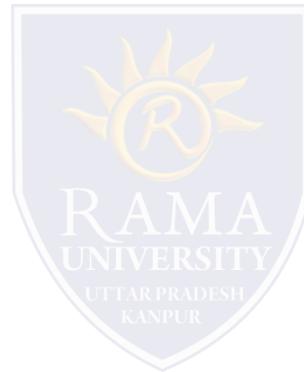




FACULTY OF ENGINEERING & TECHNOLOGY

UNIT-I
Topic- Hematopoiesis



Hematopoiesis

➤ Production of red blood cells, white cells, and platelets (blood cell formation)

Anatomy of Hematopoiesis:

- First Trimester: Yolk Sac
 - Second Trimester: Liver and Spleen
 - Third Trimester: Central, Peripheral Skeleton
 - Adulthood: Axial Skeleton, Vertebral Bodies, Sternum, Ribs, Pelvis.
- Hematopoiesis may re-expand into fetal sites in times of severe demand, e.g. thalassemia, MF (Extramedullary hematopoiesis).

The cellular pathways of Hematopoiesis:

- Overall Cellular Organization of Hematopoiesis:

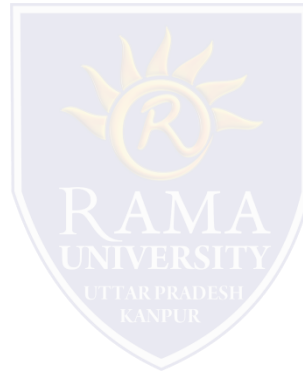
1. Stem Cells:

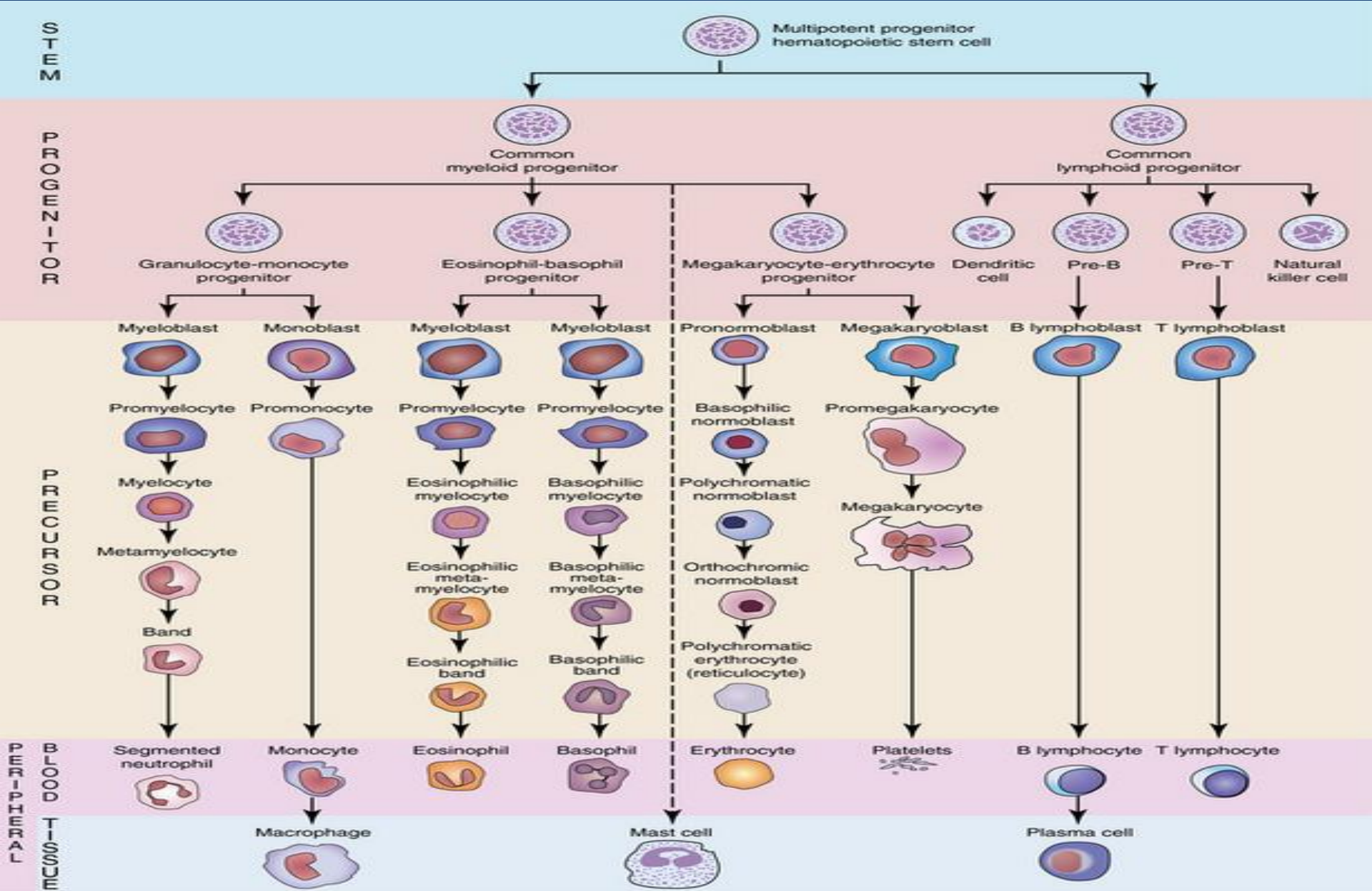
- Totipotent.
- Multipotent.

2. Progenitor Cells.

3. Precursor Cells.

4. Effector Cells.





The cellular pathways of hematopoiesis:

I. Stem cells:

Totipotential Stem Cells : "The Godfather Cells":

1. Unlimited Self-Renewal.
2. Unlimited Differentiation: can give rise to any cellular element.
3. Present in Marrow in Small Numbers.
4. Highly Resistant to Chemotherapy.
5. Reside Primarily in Marrow. Small numbers circulate in blood.
6. Surface Antigen -CD34+ ("Cluster of Differentiation 34").
7. Look like Small Lymphocytes.
8. Dysfunction leads to aplastic anemia or certain types of leukemia.

Multipotential Stem Cells:

-i.e. Lymphoid, Myeloid Stem Cells

1. Derived from Totipotential Stem Cells.
2. Capable of Extended Self Renewal.
3. Capable of Extended Differentiation • Lymphoid stem cells give rise to all categories of mature lymphocytes. • Myeloid stem cells give rise to red cells, granulocytes, monocytes, and platelets.
4. Lymphoid stem cell can give rise to so-called "lymphoproliferative" malignancies such as acute lymphocytic leukemia
5. Myeloid Stem cell can give rise to so-called "myeloproliferative" malignancies such as acute myeloid leukemia

II. Progenitor Cells:- CFU's(Colony Forming Units):

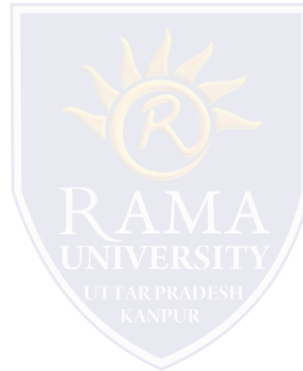
1. Derived from Multipotential StemCells.
2. Capable of limited self-renewal.
3. Capable of limited differentiation. • CFU-GEMM (colony forming unit - granulocyte, erythrocyte, macrophage, megakaryocyte). • CFU-ME (colony forming unit – megakaryocyte - erythrocyte). • CFU-GM (colony forming unit – granulocyte - monocyte). • CFU-G (colony forming unit-granulocyte).
4. Responsive to Hematopoietic Growth Factors, e.g. Erythropoietin stimulates CFU-E, GM-CSF stimulates CFU-GM, G-CSF stimulates CFU-G, etc.
5. Express differentiation antigens-surface proteins such as CD19 -B-lymphocyte.

III. Precursor Cells:- Blasts and their progeny:

- First morphologically identifiable cells:

- Erythroblast -Red Cells.
- Myeloblast -Granulocytes.
- Monoblast –Monocytes.
- Lymphoblast –Lymphocytes.
- Megakaryoblast –Platelets.

- Little if any self-renewal.



IV. Mature Effector Cells:

- Red Cells: carry oxygen, carbon dioxide; lifespan 120 days.
- Neutrophils: phagocytosis, killing.
- Monocytes: phagocytosis, killing, antigen presentation.
- Lymphocytes: identify cells as self or non-self.
- Platelets: hemostasis

