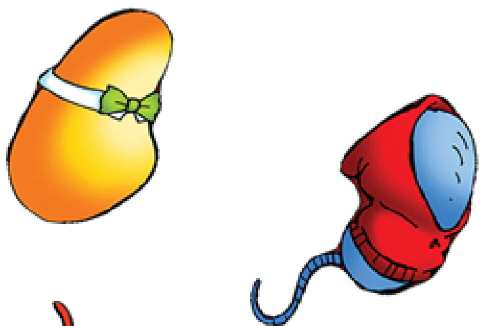
GROSSOLOGY and YOU



ACTIVITY GUIDE

For Summer Camps, Discovery Classes, Afterschool Programs, Scout Troops, and Science Clubs

UNC
MOREHEAD PLANETARIUM
AND SCIENCE CENTER

ACTIVITY GUIDE

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We are grateful to the students and educators of Morehead Planetarium and Science Center's Afterschool Program and External Programs for their help in piloting activities in this guide.

"Addressing the Science of Really Gross Things: Engaging Young Learners in Biomedical Science Through a Fulldome Show and Supporting Curricula" is supported by a Science Education Partnership Award (SEPA), Grant Number #1R25OD010522-01, from the National Institutes of Health (NIH). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NCRR or NIH.

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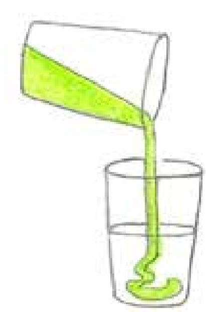
USING THIS ACTIVITY GUIDE

This guide is designed to assist educators in science clubs, summer camps, scout troops, and other organizations looking for ways to engage children in science—or to build on interests children already have. Illustrated instructions show how young learners can carry out scientific investigations. Background information helps informal and formal educators supervise the activities.

The activities in this guide relate to the respiratory, digestive, and immune systems—the three human body systems featured in Morehead Planetarium and Science Center's *Grossology and You* fulldome digital planetarium show. Activity extensions provide ideas for broadening these hands-on activities to address additional topics.



Like the *Grossology and You* show, the activities are best for children 8–13 years old. Some of the activities are messy, some are noisy, some are quiet, some are crafty. All of them involve something gross! Choose those that fit the time available and suit the interests of the children in your care.

If your planetarium has scheduled *Grossology and You*, a discovery class including some of these activities offered before or after the show will add to children's excitement and reinforce their learning. Visit Morehead partners Sky-Skan (skyskan.com) and Spitz (spitzinc.com) to learn about leasing *Grossology and You*.

Science club advisors and other educators should share this guide with their administration before carrying out the activities.

FAKE SNOT, GUTS, POOP, & PUS!

Use a polymer to make biological models

Sodium alginate is a polymer derived from brown seaweeds. Calcium chloride is a type of salt. Each is used as a firming agent in food products. In this experiment, a goopy, gloopy reaction occurs when sodium alginate and calcium chloride meet. Calcium ions replace the sodium ions, and strands of the alginate polymer attach or cross link—like a net—to form a gel.

These gels can be colored and shaped to mimic substances and structures found in the three body systems discussed in the *Grossology and You* show:

› *Snot (nasal mucus):* This substance traps invading particles (ranging from pollen and dust to bacteria and viruses) and facilitates their removal from the respiratory system. In addition, mucus contains chemicals (antibodies) that help destroy certain types of these particles.

› *Guts (intestines) and Poop (feces):* The small intestine extracts nutrients from food so the body can use them. Then the large intestine absorbs water from the undigested food and turns the food, dead cells, and other waste into feces, which leave the body.

› *Pus:* This substance forms when white blood cells (leukocytes, part of the immune system) fight infection and disease. Pus contains an accumulation of living and dead leukocytes, microbes, and other materials.

WHAT YOU DO

Use sodium alginate and calcium chloride to create gels that look like mucus, large and small intestines, feces, or pus. Illustrated instructions begin on page 4.

WHAT YOU NEED

For one experiment:

½ teaspoon of sodium alginate
1 teaspoon of calcium chloride
2 cups (480 mL) of water

2 teaspoons
2 clear, waterproof containers (e.g., beakers, plastic cups)
2 or 3 smaller waterproof containers *(optional)*
tubes of watercolor or acrylic paint (yellow, green, pink, brown)
measuring cup
waterproof bowl or plate
garbage bag
paper towels
safety glasses and gloves
drop cloth *(optional)*
funnel with narrow spout *(optional)*
funnel with wide spout *(optional)*
disposable pipette *(optional)*
mesh strainer *(optional)*

Sodium alginate and calcium chloride are available from laboratory suppliers or from stores geared toward gourmet cooking.

HOW LONG THIS TAKES

15 minutes or longer, depending on the number of gels you make.

ACTIVITY EXTENSION

After exploring the models in the guide, innovate with gels of different colors and shapes. Focus on chemistry concepts and vocabulary related to this activity (e.g., solution, solute, solvent, polymer, gel).

TAKE CARE

Chefs use sodium alginate and calcium chloride for a molecular gastronomy technique called “spherification.” However, the gels in this exploration should not be eaten.

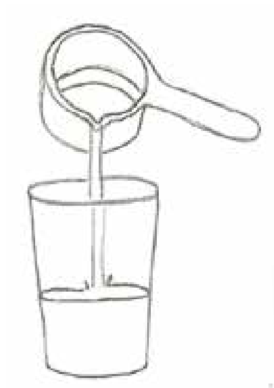
The gels are filled with liquid and, with enough pressure, can be popped and create a splash.

This activity can be messy. Use a drop cloth or work on a surface that can be easily cleaned.

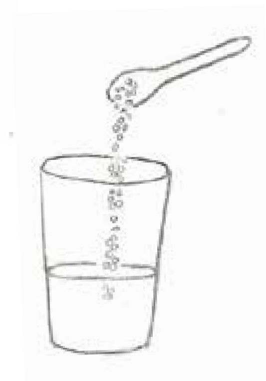
At the end of the activity, dispose of the solutions in the garbage bag, because pouring these materials into the sink could clog pipes. Before washing them, use a paper towel to wipe any residue off funnels and other items that will be reused.

FAKE SNOT, GUTS, POOP, & PUS! INSTRUCTIONS

A. Container 1:
Calcium Chloride Solution

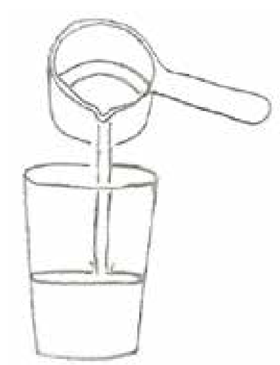


Pour 1 cup (240 mL) of water into Container 1.

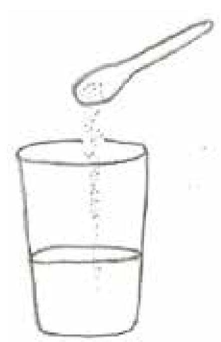


Use a clean spoon to add 1 teaspoon of calcium chloride to the water. Stir. The calcium chloride will dissolve easily.

B. Container 2:
Sodium Alginate Solution



Pour 1 cup (240 mL) of water into Container 2.

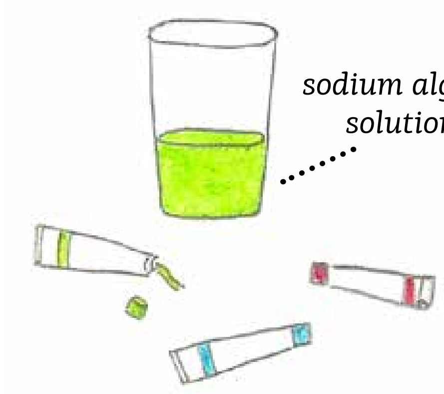


Use a clean spoon to *slowly* add ½ teaspoon of sodium alginate to the water. Stir out as many clumps as you can. The solution will work even if some clumps remain.

Optional: Divide this solution into several smaller containers so that you can experiment with different colors.

C. Begin by adding a small amount of watercolor or acrylic paint to the clear sodium alginate solution according to the type of model you want to make.

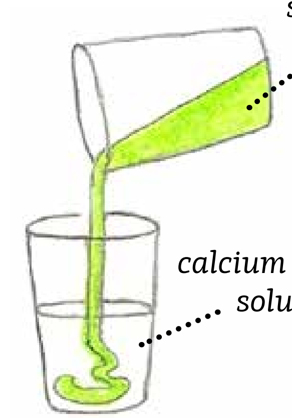
Below are six models you can experiment with.



<ins>Fake Snot</ins> (nasal mucus)

Add green or yellow paint to the clear sodium alginate solution.

Then slowly pour this solution into the calcium chloride solution to form a wormy gel—or pour it with stops and starts to make a messy, goopy gel.



<ins>Fake Guts</ins> (small intestine)

Add pink paint (or mix red and white paints to make pink) to the clear sodium alginate solution.

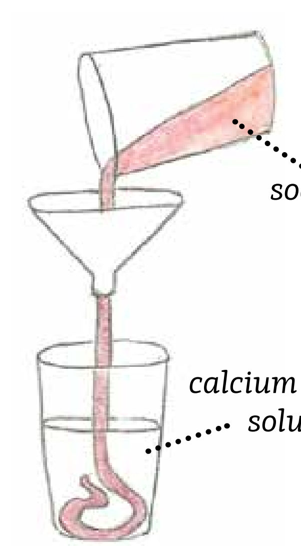
Then, using a funnel with a narrow spout, pour this solution into the calcium chloride solution to make a long, thin "worm."

<ins>Fake Guts & Poop</ins> (large intestine, feces)

The large intestine is thicker and shorter than the small intestine.

Add pink paint to the clear sodium alginate solution—or be really gross and add brown paint to represent waste products (poop!) in the large intestine.

Then, using a funnel with a wide spout, pour this solution into the calcium chloride solution to make a thick "worm."

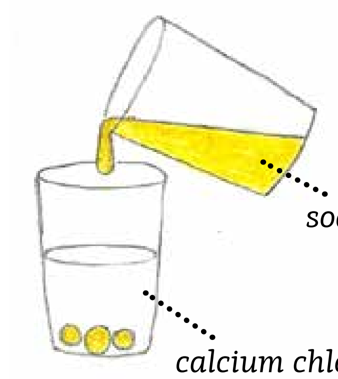


Fake Pus-Filled Boils & Pimples

Add yellow paint (or mix yellow and green paints) to the clear sodium alginate solution.

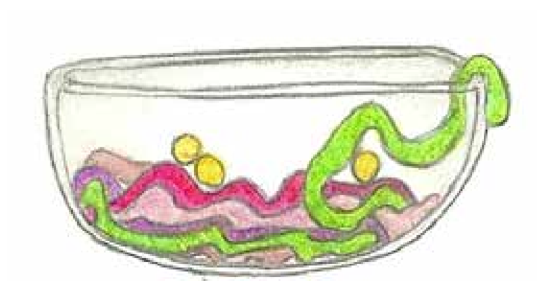
Then let a small amount of this solution drop slowly out of the container—or use a spoon to “plop” a small amount—into the calcium chloride solution.

Use a disposable pipette to make small, spherical pimples.



D. The longer you leave the sodium alginate solution in the calcium chloride solution, the firmer the gel will become. Wait at least several seconds for the reaction to take place before removing the gels.

Use a spoon or mesh strainer to scoop the gels out of the calcium chloride solution and place them in a bowl or on a plate. The gels will tend to retain their shape for some time, but the added color will leak out after several days.



FEED FUNGUS (LIKE US)

Experiment with aerobic respiration

When we take a deep breath, feel it fill our lungs, and exhale, we sense the role of oxygen in the respiratory system. It may be less obvious (except when we fart!) that oxygen also plays a role in the digestive system. This *Grossology and You* experiment demonstrates a vital connection between these two systems.

A fungus (the yeast *Saccharomyces cerevisiae*) represents us in the experiment. Like this fungus, we use oxygen to convert our digested food into energy through a process called aerobic respiration. The experiment is based on the methylene blue reduction test (MBRT) typically used to signal the presence of microbes in milk. In this case, you will be noticing that oxygen is depleted when yeast (microbes) is added to milk, which is a source of food for the yeast.

WHAT YOU DO

Conduct a version of the methylene blue reduction test to observe the result when yeast feeds on the nutrients in milk. Illustrated instructions begin on page 9.

WHAT YOU NEED

For one experiment:

¼ cup (60 mL) of fresh whole milk
1 teaspoon of active dry baker's yeast
40 drops (2 mL) of CarolinaBLU™ Final DNA Stain
2 small, clear containers
teaspoon
stir stick
pipette
safety glasses and gloves

The fungus used in this experiment is also known as baker's yeast, which can be found in the baking aisles of most supermarkets.

CarolinaBLU™ Final DNA Stain (Carolina Biological Supply Company) is similar to methylene blue and safe for educational use.

HOW LONG THIS TAKES

15–20 minutes

ACTIVITY EXTENSION

Explore the subject of chemical elements and compounds. The chemical elements carbon (C) and oxygen (O) are featured in this experiment. The sugars (lactose) in the milk are chemical compounds containing carbon, oxygen, and hydrogen. Milk's main component is the chemical compound water (H_2O). The chemical compound carbon dioxide (CO_2) can be observed developing in the cup of milk to which yeast is added.

TAKE CARE

Review the safety data sheet provided for CarolinaBLU™ stain.

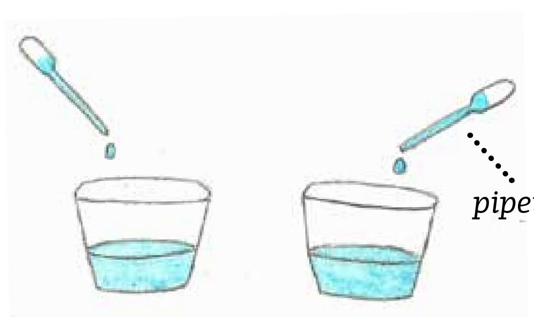
FEED FUNGUS (LIKE US) INSTRUCTIONS

A. Add 1/8 cup (30 mL) of fresh whole milk to each container.

Milk and other foods contain sugars made of carbon, a chemical element that is essential for life.

B. Add 20 drops (1 mL) of CarolinaBLU™ stain to each container. Stir gently to mix the blue stain and the milk.

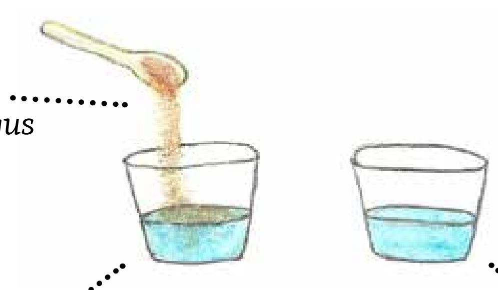
The blue color indicates the presence of oxygen.



pipette

C. What will happen if you add microscopic organisms—ones that like to feed on milk!—to one of the containers? Will the blue color remain or disappear?

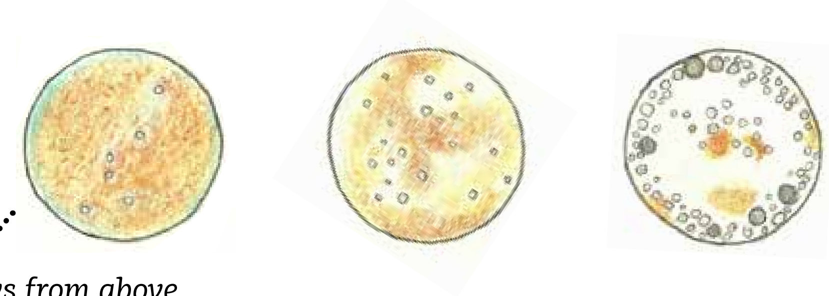
baker's yeast, a type of fungus



Add 1 teaspoon of microbes (baker's yeast) to this container. Stir gently to mix the yeast into the blue milk.

Don't add microbes to this container. This is the "control" in your experiment, which you can compare to the other container.

D. Compare what is happening—or not happening—in the two containers.



Three views from above the container with yeast. *The bubbles appearing in this container indicate that carbon dioxide is being produced.*

Through its digestive process, the yeast is breaking the milk down into small sugar molecules. When the carbon in these sugars combines with oxygen, energy is created. Another product of this chemical reaction is carbon dioxide—the gas inside the bubbles that are forming in the container with yeast. Like the fungus in this experiment, we humans use this process—called aerobic respiration—to turn food into the energy we need to help us live and grow.

E. *How does aerobic respiration work in the human body?*

After your digestive system extracts sugars from food, these sugars circulate through your body via your bloodstream. When the carbon in the sugars combines with the oxygen in your bloodstream, the chemical reaction between them produces energy, water, and carbon dioxide.

What happens to the carbon dioxide?

While your body needs some carbon dioxide for certain body functions, having too much of this gas will harm you. Your respiratory system helps by releasing carbon dioxide when you breathe out. Your digestive system also helps by releasing carbon dioxide when you fart!

F. Observe your results 10–15 minutes after adding the baker's yeast.

The stain here has become translucent, indicating that the oxygen has been used up by the microbes feeding on nutrients in the milk.

The stain in your control has remained blue, indicating that oxygen is still present.

BELLY BUTTON BACTERIA

Investigate your personal bacteria

Trillions of bacteria live in and on our bodies. Scientists have learned that some of these—like certain types of bacteria in our bellies—are required for our good health. But many continue to mystify us. Why, for example, are bacteria living in our belly *buttons*?

In order to begin answering this question, scientists at the Belly Button Biodiversity project based at North Carolina State University set out to discover what kinds of bacteria live in people's belly buttons. More than 500 volunteers across the United States swabbed their belly buttons for this project, and here are some of the findings so far:

› On average, the belly buttons contained 67 different species of bacteria.

› Some belly buttons contained species of bacteria that scientists had never seen before.

› Some species of belly button bacteria were more common than others, but no single species was found in every belly button.

› Each belly button had a unique collection of bacterial species—that is, no belly button was exactly like another!

WHAT YOU DO

Look at your own belly button bacteria by taking a sample of it and watching it grow in a Petri dish. Illustrated instructions begin on page 13.

WHAT YOU NEED

For one experiment:

belly button
small Petri dish containing nutrient agar
cotton swab
permanent marker
hand lens
clear, one-sided tape

paper for recording a prediction and result
pen or pencil
color pencils *(optional)*

HOW LONG THIS TAKES

2–3 days

ACTIVITY EXTENSION

This experiment focuses on the bacteria living in our belly buttons. We also know that bacteria make their homes on our hands, in our digestive systems, and elsewhere in and on our bodies, sometimes helping us and sometimes harming us. Relate this to symbiotic relationships between other organisms (e.g., remora fish attach themselves to the bellies of sharks; hissing-cockroach mites live on Madagascar hissing cockroaches). When are these relationships helpful to one or both of the organisms involved? When are they harmful?

TAKE CARE

Get permission from a parent or guardian before carrying out this investigation.

An experienced science educator should prepare the Petri dish with nutrient agar, store the dish between observations, and dispose of the sample safely at the end of the investigation.

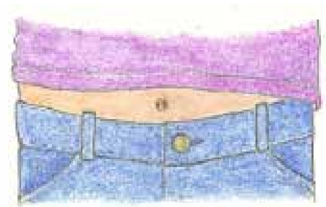
Remember that it is normal to have bacteria in your belly button—and that each person's collection of belly button bacteria will tend to look different from another person's.

BELLY BUTTON BACTERIA INSTRUCTIONS

A. Your Petri dish has been prepared with nutrient agar, a gel containing food for the bacteria.

Agar, which comes from the cell walls of red seaweeds, is used for growing bacteria and other microbes in research labs.

B. Using a clean cotton swab, gently wipe your belly button to collect a sample of the bacteria living there.



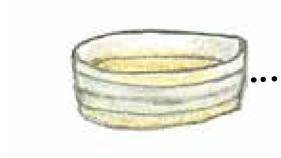
C. Place your bacteria sample in the Petri dish by moving the cotton swab in a zigzag pattern across the surface of the agar. (Take care not to press the cotton swab *into* the agar.)

As soon as you have placed your sample on the agar, put the lid on the Petri dish to prevent airborne microbes from falling in.

D. Tape the sides of the Petri dish shut.

Write your initials and the date on the bottom of the dish.

Then the dish should be stored at room temperature and out of direct sunlight.



E. Make a prediction about your experiment.

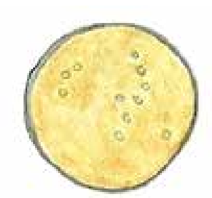
A single bacterium is so tiny you cannot see it without a microscope. What could happen on an undisturbed surface (like the agar) where bacteria have food and can grow and multiply in clusters (called colonies)? Will this help you see the bacteria?

Write a short description or draw a picture of what you think you will see in your Petri dish on Day 2 or Day 3.

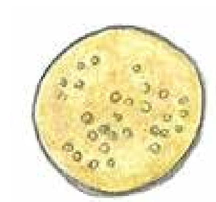
Do you expect to see more than one type of bacteria? What shape or color do you expect the bacterial colonies to be?

F. Check your Petri dish each day for two or three days.

Do not remove the lid. Look through the lid to observe any bacterial growth. Your hand lens will help you get a detailed view.



Day 2



Day 3

Did your experiment turn out as you predicted it would? Are there several colonies or just one? Do the colonies have different shapes or colors?

SPICE UP HEALTHY HANDWASHING

Test a simple technique to combat harmful bacteria

It is normal for us to have some bacteria on our hands. In fact, good bacteria are part of the immune system, helping us fight skin infections. But at certain times, effective handwashing is needed to tackle disease-causing germs, including harmful bacteria.

Bacteria that live safely in our intestines can become harmful when they leave our bodies in our feces (poop) and make us sick if we transfer them to things—including our food—that we touch and put into our mouths. This is why washing our hands after we use the toilet is so important.

Michigan State University researchers who observed more than 3,700 people found that only 5% practiced healthy handwashing after using public restrooms. Most people (95%) spent less than 15 seconds on handwashing, and many (33%) did not use soap. On average, people spent less than seven seconds washing their hands. Ten percent did not wash their hands at all.

What is the best way to wash your hands? The Centers for Disease Control and Prevention advise:

› Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.

› Lather your hands by rubbing them together with the soap. Be sure to lather the backs of your hands, between your fingers, and under your nails.

› Scrub your hands for at least 20 seconds. Need a timer? Hum the “Happy Birthday” song from beginning to end twice.

› Rinse your hands well under clean, running water.

› Dry your hands using a clean towel or air dry them.

WHAT YOU DO

Use a colorful spice to play the role of microbes as you test two handwashing methods. Illustrated instructions begin on page 17.

WHAT YOU NEED

For one experiment:

ground turmeric (approximately ¼ teaspoon per person)
soap
clean, running water
paper towels
paper or drop cloth to protect the work area *(optional)*
digital timer *(optional)*

Turmeric can be found in the spice section of most supermarkets.

HOW LONG THIS TAKES

5–10 minutes

ACTIVITY EXTENSIONS

The Michigan State University researchers who studied handwashing observed that the presence of signs about handwashing appears to have a positive effect on the way people wash their hands. Design an informative poster that will motivate people to practice healthy handwashing.

Explore public health issues that connect to "Spice Up Healthy Handwashing." These issues can include access to clean water; preventing transmission of the *E. coli* bacterium, influenza virus, and other pathogens; and the role of organizations like the Centers for Disease Control and Prevention and the National Institutes of Health.

TAKE CARE

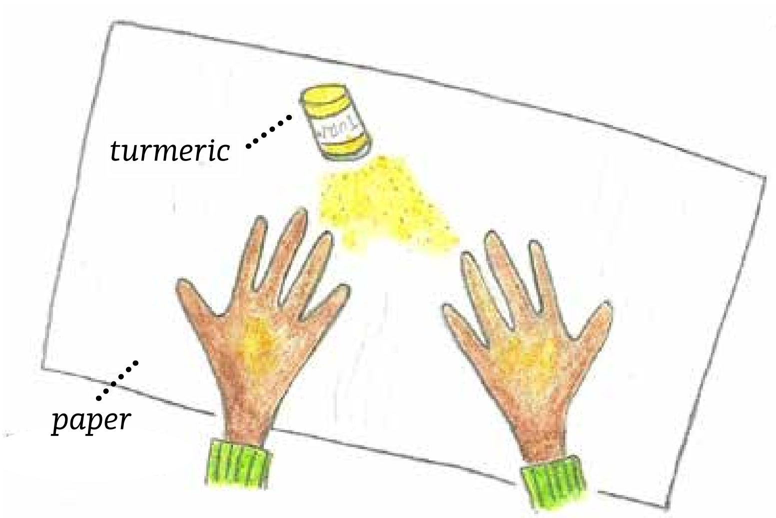
This activity can be messy, and turmeric has the potential to stain. Spread paper or a drop cloth to catch any turmeric that misses your hands, or carry out the experiment on a surface that can be easily cleaned.

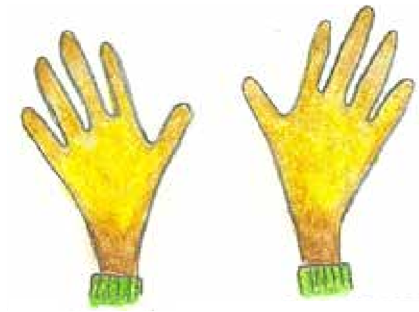
To avoid overwashing the hands and irritating the skin, only two handwashing methods are tested in this activity.

This activity is inspired by "A Lesson with Turmeric" shared by educators in India via charity: water.

SPICE UP HEALTHY HANDWASHING INSTRUCTIONS

A. Sprinkle bright-yellow turmeric on your hands.





Rub the turmeric all over your hands. It will stick to the oil your skin naturally produces.

The spice will represent bacteria and other microbes in your hand-washing experiment.

B. Experiment with handwashing methods. One person can try Method 1 while another person tries Method 2. Compare results.

Spend 10 seconds on each method. Use a digital timer—or hum the "Happy Birthday" song once!

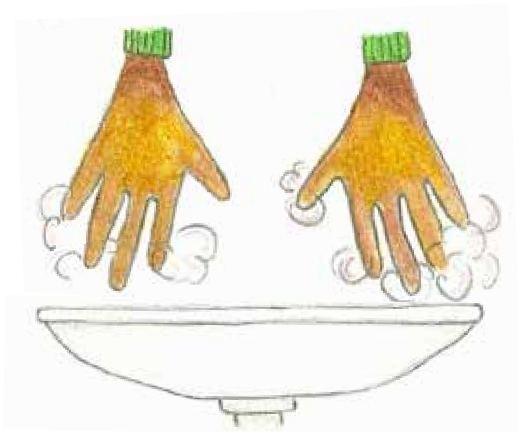
Remember to save water by turning off the tap after you have used it to wet your hands.

Method 1:
Don't use soap—just water.

Does this method work?

The friction of your hands rubbing together removes some of the spice, but does some spice still remain?

Method 2:
Use water and soap.



Is this a better method?

Soap molecules can do two things—break the bonds between your skin and the oil (where the spice is) and create bonds between the oil and the water, so you can rinse the spice away.

Researchers have found that many people spend less than 10 seconds washing their hands and many people do not use soap.

Based on your observations, should a healthy handwashing procedure include soap? How many seconds should it take?

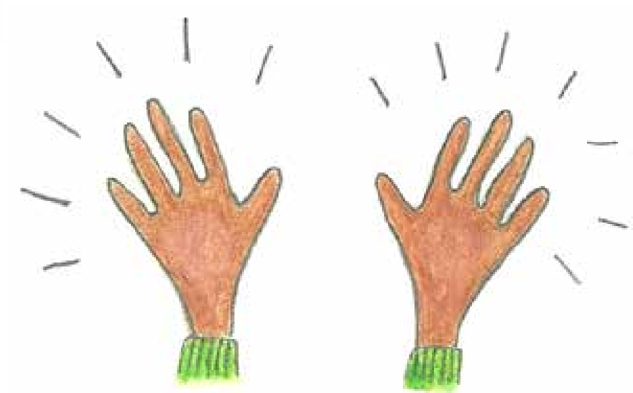
C. Review the recommended handwashing method.

clean, running water

soap

scrub for at least 20 seconds

Dry your hands afterward.
Wet hands can transfer microbes more easily than dry hands.

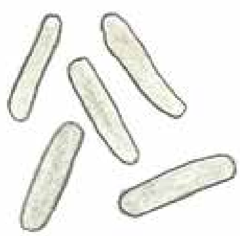


BACTERIA KALEIDOSCOPE

Make a toy with bacteria shapes

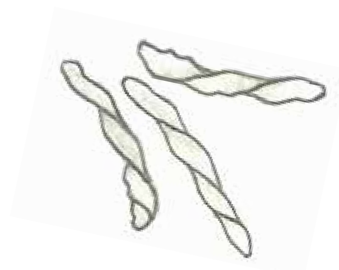
Thousands of species of bacteria live in our intestines, in our belly buttons, on our eyelids, and elsewhere in and on our bodies. But when we look at them under a microscope (or in the *Grossology and You* show, where they can be seen cheering on the body systems in the Personal Universe competition), we find they have a very small number of simple shapes in common.

Bacteria have these three main shapes:



rod

sphere



spiral

WHAT YOU DO

Make a kaleidoscope that uses the three main bacteria shapes to create patterns. A kaleidoscope is a tube with reflective surfaces and colorful objects inside. As the tube is turned, light enters it and patterns can be seen through the eyepiece. Illustrated instructions begin on page 22.

WHAT YOU NEED

For one kaleidoscope:

small, plastic Petri dish (60 mm x 15 mm)
sheet of transparency film
sheet of card stock
piece of white tissue paper, plastic, or wax paper (3 inches x 3 inches)
6–10 spherical beads of various colors
coffee stirrer made of soft plastic (or 4–6 tube beads)

jewelry wire (8 inches)
jewelry-wire cutter
pencil
scissors
ruler
glue stick
double-sided tape
single-sided tape
crayons or color markers

Transparency film is an economical alternative to the mirrors found in store-bought kaleidoscopes; another option is to upcycle clear, plastic clamshell packaging.

A white grocery bag can supply the small piece of translucent plastic for the end cap *(Step E)*.

Use beads with small openings, as other objects in the kaleidoscope may become lodged inside beads with large openings. Choose beads that will fit in the Petri dish when it is closed. Beads about ⅜ inch (10 mm) in diameter fit in a small Petri dish.

HOW LONG THIS TAKES

45–60 minutes

ACTIVITY EXTENSION

Explore the properties of light and mirrors. When light enters the kaleidoscope, the shiny surfaces inside reflect images of the bacteria-shaped objects back and forth at different angles, creating multiple images of the objects. Images in the kaleidoscope are reversed (just as our image is reversed when we look at ourselves in a mirror), and some of these images are reversed again by the kaleidoscope. Experiment by folding the transparency film at different angles to create different numbers of images in the kaleidoscope.

TAKE CARE

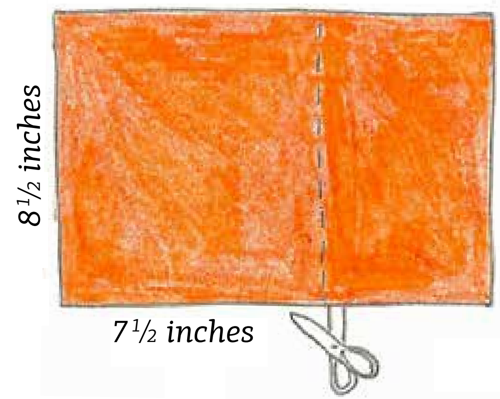
Do not point the kaleidoscope directly at the sun.

Use a coffee stirrer made of soft plastic for the rod shapes, because hard plastic is difficult to cut and the small pieces may fly into the air. Tube beads, which don't need to be cut to size, can also be used.

An adult may need to assist children with these steps in particular: curving the card stock around the Petri dish base *(Step C)*, cutting the jewelry wire into 2-inch pieces *(Step D)*, and folding the transparency film into thirds *(Step H)*.

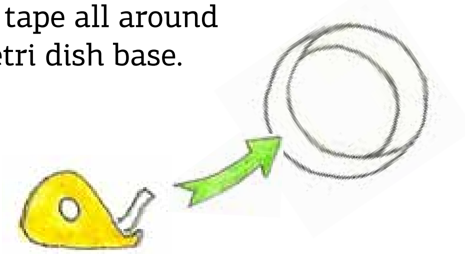
BACTERIA KALEIDOSCOPE INSTRUCTIONS

A. Cut your card stock into a rectangle measuring 8 ½ inches by 7 ½ inches.



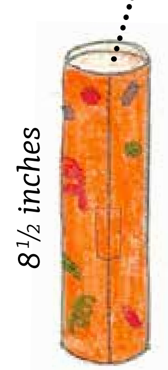
B. Decorate the card stock with bacteria shapes—rods, spheres, and spirals.

C. Put double-sided tape all around the side of the Petri dish base.



Then stick the short side of the card stock onto the double-sided tape, curving the card stock and creating a tube around the Petri dish base.

Use single-sided tape to fasten the tube together.

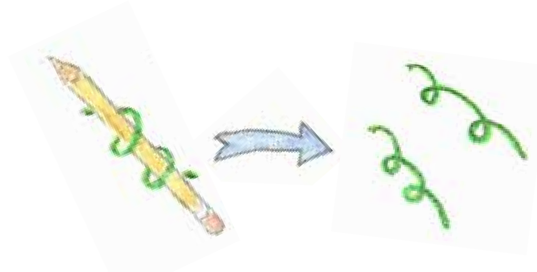


D. Prepare colorful bacteria shapes that will fit in the Petri dish.

Rods: Cut a soft plastic coffee stirrer into ½-inch pieces (or use tube beads).

Spheres: Use spherical beads.

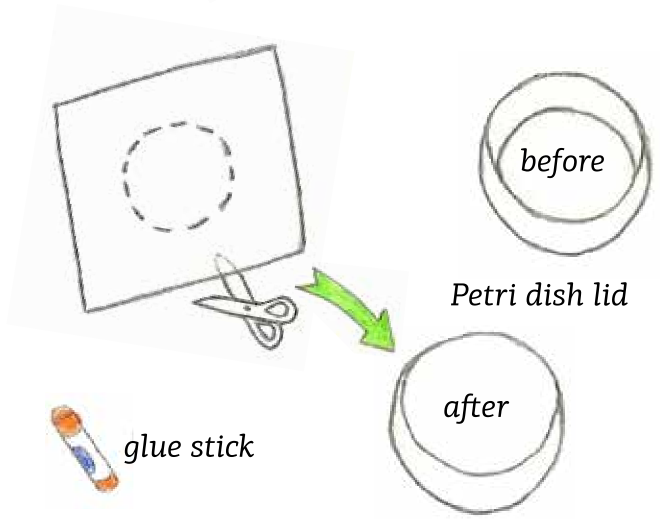
Spirals: Twist a 2-inch piece of jewelry wire around a pencil. Stretch the wire slightly to make a loose spiral.



E. End Cap

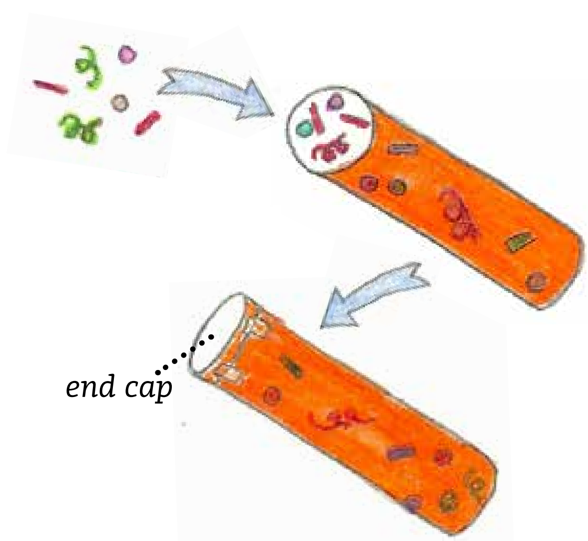
Your kaleidoscope needs a translucent end cap to obscure background distractions while allowing light to enter the tube.

Cut out a circle of white plastic, tissue paper, or wax paper the same size as the Petri dish lid. Glue the white circle to the top of the Petri dish lid.



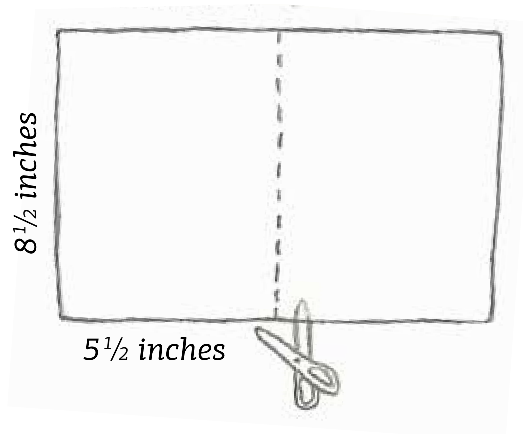
F. Place the bacteria shapes into the Petri dish. Don't put too many in—the objects will need room to move around and create patterns.

Then close the Petri dish by putting the end cap (Petri dish lid) on the kaleidoscope. Tape the end cap in place to keep the bacteria shapes from spilling out of the dish.



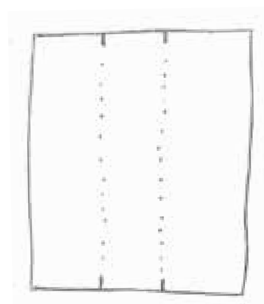
G. Cut the sheet of transparency film in half. You need a rectangle measuring 8½ inches by 5½ inches.

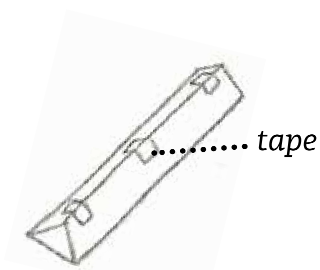
The transparency film will provide the reflective surfaces, like mirrors, in your kaleidoscope.



H. Folding the transparency film in different ways—and making the angles of the folds smaller or larger—will create different types of patterns in the kaleidoscope. Here are two methods to experiment with.

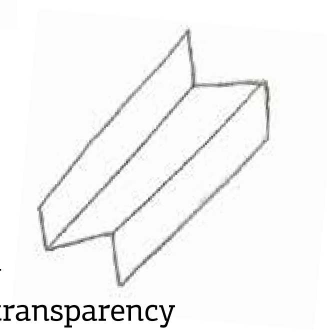
Begin by roughly dividing the transparency film into thirds lengthwise.





Method 1

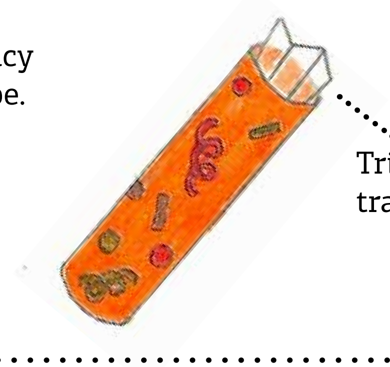
Fold the transparency film into a triangular tube and tape it shut.



Method 2

Bend the transparency film into accordion folds.

I. Slide the folded transparency film into the card stock tube.



Trim the excess transparency film.

J. Eyepiece

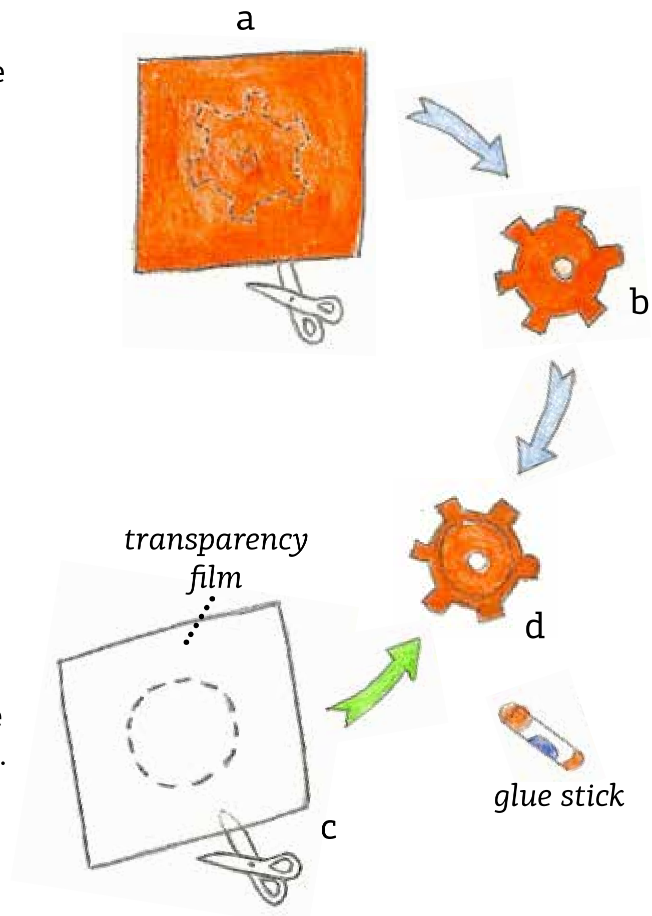
Your kaleidoscope needs an eyepiece to direct your focus into the tube.

a. On card stock, draw a circle the same size as the open end of the kaleidoscope. Draw tabs around the circle. Cut out the tabbed circle.

b. In the middle of the tabbed circle, cut a smaller circle (about $\frac{1}{2}$ inch). This is what you'll look through!

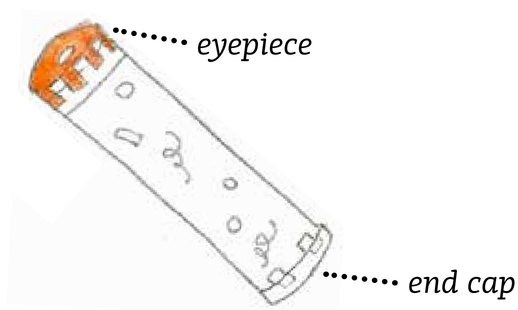
c. Using transparency film, cut a circle slightly smaller than the open end of the kaleidoscope.

d. Glue the transparency film circle onto the tabbed card stock circle. The transparency film will keep dust out of your kaleidoscope.



K. Place the eyepiece on the open end of the kaleidoscope. (The transparency film circle should face inside the tube.)

Bend the tabs down and tape the eyepiece in place.



L. Look through the eyepiece and turn your kaleidoscope to make patterns with bacteria shapes!

STICKTOITIVENESSS

Explain how mucus protects the respiratory system

Mucus is a substance that may look and feel gross but is really helpful, too. Mucus is important to maintaining the health of all three human body systems (respiratory, immune, and digestive) featured in the *Grossology and You* show. This activity focuses on the respiratory and immune systems and how mucus protects our airways, the passages from our nostrils to our lungs.

› Mucus sticks to things like pollen, dust, and bacteria that we breathe in—before they can go all the way down into our lungs.

› Mucus is slippery as well as sticky, so the body can slide mucus—and the things stuck to it—out of the body with a sneeze or cough.

› Mucus has a main ingredient (called mucins) that contains special chemicals (called antibodies) that can actually kill some harmful bacteria and viruses.

WHAT YOU DO

Build two simple models of nostrils and airways, one with mucus and one without. Use the models to demonstrate how mucus protects the human respiratory system. Illustrated instructions begin on page 28. The template for the nostrils is on page 31.

WHAT YOU NEED

For one set of models:

sheet of poster board
sticky contact paper (at least 6 inches x 22 inches)
scissors
ruler
single-sided tape
glue stick (or double-sided tape)
scrap paper
hole puncher

HOW LONG THIS TAKES

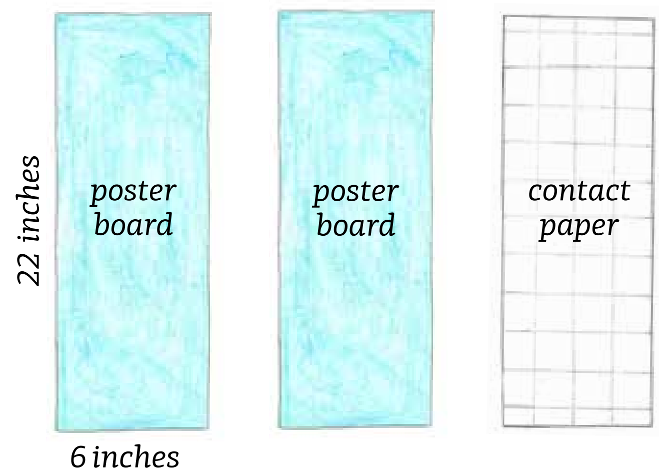
45 minutes

ACTIVITY EXTENSION

Consider mucus in relation to other non-Newtonian fluids—like Silly Putty, Oobleck, and the sodium alginate solution explored in the “Fake Snot, Guts, Poop, & Pus!” activity. Mucus’s non-Newtonian properties come from the properties of the mucin molecules. Long mucin molecules are like chains that bind to each other, creating a loose mesh. How do the non-Newtonian properties of mucus help the respiratory and immune systems?

STICKTOITIVENESS INSTRUCTIONS

A. Cut two pieces of poster board and one piece of contact paper into rectangles 6 inches wide and 22 inches long.



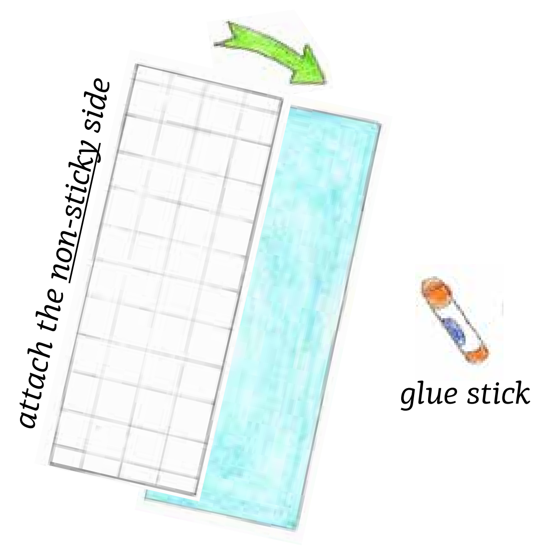
B. Airway Without Mucus

Starting on the long (22 inch) side, roll the first piece of poster board into a tube almost 2 inches in diameter.

Tape the side of the tube to keep it from unrolling.

C. Airway with Mucus, Step 1

Use a glue stick (or double-sided tape) to attach the non-sticky side of the contact paper to the second piece of poster board.

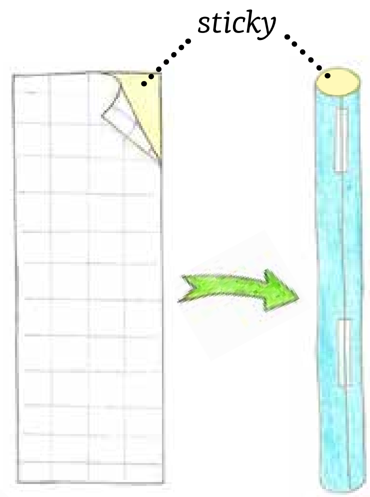


D. <u>Airway with Mucus, Step 2</u>

Remove the paper backing to expose the contact paper's sticky side.

Roll the poster board into a tube almost 2 inches in diameter. The inside of the tube will be sticky!

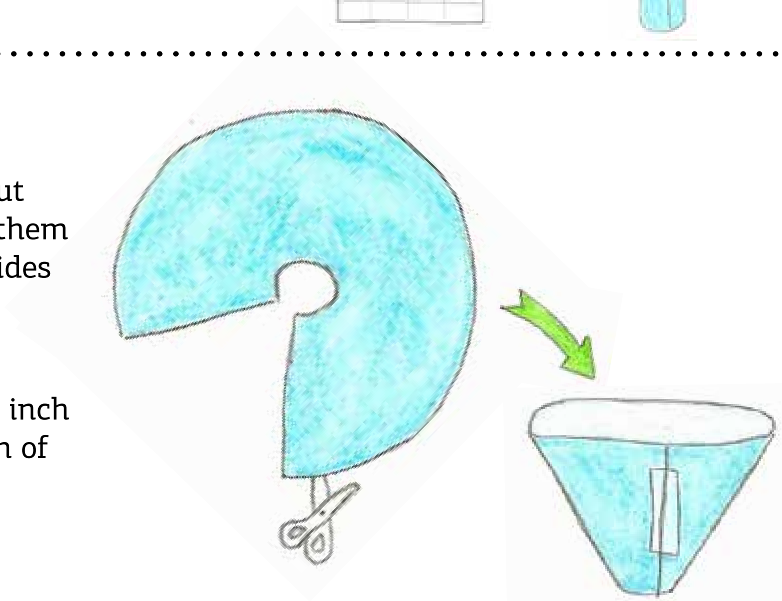
Tape the side of the tube closed.



E. <u>Nostrils</u>

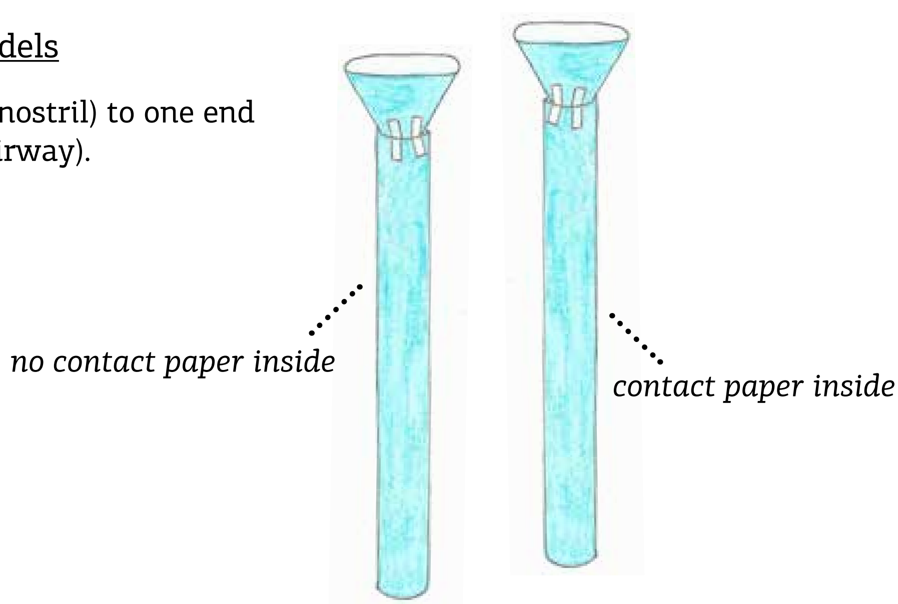
Use the template to cut out two circular shapes. Curl them into funnels. Secure the sides with tape.

There should be a small, circular opening (about ¾ inch in diameter) at the bottom of each funnel.



F. <u>Finish the Models</u>

Tape a funnel (nostril) to one end of each tube (airway).



G. Use scrap paper and a hole puncher to make paper confetti.

The confetti will represent pollen, bacteria, and other airborne particles in your demonstration.

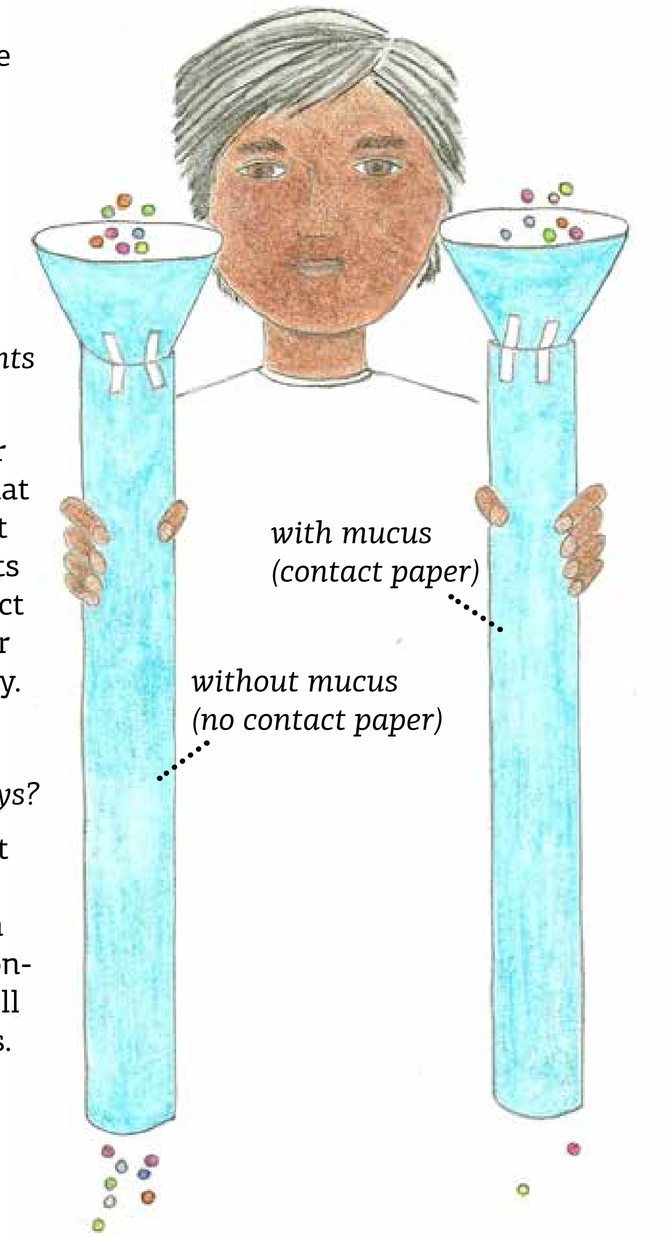
H. Demonstrate by dropping the same amount of confetti (10–20 pieces) into the funnel of each model.

Which of the models represents a healthy airway, and which represents an unhealthy airway?

Our airways are passages from our nostrils to our lungs. The model that is able to trap the confetti before it falls all the way through represents a healthy airway. The sticky contact paper represents mucus, which our airways need in order to be healthy.

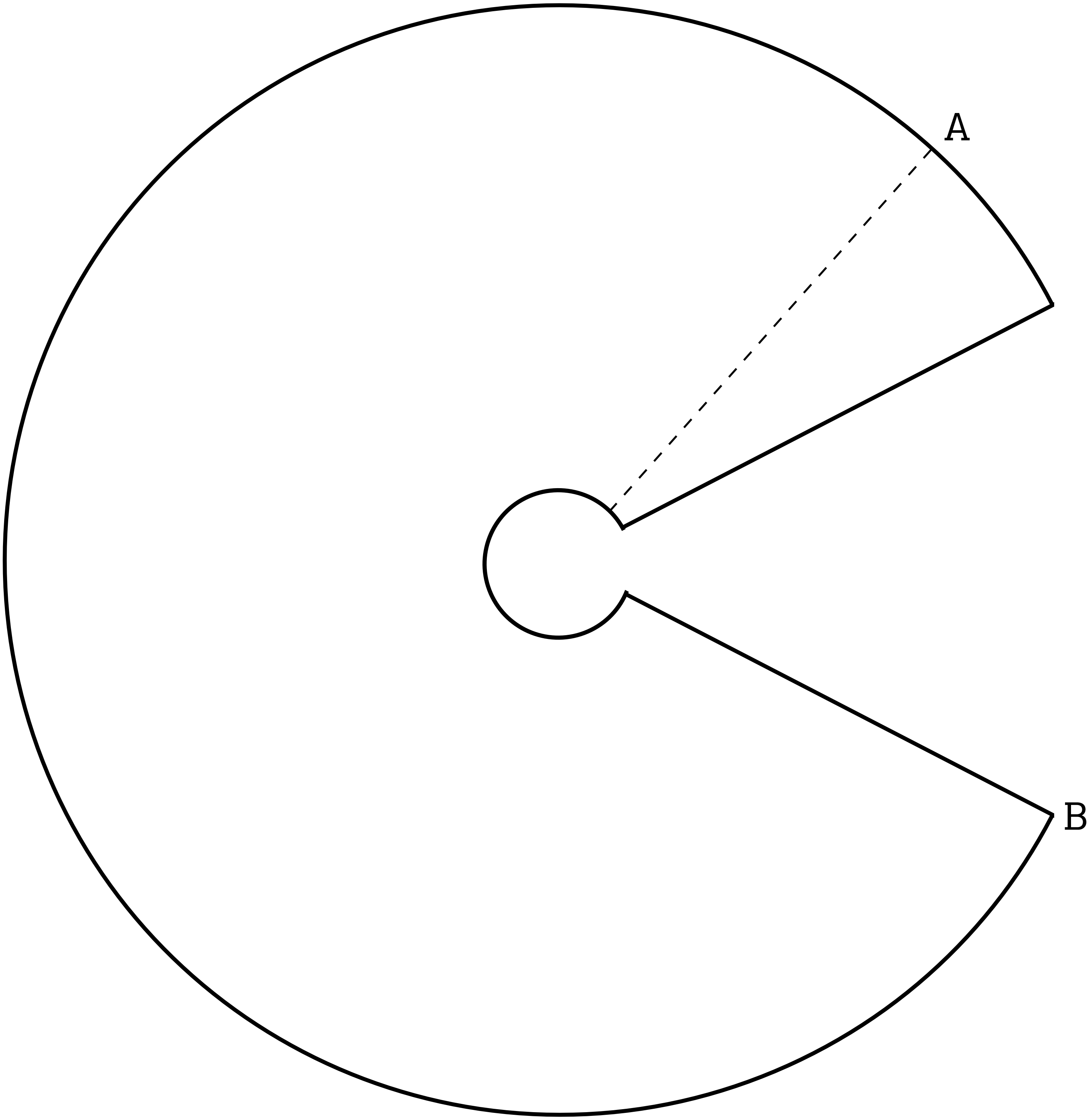
How does mucus protect our airways?

Mucus traps harmful particles that we breathe in—and then helps to carry them out of our bodies when we sneeze or cough. Mucus also contains special chemicals that can kill some harmful bacteria and viruses. Healthy airways are coated with mucus.



Most of the confetti falls through the model that has no "mucus"; most of the confetti sticks inside the model that does have "mucus."

NOSTRIL TEMPLATE



Cut on the solid lines.

Using tape or glue, join point A
to point B to create a funnel.

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