

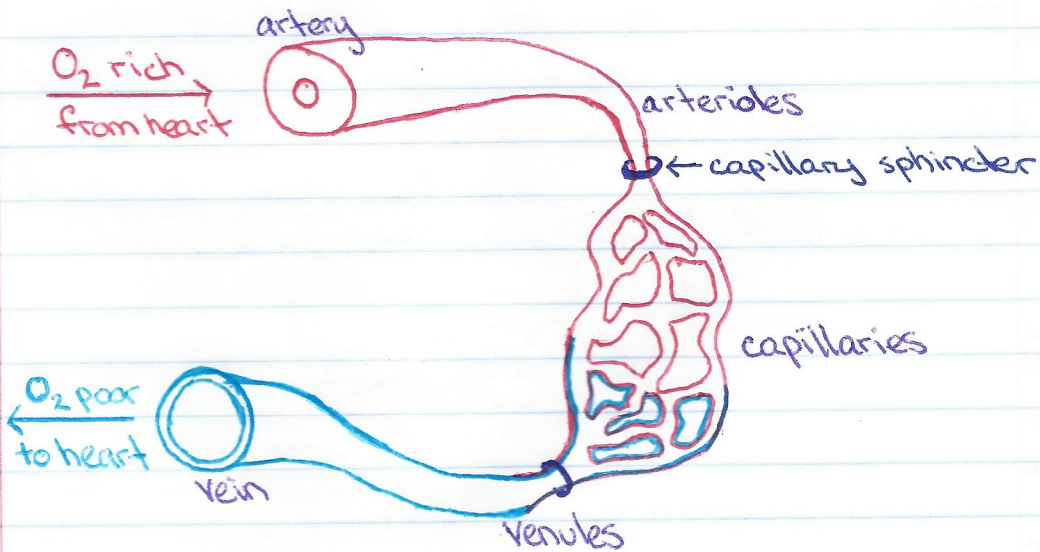
LESSON 36

Circulatory System

Function: transports nutrients, oxygen, water to every cell of the body... AND it carries away waste products (CO_2)

Main Organs: heart, veins, arteries, capillaries
↳ transport blood

→ Blood vessels come in a few different types:



i) Arteries and Arterioles

- carry blood away from the heart
- have thick muscular walls to withstand high blood pressure.

Vessel walls contain 3 layers:

- inner epithelium
- thick muscle layer
- connective tissue

* can contract to lower blood flow or expand to increase it.

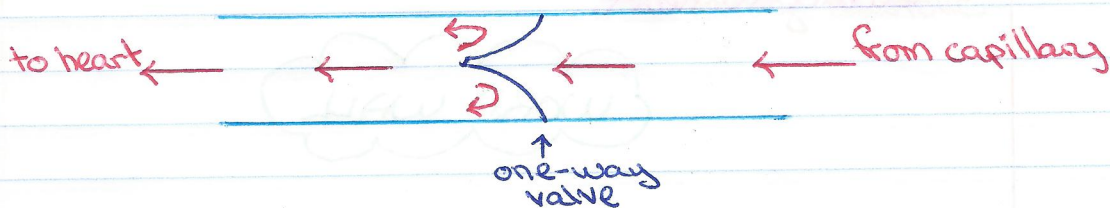
- allows the body to shift blood flow to where needed most.
ex. muscles during exercise.

2) Capillaries

- very small (walls are 1 cell thick)
- nutrients, O_2 and wastes are exchanged here.
- every cell is no further than 1mm from a capillary.
- sphincters at either end control blood flow.
- helps to maintain body temperature.

3) Veins and Venules

- carry blood to the heart
- walls contain same 3 tissue layers as arteries, only the muscle layer is thinner.
- blood pressure is lower because the inner diameter is greater.
- blood moves slower through the veins.
- veins rely on muscle contraction to pump blood along.
- one-way valves prevent backflow of blood.



Review Questions

- 1) what 3 tissue layers make up veins and arteries?
inner epithelium, thick muscle layer, connective tissue
- 2) what are the main organs and tissues of the circulatory system?
heart, veins, arteries, capillaries
- 3) what is the max distance a cell can be from a capillary?
1 cell

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Types of Blood Vessels Written Response

- 1) In which vessel does gas exchange occur?
capillaries
- 2) What structure inside veins keeps blood flowing in a forward direction?
one-way valve
- 3) Which vessels carry blood from the heart?
artery
- 4) Name the vessel that receives blood from the capillary beds.
venules
- 5) What three tissue layers make the walls of arteries & veins?
inner epithelium, thick muscle layer, connective tissue
- 6) Discuss the differences in structure between arteries & veins.
 - **arteries have thicker walls.**
 - **arteries carry blood away from heart, veins carry blood toward the heart.**

WORD WALL

Blood Pressure

- the force exerted on their inner wall of a blood vessel.
- blood pressure decreases as you move further from the heart.

Blood Pressure is highest in the arteries

Blood Pressure is lowest in the veins and capillaries.

- Diet has a large effect on blood pressure

- LDL cholesterol can buildup in arteries, narrows the diameter and \uparrow BP.
- High salt diets cause an increase in blood volume, which \uparrow BP.

- Blood pressure is measured in mmHg (millimeters of Mercury)

SYSTOLIC Pressure - pressure of the blood when the heart contracts.

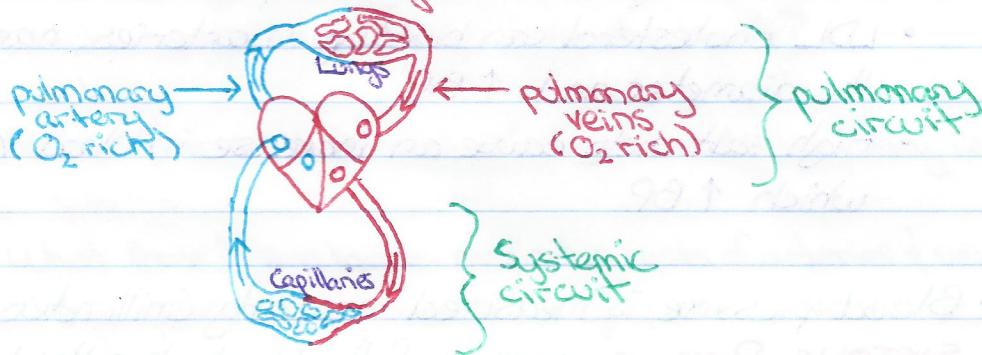
DIASTOLIC Pressure - pressure of the blood when the heart relaxes.

Normal Blood Pressure is: 120mmHg systolic
80mmHg diastolic

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Pathways of Blood

- veins from the body carry O_2 poor blood to the heart.
- blood needs to be reoxygenated.
 - * this occurs in the lungs.
- The Pulmonary Circuit carries blood from the heart to the lungs and back to the heart.



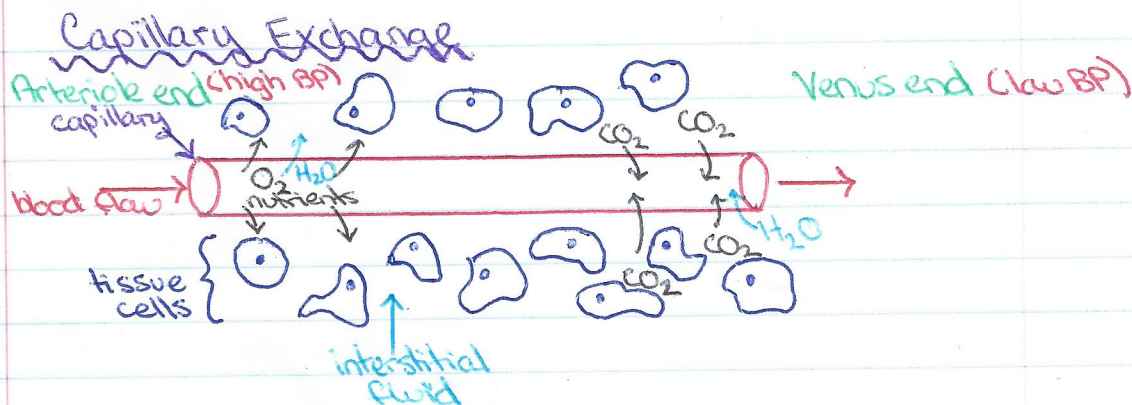
- blood leaves the heart in the pulmonary circuit through:
 - 1) pulmonary trunk
 - 2) 2 pulmonary arteries
 - 3) capillary beds in lungs (gas exchange occurs)
 - 4) pulmonary venules
 - 5) 4 pulmonary veins which re-enter the heart.

Major blood vessels of the Systemic Circuit

- 1) Aorta - largest artery, receives O_2 rich blood from heart and sends it to the entire body.
- 2) Renal artery/veins - takes blood to and away from the kidneys.
(Kidney)
- 3) Femoral artery/veins - bring blood to and away from the legs.

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- 4) Subclavian arteries/veins - run near the clavicle (collar bone) and supply blood to and take away from the arms.
- 5) Jugular vein - drains blood from the head.
- 6) Carotid artery - supplies blood to the head.



- exchange of gases and nutrients occurs in the capillary beds.
- blood slows down in the capillary bed because of an increase in surface area.
- this allows time for the exchange
- exchange in capillaries happens through diffusion and pressure differences.

Arteriole end

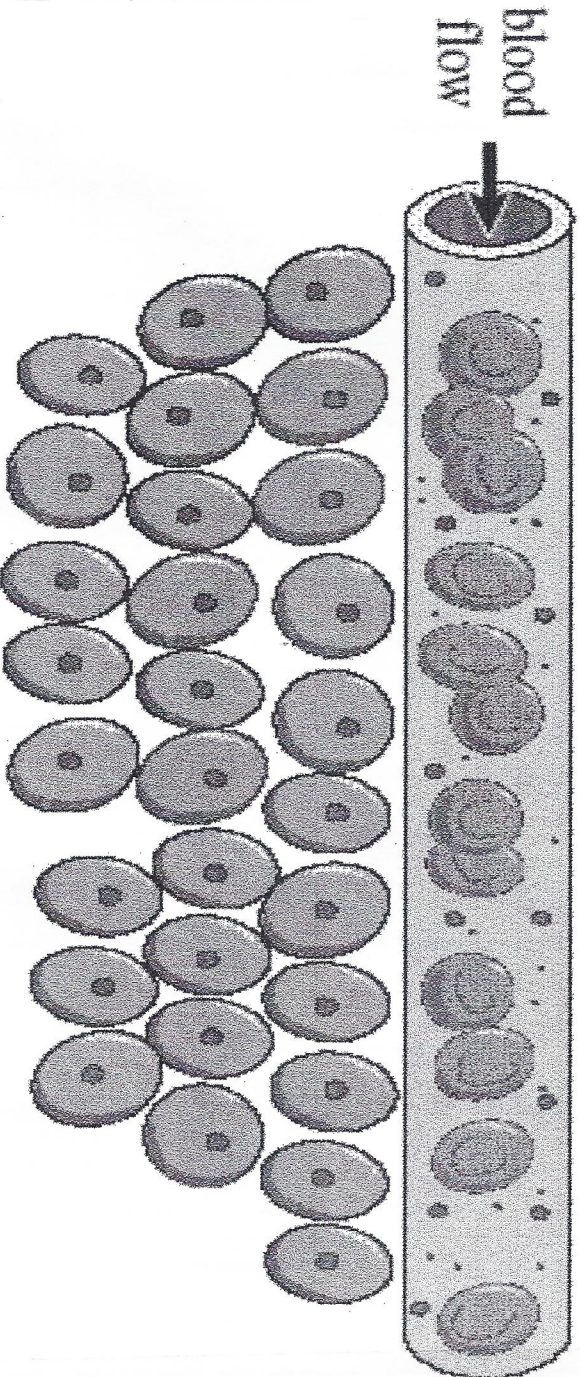
- BP is higher than pressure of tissue fluid
- O₂ and nutrients move out of the capillary.

Venous end

- BP is lower than pressure of tissue fluid.
- CO₂ moves into the capillary.

Answer the following questions.

1. On the following diagram, label the arteriole end of capillary, the capillary, the cells, the tissue fluid, and the venule end of the capillary. Also indicate the side of the capillary bed where blood pressure exceeds osmotic pressure and the side where osmotic pressure exceeds blood pressure.



2. Write an explanation of how conditions inside the capillary bed allow for the exchange of nutrients and wastes between the capillary and the tissue fluid.
3. At which location in the circulatory system is blood velocity the slowest? Explain why this is beneficial to us. In your opinion, are the capillary beds the most important part of the circulatory system? Explain.
4. Describe the differences between the pulmonary and the systemic circuits.
5. At which point do veins carry oxygenated blood?

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Blood → a liquid tissue that is responsible for delivering O_2 and nutrients as well as removing wastes.

→ blood is made of: 1) 55% plasma: water, salts, large proteins, gases, hormones

2) 45% blood cells: red, white blood

* all produced in red bone marrow (cells, platelets)
(skull, vertebra, and ends of long bones - like femur)

Erythrocytes: (red blood cells)

- gives blood its colour
- contain hemoglobin which binds to O_2 and transports it around the body.
- after 120 days, RBC's are broken down by the liver.

Anemia → a lack of iron in the diet slows RBC production.

SYMPTOMS: tired, lethargic feeling.

Leukocytes: (white blood cells)

- fight infections & diseases
- large cells
- different types have different methods of fighting infection & disease:
 - 1) phagocytize - (engulf) foreign invaders.
 - 2) release histamines - flush out foreign invaders.
 - 3) produce antibodies - tags to help identify foreign invaders which are marked for termination.

Thrombocytes: (platelets)

- not actually cells, but pieces of cells (cell fragments)
- involved in the process of blood clotting along with proteins & hormones

Hemophilia → genetic condition where one protein involved in clot formation is not produced by the body.

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Review Questions

- 1) Where are red blood cells, white blood cells, and platelets produced?

All produced in red bone marrow.

(skull, vertebra, ends of long bones)

- 2) List the scientific names for red blood cells, white blood cells, and platelets.

red blood cells - erythrocytes

white blood cells - leukocytes

platelets - thrombocytes

- 3) List the main functions of red blood cells, white blood cells, and platelets.

red blood cells - hemoglobin binds to O_2 and transports it around the body.

white blood cells - fights infections & diseases

platelets - involved in blood clotting

- 4) How are different types of white blood cells identified?

1) phagocytize - engulf foreign invaders

2) release histamines - flush out foreign invaders

3) produce antibodies - tags help identify foreign invaders marked for termination.

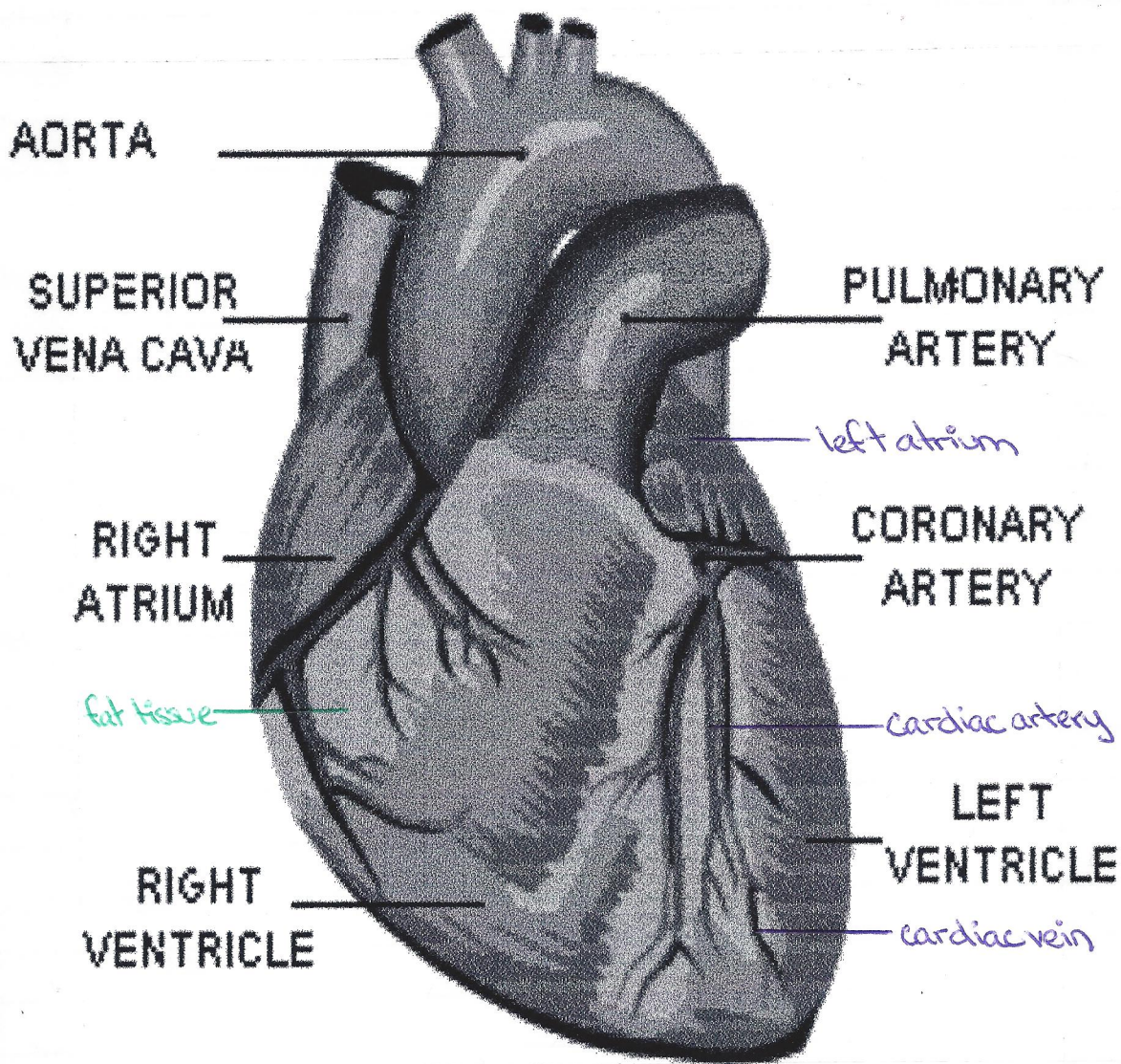
- 5) What are antibodies? How do they help fight infection?

Antibodies are chemical identification tags. They help identify foreign invaders marked for termination.

- 6) List the main components of plasma.

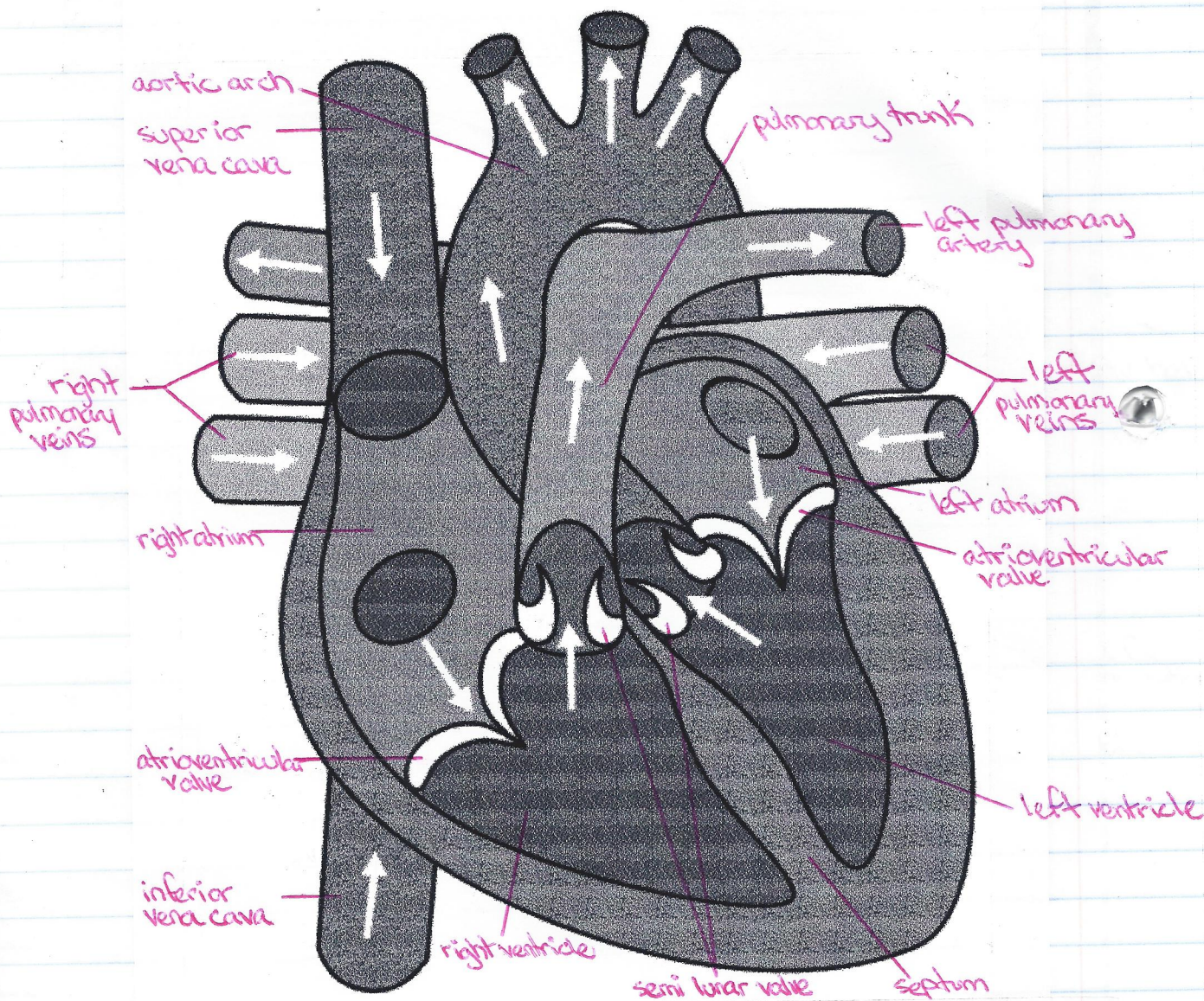
water, salts, large proteins, gases, hormones

Heart → fist-sized organ located in the center of the chest.
→ composed of cardiac muscle
→ controlled by the autonomic nervous system.



Exterior of the heart:

- cardiac arteries supply oxygenated blood to the heart tissue
- blockages in the cardiac artery can cause heart attacks.



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Internal Structure of the Heart

- 4 Chambers: 2 atria (right & left)
2 ventricles (right & left)
- Septum → separates the heart into right & left sides.
- AV valves → separate the atria from the ventricles.
- Cordae Tendinae → small ligaments attached to the ventricle and to the AV valve preventing backflow.
- Semi-lunar valves → separate ventricles from arteries.

NOTE: the wall of the left ventricle is thicker than that of the right ventricle, because the left ventricle needs to pump blood to the entire body.

Path of Blood through the heart

- blood enters the atrium from the superior vena cava (drains upper body) and the inferior vena cava (drains the lower body)
- the atria contract and blood is sent through the right AV valve into the right ventricle.
- the ventricles contract and blood is sent past a semi-lunar valve into the pulmonary trunk.
- oxygenated blood returns to the heart through the pulmonary veins and enters the left atrium.
- when atria contract, blood is pushed through an AV valve into the left ventricle.
- ventricle contraction sends blood past another semi-lunar valve, into the aorta.