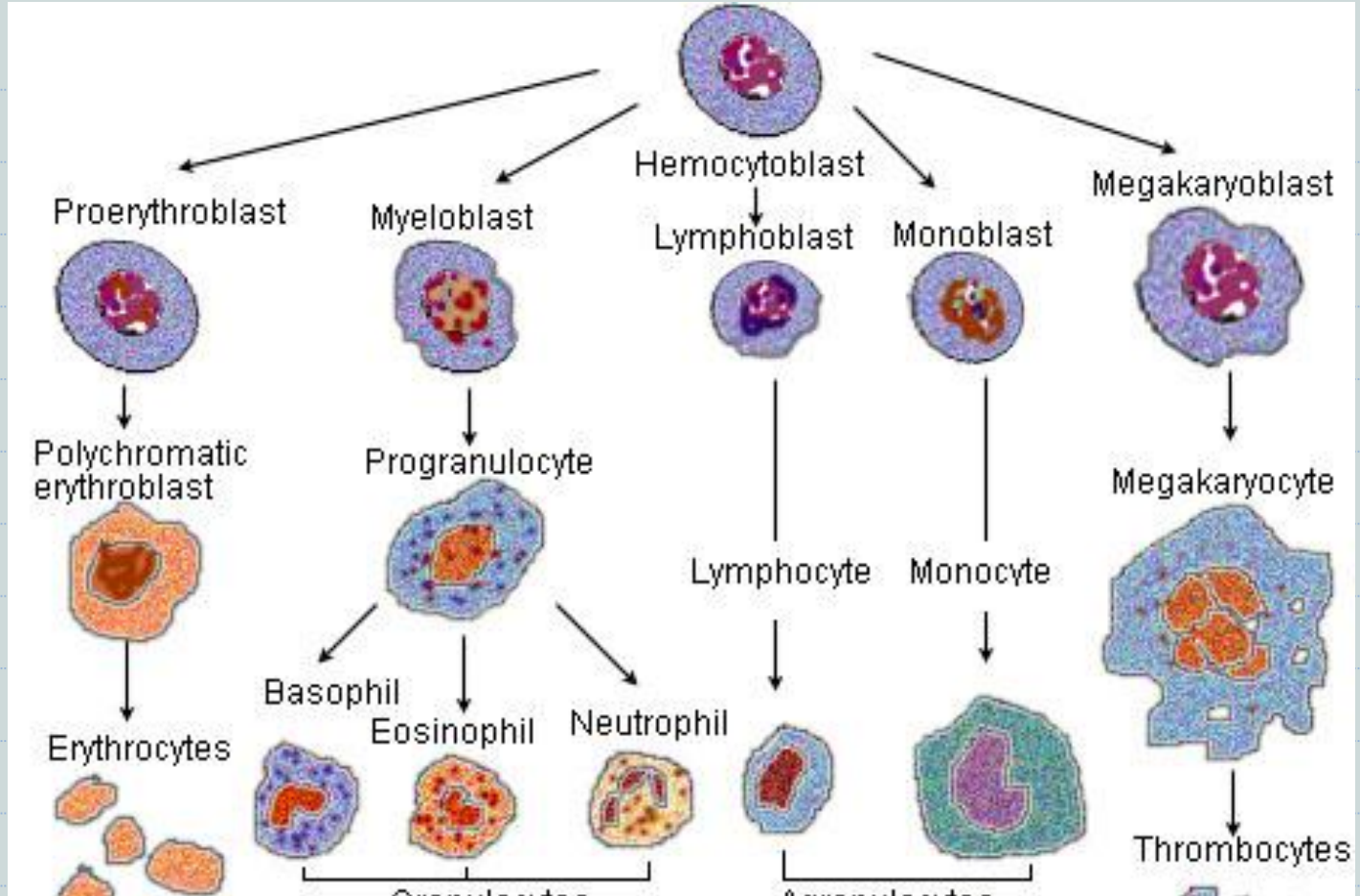
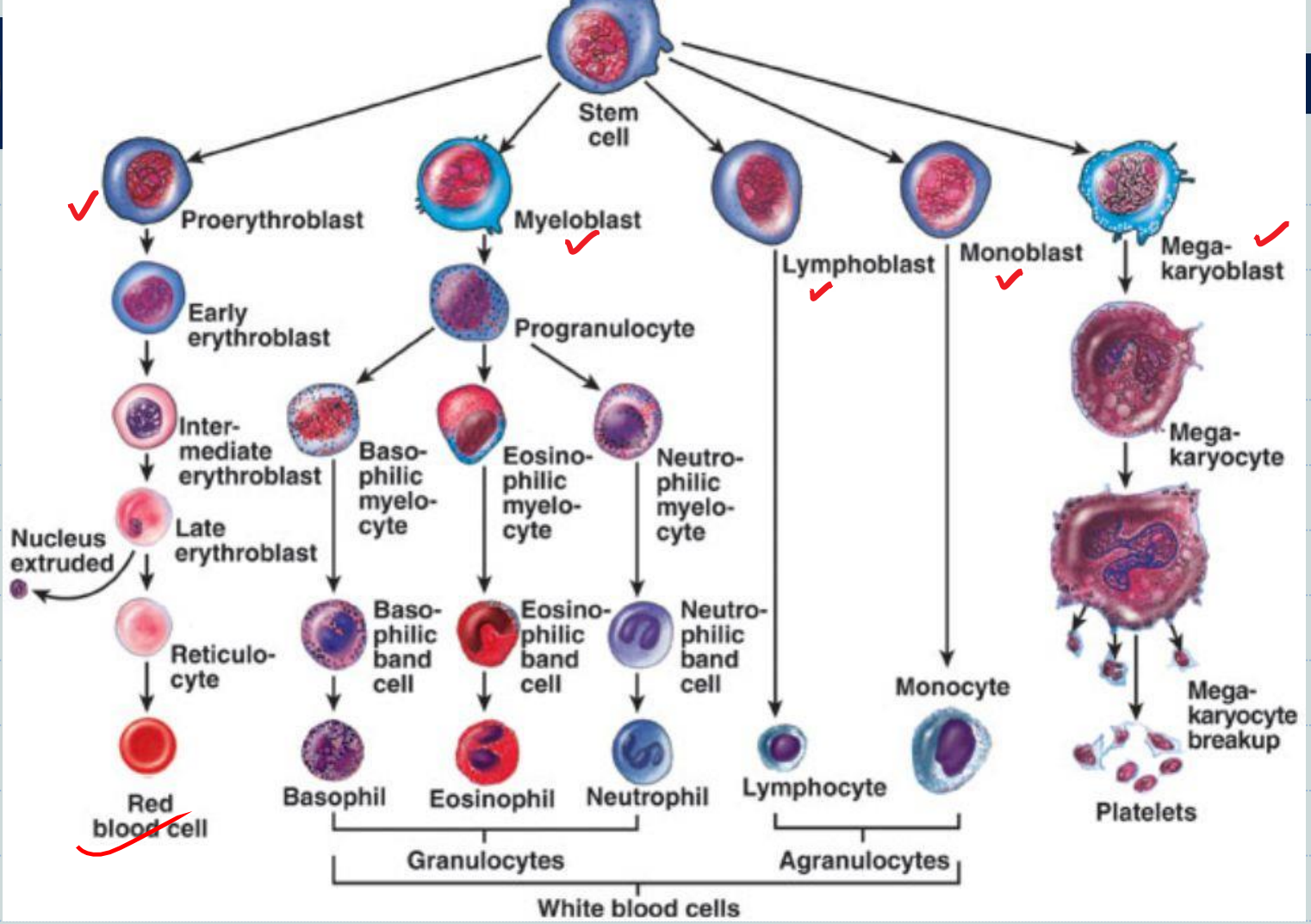
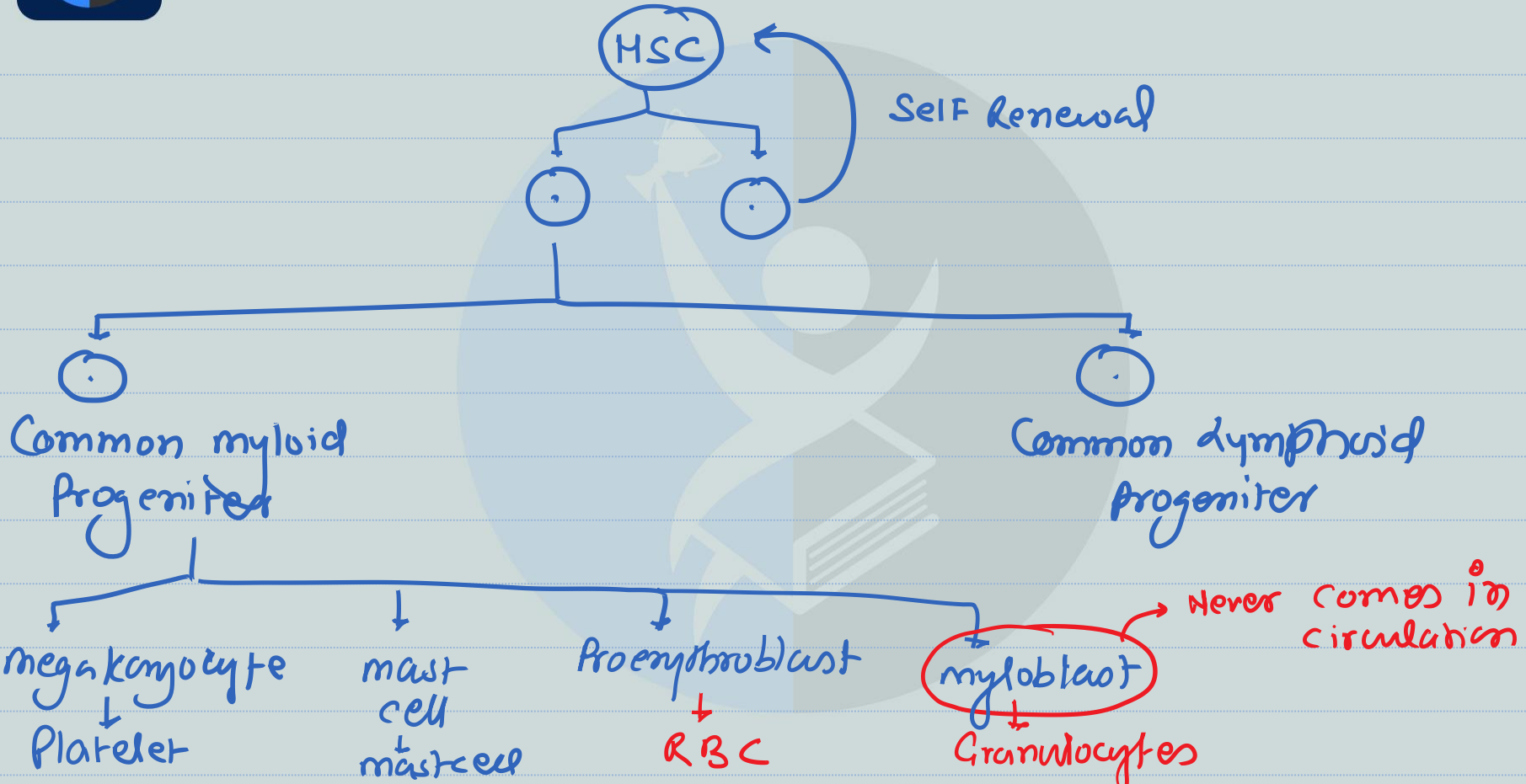
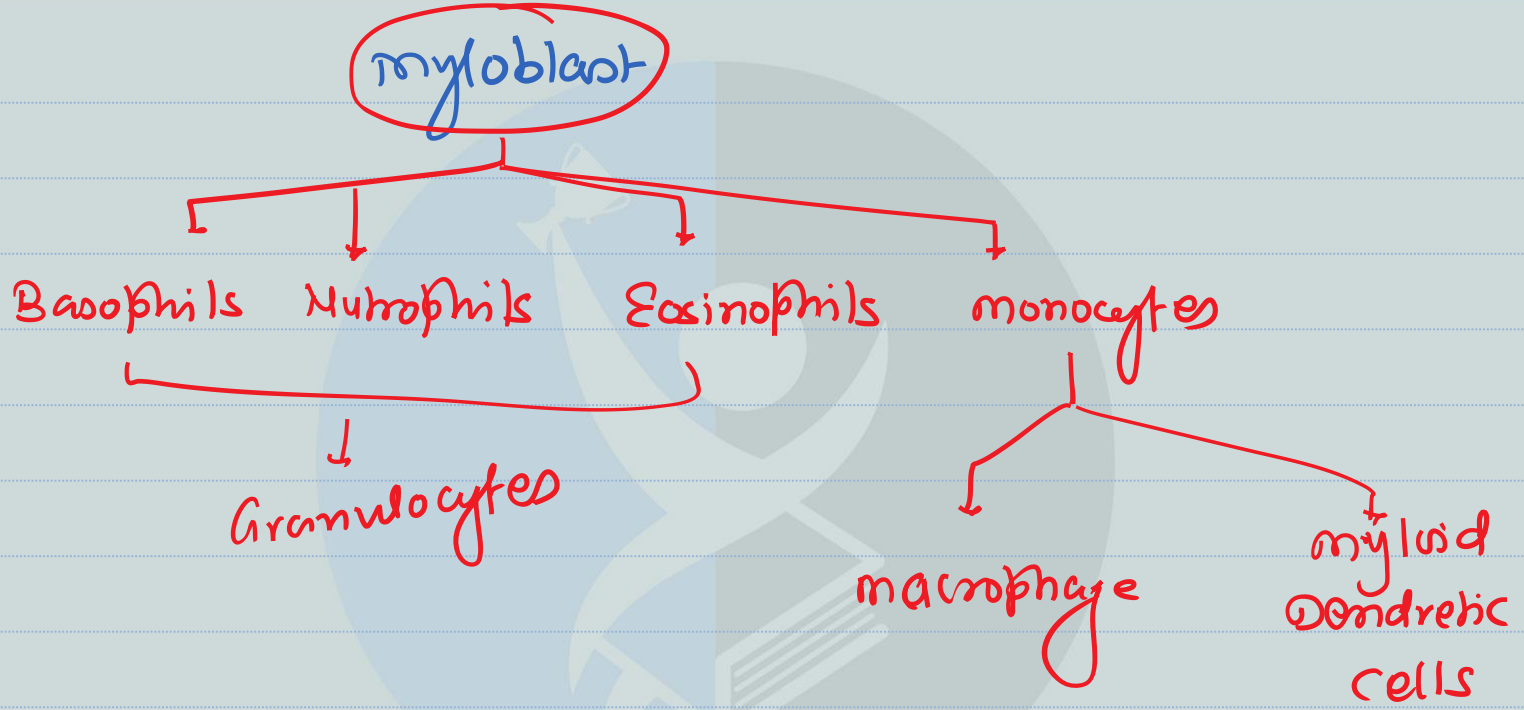
LECTURE 2

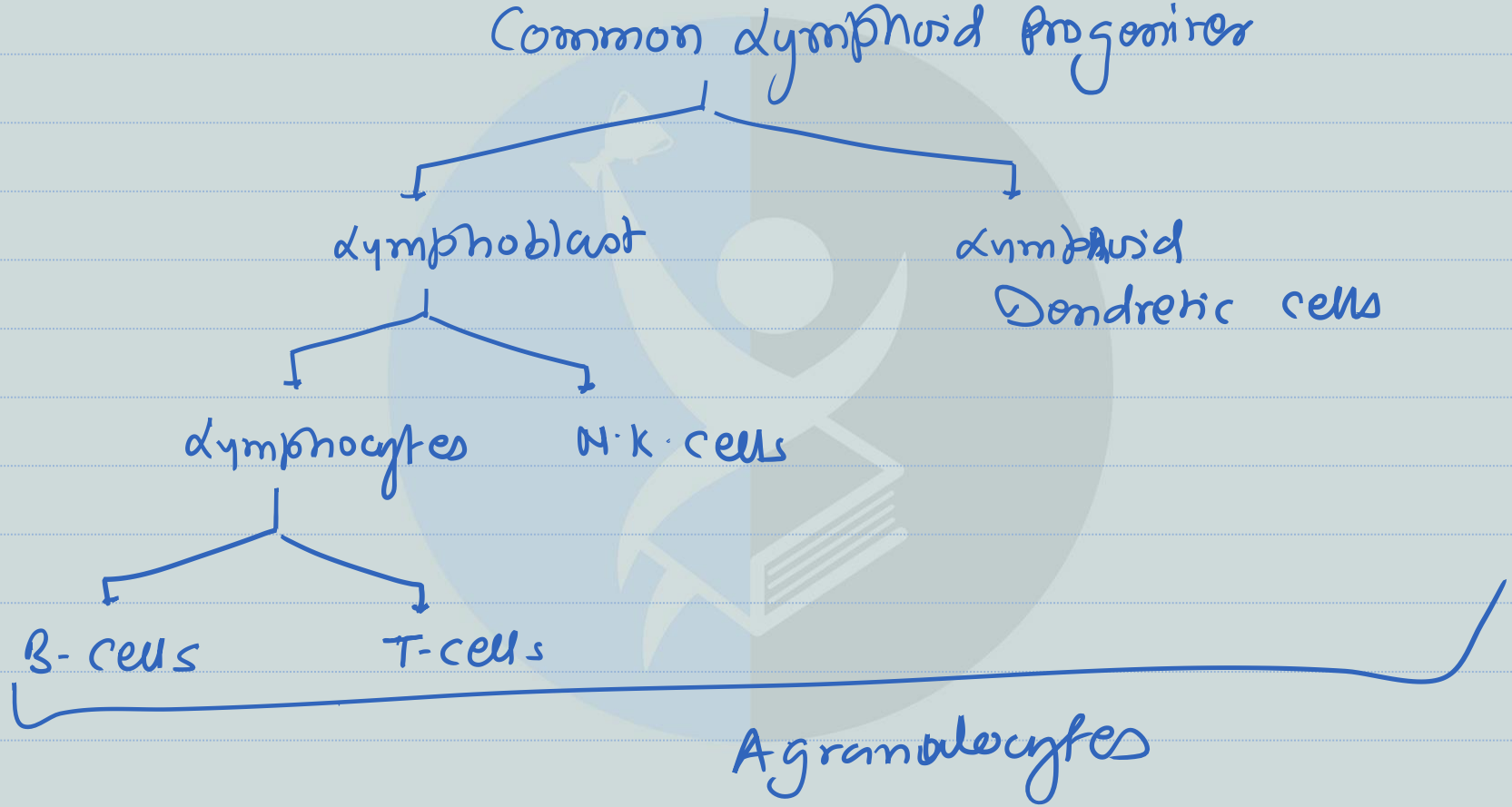
Blood group And circulatory system


Hemocytoblast
Proerythroblast
Myeloblast
Lymphoblast
Monoblast
Megakaryoblast
Polychromatic erythroblast
Progranulocyte
Lymphocyte
Monocyte
Megakaryocyte
Basophil
Eosinophil
Neutrophil
Erythrocytes
Thrombocytes


Stem cell
Proerythroblast
Myeloblast
Lymphoblast
Monoblast
Mega-karyoblast
Early erythroblast
Progranulocyte
Inter-mediate erythroblast
Baso-philic myelo-cyte
Eosino-philic myelo-cyte
Neutro-philic myelo-cyte
Mega-karyocyte
Nucleus extruded
Late erythroblast
Baso-philic band cell
Eosino-philic band cell
Neutro-philic band cell
Monocyte
Reticulo-cyte
Mega-karyocyte breakup
Red blood cell
Basophil
Eosinophil
Neutrophil
Lymphocyte
Platelets
Granulocytes
Agranulocytes
White blood cells


HSC
Self Renewal
Common myloid Progenitor
Common lymphoid progenitor
megakaryocyte
Platelet
mast cell
mastcell
Proerythroblast
RBC
myloblast
Granulocytes
Never comes in circulation


myloblast
Basophils
Neutrophils
Eosinophils
monocytes
Granulocytes
macrophage
myloid
Dendretic
cells


Common lymphoid progenitor
Lymphoblast
Lymphoid
Dendritic cells
Lymphocytes
N.K. cells
B-cells
T-cells
Agranulocytes

* During RBC Production (Erythropoesis)

HSC

↓

✓ ·

↓

✓ Pro-Erythroblast (Pro-Normoblast)

↓

✓ Early Normo

↓

✓ Intermediate Normo

↓

✓ Late Normo → Nucleus → Reticulocyte → RBC

if there is deficiency of folic acid

↓

Normoblast can be seen in Circulation (R/a megaloblast)

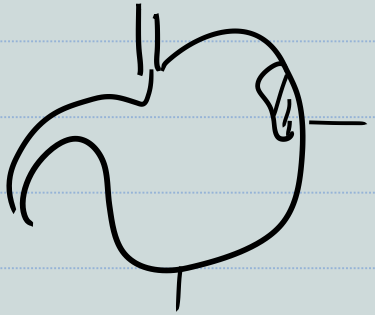
↓

(megaloblastic Anemia)

if Vit B_{12} deficiency

↓

Pernacious Anemia



Stomach

Oxyntic cell / Parietal cell

↓

Secret HCl & Intrinsic Factor

↓

Helps in Vit B_{12} Absorption

if Parietal cell Damaged

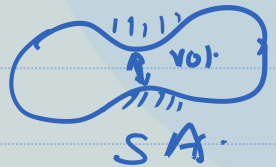
↓ Intrinsic factor → ↓ Vit B12 → RBC can not mature

↓
Pernacious Anemia

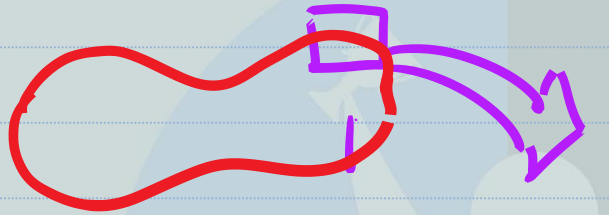
Vit B6 → also involve in Synthesis of Hemoglobin

↳ deficiency Could lead Anemia

RBC - Shape - Circular & Biconcave



S.A ↑ & vol ↓ = for Better Gaseous Exchange

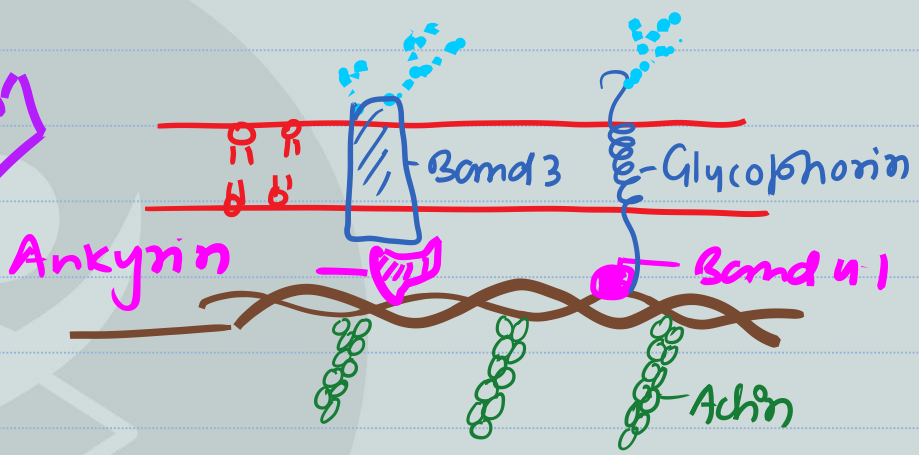


Actin Network — Spectrin

↓

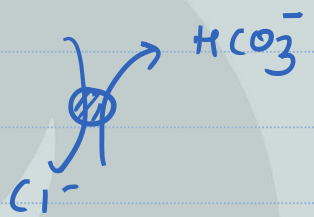
maintain

cell Shape



RBC membrane protein

1. **Band 3**
   - Anionic Exchanger



2. **Glycophorin**
   - Use Polarity of RBC
   - Provide Smooth Surface to the RBC

3. **GLUT-1 Transporter** → Glucose transporter

Cytosolic Protein of RBC

- Hemoglobin - most Abundent Cytosolic Protein
- Enzymes of Glycolysis
- " " Pentose phosphate pathway
- Anti-oxident
  - → Glutathione Peroxidase
  - → Glutathione Reductase

Hemo-globin

Heme

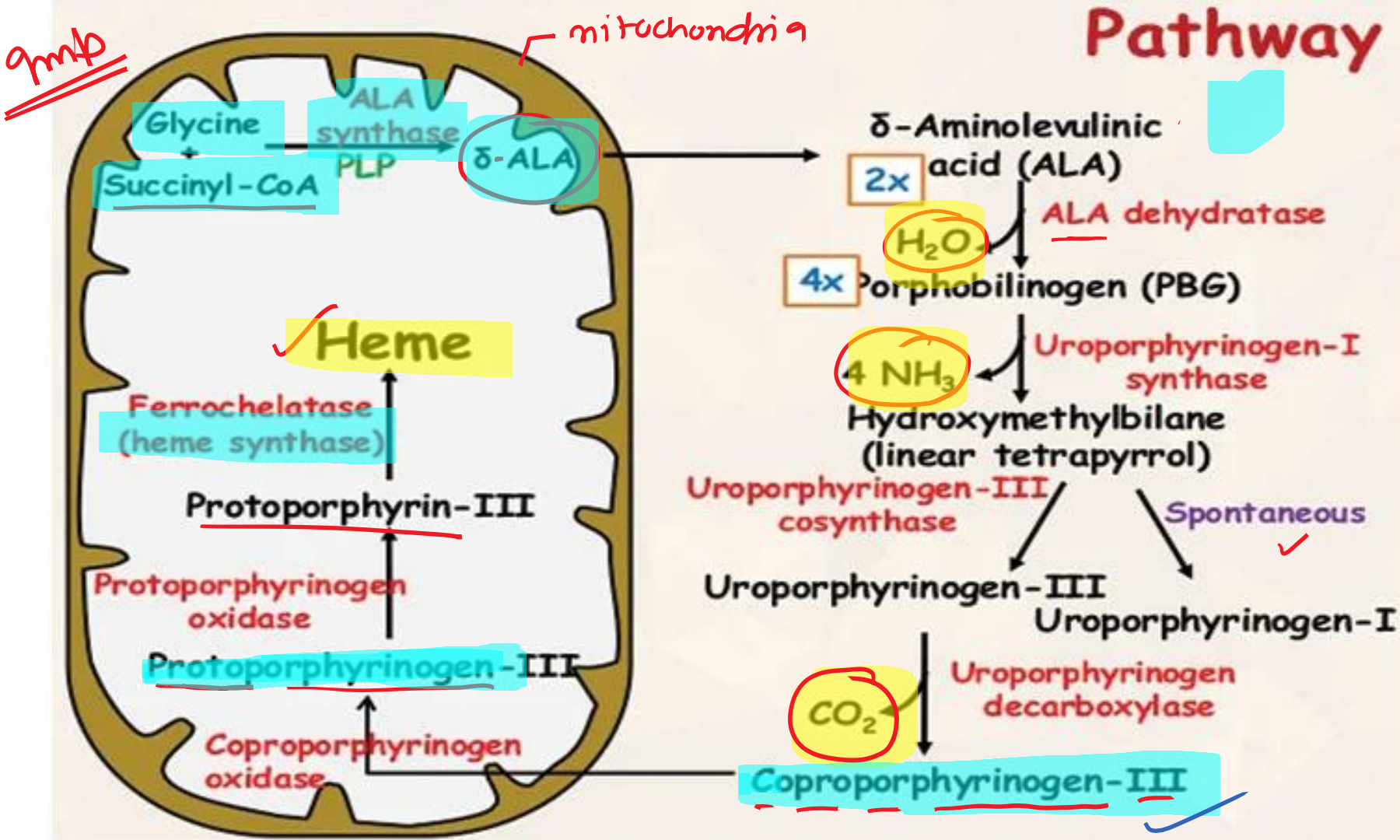
- Prosthetic Group
  - Contain Porphyrin IX Ring

Globin

Protein

2 x α Chain

2 x β Chain


Pathway
mitochondria
Glycine
+
Succinyl-CoA
ALA synthase
PLP
δ-ALA
δ-Aminolevulinic acid (ALA)
2x
ALA dehydratase
H_2O
4x
Porphobilinogen (PBG)
Uroporphyrinogen-I synthase
4 NH_3
Hydroxymethylbilane (linear tetrapyrrol)
Uroporphyrinogen-III cosynthase
Spontaneous
Uroporphyrinogen-III
Uroporphyrinogen-I
Uroporphyrinogen decarboxylase
CO_2
Coproporphyrinogen-III
Coproporphyrinogen oxidase
Protoporphyrinogen-III
Protoporphyrinogen oxidase
Protoporphyrin-III
Ferrochelatase (heme synthase)
Heme

Globin Switching

Can be seen in different devevelopmental Stage

(i) Early Embryonic Stage (1-3 month) $\alpha_2 \varepsilon_2$, $\zeta_2 \varepsilon_2$

ε_2 → [HbE]

(ii) Fetus Stage : $\alpha_2 \gamma_2$ [Hb F]

(iii) Adult = $\alpha_2 \beta_2 = 97\%$, $\alpha_2 \delta_2 = 3\%$] [Hb A]

RBC Cytosolic Protein

① Hemoglobin

- Role in O_2 Transport
- 1 Hb can binds with 4 O_2 molecule
- Hb-O_2 Affinity is Affected by various factor

Hb-O_2 Affinity ↓

- Blood pH ↓, $[H^+]$ ↑
- Temp ↑
- 2,3 BPG ↑
- mutation in Globin Gene

Affinity ↑

- Blood pH ↑ (Alkaline),
- $[H^+]$ ↓
- Temp ↓
- 2,3 BPG ↓
- Hb - Oxidation

* mutation in Globin chain

↓

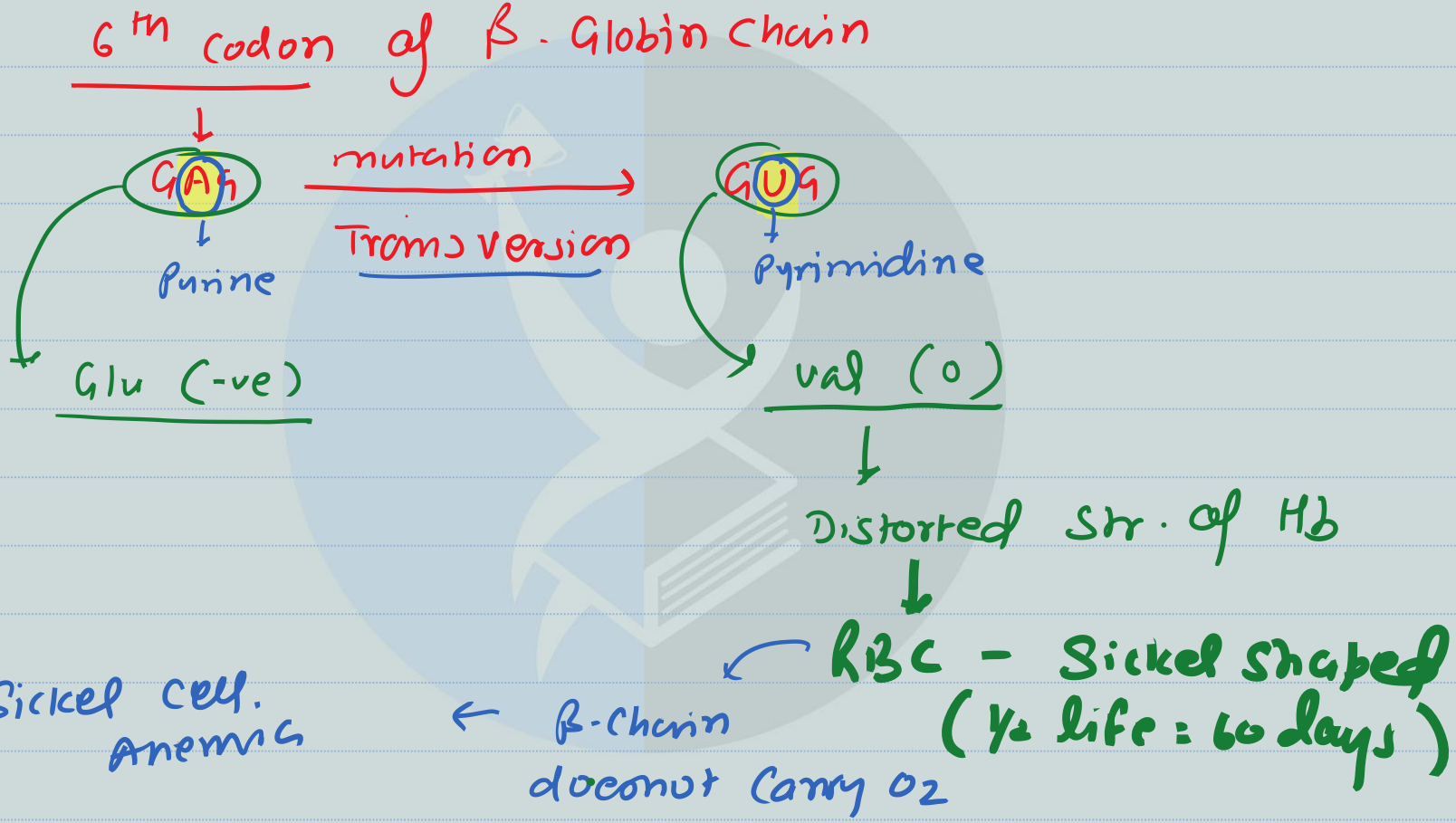
- Single nt Substitution - most common
- if mutation occurs in α chain

↓

K/a α thalasemia

if mutation in β-chain of Hb → K/a β Thalasemia

eg Sickel cell Anemia


6th codon of β-Globin chain
GAG
mutation
Transversion
GUG
Purine
Pyrimidine
Glu (-ve)
val (0)
Distorted str. of Hb
RBC - Sickel shaped
(½ life : 60 days)
β-Chain
doconut Carry O2
Sickel cell Anemia

Various other O_2 Transport Pigments –

Respiratory Pigments in Animals

Pigment	Metallic group	Distributed in animals	Colour	
			Oxygenated	Deoxygenated
Haemoglobin	Iron	All vertebrates and some annelids	Red	Red
Haemocyanin	Copper	Most mollusks and arthropods	Blue	Colorless
Haemerythrin	Iron	Some annelids	Red / Purple	Colorless
Chlorocruorin	Copper	Some annelids	Green	Green

Some annelids → Leech & Some marine worms

Haemerythrin → and marine vertebrates

RBC Age – 120days

↓

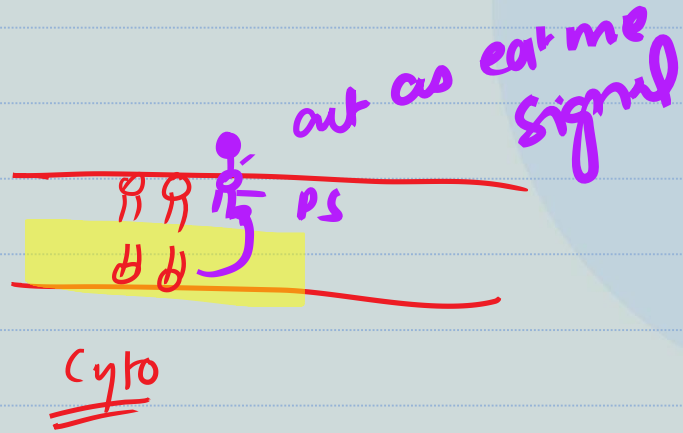
After 120 days RBC ⟶ Spleen

↓

- destruction of Aged RBC
- Macrophages
- Recognize eatme Signal present on Aged RBC

↓

- Phosphotidyl Serine Flip on outer leaflet of P.M.



Phagocytosis of Aged RBC

↓

Hemoglobin

↓ ↓

Heme | Globin

° Porphyrin IX

↓

Fe^{++}

Transport with Transferrin

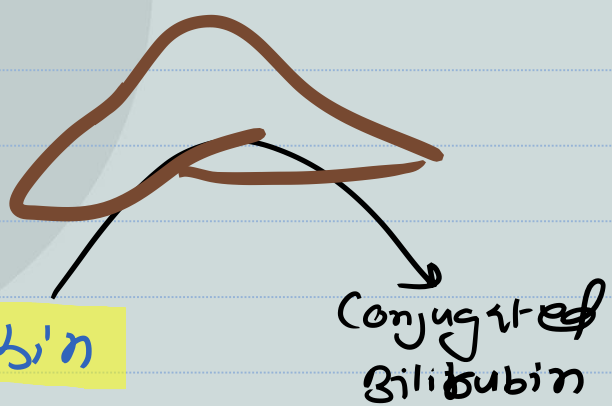
Fe^{+++}

↓

Oxidation

CO

Biliverdin → Bilirubin



Conjugated Bilirubin

Conjugated Bilirubin

↓

Stored in Gall Bladder

↓

Released in intestine

↓

in Large intestine

microorganism

Conjugated Bilirubin → Sterecobillin

↓

Excreat out

Hemoglobin → Heme part - Binds with Hemopexin & Transport to the liver

Compleat Hb + Hepto globin → liver

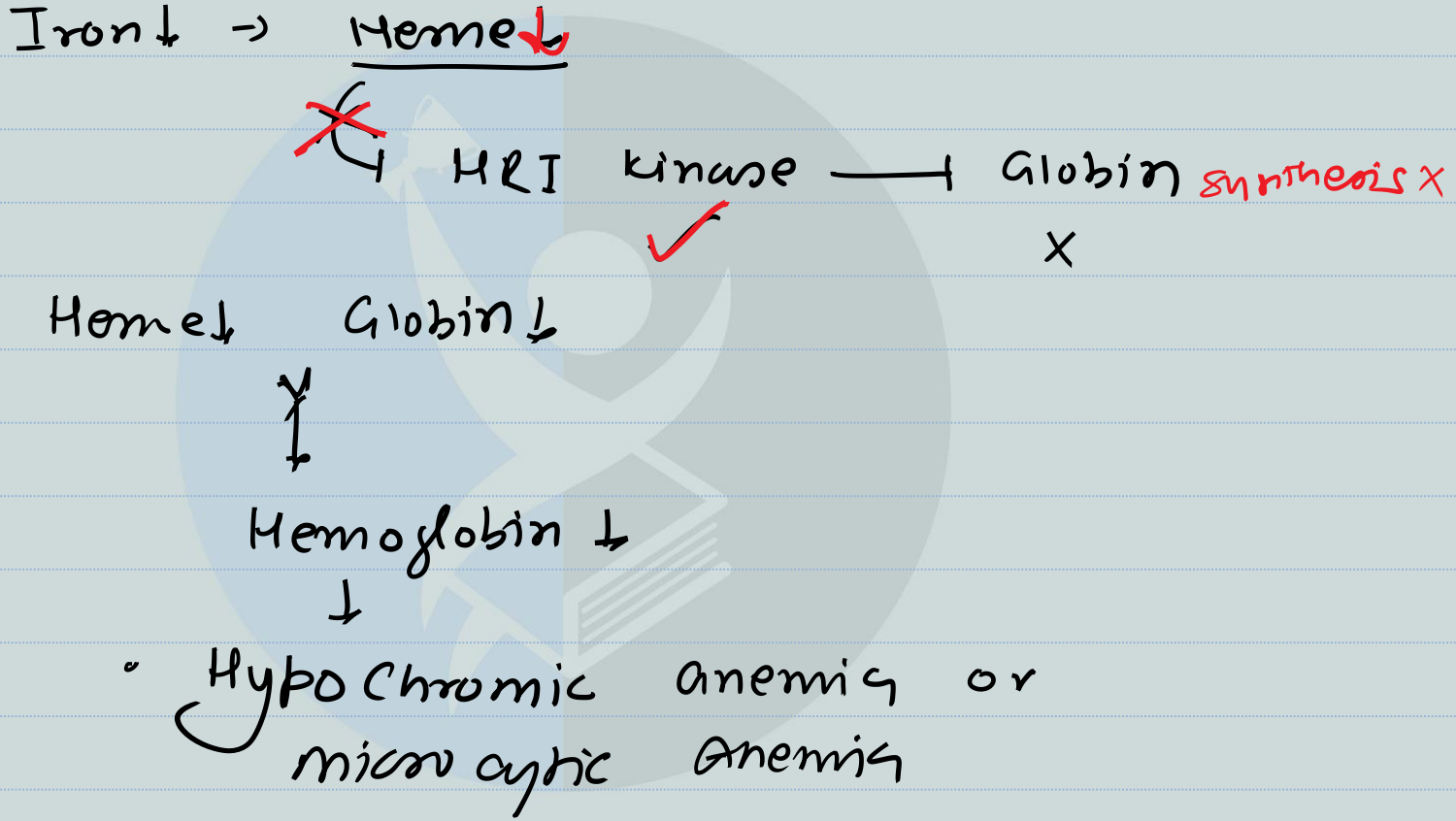
* Iron Recycled in This process

* Role of iron in Hb Synthesis

Iron ↑ → Heme ↑ ⊣ HRI kinase ⊣ Globin Synthesis ↑

✓ ✓ ✗ ✓

Hemoglobin


Iron↓ → Heme↓
HRI
kinase
Globin
synthesis X
X
Heme↓
Globin↓
Hemoglobin ↓
Hypochromic anemia or
microcytic Anemia

Hemostasis

→ maintain Constant Blood volume

HAPPY LEARNING

THANKS

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