Don’t Play Heart to Get

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Field(s) of Interest: Biology, Anatomy, Physiology

Brief Overview (1-3 sentences):
In this lesson, mentees will learn about the heart and its functionality through the use of models, games, and activities that the mentors facilitate.

Agenda:

- Introduction (5 min)
- Module 1: Listen to my heart-beat beat beat (15 min)
- Module 2: The Lengths I would go to for some oxygen (15 min)
- Module 3: Heart-y Potter and the Chamber(s) of Secrets (20 min)
- Conclusion (5 min)

Main Teaching Goals/Key Terms:

- ➔ **Heart rate:** Number of times the heat beats per minute.
- ➔ **Stethoscope:** A medical instrument for listening to the rhythm and rate of the heartbeat.
- ➔ **Heartbeat/Pulse:** A rhythmic contraction and relaxation of the heart’s muscle.
- ➔ **Veins:** blood vessels that carry blood away from the heart
- ➔ **Arteries:** blood vessels that carry blood towards the heart
- ➔ **Oxygenated blood:** blood coming from the lungs to the body
- ➔ **Deoxygenated blood:** blood coming from the body to the lungs
- ➔ **Circulation:** blood follows a cycle that consists of the heart, lungs, and body to provide oxygen to the body
- ➔ **Heart Chambers:** the four compartments of the heart through which blood flows when they contract and relax
- ➔ **Backward Flow**: the case in which the valves are nonfunctional in the heart, causing blood to flow backwards

Background for Mentors

Module 1

- Stethoscope
- Heartbeat/Pulse
- Heart rate
- Blood circulation

The **heart** is a muscular organ in the chest that *pumps* blood through the body, providing oxygen and nutrients to the cells and removing waste products. This **circulation of blood** is controlled by the rhythmic contraction and relaxation of the heart's muscle, also known as a **heartbeat**.

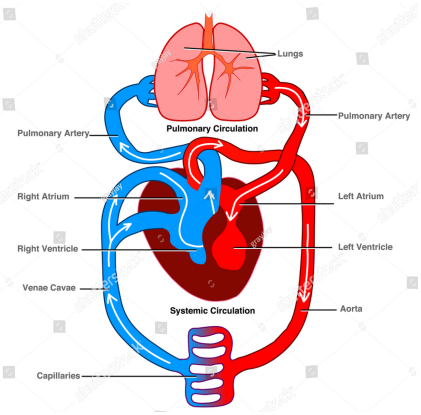

Figure 1. Oxygen, from the lungs, going through the heart.

To listen and measure the heart's **heart rate**, health professionals use a **stethoscope**. The device consists of two earpieces connected by flexible tubing to a chest piece, which is placed on the patient's chest. By amplifying the sound of a **heart rate**, healthcare professionals are able to listen to the rhythm and rate of the heartbeat in order to detect any irregularities.

Figure 2. Stethoscope to the heart.

Stethoscopes are an essential tool for diagnosing and monitoring a wide range of cardiovascular and respiratory conditions. Regular monitoring can help identify potential health issues and guide overall treatment decisions for cardiovascular care.

Background for Mentors

Module 2

- Veins
- Arteries
- Circulation
- Deoxygenated blood
- Oxygenated blood

Blood plays a vital role in keeping organisms alive by supplying our bodies with oxygen. However, to keep our blood oxygenated, it follows a cycle throughout our bodies.

When our body uses oxygen, our blood becomes **deoxygenated** and flows from various parts of our bodies to the right atrium of the heart by traveling through veins. **Veins** are blood vessels that carry blood towards the heart. From the right atrium, the blood travels into the right ventricle, and finally to the lungs, where the blood becomes **oxygenated**.

When blood becomes oxygenated in the lungs, it travels back into the heart, specifically the left atrium. After entering the left atrium, the oxygenated blood enters the left ventricle, where it ultimately is released back to the body by traveling through arteries. **Arteries** are blood vessels that carry blood away from the heart.

In summary, veins and the right side of the heart are used to carry deoxygenated blood, while arteries and the left side of the heart are used to carry oxygenated blood.

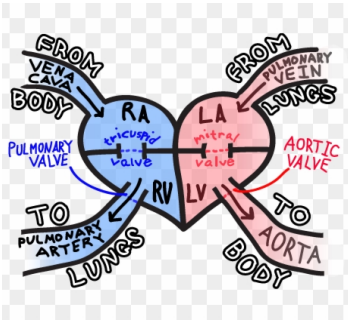

Figure 1. Diagram of directional blood flow in the heart.

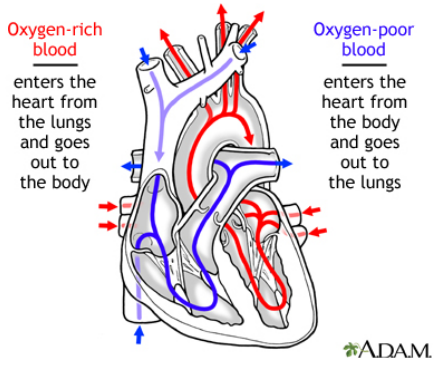

Figure 2. Anatomically correct with directional flow of blood.

Background for Mentors

Module 3

- Heart Chambers
- Backward Flow

The heart consists of four **chambers**, two atria (upper chambers) and two ventricles (lower chambers). There is a valve through which blood passes before leaving each chamber of the heart. The valves prevent the backward flow of blood. These valves are actual flaps that are located on each end of the two ventricles (lower chambers of the heart). They act as one-way inlets of blood on one side of a ventricle and one-way outlets of blood on the other side of a ventricle.

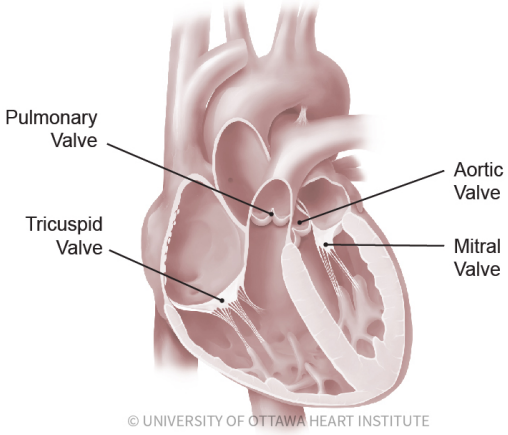

Figure 1. Diagram valves in the heart.

Mitral valve regurgitation is a heart valve condition in which the flaps of the mitral valve do not close properly, causing a **backward flow** of blood back to the heart.

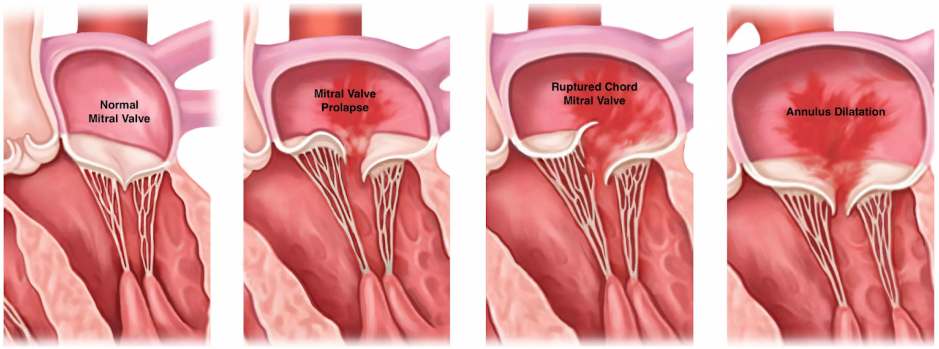

Figure 2. Examples of dysfunctional mitral valves

Introduction

The heart is one of the most important organs as it serves as the power supply for all bodily functions. It provides oxygen as well as other nutrients through the bloodstream, and if that blood supply does not reach its destination, it can quickly die.

Concepts to Introduce ● Talking about how the human body can be thought of as a robot where the brain is the actual computer that tells the body what to do, and the heart serves more like the battery. So if their battery stops working, the entire body stops running. ○ It also generates its own electricity to power the "pumps"	**Questions to Pique Interest** ● If the heart works as the power supply to give nutrients to the rest of the body, how does it receive its own nutrients/ power? ● What do you think causes the "lub-dub" feeling in the heart?
Scientists, Current and Past Events ● Christiaan Barnard (1967) performed the world's first human to human heart surgery ● Anthony Adducci (1937) is the inventor of the world's first lithium battery powered pacemaker	**Careers and Applications** ● Cardiologist: Doctor who studies and treats diseases and conditions relating to the heart. ● Cardiothoracic Surgeon: A Surgeon that specializes in the surgery with anything related to the chest, including the lungs and chest.

Module 1: Listen to my heart-beat beat beat!! ❤️‍🔥

Mentees will create a stethoscope out of tubing, tape, and a funnel. We will demonstrate what a real stethoscope looks and functions like, and then help mentees create a rudimentary model of this device. Mentees can use this to listen to their own/each other's' heartbeats.

Teaching Goals	**Materials**
1. **Heart rate:** Number of times the heat beats per minute. 2. **Stethoscope:** A medical instrument for listening to the rhythm and rate of the heartbeat. 3. **Heartbeat/Pulse:** A rhythmic contraction and relaxation of the heart's muscle.	• Plastic tube per mentee* • Balloon • Electric tape

Procedure

1. Split the class into two groups (they will rotate)
    a. Group 1: Testing radial and carotid pulse
    b. Group 2: Building a stethoscope

Group 1: Testing Radial and Carotid Pulse

2. *Radial Pulse:* Instruct mentees to apply just enough pressure between their wrist bone with two fingers (index and third finger)
3. Set a timer for 15 seconds and ask mentees to write down how many times they felt their pulse (x4 for bpm)
4. *Carotid Pulse:* Instruct mentees to place two finger (index and 4rd finger) on their neck, to the side of their windpipe
5. Repeat step 3

Figure 1: *2 ways to check pulse*

Group 2: Building a Stethoscope

6. Over the top of the funnel with a balloon
    a. Cut the end of a balloon, and then pull it over the large opening of the funnel
7. Use the electric tape around the balloon to hold it in place (if needed, but recommended)
8. Stick the end of the funnel into the plastic tube
    a. Tape the funnel and tube to secure both materials in place
9. Repeat steps 1 and 2
10. Tape the 2nd matching funnel to the other end of the tube
11. Ask the students to do jumping jacks for 1 minute
    a. This will race their heart beat so their heart rate is easier to hearth through the stethoscope
12. Instruct the students to place one side of the funnel against their ear and the other over their heart
13. Repeat step 3

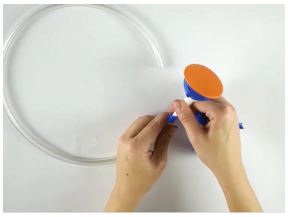

Figure 2: *Step 1-3*

Figure 3: *Finishing product*

Module 2: The Lengths I Would Go To For Some Oxygen

Mentees will be learning about the path that oxygenated/deoxygenated blood follows within the body. Mentees will be assigned to different parts of the heart. Blue and red beads will be used to represent deoxygenated blood and oxygenated blood, respectively, and mentees will figure out which part of the path the “blood” should go to next.

Teaching Goals	**Materials**
1. **Veins:** blood vessels that carry blood away from the heart 2. **Arteries:** blood vessels that carry blood towards the heart 3. **Oxygenated blood:** blood coming from the lungs to the body 4. **Deoxygenated blood:** blood coming from the body to the lungs 5. **Circulation:** blood follows a cycle that consists of the heart, lungs, and body to provide oxygen to the body	• Beads (One red, one blue per 6 mentees) • Flashcards (one per mentee)

Procedure

1. Mentees will be put into groups of 6
2. Each mentee will be given a card labeled any of the following: Body, Right Atrium, Right Ventricle, Left Atrium, Left Ventricle, Lungs
    a. There should not be any repeats of a card in each group!
3. Start by giving a blue bead (representing deoxygenated blood) to the mentee holding the “Right Atrium” card
4. Mentees should pass the blue bead to the right ventricle, then the lungs
5. At the lungs, the blue bead should be switched out to with a red bead
6. After the beads have been switched, pass the red bead from the lungs to the left atrium, then the left ventricle, then the body.
7. Once the bead has been passed to the body, switch the red bead with a blue bead, and repeat the cycle by passing the blue bead to the right atrium

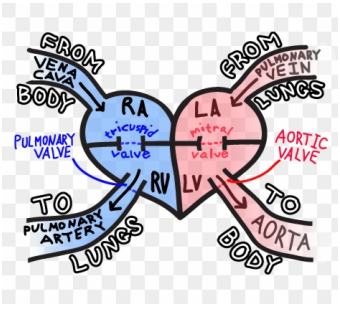

Figure 1. Diagram of directional blood flow in the heart.

Classroom Notes

Any additional tips for mentors to make their lives easier? A hint about a certain way to build something? A shortcut? What to do if a student is struggling with something?

Module 3: Heart-y Potter and the Chamber(s) of Secrets

In the module, students will create a model of the heart to understand its functionality.

Teaching Goals	**Materials**
1. **Heart Chambers:** the four compartments through which blood passes in the heart, connected by valves 2. **Backward Flow**: the case in which the valves are nonfunctional in the heart, causing blood to flow backwards	• Plastic Cups (3 per table group) • Balloons (1 per table group) • Toothpick (1 per table group) • Straws (2 per table group) • Water • Red food coloring • Paper towels

Procedure

1. Fill two cups with the water. The cups represent the heart chambers, and the water is the blood.
2. Cut the neck of a balloon off, and stretch the balloon over the top of one cup until it creates a taut membrane. In the cup without the balloon cover, add two drops of red food coloring and mix.
3. Poke two holes in the balloon using the toothpick.
4. Put one straw in each hole. One of the straws should go from one cup to the other. The other straw should point into a bucket.
5. Squeeze the cup of water with the balloon into the bucket and point out to students how it travels in one direction, demonstrating the importance of valves in blood flow through the heart. The water is initially clear, but turns red as you keep squeezing, showing its flow.
6. Explain to students that the squeezing represents the contraction and relaxation of the heart's compartments, without which blood couldn't flow.

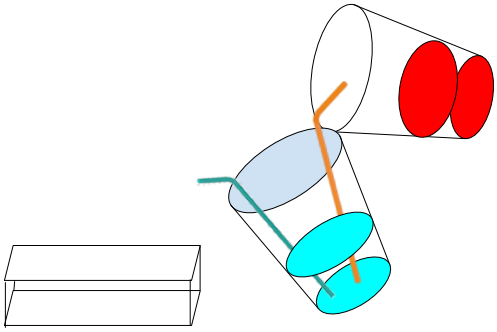

Figure 1: *Picture of finished build*

7. Ask students to recall what the different objects in our experiment represent.
8. Remove the second cup and squeeze, showing how water comes out through both straws and there is backward flow.

Classroom Notes

Have a bucket closeby for pouring the water from your device.

Conclusion

Talk about the key points and how the blood flows through the heart as well as ask what the blood does.

References

- Add references in case your mentors want additional information!
- Title of Source, Author, Organization. http://www.example.com/

Summary Materials Table

Material	**Amount per Site**	**Expected $$**	**Vendor (or online link)**
Mini Plastic Funnel	2 per student	$15	Funnel
Plastic Tubing	1 per student	$30	Amazon
Straws	10	0	bechtel
Balloons	2 per student	0	bechtel