

**Key:** Yellow highlight = required component

# Build-A-Heart

**Subject Area(s)** Biology

**Associated Unit** Biotechnology

**Lesson Title**



**Image 1**

**ADA Description:** An image of the 3D printed silicone heart that beats almost like a real human heart. As the chamber that serves as the heart's muscle inflates, it can pump fluid from the chambers.

**Source/Rights:** Copyright © ETH Zurich 2017

**Caption:** 3-D silicone heart pumping

**Grade Level**

9

**Time Required**

150 minutes (3-50 minute periods)

**Summary**

In this lesson students will attain a better understanding of the structures in the heart as well as the direction of blood flow by creating a human heart on the Tinkercad application. The students should have already completed a lesson on the basic structures of the heart and blood flow.

**Engineering Connection**

Students will be building a human heart using the tinkercad application that can be printed into a 3-D structure

**Engineering Category =**

1. Engineering design process

**Keywords**

Circulatory System, Red blood cell, Heart, 3D printer, Biotechnology

**Educational Standards (List 2-4)**

State STEM Standard

SC.912.L14.36 Describe the factors affecting blood flow through the cardiovascular system

ITEEA Standard

Standard 4, Grades K-12 Students will develop an understanding of the cultural, social, economic, and political effects of technology.

**Pre-Requisite Knowledge**

Prior to this lesson, students should know the basic concepts regarding the heart and the circulatory system.

**Learning Objectives**

After this lesson, students should be able to recall the structures of the heart, how blood flows and what factors may affect that.

**Introduction / Motivation (5E – Engage)**

Students will be shown a 1-minute video of a 3-D printed heart.

<https://www.youtube.com/watch?v=YUYNXeHfTdQ>

**Lesson Background & Concepts for Teachers (5E – Explain)**

Teachers should have an understanding of the cardiovascular system and factors that may affect blood flow. Teachers should also become familiar with the Tinkercad application before introducing it to students.

**Vocabulary / Definitions**

Word	Definition
Heart	A hollow muscular organ that pumps the blood through the circulatory system by rhythmic contraction and dilation.
Biotechnology	Technological application that uses biological systems, living organisms or derivatives, to make or modify products or processes for specific use.

**Associated Activities (5E – Explore)**

Students will be given one class period to explore the new application and plan how they would like to construct the heart in the Tinkercad application. Another period should be given for the students to complete their heart and more time may be provided if the teacher deems necessary. Students should be provided with a list of the structures to be included in 3-D heart plan.

Once complete, students should be given another period to complete a written assignment that allows the students to write how a red blood cell travels through the body.

## **Assessment (5E – Evaluate)**

### **Pre-Lesson Assessment**

*Descriptive Title: Question of the Day*

1. What factors can affect the heart's ability to function?

### **Post-Introduction Assessment**

*Descriptive Title: 3-D Heart Layout.*

Students turn in completed 3-D heart plan with labeled parts.

### **Lesson Summary Assessment**

*Descriptive Title: Journey of the Red Blood Cell*

1 page story written about the journey of a red blood cell through the cardiovascular system.

### **Lesson Extension Activities (5E – Extension)**

What are the positive and negative impacts of biotechnology?

### **Additional Multimedia Support**

Internet access for video

Internet access for Tinkercad application

### **References**

#### **Vocabulary**

Dictionary.com

#### **Youtube – Testing a Soft Artificial Heart**

<https://www.youtube.com/watch?v=YUYNXeHfTdQ>

#### **Tinkercad Application**

[www.Tinkercad.com](http://www.Tinkercad.com)

### **Attachments**

List of Structures of the Heart

## **Contributors**

Carey Lam

## **Supporting Program**

USF – Research Experiences for Teachers (RET)

## **Classroom Testing Information**

N/A

# Attachments

## **Structures of the Heart**

Right & Left Atrium  
Right & Left Ventricle  
Aorta  
Superior Vena Cava  
Inferior Vena Cava  
Pulmonary Artery  
Pulmonary Vein

## **Valves(optional)**

Pulmonary Valve  
Tricuspid Valve  
Aortic Valve  
Mitral Valve