Activity: Artitifical Heart

Materials

- 1 - 11” latex balloon 
- 2 - long latex balloons 
- 3 clear vinyl tubes 7/16 x 5/16 (2 – 12 in tubes and 1 – 2 in tube) 
- 3 – 2-way connectors 
- 1 air inflation bulb 
- 1 plastic 3/8” 3-way T-connector 
- 1 foam bowl with water (bottles or cups work too) 
- red food coloring (optional)

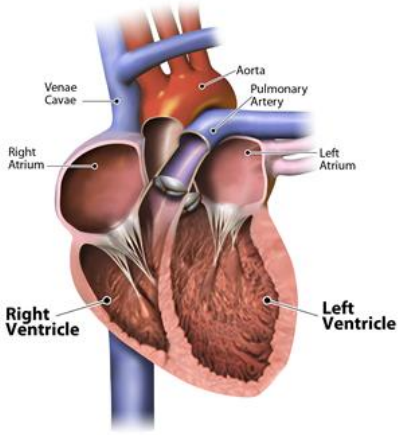
Introduction

Prostheses manufacturing is one of the many career fields available to biomedical engineers. A prosthesis is an artificial device used to replace a missing or damaged body part. Can you think of any body parts that can be replaced by an artificial device or part?

Did you know? Every year, more than 700,000 people in the United States die from heart failure. Heart failure is the number one cause of death all over the world. More than half of these patients could be saved if they had artificial valves or hearts. Today more than 800 people have artificial hearts!

Heart Anatomy

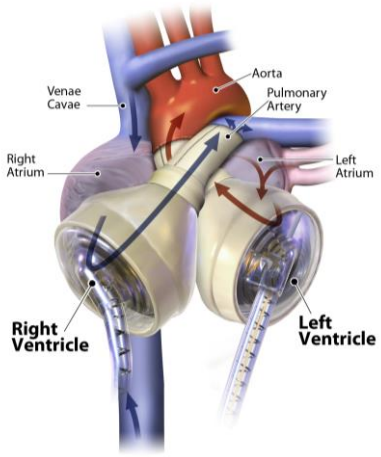
The **heart** is a hollow organ that pumps blood to all parts of the body. The human heart can be divided in two pumps, one in the right side and another in the left. Each pump has two chambers: the **atrium** and the **ventricle**. The right side receives blood without oxygen and sends it to the lungs. The left side receives **oxygenated blood** from the lungs and pumps it to the rest of the body. Therefore, it is important that the blood flows in only one direction (**unidirectional flow**).



Human Heart

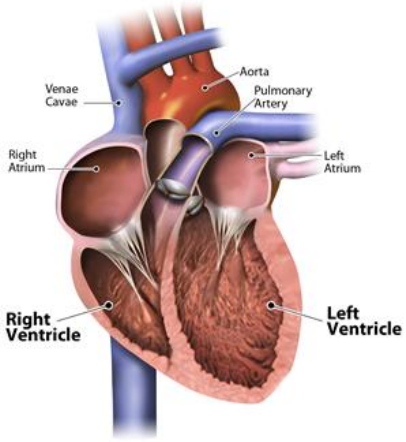
Heart Valves

Heart valves are tiny flap like structures in the heart that allow the blood to flow in one direction through the heart and the blood vessels. In the heart, valves are located in the junction between the atria and the ventricle and in the junction between the ventricle and the pulmonary artery and the aorta. Heart valves are also located in veins and arteries.



Total Artificial Heart

Syncardia Systems (June 4, 2010)



Human Heart

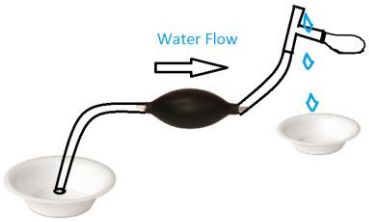
Artificial Heart

An artificial heart is an engineered device that replaces a faulty or diseased heart in the body. It is made to work exactly like a human heart and efficiently pumps blood to the whole body.

In this activity, you will create a model of your heart with one chamber. You will see how blood travels from the body to the heart and then back to the body. Remember, the blood can only flow in one direction!

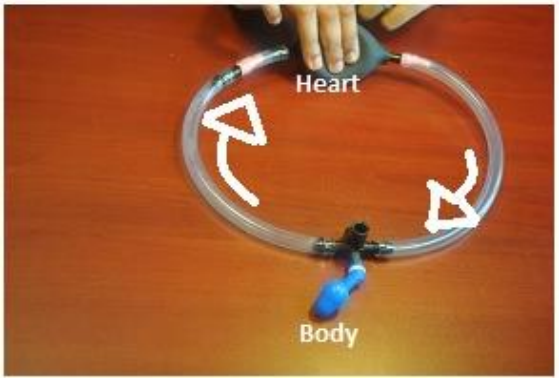
Put all materials down, and place your hand on your heart. Feel your heart pumping blood. Now, let's begin building our model of a one-chambered artificial heart.

1	Before we begin, this may get messy, so lay down some paper towels to make sure your activity space doesn't get wet. Attach a two way connector to both sides of the inflation bulb.	
2	Cut the two long latex balloons to about 1 inch in length	
3	Use the balloon to cover the middle hole of the T connector. Make sure the balloon covers the entire end of the connector. Wrap a small rubber band around the balloon and the T-connector to avoid leaking.	

4	Tightly attach the T-connector to the right tube. Place the left tube in the water bowl. **Hold the T-connector higher than the water level**, and pump water by squeezing the inflation bulb slowly until the air in both tubes, in the balloon, and in the bulb has been replaced by water.	
5	Remove the left tube from the bowl and attach it into the T-connector to close the flowing circle.	

Let's test our artificial heart!

Pump/press the inflation bulb once to see the upward flow of the blood from the body to the heart. Pump it again to watch the blood flow from the heart back to the body.



Fill in the blanks with following words: *unidirectional, chambers, blood, or heart*.

1. The _____ is the main organ in our body which pumps blood.
2. The blood's flow moves in a _____ way; it only flows one way.
3. The heart has four main _____ which separate the oxygenated and de-oxygenated blood.
4. _____ is the medium through which our body gets oxygen and nutrients.

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