Circulatory System Guided Study Notes

Circulation

Sect. 1: The Body's Transport System
Sect. 2: A Closer Look at Blood Vessels
Sect. 3: Blood and Lymph
Sect. 4: Cardiovascular Health

Sect. 1: The Body's Transport System

- The Circulatory System is the body's delivery and ________________ system.
  - “The system of organs and structures by which blood and lymph are circulated throughout the body.”
- It is more commonly referred to in science as the Cardiovascular system.
  - “Cardio” meaning “______________”.
  - “Vascular” meaning “_________________________.”
- Cardiovascular literally means heart and the blood vessels.

Components of the Cardiovascular System

- __________________________
  - __________________________
  - __________________________

Functions of the Cardiovascular System

- __________________________
  - Examples: Oxygen, Glucose, Vitamins, Minerals, etc.
  - __________________________
    - Example: Carbon dioxide

The Heart

- Hollow muscular organ that is responsible for pumping blood throughout the body.
- Made of cardiac muscle.
- 2 Separate sides
  - Septum is the tissue wall that separates the right side of the heart from the left side of the heart.
  - Each side has 2 separate chambers
    - Atrium: Upper chambers of the heart
      - One on each side (left & right)
      - Receives blood into the heart
    - Ventricle: lower chambers of the heart
      - One on each side (left & right)
      - Pumps blood out of the heart
  - Valves are flaps of tissue located inside the heart that separates the atrium, ventricle & directs blood flow.
    - Tricuspid: between right atrium & right ventricle
    - Pulmonary: between right ventricle & pulmonary artery
    - Mitral (Bicuspid): between left atrium & left ventricle
    - Aortic: between left ventricle & aorta
- Operates in 2 phases
  - Phase 1: heart muscle relaxes & the heart fills with blood
  - Phase 2: heart muscle contracts & the blood is pumped forward
- Heart (contractions) ________________ regulated by a __________________________
  - Natural pacemaker is a group of cells located in the right atrium that monitors the body’s need for oxygen & adjust the heart rate to meet the need.
  - Artificial pacemaker is an electrical device implanted in a patient that regulates the heartbeat.
Can be affected or disrupted by microwaves.

**The 2 Loops of the Heart**

--- **Loop 1: Right Pump**

- Blood travels from the _______ to the _______ & then back to the ________.
- **Oxygen poor/Carbon dioxide rich blood** flows into ____________ from the body.
- This blood is then pumped through the tricuspid valve into the right ventricle.
- The ventricles pump the blood through the pulmonary valve into the pulmonary _______ that leads to the lungs.
- Pulmonary: means lungs
- There the lungs exchange fresh oxygen for carbon dioxide.
- The now oxygen rich blood flows from the lungs into the left side of the heart or the 2\textsuperscript{nd} loop.

--- **Loop 2: Left Pump**

- Blood travels from the _______ to the _______ & then to the ________.
- **Oxygen rich blood flows** into left atrium from the ____________.
- This blood is then pumped through the mitral/bicuspid valve into the left ventricle.
- The ventricles pump the blood through the aortic valve into the _______ that leads to the ________.
- The contraction of the left ventricle is greater creating more force as this push is needed to pump the body throughout the entire body.
- Throughout the body blood drops off oxygen to various cells & picks up carbon dioxide.
- This **Oxygen poor/__________________________ rich blood** flows back to the right side of the heart to begin the 2 loops process all over again.

**Sect. 2: A Closer Look at Blood Vessels**

--- **Arteries**

- Carry **oxygen rich blood** throughout the body.
- 3 thick layers
  - Outside layer: Connective tissue
  - Middle layer: Thick smooth muscle tissue
  - Inner layer: smooth Epithelial tissue
- Structure of arteries offers both strength (muscle tissue), flexibility (connective tissue) and freedom of blood flow (epithelial tissue).
- **Aorta** is the largest artery in the body.
  - All arteries branch off from the aorta like the branches of a tree.
  - **Coronary arteries** are arteries that supply the cells of the heart with oxygen.
- A person’s **pulse** is created by the expansion & relaxation of the artery walls.
- Arteries can expand or contract to restrict blood flow to an area.
  - Example: Exercising blood flow increases to muscles and lung cells.
  - Example: During digestion blood flow to the digestive system increases
    - This is one reason why you should not do strenuous exercise right after eating.
- **Blood pressure** is the force exerted on the walls of arteries as blood is pumped through the ventricles of the heart.
  - Blood pressure decreases the further it travels from the heart.
Inadequate blood pressure can mean not enough oxygen and nutrients are being delivered to vital organs such as the brain, heart, etc., preventing these organs from functioning properly and may lead to temporary or permanent damage.

Measured using a sphygmomanometer or blood pressure cup.

- **Capillaries**
  - Connection point between arteries & veins.
  - Exchange point between body’s cells and blood
    - Diffusion: process where substances move from an area of high concentration (a lot in a small area) to low concentration (same amount but a bigger area).
  - Single layer of smooth epithelial tissue.

- **Veins**
  - Carry oxygen poor/carbon dioxide rich blood throughout the body.
  - 3 layers; layers not as thick as in arteries
    - Outer layer: Connective tissue
    - Middle layer: Smooth muscle
    - Inner layer: Epithelial tissue
  - Contraction of skeletal muscles help to push blood through veins back to the heart.

**Sect. 3: Blood & Lymph**

- **Blood** is a specialized bodily fluid in animals that delivers necessary substances such as nutrients and oxygen to the cells and transports waste products away from those same cells.
- Medical terms related to blood often begin with *hemo-* or *hemato-* from the Greek word for "blood".
- Blood is considered a specialized form of connective tissue, given its origin in the bones.

- **Blood is composed of 4 parts**
  - Plasma
  - Red Blood Cells
  - White Blood Cells
  - Platelets

- 45% is cells; 55% is plasma

- **Plasma**
  - Liquid portion of blood
  - 90% water; 10% dissolved materials such as glucose, fats, vitamins, & minerals.
  - Also carries waste materials & any messenger chemicals.
  - Yellowish tint due to 3 proteins found in plasma
    - Albumins: regulate water in blood
    - Globulins: helps fight disease
    - Fibrinogen: helps form blood clots

- **Red blood cells (Erythrocytes)**
  - Carry and deliver oxygen.
  - Circular shaped with an indented center.
  - Produced from red bone marrow.
  - Contain no nucleus therefore cannot repair or reproduce.
  - Approximate live span is 120 days or 4 months.
  - Primarily composed of *hemoglobin*
    - Hemoglobin is an iron containing protein that bonds to oxygen; when bonded or joined with oxygen, it produces a bright red color.
  - Diseases of red blood cells
    - *Anemia* is reduced number of red blood cells within the body due to different factors.
**White blood cells (Leukocytes)**
- Also produced in the bone marrow.
- *Disease fighters* of the blood stream.
- 5 primary types of white blood cells; 2 most common bacterial, viral, cancer fighters.
  - Granulocytes
  - Lymphocytes
- 1 white blood cell for every 500 to 1,000 red blood cells.
- Larger in size than their red blood cell counterparts.
- White blood cells contain a nucleus & therefore can repair themselves.
- Life span can be months to years.
- *Diseases of White blood cells*
  - Leukemia: cancer of the white blood cells
  - HIV: virus that attacks specific lymphocytes

**Platelets (Thrombocytes)**
- Cell fragments primarily responsible for blood clotting.
- *Fibrin* is a protein produced by platelets that produces thin fibers that criss-crossing each to form a net to catch blood cells.
- Blood clot (scab) forms as more & more blood is coagulated in the net and dry as it is exposed to the air & blood vessels underneath to repair themselves.
- Average life span of a platelet, 9 days.
- *Disease of Platelets*
  - Thrombocytopenia: low number of platelets

**Blood typing**
- _____ major blood types
  - A: contains the A marker protein
  - B: contains the B marker protein
  - AB: contains both marker proteins
  - O: contain no marker proteins
- Marker molecules are proteins located on red blood cells.
- Clumping proteins are made for the opposite marker molecules than those found on a person’s own red blood cells.
  - Example: Type A; anti B clumping proteins.
- Rh factor another protein found on red blood cells; 85% are positive for it (+) and 15% are negative for it (-)
  - Negatives make anti (+) clumping proteins but positives don’t make anti (-) clumping proteins.

**The Lymphatic System**
- Network of vein-like structures that return excess fluid to the blood stream.
  - *Analogy*: The blood stream is the main highway. The lymphatic system is the secondary roads leading to the main highway.
  - *Lymph* is the name given to any fluid that travels via the lymphatic system.
    - Examples: water, glucose, other dissolved nutrients
  - *Lymph nodes* are tissue that filter fluid of the lymphatic system.
    - Lymph nodes swell when you have an infection as the bacteria and other infection is trapped.

Sect. 4: Cardiovascular Health
- **Atherosclerosis**
  - Hardening of the arteries.
  - Arteries fill with plaque (fat) inside the wall prevent the artery from functioning correctly; impeding proper blood flow.
  - Caused by high fat diets or high cholesterol levels.

- **Hypertension**
  - More commonly called high blood pressure.
  - Causes the heart to work harder than necessary increasing wear & tear on the heart muscle & arteries.
  - Called “Silent Killer” because often times high blood pressure is the only obvious sign anything is wrong.

- **Myocardial Infarction**
  - Commonly referred to as a Heart Attack.
  - Caused as the heart muscle is denied sufficient oxygen to operate for an extended amount of time.
  - Can be a result of blocked coronary arteries, the arteries that supply oxygen to the heart muscle.

- **Keys to healthy living**
  - **Proper diets**
    - Low fat diet; especially saturated & trans-saturated fats.
    - Variety of fruits and vegetables; fresh is better
    - Limit intake of fried or processed foods with chemicals in the ingredients you can pronounce.
  - **Plenty of exercise**
    - Aerobic exercise 3 to 4 times a week.
    - Exercise that gets your heart rate up and keeps it at a sustained level for at least 30 minutes.
    - Example: jogging, riding a bike, playing tennis
  - Avoid smoking & other drugs