Circulatory System

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Function

The circulatory system is responsible for the transport of water and dissolved materials throughout the body, including oxygen, carbon dioxide, nutrients, and waste. The circulatory system transports oxygen from the lungs and nutrients from the digestive tract to every cell in the body, allowing for the continuation of cell metabolism. The circulatory system also transports the waste products of cell metabolism to the lungs and kidneys where they can be expelled from the body. Without this important function toxic substances would quickly build up in the body.\(^1\)
Structure of the Heart

- The most important part of the circulatory system is the Heart.

- The Heart is responsible for pumping blood through arteries and veins throughout the body, bringing nutrients and oxygen to each cell.

- Humans have double circulation. There are two circuits, one to the lungs and the other to the body. This requires a four-chambered heart.2
Structure of the Heart

- Left atrium receives oxygenated blood from lungs
- Left ventricle pumps blood to body through the Aorta
- Right atrium receives deoxygenated blood from the body
- Right ventricle pumps deoxygenated blood to the lungs
Main Types of Blood Vessels

- On average, your body has about 5 liters of blood flowing through it by way of the circulatory system. The heart, the lungs, and the...
- **blood vessels** work together to form the circle part of the circulatory system. The pumping of the heart forces the blood on its journey.
- The body's circulatory system has three distinct parts:
  - pulmonary circulation, or the lungs
  - coronary circulation, the heart
  - and systemic circulation, everything else
- Each must be working correctly independently in order for them to all work together.³
Video on the Circulatory System
Arteries

- The heart pumps blood out of one main artery called the dorsal aorta. The dorsal aorta then branches out into smaller arteries that reach every different part of the body.\(^6\)
- Arteries transport fresh, oxygen rich blood to capillaries.
- Arteries have 3 layers (like veins).\(^6\)
- Contractions of arteries keep the pace of the heart.
Veins

- Transports blood at a low pressure which makes them weaker than arteries. Veins have 3 layers— an outer layer of tissue, a middle layer of muscle and an inner layer of smooth epithelial cells.\(^6\)

- Veins receive blood from the capillaries after an exchange of Oxygen and Carbon dioxide has taken place. Veins transport waste-rich blood back to the lungs and the heart. Veins also contain valves that ensure that the waste-rich blood moves only in one direction.\(^6\)
Capillaries

- Very small blood vessels, very thin.
- Transports blood from arteries (with oxygen rich blood) then the gas exchange takes place and the capillaries pass the waste-rich blood to the veins\(^9\)
- Exchange of oxygen and CO\(_2\) takes place through the thin capillary walls.\(^6\)
Red Blood Cells

- Cells are red because of the **Hemoglobin** in the cells
- Hemoglobin contains **Iron**, which attaches to **Oxygen** and **Carbon Dioxide**
- It releases the oxygen in tissues and then carries away the carbon dioxide and other waste gases
- These blood cells have a life span of 120 days and are always being reproduced\(^4\)
White Blood Cells

- these blood cells protect the body against disease
- two groups of white blood cells: 1) GRANULOCYTES 2) ANGRANULOCYTES

- **granulocytes:**
  - NEUTROPHILIS -- first to arrive to fight bacteria, a virus, fungi, and protozoa
  - EOSINOPHILIS -- moderate allergic reactions and fight against parasitic worms
  - BASOPHILIS -- discharge histamine and heparin to encourage blood flow to damaged area

- **angranulocytes**
  - MONOCYTES -- react to inflammation signals
  - LYMPHOCYTES -- t cells: attack tumor cells, b cells: make antibodies, nk cells: prevent cancer
"Oxygen is transported from the lungs to the cells. CO$_2$ (a waste) is transported from the cells to the lungs."  

- Blood is oxygenated in the lungs.
Gas/Nutrient Exchange

- Capillaries are so tiny, that only one Red Blood Cell can squeeze through at a time. ¹¹
  - The "squeezing" causes the Red Blood Cell to make contact with the Capillary wall. ¹¹
  - Contact allows for gas exchange to easily occur between epithelial cells ¹¹

- CO₂, H₂O, and waste are transported into the blood

- O₂ is transported into the surrounding tissue
-The majority of gas and nutrient exchange occurs in the capillaries of the body.

-Nutrients and Oxygen diffuse across the membrane between the capillaries and the cells.  

-A cell is no more than 20 to 30 microns from any capillary. That is every cell (100 trillion of them) in the body has a capillary no further than 20 to 30 microns delivering oxygen and fundamental nutrients.


Bibliography
