I. Concepts: Fill in the following sections with information from the text and lecture.

1. Composition and Function of Blood:

2. Hematopoiesis:
3. Blood Typing:

4. Hemostasis:
Blood, the "life fluid" that courses through the body’s blood vessels, provides the means by which the body’s cells receive vital nutrients and oxygen and dispose of their metabolic wastes. As blood flows past the tissue cells, exchanges continually occur between the blood and the tissue cells so that vital activities can go on continuously.

This chapter provides an opportunity to review the general characteristics of whole blood and plasma, to identify the various formed elements (blood cells), and to recall their functions. Blood groups, transfusion reactions, clotting, and various types of blood abnormalities are also considered.

**COMPOSITION AND FUNCTIONS OF BLOOD**

1. **Complete the following description of the components of blood by writing the missing words in the answer blanks.**

   In terms of its tissue classification, blood is classified as a **a.________________________** because it has living blood cells, called **b.________________________** suspended in a nonliving fluid matrix called **c.________________________**. The "fibers" of blood only become visible during **d.________________________**.

   If a blood sample is centrifuged, the heavier blood cells become packed at the bottom of the tube. Most of this compacted cell mass is composed of **e.________________________**, and the volume of blood accounted for by these cells is referred to as the **f.________________________**. The less dense **g.________________________** rises to the top and constitutes about 45% of the blood volume. The so-called "buffy coat," composed of **h.________________________** and **i.________________________**, is found at the junction between the other two blood elements. The buffy coat accounts for less than **j.________________________**% of blood volume. Blood is scarlet red in color when it is loaded with **k.________________________**; otherwise, it tends to be dark red.

2. **Using the key choices, identify the cell type(s) or blood elements that fit the following descriptions. Insert the correct term or letter response in the spaces provided.**

   **Key Choices**

   **Red blood cell**  **Basophil**  **Lymphocyte**
   **Megakaryocyte**  **Monocyte**  **Formed elements**
   **Eosinophil**  **Neutrophil**  **Plasma**

   a. __________________________ Most numerous leukocyte
   b. __________________________ c. __________________________ d. __________________________ Granular leukocytes
   e. __________________________ Also called an erythrocyte; anucleate
   f. __________________________ g. __________________________ Actively phagocytic leukocytes
   h. __________________________ i. __________________________ Agranular leukocytes
   j. __________________________ Fragments to form platelets
   k. __________________________ (A) through (G) are examples of these
   l. __________________________ Increases during allergy attacks
   m. __________________________ Releases histamine during inflammatory reactions
   n. __________________________ After originating in bone marrow, may be formed in lymphoid tissue

Miss School, Miss Out!
Contains hemoglobin

Primarily water, noncellular; the fluid matrix of blood

Increases in number during prolonged infections

Least numerous leukocyte

Also called white blood cells (s-w)

3. Figure 10-1 depicts (in incomplete form) the **erythropoietin** mechanism for regulating the rate of **erythropoiesis**. Complete the statements that have answer blanks. Label the diagram with the following structures:

Kidney  Red bone marrow  Red blood cells (RBCs)

a. What’s the average life span of an erythrocyte?

b. What accounts for this short life span?

**Figure 10-1**
4. Four leukocytes are diagrammed in Figure 10-2. First, read the description of each leukocyte as it appears when stained with Wright's stain. Then, identify each leukocyte type by writing in the correct name in the blank below the illustration.

A. The granules are pale violet, the cytoplasm pink, and the nucleus dark purple.
B. The nucleus is deep blue and the cytoplasm is pale blue.
C. The granules are bright red, the cytoplasm is pale pink, and the nucleus is red/purple.
D. The smallest white blood cell. The nucleus is deep purple/blue and the sparse cytoplasm is pale blue.

5. For each true statement, insert T. If any of the statements are false, correct the underlined term by inserting the correction in the answer blank.

a. ____________________________ White blood cells (WBCs) move into and out of blood vessels by the process of positive chemotaxis.
b. ____________________________ An abnormal decrease in the number of WBCs is leukopenia.
c. ____________________________ When blood becomes too acidic or too basic, both the respiratory system and the liver may be called into action to restore it to its normal pH range.
d. ____________________________ The normal pH range of blood is 7.00 to 7.45.
e. ____________________________ The cardiovascular system of an average adult contains approximately 4 liters of blood.
f. ____________________________ The only WBC type to arise from lymphoid stem cells is the lymphocyte.
g. ____________________________ An abnormal decrease in the number of white blood cells is leukocytosis.
h. ____________________________ The normal RBC count is 1.5-2.5 million/mm³.
i. ____________________________ Normal hemoglobin values are in the area of 42% - 47% of the volume of whole blood.
j. ____________________________ An anemia resulting from a decreased RBC number causes the blood to become more viscous.
k. ____________________________ Phagocytic agranular WBCs are eosinophils.
l. ____________________________ The leukocytes particularly important in the immune response are monocytes.
6. Check (√) all the factors that would serve as stimuli for erythropoiesis.

a. ___ Hemorrhage          c. ___ Living at a high altitude
b. ___ Aerobic exercise     d. ___ Breathing pure oxygen

HEMOSTASIS

7. Using the key choices, correctly complete the following description of the blood-clotting process. Insert the key term or letter in the answer blanks.

Break     Fibrinogen     Prothrombin activator     Thrombin
Erythrocytes     Platelets     PF₃     Tissue factor
Fibrin     Prothrombin     Serotonin

Clotting begins when a. __________________________ occurs in a blood vessel wall. Almost immediately, b. __________________________ cling to the blood vessel wall and release c. __________________________ which helps to decrease blood loss by helping to constrict the vessel. d. __________________________, released by damaged cells in the area, interacts with e. __________________________ on the platelet surfaces and other clotting factors to form f. __________________________. This chemical substance causes g. __________________________ to be converted to h. __________________________. Once present, molecule “h” acts as an enzyme to attach i. __________________________ molecules together to form long, threadlike strands of j. __________________________, which then traps k. __________________________ flowing by in the blood.

Fill in the missing terms for the diagram to the right. Use the following terms: Ca²⁺, TF, dense fibrin, fibrinogen, prothrombinase, prothrombin, thrombin.
8. For each true statement, write T. If any statements are false, correct the underlined term by inserting the correction in the answer blank.

a. ______________________ Normally, blood clots within 15-20 minutes.

b. ______________________ The most important natural body anticoagulant is histamine.

c. ______________________ Hemostasis means stoppage of blood flow.

BLOOD GROUPS AND TRANSFUSIONS

9. Correctly complete the following table concerning ABO blood groups.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>Agglutinogens or antigens</th>
<th>Agglutinins or antibodies in plasma</th>
<th>Can donate blood to type</th>
<th>Can receive blood from type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Type A</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Type B</td>
<td>anti-A</td>
<td></td>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>3. Type AB</td>
<td>AB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Type O</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. a. What blood type is the universal donor?  

b. The universal recipient?

c. Identity each blood cell shown below as type A, B, AB, or O based on the cell surface markers displayed.
11. When a person is given a transfusion of mismatched blood, a transfusion reaction occurs. Define the term “transfusion reaction” in the space below.

DEVELOPMENTAL ASPECTS OF BLOOD

12. Complete the following statements by inserting your responses in the answer blanks.

A fetus has a special type of hemoglobin, hemoglobin a. __________________________ that has a particularly high affinity for oxygen. After birth, the infant’s fetal RBCs are rapidly destroyed and replaced by hemoglobin A-containing RBCs. When the immature infant liver cannot keep pace with the demands to rid the body of hemoglobin breakdown products, the infant’s tissues become yellowed, or b. __________________________.

Genetic factors lead to several congenital diseases concerning the blood. An anemia in which RBCs become sharp and “logjam” in the blood vessels under conditions of low-oxygen tension in the blood is c. __________________________ anemia. Bleeder’s disease, or d. __________________________, is a result of a deficiency of certain clotting factors. Diet is important to normal blood formation. Women are particularly prone to e. __________________________ - deficiency anemia because of their monthly menses. A decreased efficiency of the gastric mucosa makes elderly individuals particularly susceptible to f. __________________________ anemia as a result of a lack of intrinsic factor, which is necessary for vitamin g. __________________________ absorption. An important problem in aged individuals is their tendency to form undesirable clots, or h. __________________________. Both the young and the elderly are at risk for cancer of the blood, or i. __________________________.
10 Blood

Crossword Puzzle and Concept Map

Instructions: Use the vocabulary from this chapter to complete this crossword puzzle.

Across
2. The percentage of erythrocytes to total blood volume.
4. Large single-nucleus white blood cell; agranular leukocyte.
8. The most abundant plasma protein.
11. Cellular portion of blood.
13. A blood protein that is converted to fibrin during blood clotting.
14. The nonliving fluid component of blood within which formed elements and various solutes are suspended and circulated.
16. Most abundant type of white blood cell.
17. White blood cell whose granules stain deep blue with basic dye; has a relatively pale nucleus. Release histamine.
18. Obstruction of a blood vessel by an embolus (blood clot, fatty mass, bubble of air, or other debris) floating in the blood.

Down
1. An excessive or abnormal increase in the number of erythrocytes.
3. Fibrous insoluble protein formed during blood clotting.
5. A clot that develops and persists in an unbroken blood vessel.
6. Passage of blood cells through intact vessel walls into tissue.
7. Blood cell formation
9. Granular white blood cell whose granules readily take up a stain called eosin.
12. Cell fragment found in blood; involved in clotting.
15. Reduced oxygen-carrying ability of blood resulting from too few erythrocytes or abnormal hemoglobin.

Miss School, Miss Out!
1. type of tissue?

2. only tissue with a fluid?

Blood

Blood Groups

Composition

10

Plasma

Formed Elements

3. also called thrombocytes

4.

5. contains iron protein called

6.

7.

Agranulocytes

8.

9.

10.

11.

12.

13. plasma proteins

14.

15.

16.

17.

types of plasma proteins

18.

19.

20.

most common in U.S.