

# SciGirls

[pbskidsgo.org/scigirls](http://pbskidsgo.org/scigirls)



## SciGirls Live Healthy Activity Guide



Izzie

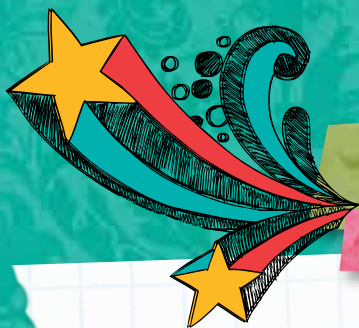


Watch companion videos on  
**Season 1** DVD or online.



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# SciGirls Live Healthy

With childhood obesity reaching alarming levels, healthy living is an important topic for kids and the adults who influence them. Collectively, the activities in this book emphasize the importance of making healthy choices by increasing girls' awareness of nutrition and the workings of the human body.

These activities are based on the national PBS Kids television series, **SciGirls**, featuring groups of middle-school girls investigating STEM (science, technology, engineering, and math) projects that are personally meaningful.

You'll notice these activities:

- follow the Scientific Inquiry Process (outlined on page 2),
- incorporate the **SciGirls Seven** strategies for engaging girls in STEM (outlined on page 3),
- connect to **SciGirls** videos and mentors from the show, and
- align to national standards.

All the activities can be used alone, but we encourage you to enhance your girls' experience by using video to incorporate SciGirls as models and mentors. Your girls can even take these activities to the next level by logging on to the **SciGirls** website, at [pbskidsgo.org/scigirls](http://pbskidsgo.org/scigirls), to create profiles and share their investigations with the online community.

Before you begin these activities, note that we understand personal health issues can be sensitive for young girls and we take that into consideration. Being healthy isn't about size or shape, but about being active, eating right, and being yourself!

Get fit, be informed, and live healthy. Be a SciGirl!

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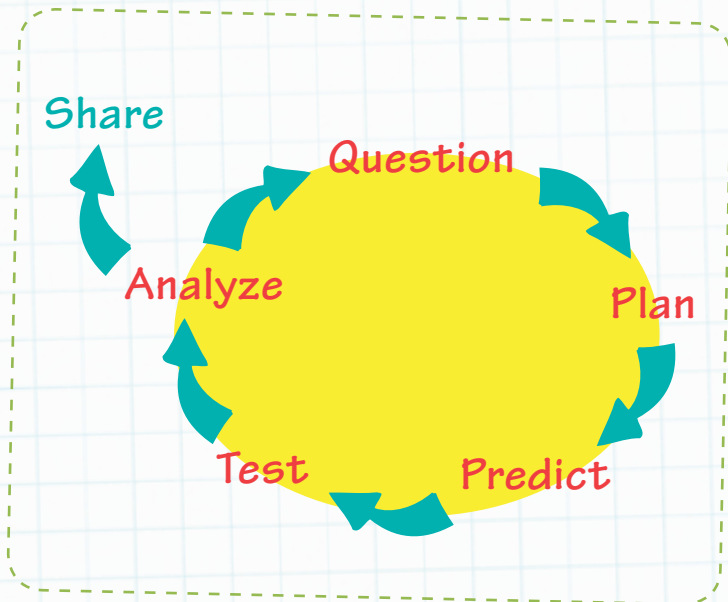
Visit [pbskidsgo.org/scigirls](http://pbskidsgo.org/scigirls) for videos and projects.



# SciGirls Want to Know

## Scientific Inquiry Process

Here is the **SciGirls'** scientific inquiry process, the same steps all scientists use when tackling a new problem. Encourage your girls to follow these steps as they approach each **SciGirls Challenge**.



**Question** The **SciGirls Challenge** lays out the initial question for investigation, but girls might come up with new questions as they work their way through the process. Steer them away from questions that have simple yes/no answers toward ones they can answer through their own investigations.

**Plan** Research ideas by consulting experts, reviewing books, browsing the Internet, and then brainstorming with others. Each group should choose one idea and plan an investigation that tests one variable at a time, includes multiple trials, and has a clear way to measure results.

**Predict** This important step is sometimes forgotten. Ask girls what they think will happen before diving in. It's OK to disagree. Different predictions make the experiment more interesting and discussing predictions can improve critical thinking skills.

**Test** Let the experimentation begin! Be sure to encourage girls to write down every observation and result in their science journals.

**Analyze** After each test, analyze the data. A failed test can still lead to important results—and new ideas. Encourage girls to calculate averages, organize their data in a table or chart, and discuss. This evaluation sometimes raises new questions and starts the entire process over again.

**Share** Encourage girls to be creative when making charts, graphs, or models to share their results. Have them use these visual aids to tell an effective story. Allow time for feedback and discussion, which could open new doors for future investigations.



Throughout this guide, the projector points you to videos on the companion DVD. Or you can watch online at [pbs.org/teachers/scigirls](http://pbs.org/teachers/scigirls).





# The SciGirls Seven

## Strategies for Engaging Girls in STEM

The **SciGirls** approach is rooted in research on how to engage girls in STEM. A quarter of a century of studies have converged on a set of common strategies that work, and these have become **SciGirls'** foundation—aka the **SciGirls Seven**. All the activities in this booklet were created with the **SciGirls Seven** in mind and incorporate as many strategies as possible. We even mark the use of select strategies within each activity. (Look for superscript numbers and refer back to this page.) For additional information, please see our introductory booklet, *SciGirls Seven: How to Engage Girls in STEM*, which includes tips for implementing these strategies. You can download it for free at [pbs.org/teachers/scigirls](https://pbs.org/teachers/scigirls).

- 1. Girls benefit from collaboration, especially when they can participate and communicate fairly.**
- 2. Girls are motivated by projects they find personally relevant and meaningful.**
- 3. Girls enjoy hands-on, open-ended projects and investigations.**
- 4. Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents, and preferred learning styles.**
- 5. Girls' confidence and performance improves in response to specific, positive feedback on things they can control—such as effort, strategies, and behaviors.**
- 6. Girls gain confidence and trust in their own reasoning when encouraged to think critically.**
- 7. Girls benefit from relationships with role models and mentors.**

Visit [pbs.org/teachers/scigirls](https://pbs.org/teachers/scigirls) for more activities!



## Activity 1

# This Bitter Be Good



### IS YOUR DISLIKE OF VEGGIES GENETIC?

Some people like broccoli and some people hate it. There may be a scientific reason! Vegetables in the mustard family contain a bitter compound called phenylthiocarbamide (PTC). Specific human genes determine whether a person can taste this bitterness. So for those who can taste PTC, you can make a scientific case for your distaste!

**SMART START:** Find out what food allergies kids have and choose your vegetables accordingly. Wash and cut all vegetables into bite-sized pieces.

Here's how:

- 1. Survey.** Take a survey to see whether your girls like or dislike each of the vegetables chosen for the experiment and record the results. <sup>2</sup> Explain that some people may dislike certain vegetables because they taste bitter, but not everyone can taste this bitterness.
- 2. Design a taste test.** Break into small groups <sup>1</sup> and present the **SciGirls Challenge:** Determine whether tasting the bitter compound PTC (phenylthiocarbamide) influences which vegetables a person likes. Have girls brainstorm ideas for how to conduct a blind taste test. <sup>3</sup> They will need to come up with a way to score the level of bitterness in each vegetable (on a scale from 1 to 10, by judging facial expressions or verbal responses). <sup>4</sup>

Watch girls design their own taste test on the *SciGirls Get Healthy* DVD. (Select Science Cooks! Brainstorm & Experiment.) <sup>7</sup>

### You'll Need:

- ♦ vegetable with PTC (e.g., broccoli, cauliflower, collard greens, kale)
- ♦ vegetable without PTC (e.g., carrots, yellow, orange or red bell peppers)
- ♦ knife and cutting board
- ♦ paper towels
- ♦ blindfolds (1 per small group)
- ♦ paper and pencils
- ♦ PTC paper (available from Carolina Biological Supply Company, [carolina.com](http://carolina.com))
- ♦ water and/or juice (for each girl)



- 3. Test for PTC sensitivity.** Hand out a strip of PTC paper to each girl and explain that it contains the bitter compound found in one of the vegetables they tested. Have them touch the strip to their tongues to see if they can taste it. The bitterness can be overwhelming so have something (like juice) available to drink!
- 4. Evaluate results.** Compile data into graphs or charts. Did girls who tasted the PTC rate the broccoli as more bitter? Did these same girls originally say they disliked broccoli? Did any girls who can't taste PTC dislike broccoli?

**POINTER:** It's OK if your results aren't perfect. Many factors affect bitterness. Collard greens and kale, especially, can be bitter, even to those who can't taste PTC. This is all part of science! Discuss why taste tests can be challenging. <sup>6</sup>





## Activity 2

# Breathing Room

### PUT YOUR LUNGS TO THE TEST IN THIS BREATHTAKING ACTIVITY.

How often do you pay attention to your breathing? For some people, breathing isn't always easy. Out of every 10 kids, 1 to 2 suffer from asthma. During an asthma flare-up, airways swell and narrow, trapping air. Kids may feel as if they are trying to breathe through a straw. Doctors use lung function tests to monitor people with asthma and find out how much air they can inhale and exhale.

Check for latex allergies before purchasing balloons. Kids with respiratory problems should not breathe through the straws or blow up the balloons, but they can help record measurements and collect data.

#### Here's how:

- 1. Experiment with breath.** Pass out the straws. Have girls stand up and breathe in and out. Now, have them repeat this while breathing through the straw. Ask girls how it made them feel. <sup>2</sup> Could they function all day while only breathing through the straw? (Some people describe asthma as "breathing through a straw.")
- 2. Question.** Divide the group into pairs. <sup>1</sup> Pass out the remaining materials and ask girls to think about how they could measure their lung capacity. <sup>6</sup> Then, give the **SciGirls Challenge**: How does the amount of air in

### You'll Need:

#### per small group

- ◆ string
- ◆ scissors
- ◆ ruler
- ◆ tape (any kind)
- ◆ paper and pencil
- ◆ optional: permanent marker

#### per girl

- ◆ balloon
- ◆ drinking straw

30-45  
min.

a balloon change as you vary the size of the hole you blow through?

- 3. Prepare your balloon.** Have each girl stretch her balloon and blow it up a few times to relax the material.
- 4. Test vital capacity.** Have girls stand up and inhale as much air as possible. Then, exhale forcefully into the balloon in one breath. (This measures the maximum amount of air that can be pushed out of the lungs, which is called the vital capacity.)

Visit [pbskidsgo.org/scigirls](http://pbskidsgo.org/scigirls) for videos and projects.



# Breathing Room continued



- 5. Measure.** To measure how much air this is, girls can pinch the balloon shut (not tying it!) and measure its circumference at the widest part using string and a ruler. Have girls do this three times and then find the average circumference. (See right.)

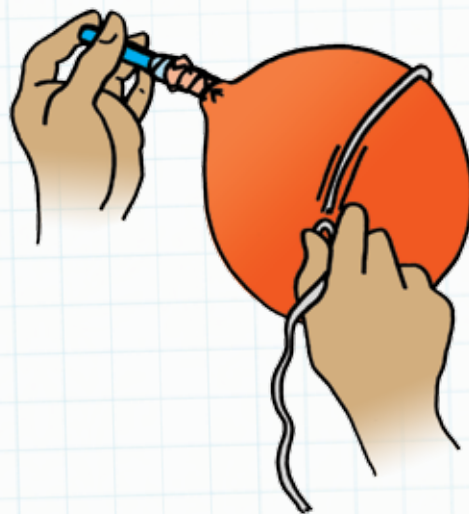
**POINTER:** Have girls use a permanent marker to draw a line where they measure the circumference. This way, they can measure at the same place over multiple trials.

- 6. Predict.** Now, have the girls cut a 4-in. piece of straw and insert it into the balloon opening. They should tape the balloon around the straw so no air can escape. Ask girls to make a prediction about whether the circumference of the balloon will increase, decrease, or stay the same when they try to blow it up now. <sup>6</sup>

- 7. Try it!** Tell the girls to inhale as much air as possible and exhale through the straw. Measure the circumference. Repeat two more

times, and find the average. How does this average circumference compare to the first one, without the straw?

- 8. Continue exploring.** Suggest that girls design an experiment to find out what other factors affect vital capacity besides asthma. For example, they might consider height, age, various postures (standing, sitting, lying down), gender, and fitness level. Be creative! <sup>3 4</sup>



Watch Madeleine shadow Dr. Beck at work on the *SciGirls Live Healthy* DVD. (Select Horsing Around: Mentor Moment.) <sup>7</sup>



**Mentor Moment** Dr. Jodene Beck is a veterinarian who loves horses, but it was actually her childhood dog combined with her love of science and medicine that drove her to the field. She inspires young girls by letting them shadow her at the clinic.



## Activity 3

# Take It in Stride

### GET STEPPING AND MEASURE YOUR WAY AROUND TOWN.

The *Physical Activity Guidelines for Americans* recommends that youth (ages 6 -17) engage in at least one hour of physical activity daily. When it comes to walking, studies show that for 6- to 12-year-olds, girls need 12,000 steps/day and boys need 15,000 steps/day to stay healthy. One fun way to get kids stepping is to measure stride length. It's an important factor for speed in sports, such as soccer, and can even help kids estimate distances without a ruler!

#### Here's how:

1. **Discuss steps and strides.** Ask girls if they know the difference between a step and a stride. (A step is the distance between the heel print of one foot to the heel print of the other foot. A stride is the distance from the heel print of one foot to the heel print of that same foot, or two steps.) How does distance traveled relate to a person's stride length?

$$\text{stride length} = \frac{\text{distance}}{\text{number of strides}}$$

2. **Plan.** Break into small groups <sup>1</sup> and give the **SciGirls Challenge:** Find a method to measure stride length. <sup>3</sup> It sounds simple, but there are many things to consider.

- ★ **Number of replicates** Stride length can change while walking, so replicates are important.
- ★ **Method** Girls could mark a set distance (e.g., 20 ft.) with tape and count the number of

### You'll Need (per small group):

- ♦ tape measure
- ♦ paper and pencil
- ♦ masking or duct tape

45  
min.

strides it takes to walk it; or they might pick a certain number of strides (e.g., 10) to do, then measure the distance covered. <sup>4</sup>

- ★ **Distance** The longer the distance, the more accurate the measurement.

Watch girls measure the stride length of a horse on the *SciGirls Get Healthy* DVD. (Select Horsing Around: Experiment). <sup>7</sup>

**POINTER:** Encourage girls to take a few steps to get into their "normal" stride before measuring.

3. **Calculate and test.** Ask each girl to calculate her average stride length and then choose a place to test it (e.g., soccer field, hallway, or playground). Have girls walk from point A to point B and count the number of strides. (Remind them that one stride equals two steps!) Then ask them to use their average stride length to calculate the distance. Compare results. Ask: How accurate were you?
4. **Continue exploring.** Can you figure out the distance you walk to school each day? To your friend's house? To walk the dog? <sup>2</sup> If you walked 12,000 steps each day, how many stride lengths is that? How far would you go?



# Science Cooks!



## WHIP UP A HEALTHY GRANOLA SNACK THAT TASTES GREAT, TOO!

Good nutrition is an essential part of maintaining a healthy lifestyle. Nutrients provide energy and are the building blocks our bodies need to function. Learning to make sound choices about food is an important life skill, one that can be practiced by looking at and understanding Nutrition Facts labels.

Be aware of any food allergies among your group, especially nut allergies. Feel free to add, subtract, or use other ingredients, but try to provide at least two choices for each ingredient category.



**SMART START:** Ask girls to bring in their favorite prepackaged snack and use these labels to help start a discussion on nutrition for Step 1.

For each ingredient you use in this activity, you will need to find nutritional information and the typical serving size. You can either photocopy labels directly from prepackaged foods or find this information on the Web from places such as [whfoods.org/sitesearch.php](http://whfoods.org/sitesearch.php) and [livestrong.com](http://livestrong.com). Simply type the ingredient name in the search bar.

## You'll Need:

- ◆ prebaked plain granola
- ◆ sticky sweetener: honey, corn syrup, maple syrup, brown rice syrup, agave nectar, molasses, peanut butter, almond butter (For nut allergies, try sunflower seed butter.)
- ◆ spices: cinnamon, ginger, nutmeg, allspice, pumpkin spice
- ◆ dried fruits: raisins, cherries, blueberries, pineapple, apricots, mangoes, figs, dates, currants, cranberries, banana chips, coconut (If nut allergies are an issue, buy bulk dried fruit rather than prepackaged.)
- ◆ nuts: almonds, macadamias, pistachios, pecans, walnuts, cashews, hazelnuts, Brazil nuts, pine nuts
- ◆ legumes: peanuts, soy nuts
- ◆ seeds: sunflower, pumpkin, flax, sesame
- ◆ other: crispy, puffed, or popped grains such as rice, wheat, and popcorn, and dark or milk chocolate chips
- ◆ bowls
- ◆ measuring cups and spoons
- ◆ stirring spoons, spatulas
- ◆ wax paper
- ◆ paper and pencils
- ◆ optional: computer, calculators, and cookie cutters





# Science Cooks! continued

Here's how:

**1. Introduce nutrition.** Start a discussion by using the labels from the foods the girls brought in. <sup>2</sup> Have girls make a list of the nutrients they know. (fat, protein, vitamins, minerals, fiber, sugar) Can they think of anything else to consider when choosing foods to eat? (calorie content, sodium, cholesterol) What makes a food healthy? (high in fiber, contains "good" fats in moderation, high in protein, loaded with vitamins) How healthy is the snack they brought in? Girls can learn more about nutrients by visiting [kidshealth.org/kid/stay\\_healthy](http://kidshealth.org/kid/stay_healthy) and selecting "Fabulous Food."

**2. Review nutrition labels.** Go over the main components of a Nutrition Facts label. (See below.) Or, for more in-depth information, visit The Kids Health website [kidshealth.org/kid/stay\\_healthy](http://kidshealth.org/kid/stay_healthy) and read "Figuring Out Food Labels."

**3. Identify the problem.** Ask girls to break into small groups <sup>1</sup> and present the **SciGirls Challenge:** Create a healthy version of a granola bar using the ingredients provided and then create a nutrition label for it. Give each group a copy of the nutrition information for each ingredient.

**POINTER:** Ask girls to pretend they are food chemists, mixing their latest creation. They will need to develop a name for their product, test it, and produce a Nutrition Facts label so they can sell it to stores. <sup>2</sup>

**4. Plan.** Have groups determine which ingredients to put into their recipe by looking at the Nutrition Facts labels you handed out and considering what nutritional characteristics they want their final granola bar to have. For instance, girls may want to focus on creating a bar that is: high in protein (add legumes and nuts); high in fiber (add flax seed or certain dried fruits); low in sugar (carefully choose their sweetener). <sup>3</sup>

**5. Experiment.** Give each group *one serving* of granola. Girls may want to divide their granola in order to test multiple recipes. Before adding additional ingredients, girls must measure and record each item. This is an exercise in recording data and keeping an accurate science journal for future calculations.

Serving Size

Nutrition Facts	
Serving Size 1 cup (228g)	
Serving Per Container 2	
Amount Per Serving	
Calories 250	Calories from Fat 110
% Daily Value*	
<b>Total Fat</b> 12g	<b>18%</b>
Saturated Fat 3g	<b>15%</b>
<b>Cholesterol</b> 30mg	<b>10%</b>
<b>Sodium</b> 470mg	<b>20%</b>
<b>Total Carbohydrate</b> 31g	<b>10%</b>
Dietary Fiber 0g	<b>0%</b>
Sugars 5g	
<b>Protein</b> 5g	
Vitamin A	4%
Vitamin C	2%
Calcium	20%
Iron	4%

Focus on only a few nutrients.

Relate grams to something girls know (a dollar bill weighs about 1g).

Some labels say "less than 1g." If so, round down to zero.

Visit [pbskidsgo.org/scigirls](http://pbskidsgo.org/scigirls) for videos and projects.



# Science Cooks! continued



**POINTER:** Using simple proportions relative to servings—such as halves, fourths, thirds—will make calculations easier.

**6. Calculate servings for each ingredient.** Girls must first figure out how much of a serving they used for each ingredient. Feel free to ignore spices, since they offer little nutritional value and add unnecessary complication.

$$\frac{\text{amount in final recipe}}{\text{serving size}} = \text{how much of a serving we used}$$

## Servings per Ingredient

Ingredients	Amount in Final Recipe		Serving Size (on package)		How Much of a Serving We Used
Granola	$\frac{1}{2}$ cup	÷	$\frac{1}{2}$ cup	=	1
Dried cranberries	$\frac{1}{4}$ cup	÷	$\frac{1}{2}$ cup	=	$\frac{1}{2}$ (0.5)
Almonds	$\frac{3}{8}$ cup	÷	$\frac{1}{4}$ cup	=	1 $\frac{1}{2}$ (1.5)
Maple Syrup	3 tbsp.	÷	1 tbsp.	=	3

**POINTER:** If girls are struggling with the math, try using a **think aloud**. Ask girls to explain out loud to others how they solved a problem. When groups share their work, everyone sees there are multiple ways to solve a problem. Think alouds are also good ways to catch misunderstandings about math concepts.

**7. Get cooking!** Mix dry ingredients in the bowl and add sweetener to bind everything together. Once evenly coated, spread the

mixture onto wax paper. Girls can shape their granola into bars, roll balls, or use cookie cutters. Be creative! <sup>4</sup>

**8. Calculate nutritional information for each ingredient.** We recommend focusing on no more than three items on the Nutrition Facts label (e.g., protein, fat, and carbohydrates).

**Example:** Here is the nutritional information for dry roasted almonds taken from [whfoods.org/sitesearch.php](http://whfoods.org/sitesearch.php), found by scrolling down and clicking on the in-depth nutritional profile (grams have been rounded to the nearest tenth).

**Dry roasted almonds** (serving size:  $\frac{1}{4}$  cup)  
protein: 7.6 g  
fat (total): 18.2 g  
carbohydrates (total): 1.7 g

The sample recipe from Step 6 uses  $\frac{3}{8}$  of a cup of almonds, which equals 1.5 servings. Use this to determine the amount of each nutrient in the final recipe.

## Nutrients from Almonds

Nutrient	Amount in 1 Serving		How Much of a Serving We Used		Amount in Final Recipe
Protein	7.6 g	×	1.5	=	11.4 g
Fat	18.2 g	×	1.5	=	27.3 g
Carbohydrates	1.7 g	×	1.5	=	2.6 g

Create a similar table for each of your ingredients.



# Science Cooks! continued

**9. Calculate total nutrients.** To find the total protein, fat, and carbohydrates in the granola bar recipe, add the numbers from each ingredient (found from the tables created in Step 8).

## Total Nutrients

Ingredient	Protein (g)	Fat (g)	Carbohydrates (g)
Granola	4.5	7.5	16
Dried Cranberries	1	0	12
Almonds	11.4	27.3	2.6
Maple Syrup	0	0	10
<b>TOTALS</b>	<b>16.9</b>	<b>34.8</b>	<b>40.6</b>

**10. Find the nutrition facts per serving.**

To find the nutrition facts for one serving, divide the total for each nutrient by the number of servings (i.e., bars, balls, or bites) the girls made. Round to the nearest tenth.

## Nutrition Facts per Serving

	Total		# of bars		Amount per Serving
Protein	16.9 g	÷	10	=	1.7 g
Fat	34.8 g	÷	10	=	3.5 g
Carbohydrates	40.6 g	÷	10	=	4.1 g

**POINTER:** For younger girls, set up a spreadsheet where they can input the information or go to [nutritiondata.com](http://nutritiondata.com) (free login required) and input each ingredient. Then click on "analyze recipe" to make a Nutrition Facts label for the product.

**11. Share.** Have each group present their final product, name, and nutritional data to the entire room and explain their reasoning. Have girls compare their calculated Nutrition Facts label to a label from their favorite prepackaged snack. Is their granola "healthier?" Why or why not? What would they change? Conduct a taste test or compile all the recipes and create a recipe book! <sup>4</sup>

Watch Emily discuss how to choose fruits and veggies on the *SciGirls Live Healthy* DVD. (Select Science Cooks!: Mentor Moment.) <sup>7</sup>



**Mentor Moment** Emily Noble received her bachelor's degree in chemistry, but found herself putting a food focus on all of her papers and projects! So she set sail to work as a cook on a tall ship. Now Emily is a graduate student studying nutrition science at the University of Minnesota. She loves mentoring youth in healthy ways to prepare meals from fresh fruits and veggies.



## Activity 5

# 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, girls will compare ways to measure heart rate (and build their own stethoscopes!) to learn how exercise affects heart rate.

#### Part 1 Find Your Heart Rate

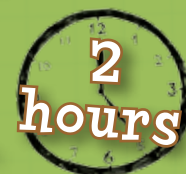
Here's how:

- 1. Introduce heart rate.** You may want to show an image of the circulatory system. Ask girls what is the purpose of the heart? (to pump oxygenated blood out to the body) What is a heart rate? (the rate at which the heart beats, contracting and squeezing out blood)
- 2. Brainstorm.** Ask girls to list all the methods people use to measure heart rates.<sup>2</sup> (pulse, stethoscope, heart rate monitor)
- 3. Experiment with the pulse method.** Ask girls 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

### You'll Need (per small group):

#### Part 1:

- ◆ 18 in. of vinyl tubing (from a hardware store)
- ◆ 1 empty plastic water or soda bottle
- ◆ scissors
- ◆ duct tape
- ◆ stopwatch or a clock with second hand
- ◆ paper and pencil
- ◆ rubbing alcohol
- ◆ cotton balls
- ◆ optional: image of circulatory system, heart rate monitor



#### Part 2:

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

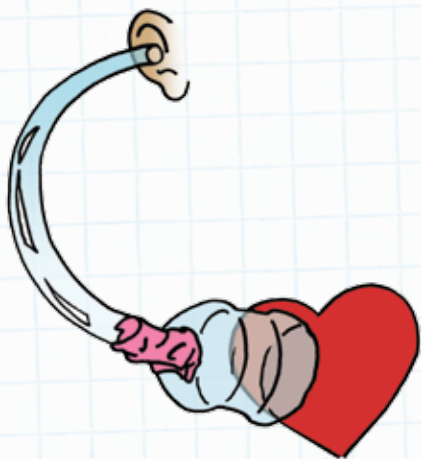
the wrist, beneath the palm of the hand, and pressing down firmly. Count the number of beats for 10 seconds and multiply this by 6 to get the number of beats per minute (bpm). Sit quietly for a few minutes before taking your measurement. For better accuracy, do three trials, record the results, and find your average resting heart rate.





# Heart to Heart continued

**4. Build a stethoscope.** Ask the girls to break into small groups <sup>1</sup> 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 below.) Girls can then place the funnel on the chest and move it around to find the spot where the heart beats the loudest. Girls 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 girls are respectful of one another and ask permission before taking the measurements. <sup>1</sup>



**POINTER:** If girls are struggling, applaud their efforts. <sup>5</sup> Ask 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 girls 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 the girls into small groups and deliver the **SciGirls Challenge**: Explore how heart rate changes with activity. At least one girl in each group will need to exercise, so you may want to group girls who are comfortable exercising with girls who aren't. <sup>1</sup>

To learn how activity influences a horse's heart rate, watch the *SciGirls Get Healthy* DVD. (Select Horsing Around: Test). <sup>7</sup>

Anyone with heart or respiratory conditions should not exercise. Kids who cannot exercise should be in charge of collecting data.



Wipe off the “earpiece” of the tubing with rubbing alcohol on a cotton ball before reusing.





# Heart to Heart continued



**7. Plan.** Ask your girls how they think heart rate changes with activity. Which activities would raise your heart rate the most? Design your own experiment to test.<sup>3,4</sup> 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 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 working during each kind of exercise, find the intensity level with this equation:

$$\text{intensity level} = \frac{\text{heart rate after exercise}}{\text{maximum heart rate}} \times 100\%$$

**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 engaging in moderate activities 30 min. every day.



**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?

## Standards Correlation

The activities in this book align to national education standards including: Standards for Technological Literacy, National Science Education Standards and the National Council of Teachers of Mathematics Standards. To download the complete and most current alignments, please visit [pbs.org/teachers/scigirls](http://pbs.org/teachers/scigirls).





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