Ch. 13 Lecture 1

I. Functions and Components of the Circulatory System
   a. Two systems:
      i. Systemic
      ii. Pulmonary
   b. Transportation
      i. We transport O2/CO2.
      ii. Nutrient Transport
      iii. Waste products from metabolism
   c. Regulation
      i. Hormones
      ii. Temperature
         1. Regulation of blood flow to the skin (dilation/constriction)
   d. Protection
      i. Blood Clotting (protection)
      ii. Immune system functions (We won't get into detail in this)

II. Components
   a. Cardiovascular System
      i. Blood Vessels
         1. Away: Arteries, oxygenated
         2. Towards Heart: Veins
         3. Arteries->arterioles->capillaries ->venules ->veins
      ii. Heart: 4 chambered pump
   b. Lymphatic System
      i. Fluid for interstitial space
      ii. Helps protect from foreign invaders
      iii. Lymphatic vessels, lymphoid tissues, lymphatic organs

III. Composition of the Blood
   a. Plasma: Fluid Part
      i. Full of proteins
         1. Primary is Albumin
            a. Creats osmotic/oncotic pressure
            b. Helps keep most water from going into interstitial space
            c. Maintains Blood Volume
         2. Globulins
            a. Carry lipids and fat soluble vitamins
            b. Gamma Globulins: ANTIBODIES
         3. Fibrinogen
            a. Helps in clotting after it transforms to fibrin
   b. "Buffy Coat"
   c. Formed Elements

i. Mostly red blood Cells
    1. Erythrocytes
        a. Primary function is transport of O2 and CO2(30%)
        b. No Nuclei or mitochondria, only cells in body that don't use Oxygen
        c. Only live 120 days
        d. Contain hemoglobin which binds the oxygen/ some CO2 and also acts as a pH buffer by binding Hydrogen ions
        e. Transferrin: Recycles iron from dead erythrocytes
    2. Leukocytes
        a. Do have Nuclei and mitochondria
        b. Granular: Neutrophils, eosinophils, basophils
        c. Aggranular: Monocytes and lymphocytes
    3. Platelets
        a. Smallest
        b. No Nuclei
        c. Short Life span (5-9 days)
        d. Clot blood using fibrinogen
    4. Don't worry about that big chart, just basic functions of each type of cell

d. Cell Formation
    i. Hematopoiesis
        1. Leukopoiesis: White blood cell formation
            a. Red bone marrow and lymphoid tissues
            b. Regulated by cytokines
        2. Erythropoiesis: RBCs
            a. Erythropoieten
                i. Regulated by Kidneys
                ii. When O2 levels are low, erythropoietin production is increased
                iii. Major component of athletic blood doping (AKA Epo)
            b. Hepcidin
                i. Secreted by the liver, regulation of iron metabolism
            c. Don't need to know the diagram ☺

e. Blood Typing
    i. Antigens are on the surface of RBC
        1. Helps immune system recognize self cells
    ii. Antibodies secreted by lymphocytes in response to foreign cells
        1. People in more populated areas have a more "primed" immune system
    iii. ABO System uses anthigens on the erythrocyte cell surfaces
        1. Type A: has A antigen
        2. Type AB: Has A and B Antigen
        3. Type O: Has no antigen

4. When you have a transfusion reaction, you make antibodies against foreign antigens
    a. If a person receives the wrong blood type, antibodies bind to erythrocytes and cause **agglutination**
    b. Also important in tissue typing for transplants
5. Rh Factor
    a. AKA Antigen D
    b. People who are Rh (+) Have the antigen, people without it are(-)
    c. Important in pregnancy
        i. If you have a - mom and a + baby can cause **erythroblastosis fetalis** as the mother's immune system attacks the babie's RBC, not always death but often results in a very anemic baby ☹
            1. Often happens for the second baby once the immune response has been built up
        ii. Solution? OB can give Rho gam which is an antibody against the Rh factor. Binds the antibody before it can attack the baby blood.

f. Blood Clotting
    i. Hemostasis
        1. This is super complicated, so the details aren't important
        2. Stopping (cessation) of bleeding when the blood vessel is damaged
        3. Damage of the vessel causes the collagen fibers to be exposed to blood Produces:
            a. Vasoconstriction
            b. Formation of Platlet Plug
                i. Platelets bind to the collagen
                ii. Held in place by the **Von Willebrand Factor**
                iii. Platelets recruit more platelets and form plug by secreting:
                    1. ADP(stickiness) , Serotonin(Vasoconstriction), Thromboxane A(Sticky and Vasoconstriction)
            c. Formation of Fibrin Protein Web
                i. Fibrinogen -> fibrin
                    1. Intrinsic/Extrinsic Pathway
                    2. Intrinsic: Activated by collagen exposure, factor XII activates other clotting factors (don't memorize)
                        a. *** Next, calcium and phospholibpids convert **prothrombin to thrombin** which converts fibrinogen to fibrin (know what thrombin is for sure)