

Laboratory -1-

Hematology

Third Stage

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Hematology:

Hematology is the study of the cells and proteins found in blood. A diagnostic hematology Laboratory is usually divided up into four main areas:

- 1) **Routine hematology** – full blood examinations, morphology + other tests.
- 2) **Coagulation – testing** - for the proteins and cells involved in clotting.
- 3) **Blood bank** – blood and blood product transfusions.
- 4) **Special tests** – performed only when required.

Blood

Is specialized fluid of connective tissue that Contains cells suspended in a fluid matrix, Blood makes up 6–8% of our total body weight and the normal adult blood volume is 5 L.

Blood composed of two major elements:

A- Cellular Elements

1- Red blood cells (erythrocytes) transport oxygen around your body and remove waste products and carbon dioxide. The life span is short because it lacks nucleus that about 120 days and it contain hemoglobin, which is responsible for transporting oxygen and carbon dioxide. It is also the pigment that gives red color to blood.(Fig.1)

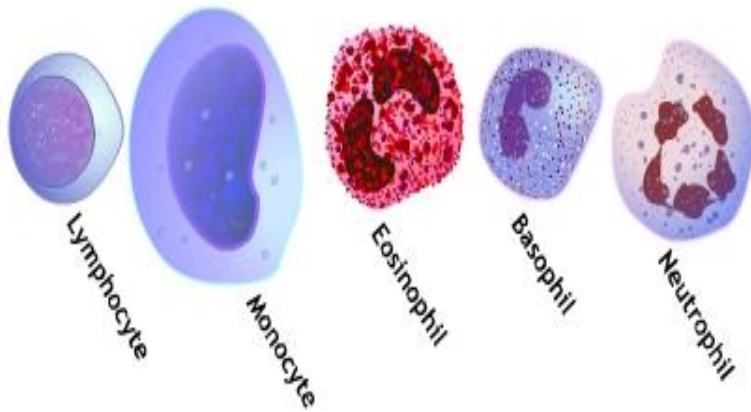


(Fig.1)

2- White blood cells (leukocytes) White blood cells (leucocytes) are responsible for fighting infections and invading pathogens (e.g. viruses or bacteria) (Fig.2)

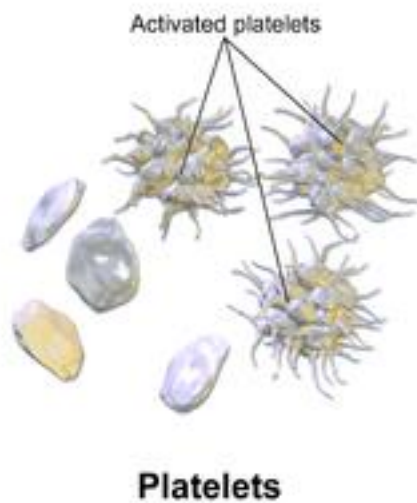
It divided to:

- Granular leukocytes (neutrophil, eosinophil and basophils)
- A granular leukocytes (lymphocyte and monocytes)



(Fig.2)

3- Platelets (thrombocytes) that help your blood clot if you are bleeding. (Fig.3)



(Fig. 3)

B-Fluid Elements (Plasma)

Plasma is composed of

1-Water: 70% of body

2-Electrolytes: essential to cellular function, the important Plasma Cl^- , H^+ , Ca^{++}) electrolytes are (Na^+ , K^+ ,

a -Coagulation proteins (fibrinogen).

b -Immunoproteins (anti bodies).

c -Transport proteins.

Blood Plasma and Serum

Plasma is the fluid portion of the blood in which cellular elements are suspended and circulated through the body. The volume of the plasma part of blood is usually a little more than half the volume of the whole blood. Blood cells make up the remaining part of the whole blood's volume. (Normal volumes: 2.6 L, blood cells 2.4 L. total blood volume 5 L) Serum is the clear fluid that separates from blood upon coagulation when all cellular elements are removed.

Blood Collection

A-Capillary Blood

Capillary blood may be used for hemoglobin estimation, cell counts, blood grouping, bleeding and coagulation times or for micro chemical investigations. Although of great value in children and the adults with "difficult " veins is not only subject to sampling error but tests cannot be repeated in the laboratory, as the whole sample will have been used and further tests which may be required cannot be performed.

Procedure:

1. Select a suitable site of puncture (Fig.4)
 - (a) The lobe of ear
 - (b) The ball of the finger, or the side of the thumb (in adults)
 - (c) The base of the heel, or the great toe (in babies)
2. Clean the site with alcohol, and allowed to dry
3. A quick stab is made with a pre-sterilized disposable lancet.

4. Apply a little pressure to insure a free flow of blood. Squeezing must be avoided as this can cause lymph to dilute the blood, giving errors in results
5. Wipe away the first few drops of blood
6. Gently draw blood into the capillary tube.
7. If blood films are required, gently touch a fresh drop of blood onto one end of a clean, grease-free slide or onto coverslip.



B-Venous Blood

Puncturing a vein with a needle attached to syringe is called venipuncture. This is best withdrawn from an antecubital vein by means of dry glass or plastic syringe; the needle should not be too fine or too long. If larger volumes of blood are required, a venous sample of blood must be obtained

Procedure:

1. Support the arm on the edge of a table
2. Inspect the vein, use the tourniquet if needed.
3. Clean the area with a swab of cotton dipped in alcohol and allowed to dry
4. Use a sterile, dry syringe of a size according to the amount of blood required.
5. Choose a proper vein and introduce the needle into the skin with a firm and smooth motion
6. Puncture the vein (antecubital vein) a few millimeters ahead of the skin puncture site and a little from the side of the vein.
7. Draw the required amount of blood, and release the tourniquet.
8. Withdraw the needle and put a fresh cotton swab over the skin puncture and ask the subject (or patient) to flex the arm at the elbow.
9. Remove the needle from the syringe and expel the blood gently into a prepared container of anticoagulant (if whole blood need).
10. Shake the container gently so that the anticoagulant mixes well with the blood and prevents coagulation.

In obese subjects blood may have to be collected from the venous on the back of the hand.

Note: All blood samples;

- (a) Must be regarded as a potential source of infection.
- (b) Should be clearly labeled with patient's name, number, time of collection and the date.

Anticoagulants:

1-EDTA: Na⁺ or K⁺ salts of Ethylene diamine Tetra Acetic acid, the anticoagulant of choice for routine hematological work. EDTA effects on Ca⁺⁺, so it is not suitable for use in the investigation of coagulation problems and should not be used in the estimation of prothrombin time.

2-Tri-sodium Citrate: is the anticoagulant of choice in coagulation studies. It is also the anticoagulant most widely used in the estimation of the sedimentation rate (ESR). **3-Heparin:** is an effective anticoagulant and does not alter the size of the red cells. Heparinized blood should not be used for making blood films as it gives a faint blue colouration to the background when the films are stained by Romanowsky dyes. Heparin is the best anticoagulant to use for fragility test.

4- Acid Citrate Dextrose: is used in blood transfusion