

A&P Chapter 10 Blood

1. Describe the composition and volume of whole blood.
 - blood is unique in being body's ONLY FLUID TISSUE
 - has both liquid and solid components
 - essentially blood is complex connective tissue in which living blood cells (**formed elements**) are suspended in nonliving fluid matrix called **plasma**
 - plasma**--->**buffy coat (leukocytes and platelets)**--->**erythrocytes**
 - HEMATOCRIT** is percentage of erythrocytes in total volume of blood sample (normally about 45 percent)
 - plasma accounts for about 55%
 - leukocytes and platelets account for less than 1%
 - blood is sticky opaque fluid with salty, metallic taste
 - color ranges from **scarlet** (oxygen-rich) to **dull red** (oxygen-poor)
 - heavier than water, about 5 times thicker (more **viscous**)
 - slightly alkaline (pH 7.35 to 7.45)
 - its temperature (38°C or 100.4°F) always slightly higher than body temperature
 - accounts for about 8% of body weight, and volume in healthy male is 5 to 6 liters (approximately 6 quarts)
2. Describe the composition of plasma and discuss its importance in the body.
 - plasma** is liquid portion of blood and is about 90% water
 - plasma proteins** most abundant solutes in plasma
 - except for antibodies and protein-based hormones, most plasma proteins made by liver
 - plasma proteins serve variety of functions
 - ALBUMIN** contributes to osmotic pressure of blood which acts to keep water in bloodstream
 - FIBRINOGEN** are clotting proteins that help stem blood loss when vessel is injured
 - GLOBULINS** are for defense (antibodies) and lipid transport
 - plasma transports **electrolytes (salts)**
 - sodium, potassium, calcium, magnesium, chloride, and bicarbonate**
 - important in osmotic balance, pH buffering, and regulation of membrane permeability
 - plasma transports various substances around the body
 - nutrients** (glucose, fatty acids, vitamins, amino acids), **waste products of metabolism** (urea and uric acid), **respiratory gases** (O₂ and CO₂), and **hormones**

3. List the cell types making up the formed elements and describe the major function of each type.

ERYTHROCYTES or red blood cells

- primary function is to carry oxygen in blood to all body cells
- are **anucleate** and contain very few **organelles**
- mature RBCs just sacs of hemoglobin molecules
 - hemoglobin** is iron-containing protein that transports bulk of oxygen that is carried in blood
 - also binds with small amount of carbon dioxide
- lack mitochondria, so do NOT use the oxygen any of oxygen they are carrying
 - rely on anaerobic respiration
- are **biconcave in shape** (small disk-like "doughnuts")
- RBCs outnumber leukocytes by about 1000 to 1 and are major factor contributing to blood viscosity
- normally live only about 120 days
- ANEMIA** is decrease in the oxygen-carrying ability of blood (whatever the reason)
 - may be result of lower-than-normal number of RBCs, or abnormal/deficient **hemoglobin content** in RBCs
 - hemorrhagic, hemolytic, pernicious, aplastic, iron-deficiency, and sickle cell**
- sickle-cell anemia** results from ONE change in the 287 amino acids in the globin molecule
 - sickle-cell trait (SCT)
- POLYCYTHEMIA** is excessive or abnormal increase in number of erythrocytes
 - may result from bone marrow cancer (polycythemia vera)
 - may also be normal physiological response to living at higher altitudes (secondary polycythemia)
 - major problem from polycythemia is increased blood viscosity which causes sluggish blood flow

LEUKOCYTES or white blood cells

- far less numerous than RBCs and are ONLY complete cells of blood (contain nuclei and usual organelles)
- are crucial to body defense against disease
- leukocytes have some very special characteristics
 - are able to slip into and out of blood vessels by **diapedesis**
 - circulatory system just their means of transportation to areas of body where they are needed
- positive chemotaxis and ameboid motion**
- LEUKOCYTOSIS** term given total WBC above 11,000 cells/mm³
 - generally indicates bacterial/viral infection
- LEUKOPENIA** is abnormally LOW WBC count
 - commonly caused by certain drugs (corticosteroids/chemo)

- **LEUKEMIA** is excessive production of **abnormal** WBCs
 - bone marrow becomes cancerous and turns out large numbers of WBCs that are immature and not able to perform normal functions
 - body becomes easy prey to bacteria/viruses

2 GENERAL CATEGORIES OF LEUKOCYTES: granulocytes/agranulocytes

GRANULOCYTES are **granule-containing** WBCs

- they have lobed nuclei of several rounded nuclear areas connected with thin strands of nuclear material
- granules in cytoplasm stain specifically with Wright's stain
- includes the **neutrophils, eosinophils, and basophils**
- NEUTROPHILS** have multilobed nucleus and very fine granules that respond to both acidic and basic stains
 - cytoplasm as a whole stains pink
 - are avid phagocytes at site of acute infection
 - numbers increase during acute infections
- EOSINOPHILS** have blue-red nucleus that looks like old fashioned telephone receiver
 - display large brick-red cytoplasmic granules
 - numbers increase during allergies and parasitic worm infections (flatworms, tapeworms, etc.)
- BASOPHILS** are the rarest of the WBCs
 - contain large histamine-containing granules that stain dark blue
 - histamine** is inflammatory chemical that makes blood vessels leaky and attracts other WBCs to inflammatory site

AGRANULOCYTES lack visible cytoplasmic granules

- their nuclei are spherical, oval, or kidney-shaped
- closer to "normal" nuclei
- includes the **lymphocytes and monocytes**
- LYMPHOCYTES** have large purple nucleus that occupies most of cell volume
 - major cell of the immune system
 - two kinds of lymphocytes: **B and T**
 - B-lymphocytes** involved in HUMORAL IMMUNITY
 - T-lymphocytes** involved in CELLULAR IMMUNITY
 - tend to take up residence in lymphatic tissues where they play role in immune response
- MONOCYTES** are the largest of the WBCs
 - have more abundant cytoplasm and indented nuclei
 - migrate into tissues and change into **MACROPHAGES (BECOME EVEN MORE PHAGOCYTTIC)**
 - microphages very important in fighting chronic infections such as tuberculosis