

Chapter 19: Cardiovascular System: Blood

I. Functions of Blood

A. List and describe the seven major homeostatic functions of blood:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

II. Plasma

A. Composition

1. It is a _____ fluid consisting of about:
 - a. 91% _____
 - b. 9% _____ such as _____
2. What is a colloid? _____

3. Most of the suspended substances are _____
 - a. Albumin
 1. Makes up about _____
 2. Albumin is important in regulating _____
 3. It maintains the _____ of blood
 - b. Globulins
 1. Make up about _____
 2. Which globulins are part of the immune system?
 - a. _____
 - b. _____
 3. Some globulins function as _____
 - c. Fibrinogen
 1. Makes up about _____
 2. Fibrinogen is responsible for the _____
4. Substances dissolved in the blood are maintained _____
5. Plasma volume remains _____

III. Formed Elements

A. General

1. 95% of formed element volume consists of _____
 - a. The remaining 5% is composed of _____ & _____
2. Which formed elements in adults possess nuclei? _____
3. Granulocytes have _____ and _____
 - a. The three types of granulocytes based on staining are:
 1. _____ stain with _____ dyes
 2. _____ stain with _____ dyes
 3. _____ stain with _____ dyes
4. Agranulocytes appear to have _____ and nuclei that are not _____
 - a. The two types of agranulocytes are _____ & _____

B. Production of Formed Elements

1. The process of is called _____ or _____

2. In the embryo and fetus blood cell production occurs in:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 - f. _____
 3. After birth blood cell production is limited to:
 - a. _____
 - b. Some _____ helping in production of _____
 4. All formed elements are produced from a single population of _____
 5. Hemopoietic stem cells produce daughter cells called:
 - a. Proerythroblasts that develop into _____
 - b. Myeloblasts that develop into:
 1. _____
 2. _____
 3. _____
 - c. Lymphoblasts that develop into _____
 - d. Monoblasts that develop into _____
 - e. Megakaryoblasts that develop into _____
 6. The development of cell lines is regulated by _____
- C. Red Blood Cells
1. Red blood cells are more technically called _____
 2. The average male has _____
 3. The average female has _____
 4. Structure
 - a. Describe the size and shape of a red blood cell: _____

 - b. The biconcave shape increases _____
 1. This allows gases _____
 - c. When a red blood cell folds _____

- d. About one-third of a red blood cell's volume is _____
- e. What enzyme is found in red blood cells? _____
5. Function
- a. What is the primary function of red blood cells? _____

- b. List the three major forms of carbon dioxide transport in the blood:
1. 7% _____
 2. 23% _____
 3. 70% _____
- c. What is formed when carbon dioxide joins with water? _____
1. What enzyme catalyzes this reaction? _____
- d. Carbonic acid dissociates into:
1. _____
 2. _____
6. Hemoglobin
- a. What is a globin? _____
- b. What is a heme? _____
- c. How many globins and hemes in a hemoglobin molecule? _____
- d. In normal adult hemoglobin there will be:
1. _____ globin chains
 2. _____ globin chains
- e. What atom does oxygen attach to for transport in the blood? _____
- f. What is oxyhemoglobin? _____
1. What color is oxyhemoglobin? _____
- g. What is deoxyhemoglobin? _____
1. What color is deoxyhemoglobin? _____
- h. What is carbaminohemoglobin? _____
7. Life History of Red Blood Cells
- a. How many red blood cells are destroyed per second? _____
- b. To maintain homeostasis what is the production rate of new erythrocytes?

- c. The process of producing new erythrocytes is called _____
1. The time required for production of one red blood cell is _____
- d. What substances are required for normal red blood cell production?
1. _____
2. _____
3. _____
- e. What is the stimulus to increase red blood cell production? _____
- f. What hormone stimulates red blood cell production? _____
1. Where does this hormone come from? _____
- g. The hormone increases red blood cell production by:
1. Increasing _____
2. Decreasing _____
- h. How long do red blood cells normally stay in circulation? _____
- i. What causes them to be destroyed? _____
- j. Where are macrophages located? _____, _____, & _____
- k. What digests hemoglobin inside the macrophage? _____
- l. The globin part of hemoglobin is broken down into _____
- m. What happens to the iron atoms? _____
- n. What is the source of bilirubin? _____
- o. Eventually bilirubin ends up in the liver as part of _____
- p. What is jaundice? _____
- D. White Blood Cells**
1. White blood cells protect the body against _____
2. What is ameboid movement? _____
3. What is diapedesis? _____
4. What is chemotaxis? _____
5. What is the composition of pus? _____
6. Neutrophils
- a. What does polymorphonuclear neutrophil mean? _____
- _____
- b. How long are they in the circulation? _____

- c. In the tissues they become _____ and _____
 - d. What are lysozymes? _____
 - e. How long do neutrophils survive in the tissues? _____
7. Eosinophils
- a. The cytoplasmic granules in eosinophils stain _____
 - b. Eosinophils enter the tissues during _____
 - c. Eosinophils are most common in tissue _____
 - d. Functionally eosinophils reduce the inflammatory response by _____

 - e. Toxic chemicals produced by eosinophils attack _____
8. Basophils
- a. The large cytoplasmic granules in basophils stain _____
 - b. Basophils migrate through tissues playing a role in both:
 - 1. _____
 - 2. _____
 - c. Basophils contain large amounts of _____ that is used to _____
 - d. Basophils also release heparin which _____
9. Lymphocytes
- a. The majority of lymphocytes are found _____
 - b. What stimulates B cells (B-lymphocytes)? _____
 - c. What do B cells produce when they are stimulated? _____
 - d. T cells (T-lymphocytes) protect against _____

 - e. T cells are also involved in _____ & _____
10. Monocytes
- a. How long do monocytes stay in the circulation? _____
 - b. When they enter tissues they become transformed into _____
 - c. What do they phagocytize? _____

 - d. An increase in monocyte number may indicate _____

- e. How do macrophages function to activate lymphocytes? _____

11. Which white blood cell is most common? _____
12. Which white blood cell is least common? _____
13. Which white blood cell is about the size of an erythrocyte? _____
14. Which white blood cell is the largest in size? _____

E. Platelets

1. Are also known as _____
2. Structurally platelets are minute _____ consisting of a:
 - a. Small _____
 - b. Surrounded _____
3. Platelets are roughly _____
4. What is found on the surface of platelets? _____
 - a. What are these molecules involved in? _____
5. Granules from platelets and surface molecules play important roles in

6. Platelet contraction is the result of _____ & _____ in the cytoplasm
7. What is the life expectancy of a platelet? _____
8. Platelets are formed by _____
9. Functionally platelets prevent blood loss by:
 - a. Forming _____
 - b. Promoting _____

IV. Hemostasis

- A. Define hemostasis _____
- B. Vascular Spasm
 1. Vascular spasm is an immediate but temporary _____
 resulting from _____
 2. The constriction can _____
 3. What produces vascular spasm?
 - a. _____ reflexes

- b. _____ released by platelets
- c. _____ released by endothelial cells

C. Platelet Plug Formation

1. What is a platelet plug? _____
2. The formation of platelet plugs occurs many times a day to close _____

3. Formation of a platelet plug involves:
 - a. Damage to the vessel exposes _____
 - b. Platelets adhere to the exposed _____
 1. Adhesion is mediated through _____
 2. Other platelet receptors can _____
 - c. Attachment activates platelets and initiates _____ reaction
 1. In this reaction exocytosis causes the release of:
 - a. _____
 - b. _____ & other chemicals
 - d. The release of these chemicals causes _____
thereby producing _____
 - e. Activated platelets express surface receptors that _____

 - f. In platelet aggregation _____

 - g. Activated platelets also express chemicals important in _____

D. Coagulation

1. Coagulation or blood clotting results in the formation of a _____
2. Describe the structure of a blood clot: _____

3. What are coagulation factors? _____

4. What happens during each of the three main phases of coagulation?
 - a. Stage 1 _____
 - b. Stage 2 _____

- c. Stage 3 _____
5. Extrinsic Clotting Pathway
- The term extrinsic refers to _____
 - In Stage 1:
 - Damaged tissues release _____ called _____ also known as _____
 - In the presence of Ca^{2+} _____ forms a complex with _____ which activates _____
 - Prothrombinase is formed when activated factor _____, factor _____, platelet _____, and _____ complex together
 - In Stage 2: _____
 - In Stage 3: _____
 - Fibrin forms _____
 - Thrombin also stimulates _____ which is necessary to _____
6. Intrinsic Clotting Pathway
- The term intrinsic refers to _____
 - In Stage 1:
 - Contact with exposed collagen activates _____
 - Activated factor XII stimulates factor _____, which activates factor _____
 - Factor X is activated when activated factor _____ joins with factor _____, platelet _____, and _____
 - Prothrombinase is formed when activated factor _____, factor _____, platelet _____, and _____ complex together
 - Stages 2 and 3 are then _____
7. Thrombin is part of a positive-feedback system in _____
8. Thrombin also has a positive-feedback effect by _____

E. Control of Clot Formation

1. To prevent unwanted clotting the blood contains _____
2. Why don't anticoagulants prevent clotting at the site of an injury? _____

3. Away from a site of injury _____
4. How does each of the following anticoagulants function in the body?
 - a. Antithrombin _____
 - b. Heparin _____
 - c. Prostacyclin _____ &

5. EDTA and sodium citrate prevent clot formation by _____

F. Clot Retraction and Dissolution

1. A blood clot condenses into a denser, compact structure by the process of _____
2. The process involves the contractile proteins _____ & _____
3. Serum is squeezed out as the clot _____
 - a. What is serum? _____

4. Edges of the damaged vessel are pulled together by _____
 - a. Pulling the edges together can help _____,
reduce _____, and _____ healing
5. Repair of the damaged vessel is accomplished by:
 - a. Fibroblasts _____
 - b. Epithelial cells _____
6. What is fibrinolysis? _____
7. What is plasmin? _____
8. Plasminogen is activated to become plasmin by:
 - a. _____
 - b. _____
 - c. _____
 - d. _____

e. _____

V. Blood Grouping

A. Definitions

1. What is a transfusion? _____
2. Define infusion: _____
3. Transfusion reactions include:
 - a. _____
 - b. _____
 - c. _____
4. Transfusion reactions are caused by _____
5. The surface of the red blood cells have _____
6. The plasma contains _____
7. Since antibodies are very specific they can _____
8. What is agglutination? _____
9. What is hemolysis? _____
10. Since the antigen-antibody reaction causes agglutination:
 - a. The antigens on the erythrocytes are called _____
 - b. The antibodies in the plasma are called _____
11. What is the basis of blood groups? _____

B. ABO Blood Group

1. Complete the following table for the ABO blood group:

Blood Type	Agglutinogen present on Erythrocytes	Antibodies present in the Plasma	What percent of Caucasians are each type?	What percent of African-Americans are each type?
A				
B				
AB				
O				

2. Many people have antibodies to erythrocyte antigens even though they have never had a transfusion. What is a possible explanation for these antibodies?

3. A blood donor _____
4. A blood recipient _____
5. Describe the reaction if Type A blood is given to a person with Type B blood:

6. What blood type is considered the "universal donor"? _____
- a. Why is this so? _____
- b. Why can this be a problem? _____

C. Rh Blood Group

1. What is the Rh blood group named for? _____
2. People are Rh-positive if _____
3. People are Rh-negative if _____
4. What percent of Caucasians are Rh-positive? _____
5. What percent of African-Americans are Rh-positive? _____
6. B negative blood, is type B for the _____ group & Rh _____
7. Antibodies against the Rh antigen develop only after _____

- a. This can occur through:

1. Blood _____
2. Transfer _____

8. The transfusion reaction would occur with a _____ transfusion
9. The major Rh incompatibility occurs for an Rh _____ mother that has an Rh _____ fetus
- a. The first pregnancy is usually not a problem because _____

- b. During subsequent pregnancies if fetal blood leaks through the placenta:
 1. The sensitized mother produces _____
 2. The antibodies cross the placenta and cause:
 - a. _____ &
 - b. _____ of fetal red blood cells
 3. This disorder is called _____ or _____
10. How can HDN be prevented? _____
 - a. The injection contains _____
 - b. This prevents _____
11. How is HDN treated? _____

VI. Diagnostic Blood Tests

A. Type and Crossmatch

1. What does blood typing determine? _____
 - a. Cells are tested with _____
 - b. Serum is mixed with _____
2. What does a crossmatch determine? _____
 - a. Donor's cells are mixed with _____
 - b. Donor's serum is mixed with _____

B. Complete Blood Count (CBC)

1. Red Blood Count
 - a. Determines the number of _____ per _____ of blood
 1. Normal range for males is _____
 2. Normal range for females is _____
 - b. What is erythrocytosis? _____
 - c. Erythrocytosis can:
 1. Make it more difficult _____
 - a. Increases the _____
 2. Reduce _____
 3. Result in _____ capillaries

2. Hemoglobin Measurement

- a. Determines the amount of _____
 1. Normal range for males is _____
 2. Normal range for females is _____
- b. What is anemia? _____
 1. This is due to:
 - a. Reduced number _____ OR
 - b. Reduced amount _____

3. Hematocrit Measurement

- a. The hematocrit is the _____
 1. Normal range for males is _____
 2. Normal range for females is _____
- b. Hematocrit is determined by _____
- c. What is the buffy coat? _____
- d. What is a normocyte? _____
- e. What is a microcyte? _____
- f. What is a macrocyte? _____
- g. A low hematocrit indicates the volume of red blood cells is _____
 - a. Could be result of _____ normocytes or _____ microcytes

4. White Blood Count (WBC)

- a. Measures the _____
 1. The normal range is _____
- b. What is leukopenia? _____
- c. What is leukocytosis? _____
- d. What is leukemia? _____
 1. What is the effect on number of white blood cells? _____
- e. What else can cause leukocytosis? _____

C. Differential White Blood Count

1. Determines _____
2. What are the normal ranges for each type of leukocyte?
 - a. Neutrophils _____

- b. Lymphocytes _____
 - c. Monocytes _____
 - d. Eosinophils _____
 - e. Basophils _____
- 3. Clinically a high neutrophil count usually indicates _____
 - 4. People with allergic reactions will have elevated _____ & _____
- D. Clotting
- 1. Platelet Count
 - a. What is the normal range for platelets? _____
 - b. What is thrombocytopenia? _____
 - 2. Prothrombin Time Measurement
 - a. Measure of how long it takes _____
 - 1. It normally takes _____
 - b. Determined by adding _____ to _____
- E. Blood Chemistry
- 1. Determines the composition of materials _____ or _____ in plasma