



HEMATOLOGY INTRODUCTION

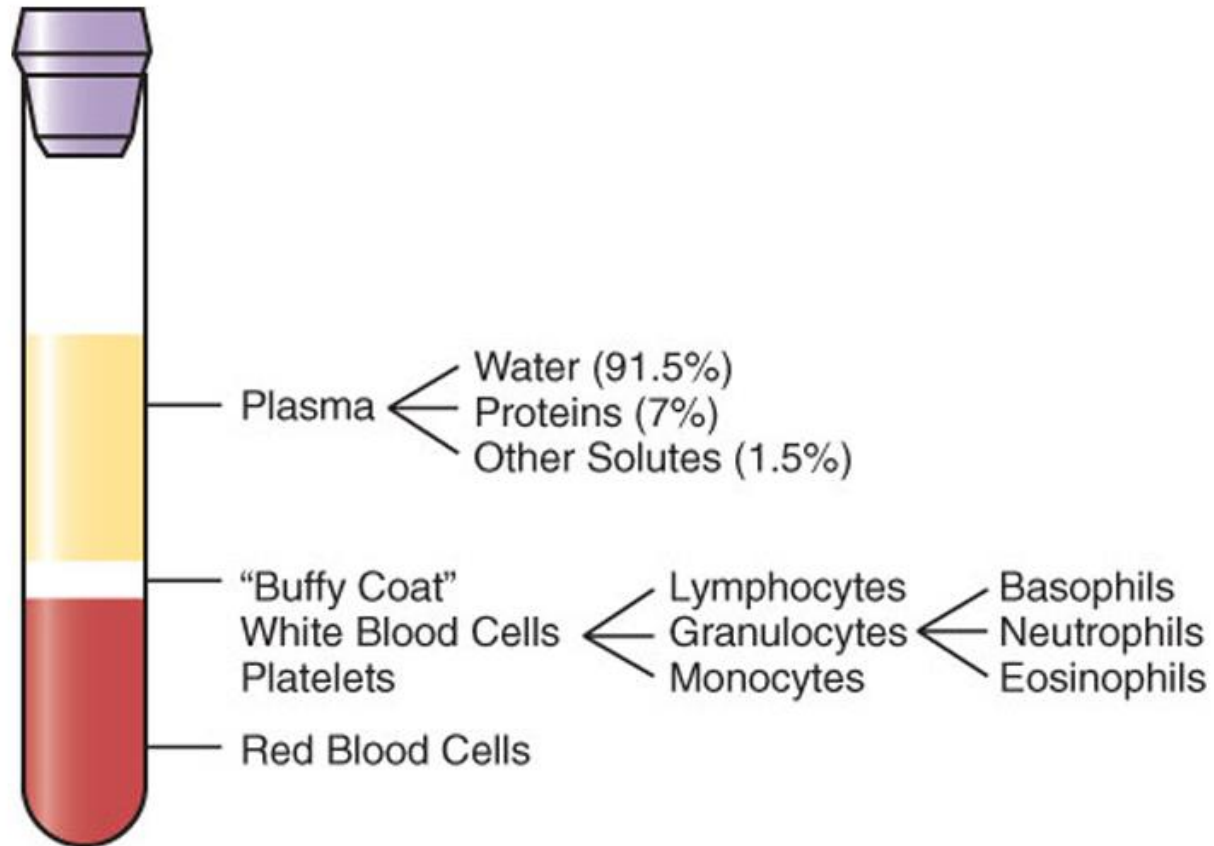
Organization of blood and blood forming organs

WHAT IS HEMATOLOGY?

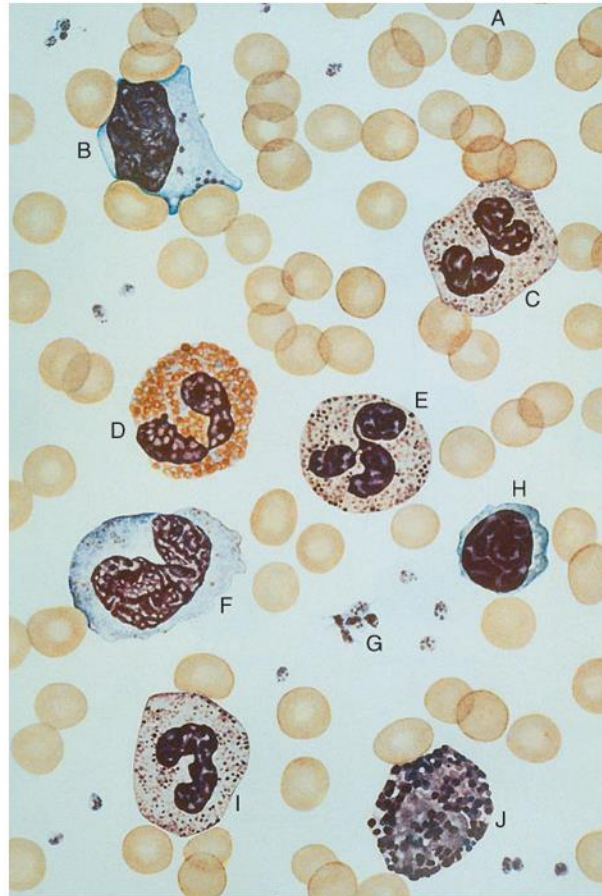
- Hematology is the study of blood which is composed of plasma (~55%), and the formed elements which are:
 - The erythrocytes (RBCs) (~45%)
 - Contain hemoglobin
 - Function in the transport of O₂ and CO₂
 - The Leukocytes (WBCs) and platelets (thrombocytes) (~1%)
 - Leukocytes are involved in the body's defense against the invasion of foreign antigens.
 - Platelets are involved in hemostasis which forms a barrier to limit blood loss at an injured site.



COMPOSITION OF BLOOD



TYPES OF FORMED ELEMENTS IN THE BLOOD



WHAT IS HEMATOLOGY?

- Hematology is primarily a study of the formed cellular elements.
- Alterations in the formed elements in the blood are usually a **result of disease** rather than being the primary cause of disease.
 - In fact, variations in the formed elements in the blood are often the **first sign** that disease is occurring in the body.
 - The changes caused by disease may be detected by lab tests that measure deviations of the blood constituents from the normal values. These lab test may include:



WHAT IS HEMATOLOGY?

- RBC count
- WBC count
- Platelet count
- Hematocrit (packed cell volume)
- Mean corpuscular volume (MCV)
- Mean corpuscular hemoglobin concentration (MCHC)
- Under normal conditions the production, release, and survival of blood cells is a highly regulated process. Quantitative and/or qualitative hematologic abnormalities may result when there is an imbalance between cell production, release, and/or survival.



WHAT IS HEMATOLOGY?

- Age, sex, and geographic location are involved in **physiologic changes** in normal values of the formed cellular elements
- **Pathologic changes** in the values of the formed cellular elements occur with disease or injury.
- Normal values for a group are determined by calculating the mean for healthy individuals of the group and reporting the normal range as the mean \pm 2 standard deviations



WHAT IS HEMATOLOGY?

- Hematopoiesis is a term describing the formation and development of blood cells.
 - Cells of the blood are constantly being lost or destroyed. Thus, to maintain homeostasis, the system must have the capacity for self renewal. This system involves:
 - Proliferation of progeny stem cells
 - Differentiation and maturation of the stem cells into the functional cellular elements.
 - In normal adults, the proliferation, differentiation, and maturation of the hematopoietic cells (RBCs, WBCs, and platelets) is limited to the bone marrow and the widespread lymphatic system and only mature cells are released into the peripheral blood.

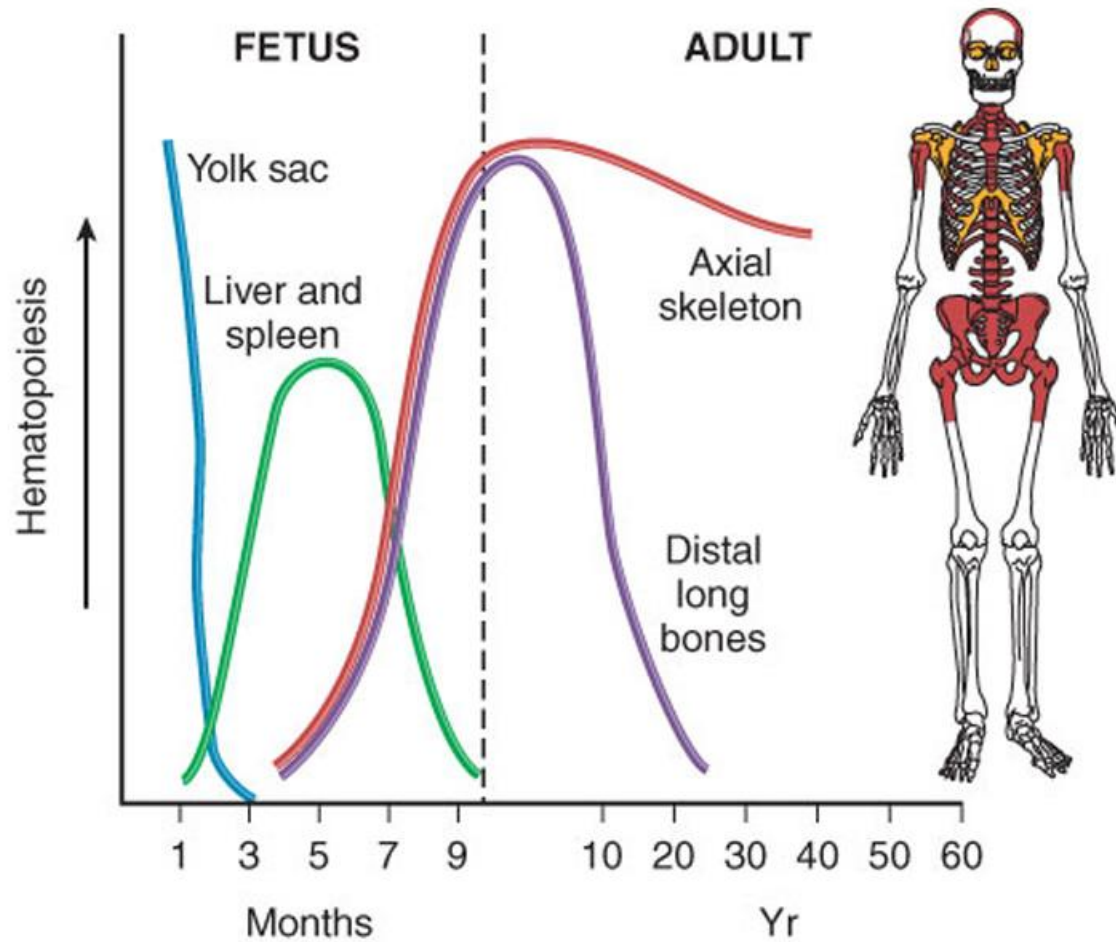


WHAT IS HEMATOLOGY?

- Hematopoiesis begins as early as the nineteenth day after fertilization in the **yolk sac of the embryo**
 - Only erythrocytes are made
 - The RBCs contain unique **fetal hemoglobins**
- At about 6 weeks of gestation, yolk sac production of erythrocytes decreases and production of RBCs in the human embryo itself begins.



HEMATOPOIESIS

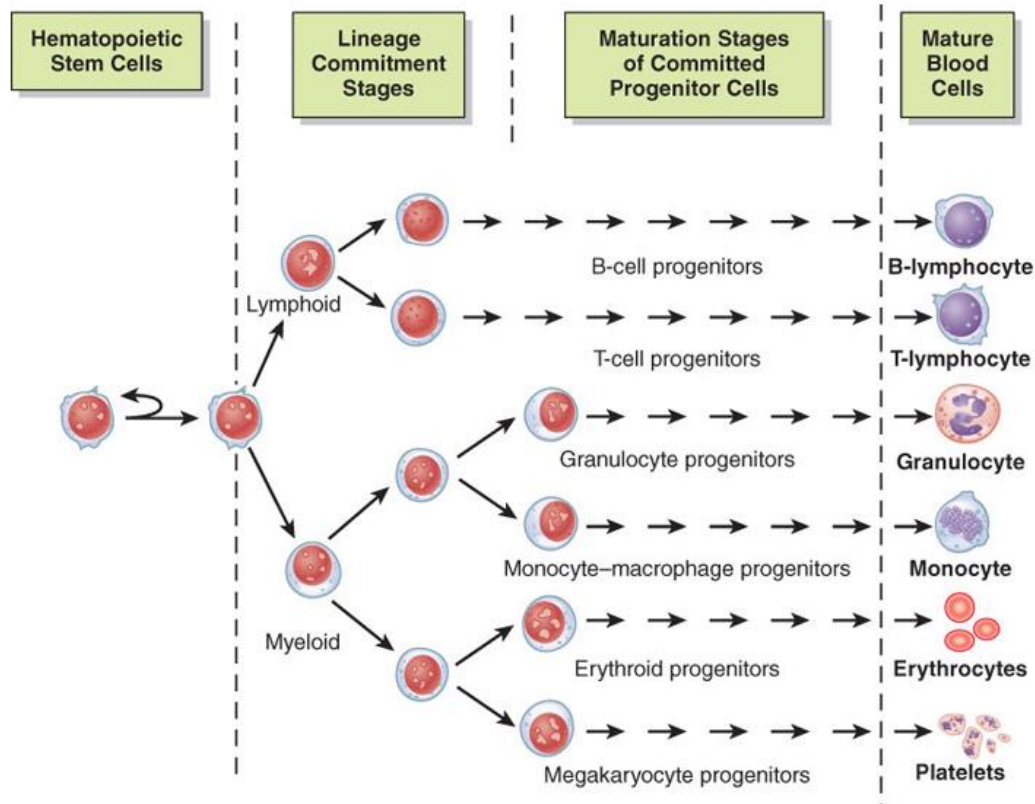


WHAT IS HEMATOLOGY?

- Hematopoiesis in the bone marrow is called **medullary hematopoiesis**
- Hematopoiesis in areas other than the bone marrow is called **extramedullary hematopoiesis**
 - Extramedullary hematopoiesis may occur in fetal hematopoietic tissue (liver and spleen) of an adult when the bone marrow cannot meet the physiologic needs of the tissues. This can lead to hepatomegaly and/or splenomegaly (increase in size of the liver and/or spleen because of increased functions in the organs).
- **Hematopoietic tissue** includes tissues involved in the proliferation, maturation, and destruction of blood cells



HEMATOPOIESIS



Differentiation of pluripotent stem cells during hematopoiesis

Phase	Stem Cells	Progenitor Cells	Precursor Cells (Blasts)	Mature Cells
Early morphologic	Not morphologically distinguishable; have the general aspect of lymphocytes		Beginning of morphologic differentiation	Clear morphologic differentiation
Mitotic activity	Low mitotic activity; self-renewing; scarce in bone marrow	High mitotic activity; self-renewing; common in marrow and lymphoid organs; mono- or bipotential	High mitotic activity; not self-renewing; common in marrow and lymphoid organs; monopotential	No mitotic activity; abundant in blood and hematopoietic organs

