ERYTHROPOIESIS

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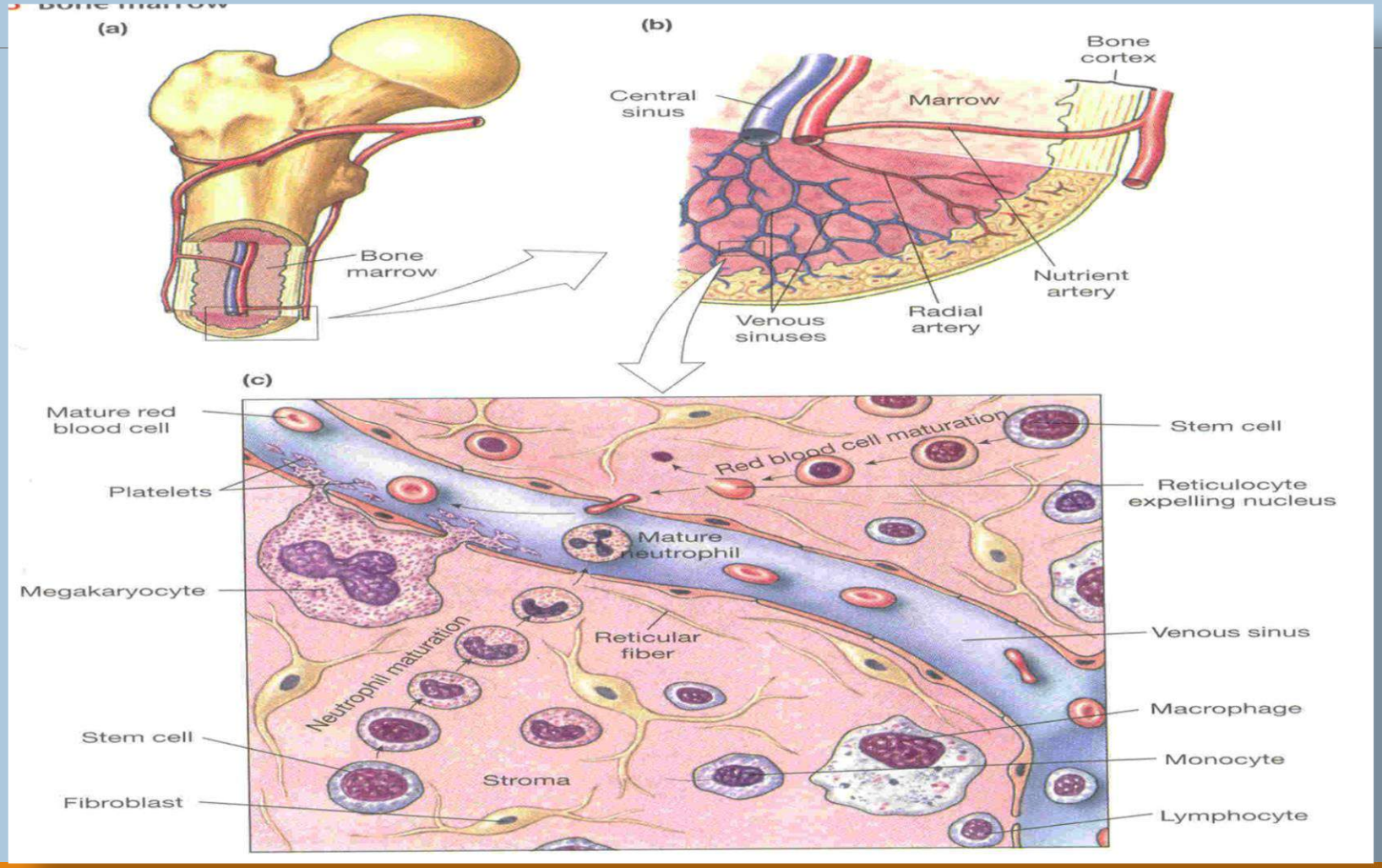
Hematopoiesis

Formation of blood cells in general is termed as Hemopoiesis or Hematopoiesis

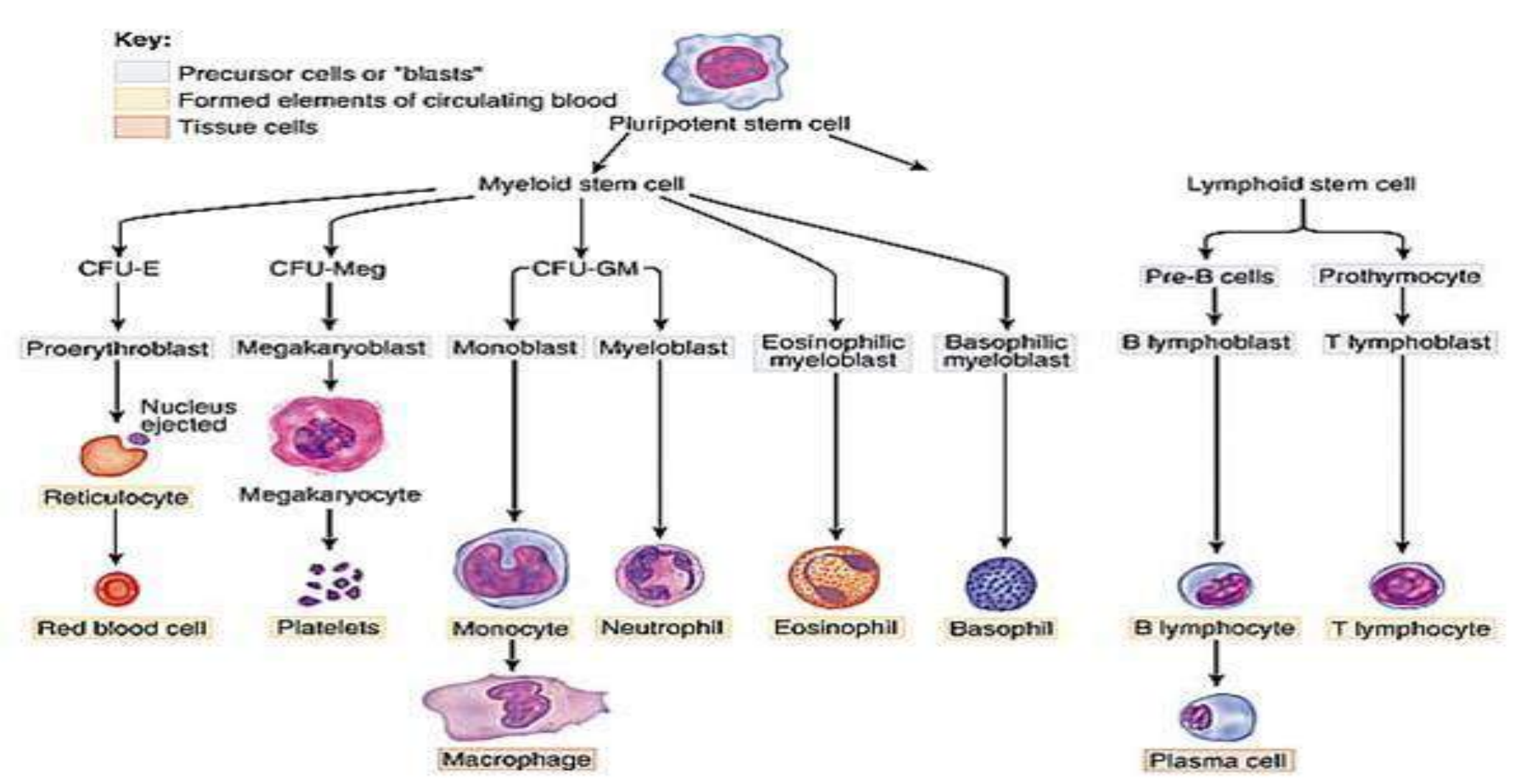
The process of differentiation from stem cells to mature erythrocyte is called Erythropoiesis

The rate at which the blood cells are produced are regulated in healthy individuals to match the rates at which they leave the circulation.

Hematopoiesis

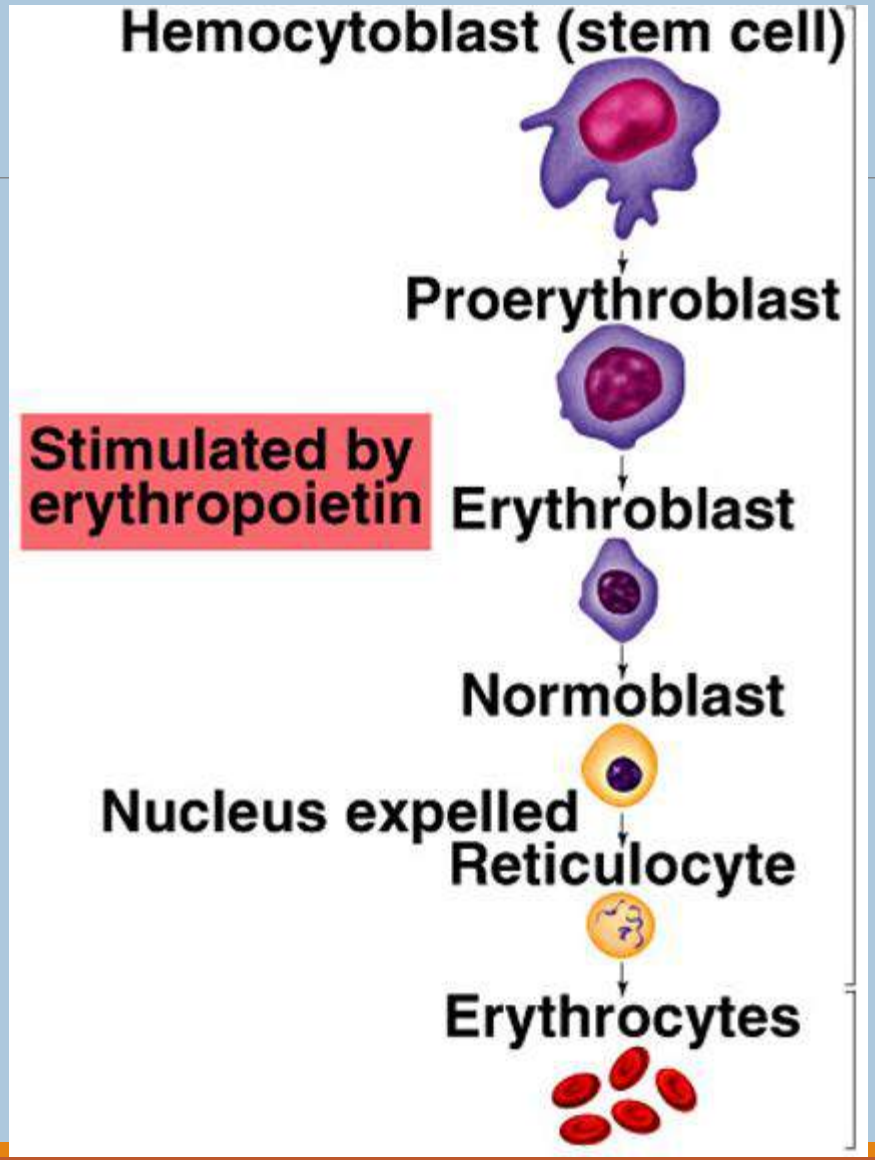


HEMOPOIESIS

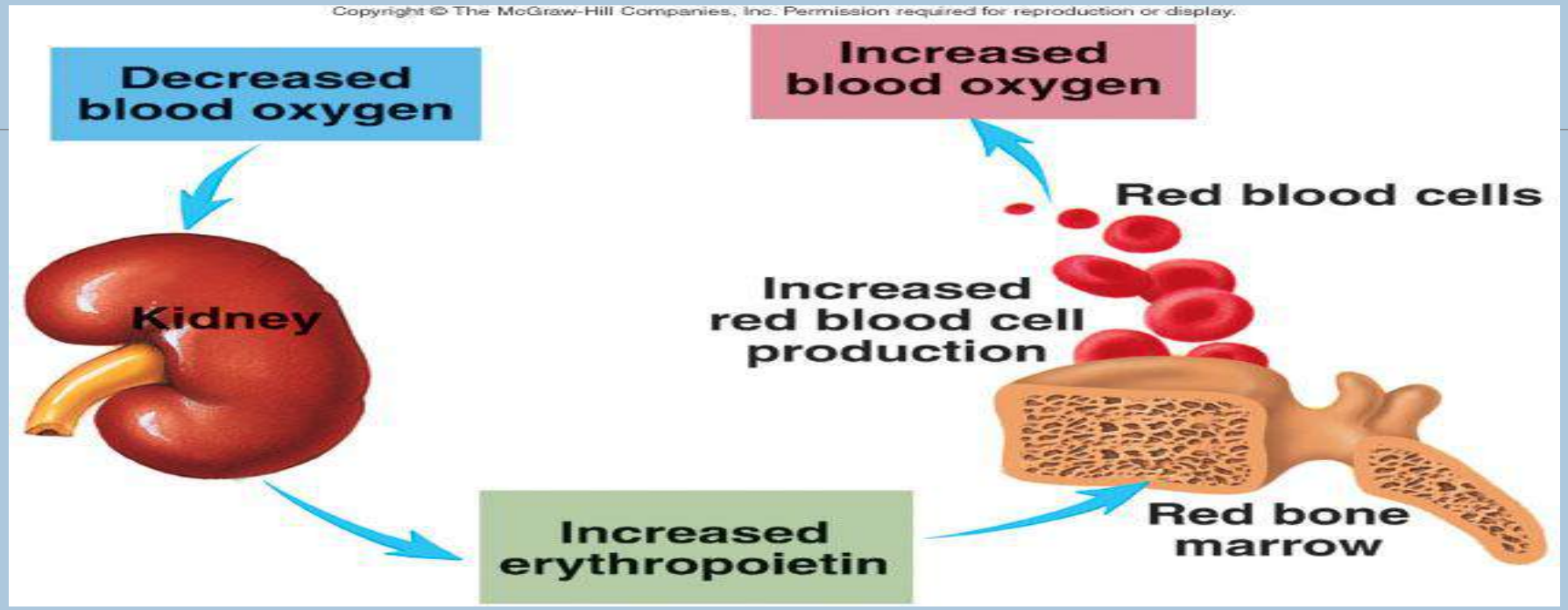


Erythropoiesis-Stages

- Proerythroblast
- Early normoblast
- Intermediate normoblast
- Late normoblast
- Reticulocyte
- Matured erythrocyte



Erythropoiesis



Production of red blood cells

Stem cells ➡ proerythroblasts ➡ early normoblast ➡ intermediate normoblast ➡ late normoblast ➡ reticulocytes ➡ matured RBC

Erythropoietin: Hormone to stimulate RBC production

ERYTHROPOIESIS

The origin , development and maturation of erythrocytes

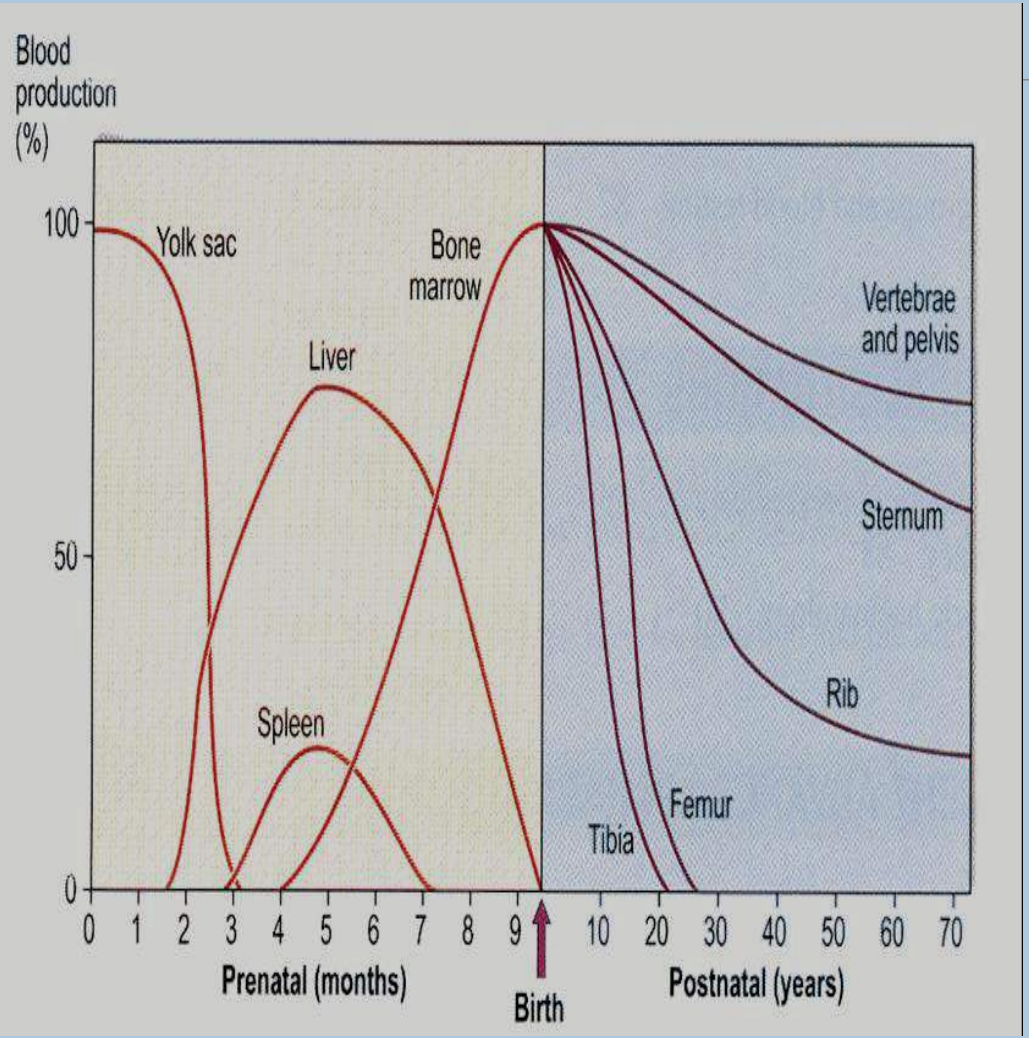
Various control mechanisms regulate erythropoiesis, so that the red cells mass in the body remain constant.

Intra uterine life

Mesoblastic stage

Hepatic stage

Myeloid stage



mesoblastic stage

starts in the 3rd week of intrauterine life in the mesoderm of the yolk sac and continues up to the 3rd month. -intravascular erythropoiesis

hepatic stage

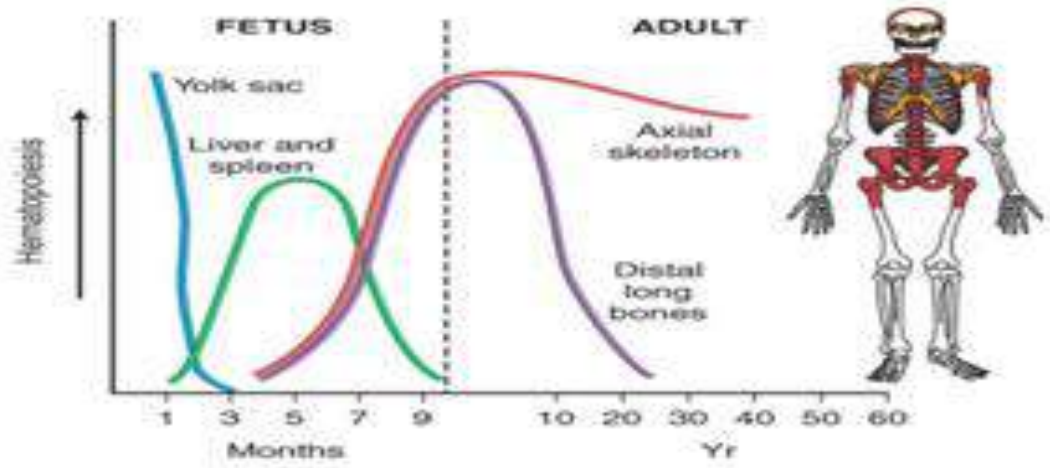
from the 2nd month up to delivery, peak during the 5th and 6th month. spleen - between 2nd and 6th month

Myeloid stage

from the 5th month onwards

Site of Hematopoiesis

During fetal life	After birth
1) Yolk sac: 2) Liver & Spleen: 3) Bone marrow (BM):	Active (red) BM: In infancy & childhood In adult



Site of Erythropoiesis

Site of Erythropoiesis

- **During intrauterine life**

Mesoblastic stage (3rd week to 3 months)

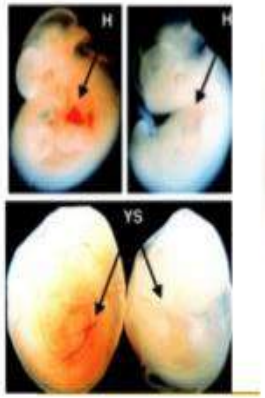
Hepatic stage (after 3 months)

Myeloid stage (3rd trimester)

Intravascular erythropoiesis

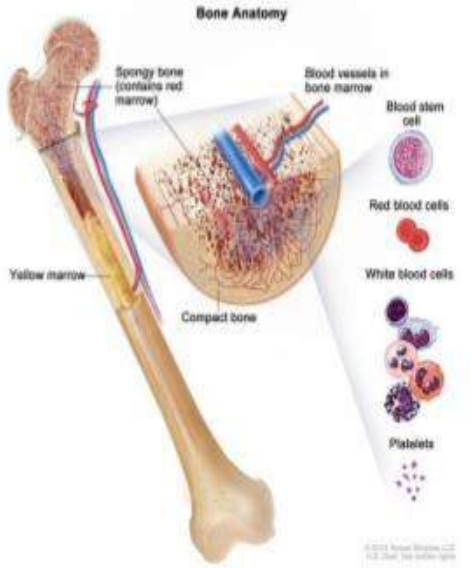
Extravascular erythropoiesis

Nucleated RBCs

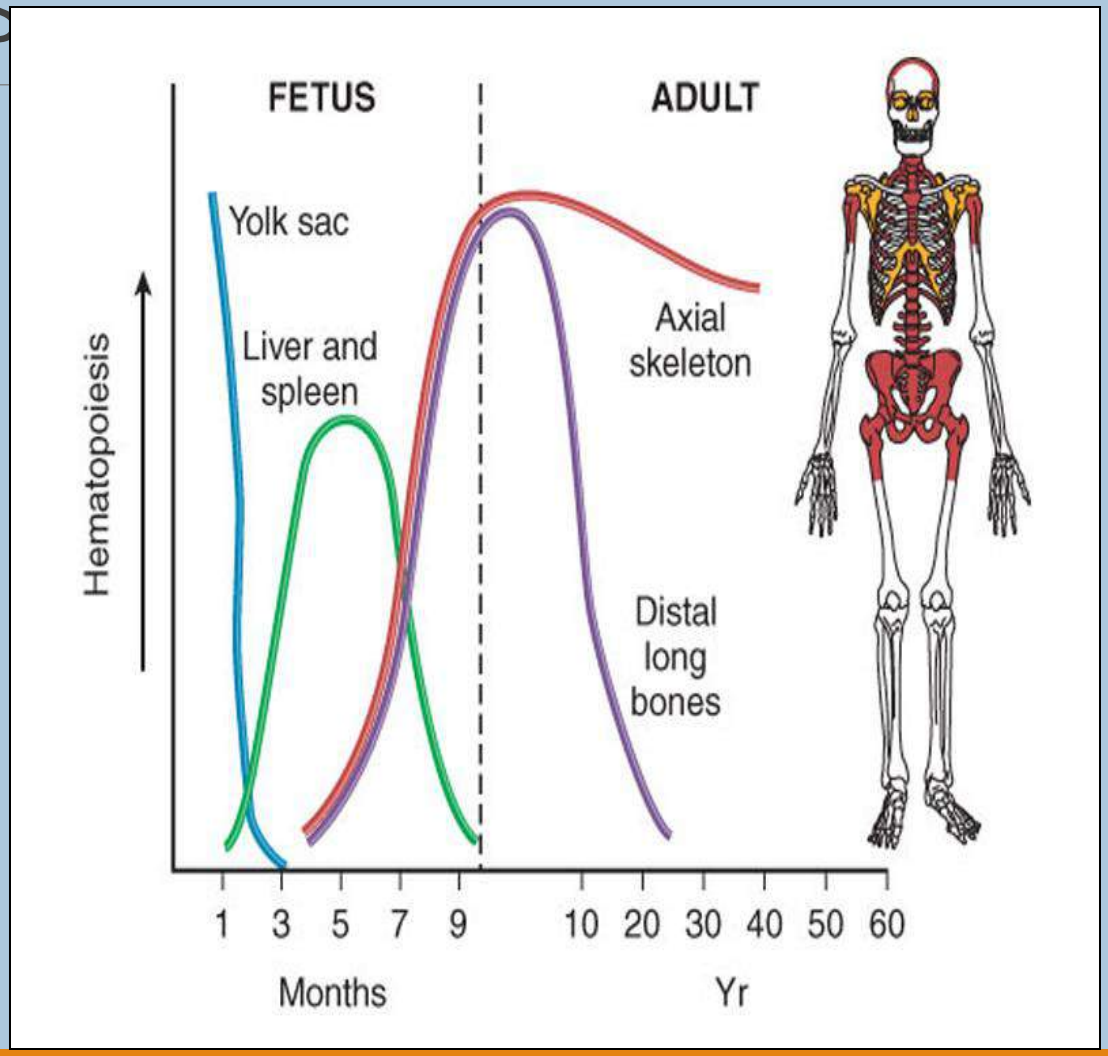


Yolk sac

Liver & spleen



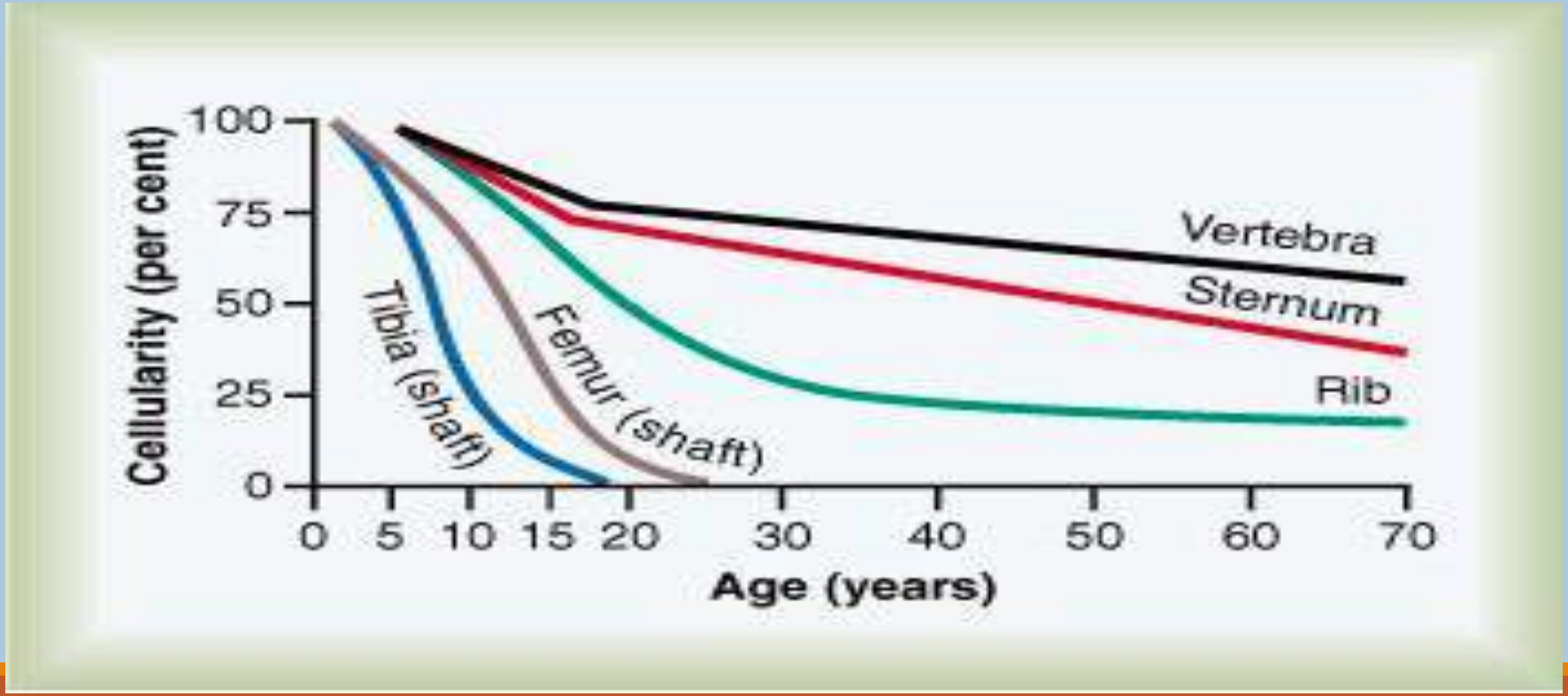
Bone marrow



After birth

- red bone marrow is alone concerned with erythropoiesis
- upto 6 years all marrow is red
- by 6-20 years red marrow is present only in long bones and in membranous bones
- after 20 yrs, red marroe is present only at the ends of long bones like humerus, femur etc, and in the membranous bones like sternum, ribs, scapula, ilium, skull and vertebrae.

Relative **rates of red blood cell production** in the bone marrow of different bones at different ages



- when there is increased demand of RBC the yellow marrow is capable of reverting back to active red marrow.
- when bone marrow is destroyed or fibrosed, extramedullary hemopoiesis occurs-
- in adults at times of need , liver and spleen also produce red blood cells.

75% of active marrow is involved in production of WBC

-MYELOID SERIES

25% Produces RBC- erythroid series

----3:1(WBC to RBC)

-----in peripheral blood ratio of wbc to rbc is 1: 700

----the life span of RBC is far greater than of WBC

Changes occurring in each stage of Erythropoiesis

- Reduction in size of the cell
- Disappearance of nucleoli and nucleus
- Appearance of hemoglobin
- Changes in the staining properties of the cytoplasm

Pronormoblast or proerythroblast

Round or oval in shape

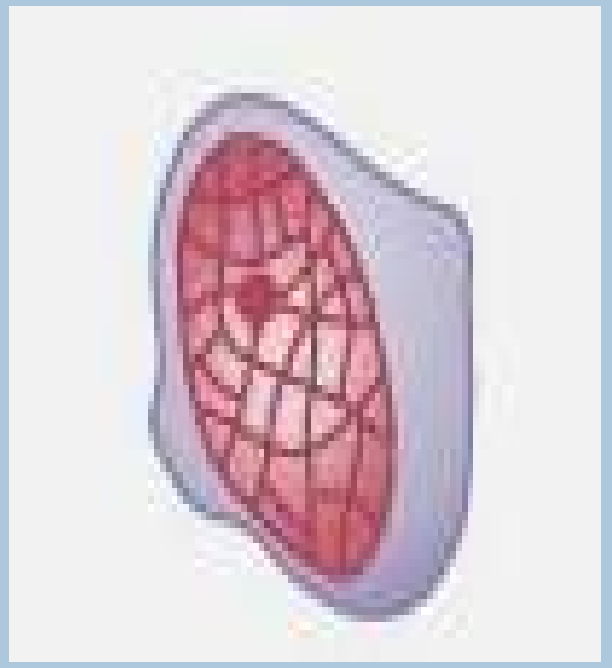
15-20 micrometer in diameter

Large nucleus which occupies 80% of cell and contains 2-3 nucleoli

Thin rim of cytoplasm is seen

No hemoglobin

Ferritin molecules present



Basophilic normoblast/early normoblast

12-17 micrometer in diameter

Nucleus smaller

Nucleoli disappear

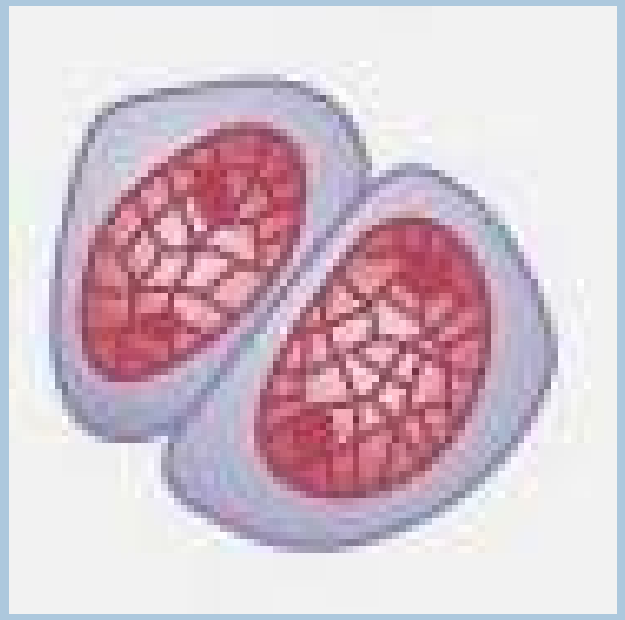
Show **mitosis**

Chromatin condensation seen

Cytoplasm more deeply basophilic- deep blue

- Increase in ribosomes **RNA**

Hemoglobin starts appearing



Polychromatophilic erythroblast/Intermediate normoblast

12-15micrometer in diameter

Nucleus very small and assumes a cart wheel

appearance

Chromatin condensation more

Cytoplasm shows both pink and blue areas.pink colour

is due to increase in hemoglobin content

No. of mitochondria decreases

Orthochromatic Normoblast or late Normoblast

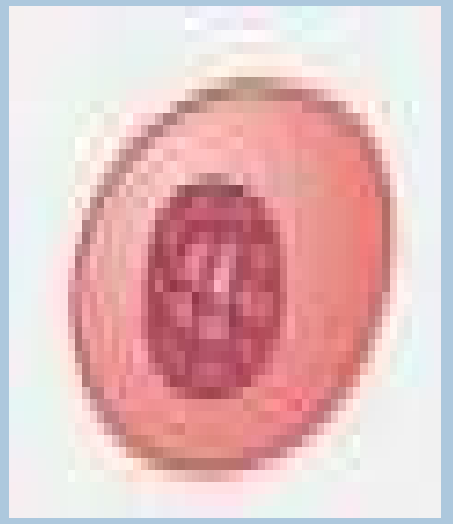
8-12 micrometer in diameter, smallest of the nucleated precursors

Cytoplasm is pink and hb synthesis is complete

Nucleus undergoes pyknotic degeneration and it shrinks and becomes irregular

Nuclear lysis and

Nuclear extrusion



Reticulocyte

8 micrometer in diameter, irregular and polylobulated due to extrusion of nucleus

Cytoplasm contains ribosomes, mitochondria and golgi complex

- **Synthesize Hb**

Young RBCs (34% Hb)

1 % of Red Cells

Matured Erythrocyte

RBC pass **from the bone marrow** into the **blood capillaries**

Dia -7.2 micrometer in diameter

Factors regulating ERYTHROPOIESIS

BPA(burst promoting activity)

Erythropoietin

Hormones

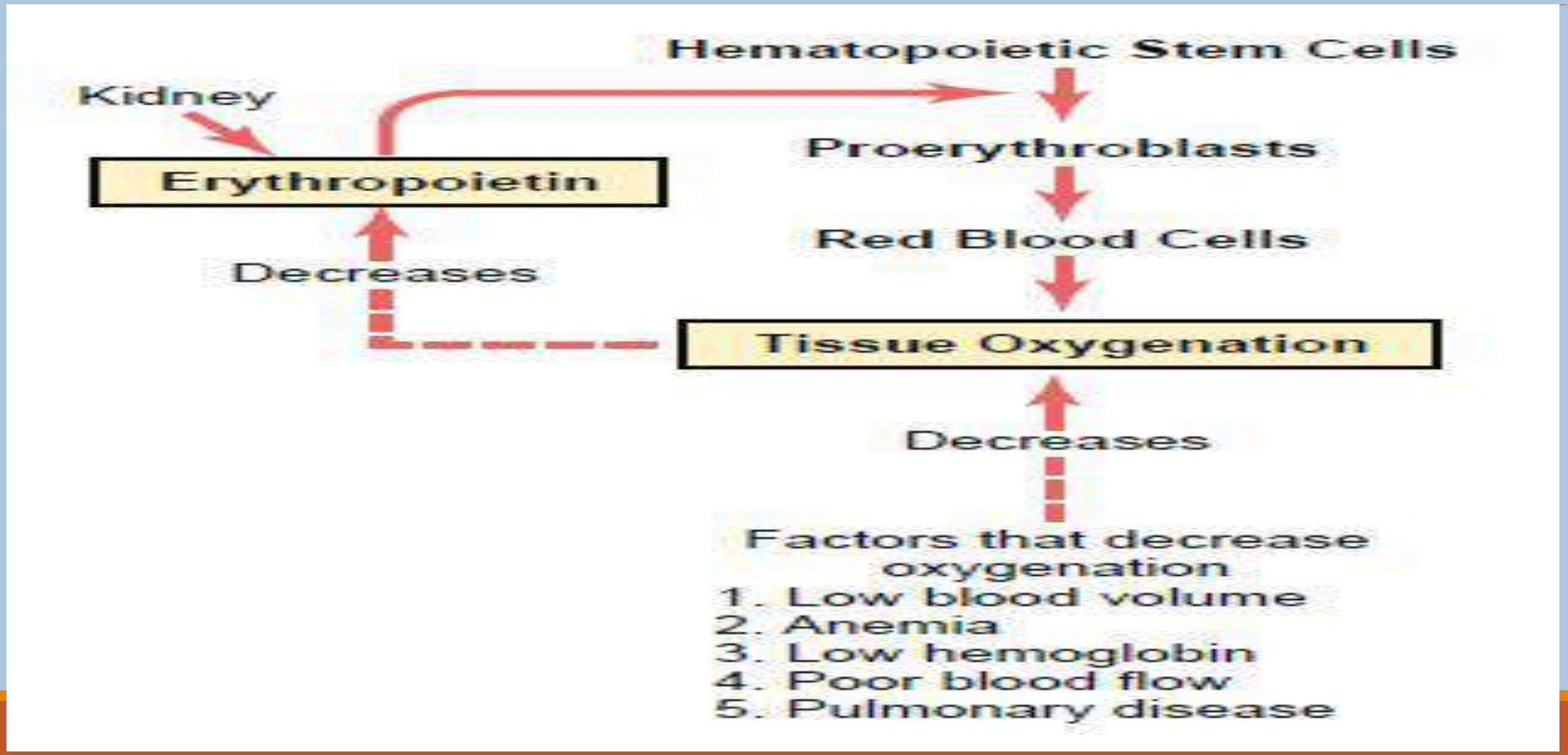
Metals

Lipids& proteins

Vitamins

Maturation factors

FEEDBACK REGULATION OF ERYTHROPOIESIS



THANK YOU