrow, followed by the spleen and lymph nodes. |
| 11 | Both Thymus dependent and Thymus independent antigen gives primary immune response. | Only Thymus-dependent antigen gives secondary immune response. |