Blood consists of **plasma**, the liquid phase; and the **formed elements** (cells and platelets). Allowed to remain in a test tube following centrifugation, blood will separate into plasma (55% of the volume) and the formed elements (45% of the volume). Decant off the plasma, and the erythrocytes will occupy 99% of the volume, and the 1% leukocyte and platelet fraction ("buffy coat") rises to the top. The erythrocyte fraction is called the *hematocrit* in the clinical laboratory; generally, males have a slightly higher hematocrit (45–49% than females (37–47%). A significantly low hematocrit can be an indication of several disorders, including anemia and hemorrhage.

Erythrocytes (*erythro-*, red; *-cyte*, cell; red blood cells, RBCs) number approximately 4.5–6.2 million in each cubic millimeter (mm^3) µl of blood in men and 4–5.5 million in each cubic mm^3 µl in women. They are formed in the bone marrow as true cells (i.e., they are nucleated). As they approach maturity, each erythrocyte *loses its nucleus and most of its organelles* prior to entering the peripheral blood. Recently released immature erythrocytes may retain some ribosomes, giving a slightly reticulated appearance when stained (*reticulocytes*). The circulating erythrocyte is a nonrigid, biconcave-shaped, membrane-lined sac of hemoglobin. Hemoglobin is a protein that contains iron to which oxygen binds and which gives a red color to the erythrocytes. Hemoglobin is the principal carrier of oxygen in the body, plasma being the second. Erythrocytes pick up oxygen in the lungs and release it in the capillaries to be taken up by nearby tissues/cells. After 120 days, aged erythrocytes are removed from the circulation in the spleen.

Thrombocytes (platelets) (150,000–400,000/µl of blood; 2–5 µm in diameter) are small bits of cytoplasm from giant cells (*megakaryocytes*) of the bone marrow. They play a significant role in limiting hemorrhage: aggregation of platelets releases thromboplastin, which enhances formation of clots (*coagulation*). When blood is allowed to clot, the cells disintegrate (*hemolysis*), forming a thick yellow fluid called *serum* (not shown). Serum is plasma minus the clotting elements.

Leukocytes are white blood cells that primarily have a protective function. They may be **granular** (granulocytes include neutrophils, eosinophils, and basophils) or **nongranular** (lymphocytes, monocytes).

Segmented **neutrophils** arise in the bone marrow and live short lives in the blood and connective tissues (hours–4 days). Immature forms ("bands") may be seen in the blood during acute infections. Neutrophils destroy microorganisms and take up cellular debris.

Eosinophils exhibit colorful granules when properly stained. Eosinophils are phagocytic in immune reactions with allergens, and particularly against parasites.

Basophils contain dark-staining granules. Basophils are mediators of allergic reactions and parasitic infections.

Lymphocytes (20–45% of WBCs), which arise from bone marrow, roam lymphoid tissues as well as blood. Lymphocytes are associated with immunity. See page 120.

Monocytes (2–8% of WBCs) arise in the bone marrow, mature in the blood, and then leave the circulation to enter the extracellular spaces as **macrophages**.