### Heart to Heart

**Discover How Hard Your Heart Works with Different Types of Exercise.**

The heart is the hardest working muscle in the human body, pumping out oxygenated, nutrient-rich blood with every beat. But no matter how hard this muscle works each second, it still needs exercise to stay strong. Hearts that get regular exercise can pump more blood with less strain. In this activity, youth will compare ways to measure heart rate (and build their own stethoscopes!) to learn how exercise affects heart rate.

#### You’ll Need (per small group)

**Part 1**
- 18” of vinyl tubing
- 1 empty plastic water or soda bottle (rigid bottles work better)
- scissors
- duct tape
- stopwatch
- paper and pencil
- disinfecting wipes
- optional: image of circulatory system
- optional: heart rate monitor

**Part 2**
- stethoscope from part 1
- optional: various types of exercise equipment (e.g., jump rope, hula hoop, basketball)

**2 Hours**

#### Part 1
**Find Your Heart Rate**

1. **Introduce heart rate.** You may want to show an image of the circulatory system. Ask youth what the purpose of the heart is. (To pump oxygenated blood out to the body.) What is a heart rate? (E.g., The rate at which the heart beats, contracting and squeezing out blood).

2. **Brainstorm.** Ask youth to list all the methods people use to measure heart rates. (E.g., pulse, stethoscope, heart rate monitor).

3. **Experiment with the pulse method.** Ask youth how they could find their resting heart rate by measuring their pulse. Find a pulse by placing an index and middle finger on the inside of the wrist, beneath the palm of the hand, and pressing down firmly. Count the number of beats for 10 seconds and multiply this by 6 to get the number of beats per minute (bpm). Sit quietly for a few minutes before taking your measurement. For better accuracy, do three trials, record the results, and find your average resting heart rate.
4. **Build a stethoscope.** Break into small groups and think about how to design a stethoscope using the materials provided. Remind them to make a plan before diving in. One approach is to cut off the bottom third of a water or soda bottle, then insert the vinyl tubing into the mouth of the bottle and secure it with duct tape. (See image below.) Youth can then place the bottle on the chest and move it around to find the spot where the heart beats the loudest. Youth should take turns listening and recording each other’s resting heart rate. Do three trials, record the results, and find your average resting heart rate. Make sure that youth are respectful of one another and ask permission before taking the measurements.

**SAFETY FIRST:** Wipe off the “earpiece” of the tubing with disinfecting wipes before reusing.

**POINTER:** If youth are struggling, ask questions to help them think about their process. What factors could help them hear better? (reduce background noise, find the proper placement, place a hand over their other ear to eliminate excess noise) To help find the proper placement, have the “patient” run in place for a few seconds before testing. Tell youth to listen for the “lub-dub” sound—the heart valves closing to prevent blood from flowing backward.

5. **Compare.** How do the heart rates from these two methods compare? If you have a heart rate monitor available, try using it. How accurate are the pulse and stethoscope methods compared to the monitor?
Part 2
Explore How Exercise Affects Heart Rate

6. Question. Divide youth into small groups and deliver the SciGirls Challenge: Explore how heart rate changes with activity. At least one youth in each group will need to exercise, so you may want to group youth who are comfortable exercising with youth who aren’t.

To learn how activity influences a horse’s heart rate, watch Horsing Around (Test).

SAFETY FIRST: Anyone with heart or respiratory conditions should not exercise. Youth who cannot exercise should be in charge of collecting data.

7. Plan. Ask youth how they think heart rate changes with activity. Which activities would raise your heart rate the most? Design your own experiment to test. Here are some things to consider:
- types of exercise (running, walking, jumping jacks, jumping rope)
- length of time spent doing each activity
- method for measuring heart rate (pulse, stethoscope, heart rate monitor)
- recovery time between each activity
- how many people will participate

8. Encourage predictions. Predict which type of exercise will increase heart rate the most or rank activities from highest to lowest expected heart rate.

9. Find your maximum heart rate. Find your heart rate zone. Calculate your approximate maximum heart rate (the upper limit your heart can handle while exercising) by using the following equation:

\[
\text{maximum heart rate} = 220 - \text{age}
\]

10. Find out how hard you worked. To calculate how hard the heart is working during each kind of exercise, find the intensity level with this equation:

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\text{intensity level} = \left( \frac{\text{heart rate after exercise}}{\text{maximum heart rate}} \right) \times 100\%
\]

POINTER: Knowing your target heart rate zone helps you get the most benefit from exercise with fewer injuries. This zone is 50% to 85% of your maximum heart rate. If you exercise at less than 50% of your target heart rate, you may not be working hard enough. Moderate activities reach 50% to 70% of your target heart rate. If your body is conditioned, you can engage in vigorous activities at 70% to 85% of your target heart rate. The American Heart Association recommends adults engage in moderate activities 30 minutes a day, five days a week.

11. Communicate results. Have each group create a presentation of their data. How did results compare to predictions? Which type of exercise raised your heart rate the most? Why? Where does this level fall in your heart rate zone?

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