

كلية تقنيات المختبرات الطبية/الحدباء

المرحلة الثالثة

Hematology

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# Learning objectives

- Introduction to hematology
- Function of blood
- Hemopoiesis
- Erythropoiesis

# Introduction

Hematopathology is structured around disorders of:

- ❑ red cells
- ❑ white cells
- ❑ platelets
- ❑ coagulation.

Remember, however, that individual diseases commonly affect more than one of them.

# *Physiology*

- ❖ The marrow is a large organ, approaching the size of the liver.
- ❖ In adults, most of it is in the flat bones, including the sternum, pelvis and vertebrae.
- ❖ White blood cell precursors form 75% of the marrow and most of the rest consists of erythroid precursors.
- ❖ Megakaryocytes (from which platelets are formed) are scattered throughout.

It may seem surprising that so much of the marrow is devoted to the white cell series, given that there are 500 times as many red cells as white cells in the circulation. However, erythrocytes have a mean life of 120 days whereas white cells have a circulating lifespan measured in hours.

- ❑ All blood cells are derived from **multipotent, uncommitted stem cells**.
- ❑ These differentiate into the lines of committed stem cells from which red cells, platelets, monocytes, granulocytes and lymphocytes are formed.
- ❑ The processes of **differentiation and proliferation** are controlled by growth factors, including interleukins, colony-stimulating factors and erythropoietin.

## **Box 10** Investigations in haematology

### **Blood count and film**

Full blood count; red cell count (RCC), white cell count (WCC)

Blood film

Differential white cell count

Platelet count

Erythrocyte sedimentation rate (ESR)

Mean cell volume (MCV)

Red cell width distribution (RDW)

### **Haematinics**

Iron and total iron-binding capacity

Ferritin

Vitamin B<sub>12</sub>

Folate and red cell folate

### **Coagulation**

International normalised ratio (INR)

Prothrombin time (PT)

Activated partial thromboplastin time (APTT)

Plasma fibrinogen

Fibrin degradation products (FDPs)

D-dimer

### **Bone marrow**

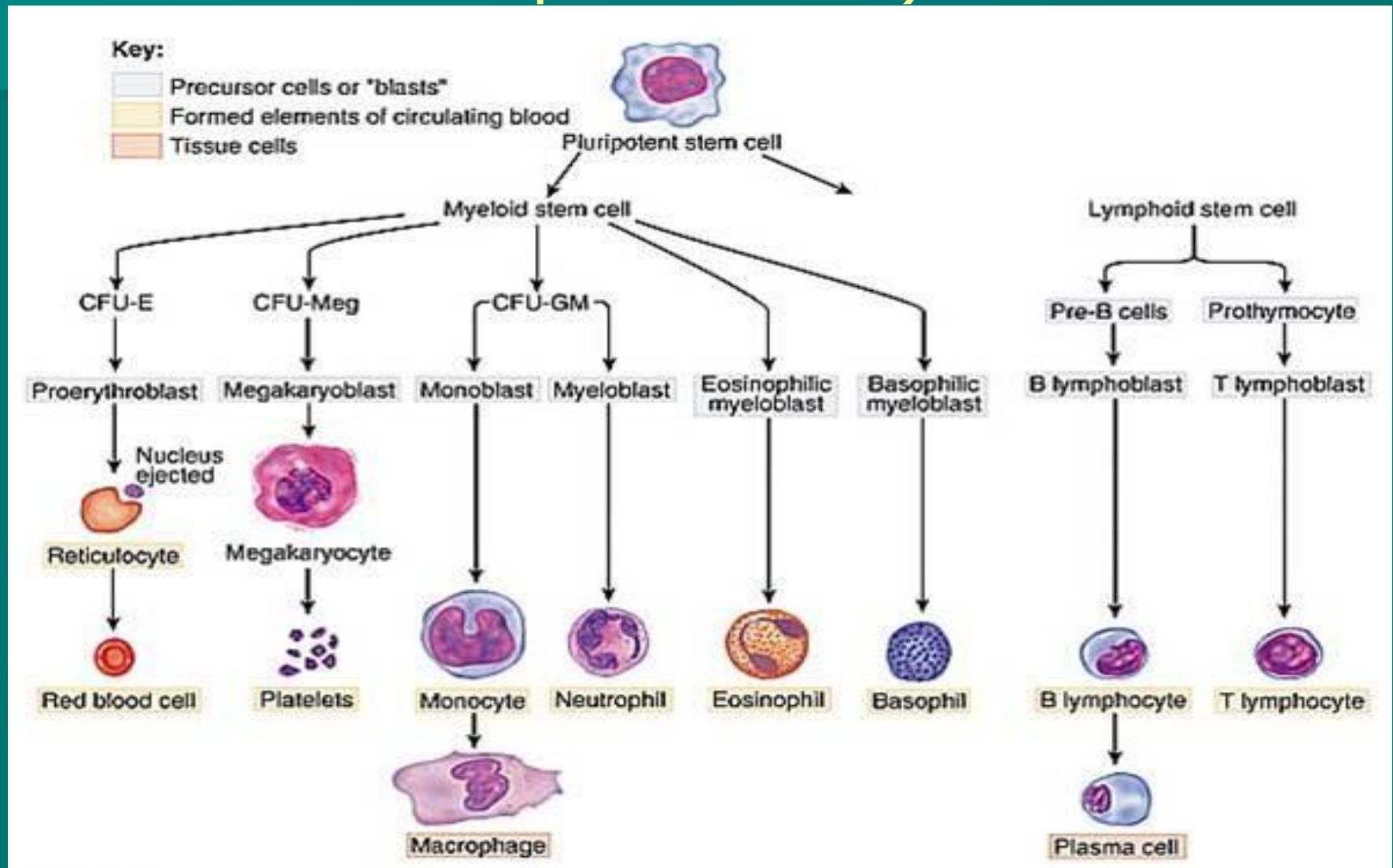
### **Lymph node biopsy**

# FUNCTIONS OF BLOOD

- ❖ Nutrient supply
- ❖ Respiratory Function
- ❖ Excretory Function
- ❖ Transport Of Hormones And Enzymes
- ❖ Regulation of Acid-Base Balance
- ❖ Regulation of body Temperature
- ❖ Storage Function
- ❖ Defensive function

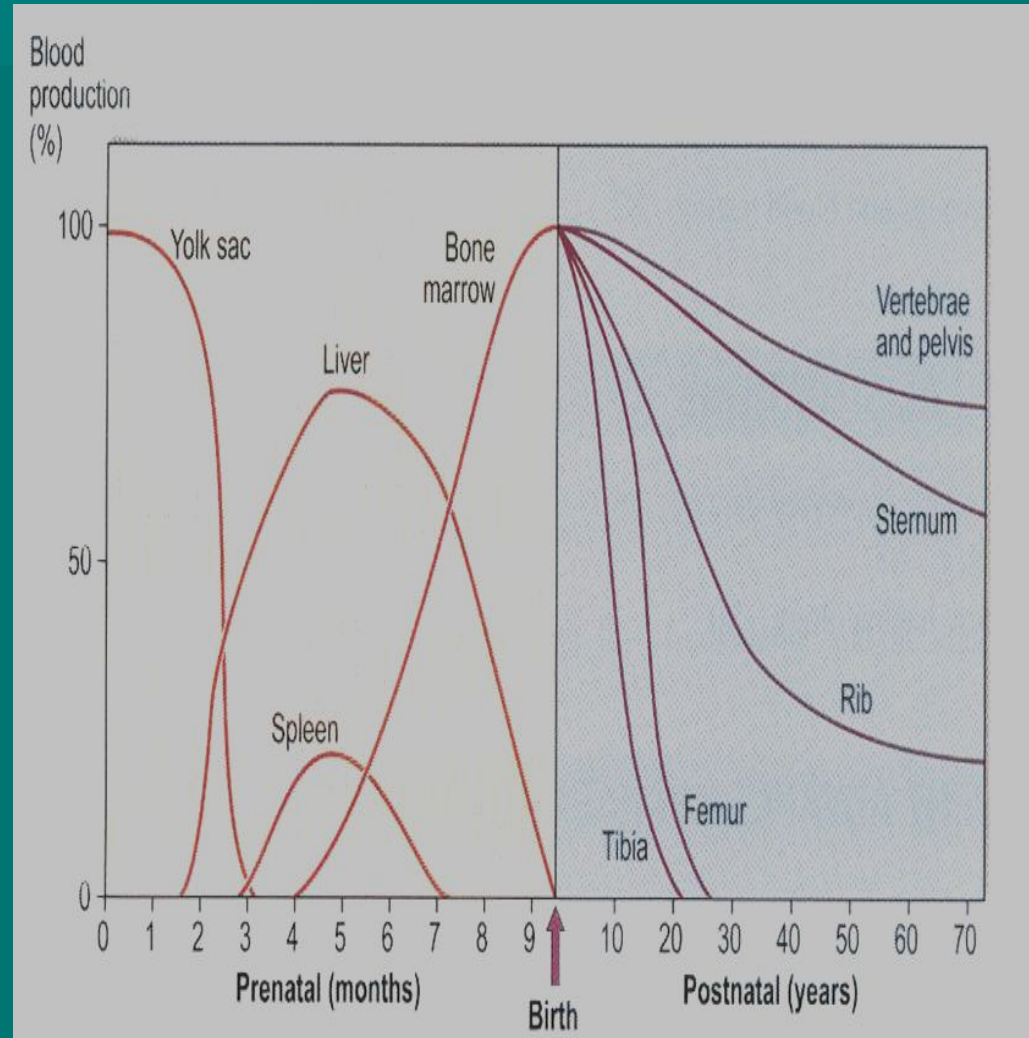


# Normal Haemopoiesis : Cell hierarchy (Haemopoiesis schematic representation)



# Sites of Haemopoiesis

- Yolk sac
- Liver and spleen
- Bone marrow



# Haemopoietic growth factors

- GM-CSF
    - Granulocyte-Macrophage colony stimulating factor
  - M-CSF
    - Macrophage colony stimulating factor
  - Erythropoietin
    - Erythropoiesis stimulating hormone
- (These factors have the capacity to stimulate the proliferation of their target progenitor cells when used as a sole source of stimulation)
- Thrombopoietin
    - Stimulates megakaryopoiesis

# Haemopoietic growth factors

## ■ Cytokines

- IL 1 (Interleukin 1)
- IL 3
- IL 4
- IL 5
- IL 6
- IL 9
- IL 11
- TGF- $\beta$
- SCF (Stem cell factor, also known as kit-ligand)

Cytokines have no (e.g IL-1) or little (SCF) capacity to stimulate cell proliferation on their own, but are able to synergise with other cytokines to recruit naive cells into proliferation.

# Erythropoiesis and erythrocytes

- Lifespan – 120 days
- Non nucleated
- Biconcave disc
- Production regulated by Epo
- Needs Fe, B12, folate & other elements for development

