



## An 🍎 a Day Keeps the Premeds Away

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**Field(s) of Interest:** Biology, Biomedical Engineering, Medicine

### **Brief Overview (1-3 sentences):**

Mentees will be given an overview of the tools that doctors use on a day to day basis along with hands-on activities.

### **Agenda:**

- Introduction (5 min)
- Module 1: It's getting hot in here (so hot) (10 mins)
- Module 2: Are you Atrial Fibrillation... (25 mins)
- Module 3: Shots! Shots! Shots shots shots shots! (15 mins)
- Conclusion (5 min)

### **Main Teaching Goals/Key Terms:**

- Temperature
- Thermometer
- Fever
- Vaccine
- Syringe
- Intramuscular Injection
- Subcutaneous Injection
- Stethoscope
- Heart Rate
- Cardio

### **Mentor Development Goals:** *\*Written by Bradley Louie Saito and Carina Kim\**

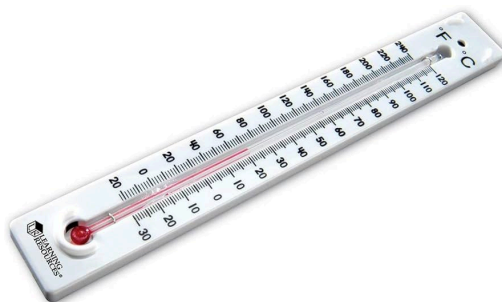
- **INFECT** your **MENTEES**... with enthusiasm! 🤒💉
- Flu's Clues
- Listen to the **heart beat**... of site
- From RSF to the couch... bringing it back
- Inject safety into site!!
- Trypanophobia... and other fears

## Background for Mentors

### Module 1

- Thermometer
- Temperature
- Fever

**Temperature** is a measure of the amount of heat in a certain object. We assign numbers to that heat in order to understand its heat content. Temperature can be measured using a **thermometer**. Although most thermometers today are digital, in the past, they were calibrated using mercury.



**Figure 1:** A traditional mercury thermometer

Like all fluids, Mercury expands as temperature increases, and decreases in volume when temperature decreases. Older thermometers correlated the length that Mercury traveled with a certain temperature, allowing us to get an accurate reading. Although mercury is a great fit for thermometers due to its ability to move significantly and liquid state, it is also highly poisonous, so a water/rubbing alcohol mixture will be used instead.



**Figure 2:** Fevers are usually signs of your body trying to fight off illnesses

Normally, the human body likes to maintain a temperature around 98.6°F. However, when unwanted viruses or bacteria get in the body, one's body will raise its temperature to make the environment uncomfortable for these viruses. This is commonly known as a **fever** when it reaches 100.4°F. Although fevers are used to fight off illnesses, having a fever for too long or having too high of a fever can damage our brains and bodies.



## Module 2

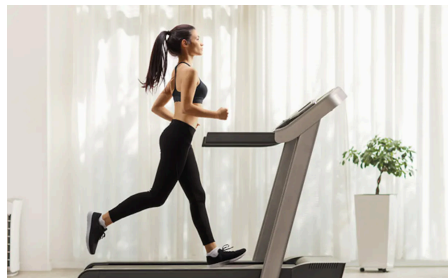
- Stethoscope
- Heart Rate
- Cardio

The heart is the central muscle for keeping your body alive and moving. Doctors want to make sure that the heart is beating consistently and at normal rates. In order to better hear the heart, **stethoscopes** are used to amplify the sound made by the heart's contractions. Hearing the heartbeat is important, as irregular heartbeats can imply bigger issues such as cardiac arrest.



**Figure 1:** A typical stethoscope used by doctors

Using stethoscopes can also help determine the speed at which the heart beats. This is known as the **heart rate**. The average resting adult heart rate ranges from 55-85 beats per minute (bpm). For children ages 7-9, the average resting heart rate sits at about 70-110 bpm.



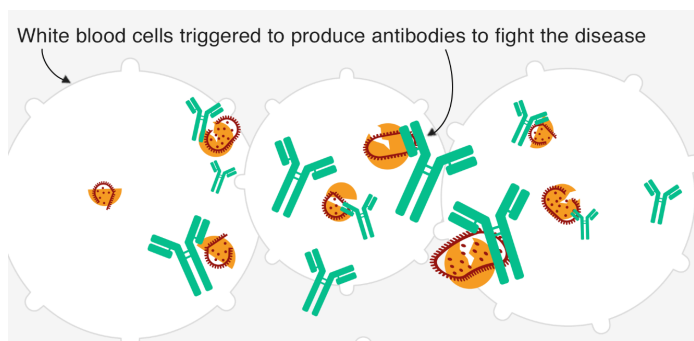
**Figure 2:** Running is a common example of cardio

Although these rates are measured when people are “resting” or not moving around, heart rates will increase as people move around more. The heart beats in order to deliver oxygen to the rest of the body, so when the body requires more oxygen, the heart rate will increase. This increase especially happens when someone performs **cardio**, a type of exercise specifically aimed towards heavy movement in order to increase heart rate.

### Module 3

- Vaccine
- Syringe
- Intramuscular injection
- Subcutaneous injection

**Vaccines** are a common way to prevent individuals from contracting viruses. Our body has white blood cells in order to fight unwanted diseases. Unfortunately, viruses such as Influenza or COVID-19 are able to slip by unnoticed and infect the body. Vaccines introduce a dead or heavily damaged version of the virus to the body so that the white blood cells can “learn” about these viruses. Therefore, next time a virus gets in the body, the white blood cells can recognize and attack them.



**Figure 1:** White blood cells “learn” how to fight diseases through the use of vaccines

Vaccines are commonly administered using **syringes**. The vaccine is pulled up into the container using a very thin needle before being administered into a person’s arm. Syringes are able to pull up fluid by creating a vacuum when the plunger (back part) is pulled backwards. Similarly, the fluid can be administered by pushing down on the plunger.



**Figure 2:** Vaccines can be administered into muscle or fat, usually in the arm

There are two common sites that vaccines are administered to. The first, known as **intramuscular injection**, uses a longer needle in order to deliver the vaccine directly to the muscle. This results allows for the vaccine to work faster, but it can also be more painful. **Subcutaneous injections** use a much shorter needle which does not go as far into the skin. However, the vaccines will not be absorbed as quickly.

## Introduction

Why is this lesson important to teach? What is interesting or applicable about this lesson? Work with your MD partner to *provide mentors with various options to introduce your lesson here*. If you would like to put a demo here to open the lesson, then label this section as Module 0 and create a module page like the others.

<b>Concepts to Introduce</b> <ul style="list-style-type: none"><li>• Why people feel hot when sick<ul style="list-style-type: none"><li>◦ Make sure to highlight that our body is fighting back!</li></ul></li><li>• How vaccines work</li><li>• Treating vs preventing illnesses</li><li>• The functions of the heart<ul style="list-style-type: none"><li>◦ Why is it important to hear the heart beating?</li></ul></li></ul>	<b>Questions to Pique Interest</b> <ul style="list-style-type: none"><li>• Have you been to a doctor's appointment before? What do you have to do?</li><li>• How do doctors know that you are healthy? What might they check if you feel sick?</li><li>• Have you ever gotten sick before? What can you do to avoid feeling sick?</li></ul>
<b>Scientists, Current and Past Events</b> <ul style="list-style-type: none"><li>• After COVID resulted in a worldwide shutdown, scientists were able to create a vaccine within the next year. This helped reduce deaths greatly, as well as allow more safe contact between individuals.</li><li>• Smallpox used to be a deadly disease commonly affecting children. However, thanks to widespread vaccination, the disease was able to be eradicated.</li></ul>	<b>Careers and Applications</b> <ul style="list-style-type: none"><li>• Biomedical Engineer<ul style="list-style-type: none"><li>◦ Invents tools and devices to be used by doctors in the medical field</li></ul></li><li>• Pediatrician<ul style="list-style-type: none"><li>◦ A type of doctor who specializes in child care</li></ul></li><li>• Microbiologist<ul style="list-style-type: none"><li>◦ Scientists who study miniscule organisms, such as viruses</li></ul></li></ul>

## Module 1: It's getting hot in here (so hot 🔥)

Summarize the module here. What will kids be doing? How does this module teach/show that? **If the activity is a demo, build, individual, or group activity, please specify here.**

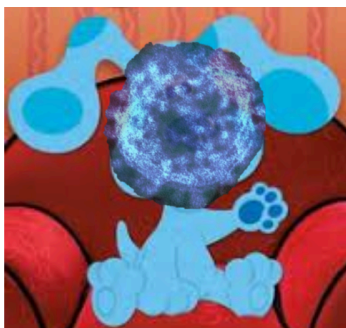
### Teaching Goals

List and explain/define the 1-3 main concepts you want to focus on *for this specific module*. For example...

1. **Thermometer:** A tool used to measure the temperature of an object
2. **Temperature:** How hot or cold something is
3. **Fever:** A high (100.4°F) body temperature, common with the cold or flu

### MD Goals

**INFECT** your **MENTEES**... with **enthusiasm!** - Have mentees talk about times when they have been sick. Let them be their own **VIRAL INFLUENZERS!** Mentees are often excited to talk about *their own lives*. Bring their stories into the lesson to create infectious engagement! **GET EVERYONE INFECTED**



**Flu's Clues** - Make connections to events in mentees' lives. How do doctors use **clues** 🧩 such as fever, symptoms, etc. to figure out how healthy a patient is? Use the mentees' input as clues to steering the lesson! You can **veer off to adjacent topics** related to symptoms, doctor's visits, and temperature.

### Materials (Per group)

- 1 water bottle
- 1 container of play-dough
- 1 straw
- Food dye
- 1 hand warmer per site
- Rubbing Alcohol
- Water

### Different Methods for Teaching

Give a couple of different teaching techniques that you think would be the most effective way

for mentors to teach this module/the different teaching goals. For example...

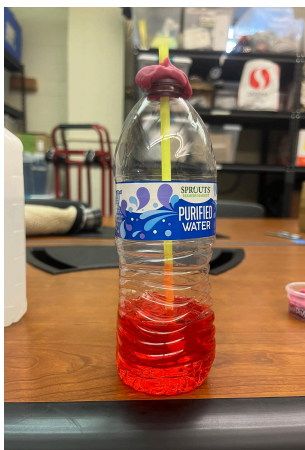
1. **Thermometer:** Although most mentees are familiar with thermometers, some may have never seen a traditional mercury one. Feel free to pull up a picture to show them what this looks like before starting the activity
2. **Fever:** Ask students if they have ever been sick before. Did their body feel hot? This is most likely because they had a fever, and their body temperature was too high.

### Procedure

1. Take the water bottle, and fill it  $\sim\frac{1}{4}$  of the way with equal parts rubbing alcohol and water
2. Add a few drops of food dye to the water
3. Take the straw and surround it with modeling clay, leaving the top uncovered, then insert it into the water bottle so that it does NOT reach all the way to the bottom
4. Your thermometer is now made! Using a hand warmer/your hands, heat the outside of the bottle
5. Watch what happens to the liquid inside the straw. It should travel upwards!



**Figure 1:** Make sure to keep a seal around the straw or else this will not work!



**Figure 1:** Finished product

### Classroom Notes

Any additional tips for mentors to make their lives easier?

## Module 2: Are you Atrial Fibrillation? Cause you just made my heart skip a beat <3

Summarize the module here. What will kids be doing? How does this module teach/show that? **If the activity is a demo, build, individual, or group activity, please specify here.**

### Teaching Goals

List and explain/define the 1-3 main concepts you want to focus on *for this specific module*. For example...

4. **Stethoscope:** A device used to better hear heartbeat and breathing
5. **Heart Rate:** How often a heart beats. Typically measured in beats per minute (bpm)
6. **Cardio:** A type of physical activity which typically uses lots of movement and increases the heart rate

### MD Goals

**Listen to the heart beat... of site** - Pay attention and be mindful of the activity level of site so that the exercise doesn't overwhelm the kids or make the site rowdy 🤖. Based on what you observe, you can make adjustments to the activity.



**From RSF to the couch... BRINGING IT BACK** - The kids will be excited after all the exercise! RSF BADDIES Make sure to bring back their focus to the lesson so that you can continue with the module. Be a COUCH POTATO 🥔. Allow the kids to settle in and get their energy out. You can try using a call-and-answer or ask what they learned.



### Materials

- 1 piece of plastic tubing per group
- Tape
- 2 funnels per group
- 1 balloon per group
- Space for writing (whiteboard, big piece of paper, etc.)

### Different Methods for Teaching

Give a couple of different teaching techniques that you think would be the most effective way for mentors to teach this module/the different teaching goals . For example...

3. **Stethoscope:** Ask mentees what doctors place on their heart when they go for a checkup. Additionally, feel free to draw/pull up a picture of an actual stethoscope, as many kids might know the object but not the name.
4. **Heart Rate:** For young (K-1) sites, don't worry too much about counting the amount of heart beats. Instead, try to see if the kids notice the hearts beating faster than before.
5. **Cardio:** This is just a fancy word for moving around a lot! Things like running, dancing, or jumping can all count as cardio.

## Procedure

### Part 1:

1. Each group will receive plastic tubing, 2 funnels, tape, and a balloon
2. Tape the two funnels on either side of the tubing.
3. On one side of the tubing, cover with a balloon
4. This is like a makeshift stethoscope! To mimic a heartbeat, have kids tap on the balloon side while holding the other side up to their ear.

### Part 2:

1. Mentees will be trying different activities to test their impact on heart rate
2. Have one or two mentees per group relax. This can be by sitting/lying down, getting quiet, etc.
3. After doing this for about a minute or so, have students place a hand on their pulse and count the number of times their heart beats in the span of 15 seconds (mentors might want to do the time tracking to make it easier for mentees)
4. If the site is advanced, have students multiply this number by 4 to achieve the bpm
5. Record this number on the board under the category "resting"
6. Repeat steps 3-5 but with walking, and then cardio/exercise. For the latter, encourage students to go outside and run around (weather permitting). Alternative activities can include jumping jacks or burpees
7. Compare the numbers in each of the 3 categories for each group, is there an



**Figure 1:** Tape the funnels to the tubing to make the stethoscope

A hand-drawn chart on a piece of paper. The chart has three columns labeled 'Rest', 'Walk', and 'Run' at the top. On the left side, there are three rows labeled 'Group 1', 'Group 2', and 'Group 3'. The chart is a 3x3 grid of boxes for recording data.

	Rest	Walk	Run
Group 1			
Group 2			
Group 3			

**Figure 2:** An example of what the chart might look like

increase?	
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**Classroom Notes**

Any additional tips for mentors to make their lives easier?



## Module 3: Shots! Shots! Shots shots shots shots!

Summarize the module here. What will kids be doing? How does this module teach/show that? **If the activity is a demo, build, individual, or group activity, please specify here.**

### Teaching Goals

List and explain/define the 1-3 main concepts you want to focus on *for this specific module*. For example...

7. **Vaccine:** A substance which allows one's body to recognize and fight against certain viruses
8. **Syringe:** A tube which can push/pull fluids to a desired location
9. **Intramuscular Injection:** When medicine is injected into part of a muscle in order to be absorbed faster
10. **Subcutaneous Injection:** When medicine is injected into the fat above a muscle

### MD Goals

**Inject safety into site!** - There are only a few syringes and the students may all be eager to use them! Assign an order to take turns among the mentees, so they don't all fight and grab for the materials.



### Trypanophobia... and other fears -

Students might be afraid of going to the doctor or needles (trypanophobia). Let kids know that going to the doctor is good for your health. For this activity, the syringes represent needles, which aren't too scary after all Address any fears with the mentees!

Acu**PUNCH**ture those scary fears away! 🦊💪🦊

### Materials

- 1 tiny plastic container per student
- 1oz clear glue per student
- ~¼ oz slime activator per student
- 1 Stir rod per student
- ~2-4 syringes per site
- Food dye (1 per site)
- 1 Plastic cup per group
- 1-2 pipettes per site

### Different Methods for Teaching

Give a couple of different teaching techniques that you think would be the most effective way for mentors to teach this module/the different teaching goals . For example...

6. **Vaccine:** Vaccines can act as “teachers” for the body in order to make it aware of sicknesses. Think of it like learning a certain multiplication fact after a teacher teaches it to you.
7. **Syringe:** Many kids might be scared of getting shots. Be sure to assure them that no

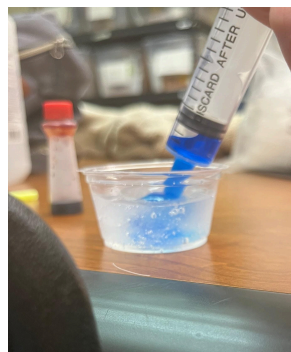
actual needles will be used during this activity!

### Procedure

6. Each student will receive a small, clear container, as well as some clear glue
7. Each mentor should pipette about 3-4 pipettes (6-8mL) of activator into each mentee's container
8. Using the stir rods, mix together the glue and activator until a jello-like solution forms
9. Using the syringe, pull up a small amount of food dye in water
10. Insert the straw into the jello, and release the dye into the jello.



**Figure 2:** Pull up a small amount of dye into the syringe



**Figure 3:** Finished product

### Classroom Notes

Any additional tips for mentors to make their lives easier?

## Conclusion

Ask mentees what devices they learned about and why they are used. Make sure to connect it back to doctor's visits in order to (hopefully) make them less scary!

## 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)
Extremely Specific Item Name	1 per student		<a href="#">Amazon</a>