HEMATOPOIESIS and BONE MARROW

Because of their finite life span, the blood cells in the peripheral stream must constantly be replenished. Most types of blood cells are highly differentiated and do not divide. A continuous supply of new blood cells is produced by the hematopoietic (hemopoietic) tissues (Gk., hemato, blood; poiein, to make), which are two special types of connective tissue derived from mesenchyme. Because they have many “fixed” macrophages, an additional important function of the hematopoietic tissues is the elimination of old and/or defective blood cells.

The first type of hematopoietic tissue is red bone marrow, alternatively known as myeloid tissue (Gr., myelos, marrow). This vital hematopoietic tissue is the essential source of most kinds of blood cells. The second hematopoietic tissue is lymphoid (lymphatic) tissue, which is chiefly involved in the production and maturation of lymphocytes. We will consider this tissue later with the immune system.

In the adult, red bone marrow (myeloid tissue) is largely confined to the medullary cavities of certain flat bones, such as ribs, sternum and pelvic bones, and in the vertebrae. For bone marrow transplants, the iliac crest or sternum are usually tapped under local anesthesia. The yellow marrow typical of adult long bones normally stores fat instead of producing blood cells. The microscopic organization of red marrow is not easily appreciated in routine histological sections. Basically the tissue consists of two major regions: a stroma, made up of CT cells supported by a delicate network of reticular fibers that holds a heterogeneous population of blood forming cells at various stages of differentiation; and abundant wide vascular channels called sinusoids by which newly formed blood cells enter the general circulation. The functional state of the blood forming cells of red marrow is routinely assessed by making smears of aspirated red marrow or by making sections of punch (core) biopsies of red marrow.

Venous sinusoids are identified by the aggregations of mature RBCs in their lumens. You may also be able to see some arterioles.

Megakaryocytes. Giant cells with single large polyploid nuclei that send protoplasmic extensions into the venous sinusoids. These fragment to become platelets.

Erythroblastic (erythroid) islands. Clusters of developing red blood cells, the erythroid islands, can be found in the stroma of the bone marrow. These are in close proximity to the marrow sinusoids. A macrophage is typically found in the midst of the cluster, but may be difficult to distinguish. These are the sites of RBC production.
Understand the basic architecture of the red marrow slides, including:
- erythroid islands
- megakaryocytes
- marrow sinusoids
- lipocytes (fat cells)

With the marrow smear be prepared to identify in the erythroid series:
- proerythroblasts
- basophilic erythroblasts,
- polychromatophilic erythroblasts
- orthochromatophilic erythroblasts
- reticulocytes

With the marrow smear be prepared to identify in the granulocye series:
- myeloblasts
- promyelocytes
- myelocytes (neutrophilic; eosinophilic only)
- metamyelocytes (neutrophilic; eosinophilic only)
- band cells (neutrophilic; eosinophilic only)
- mature neutrophils & eosinophils

Define: myeloid tissue, lymphoid tissue