

Chapter 32-Circulation

Understand the 3 basic parts of all circulatory systems and the main functions of each

- A pump, the heart, that keeps the blood circulating
- A liquid, blood, that serves as a medium of transport
- A system of tubes, blood vessels, that conduct the blood throughout the body

Understand the functions of the human circulatory system

- 1. Transporting oxygen from the lungs to the tissues, and transporting carbon dioxide from the tissues to the lungs
- 2. Distributing nutrients from the digestive system to all body cells
- 3. Transporting waste products and toxic substances to the liver, where many of them are detoxified, and to the kidneys for excretion
- 4. Distributing hormones from the glands and organs that produce them to the tissues on which they act
- 5. Regulating body temperature by adjustments in blood flow
- 6. Wound healing and blood clotting to prevent blood loss
- 7. Protecting against disease by circulating white blood cells and antibodies

Understand how the human heart differs from fish, amphibian and reptile hearts

- The hearts of fish (the 1st vertebrates to evolve) consist of two chambers: a single atrium that empties into a single ventricle
- Some fish turned into amphibians who then evolved into reptiles who have a three-chambered heart: having two atria and one ventricle
- The four-chambered hearts of some reptiles, including crocodiles and their relatives, and all birds and mammals have separate right and left ventricles that completely isolate oxygenated and deoxygenated blood

Understand the circulation terminology

- Artery- vessel that carries blood **away** from the heart
- Vein- vessel that carries blood **to** the heart
- Pulmonary- anything dealing with the lungs
- Systemic- having to do with everywhere else in the body
- Vena Cava- **largest vein in the human body**
- Aorta- **largest artery in the human body**

Be able to trace the flow of blood through the mammalian heart, including all valves involved

Right atrium → Atrioventricular valve → right ventricle → semilunar valve → pulmonary artery → lungs → pulmonary vein → left atrium → Atrioventricular valve → left ventricle → semilunar valve → aorta → body

Understand the difference between systolic and diastolic pressure, and what causes each

- Systolic pressure, the higher of the two readings, is measured during ventricular contraction
- Diastolic pressure is the minimum pressure in the arteries as the heart rests between contractions

Be able to trace the flow of the electrical signal throughout the heart, and all of the structures involved

- Electrical impulses coordinate the sequence of heart chamber contractions
 - The contraction of the heart is initiated and coordinated by a pacemaker, a cluster of specialized heart muscle cells that produce spontaneous electrical signals at a regular rate
 - **The heart's pacemaker is the Sinoatrial node**, located in the upper wall of the right atrium
 - Electrical signals from the SA node pass freely into the connecting cardiac muscle cells and then throughout the atria.
- The electrical signal then passes from the right atrium to a specialized group of muscle cells between the right atrium and right ventricle called the **Atrioventricular (AV node)**
 - From the AV node, the signal to contract spreads along specialized tracts of rapidly conducting muscle fibers called the **Atrioventricular bundle (AV bundle)**, which sends branches to the lower portion of both ventricles
 - Here, the bundles branch further, forming **Purkinje fibers** that transmit the electrical signal throughout the ventricle
 - Sinoatrial node- pace maker top of the right atrium
 - Atrioventricular node- the valve between atrium and ventricles
 - Atrioventricular bundle (AV bundle or bundle of his)
 - Delays contraction of ventricles
 - Allows time for atria to contract completely and fill ventricles with as much blood as possible
 - Purkinje fibers

Understand the purpose of the AV nodal delay

- It allows time for the atria to contract completely and the ventricles to fill up completely with as much blood as possible

Understand the major components of both the plasma portion and cellular portion of blood, and their functions

- Plasma comprises about 55% of total blood volume
- The cell-based portion, which is about 40-45% of total blood volume, consists of red blood cells, white blood cells, and platelets
- Plasma is primarily water in which proteins, salts, nutrients, and wastes are dissolved
 - Proteins are the most abundant dissolved molecules by weight and include:
 - Albumin, which helps to maintain the blood's osmotic strength
 - Globulins, which are antibodies that play an important part in immune response
 - Fibrinogen, which is important in blood clotting
- The cell-based components of blood are formed in bone marrow
 - Blood contains three cell-based components—red blood cells, white blood cells, and platelets—but only the white blood cells are complete, functional cells
 - Mature red blood cells are not actual cells because they lack a nucleus, which is lost during development
 - All three components originate from blood stem cells that reside in the bone marrow
 - Stem cells are unspecialized that can divide to produce offspring capable of maturing into one or more types of specialized cells
- Red blood cells carry oxygen from the lungs to the tissues
 - About 99% of all blood cells, and about 45% of the total blood volume, are oxygen-carrying red blood cells, also called **erythrocytes**
 - The red color of erythrocytes is caused by the protein **hemoglobin**, which transports oxygen in the blood

Understand the structure of hemoglobin, and its role regarding O₂ and CO₂ in the blood

- Hemoglobin is a protein that transports oxygen in the blood. Each hemoglobin cell has 4 iron-containing heme groups that can bind four oxygen molecules. Oxygenated hemoglobin takes on a bright red color, and becomes bluish as it releases oxygen and picks up carbon dioxide at tissues.

Understand the structural and functional differences between veins, arteries, venules, arterioles, and capillaries

- Heart – arteries- arterioles- capillaries- venules- veins- heart
- Arteries and arterioles carry blood away from the heart
- Arterioles control the distribution of blood flow (they contract and relax in response to the needs of the tissues and organs they supply)
- The walls of arteries are thicker and more elastic than those of the veins
- Capillary walls are a single cell thick and allow exchange of nutrients and wastes
- Arterioles conduct blood into elaborate networks of tiny capillaries, microscopically thin vessels
- Capillaries allow individual body cells to exchange nutrients and wastes with the body by diffusion
- Veins and venules carry blood back to the heart
- After picking up carbon dioxide and other wastes from cells, capillary blood drains into larger vessels, called venules, which empty in larger veins

Chapter 33-Respiration

Understand the functions of your respiratory system

- The act of breathing is called **respiration**
 - o The process of cellular respiration, which converts the energy in nutrients into the ATP used by cells, requires a steady supply of oxygen and generates carbon dioxide as a waste product
 - o The circulatory system gets oxygen from your lungs, carries it to each cell, and then picks up CO₂ to be expelled from your body by the lungs

Be able to explain why gases diffuse in and out of your lungs, and in and out of your cells

- There is more oxygen in your lungs than your blood; it naturally diffuses from high concentration to low concentration.
- When blood is oxygenated the cells produce more CO₂

Understand how fish use gills to breathe

- Gills facilitate gas exchange in an aquatic environment
 - o The simplest type of gill, found in amphibians, consists of many thin projections of the body surface that protrude into the surrounding water
 - o Fish gills are complex structures. Fish create a continuous current over their gills by pumping water into their mouths and ejecting over the gills

Understand the functions of the conducting portion and gas-exchange portion of your respiratory system

- The diaphragm increases the volume of your lung, allowing them to fill. When you exhale, it relaxes and puts pressure on your lungs, increasing pressure and forcing air out of your lungs into the atmosphere.
- The **conducting portion**, a series of passageways that carry air into and out of the gas-exchange portion of the respiratory system
- The **gas-exchange portion**, where gases are exchanged with the blood in tiny sacs within the lungs

Know the function of the pharynx, larynx, and epiglottis