Unit 3 – TRANSPORTATION SYSTEMS

Circulatory System - Lecture Notes

DESCRIBE THE BASIC FUNCTIONS OF THE CIRCULATORY SYSTEM

A. The circulatory system transports nutrients and wastes.
   a. Arteries in the circulatory system pick up nutrients from the digestive system and deliver the nutrients to each cell of the body.
   b. Veins in the circulatory system carry away the waste products and excess fluid of each cell of the body.

B. The circulatory system transports heat.
   a. Helps regulate heat in the body by distributing the heat generated by the muscles.

C. The circulatory system transports oxygen to body cells and carbon dioxide away from body cells.
   a. Arteries carry oxygen to the body cells.
   b. Veins take carbon dioxide away from the body cells.

D. The circulatory system transports hormones.
   a. Transports hormones through the blood stream.

E. The circulatory system transports antibodies.
   a. Transports antibodies through the blood stream to help the body fight infection.

IDENTIFY THE BASIC STRUCTURES AND FUNDTIONS OF THE CIRCULATORY SYSTEM

A. Heart

1. The heart is a hollow organ about the size of a closed fist and is located between the lungs, behind the sternum, and above the diaphragm.
2. The heart functions to pump blood throughout the body.
3. There are four chambers of the heart: right atrium, right ventricle, left atrium, and the left ventricle.
   - The right atrium receives unoxygenated blood from the veins.
   - The right ventricle receives blood from the right atrium and pumps it to the lungs through the pulmonary artery.
   - The left atrium receives oxygenated blood from the lungs and pumps it into the left ventricle
   - The left ventricle pumps blood into the aorta, which will then transport the blood throughout the entire body.
4. The heart has major blood vessels: aorta, superior vena cava, inferior vena cava, pulmonary arteries, and pulmonary veins.
5. The heart has four valves: tricuspid, pulmonary valve, mitral valve (bicuspid valve), and the aortic valve.

B. Blood flow through the heart

This is how the blood flows from the body back through the heart:

- Superior and Inferior Vena Cava
- Right Atrium
- Tricuspid Valve
- Right Ventricle
- Pulmonary Semilunar Valve
- Pulmonary Arteries
- Lungs
- Pulmonary Veins
- Left Atrium
- Bicuspid (Mitral) Valve
- Left Ventricle
- Aortic Semilunar Valve
- Aorta

C. Blood Vessels

The heart and blood vessels form a closed system for the flow of blood. There are three main types of blood vessels: arteries, capillaries, veins.

1. Arteries

Carry blood away from the heart. The blood is generally oxygenated. The aorta is the largest artery in the body and it receives the blood from the left ventricle of the heart, to transport it to the body. The smallest branch of arteries is called arterioles.

2. Capillaries

Connect arterioles with venules. They have thin walls that contain only one layer of cells and are important for nutrient and waste exchange between the blood and the cells.

3. Veins

Carry blood to the heart. The blood is generally deoxygenated. The smallest branches are called venules. Veins contain one-way valves that help the blood to flow against gravity on its way back to the heart without back-flow.

D. Blood

1. Blood provides vital transportation services for the body.
2. There are four components of blood:
   - Red blood cells (erythrocytes) – transport oxygen and nutrients to the cells, and carry carbon dioxide away from the cells.
   - White blood cells (leukocytes) – protect against infection and disease.
   - Platelets (thrombocytes) - start the clotting process.
   - Plasma – clear yellow liquid that makes up 55% of the whole blood.

DESCRIBE THE DISEASES AND DISORDERS ASSOCIATED WITH THE CIRCULATORY SYSTEM

A. Anemia
Anemia is a blood disorder in which the capacity of the blood to transport oxygen is decreased, usually because the total number of red blood cells is diminished. Anemia results from internal bleeding, vitamin deficiencies, decreases in red blood cell production, or increases in red blood cell destruction by the spleen. Possible symptoms of anemia include fatigue, chest pain, skin pallor, increased heart rate, and difficulty breathing. Possible treatments include iron supplements, vitamin supplements, blood transfusions, and erythropoietin.

B. Heart Attack (myocardial infarction)
Occurs when the coronary artery or a branch of the coronary artery is blocked with a blood clot or fatty plaque and the blood cannot flow to the heart muscle. The heart muscle dies resulting in the heart attack. Symptoms include chest pain, crushing pressure behind the breastbone and chest pain radiating to the neck, jaw, abdomen, shoulder or left arm. Other symptoms include nausea, vomiting, difficulty breathing, and anxiety or fear. Treatments include oxygen, nitroglycerin, pain medications, blood thinning medications, antiplatelet medications, beta-blockers, and ACE inhibitors. Surgical procedures may also be necessary.

C. High Blood Pressure (hypertension)
High blood pressure is a medical condition in which the blood pressure is chronically elevated. High blood pressure can contribute to coronary artery disease, strokes, kidney failure, and sudden rupture of the aorta. There are not rigid rules for determining high blood pressure, but a sustained systolic pressure of over 140 or a sustained diastolic pressure of over 90 is considered hypertension. Usually, no symptoms are present other than a mild headache. More severe symptoms may include tiredness, confusion, vision changes, chest pain, heart failure, bloody urine, ringing in the ears, and nosebleed. It is treated with medications.

D. Atherosclerosis
Atherosclerosis is a build-up of fatty deposits on the inner walls of arteries. This build-up causes a narrowing of the inner vessel diameter, restricting the flow of blood. Fats and other particles combine to form this deposit, known as plaque. As time passes, calcium can be deposited at the site of plaque, causing the area to harden. Symptoms may include chest pain, periods of inability to function, strokes, fainting, pain, and numbness or tingling. Treatment includes medications and diet to reduce fats and cholesterol levels. Exercise and weight loss are also recommended.