

Introduction to Laboratory Tests



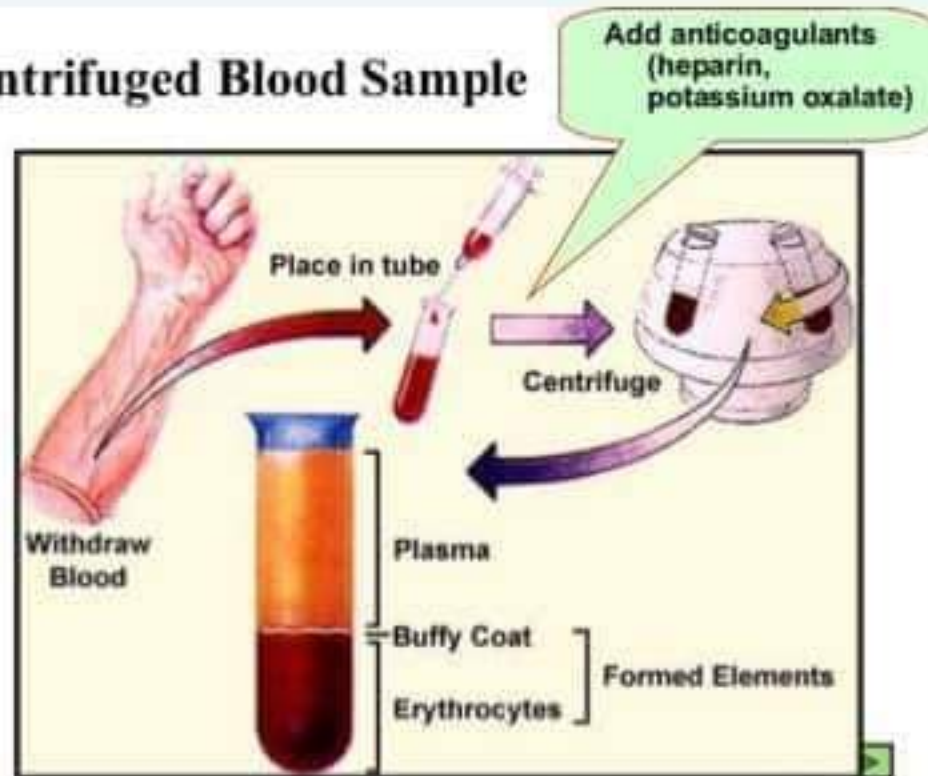
HEMATOLOGY BASICS

- What does blood do?
- What is blood?

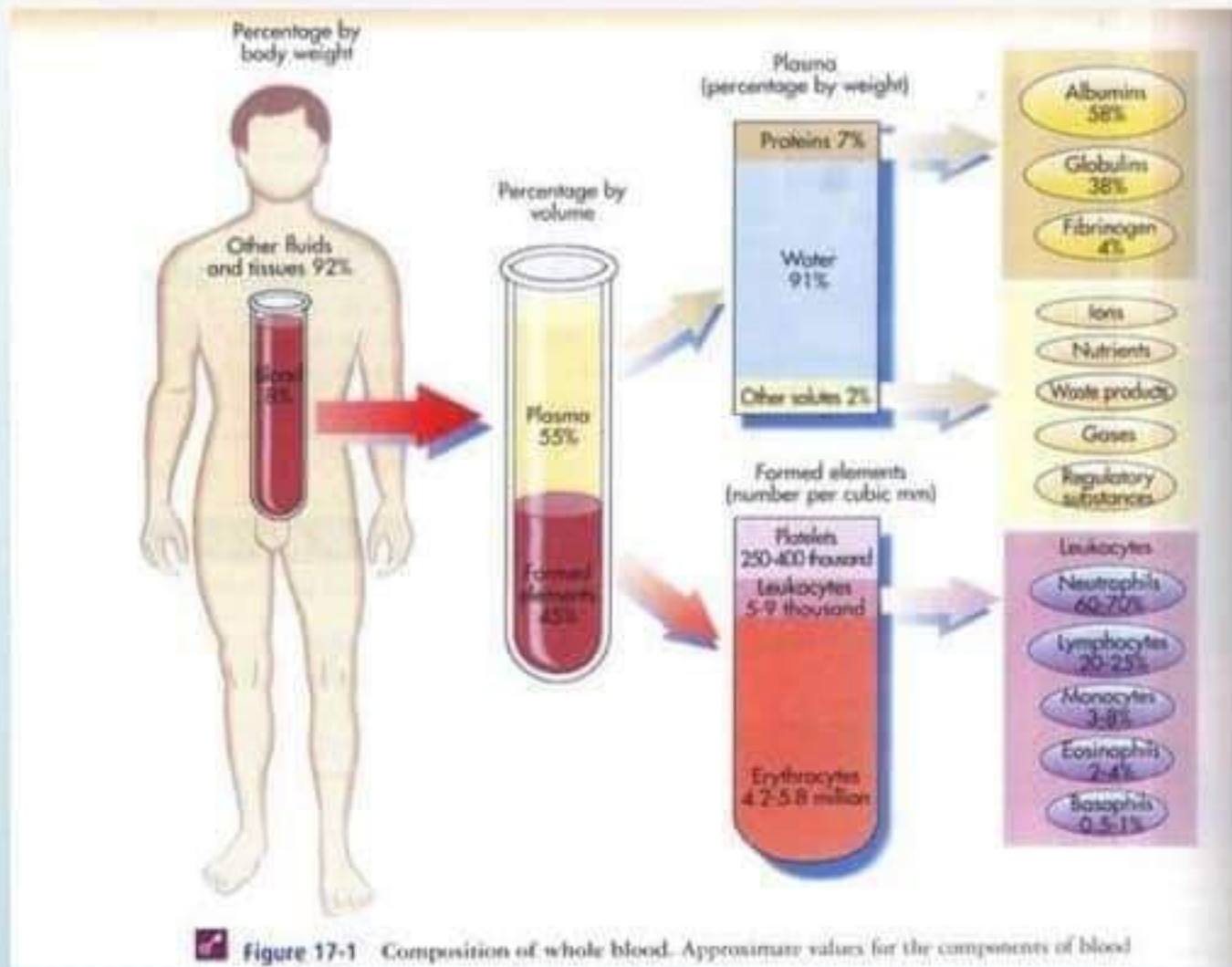


Mechanics of analyzing blood

Centrifuged Blood Sample



Composition of Blood



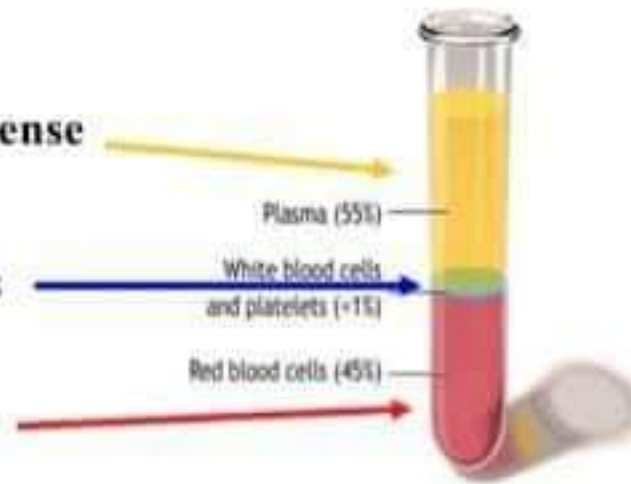
Mechanics of analyzing blood

Separation of Components

Plasma = Less Dense

Platelets / WBCs

**RBCs
More Dense**



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Hematology: Purpose of Testing

- Determine well-being of patient
- To detect diseases:
 - Anemias
 - Leukemias
 - Other blood disorders
- To evaluate success of treatment

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Functions of Blood

- Respiratory
 - Transports O_2 from lungs to tissues
 - Transports CO_2 from tissues to lungs
- Nutrition
 - Transports nutrients from gut to tissues

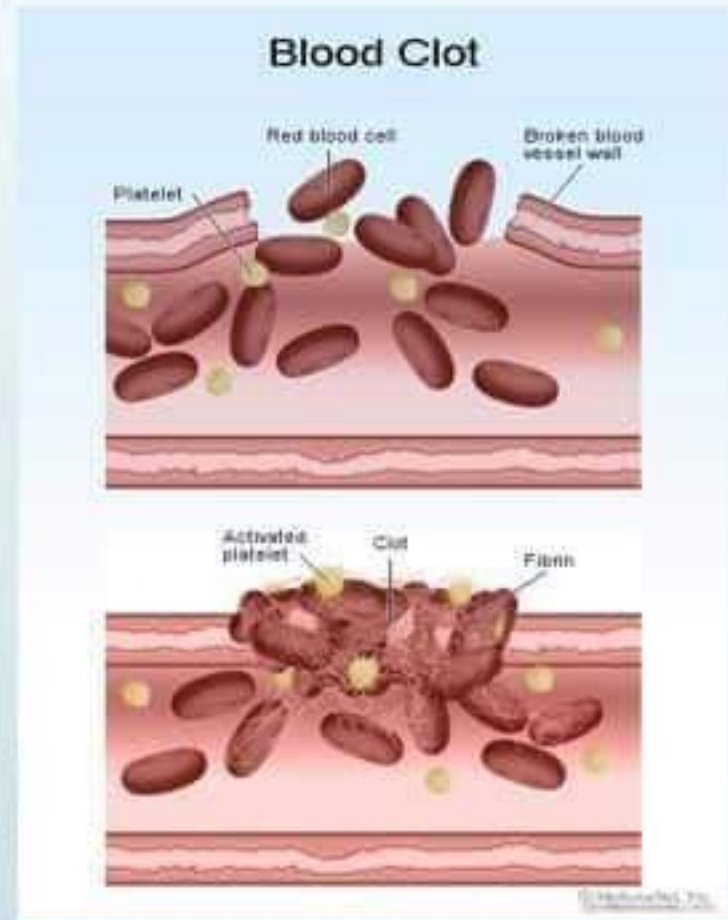
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Functions of Blood

- Excretory
 - Transports waste from tissues to kidneys (urea, uric acid, water)
- Regulatory
 - Water content of tissues
- Body temperature
- Protective (antibodies, WBC, etc.)

Functions of Blood

- Acid-base balance
- Coagulation



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Composition of Blood

- 6% - 8% of total body weight
- Normal adult's blood volume
 - 5 liters
- Made up of cellular elements (RBC, WBC) suspended in a fluid (plasma)

Mechanics of analyzing blood

2. Plasma vs. serum

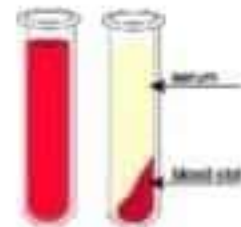
•**Plasma** is the liquid, cell-free part of blood, that has been treated with anti-coagulants.

Anticoagulated



Serum is the liquid part of blood **AFTER** coagulation, therefore devoid of clotting factors as fibrinogen.

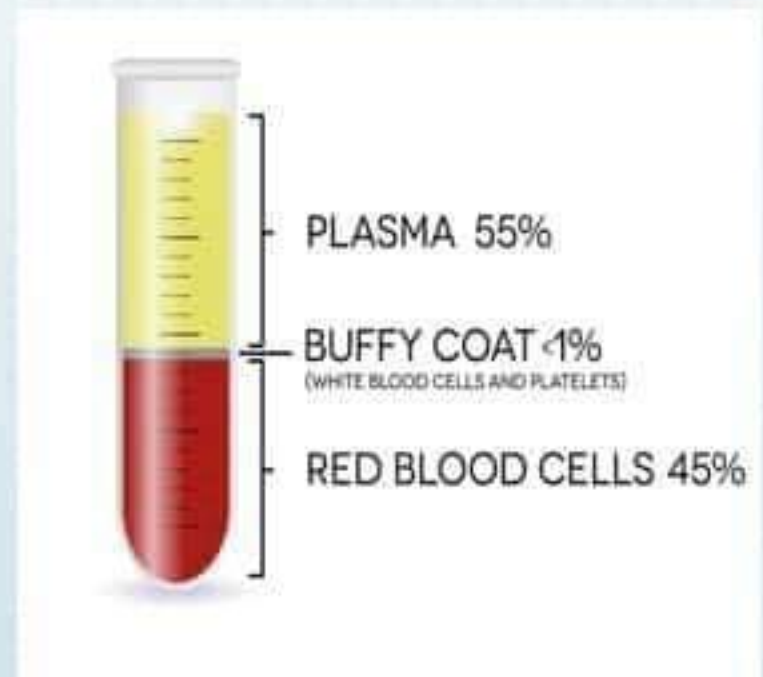
Clotted



*serum = plasma - fibrinogen

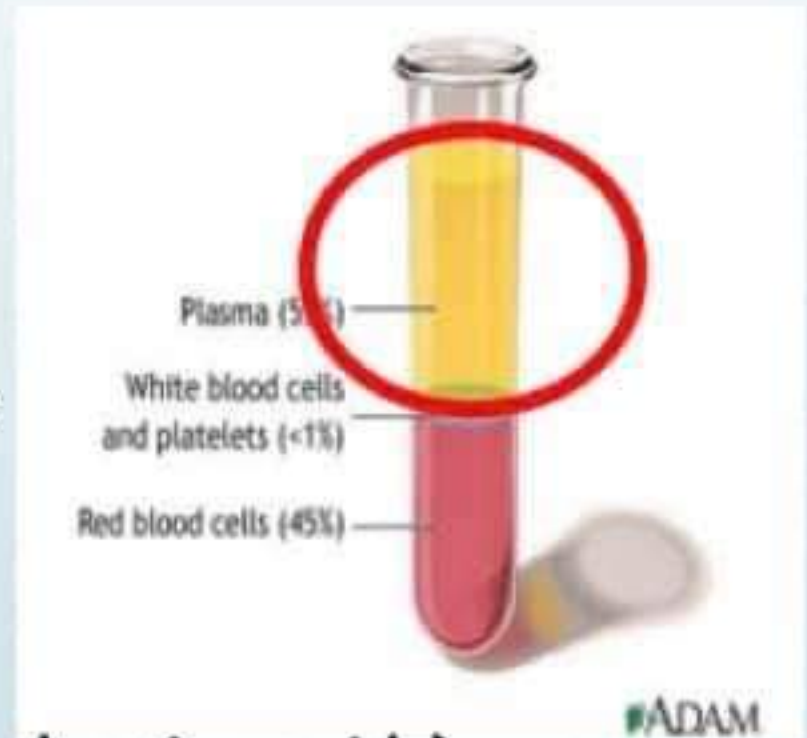
Composition of Plasma:

- 50% - 60% of total blood volume
- 90% water
- 6 - 8% plasma proteins



Composition of Plasma

- 1% Electrolytes
 - Na^+ , Cl^- , K^+ , Co_2
- Other:
 - Glucose, amino acids
 - Hormones
 - Wastes
 - Blood gases



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Cellular Components of Blood

- Called blood cells and include:
 - Red blood cells (erythrocytes)
 - White blood cells (leukocytes)
 - Platelets (thrombocytes)

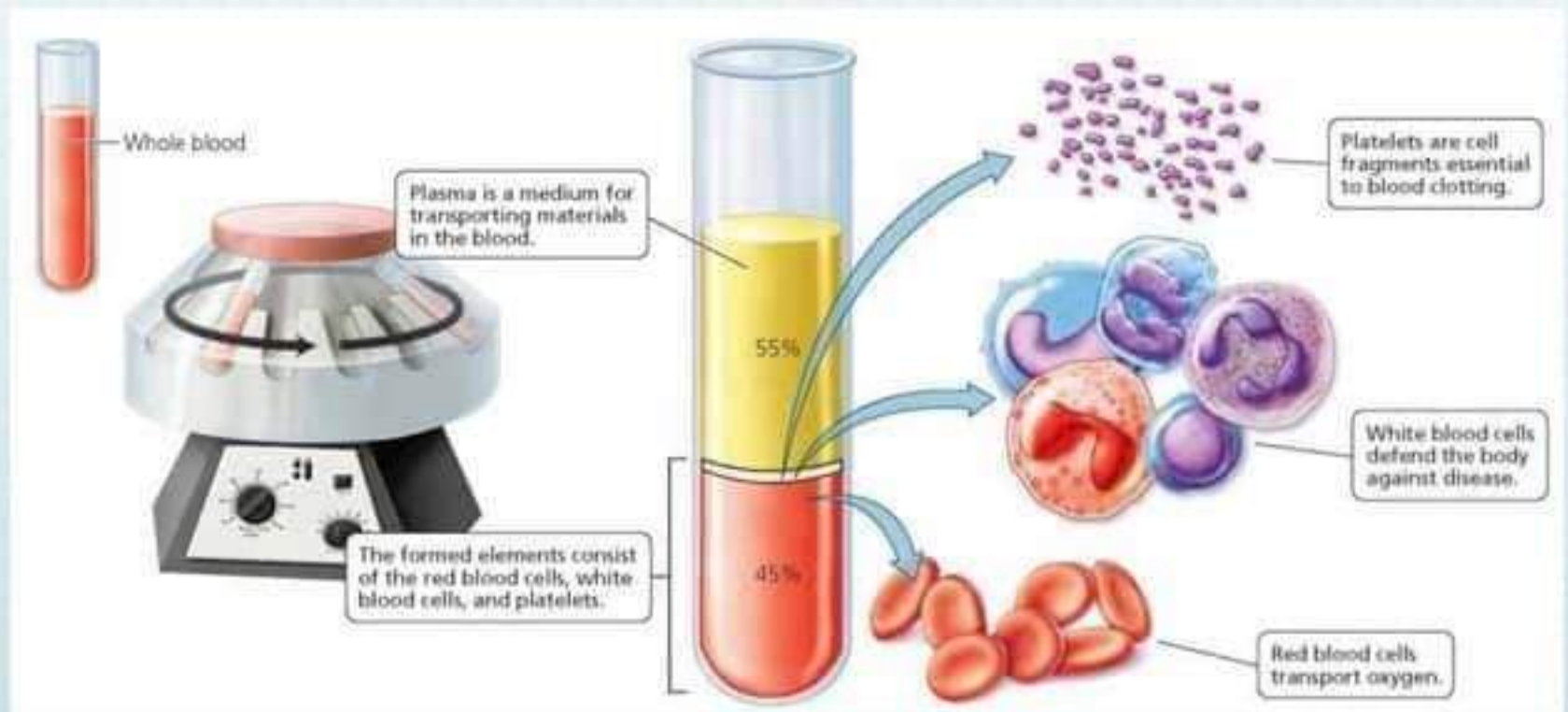


Introduction



- Purpose of Understanding Basic Lab Tests
 - Provide education to patient and family
 - Plan nursing care
 - Communicate significant alterations in test outcomes to appropriate personnel

Cellular Components of Blood



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RED BLOOD CELLS

- Most numerous
- 1 drop of blood contains how many RBC's?
 - 250 million!
- Live an average of 120 days
- Spleen helps remove old RBC's

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Red blood cells

- Primary function:
 - Transport O_2 to tissues and CO_2 to lungs
 - Done via the hemoglobin molecule
 - Red color of blood
 - Arterial blood - bright red
(oxyhemoglobin – has bound O_2)
 - Venous blood – dark red
(deoxyhemoglobin – has released O_2)

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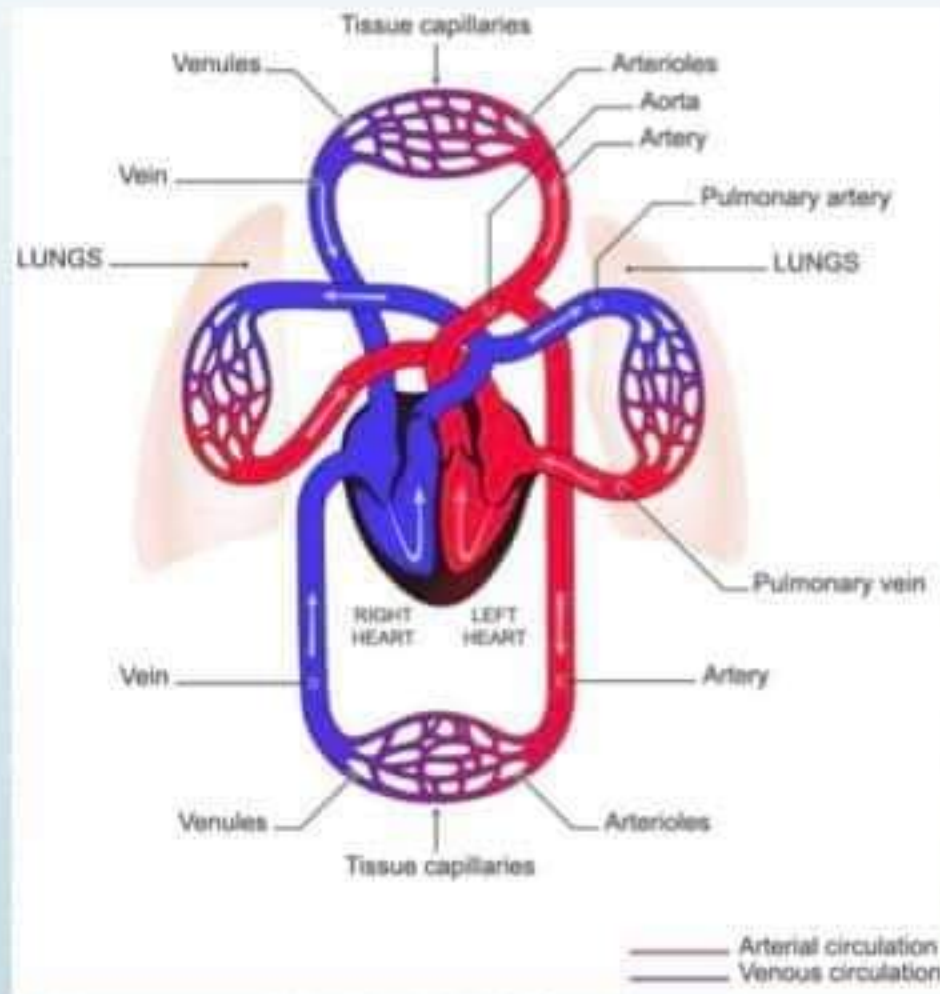
Labs tests do not stand alone!

- Tell of:
 - Health or disease in the blood and tissue of a person
- Help complete the picture of what's going on with a patient
- Guide treatment plans

Venous vs. Arterial Blood



Arterial vs. Venous circulation



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Overview of the clinical laboratory

- A place where blood, body fluids, and other biological specimens are tested, analyzed, or evaluated

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Blood test for RBC

- A count of actual (or estimated) number of RBC's per cubic mm of whole blood
- Normal values:
 - Male: 4.5 to 6.0 million/cu mm bld
 - Female: 4.0 to 5.5 million/cu mm bld

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Clinical significance of RBC

- To detect problems such as:
 - Anemia
 - Hemorrhage
- Red Cell Indices
 - Used to determine type of anemias & includes:
 - MCV (Mean Corpuscular Volume)
 - MCH (Mean corpuscular Hemoglobin)
 - MCHC (Mean corpuscular Hemoglobin Concentration)

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Collection of blood samples and nursing responsibilities

- Use correct blood tubing
- Correct patient identification
- Correct blood sample
- Properly labeled specimen
- Laboratory requisition completed and sent
- Any food restrictions
- Drug considerations

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Clinical significance of RBC

- Increase:
 - severe COPD,
 - severe dehydration
- Decrease
 - Anemia
 - Hemorrhage
 - Renal disease
 - More

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Hemoglobin (Hb or Hbg)

- Measures total amount of Hgb in blood
- Most common clinical lab
- Primary component of RBC
- Oxygen-carrying molecule
 - Binds O_2 and transports from lungs to tissues
 - In tissues – O_2 released, Hbg binds CO_2 and carries back to lungs

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Patient and Clinical factors that can affect test results:

- Time of day
- Fasting
- Postprandial
- Supine, upright
- Age, gender
- Climate
- Effects of drugs
- Effects of diet

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Hemoglobin (Hb or Hbg)

- Indirectly evaluates oxygen capacity of blood
- Important to detect blood loss and anemia

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Hemoglobin

- Made of:
 - Globin (contains 4 protein chains)
 - Heme (attached to chains)
 - Contains iron
 - 2/3 of body's iron is in the heme



Hemoglobin

- Females:
 - Up to middle age: 12 – 16 g/dL
 - After middle age: 11.7 – 13.8 g/dL
- Males:
 - Up to middle age: 14 – 17.4 g/dL
 - After middle age: 12.4 – 14.9 g/dL
- Critical: < 7 or > 20 g/dL

HEMATOLOGY: DEFINITION

- The branch of medicine concerned with studying:
 - Formed elements of blood
 - Blood-forming tissues



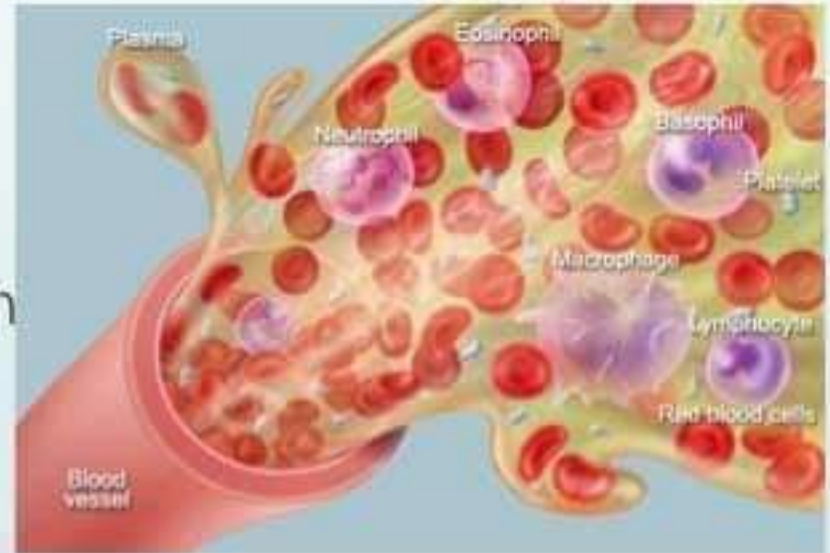


Hematocrit

- Measure of RBC percent of total blood vol
 - Indirect measure of RBC # & volume
 - Part of "routine" testing and anemia evaluation
- Normal: 36 – 48%
- Critical: < 15% or > 60%

White Blood Cells

- Functions:
 - Immunity
 - Prevent infection
 - Fight invader cells
 - WBC's do most of their work in the tissues; are transported via the blood



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Blood test for WBC

- Each microliter of blood contains 5,000 – 10,000 WBC's
- Differential cell count ("diff")
 - Evaluates distribution and shape of WBC's

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WBC differential

- Useful for infection, neoplasm, allergy & immunosuppression evaluations
- Normal:
 - Neutrophils (50 – 70%)
 - Lymphocytes (20 – 40%)
 - Monocytes (2 – 8%)
 - Eosinophils (0 – 5%)
 - Basophils (0 – 2%)



Other WBC conditions:

- Leukocytosis – abnormally large number of leukocytes
 - WBC count of $\geq 10,000$ cells/mm³
 - Lymphocytosis – form of leukocytosis due to increase in numbers of lymphocytes
- Left shift – increase in the number of immature neutrophils (bands/stabs) found in the blood

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PLATELETS

- Help stop bleeding
- Life span of approximately 10 days
- Form a plug in injured vessels
- Release:
 - Chemicals
 - Enzymes