

STEM ACTIVITY GUIDE





The Buzz on Pollination

Get the buzz on the power of pollination with a quick game and invention challenge to help ensure a future full of flowering plants!

MATERIALS NEEDED

- Construction paper
- Craft items (e.g., rubber bands, pipe cleaners, etc.)
- Paper
- Pencil
- Recyclables
- Scissors
- Tape

AT-HOME INSTRUCTIONS

1. Create targets by cutting flowers out of construction paper and scattering them in an open space. Crumple up several pieces of paper to symbolize pollen.
2. Stand facing the flower targets and blow or throw the paper pollen at the flowers.
3. Play the [Pollination Video](#) to discover more about the science behind pollination and receive an additional invention challenge.
4. After watching the video, take a moment to sketch your design of a new type of pollinating device.
5. Use recyclables and any nearby craft items such as rubber bands and pipe cleaners to build a prototype of your unique pollinating device. Remember, a prototype is simply a preliminary model or “rough draft” of a final product and does not need to function.

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

To get a bee’s eye view of pollination, consider planting a garden outdoors. Select native plants that attract pollinators such as butterflies and bees. Have children make predictions about what types of insects or birds will visit the garden. Then, have them observe the garden and jot down notes about their findings. Do the pollinators prefer one type of plant over another? How much time do they spend on a flower? Is there a pattern to how they visit the flowers? The amount of data students can collect is endless!

WHAT ARE WE LEARNING?

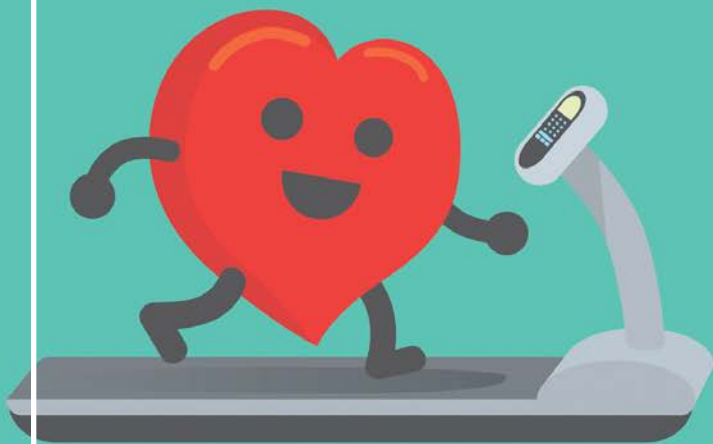
In this STEM activity, students learn about the importance of pollination, and about how different birds and insects play an essential part in ensuring the future of our food supply. By exploring how pollination works, and what types of flowers pollinators prefer, children can begin making decisions that will improve the environment and help maintain the populations of pollinators for years to come.

INSPIRATION

Become inspired by National Inventors Hall of Fame® Inductees [Lorenzo Langstroth](#) and [Luther Burbank](#). Langstroth is credited with inventing the modern beehive, which includes moveable frames that allow beekeepers to easily manage their bees and extract honey. Burbank created more than 800 strains and varieties of plants, including 113 plums and prunes, 10 types of berries and the Freestone peach (a peach with an easily removable pit).

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Heart Racer

Race against the clock while increasing your heart rate and discover how an important heart-saving medical device functions.

MATERIALS NEEDED

- Balloon
- Clay
- Coin battery
- LED
- Tape
- Stopwatch, timer or smartphone

AT-HOME INSTRUCTIONS

- Locate a [miniature two-legged LED](#) and remove the bulb from the base to expose the wires.
- Set a timer for 3 minutes. Before time runs out, perform the following procedure:
 1. Power the LED by placing one wire on one side of a coin battery and the other wire on the other side of the battery.
 2. Tape the LED to the battery securely.
 3. Sculpt a "patient" figure out of clay.
 4. Insert the lit LED into the patient and place him/her in the recovery room (such as a cup or toy bed).
 5. Run in place for 20 seconds to get the heart pumping.
 6. After running in place, inflate a balloon to represent a healthy heart.

For an extra challenge, try performing the procedure even faster. Challenge a friend to see how many patients you can each help in 2 minutes.

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

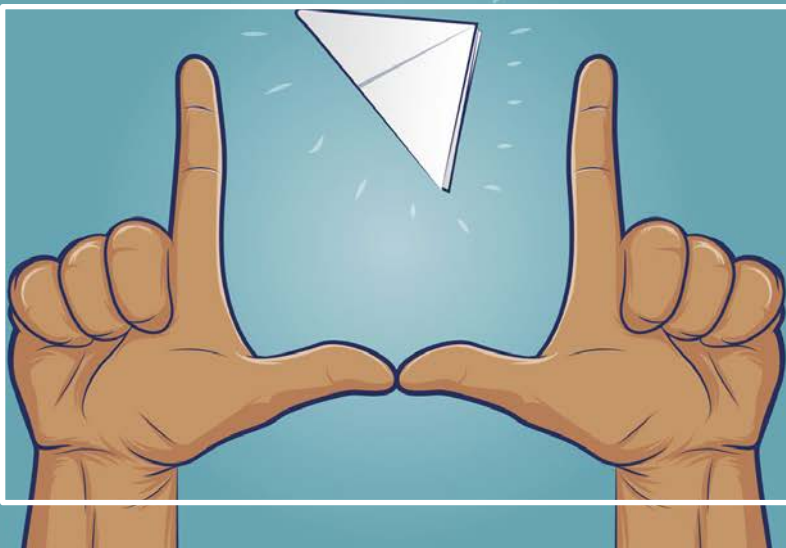
Split your students into teams and in 5-minute increments, see how many patients each group is able to help by working together. Once a balloon is completely inflated, consider this one patient helped. After each 5-minute round, give teams a chance to discuss ways they can be more effective in how they treat the clay figures in their care.

WHAT ARE WE LEARNING?

The heart is an organ responsible for pumping blood to all parts of the body. Hearts rely on electrical messages to keep their beat and sometimes need a little help to keep going. National Inventors Hall of Fame® Inductee [Al Langer](#) co-invented the [implantable cardioverter defibrillator \(ICD\)](#). An ICD is a device that can be placed in the body of a person who has heart trouble so that it will electrically trigger the heart to start beating if it stops. In this activity, the LED represents Langer's ICD powered by a battery, and the deflated balloon represents the patient's heart, which is not working at full capacity. Once the ICD is inserted into the patient, the heart can function normally and start pumping again!

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Paper Football

Explore the science of aerodynamics by playing this unique take on paper football. Encourage children to experiment with many different shapes to see how far they can flick their custom-made "footballs."

MATERIALS NEEDED

- Recyclables and other objects from around the home (straws, paper cups, cardboard tubes, etc.)
- Scissors
- Tape
- Paper

AT-HOME INSTRUCTIONS

1. Build two goal posts using objects found around the house.
2. Find a smooth, flat surface to use as the game field.
3. Fold sheets of paper into different shapes including triangles and squares, or try crumpling the paper into a ball.
4. Attempt to make field goals by flicking these newly created shapes through the goalposts.
5. Discover which paper shapes travel the farthest and highest!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Incorporate the power of teamwork by splitting students into multiple teams, having them work together to design and create "footballs" with different shapes and sizes. Encourage them to predict which of their designs will perform best, and then have them record their data. By organizing this game into multiple rounds, students will have the opportunity to engage in creative problem solving by improving on their designs over time.

WHAT ARE WE LEARNING?

In this activity, children explore the [science behind projectile motion](#) and experience firsthand how gravity causes a thrown, kicked or flicked object to fall in what's known as a parabolic arc. Additionally, students learn that geometry is everywhere – even in sports!

INSPIRATION

Become inspired by NIHF Inductee [Beulah Louise Henry](#), a prolific inventor who created products ranging from an umbrella with interchangeable covers to a vacuum-sealed ice cream freezer. Did you know that Henry is also credited with [inventing a valve for inflatable articles like footballs?](#)

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Birds of a Feather

Learn about feathers and how nature can be a great source of inspiration in this fun STEM activity!

MATERIALS NEEDED

- Item with VELCRO® Brand fastener
- Magnifying glass
- Recyclables and other objects from around the home
- Scissors
- Tape
- Turkey/bird feather (or other large feather)

AT-HOME AND CLASSROOM INSTRUCTIONS

Gather a turkey/bird feather (or other large feather) from your local craft store and check out the detail of the design under a magnifying glass. The soft, feathery part extending out from the stem of the feather has barbs (like fishing hooks) with tiny hooklets. These barbs and hooks attach to each other, holding the strands of the feather together, making it smooth and retaining its shape even in windy conditions.

This barb and hook structure is similar to the VELCRO® Brand fastener, the design of which was inspired by nature! National Inventors Hall of Fame® Inductee George de Mestral went on a walk, and while pulling burrs from his jacket, he began to think about how burrs could stick to clothing and his dog's fur. Upon further investigation with a microscope, de Mestral discovered that there were tiny hooks that entangled themselves in the loops of fabric and fur. This allowed the seedpod to catch a free ride on the fur of passing animals. This discovery inspired de Mestral to design a unique, two-sided fastener just like VELCRO® Brand! One side was made up of stiff hooks like the burrs, while the other side had soft loops like fabric or fur. Check out the VELCRO® Brand fastener under the magnifying glass, too!

YOUR TASK

What might you build that is inspired by nature? Will it be able to attach one object to another? With the help of an adult, gather scissors, tape and recyclables from around the house or classroom to build with. Draw a sketch of your ideas and then start creating your prototype!

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The Big Game

Check out this STEM sports activity for sports and science fans alike. Use the story of game-changing inventor and National Inventors Hall of Fame® Inductee Stan Honey to help you create your own game or sports invention!

MATERIALS NEEDED

- Football (or other sports ball)
- Recyclables and other objects from around the home
- Scissors
- Tape

AT-HOME INSTRUCTIONS

Get ready for the next big game by inventing your own sports accessory or a whole new game! Start by grabbing a football, recyclables and other objects from your home or classroom. How might you create a new game or sports accessory that can bring the action to the viewers? Can you think of a whole new game? Or maybe a way to transform your favorite sport with new ways to score points on the field? Brainstorm ideas with your family or friends. Then, play like a champion! After giving your new game or invention a try, rethink your innovation to see if there are additional ways you can improve your idea to make it even more useful and fun.

INSPIRATION

Become inspired by NIHF Inductee Stan Honey, who forever changed how the game of football is watched by inventing the Virtual Yellow 1st & Ten® line. Now found in almost every football game, the digitally superimposed yellow line has been hailed as one of the most important developments in sports broadcast technology since the debut of instant replay in 1963. Stan Honey improved the viewing experience of millions of sports fans by allowing viewers to get in on the action!

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Science Spot

Create a special spot for exploring science and invention! The best way to make these fascinating subjects an everyday part of life is to keep them top of mind.

MATERIALS NEEDED

- Consumables (e.g., aluminum foil, straws, string)
- Recyclables
- Science-type toys or objects (e.g., magnets, magnifying glasses, washers)
- Scissors
- Tape
- Writing and drawing materials (e.g., markers, paper, pencils)

AT-HOME INSTRUCTIONS

1. Identify a spot that shouts “Science and invention happen here!” It could be a corner of a room, garage or basement, or even a small tub on an open shelf. The idea is to have easy access to materials that encourage exploration and discovery.
2. Search through the toy bin, junk drawer and recycling bin to find items that can be used for science exploration and invention prototype (model) making.
3. Consider adding a sign, some hooks and maybe even a few containers or baskets.
4. Upcycle mint tins for tiny parts, ask a florist for spare water tubes to use as test tubes or purchase eye droppers at the drug store to experiment with colored water. There’s no way to go wrong with creating a special spot for science and invention!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Find a spot in your classroom that can serve as a dedicated science corner. If you have space, consider adding a cart with recyclable materials. Sometimes businesses and factories have scrap materials they are willing to donate (e.g., bottle caps, fabric pieces, containers, etc.) that can be used by children to make invention prototypes (models). Include paper, pencils and markers for idea sketching, as well as books and objects from nature. Be sure to help students understand that this space is for them to pursue their curiosity as a scientist, maker and inventor!

WHAT ARE WE LEARNING?

While inventing or exploring science does not require an official spot or location, creating one can help children (and adults) be more mindful of weaving science into everyday activities. When children approach a space of this nature, they are reminded that they have the ability to make, experiment, discover and invent!

LOOKING FOR MORE SCIENCE ACTIVITIES?

Check out more exciting STEM activities for at home or in the classroom by visiting our [blog](#) or by visiting our Camp Invention [Facebook page!](#)

Ice Excavation

Get ready to go on an arctic adventure! Learn about ice excavation in this exciting ice science experiment while discovering why water freezes and ice melts.



MATERIALS NEEDED

- Clear cup
- Balloon
- Food coloring
- Ice cube tray
- Fruit or plastic toy figures, small
- Salt
- Spoon or craft sticks
- String
- Water

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

To prepare this activity for an entire class, use ice cube trays with small toys such as game pieces or Legos. Prepare one to two ice cubes per child and have a handful of salt shakers the students can share.

LOOKING FOR MORE SCIENCE ACTIVITIES?

If you're interested in more winter science activities for kids, check out our fun winter science experiments on our [blog](#) or our Camp Invention [Facebook page](#)!

AT-HOME INSTRUCTIONS

Raid your refrigerator and gather several small pieces of fruit or other small objects that can get wet. With an adult's help, place the items inside an ice cube tray, fill with water and place in the freezer to create frozen artifacts. For an even bigger challenge, grab a balloon and insert a few of the plastic figures, fill it with water until it is about the size of a water balloon and place in the freezer. Once everything is frozen, place the ice cubes in a cup of water. Take your string and try to fish the ice cubes with frozen artifacts out of the water. Any luck? Nope! Those ice cubes are too big and slippery to catch with one piece of string.

Now, sprinkle the ice cubes with salt and wait a minute or two. Go fishing for frozen artifacts again with your string. Catch anything? Yes? Cool – check out the science behind it below to find out why!

Now, place the ice cubes on a tray and if you have it, peel off the balloon and place the ice ball on the tray. If an adult says it is okay, place a few drops of food coloring on each piece of ice. You might think the ice is 100% solid, but now you can see how the color finds its way into all of the small cracks in the ice.

Now for the excavation! Use spoons or craft sticks to chip and dig your way through the ice, uncovering the frozen artifacts. To speed up the process, sprinkle salt on top of the ice and observe what happens.

WHAT ARE WE LEARNING?

What is ice? Yes, ice is frozen water, but did you know that the hydrogen and oxygen atoms found in liquid water lock together in patterns when the water is cooled below 32 degrees Fahrenheit, forming a crystal? The crystals take up a lot more space than the moving liquid molecules in water, which is why if you freeze a full bottle of water, it bulges out. It's also why ice cubes float! Another cool fact – ice has 15 different crystal forms!

Why does salt make ice melt? This reaction happens because salt lowers the freezing point of the ice, meaning that the temperature has to be even lower for the water to stay frozen. Why did the string catch the ice cubes after using salt? The salt melted the ice, but since it was only a small amount of salt, the water around the ice cubes rapidly froze again, trapping the string in the newly formed ice layer!



Land Ahoy

In this activity, boats aren't just for water! Children use a limited selection of materials and their creativity to build a land boat that sails across different surfaces.

MATERIALS NEEDED

- Tape
- Straws
- Paper

AT-HOME INSTRUCTIONS

1. Using only tape, straws and paper, have children design land boats that they can sail across a table or floor surface. Challenge them to think about the boat's body shape. Will it have sails? If so, how many? Ask what materials will help it sail smoothly. How will they keep it from tipping over?
2. Designate an area as the "pond" and have children race their land boats across the pond. After testing their boats, have them make changes based on their discoveries and then retest them. Encourage children to think creatively and critically by asking them what is working well, what needs problem solving and what other imaginative ideas they have for making changes. To keep the fun going, select a new "pond," changing the surface material the boats must sail on. Consider any readily available surface: table tops, tile flooring, carpeting, tin foil, plastic or even grass!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

This activity is classroom ready! Consider using paper from the recycling bin to show students how you can upcycle items for new uses.

WHAT ARE WE LEARNING?

In this activity, children are challenged to learn the importance of accepting failure as an obstacle and the value of making modifications and retesting. Creative problem solving comes into play as children determine what is working well and what could be improved upon in their designs. Introducing new challenges with the "pond" surface encourages children to think creatively and be innovative to overcome obstacles!

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The Great Marble Pass

Are you ready to take the challenge? In this activity, get the kids together for a fun and exciting race filled with innovation and creativity. Challenge children to think creativity, test their inventions and make modifications to retest!

MATERIALS NEEDED

- Two marbles
- A full recycling bin or craft supply area
- Scissors and tape

AT-HOME INSTRUCTIONS

Gather the whole family or invite some friends over for this fun activity! Divide into even teams and have each team form a line, standing side by side, with a few inches in between each person. Tell them that their challenge is to use recyclable items to pass a marble from one end of the line and back as fast as possible, making sure no one's hands ever touch the marble.

Give 10 minutes for individuals to build their inventions for moving the marble quickly to the next team member. Once done, have them return to their lines to begin the races!

Once teams have completed their first race, have them brainstorm ways of adapting their passing mechanisms and strategies to improve their speed. After a third round, tell teams that they must make at least three changes to their approach and try again. Encourage creativity, open mindedness and ingenuity!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Consider breaking into additional teams based on the number of students in the class.

If there is an odd number of students, join in on the fun to make the teams even!

WHAT ARE WE LEARNING?

In this fun activity, students are learning the importance of thinking creatively and making improvements and modifications to achieve even better results. Students are challenged to face failure and overcome assumptions to test and retest until they find the best solution to move their marble as quickly as possible!

INSPIRATION

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The SuperFast SuperCool

Science is super cool – especially when ice and salt are involved. Supercool water below freezing point and then discover how to make ice on demand in this ice experiment!

MATERIALS NEEDED

- Glass, very clean
- Ice cubes (made from tap water)
- Mixing bowl, large
- Salt (1/4 cup)
- Thermometer (optional)
- Water, purified or distilled

AT-HOME INSTRUCTIONS

1. Fill a mixing bowl with ice.
2. Pour a couple tablespoons of purified or distilled water into a clean glass.
3. Nestle the glass with water into the center of the bowl of ice so that the ice is higher than the level of water in the glass. Be very careful not to spill any ice into the glass of water.
4. Generously and carefully sprinkle the salt onto the ice. DO NOT get any of the salt in the glass of water.
5. Wait approximately 15 minutes for the water to cool below freezing (known as supercool). Optionally, you can carefully insert a thermometer into the glass of water to confirm if it is supercooled (less than 32 degrees Fahrenheit).
6. Place a fresh ice cube or frozen ice pack on a small plate or other dry surface.
7. Carefully remove the glass of supercooled water and slowly pour the water directly onto the ice and watch it freeze instantly on the ice.

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

This is easy to demonstrate in the classroom on top of any desk or table. Prepare the materials and use this activity as an energizer or fun opening exercise to warm up your students' minds for further investigation and discovery.

WHAT ARE WE LEARNING?

Purified water can be chilled below freezing temperature and still remain in liquid form. This is possible because ice crystals need surfaces to grow upon. With purified water, however, there are not enough impurities in the liquid for ice crystals to form. When purified water is supercooled and then carefully poured onto a fresh ice cube or frozen ice pack, the cube or pack serves as the surface upon which the ice crystals are able to form. Try making ice on demand with supercooled water!

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