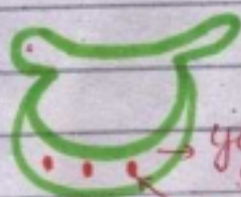


1-10

BONE MARROW & HEMATOPOISES

1

Hematopoiesis: the process by which blood cells are made.



3wk
Yolk Sac
Stem cells
(Hematopoietic)

Stem cells → Any cells
Capable of Asymmetrical
division leads to
formation of
well differentiated cells.
its own population

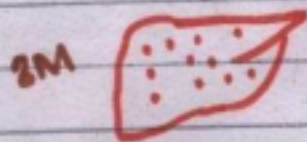
Aorta

Gonads

Mesonephros

Hematopoietic Stem cells
1st appears in yolk sac
at 3wk but they also
develops in mesoderm of all above three
structures.

From all these 4 sites these
cells appears in
Liver around 3 months.



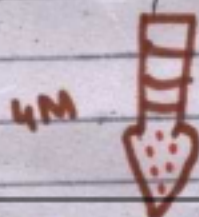
3M



Spleen

& some cells also move to
Lymph node Spleen

This process continues in these cells
just before birth



4M

Bone marrow

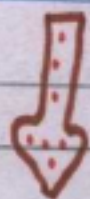
All hematopoiesis
in Newborn occurs
in Bone Marrow.

3M

4M

3wk

2



→ At Birth in full term baby all the Bone marrow is red (active)

→ ^{upto} Puberty all B Marrow is Red

After Puberty → Axial skeletal } Membranous bone
Proximal End }
Humerus Femur }

Now Bone Marrow in Remaining bones are Inactive (yellow)

e.g at 20 yrs of age.

50% → Bone Marrow is Red

" → " " " yellow

But after that if body need of blood res then yellow marrow may converts into Red Marrow.

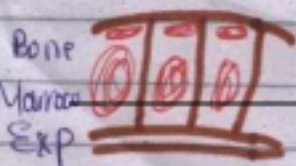
e.g In severe Hemolysis

Normal



Whenever there is Excessive Ectropases

BM expands all over the body.

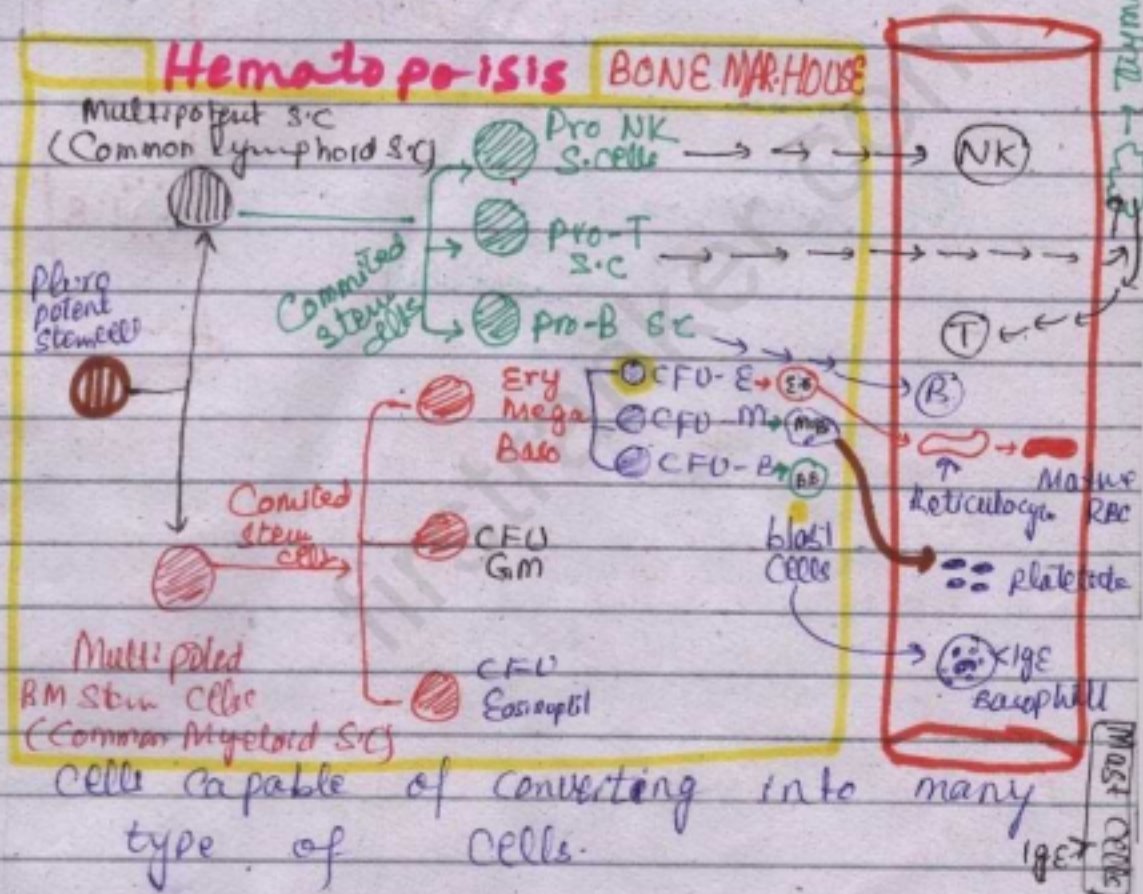


X-rays

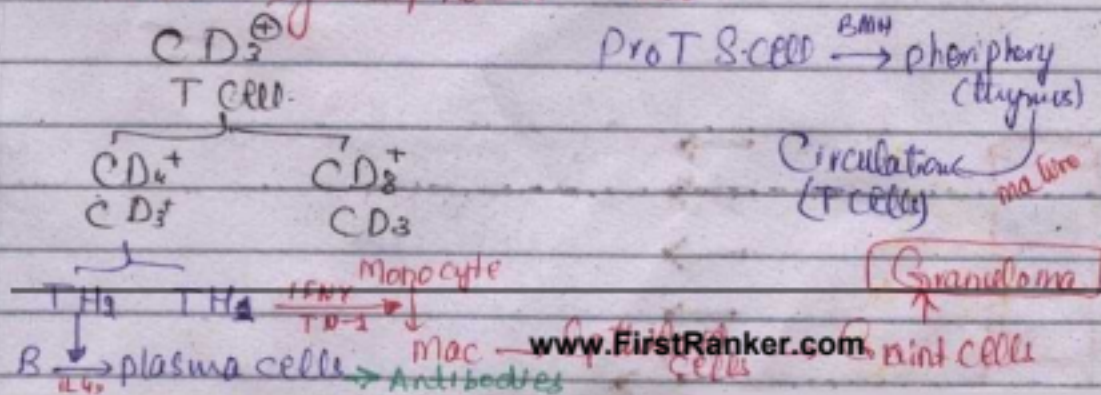


Hair On End appearance

Bone marrow is one of the largest organ in the body. In size & wt it is almost equal to liver.

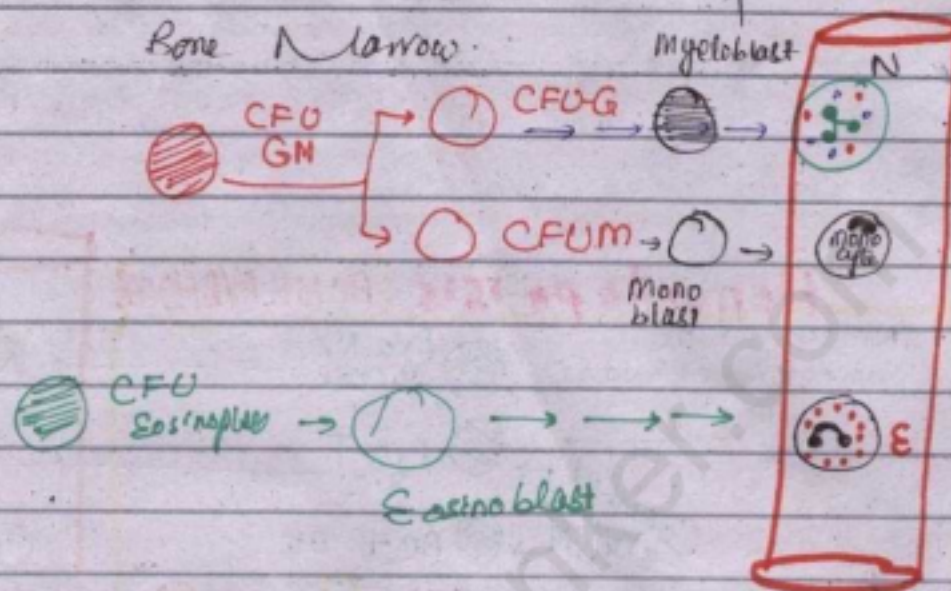


Myeloid Sys $\rightarrow$ BM + all cells other than lymphoid cells.



4

Most cell is also derivative of Bone Marrow.

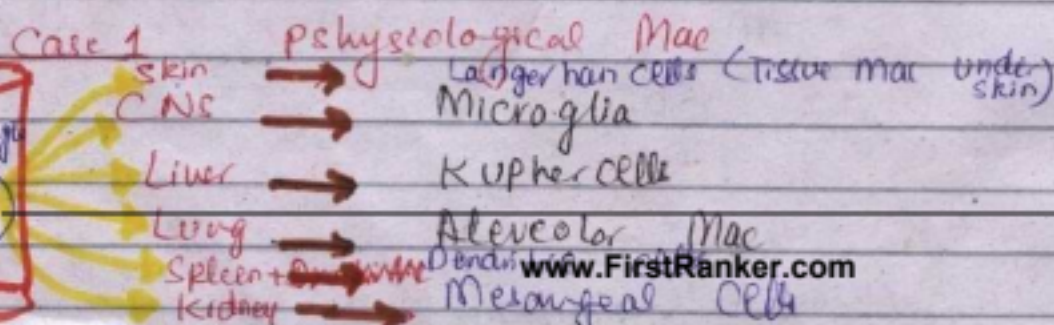


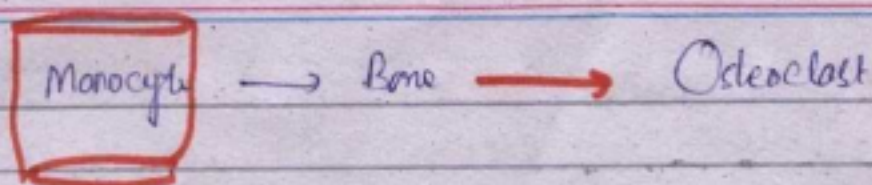
Monocyte $\xrightarrow{\text{Tissue}}$ Macrophages

when Monocyte shift to tissues?

- ① Monocyte shift to tissues under Normal Physiological Conditions
- ② other shift to tissues only when there is Inflammation they are known as Inflammation Related Macrophage

Examples





Aplastic Anemia :

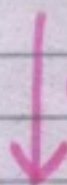
If there is Stem cells destruction or Hypofunction then there is proliferative dysfunction

So in Blood No of

RBC

WBC

Platelets



ed.

Pancytopenia

i.e. BM is Hypocellular or hypoplastic

Leukemia:

Malignancy of Hematopoietic Precursor cells & Stem cells.

i.e. ↑ed Proliferation of these cells

Bone Marrow provides the Smp MicroEnv to all these cells.

In BM there are lot of stromal cells these stromal cells support the Hematopoietic Process

these stromal cells are capable of secreting lot of soluble growth factors e.g. Erythropoietin, thrombopoietin, CSF

2 Many of interleukin eg IL-3 which is responsible for stem cell proliferation

these stromal cells also have cell-cell interaction with Hematopoietic cells & direct their proliferation & differentiation

Soluble Factors: Also now available Commercially

Erythropoietin

Thrombopoietin

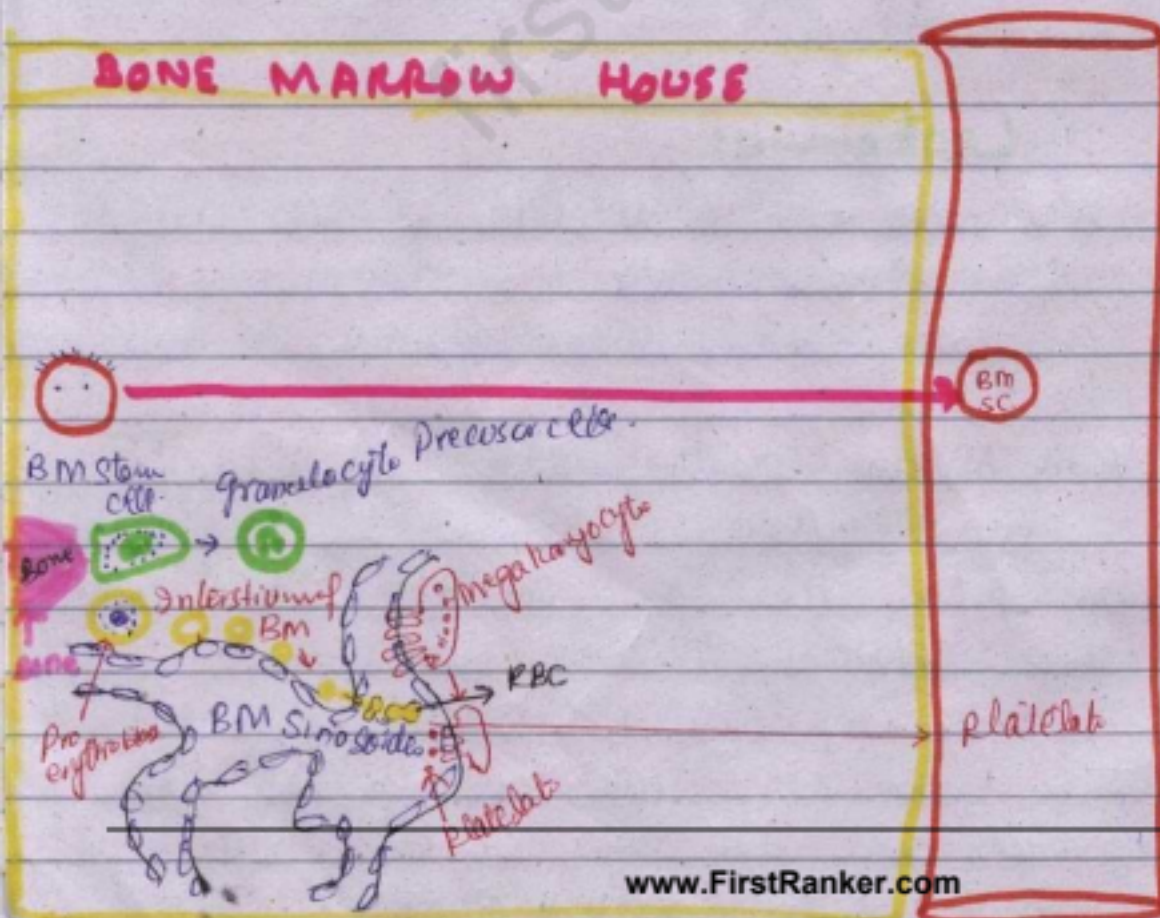
GM - CSF

G-CSF

Synthesized by

Genetic Recombination
technique.

BONE MARROW HOUSE



7

• During BM Transplant BM is injected into Venous or Systemic Circulation from there they finally reach to BM.

• Under Certain Circumstances BM are Induced to produce Hemangioblast.

Hemangioblast are cells which can differentiate into ~~Blood~~ Endothelial cells.
Acc to New Research

BMSC can also form

- Liver cells
- Biliary cells
- Myocardial cells
- Skeletal cells
- Neurons
- Glial cells

BMSC are present in BM Interstitium
Megakaryocyte infiltrate the Sinusoids while blood is passing through these channels then foot of Megakaryocyte break & forms the platelets.

Near the Bone there is Proerythroblast

It progressively decreases in size &

Nucleus undergoes changes & finally disappears



Intermediate Normoblast also called
Multichromatic Normocyte

Size of Cell Progressively Inc.

20 μ	1st basophilia progressively
17 μ	B ↓ E, Eosinophilia inc
14 μ	
10 μ	
8-9 μ	
7-8 μ	] Normal

• B₁₂ & folic acid is required for
Nuclear Maturation

Megaloblast:-

Abnormal Normoblast which
are found in BM have def of
B₁₂ & folic acid so

heavily hemoglobinized & have
large amount of Eosinophilic cytoplasm
• (i.e. Cytoplasm — Over Mature)
Nucleus — Under Mature)

Most of these cells are
destroyed within BM
& they do not result in
formation of lot of



So total RBC in blood become less

So we say there is Anemia bc whatever RBC are formed they are of larger size.
So

Megalo~~blast~~ Macrocytic Anemia

For Nuclear Maturation

we Need B₁₂ & folic acid

For Cytoplasmic Maturation

we Need Iron

As they are rapidly growing have

↑ Metabolism so they

• thyroid Hormone & Growth hormone.

& Amino acid

Megakaryoblast → Promyelocyte → Myelocyte → Immature Neutrophil ← Mature Neutrophil

All types of cell formation occurs.

Granulocyte = 65%

Erythropoietic = 35%

Lymphopoiesis = 10%

Myeloid : Erythroid

3 : 1

Bone Marrow Study

(1) Bone marrow Aspiration:-

If there is Dry Tap (no B.M aspirated)

then we do

② BM Trepan Biopsy

(usually from Post iliac crest)

- Now we recognize blast cells or precursors cells.

They are recognized by company they keeps.

g.f. blast cells surround by Erythropoietic series → Erythroid cells.

g.f. blast cells surrounded by granulopoietic ^{Myeloid} series → Granulocytes / Myeloid cells

Transcellular Migration: The Process by which cells move from B.M Interstitium → B.M Sinusoids & they become part of general Circulation.

Life Span	RBC	→ 120 days
	Platelet	→ 7-9 days
	Neutrophil	[24-48 hrs → Circulation 6-7 hrs → Inflammation]
	Lymphocyte	→ Life of decades