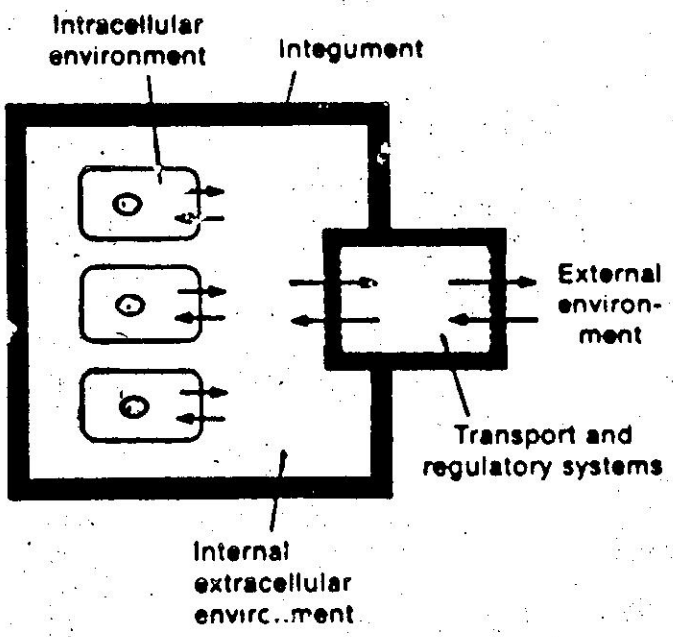
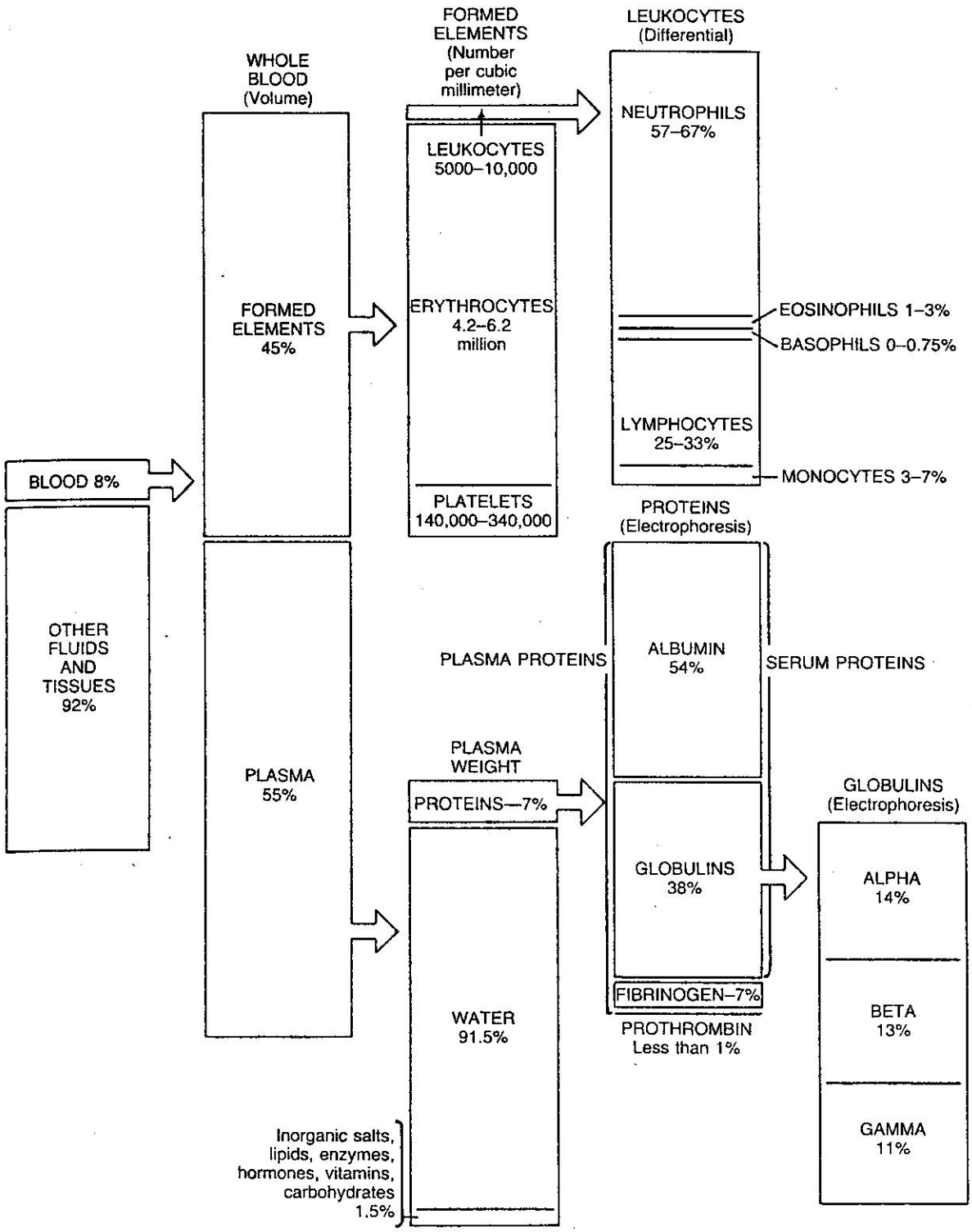
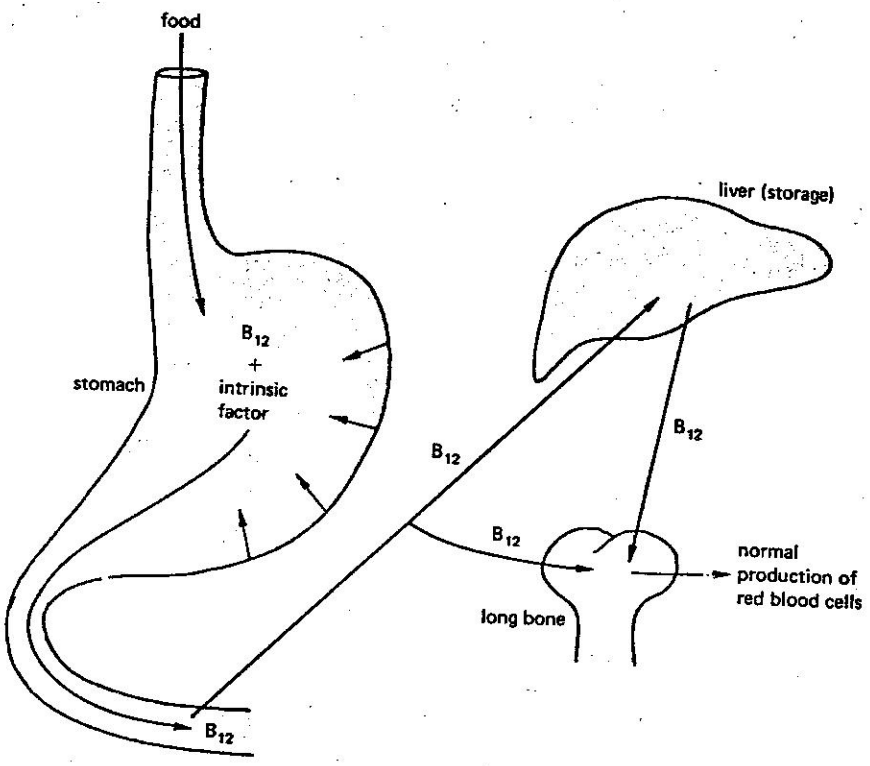
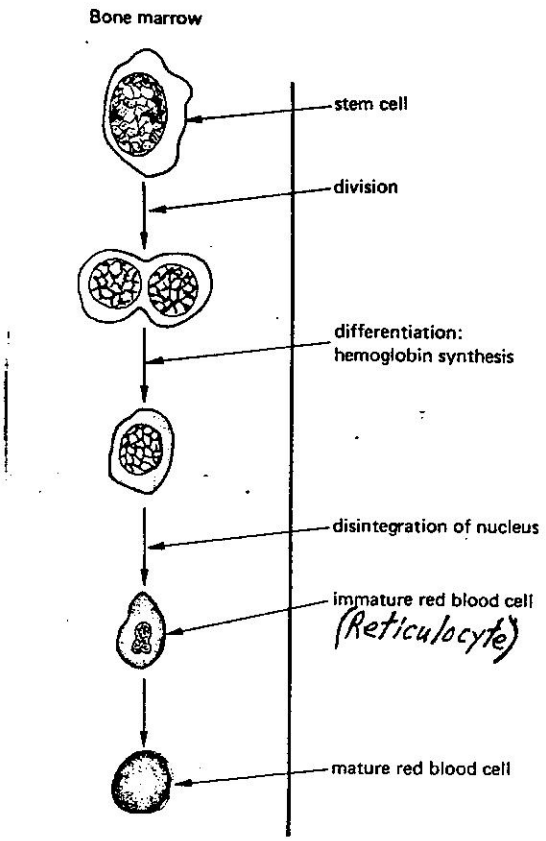

Intracellular environment
Integument
External environ-ment
Transport and regulatory systems
Internal extracellular envirc..ment

(2)

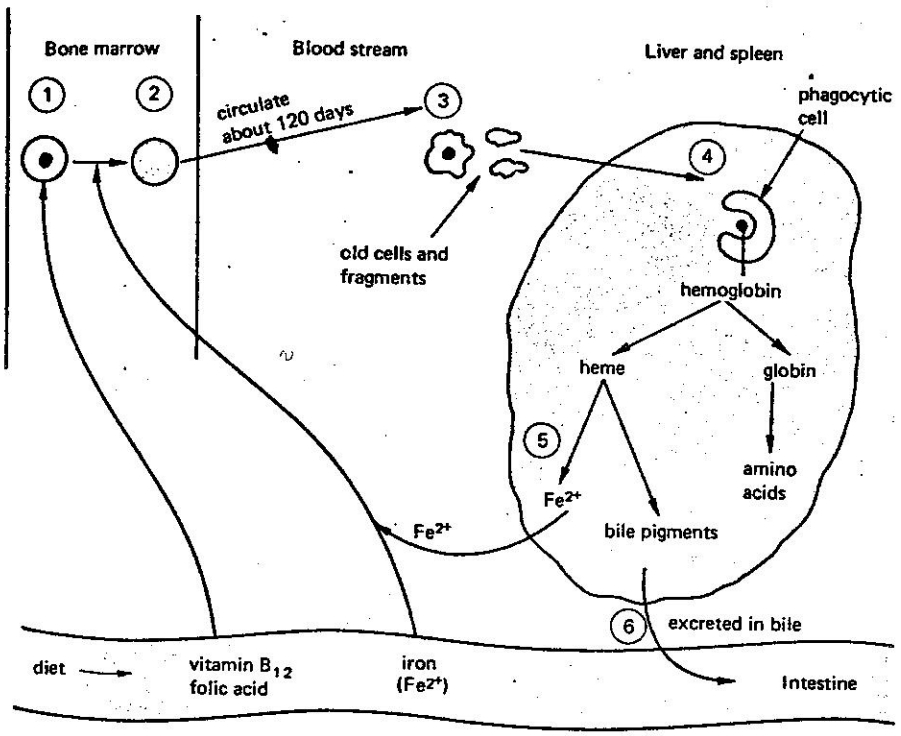

WHOLE BLOOD (Volume)
FORMED ELEMENTS (Number per cubic millimeter)
LEUKOCYTES (Differential)
BLOOD 8%
OTHER FLUIDS AND TISSUES 92%
FORMED ELEMENTS 45%
PLASMA 55%
LEUKOCYTES 5000–10,000
ERYTHROCYTES 4.2–6.2 million
PLATELETS 140,000–340,000
NEUTROPHILS 57–67%
EOSINOPHILS 1–3%
BASOPHILS 0–0.75%
LYMPHOCYTES 25–33%
MONOCYTES 3–7%
PROTEINS (Electrophoresis)
PLASMA PROTEINS
ALBUMIN 54%
SERUM PROTEINS
PLASMA WEIGHT
PROTEINS—7%
GLOBULINS 38%
FIBRINOGEN—7%
PROTHROMBIN Less than 1%
GLOBULINS (Electrophoresis)
ALPHA 14%
BETA 13%
GAMMA 11%
WATER 91.5%
Inorganic salts, lipids, enzymes, hormones, vitamins, carbohydrates 1.5%

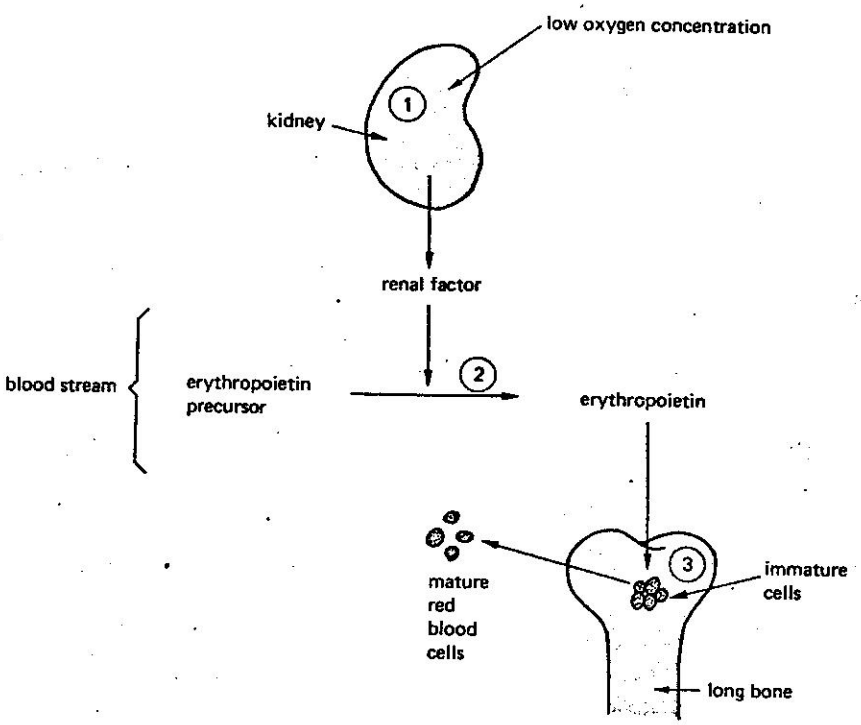
(3)


food
stomach
B_{12} + intrinsic factor
liver (storage)
B_{12}
B_{12}
B_{12}
B_{12}
normal production of red blood cells
long bone


Bone marrow
stem cell
division
differentiation: hemoglobin synthesis
disintegration of nucleus
immature red blood cell
(Reticulocyte)
mature red blood cell

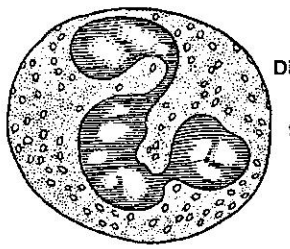
(4)


Bone marrow
Blood stream
Liver and spleen
1
2
circulate about 120 days
3
phagocytic cell
4
old cells and fragments
hemoglobin
heme
globin
5
amino acids
Fe^{2+}
bile pigments
Fe^{2+}
6
excreted in bile
diet
vitamin B_{12}
folic acid
iron (Fe^{2+})
Intestine


low oxygen concentration
kidney
1
renal factor
blood stream
erythropoietin precursor
2
erythropoietin
mature red blood cells
3
immature cells
long bone

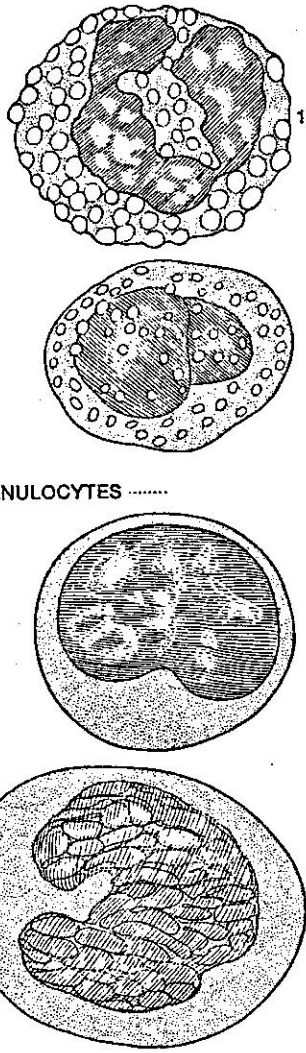
(5)

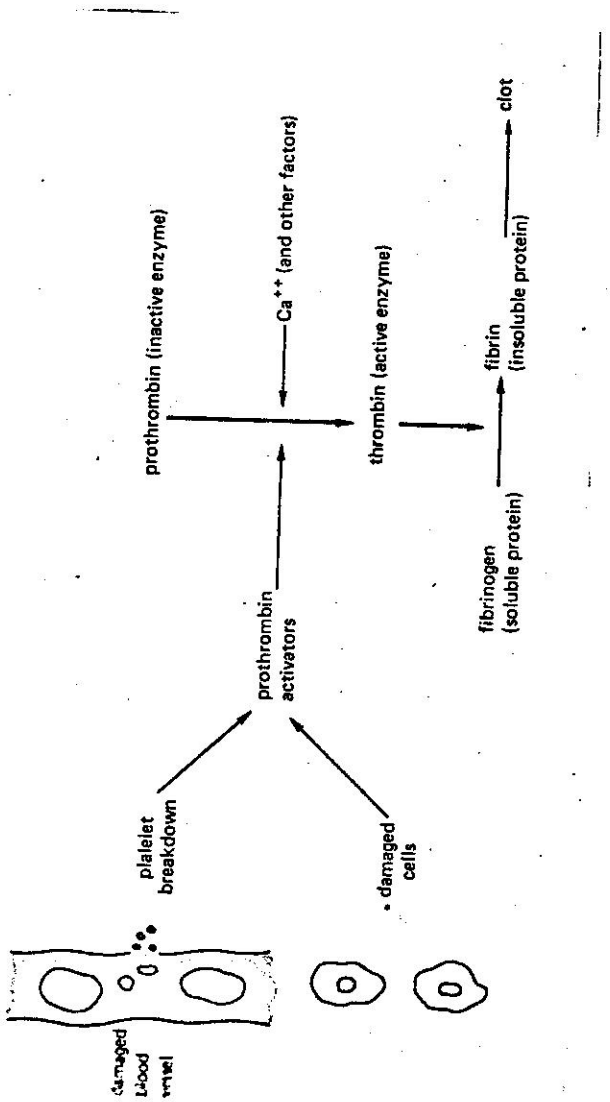
GRANULOCYTES .....



	Diameter	Number/ mm³	% Among Leukocytes	Pathologic Condition in Which Number Is Increased
NEUTROPHILS	9-12 μ	3,000-6,750	60-65	Acute pus-forming infection
EOSINOPHILS	10-14 μ	100-360	2-4	Allergies and parasitic infections
BASOPHILS	8-10 μ	25-90	0.5-1.0	Chickenpox
LYMPHOCYTES	6-12 μ	1,000-2,700	20-35	Whooping cough
MONOCYTES	12-15 μ	150-170	3-8	Tuberculosis

AGRANULOCYTES .....




damaged blood vessel
platelet breakdown
damaged cells
prothrombin activators
prothrombin (inactive enzyme)
Ca^{++} (and other factors)
thrombin (active enzyme)
fibrinogen (soluble protein)
fibrin (insoluble protein)
clot

—GENERALIZED, SIMPLIFIED SCHEME OF COAGULATION—

1) Contact Factor (XII) + Platelets + Antihemophilic Globulin (VIII) + PTA* (XI) $\xrightarrow{\text{Christmas Factor (IX)}}$ PRODUCT-I

2) Product-I + Proaccelerin (V) $\xrightarrow[Ca^{++}\ IV]{\text{Proconvertin VII}}$ THROMBOPLASTIN (III)

3) Prothrombin (II) $\xrightarrow[Ca^{++}]{\text{Thromboplastin}}$ THROMBIN

4) Fibrinogen (I) $\xrightarrow{\text{Thrombin}}$ FIBRIN

[* = Plasma Thromboplastin Antecedant]

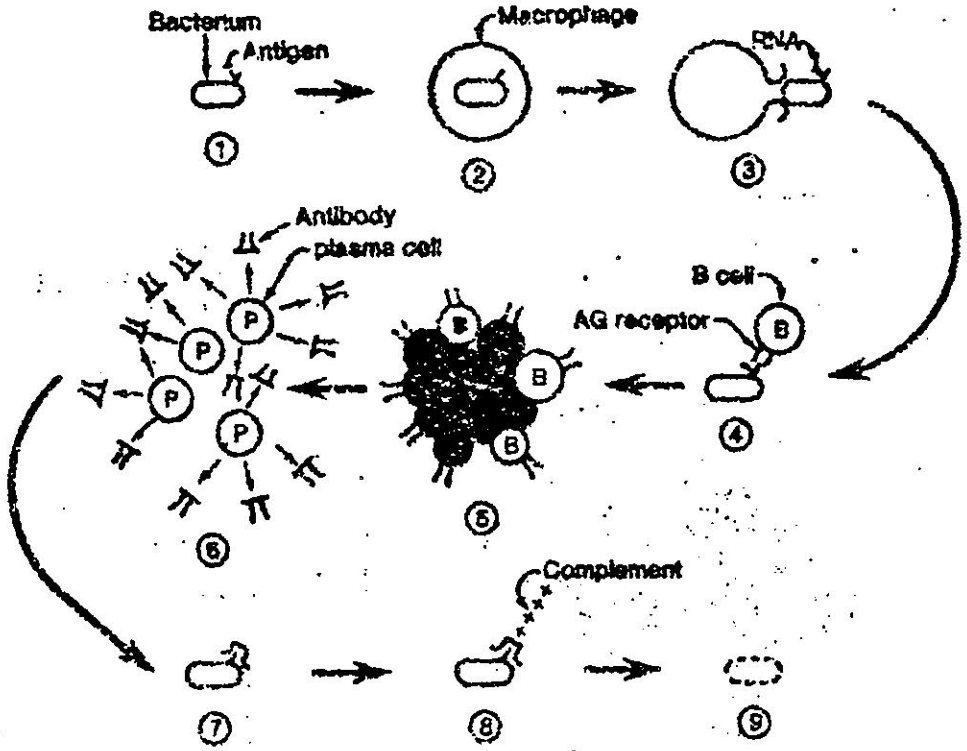
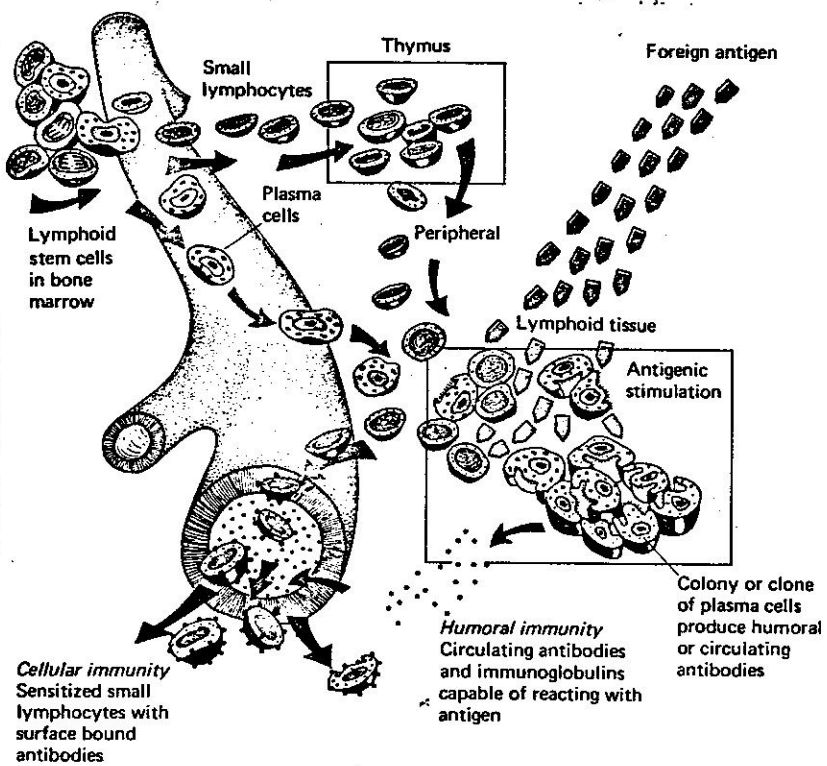
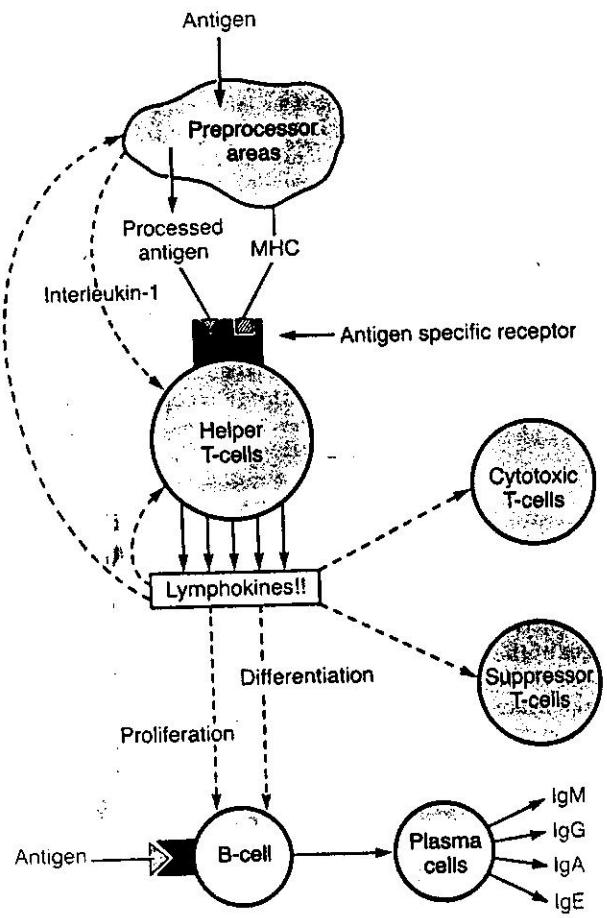


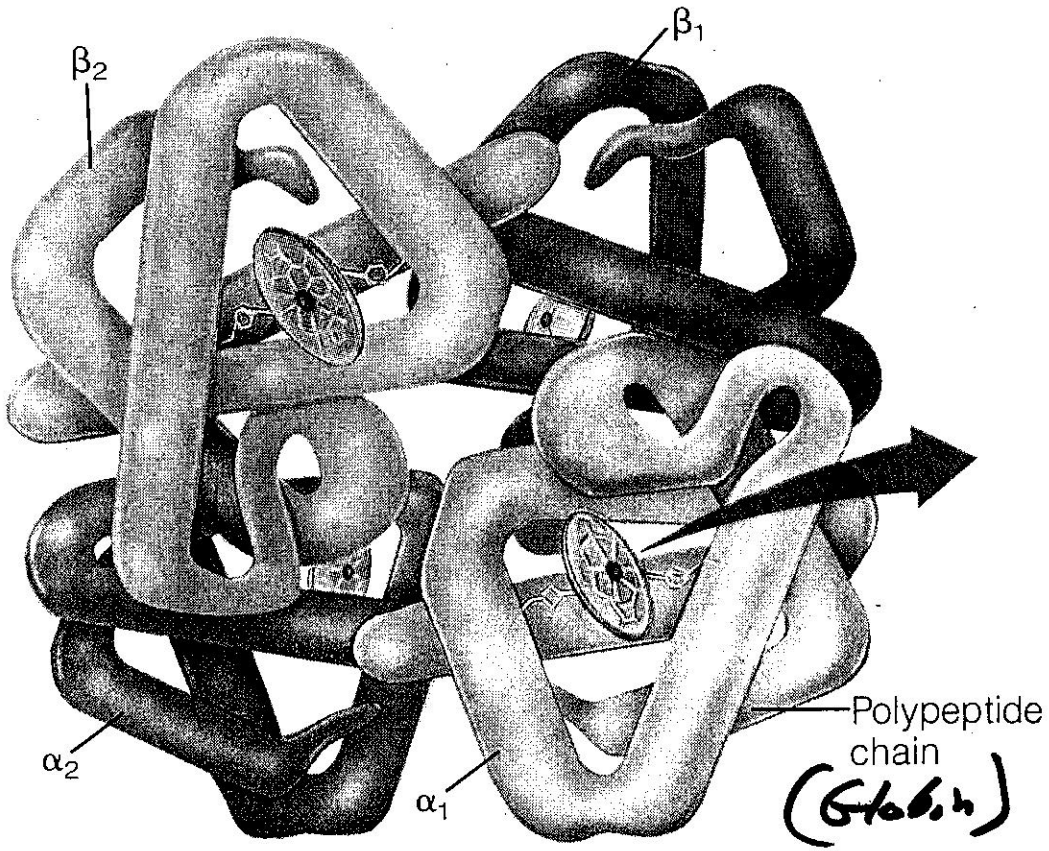
Fig. 1. Humoral immunity. *1:* Bacterium with antigen; *2:* macrophage processes antigen; *3:* macrophage expels bacterium-antigen-RNA complex; *4:* antigen-RNA complex combines with antigen receptor on B cell; *5:* proliferation of B cells; *6:* plasma cells produce antibodies; *7:* antibodies combine with bacterium antigen free in circulation; *8:* antigen-antibody complex induces complement fixation; *9:* lysed bacterium.



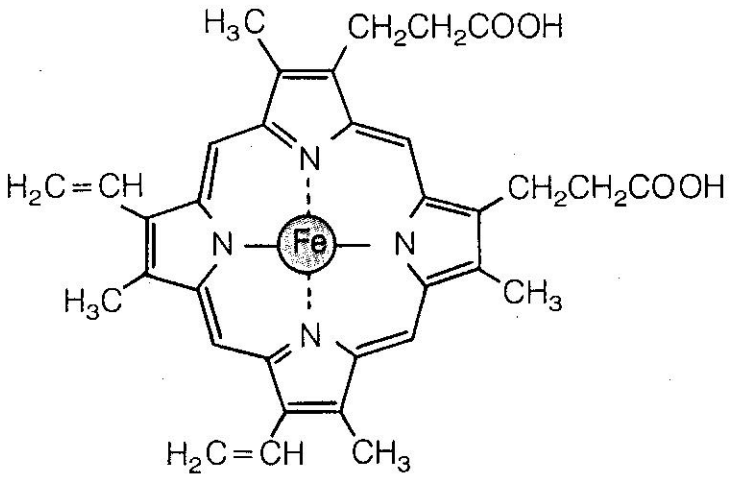


Interleukin-2
Interleukin-3
Interleukin-4
Interleukin-5
Interleukin-6
Granulocyte-monocyte colony stimulating factor
Interferon-γ

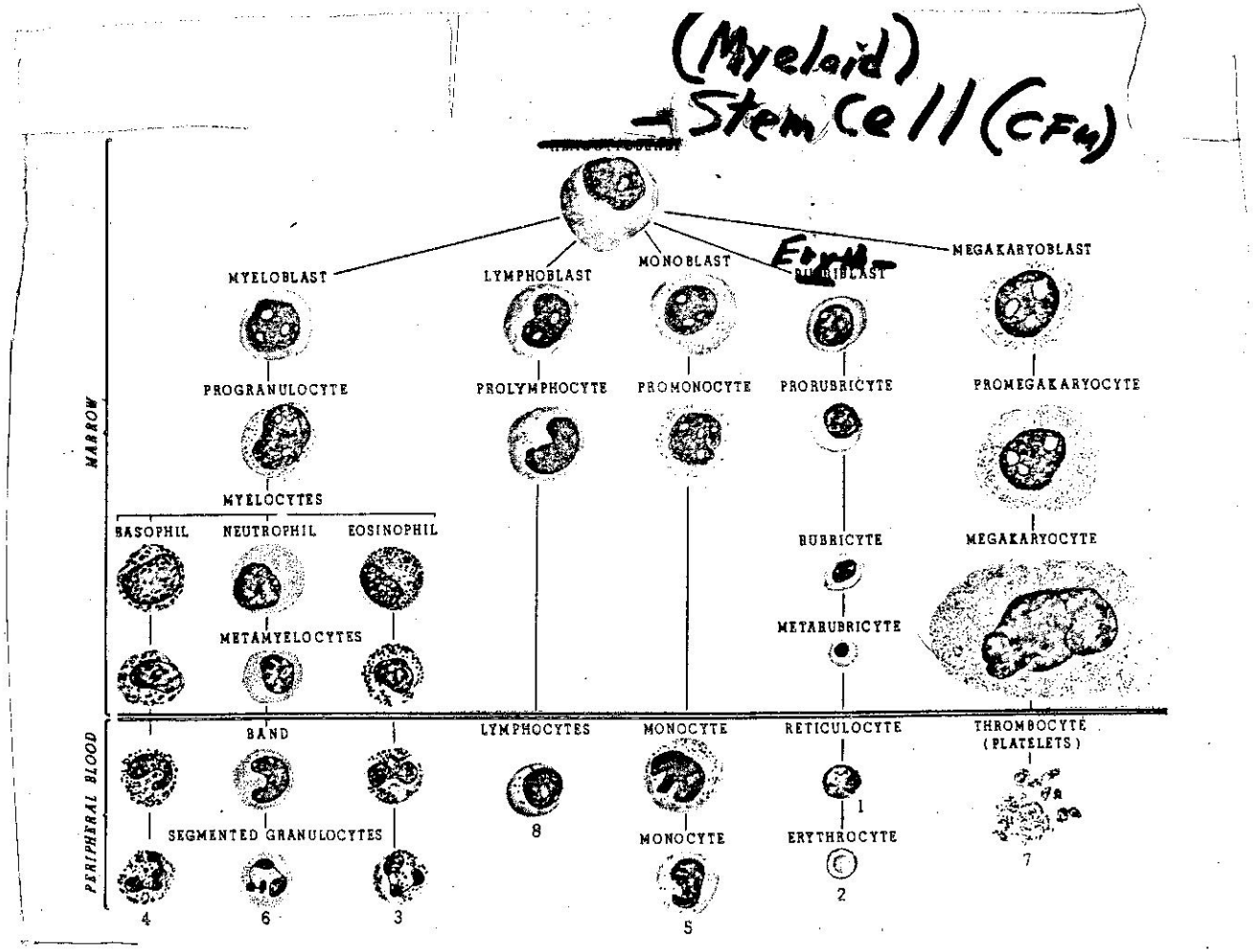
Structure of hemoglobin



(a) Hemoglobin

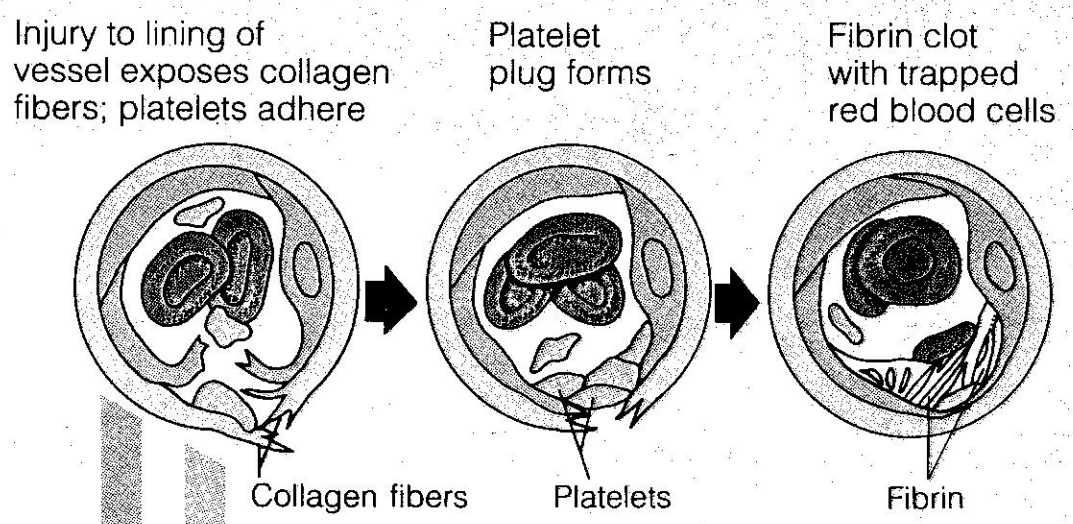


(b) Iron-containing heme group


(Myeloid)
Stem Cell (CFU)
MYELOBLAST
LYMPHOBLAST
MONOBLAST
MEGAKARYOBLAST
PROGRANULOCYTE
PROLYMPHOCYTE
PROMONOCYTE
PRORUBRICYTE
PROMEGAKARYOCYTE
MYELOCYTES
BASOPHIL
NEUTROPHIL
EOSINOPHIL
METAMYELOCYTES
RUBRICYTE
METARUBRICYTE
MEGAKARYOCYTE
BAND
LYMPHOCYTES
MONOCYTE
RETICULOCYTE
THROMBOCYTE (PLATELETS)
SEGMENTED GRANULOCYTES
ERYTHROCYTE
MARROW
PERIPHERAL BLOOD
4
6
3
8
5
1
2
7

(12)

Events of platelet plug formation and blood clotting



Platelets release chemicals that make nearby platelets sticky

PF_3 from platelets and thromboplastin from damaged cells + Calcium and other clotting factors in blood plasma

Coagulation

1. Prothrombin activator
2. Prothrombin → Thrombin
3. Fibrinogen (soluble) → Fibrin (insoluble)