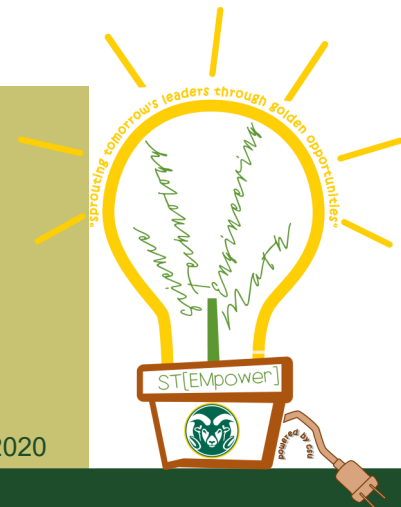


# ST[EMpower]

## VIRAL-CYCLES: CONTAGIOUS!

VOLUME 10, ISSUE 6, May 20, 2020



### How Disease Spreads

#### THIS ISSUE

- Friends Set-up page 2
- Chillin' with BFFs... page 6

#### POWER WORDS

- **contagious:** spread from one person or organism to another by direct or indirect contact
- **herd immunity:** resistance to the spread of a contagious disease within a population that results if a sufficiently high proportion of individuals are immune to the disease
- **host:** organism from which a parasite obtains its nutrition or shelter
- **pathogen:** a bacterium, virus, or other microorganism that causes disease
- **vector:** an organism, typically a biting insect, that transmits a disease or parasite from one animal or plant to another

In the last lesson, you explored the concepts of doubling in disease. With COVID-19, our governors are working to reduce the doubling rate of infection to as long as possible. This will help us to live with the disease until we reach **herd immunity**.

So how do diseases spread? In short, the **pathogen** needs to get from one **host** to another **host**. Depending on the **pathogen**, that can take many different pathways.

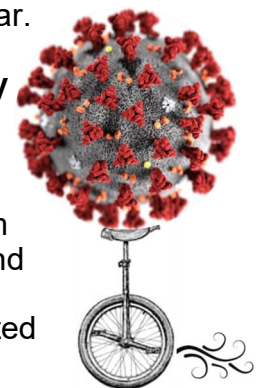
Malaria is the disease that throughout human history has killed more people than any other cause. The highest estimates are that this disease has killed half of all humans that have ever lived. Malaria is spread from person to person (the **host**) by an *Anopheles* mosquito (the **vector**). This species of mosquito carries the parasite *Plasmodia*, a single celled organism, that causes malaria.

Viruses are typically spread on our droplets when we sneeze,

cough, or even talk. These droplets are so small, we really can't see them. The droplets remain suspended in the air and spread outwards. We are nearby or walk through the droplets, we can inhale them. We are now infected.

If someone sneezes into their hand, and then grabs a handrail, they can transfer from the sneezer's hand to a surface. You grab the handrail, touch that spot, and the virus is now on your hands. By simply rubbing your eye or nose, the virus now has a pathway into you. It is up to your immune system to find the intruder. Once located, your immune system will mount an offensive to kill it before it spreads too far.

**Herd immunity** happens when enough people have their immune system ready to respond as soon as an intruder is located in our bodies.



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4-H PROGRAMS ARE AVAILABLE TO ALL WITHOUT DISCRIMINATION

**DO**

We are beginning to relax the stay-at-home orders to safer-at-home. Your family may still be sheltering to protect family members who would be the most venerable to suffering the severe symptoms of this disease. This activity is designed for you to conduct it by yourself, but can be modified to do this with family or friends.

First, you need to set up your experiment.

**Directions:**

**Pathogen**

- Insert the funnel into the mouth of one of your plastic bottles.



- Add about ¼ cup baking soda into the bottle using the funnel.
- Fill ¾ full with warm tap water. If you are using a plastic bottle larger than 16 ounces, only add about 10 ounces of water (1¼ cup).
- Put on the cap, and with a sharpie, label the bottle



“baking soda.” Shake the bottle vigorously to dissolve the baking soda in the water.

- Allow the baking soda to settle to the bottom of the bottle.



**Indicator**

- Completely rinse the funnel. Be sure that you flush it for about 30 seconds.
- You need a parent to help you with this next step. Cut the red cabbage in half. Cut one of the halves in half. You now have one-quarter of the cabbage. Use the quarter of your red cabbage for this experiment. You do not need the remaining ¾



**MATERIALS**

- print 5 copies of pg. 8
- print pg. 10 and 11
- art supplies
- scissors
- 10 rubber bands
- 10 glasses, cups, and/or canning jars
- 10 plastic spoons
- small red cabbage
- 2 large bowls
- knife and sieve
- cutting board
- parent supervision
- baking soda
- 2 small (e.g. 16 oz.) plastic bottles w/ lids
- funnel
- mixing spoon
- paper towels
- hot tap water
- number cube (or print pg. 9 to make one)
- pencil

**POWER WORDS**

- **indicator:** any substance that gives a visible sign, usually by a color change, of the presence or absence of an acid or a base in a solution

cabbage. Some recipes that use cabbage are:

- Grate cabbage into lettuce salads for color and crunch!
- Polish cabbage rolls are a wonderful dish.
- Cabbage Koora is a scrumptious recipe from India.

- Tear the cabbage into tiny pieces. The smaller the pieces, the better.



- Place the torn cabbage bits into one of the bowls. What happens to your fingers? Can you wash off the stain? (Don't worry; it will go away.)



- Heat the tap water as hot as it will go. Be careful not to burn yourself. Add hot water into the bowl until the red cabbage bits are barely covered. Do not add extra water. You want the "red" in the cabbage as concentrated in the water as possible. Stir the cabbage / water with a spoon.



- Allow the cabbage to **steep** for about 30 minutes.



- Place the second bowl in the sink. Place the sieve over the bowl.



- Carefully pour the cabbage bits and water into the sieve. Lift the sieve out of the red



**POWER WORDS**

- **steep:** allow dry ingredients, such as coffee, tea, spices, or red cabbage to soak in a liquid until the liquid takes on the flavor of the dry ingredient

- cabbage liquid and drain all liquid from the red cabbage bits in the sieve.
- You no longer need the red cabbage bits, and you can compost them.
- Do this next step in the sink. If you spill, clean-up is a breeze! Insert the funnel into the mouth of the plastic bottle, and ask a parent to hold the

**YOUTUBE VIDEOS** (scroll down to find)

- CDC video on how tuberculosis spreads: <https://www.cdc.gov/tb/topic/basics/howtbspreads.htm>
- CDC video on how to protect yourself from COVID-19 and handwashing: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>

bottle. Carefully pour the red cabbage juice into the bottle.

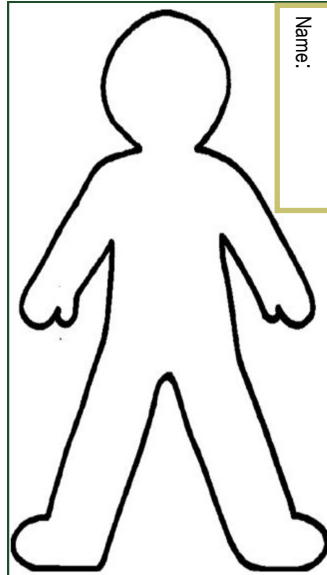


- Label “cabbage juice,” put on a cap, and store in the refrigerator. The image doesn’t show, but the bottle is labeled.



**Participants**

- You need 5 copies of page 8 for 10 people.



- Identify 9 family members and friends. Write their names in the gold box by each **outline**. The 10th **outline** is you.
- Use your artistic skills to make each **outline** look like the person you identified. Use markers and colored pencils. You can get really creative. Use tissue paper or scrap of material for clothes, yarn or thread for hair. What



**POWER WORDS**

- **outline:** a line or set of lines enclosing or indicating the shape of an object in a sketch or diagram

- color are her eyes? Sketch and color each person. Try to capture how each family member and friend looks.
- Cut out your family, friends, and you around the green frames.
- Use the rubber band to attach one **outline** family member/friend to each cup jar, or glass.

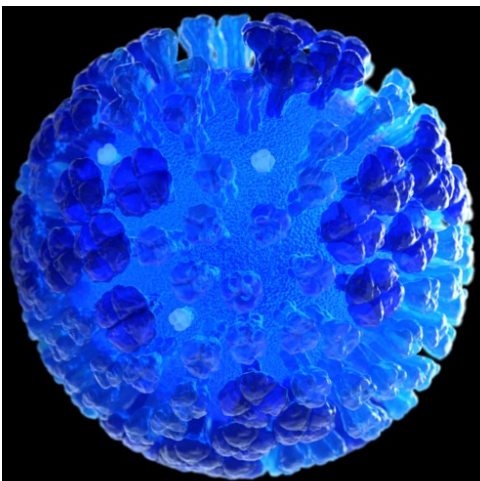




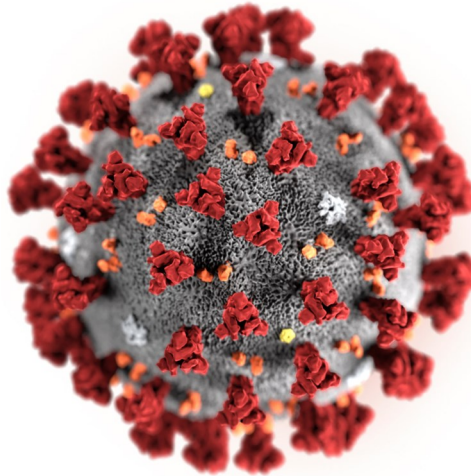
- **NO PEEKING!**
- **Ask a parent to help you with this next step.** Do not do this yourself. **In fact, you need to leave the room.**
- **Parent,** randomly pick one of the cups. Use the baking soda water and carefully pour the baking soda water into the cup. Be sure to pour slowly so the baking soda remains in the bottom of the bottle. Remember which cup you added the baking soda.
- Fill the other 9 cups with water.
- Refill the baking soda bottle with water and shake vigorously to dissolve the baking soda for the next **trial**. Add more baking soda to the bottle.
- Your child will need to repeat this experiment 10 times.

**REFLECT**

- You have 2 **treatments** of this experiment:
  - **Treatment 1 Seasonal Flu**  
It is caused by about 100 different viruses. The two most common are influenza Type A and Type B (image below). The infection rate is 1.33. That means for every three people who are sick, they



- infect a total of about four other people.
- **Treatment 2 COVID-19**  
It is highly **contagious**. The infection rate is an average of 2.5, which means every two people who are infected will infect a total of 5 other people.
- The cup with the baking soda



- water represents the person who is infected. That person does not know it...yet. It takes a couple of days before symptoms appear.
- Put one plastic spoon in each cup. The spoon must only dip in that cup. If the spoons are mixed, you can contaminate the other cups, it will only be used in that one cup.
- Line up all the cups, start with you, and then your family, then your friends.

**POWER WORDS**

- **treatment:** in an experiment, the factor (also called an independent variable) is an explanatory variable manipulated by the experimenter; in our experiment, it is the disease (seasonal flu or COVID-19) rate of infection—two or more levels or different values of the factor
- **trial:** one of a number of repetitions of an experiment.

- Your number cube (die) helps to determine the infection rate.
  - Seasonal flu—if you roll a 1, 2, or 3, then exchange two (2) spoonful of water from your cup into your friend's cup, and 2 spoonful of water from your friend's cup into your cup. If you roll a 4, 5, or 6, do not



- exchange water.
- COVID-19—if you roll a 2, 3, 4, 5, or 6, exchange two (2) spoonful of water from your cup into your friend's cup, and 2 spoonful of water from your friend's cup into your cup. If you roll a 1, do not exchange water.
- When you visit a friend, record their name on your data sheets (page 10 and 11). Roll the number cube. The number you roll will determine your action.
- When you return home, exchange water with each of your family members: put 2 spoons of water in your cup in each family member's cup. Put 2 spoons of their water into your cup.
- For your second through fifth



**trials**, visit each person in the same order you recorded on your data sheet. If you repeat the order, it is just easier to analyze later.

**APPLY**



**SEASONAL FLU:**

- Visit one friend at a time. Record their name on the next row in your data sheet.
- Roll the number cube and record that number on your data sheet. If 1, 2, or 3, scoop 2 of water with your friend's spoon and pour into your cup. Do not touch their spoon to your water. With your spoon, scoop 2 spoons of your water into their cup with your spoon. Do not touch your spoon to their water.
- Return home and exchange water by adding 2 spoons of your water to your family member cups, and 2 spoons of each family member to your cup. Remember to only use the spoon in each cup.
- Repeat for each friend, record their name on your data sheet, return home and repeat for your family.

**Analysis:**

- The color of the red cabbage in the bottle should be a dark purple. Use the spoon in each cup only. Pour the cabbage juice into your spoon, and add the spoon of red cabbage juice into the cup. Record the color in the third (light yellow) column (see example below).
- If the cup changed color from

**FASCINATING FACT**

- Anosmia (loss of smell) is a symptom. The most commonly reported symptoms of COVID-19 include fever, cough and shortness of breath. However, healthcare providers have noticed a few unusual symptoms, including loss of smell (anosmia) and decreased sense of taste (ageusia). In South Korea, 30% of people who tested positive for the virus said that loss of smell was their first major symptom. In Germany, more than 2 out of 3 confirmed cases included loss of smell and taste.

purple to green (or any other color), record the new color.

- Note: If you can't see the color in the cup, hold up a spoon of liquid to get the correct color.
- In the bottom row "Total Infected" count the number of your family and friends who had a color change. That means they had the flu.

Epidemiology Data Sheet Seasonal Flu						10
Family / Friend Name	Number Cube	Color	Number Cube	Color	Number Cube	Color
Me		green		purple		green
Drew	2	purple	4	purple	5	1
Mom	3	green	2	purple	4	6
						4
						green

In the picture below, three glasses are green. Green represents an infection.



Reset:

- Carefully remove your paper family and friends.
- Pour the liquid in the cup down the drain.
- Wash and rinse each cup and spoon. Ask your parent to reset your experiment. Repeat these steps five (5) times for Seasonal Flu.

### COVID-19

- Visit one friend at a time. Record their name on the next row in your data sheet.
- Roll the number cube and record that number on your data sheet. If 2, 3, 4, 5, or 6 on your number cube, scoop 2 spoons of water with your friend's spoon and pour into your cup. Do not touch their spoon to your water. With your spoon, scoop 2 spoons of your water into their cup with your spoon. Do not touch your spoon to their water.
- Return home and exchange water by adding 2 spoons of your water to your family member cups, and 2 spoons of each family member to your cup. Remember to only use the spoon in each cup.
- Repeat for each friend, record their name on your COVID-19 data sheet, return home, and repeat for your family.

Analysis:

- The color of the red cabbage in the bottle should be a dark purple. Use the spoon in each cup only. Pour the cabbage juice into your spoon, and add the spoon of red cabbage juice into the cup. Record the color in the third (light yellow) column (see example to the left).



- If the cup changed color from purple to green (or any other color), record the new color.
- Note: If you can't see the color in the cup, hold up a spoon of liquid to get the correct color.
- In the bottom row "Total Infected" count the number of your family and friends who had a color change. That means they had contracted COVID-19.

Reset:

- Carefully remove your paper family and friends.
- Pour the liquid in the cup down the drain.
- Wash and rinse each cup and spoon. Ask your parent to reset your experiment. Repeat these steps a total of five (5) times for Seasonal Flu.

### WHAT DOES IT MEAN?

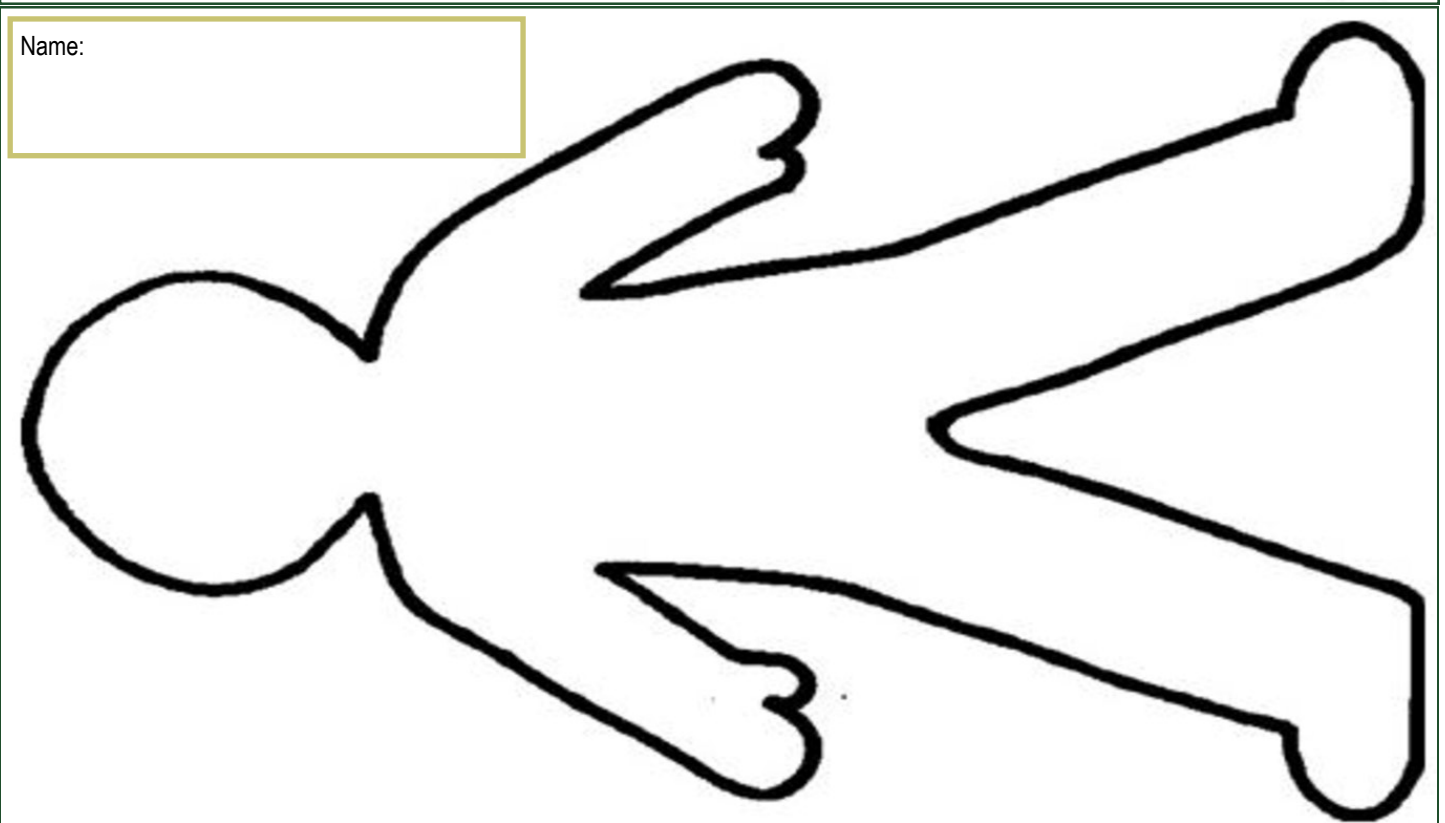
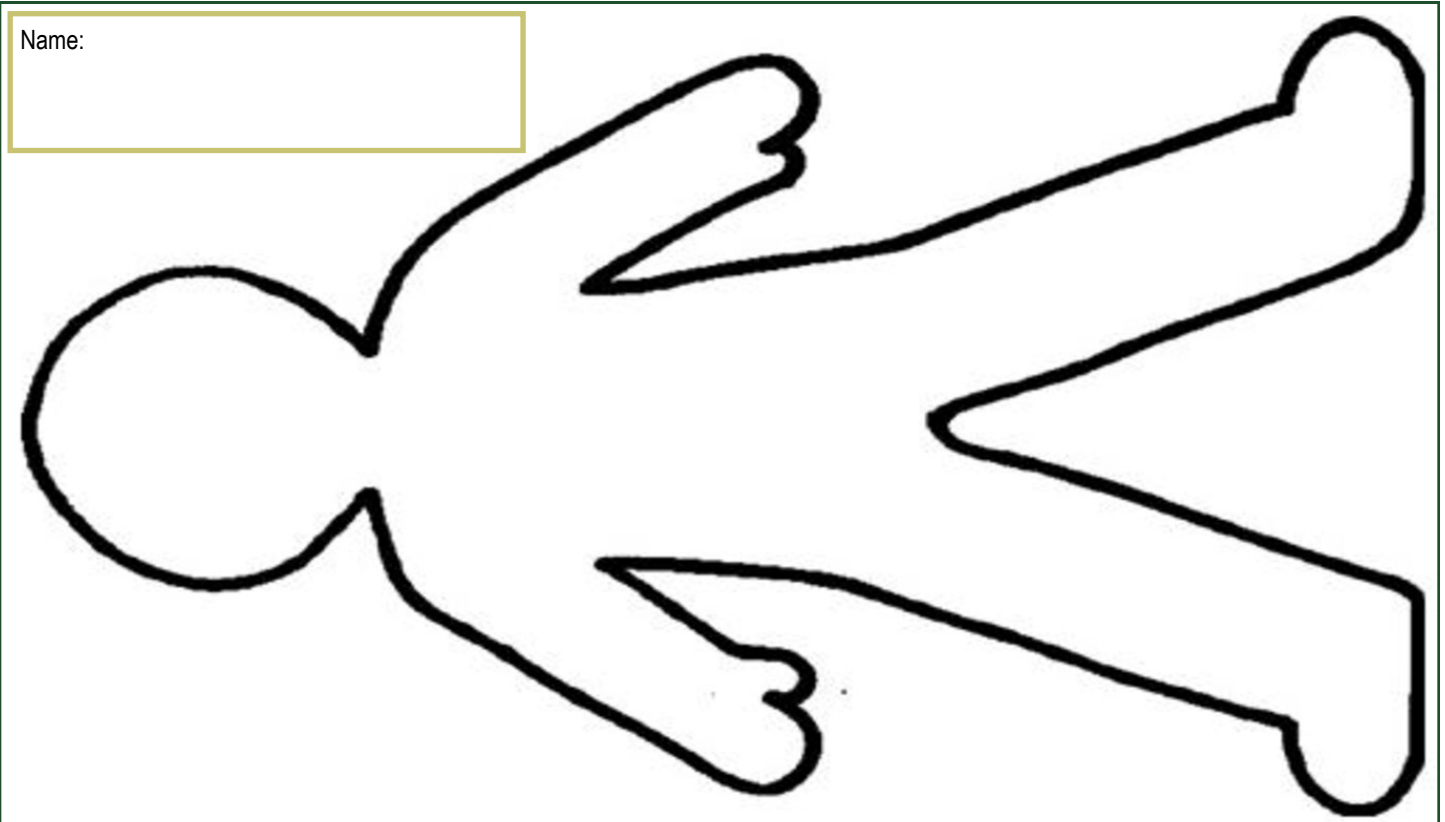
- Can you determine who was originally infected? How?

### FASCINATING FACTS

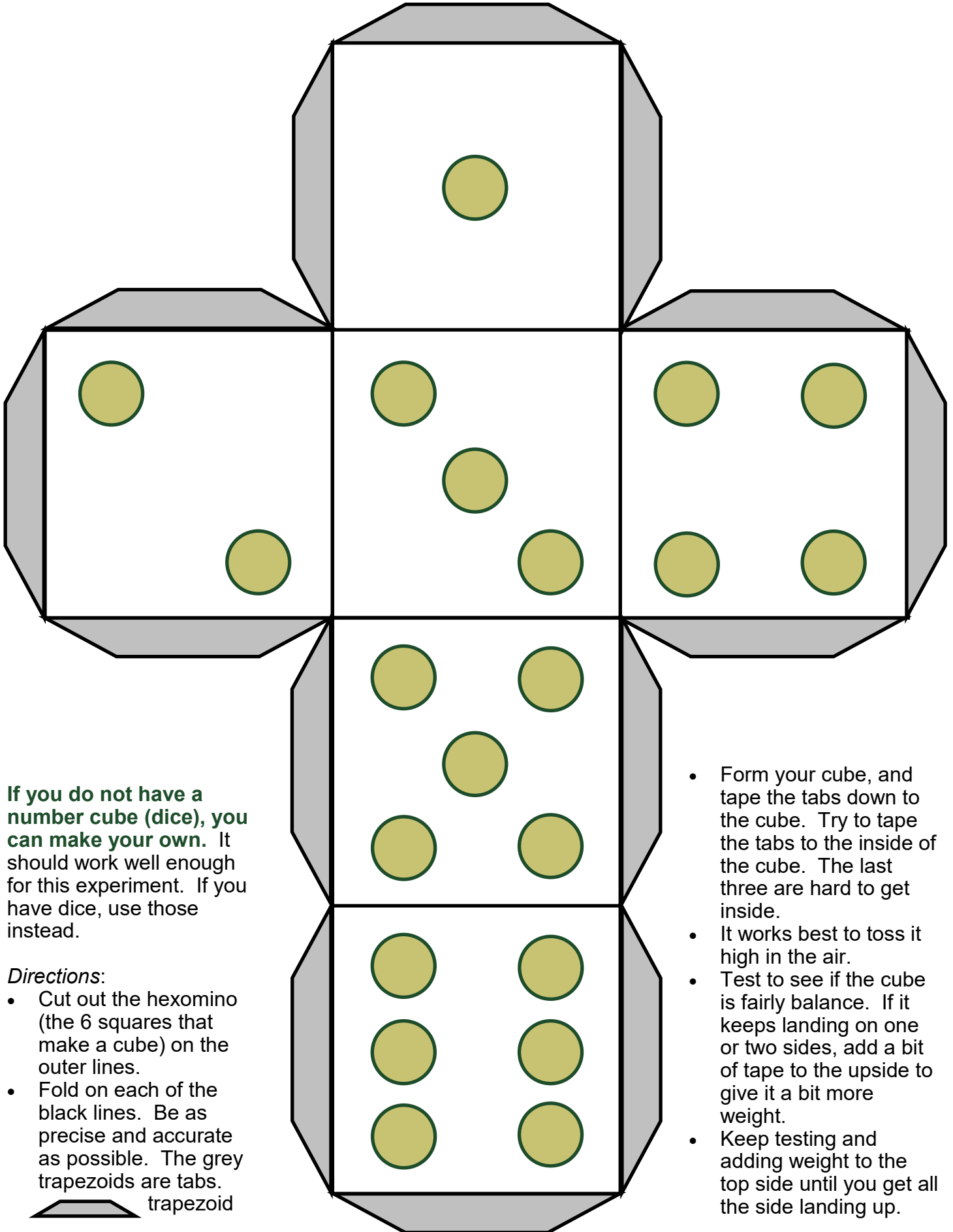
- People with type A blood may be more susceptible to infection. A Chinese study of 2,173 individuals who were hospitalized with COVID-19 found that the proportion of sick people with type A blood was significantly greater than researchers would expect based upon the percentage of people with type A blood in the general population. The study also found that there were fewer sick people with type O blood than would be expected.
- Verify with your parent which cup at each trail "infected" with the baking soda water.
- From your experiment, can you tell with disease, the Seasonal Flu or COVID-19, has a greater infection rate?
- Did any of your **trials** show only one person sick? It is possible that you can be exposed to a disease, but do not catch it. The different steps we take to protect ourselves and others (washing hands, wearing masks, and social distancing) all can reduce the rate of infection.
- What steps can you do to protect yourself and others from disease?

*Directions:*

- Make 5 copies of this page, for a total of 10 individual **outlines**.
- Label each **outline** with a name; 1 for you and the others with your family and friends names.
- Decorate each **outline** to represent each person. Be creative.








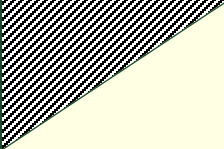
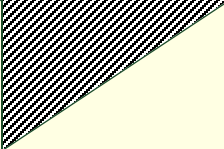



**If you do not have a number cube (dice), you can make your own.** It should work well enough for this experiment. If you have dice, use those instead.





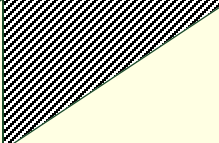
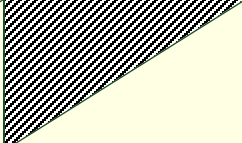
**Directions:**

- Cut out the hexomino (the 6 squares that make a cube) on the outer lines.
- Fold on each of the black lines. Be as precise and accurate as possible. The grey trapezoids are tabs.

 trapezoid

- Form your cube, and tape the tabs down to the cube. Try to tape the tabs to the inside of the cube. The last three are hard to get inside.
- It works best to toss it high in the air.
- Test to see if the cube is fairly balance. If it keeps landing on one or two sides, add a bit of tape to the upside to give it a bit more weight.
- Keep testing and adding weight to the top side until you get all the side landing up.

Family / Friend Name 	Number Cube Color	Number Cube Color	Number Cube Color	Number Cube Color	Number Cube Color
Me					
<b>TOTAL INFECTED</b> (color—blue-green, yes infected)	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5

<b>Family / Friend Name</b> 	<b>Number Cube</b> Color	<b>Number Cube</b> Color	<b>Number Cube</b> Color	<b>Number Cube</b> Color	<b>Number Cube</b> Color
Me					
<b>TOTAL INFECTED</b> (color—blue-green, yes infected)	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5

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## ACKNOWLEDGMENTS

- Funding for this project provided by Colorado State University System Venture Capital Fund
- CJ Mucklow, Colorado State University Extension Western Regional Director
- Tom Lindsay, retired Portland State University instructor (geology and paleontology); HS science teacher (AP and IB Chemistry, Physics, Biology, and Calculus)
- Stephanie Lamm, Colorado State University Extension Montrose County 4-H Youth Development STEM K/12 Agent
- Andrew Reed, Colorado State University Extension Montrose County Administrative Assistant II
- Dr. Joe Cannon and Marketing Strategies students Berlyn Anderson, Jenna Balsley, Rachel Kassirer, Rachel Richman, Colorado State University, College of Business, for marketing strategies and ST[EMpower] graphics
- Doug Garcia, Colorado State University Creative Services Communication Coordinator/ Designer

## CITATIONS

### Information:

- Epidemiology: <https://www.cdc.gov/publichealth101/epidemiology.html>; <https://www.cdc.gov/csels/dsepd/ss1978/lesson1/index.html>; [https://www.who.int/diseasecontrol\\_emergencies/field\\_epidemiology/en/](https://www.who.int/diseasecontrol_emergencies/field_epidemiology/en/)
- Fascinating Facts: <https://www.healthgrades.com/right-care/coronavirus/10-surprising-facts-about-coronavirus>

### Images:

- Outlines: <http://clipart-library.com/free/man-silhouette-outline.html>
- Influenza Type A: <https://www.cdc.gov/flu/about/viruses/index.htm>
- Coronavirus: <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/index.html>