

CHAPTER 19

CARDIOVASCULAR SYSTEM: BLOOD

CHAPTER OVERVIEW: This chapter describes the composition and major functions of the components of blood. Cell types are identified and the specific functions associated with each type of cell are discussed. Mechanisms for general functions such as coagulation, clot formation and wound healing are explained. Blood typing and diagnostic blood tests are reviewed.

OUTLINE (two or three fifty-minute lectures):
Seeley, A&P, 5/e

| Chapt. Object. | Topic Outline, Chapter 19 | Figures & Tables | Transparency Acetates |
|----------------|---|---|-----------------------|
| 1 | I. Functions, p. 583 A. Transportation 1. Gases & Nutrients to Cells 2. Gases & Metabolic Waste Products Away from Cells 3. Movement of Other Substances - Intermediates and Regulatory Compounds B. Maintenance (of Homeostasis) 1. Electrolytes, Fluid Balance, pH 2. Body Temperature C. Protection 1. Against Foreign Substances - Immune System 2. Against Blood/Fluid Loss - Clotting Cascade | | |
| 2 | II. Plasma, p. 583 A. Colloidal Solution B. Components of Plasma 1. Water (91%) 2. Suspended Proteins a. Albumin (58%) b. Globulins (38%) c. Fibrinogen (4%) 3. Dissolved Components a. Ions b. Nutrients c. Waste Products d. Gases e. Regulatory Substances | Fig. 19.1, p.584 Table 19.1, p.585 | TA-365 |
| 3 | III. Formed Elements, p. 584 | Fig. 19.1, p.584 Table 19.2, p.586 | TA-365 |
| 4 | A. Production of Formed Elements = Hematopoiesis 1. Embryonic - Yolk Sac, Liver, Thymus, Spleen, Lymph Nodes and Red Bone Marrow 2. Adults - Confined to Red Bone Marrow, Some Lymphoid Contribution 3. Single Population of Stem Cells = | Fig. 19.2, p.587 | TA-366 |

Hemocytoblasts
B. Erythrocytes (Red Blood Cells, RBC's)

Clinical Note, p.585
Fig. 19.3, p.588
Clinical Focus,
pp.590-591

- 5
1. General
 - a. 700 times More Numerous than Leukocytes, 17 Times More Numerous than Platelets
 - b. % Have 4.2 - 5.8 Million RBCs per mm^3 ; & Have 3.6 - 5.2 Million RBCs per mm^3
 - c. Erythrocytes are Moved Passively as the Blood Circulates
 2. Structure
 - a. Biconcave Disks - 7.5 μm
 - b. Mature Erythrocytes Lack a Nucleus
 - c. Usually Flexible
 - d. Contents - Hemoglobin (1/3 Vol.), Lipids, ATP, Carbonic Anhydrase
 3. Function
 - a. Transport of O_2 from Lungs to Tissues - Hemoglobin Important
 - b. Transport of CO_2 from Tissues to Lungs - Carbonic Anhydrase Important
 4. Hemoglobin
 - a. Four Protein Chains - Globins
 - b. Four Heme Groups
 - 1). Contain Iron
 - 2). Reversibly Bind O_2
 - c. Oxyhemoglobin, Deoxyhemoglobin, & Carbaminohemoglobin
- 6
- 7
5. Life History of Erythrocytes
 - a. Erythrocyte Production
 - 1). Erythropoiesis
 - 2). 4 Days to Make; 2.5 Million Destroyed / Sec
 - 3). Red Bone Marrow
 - b. Released into Blood as Reticulocytes
 - 1). 1-3% of Circulating RBCs are Normally Reticulocytes
 - 2). No Nucleus Remains
 - c. Control of Erythropoiesis by Hormone Erythropoietin
 - d. Old Cells Removed by Macrophages of Liver, Spleen & Lymphatic Tissue
- 8
- Fig. 19.4, p.589
Predict Quest. 1
Clinical Note, p.588
Clinical Note, p.589
- Fig. 19.5, p.591
- Fig. 19.6, p.592
- TA-368
- TA-369
- TA-370
- Predict Quest. 2
- Predict Quest. 3

- 1). Iron and Amino Acids Recycled
- 2). Heme Converted to Bilirubin & Excreted in Bile and Urine
- 3). Build up of Bilirubin = Jaundice

| | | | |
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| 9 | <p>C. Leukocytes (White Blood Cells or WBC's)</p> <ol style="list-style-type: none"> 1. General Characteristics <ol style="list-style-type: none"> a. Primarily Protective Functions, such as Phagocytosis and Antibody Production b. Enter Tissue via Diapedesis c. Move along Chemical Gradients = Chemotaxis 2. Neutrophils - Polymorphonuclear Neutrophils (PMN's) <ol style="list-style-type: none"> a. Most Common WBC b. 10 -12 hrs in Circulation then Migrate to Tissues for 1-2 Days c. Phagocytosis and Lysozymes 3. Eosinphils <ol style="list-style-type: none"> a. Associated with Inflammatory Reactions b. Contain Enzymes that Limit the Inflammatory Response and Phagocytize Antigen-Antibody Complexes 4. Basophils <ol style="list-style-type: none"> a. Least Common of WBCs - Participate in Inflammation and Allergy b. Also Migrate to Tissues c. Contain Mediators of Inflammation (Histamine) and Heparin (Anti-coagulant) 5. Lymphocytes <ol style="list-style-type: none"> a. Smallest of the WBCs (6-14 μ m in diameter) b. Little Cytoplasm c. Proliferate in Lymphatic Tissue d. B Cells Produce Antibodies e. T Cells Destroy Virally Infected and Tumor Cells 6. Monocytes <ol style="list-style-type: none"> a. Largest WBCs (12-20 μ m in diameter) b. In Circulation 3 Days | <p>Fig. 19.7, p.593 Table 19.2, p.586</p> <p>Fig. 19.7, p.593 Table 19.2, p.586</p> <p>Table 19.2, p.586</p> <p>Table 19.2, p.586</p> <p>Fig. 19.7, p.593 Table 19.2, p.586</p> <p>Table 19.2, p.586</p> | <p>TA-371</p> <p>TA-371</p> <p>TA-371</p> |
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- c. Primary Function is Phagocytosis with Presentation of Breakdown Products to Lymphocytes
- d. Become Macrophages in Tissues
- 10 D. Platelets
- Predict Quest 4. (See Fig. 19.8, p.594) TA-372
 Fig. 19.7, p.593 TA-371
 Table 19.2, p.586
1. Circulate as Cell Fragments of Megakaryocytes
 2. Very Small (3 μ m in diameter)
 3. Exist 5-9 Days
 - 4 Resist Blood Loss
 - a. Platelet Plug Formation - Small Holes
 - b. Initiate Blood Clot Formation - Larger Wounds
- 11 IV. Hemostasis (Arrest of Bleeding), p. 594
- A. Vascular Spasm
1. Immediate & Temporary Constriction of Smooth Muscle Cells
 2. Nervous Reflex and Chemical Mediators
 - a. Thromboxanes (Prostaglandin Derivative) - Platelet Plugs
 - b. Endothelin (Peptide) - Endothelial Cells
- B. Platelet Plug Formation
- Fig. 19.9, p.595 TA-373
 Clinical Note, p.595
1. Exposure of Vessel Connective Tissue
 2. Platelets Adhere, Release ADP, Thromboxane & Coagulation Factors
 3. Mediators Help Stick Platelets Together to Form Aggregate, Further Release of Mediators
 4. Mass of Platelets Physically Plugs Tear in Endothelium
- C. Coagulation
1. Network of Fibrin, Cells, Platelets and Fluid
 2. Initiated and Sustained by Coagulation Factors in Plasma
 3. Stages
 - a. Stage 1 - Formation of Prothrombinase
 - b. Stage 2 - Conversion of Prothrombin to Thrombin
 - c. Stage 3 - Conversion of
- Table 19.3, p.596
 Predict Quest 5;
 Clinical Note, p.597-598
 Fig. 19.10, p.597 TA-374

3. monocytes, 2-8%
4. esinophils, 1-4%
5. basophils, 0.5-1%

D. Clotting

1. platelet count – 250,000-400,000 per cubic millimeter of blood
2. prothrombin time measurement, 9-12s,=.

E. Blood Chemistry

SEE INSTRUCTOR'S MANUAL AND COURSE SOLUTIONS MANUAL FOR ADDITIONAL RESOURCES.