

Hematopoiesis

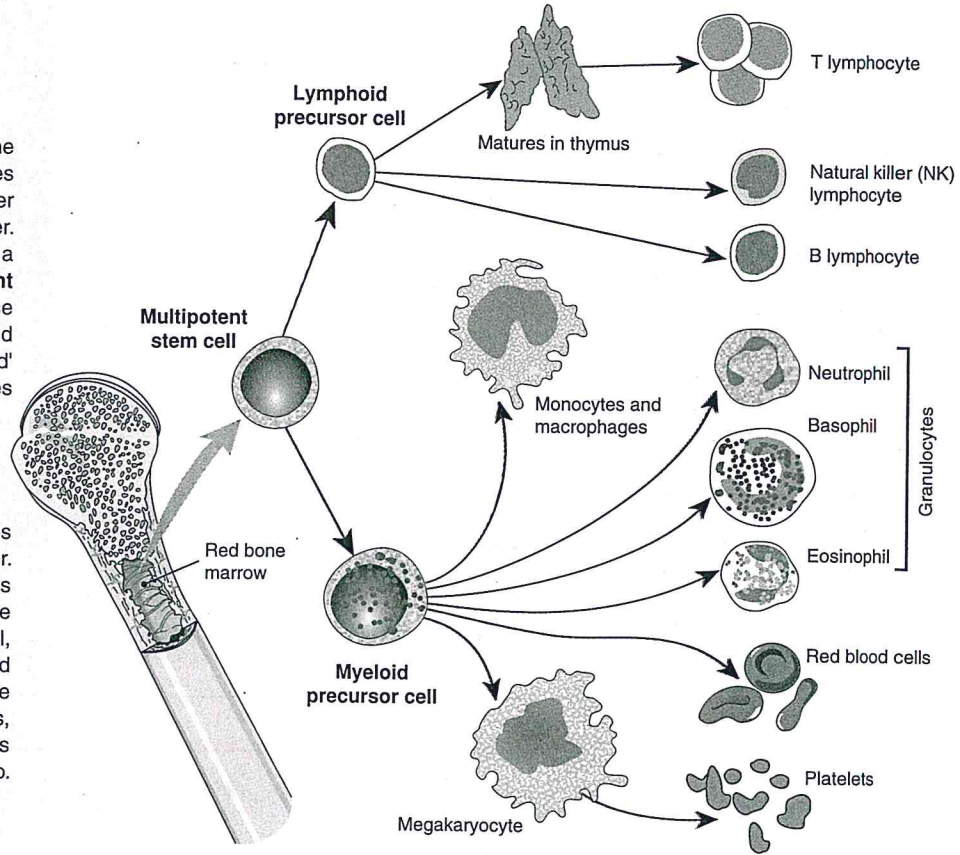
Hematopoiesis (also called hemopoiesis) refers to the formation of blood cells. All cellular blood components are derived from **hematopoietic stem cells** (HSCs). In a healthy adult person, approximately 10^{11} - 10^{12} new blood cells are produced every day in order to maintain homeostasis of the peripheral circulation. Before birth, hematopoiesis occurs in aggregates of blood cells in the yolk sac, then the liver, and eventually the bone marrow. In normal adults, HSCs reside in the red bone marrow and have the ability to give rise to all of the different mature blood cell types. Like all stem cells, HSCs can divide many times while remaining unspecialized and, when given the right signals, they

can differentiate into other cell types. When they proliferate, some of the daughter cells remain as HSCs and some give rise to progenitor cells. The progenitor cells then each commit to any of the alternative differentiation pathways that lead to the production of one or more types of blood cells. Blood cells are divided into lineages. **Erythroid cells** are the oxygen carrying red blood cells. **Lymphoid cells** are the white blood cells of the adaptive immune system. They are derived from common lymphoid progenitors. **Myeloid cells** are derived from common myeloid progenitors, and are involved in many diverse roles within the body's defense system.

Stem Cells and Blood Cell Production

New blood cells are produced in the red bone marrow, which becomes the main site of blood production after birth, taking over from the fetal liver. All types of blood cells develop from a single cell type: called a **multipotent stem cell** or hemocytoblast. These cells are capable of mitosis and of differentiation into 'committed' precursors of each of the main types of blood cell.

Each of the different cell lines is controlled by a specific growth factor. When a stem cell divides, one of its daughters remains a stem cell, while the other becomes a precursor cell, either a lymphoid cell or myeloid cell. These cells continue to mature into the various type of blood cells, developing their specialized features and characteristic roles as they do so.



1. Where are new blood cells produced in the body:
 - (a) Before birth? _____
 - (b) After birth? _____

2. Identify the blood cell types arising from each of the progenitor cell types:
 - (a) Myeloid progenitor cells: _____

 - (b) Lymphoid progenitor cells: _____

3. (a) Using an example, explain the purpose of stem cells in an adult: _____

- (b) Identify where else in the body, apart from the red bone marrow, you might find stem cells: _____

- (c) Explain why blood cells are constantly being produced, when some other cells (e.g. neurons) are not: _____
