Hemopoiesis

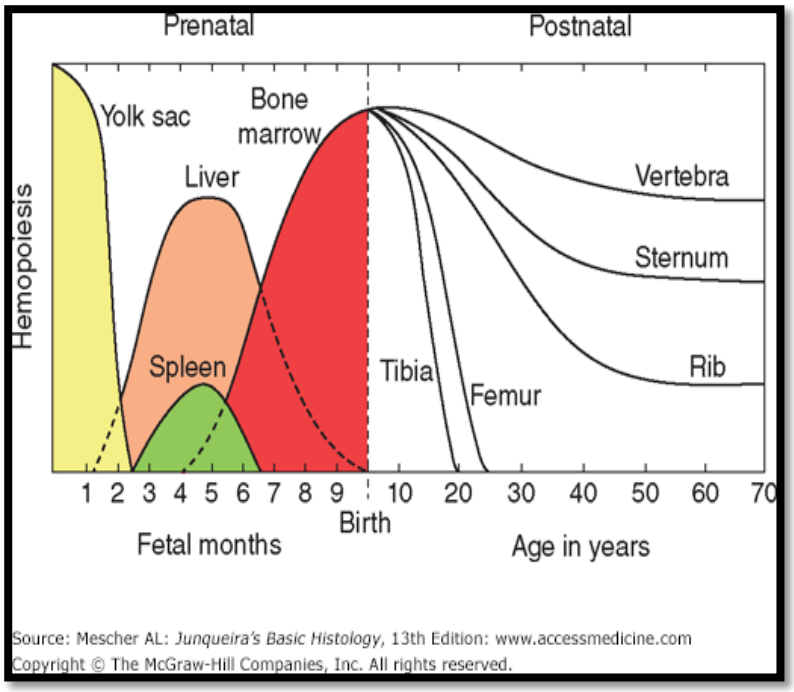
The hemopoiesis or hematopoiesis [(hemo = blood) + (poiesis = making)] **is a process' by which blood cells are formed and occurs the hemopoietic tissue** .

❖ Prenatal hemopoiesis

1-In the earliest phase of human embryogenesis, blood cell arises from **yolk sac mesoderm**.

2- In the second trimester, hemopoiesis occurs primarily in the developing **liver and spleen**.

3- in the third trimester, **bone marrow** become the major hemopoietic organ.



❖ Postnatal hemopoiesis :

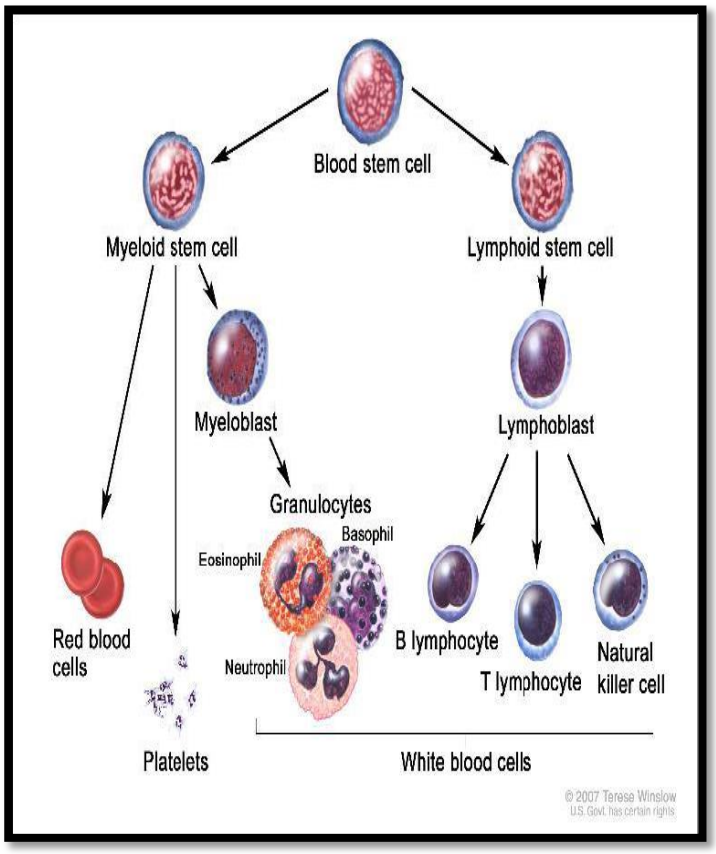
After birth, blood cells are derived from **stem cells** located in bone marrow. Hemopoietic stem cells are'**pluripotent** cells it is believed that all blood cells arise from this single type of cells .

Pluripotent cells are capable of asymmetric division and self-renewal .some of their daughter cell form specific, irreversibly differentiated cell types and other daughter cells remain stem cells

The origin and maturation of blood cells are termed **erythropoiesis, granulopoiesis, monocytopoiesis, thrombocytopoiesis and lymphopoiesis .**

The pluripotent stem cells proliferate and form **two major cell line:**

- **form lymphoid cell (lymphocytes)**
- **form myeloid cells.**

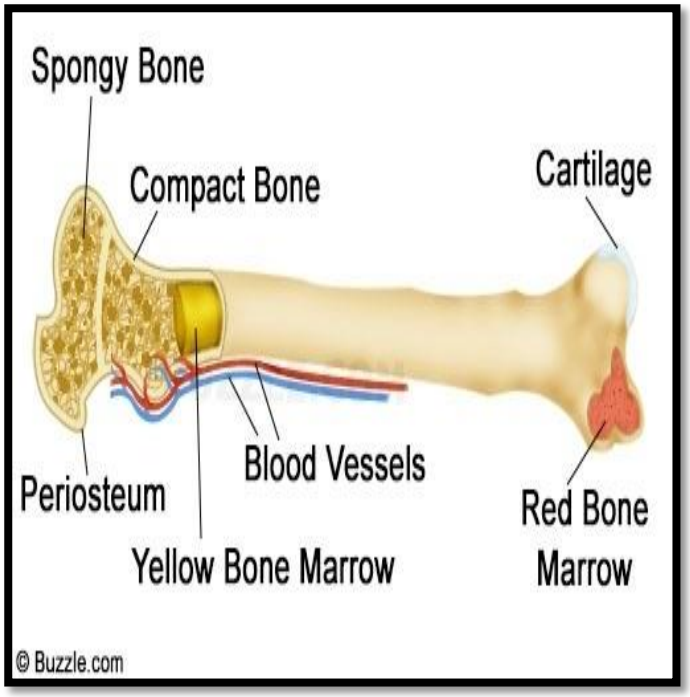


Which develop in bone marrow, myeloid cells include granulocytes, monocytes, erythrocyte and megakaryocytes .

Early in their development, lymphoid cells migrate from bone marrow to the thymus or to other lymph organs, where they proliferate and differentiate and subsequently become incorporated into lymphatic tissues.

Bone marrow

Under normal condition the production of the blood cells by the **bone marrow** is adjusted to the body's need, increasing its activity several-fold in a very short time .



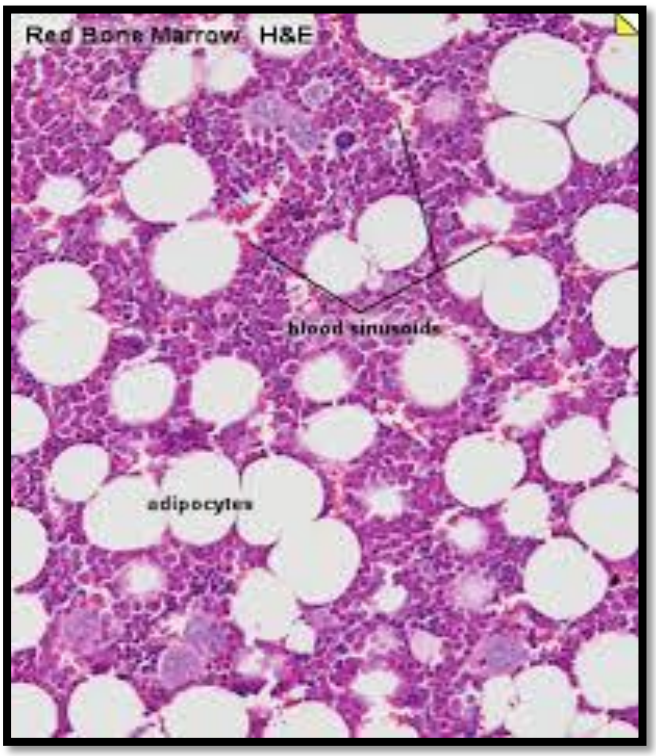
Bone marrow and **adipocytes** are found in **medullary canals** of long bones and in the cavities of flat bones .

There are two types of bone marrow based on their appearance at gross examination :

1- **Red bone marrow:** (blood-forming tissue) whose color is produced by an abundance of blood and hemopoietic cells .
2- **Yellow bone marrow:** It is filled with adipocytes and essentially excludes hemopoietic cells .

Red bone marrow is composed of :

1- Stroma: - is a network of reticular cells, a **delicate reticular fibers, collagen (type I, III) , supporting hemopoietic cells and macrophages.**
2- **Hemopoietic Cords**: consist of a population of **developing blood cells** represent all stages in the maturation of red and white blood cells
3- **Sinusoidal Capillaries**: the walls of sinusoids are thin consisting of a thin layer of endothelial cells supported by reticular fibers .



Differentiated blood cells from the hemopoietic cords **enter** the blood circulation by passing through openings in the endothelium .

Blood cells

❖ Erythrocytes or Red Blood Corpuscles (RBC)

RBC's are quite flexible rounded, biconcave, non-nucleated discs. In small vessels red blood cells also often stack up in aggregates called **rouleaux**, or in stagnant circulation or in blood removed from circulation .

The diameter of RBC varies between 7-8µm .Their thickness is about 2µm. RBC's with larger diameter (more than 9 µm) are called **macrocytes,** while RBC's of smaller diameter less than 6 micron are termed **microcytes** . Great variation in the size of the RBC's is called **Anisocytosis**.

They are acidophilic after staining due to the presence hemoglobin. Darker RBC's are called **hyperchromic**, while lightly stained RBC's are **hypochromic** .

Structure

RBC's are not true cells; they have no nuclei or organelles .

Each one contains a mass of hemoglobin (O_2-carrying protein) surrounded by a cell membrane. The cell membrane is affected by changes in the osmotic pressure .

Lifespan

It is about 120 days, senile RBCs are destroyed by the phagocytic cells in liver and spleen. Their iron content is stored while the pigment is excreted as bile pigment .

Number

In males the number varies between 5 and 6.0 milllon/mm^3. In females it is 4.5 - 5 millions/mm^3.

	Red blood cells	White blood cells	Platelets
Scientific name	Erythrocytes	Leucocytes	Thrombocytes
Size	Small(diameter 0.008 mm)	Bigger than red cells (diameter 0.02mm)	Smaller than red cells (diameter 0.003mm)
Number	(4-5 million/ mm³)	Less in number (about 8000/ mm³)	More than WBC (250,000/ mm³)
		Phagocytes *Lymphocytes*	
Shape	Biconcave disc shape	Irregular shape Round shape	Irregular shape
Nucleus	Absent	Irregular/ bilobed Round	Absent
Function	Carry respiratory gases, mainly oxygen	Phagocytosis Produce antibodies	Helps in blood clotting

Reference:

1- diFIORE'S Atlas of histology with Functional Correlations, eleventh edition,2008.

2- diFIORE'S Atlas of histology with Functional Correlations, twelfth edition,2013.

3- ***Jonquiere's basic histology text and atlas 13th edition (2013) by Anthony L. Mescher ; Di Fiore's Atlas of Histology 12th ed. (2013) Victor P. Eroschenko***