Chapter 1  Tissue and Cells of the Immune System

Histology and Histogenesis of Lymphoid Tissue

The immune system is formed by antigen-specific cells represented by thymus-dependent or T lymphocytes and by thymus-independent or B lymphocytes (B from bursa in birds or bone marrow in mammals). Functionally closely associated with these cells are antigen non-specific cells such as macrophages, dendritic cells, and the epithelial cells of the primary lymphoid organs. The lymphocytes are part of a complex network of cells interacting with each other through recognition molecules (receptors) in order to keep the system in homeostasis. This autoreactivity seems to be essential for the function of the immune system. The introduction of a foreign substance or antigen (that must have some similarity with self molecules) into the organism perturbs the lymphocyte network homeostasis resulting in a transitory increase in the lymphocytes whose receptors fit the antigenic determinants (epitopes) of the foreign substance. Since these lymphocytes are part of the chain of interacting cells the whole system is pertubated. The assemblage of changes caused by the antigen constitutes the so-called immune response.

Lymphoid tissue is constructed of fibrillar reticulum whose networks contain free cells. This fibrillar reticulum is composed of reticular fibers, reticular cells, and fixed macrophages that are integral to the reticuloendothelial system. The majority of free cells are lymphocytes in different stages of differentiation plasma cells and macrophages. Two types of lymphoid tissues are recognized – loose lymphoid tissue in which reticulum cells predominate, and dense lymphoid tissue in which lymph cells predominate. The dense lymphoid tissue is capable of organizing nodular formations that constitute nodular lymphoid tissue. Once localized in the primary lymphoid organs the primordial immature cells are subjected to the action of a number of differentiation and growth factors present in the hemopoietic-inducing microenvironment (HIM) of these organs. T lymphocytes differentiate in the HIM of the bursa of Fab-
B cells

Bone marrow

(Bursa of Fabricius in birds)

Undifferentiated immature cell existing in the blood-forming islets of the embryo, in the fetal liver, and in the bone marrow of the adult

T cells

Thymus

Induction and proliferation in the HIM of these organs

Secondary lymphoid organs

Activation of the cellular clones by the antigen

Effector and memory B cells

Effector and memory T cells

Fig. 1.1. Origin and differentiation of the lymphoid cells in the primary lymphoid organs

Evans in birds and probably in the bone marrow HIM in mammals. After differentiation, the lymphocytes migrate to the secondary lymphoid organs where they complete their differentiation. It is believed that after a few days in these organs the lymphocytes die unless they contact antigens. In meeting antigen these cells are activated and proliferate resulting in effector cells and memory cells (Fig. 1.1). Most of these cells then leave the secondary lymphoid organs and enter the circulatory pool of lymphocytes.

**Lymph and Lymph Vessels**

Lymph vessels originate in tissue as extremely fine lymph capillaries that communicate with each other and then anastomose, forming networks. These capillaries are of varying diameter and develop into the major lymphatic vessels. Their walls are composed of a layer of endothelial cells, outwardly surrounded by a loose reticular fibrous lattice. Lymphatic capillaries, unlike blood capillaries, do not possess basement membranes. This fact is probably responsible for the capacity exhibited by lymphatic capillaries to absorb macromolecules present in interstitial liquid and in inflammatory exudates. Lymph results from interstitial liquid that passes through the walls of lymphatic capillaries and is directed via these capillaries to the lymph nodes. The passage of lymph through the interstices of the meshwork of these organs allows intimate contact be-