

LYMPHOID TISSUES AND ORGANS

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The immune system of our body induces natural (Innate) humoral and cell mediated immune responses whenever antigens enter our body. These immune responses drive away or kill the antigen bearing pathogen. The interplay between the antigen bearing pathogen, B cell, T cell, cytokines and lymphoid organs involves several interactions.

The 'Super cells' are made up of immune component cells of our defense system. These immune component cells are produced by lymphoid organs such as bone marrow, thymus, Bursa of Fabricius (in birds), Spleen, lymph nodes, Mucosa associated lymphoid tissue (MALT), Peyer's patches, tonsils and cutaneous tissue (skin).

The key components of immune system consists of B-lymphocytes (B cells), T lymphocytes (T cells), natural killer cells (NK cells) basophils, neutrophils, mast cells, eosinophils cells, macrophages dendritic cells, cytokines and antibodies.

Antigens are processed by antigen presenting cells such as B-cells, macrophages and dendritic cells which would in turn present the antigen derived peptides to CD4 and CD8 T cells for recognition as non self. CD4 cells provide help to B cells, cytotoxic T-cells and also facilitates effector cells to kill antigen bearing pathogen.

Inside human body, there is molecular integration of complex cellular and molecular interactions. These interactions take place within a very well defined and well organized architecture of primary and secondary lymphoid organs, lymph tissues, spleen, encapsulated linings to respiratory tract, genitourinary tract, alimentary tract and peripheral tissues. The above architecture facilitates immune responses to occur.

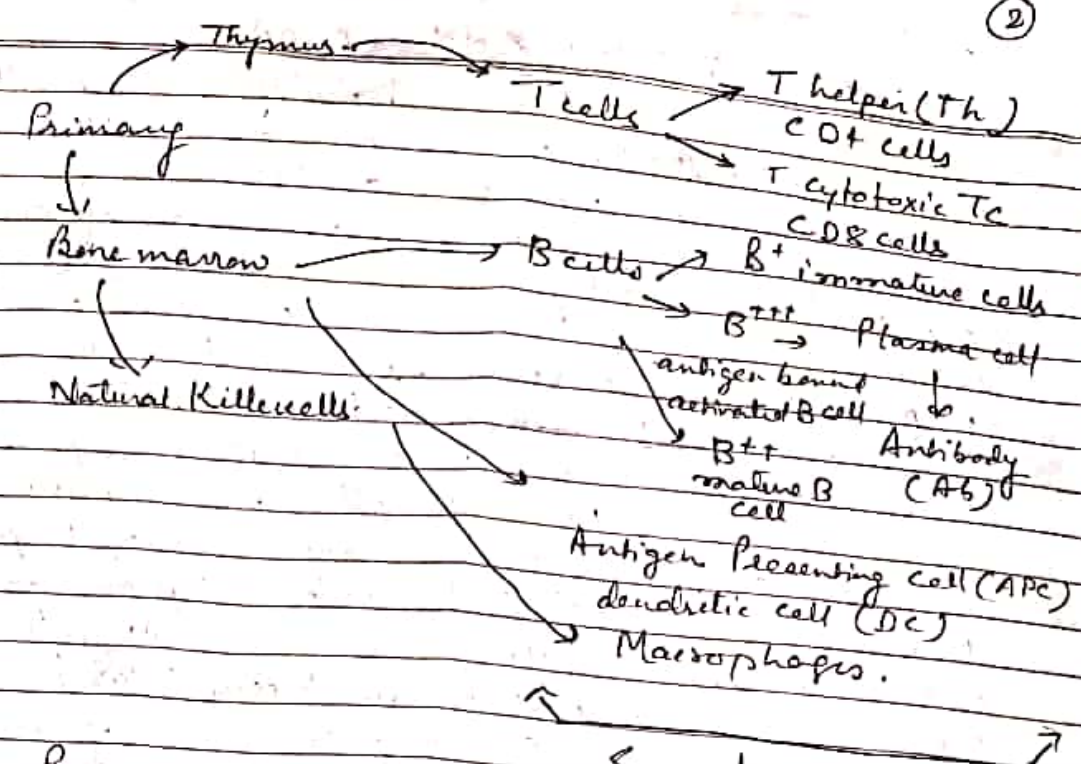


fig -> Primary and Secondary lymphoid organs and development of immune response cells.

The structural layout is depicted in the figure with the above and forms very impressive network of filtering and draining of antigens from viscera and uppermost peripheral tissue before returning to blood and this task is accomplished by thoracic duct which maintains lymphocyte traffic or circulation. The body uses the lymphoid system to enable lymphocytes to encounter antigens thus initiating adaptive immune responses. The lymphoid system consists of Primary and Secondary lymphoid organ and lymphatic vessels.

The bone marrow, Bursa of Fabricius in birds and the thymus constitute the primary lymphoid organs. Both B-lymphocytes and T lymphocytes are produced from hematopoietic stem cells in the bone marrow. B lymphocytes mature in the bone marrow and blood while T lymphocytes migrate to the thymus and mature there.

After maturation both B lymphocytes and T lymphocytes are circulated through blood to secondary lymphoid organ.

Lymphatic vessels are responsible for flow of lymph within the lymphoid system and are also a part of body fluid circulating system. The liquid portion of the blood called plasma constantly leaks out of capillaries to deliver oxygen and nutrients to cells of the surrounding tissue. Once in the tissue, the plasma is now called tissue fluid. While most of this tissue fluid reenters capillaries and is returned directly to the blood stream, some fluid enters lymph vessels as lymph. The lymph flow through regional lymph nodes and eventually enters the circulatory system and the heart to maintain the fluid volume of the circulation.

Adaptive immune responses require antigen presenting cells, such as macrophages and dendritic cells, and ever changing populations of B lymphocytes and T lymphocytes. These cells gather to detect antigens in secondary lymphoid organs. The secondary lymphoid organs include highly organized lymphoid organs such as lymph nodes and the spleen, as well as less organized accumulations of lymphoid organs scattered strategically throughout of the body. The latter includes tonsils, appendix, Peyer's Patches in the lining of the small intestine (part of the gut associated lymphoid tissue or GALT) lymphoid associated lymphoid tissue or MALT) and beneath the skin (Skin associated lymphoid tissue or SALT)

Lymph nodes contain many reticular fibres that support fixed macrophages and dendritic cells as well as changing populations of circulating B-lymphocytes and T-lymphocytes. When microorganisms and other antigens enter tissues, they are transported by tissue fluid

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the lymph vessels. Lymph vessels in turn carry these antigens in the lymph, to regional lymph vessels nodes. Here the microbes and other antigens in the lymph encounter changing population of B-lymphocytes are filtered out and phagocytosed by the fixed macrophages and dendritic cells and are presented to changing populations of T-lymphocytes about 2.5 billion different lymphocytes migrate through each lymph node every day.

Like lymph nodes, spleen contains many reticular fibres that support fixed macrophages and dendritic cells as well as ever changing populations of circulating B-lymphocytes and T-lymphocytes. When microorganisms and other antigens enter the blood, they are transported by the blood vessels to the spleen. Here they encounter changing populations of B lymphocytes, are filtered out and phagocytosed by the fixed macrophages and dendritic cells, and are presented to changing population of T-lymphocytes.

Micro-organisms and other antigens entering the respiratory tract encounter macrophages, dendritic cells, and the changing population of B-lymphocytes and T-lymphocytes in the tonsils, the bronchial associated lymphoid tissue (BALT) and other mucosa associated lymphoid tissue (MALT). These antigens entering the intestinal tract encounter macrophages, dendritic cells and the changing population of B lymphocytes and T lymphocytes in the Peyer's Patches also and other gut associated lymphoid tissue (GALT). Antigens entering the genitourinary tract are exposed to mucosa associated lymphoid tissue (MALT) found there. Antigens penetrating the skin encounter the skin associated lymphoid tissue (SALT).

It has been seen that no matter how microbes and other antigens enter the

the lymphoid system to initiate adaptive immune responses. (5)

The function of the lymphoid organs is

(i) To provide suitable and optimum environment for the proliferation and maturation of lymphocytes. (B cells and T cells)

(ii) To drain out and to collect variety of antigens or pathogens.

(iii) To disperse the effector components of the immune system and

(iv) to eliminate the antigens or antigen bearing pathogens.

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