Biology

Bone marrow:

- Is one of the largest organs in the body, it is the main site for hematopoiesis.

- red bone marrow:
- yellow bone marrow:

What is Bone marrow & Where do you find it ???

Yellow Marrow

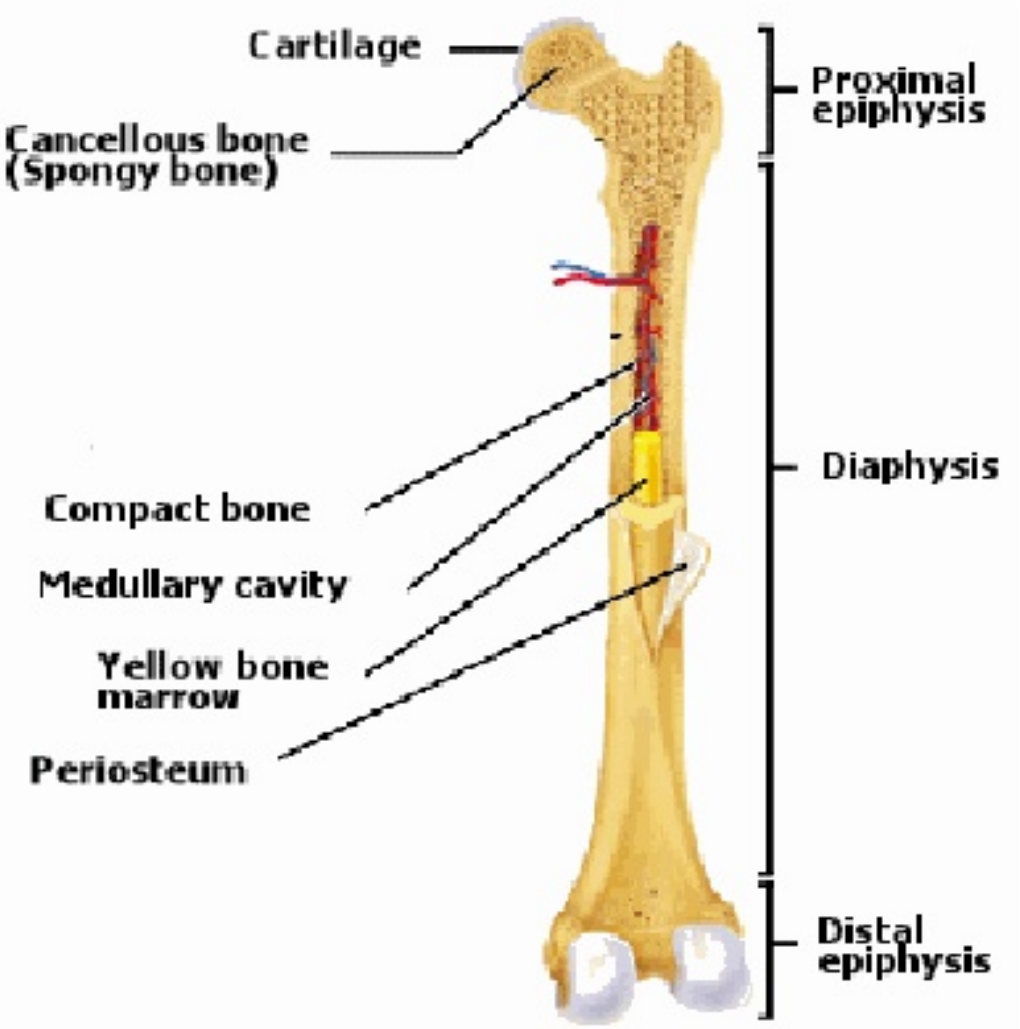
- Presence of Adipocytes

Red marrow

- Consists of Stroma, Hemopoitic cord, Sinusoidal capillaries

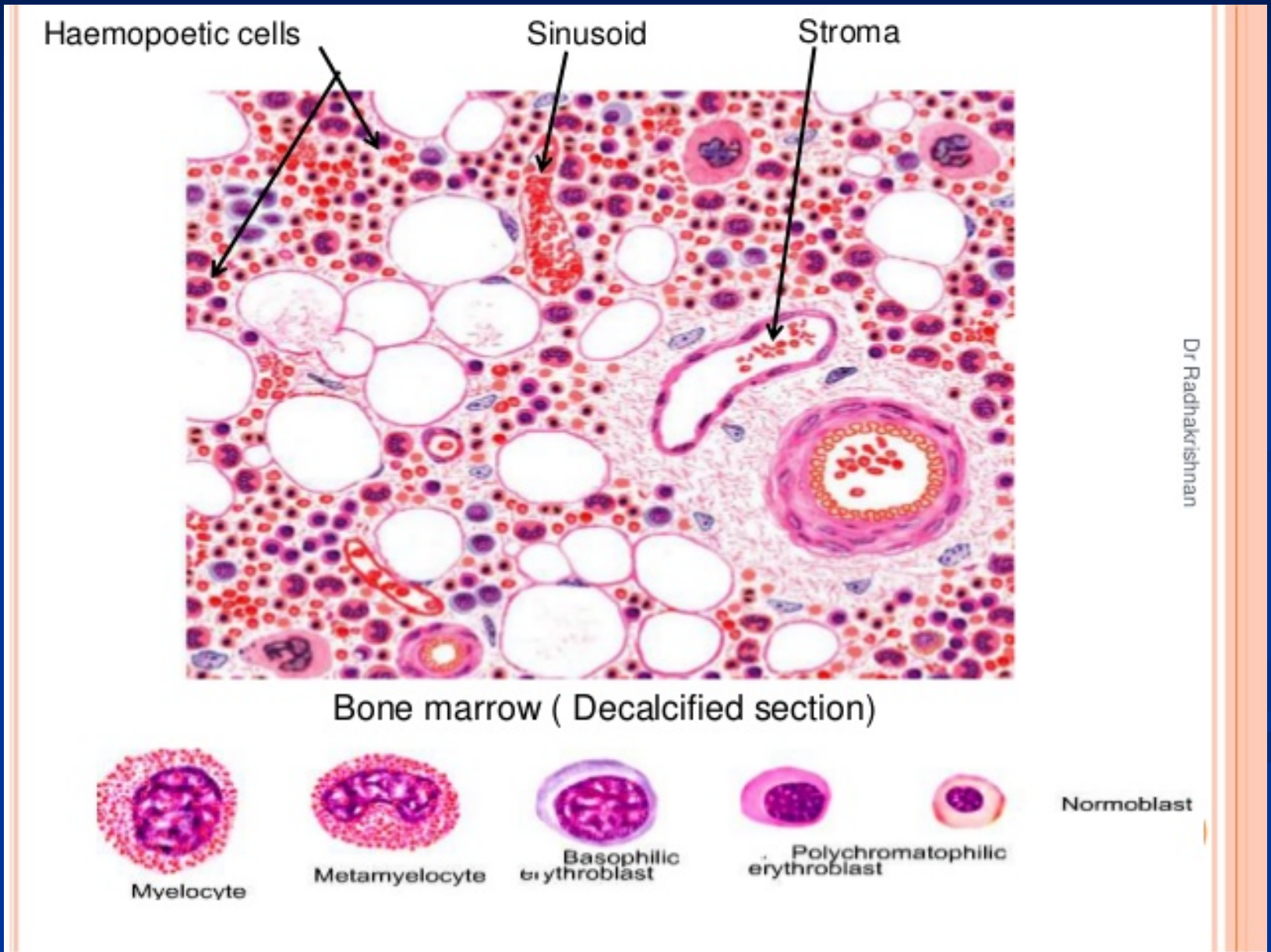
Dr Radhakrishnan

The "hollow" center of the diaphysis, called the ***medullary cavity***, is filled with a fatty substance called, ***yellow bone marrow***, while the "hollow" spaces of the epiphyseal spongy bone are filled with blood making tissue called ***red bone marrow***.



- In newborns, all bone marrow is red & active, but as the child grows most of the marrow changes to yellow type, but with severe bleeding or hypoxia, yellow marrow reverts to red marrow.

- **Red bone marrow:**



- **Hematopoiesis**

- 1st trimester: yolk sac mesoderm.
- 2nd trimester: liver and spleen.
- 3rd trimester: bone marrow.

- Stem cells:
- Stem cells will proliferate and differentiate in two ways:
- where the cells will eventually become lymphocytes (lymphoid cells)
- where the stem cells will form the myeloid cells that will develop in the bone marrow leading eventually to the formation of erythrocytes, granulocytes, monocytes & megakaryocytes.

Progenitor cells (colony-forming units(CFUs)):

1. Lymphoid lineage of CFU-lymphocytes of all types (CFU-L).
2. Erythroid lineage of CFU-erythrocytes (CFU-E).
3. Thrombocytic lineage of CFU-megakaryocytes (CFU-Meg).
4. Granulocyte-monocyte lineage of CFU-granulocytes-monocytes (CFU-GM).

Hematopoietic growth factors called colony-stimulating factors (CSF) are proteins with complex functions:

Stimulating proliferation (mitogenic activity) of immature progenitor & precursor cells.

Supporting differentiation of maturating cells.

Enhancing the functions of mature cells.

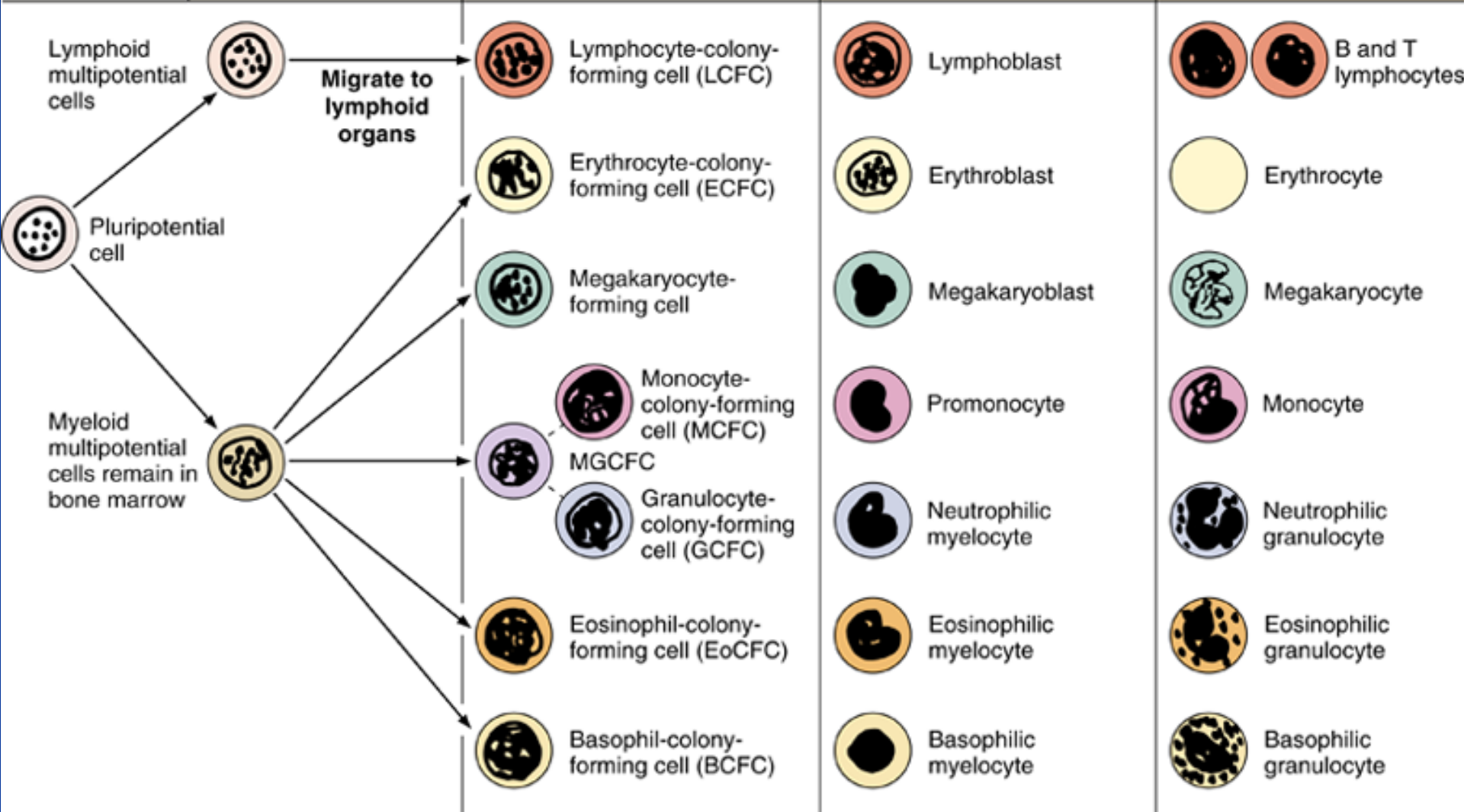
e.g. granulocyte (G-CSF), Erythropoietin (EPO), thrombopoietin (TPO) which are important clinically to increase marrow cellularity and blood cell counts in immunodeficient diseased conditions, BM transplant and malignancies.

- Precursor cells: (blast cells)
- In these cells the morphologic characteristics will differentiate for the first time suggesting the cell types they will become.

- **Additional information:**

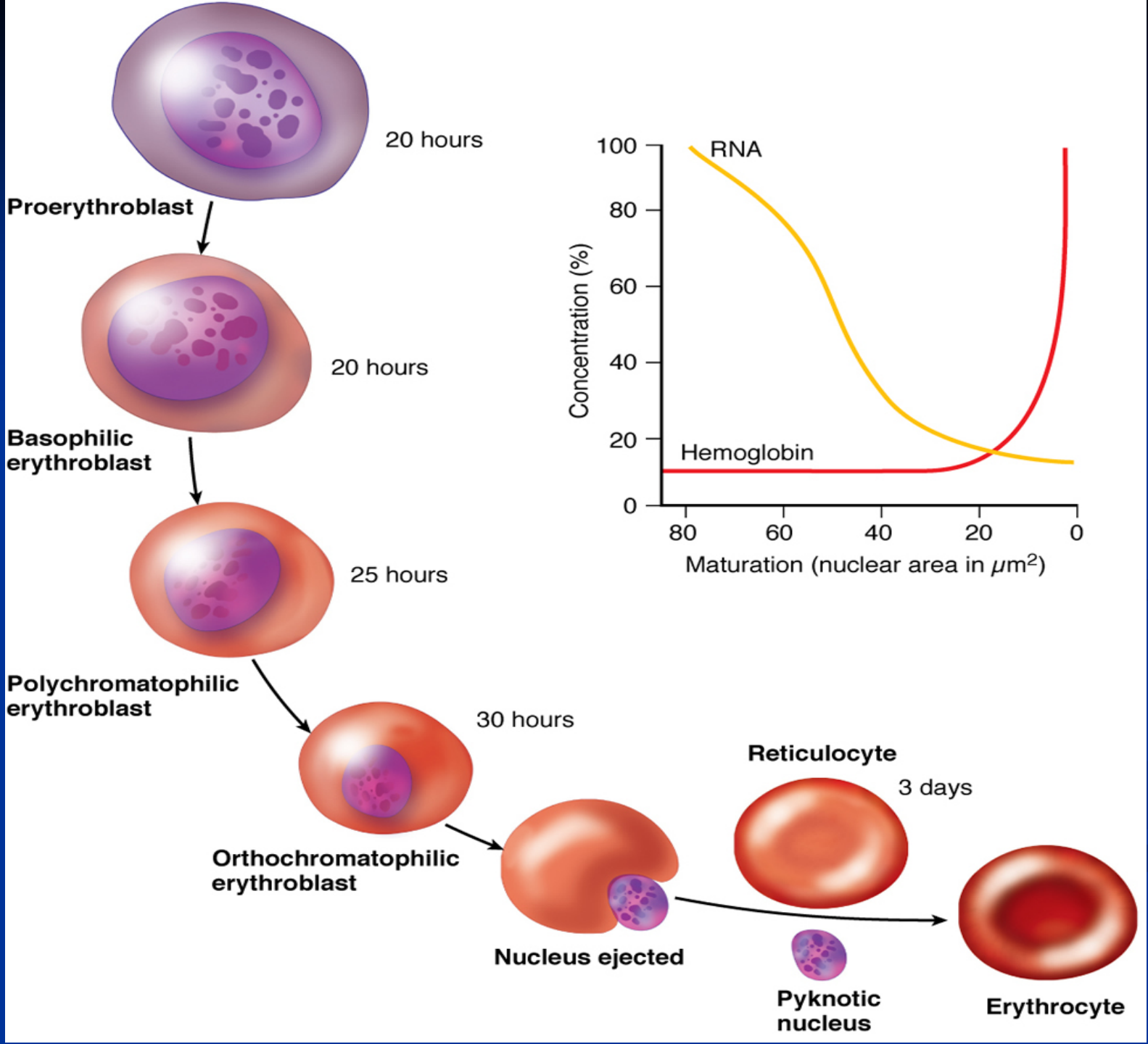
- **Are stem cells only present in embryos?**

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



- **Erythropoiesis:**
- proerythroblast:
- basophilic erythroblast:
- polychromatophilic erythroblast:
- normoblast (orthochromatophilic erythroblasts):
- Reticulocytes:
- erythrocytes

- the process of development of RBC from the proerythroblasts into the release of reticulocytes into the circulation takes about 7 days & it is under control of the hormone erythropoietine.


20 hours
Proerythroblast
20 hours
Basophilic erythroblast
25 hours
Polychromatophilic erythroblast
30 hours
Orthochromatophilic erythroblast
Nucleus ejected
Reticulocyte
3 days
Pyknotic nucleus
Erythrocyte
100
80
60
40
20
0
Concentration (%)
RNA
Hemoglobin
80
60
40
20
0
Maturation (nuclear area in μm²)

Clinical informations

- Reticulocytosis:

Thank you