Component I: Core

Module B: Terminology, Anatomy and Physiology

Topic 6: Cardiovascular System

Statement of Purpose
To prepare the learner with basic knowledge of the cardiovascular system.

Student Learning Outcomes
Upon completion of this topic, the learner will be able to:

1. Spell and define key terms.
2. List the structure of the circulatory system.
3. Label internal and external structure of the heart.
4. Describe the flow of blood through the heart and cardiac cycle.

Terminology

1. Albumin
2. Apex
3. Aortic arch
4. Aorta
5. Aortic valve
6. Arterioles
7. Artery
8. Atrium
9. Bicuspid
10. Bilirubin
11. Brachiocephalic artery
12. Capillary
13. Carotid arteries
14. Coronary arteries
15. Deoxygenated
16. Endocardium
17. Epicardium
18. Erythrocyte
19. Erythropoietin
20. Fibrillation
21. Fibrinogen
22. Globulin
23. Hemocytoblasts
24. Hemoglobin
25. Inferior vena cava
26. Mitral
27. Myocardium
28. Leukocyte
29. Leukocytosis
30. Leukocytopenia
31. Oxygenated
32. Pericardium
33. Plasma
34. Platelet
35. Pulmonary arteries
36. Pulmonary valve
37. Pulmonary veins
38. Red Blood Cell (RBC)
39. Sinoatrial (SA) node
40. Semilunar
41. Septum
42. Sternum
43. Subclavian arteries
44. Superior vena cava
45. Tricuspid
46. Valve
47. Vasoconstriction
48. Vasodilation
49. Vena cava
50. Vein
51. Ventricle
52. Venules
53. White blood cell (WBC)

References

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Websites

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Content Outline/Theory Objectives	Suggested Learning Activities
Objective 1 **Spell and define key terms.** A. Review the terms listed in the terminology section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper contexts.	A. Games: word searches, crossword puzzles, Family Feud, Jeopardy, bingo, spelling bee, hangman and concentration. B. Administer vocabulary pre-test and post-test. C. Discuss learning gaps and plan for applying vocabulary.
Objective 2 **List the structures of the circulatory system.** A. Heart 1. Cone shaped organ about the size of a loose fist 2. Two-sided pump 3. Located in the thoracic cavity, bordered laterally by the lungs 4. Upper border is directly above the sternum at the level of the 3rd rib; called the base of the heart 5. Lower border of the heart located on the left at the level of the 5th rib; called the apex 6. Heart wall a. Pericardium: fibrous covering b. Epicardium: outermost layer c. Myocardium: middle layer and thickest d. Endocardium: innermost layer, thin and very smooth 7. Has four chambers a. Two upper called atria b. Two lower called ventricles 8. Divided right and left by a thick wall called the septum 9. Valves a. Tricuspid valve has three cusps and is situated between the right atrium and the right ventricle b. Mitral (bicuspid) has two cusps and is situated between the left atrium and the left ventricle c. Pulmonary (pulmonic) valve is between the right ventricle and the pulmonary trunk. Prevents blood from flowing back into the right ventricle. d. Aortic valve is located between the left ventricle and the aorta B. Blood vessels 1. Arteries a. Take oxygenated blood away from the heart except is the pulmonary artery.	A. Lecture/Discussion B. Assigned Readings C. Use anatomical diagrams/ posters/videos/computer assisted learning/ workbook activities. D. Trace flow of blood. E. Have students use an animal heart to dissect and name the structures. F. Show slides of blood, blood vessels and heart G. Discuss how the following factors influence the cardiac cycle 1. Exercise 2. Body temperature 3. Fear 4. Sleep

b. Strongest of the blood vessels. c. Muscular wall can constrict (vasoconstriction) and dilate (vasodilation). d. Vasoconstriction increases blood pressure. e. Vasodilation decreases blood pressure. f. Tissues of the heart receive blood supply through the coronary arteries. g. Aorta is the largest artery in the body. 2. Arterioles a. Very small arteries at distal end leading into capillaries. b. Allows red blood cells to circulate through in a single line. 3. Capillaries a. Smallest of the blood vessels that branch off arterioles. b. Thin walls allow substances to pass into and out of their walls. c. The only blood vessel that allows passage of substances through walls. d. Carry oxygenated blood to all parts of the body including skin. e. Tissues requiring a lot of oxygen, such as muscles and nervous tissue have many capillaries. f. Link between the arterial and venous system. g. Exchange of oxygenated blood and deoxygenated blood takes place in the capillaries. 4. Venules a. Small veins. b. Merge together to form veins. 5. Veins a. No pulse pressure in veins; moves blood slowly. b. Venous return of blood to the heart requires skeletal muscle contractions and pressure in the abdomen and the chest to squeeze veins. c. Blood is pushed through, similar to the action of pushing toothpaste out of a tube. d. One-way valves in veins prevent blood from flowing backward. e. The sympathetic nervous system influences the flow of blood by constricting and dilating the veins. f. Takes deoxygenated blood back to the heart, exception is the pulmonary vein. g. Superior and inferior vena cava are the largest veins in the body. C. Blood 1. Type of connective tissue.	

2. Percentage of red blood cells in a sample of whole blood is referred to as hematocrit.
3. Plasma
    a. Fluid portion of blood.
    b. Carries blood cells.
    c. Transports nutrients to cells.
    d. Transports waste from cell metabolism to organs of excretion.
    e. Transports enzymes, hormones and protective proteins.
4. Erythrocytes
    a. Red Blood Cells (RBC).
    b. Small enough to pass through capillaries.
    c. Transports oxygen which gives it the bright red color.
    d. Contains pigment called hemoglobin (oxyhemoglobin).
    e. Red blood cell count is the number of red blood cells in one cubic millimeter of blood (20 drops).
    f. Normal count is 4 million to 6.5 million red blood cells
        1) Red blood cells are produced in the bone marrow by cells called, hemocytoblasts.
        2) Erythropoietin made in the kidney is responsible for regulating the production of red blood cells.
        3) Because function of red blood cell is to carry oxygen, a low count reflects a decreased ability to carry oxygen (anemia).
        4) Old red blood cells go to the liver and the spleen destroys them.
        5) As the RBC breaks down, a pigment called bilirubin is released from the cell, used to make bile which is needed for digestion.
5. Leukocytes
    a. White blood cells (WBC).
    b. Two categories
        1) Granulocytes.
        2) Agranulocytes.
    c. Granulocytes have granules in their cytoplasm and include neutrophils, eosinophils and basophils.
    d. Agranulocytes do not have granules in their cytoplasm and include monocytes and lymphocytes.
    e. Fights infection by destroying microorganisms and producing antibodies.

f. White blood cell count is the number of white blood cells in 1 cubic millimeter of blood (5,000-10,000). g. Leukocytosis, white blood cell count is above normal and is indicative of an infection. h. Leukocytopenia, below normal count, which is caused by some viral infections and other various conditions. 6. Platelets a. Small cellular element that aids in clotting. b. Also called thrombocytes. c. Normal count is 130,000 – 360,000 per cubic millimeter of blood. d. Clotting usually takes 6 - 7 minutes. 7. Blood plasma a. Liquid portion of blood and is mostly water with mixture of proteins, nutrients, gases, electrolytes and waste products. b. Albumin is the smallest protein that is important for pulling water into the bloodstream to help maintain blood pressure. c. Globulin is plasma protein that transports lipids and some vitamins in plasma. d. Fibrinogen, important for blood clotting.	
Objective 3 **Label internal and external structures of the heart.** A. Internal 1. Aorta 2. Aortic semilunar valve 3. Apex 4. Endocardium 5. Inferior vena cava 6. Left atrium 7. Left pulmonary artery 8. Left pulmonary veins 9. Left ventricle 10. Mitral (bicuspid) valve 11. Myocardium 12. Pulmonary semilunar valve 13. Right atrium 14. Right pulmonary artery 15. Right pulmonary veins 16. Right ventricle 17. Septum 18. Superior vena cava 19. Tricuspid valve B. External 1. Anterior coronary artery 2. Aortic arch 3. Apex 4. Ascending aorta	A. Lecture/Discussion B. Assigned Readings C. Use anatomical diagrams/ posters/videos/computer assisted learning/workbook activities. D. Locate each structure with students and discuss how they function.

5. Brachiocephalic artery 6. Left atrium 7. Left common carotid artery 8. Left coronary artery 9. Left pulmonary artery 10. Left pulmonary veins 11. Left subclavian artery 12. Left ventricle 13. Pericardium 14. Right atrium 15. Right common carotid artery 16. Right coronary artery 17. Right coronary vein 18. Right pulmonary artery 19. Right pulmonary veins 20. Right subclavian artery 21. Right ventricle 22. Superior vena cava	
Objective 4 **Describe the flow of blood and cardiac cycle.** A. Blood flow through the heart 1. Blood low in oxygen and rich in carbon dioxide enters the right atrium of the heart through inferior and superior vena cava. 2. From right atrium blood flows through the tricuspid valve into right ventricle. 3. When right ventricle contracts, blood is pushed through the pulmonary valve into pulmonary artery. 4. In the lungs blood exchanges carbon dioxide for oxygen and returns to the heart through four veins called the pulmonary veins. 5. Pulmonary veins carry blood rich in oxygen and low in carbon dioxide to the left atrium. 6. Blood flows through the mitral valve into the left ventricle. 7. Left ventricle contracts and sends blood through the aortic valve into the aorta and to all of the cells of the body. B. Cardiac cycle 1. One heartbeat makes up a cardiac cycle. 2. Top chambers (atria) of heart contract and relax together. 3. Right atrium (RA) fills, the tricuspid valve opens and blood flows into the right ventricle. 4. Right ventricle (RV) fills and then RA contracts and tricuspid valve closes. 5. RV contracts, pulmonary valve opens and blood flows into pulmonary artery and then to lungs. 6. Left atrium (LA) fills, mitral valve opens and the blood flows into the left ventricle. 7. LA contracts and mitral valve closes. The left ventricle	A. Lecture/Discussion B. Assigned Readings C. Use anatomical diagrams/ posters/videos/computer assisted learning/ workbook activities. D. Identify with students how each of structures is utilized during the cycle. E. Trace a drop of blood through the heart.

contracts, the aortic valve opens, and blood is pushed into the aorta and then to the body. C. Conduction system of the heart 1. The sinoatrial (SA) node controls the rate of heart contraction by initiating electrical impulses every minute, 60 to 100 times. 2. The heart beats in response to an electrical signal that originates in the SA node in the right atrium, spreads over the atria, and causes atrial contraction. 3. This impulse continues to the atrioventricular (AV) node, through the bundle of His, then the right and left bundle branches, and lastly to the Purkinje fibers, eventually causing ventricular contraction.	