HEMATOLOGY

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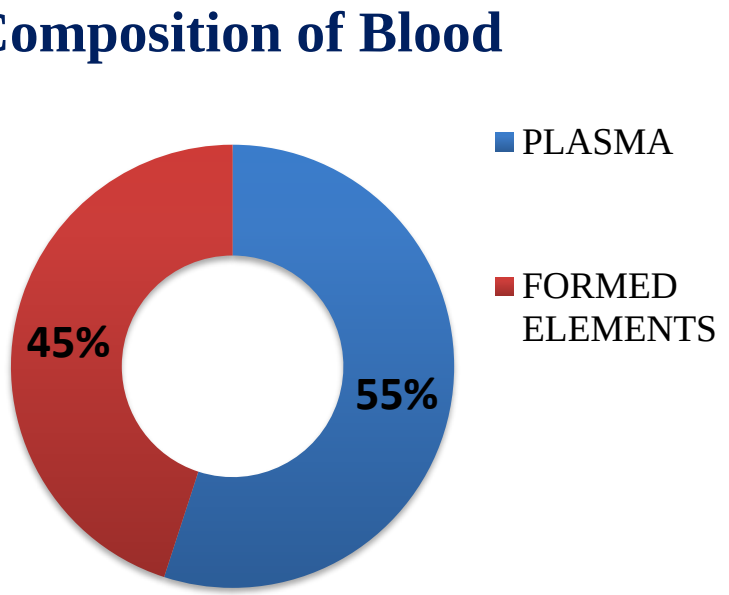
BLOOD

- Blood is a type of connective tissue composed of a colloidal liquid (plasma) that dissolves and suspends different cells.
- The formed elements of the blood includes erythrocytes, leukocytes and thrombocytes (platelets).

- Hemoglobin is the protein present in the Red Blood Cells (RBCs).
- The color of the blood varies with its oxygen content.



What does blood do?

- Transportation
  - ✓ Oxygen and Carbon dioxide
  - ✓ Nutrients / Metabolites
  - ✓ Waste materials
  - ✓ Hormones and Enzymes
- Regulation
  - ✓ Body pH (acid-base balance)
  - ✓ Temperature
  - ✓ Fluid and Electrolyte
- Protection
  - ✓ Provides Immunity (antibodies synthesis)
  - ✓ Coagulation factors

COMPOSITION OF BLOOD PLASMA

Blood Plasma

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Solutes (10% of Plasma Volume)

Major Constituent

- **Proteins**
  - Albumin
  - Globulin

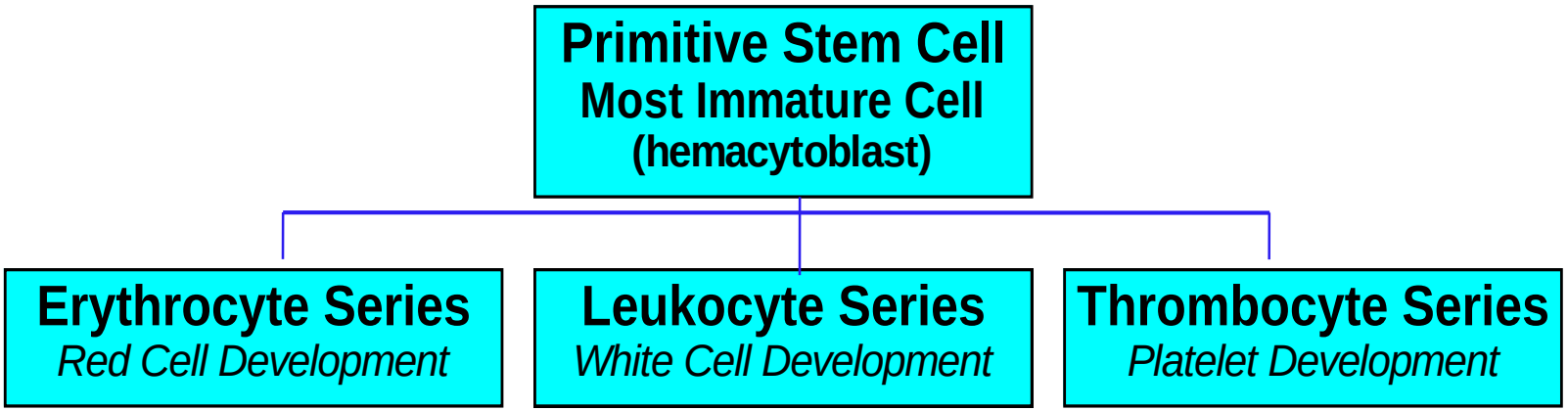
Minor Constituents

- **Nutrients**
  - Glucose, Lipids & Amino acids
- **Metabolic end products**
  - Uric acid, Urea, Creatinine
- **Gases**
  - Oxygen, Carbon dioxide
- **Hormones, Enzymes and Antibodies**

ORIGIN OF BLOOD CELLS

- Initial 2 months: Yolk sac, body stalk, placenta
- 2nd to 5th month: Liver, Spleen, Thymus
- 6th month onwards: Bone marrow.

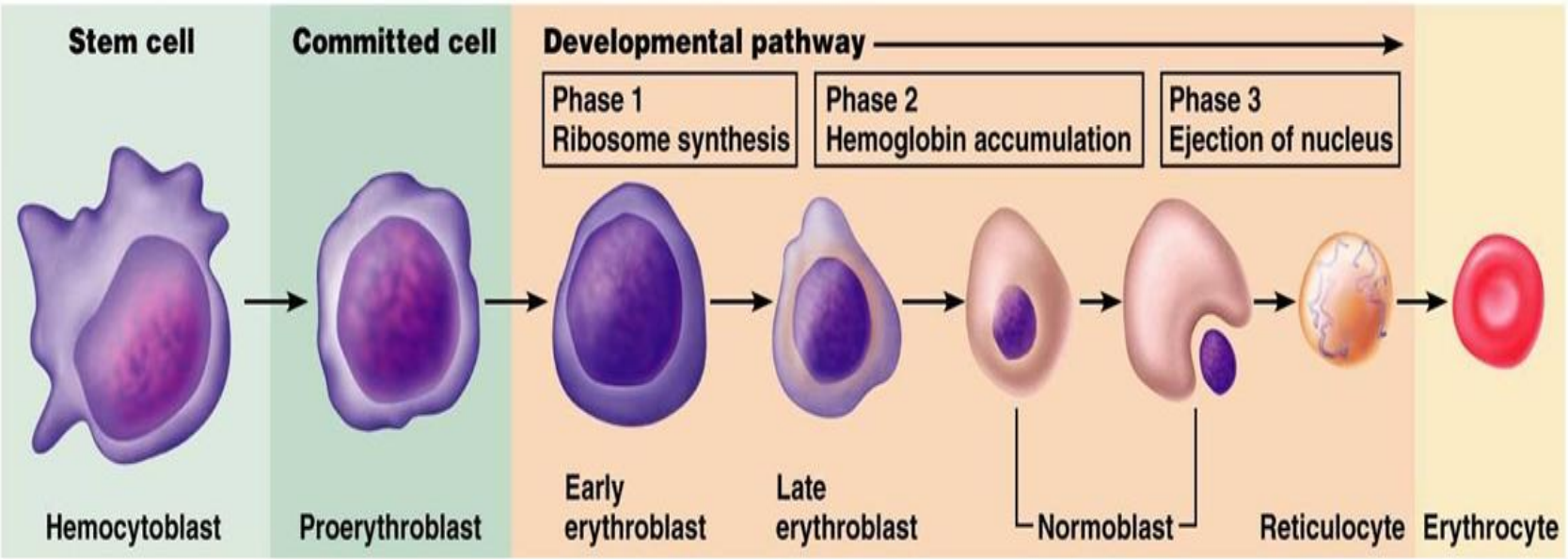
DEVELOPMENT OF BLOOD CELLS



- Erythrocytes : Reticulo-endothelial cells
- Granulocytes : Reticulo-endothelial system
- Leukocytes : Proliferation of reticulum cells of lymphatic tissues
- Thrombocytes : Reticulo-endothelial cells

STEPS OF ERYTHROPOIESIS

- In Adult, the RBC is produced in red bone marrow.



http://www.studyblue.com/notes/note/n/exam-2/deck/2477553]

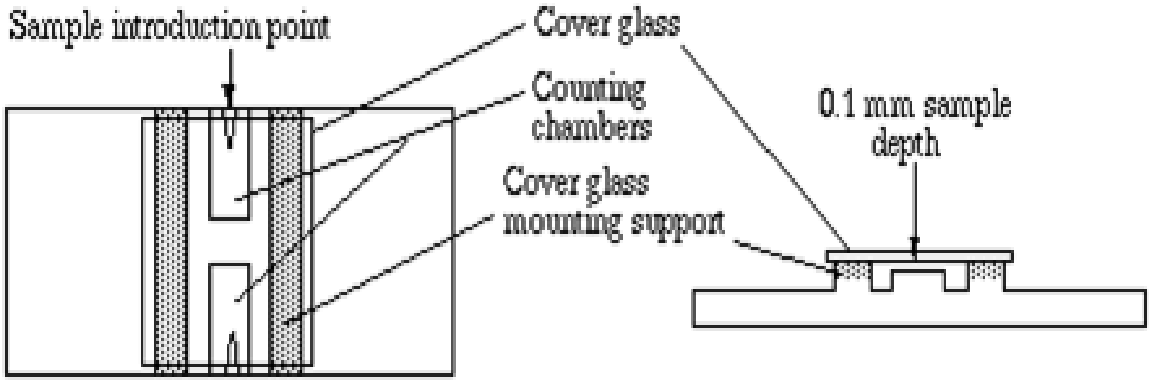
HEMATOLOGICAL PARAMETERS

- WBC: White Blood Cells
- RBC: Red Blood Cells
- Hb: Hemoglobin
- Hct: Hematocrit
- MCV: Mean Cell Volume
- MCH: Mean Cell Hemoglobin
- MCHC: Mean Cell Hemoglobin Concentration
- RDW: Red Blood Cell Distribution Width (RBC volume/MCV)

HEMATOLOGICAL INDICES (NORMAL)

Measurements	Units	Normal range
Total Leucocytes Count (WBCs)	X 10^3 / µL	4.4 - 11
Total Red Blood cells (RBCs)	X 10^6 / µL	**Males**: 4.3 – 5.9 **Females**: 3.5 - 5.0
Hemoglobin	g / dL	**Adult Males**: 13 - 18 **Adult Females**: 12 - 16
Hematocrit (PCV)	%	**Adult Males**: 40 - 54 **Adult Females**: 35 - 47
Mean cell volume (MCV)	fL	78 - 98
Mean cell hemoglobin (MCH)	pg	28 - 33
Mean cell hemoglobin concentration (MCHV)	g / dL	33 - 37
Platelets count	X 10^3 / µL	150 - 450
Erythrocytes sedimentation rate (ESR)	1 mm / hr	**Males**: 0 – 15 **Females**: 0 – 20

HEMOCYTOMETER

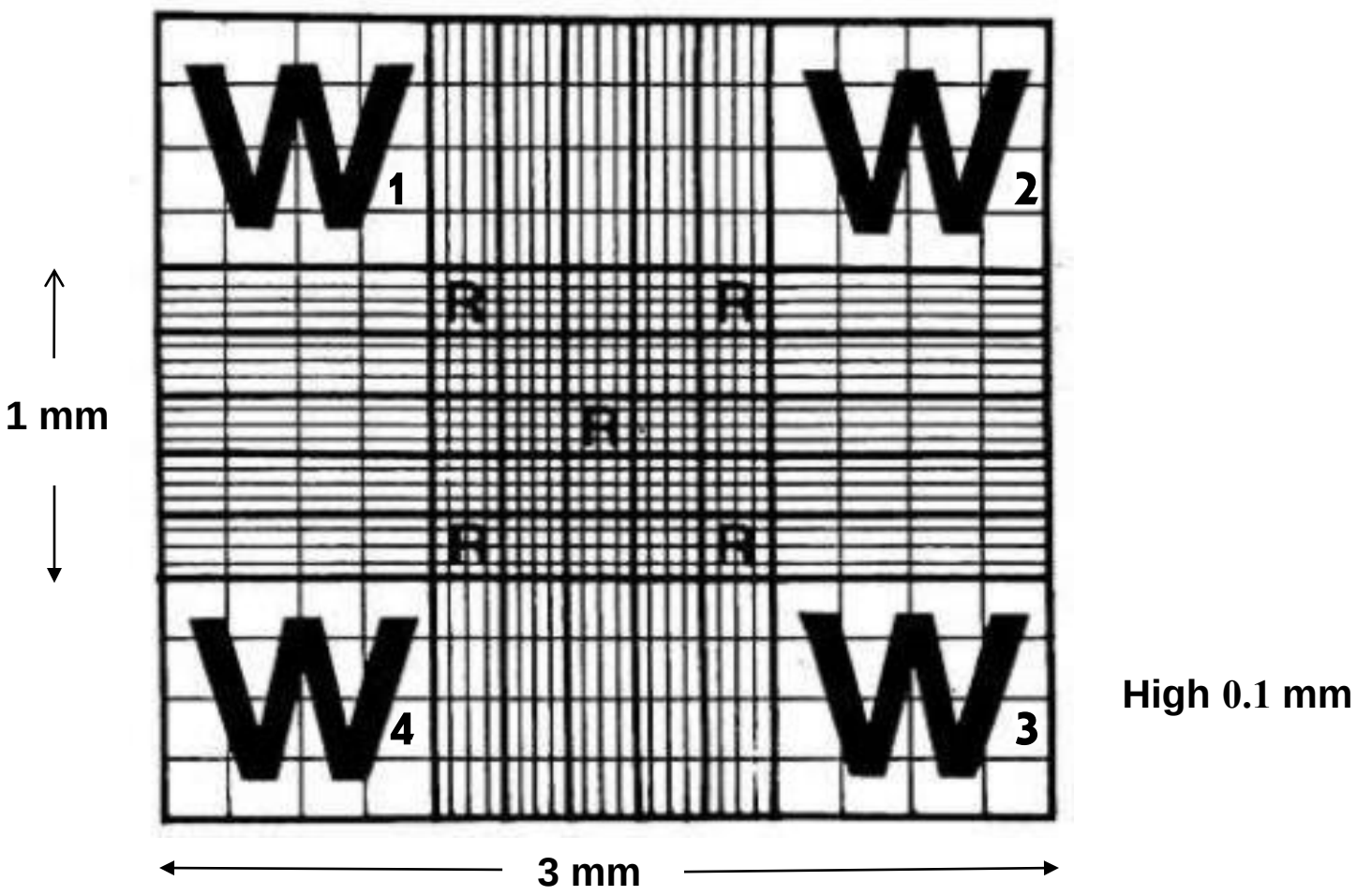


https://www.ruf.rice.edu/~bioslabs/methods/microscopy/cellcounting.html

Neubauer Hemocytometer:

The central platforms contain the ruled counting areas (0.1 mm
under the cover slip, which is suspended on the raised ridges.

HEMOCYTOMETER GRID

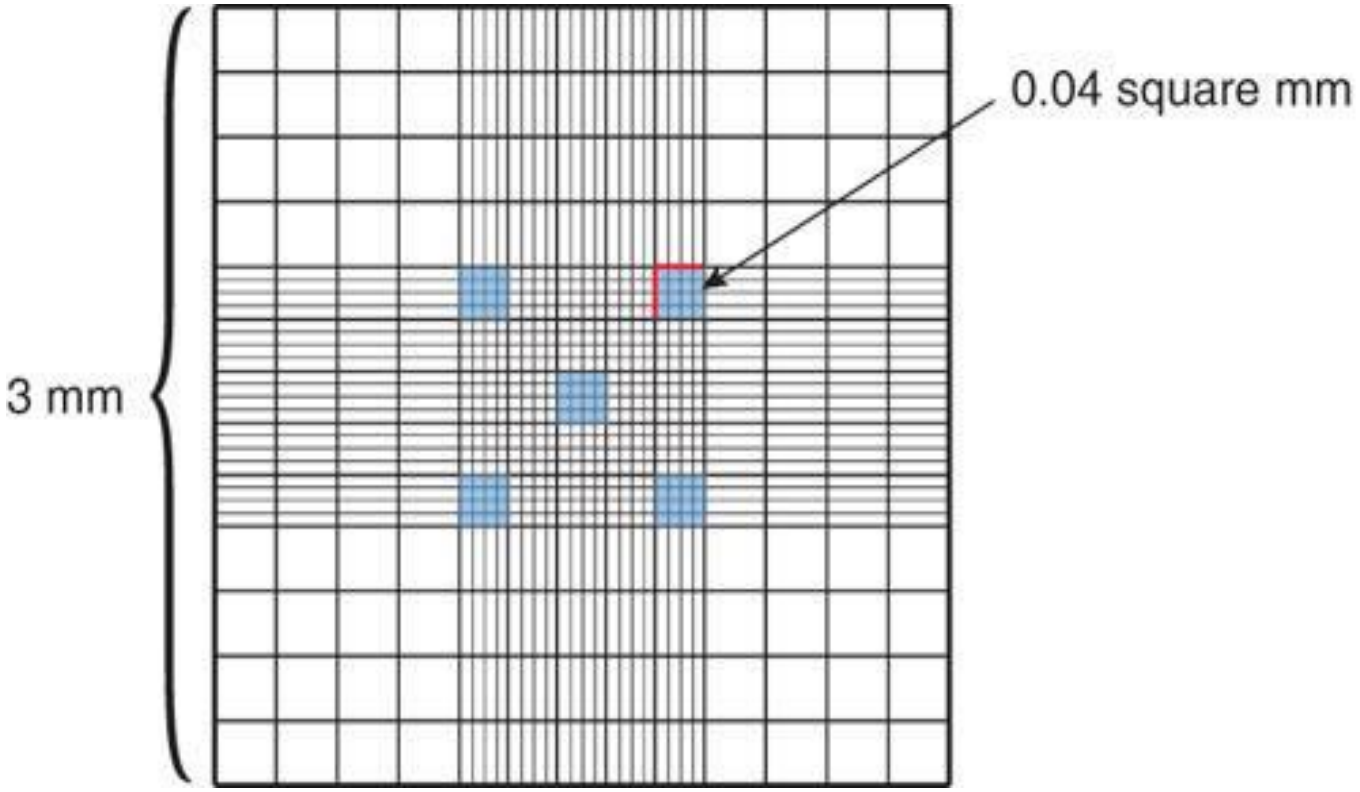


Red blood cell counting area is marked by "R" (200 µm × 200 µm)

White blood cell counting area is marked by "W"

https://www.labce.com/spg62882_improved_neubauer_hemocytometer.aspx

TOTAL RED BLOOD CELLS (RBCs) COUNT



http://www.nature.com/nprot/journal/v2/n6/fig_tab/nprot.2007.178_F2.html

RBC/μL = Number of cells counted in all 5 squares (N)
X Volume factor (=50) X Dilution factor (=200)
= N X 10000

TOTAL RED BLOOD CELLS (RBCs) COUNT

Normal value :

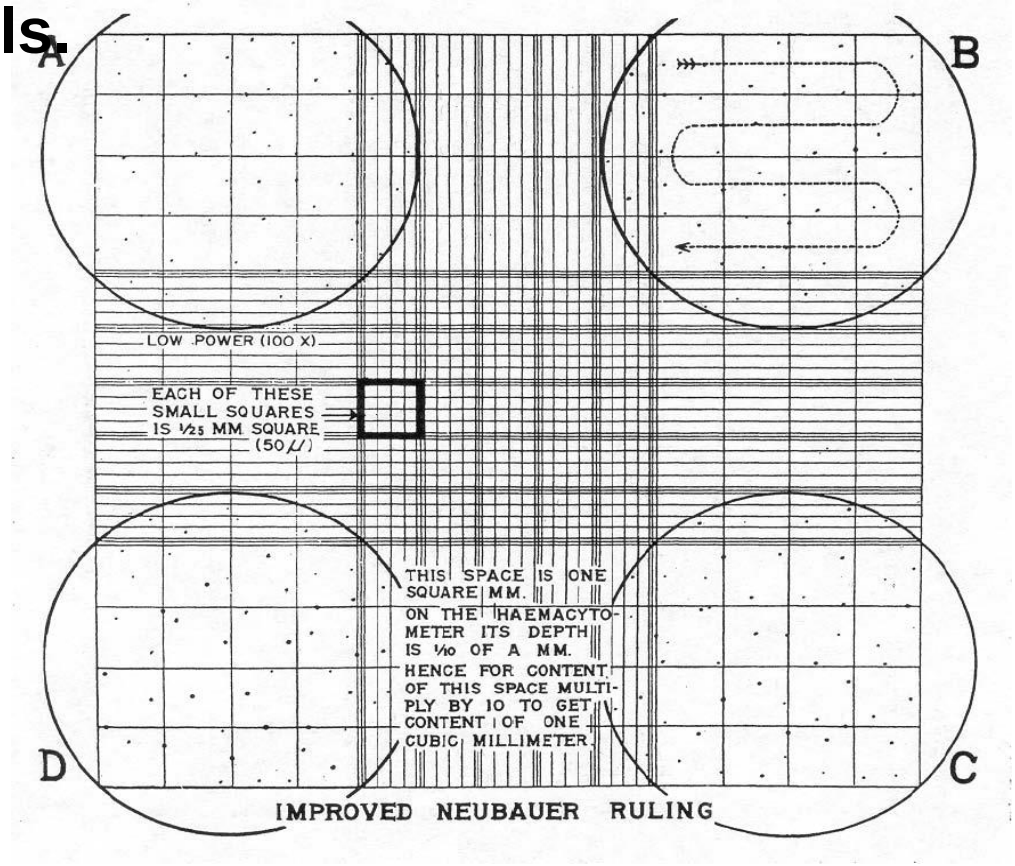
Male: 4.3 – 5.9 x 10^6 / μL

Female: 3.5 – 5.0 x 10^6 / μL

- Decreased RBC – Anemia
- Increased RBC – Polycythemia

White Blood Cells (WBCs) Count

Areas marked A, B, C, and D are used to count white blood cells.



http://www.free-ed.net/sweethaven/MedTech/Hematology/lessonMain.asp?iNum=0502

WBC/μL = Number of cells counted in all 4 chambers (N)
X Volume factor (=2.5) X Dilution factor (=20)
= N X 50

TOTAL LEUCOCYTES COUNT (WBCs)

Normal value : 4.4 – 11.0 x 10^3 / μL

- Lymphocytosism – Viral hepatitis and other viral infections, lymphocytic leukemias and heavy metal poisonings.
- Lymphocyte count > 7000 uL – Chronic lymphocytic leukemia.
- Lymphopenia – AIDS, acute infections, Hodgkin's disease, systemic lupus, renal failure and radiation therapy.

PLATELETS COUNT

Normal value : 150 – 450 x 10^3 / μL

- Thrombocytosis :
  - Inflammatory disorders
  - Myeloproliferative states
  - Acute blood loss
  - Hemolytic anemias
  - Carcinomatosis
  - Status post-splenectomy
  - Exercise etc.