

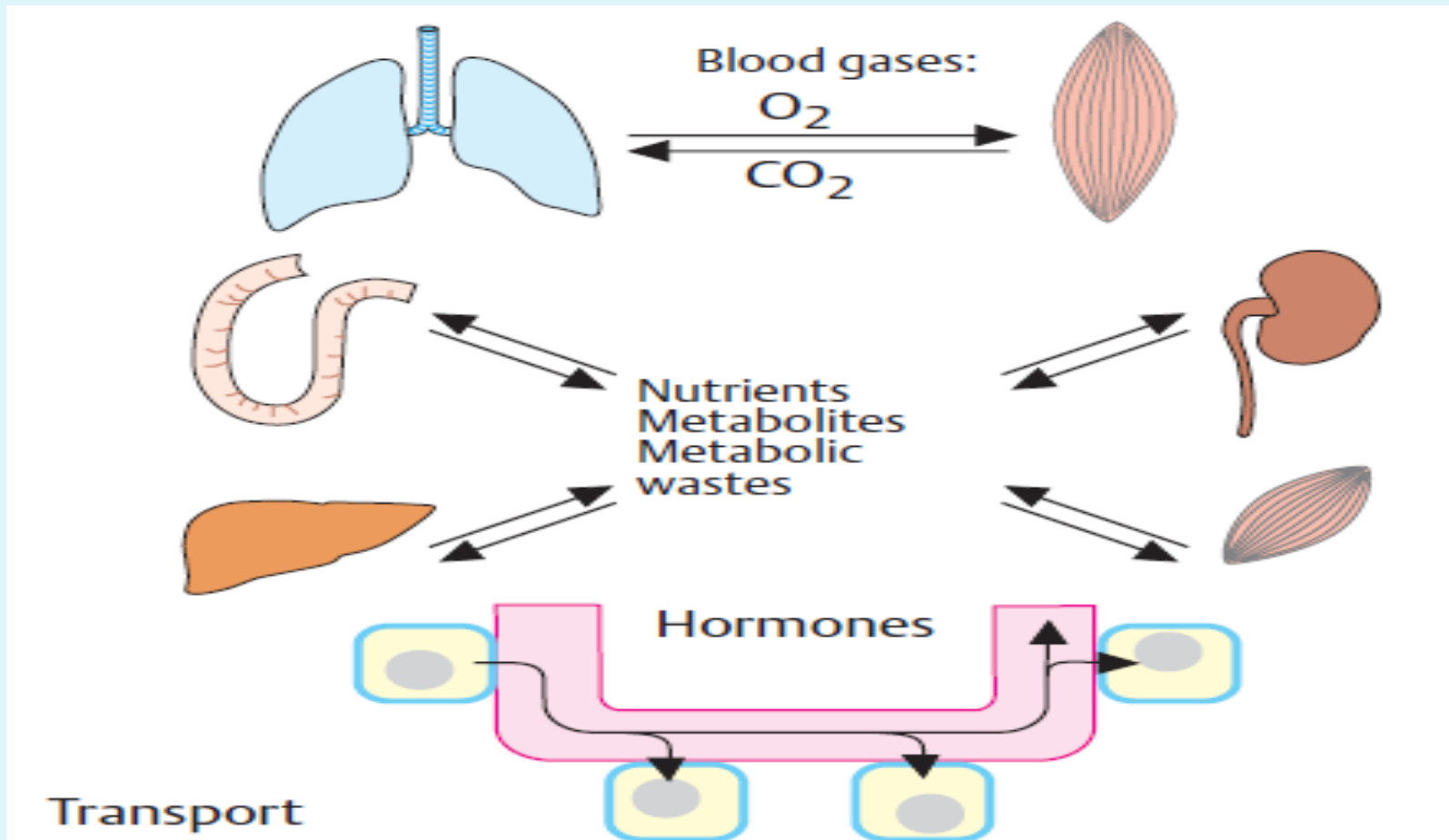
# BLOOD

## Functions & Compositions of the Blood

## **Functions of the blood**

**Transport: The blood is the most important transport medium in the body**

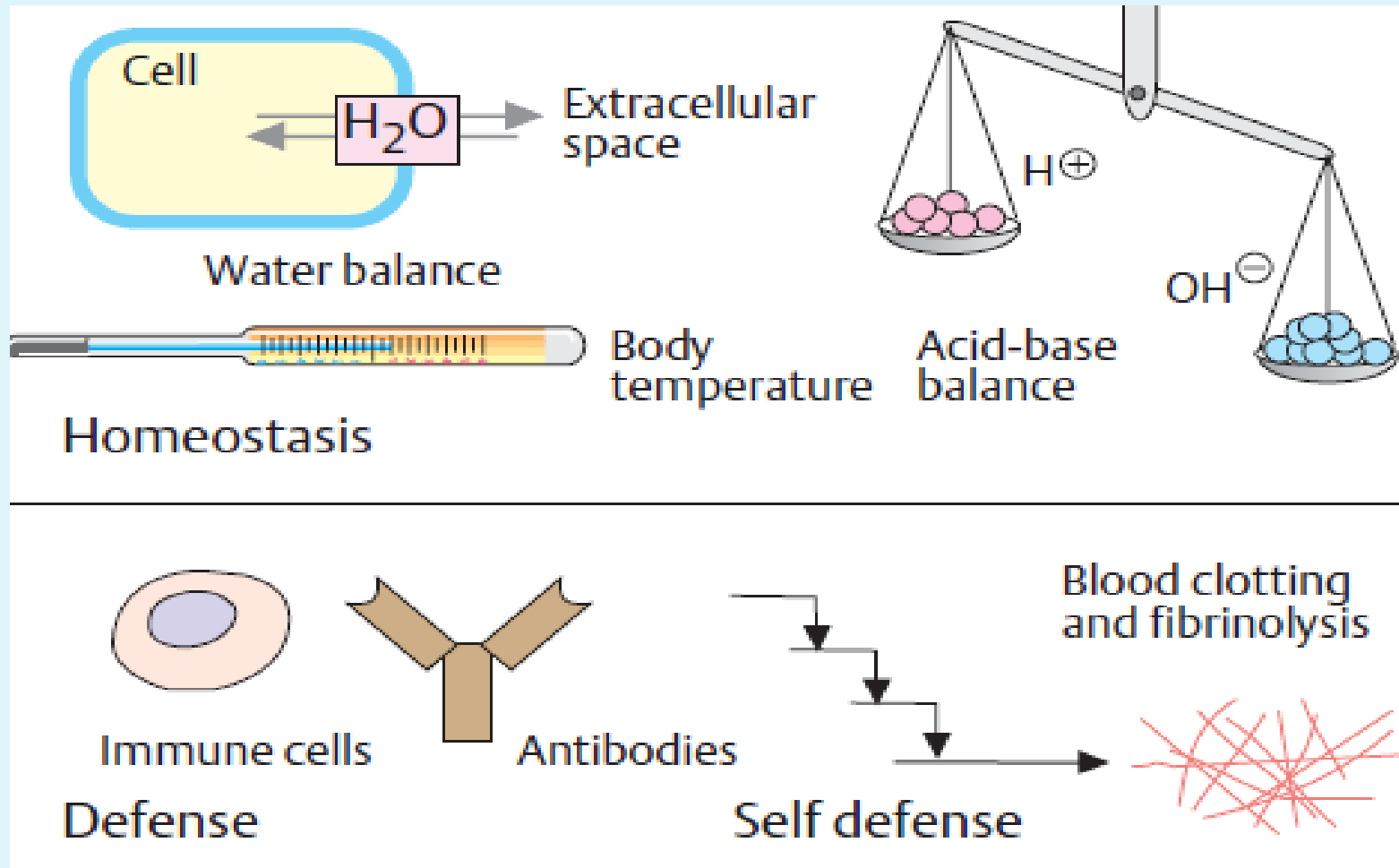
- **The blood gases (oxygen and carbon dioxide) exchange.**
- **Exchange of substances between organs and transport metabolic wastes from tissues to the lungs, liver, and kidney for excretion.**
- **Distribution of hormones throughout the organism.**



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## **Homeostasis & Regulation:**

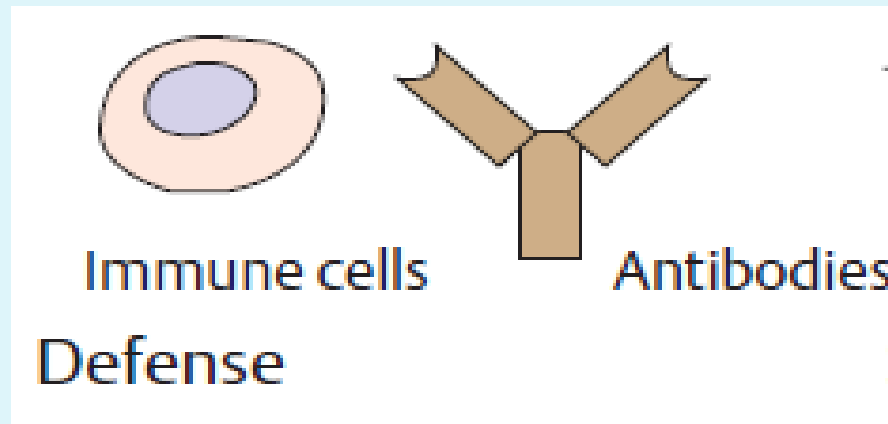
- **Blood activate plasma proteins and platelets and initiate clot formation when a vessel is broken. Blood managed fibrinolysis (dissolution of blood clots) (Self defense).**
- **Blood regulate body temperature by absorbing and distributing heat to other parts of the body.**
- **Blood maintain body PH in the body tissues using buffer system.**
- **Blood maintain adequate fluid volume in the circulatory volume.**



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## Protection against pathogens in blood:

- **Synthesizing and utilizing antibodies.**
- **Activating complement proteins.**
- **Activating WBCs to defend the body against pathogens.**



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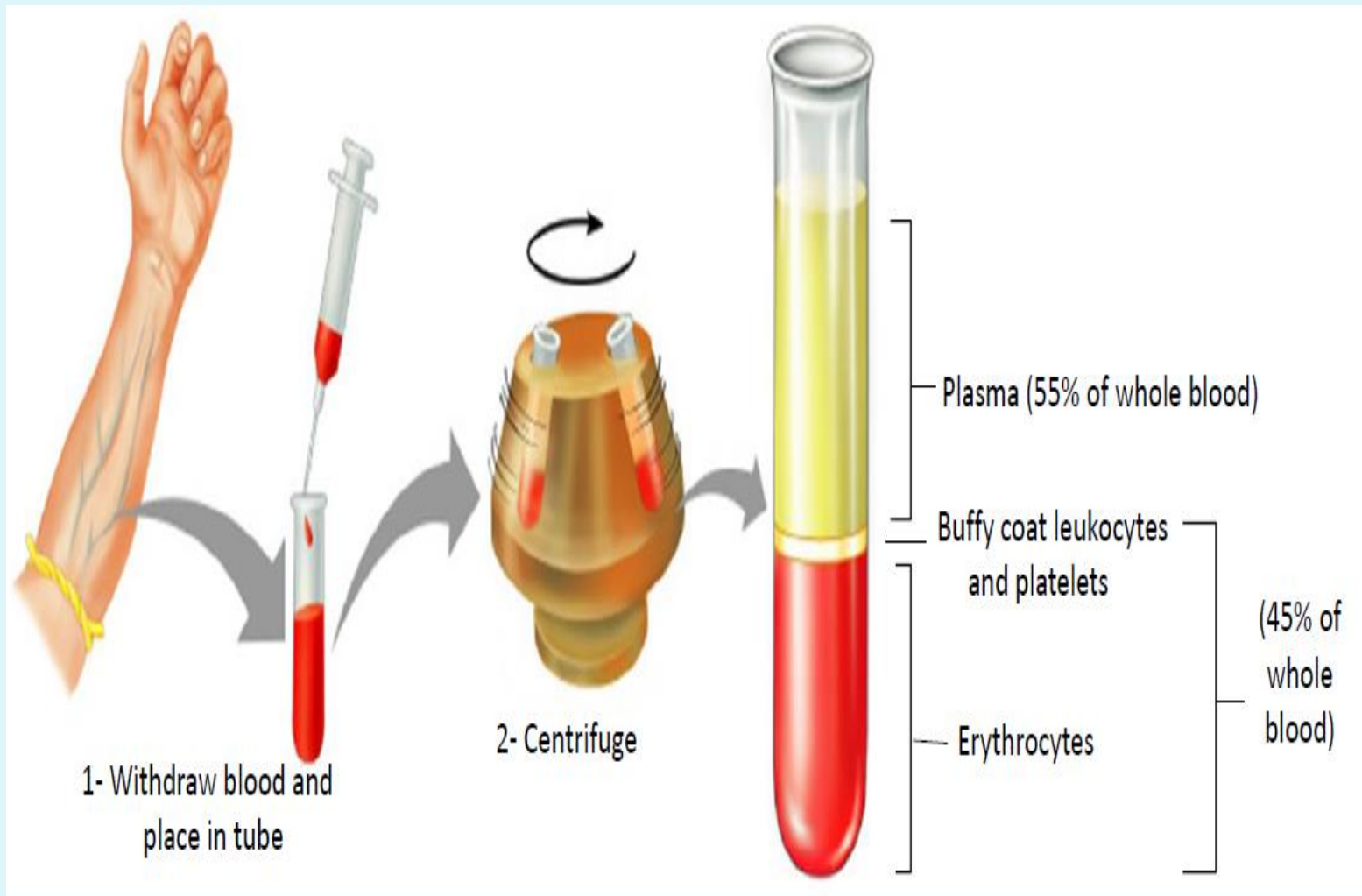
## **Composition of Blood**

**Blood consists of solid elements (45%) cells and cell fragments in an aqueous medium (blood plasma) (55%).The solid elements in the blood are the erythrocytes (red blood cells), leukocytes (white blood cells), and thrombocytes (platelets).**

- The erythrocytes (gas transport in the blood).**
- The leukocytes include various types of granulocyte, monocyte, and lymphocyte (immune defense functions).**
- Thrombocytes are cell fragments that arise in the bone marrow from megakaryocytes (hemostasis).**

**Blood plasma is an aqueous solution of electrolytes, nutrients, metabolites, proteins, vitamins, trace elements, and signaling substances. The fluid phase of coagulated blood is known as blood serum. It differs from the plasma in that it lacks fibrin and other coagulation proteins. Laboratory assessment of the composition of the blood plasma is often carried out in clinical chemistry.**





## Components of Whole Blood

## **Packed Cell Volume (PCV) Or Hematocrit (Hct)**

**The percentage of the blood that is cells is called the hematocrit. (the percentage by volume of packed RBC)**

### **Procedure:**

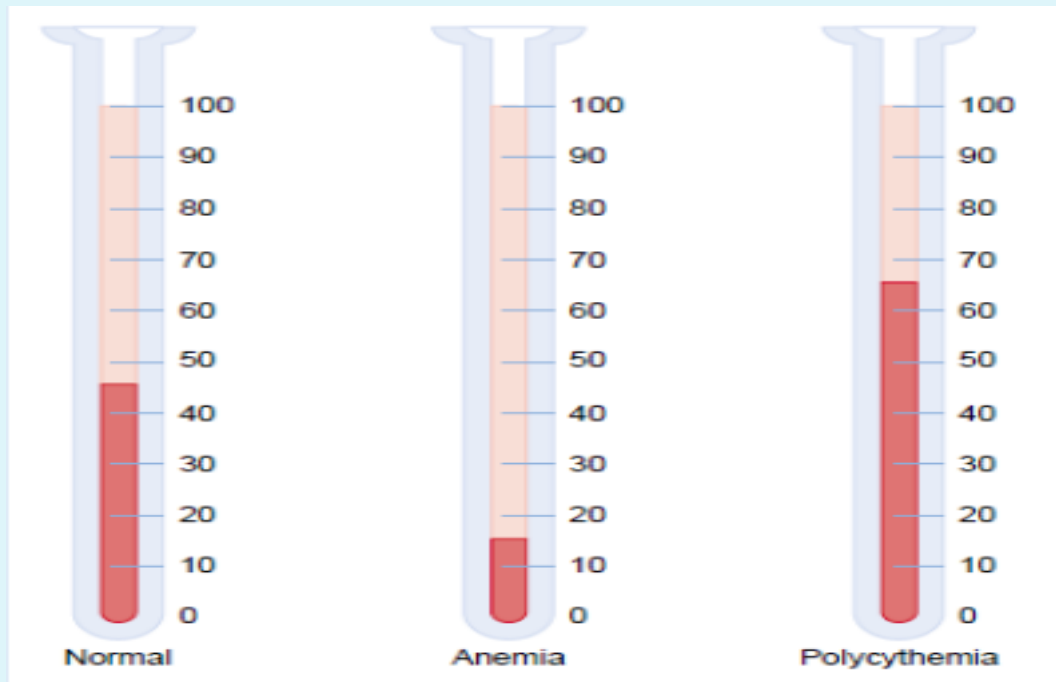
**Hematocrit is determined by centrifuging blood in a calibrated tube, as shown in figure. The calibration allows direct reading of the percentage of cells. Centrifuge of uncoagulated blood at a high speed (10-15 min). RBC precipitate down to the bottom. The plasma portion remains floating. The cells that settle down to the bottom (mainly RBCs) form the hematocrit or packed cell volume (PCV).**

If a person has a hematocrit of 40 (40 %, 40 percent of the blood volume is cells and the remainder is plasma). The hematocrit of men averages about 42, while that of women averages about 38. PCV values vary depending on:

- The person has anemia or not.
- The degree of bodily activity.
- The altitude at which the person resides.

At very high altitudes, where the quantity of oxygen in the air is greatly decreased, insufficient oxygen is transported to the tissues, and red cell production is greatly increased with a resultant increase in hematocrit.

**Normal value: Males, 47%  $\pm$ 5%. Females, 42%  $\pm$ 5%. HCT increase in polycythemia and dehydration states and decrease in anemia.**



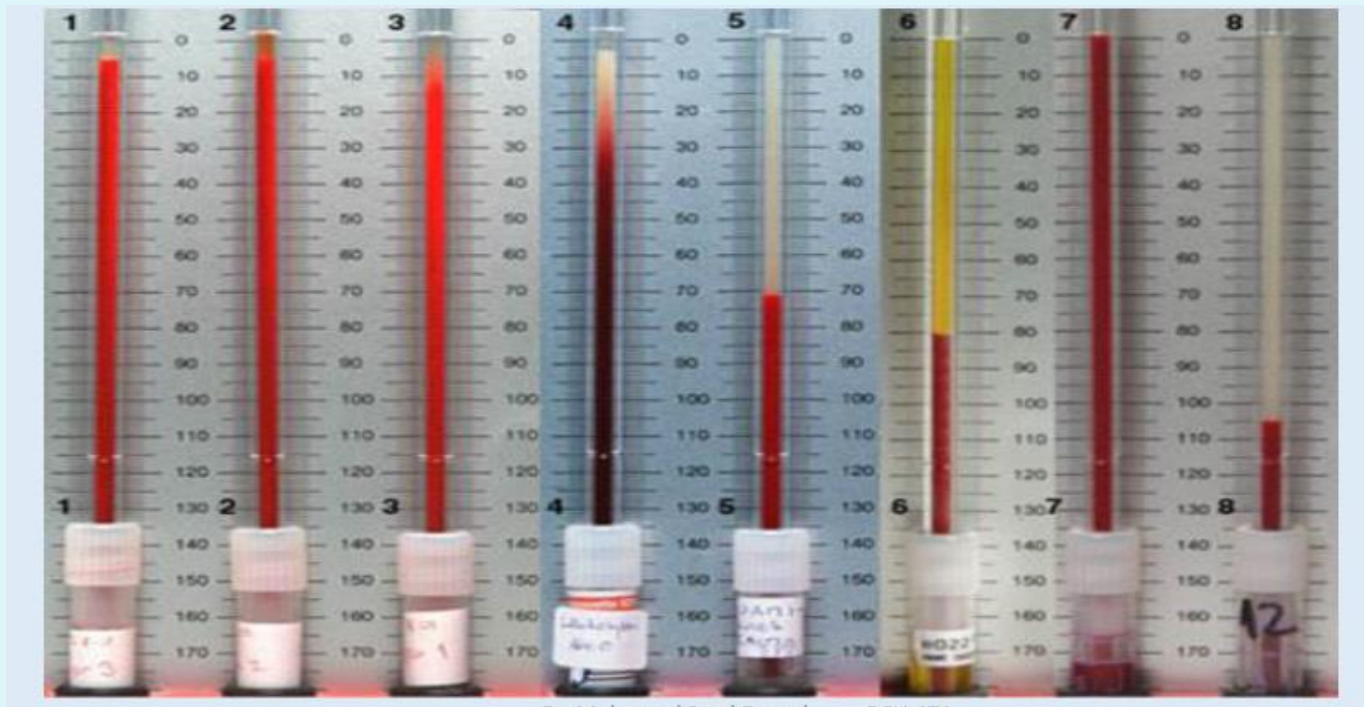
**Hematocrits in a healthy (normal) person and in patients with anemia and polycythemia.**

## **Erythrocyte Sedimentation Rate (ESR)**

**The erythrocyte sedimentation rate (ESR) test based on the principle that the sedimentation of red cells in autologous plasma provides a measure of the level of acute phase reaction or inflammation. Red cell sedimentation is accelerated by an increase in the plasma concentration of so called acute phase proteins, which are increased in acute tissue damage, chronic inflammation, chronic infection, malignancy, and pregnancy.**

**The ESR reflects both the increase in certain accelerating proteins, such as fibrinogen and  $\gamma$ -globulins, and the decrease in retarding proteins, such as albumin.**

**This is an advantage for the monitoring of rheumatoid arthritis, but decreases the sensitivity and specificity of the test when used for disease screening purposes. Sedimentation is also accelerated in anemia.**



**The ESR method is based on the original methodology of Westergren, which used diluted blood in open ended, Westergren-type glass pipettes that were mounted vertically in a rack or stand. The recommended tube is a straight glass or rigid, transparent plastic tube 30 cm in length and not less than 2.55 mm in diameter. Some plastic materials, such as polypropylene and polycarbonate, are recommended as substitutes for glass in Westergren tubes. A scale that is graduated in millimeters extends over the lower 20 cm of the tube, which must be clean, dry and kept free from dust.**

**Non specific test for inflammatory process anticoagulated blood in calibrated tube; rate of sedimentation of RBCs in 1 hour.**

**Normal range:** <15 mm/hr for male, <20mm/hr for female and <10mm/hr for children. Add 10 past age 60

