NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

Build a Cell

Big idea

Get familiar with the basic parts of a cell by making a simple model.

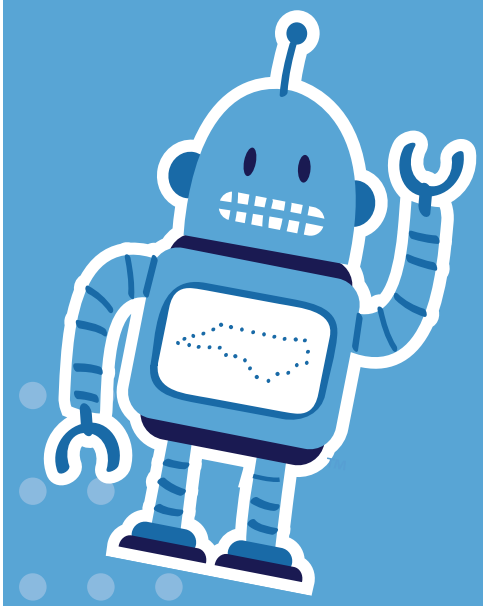
You will need

WHAT WE GAVE YOU:

- pipe cleaners
- plastic capsules
- plastic bags
- Build a Cell instruction sheet

STUFF YOU PROVIDE:

- scissors
- permanent markers
- pencils



Set it up

Each of the 12-inch pipe cleaners needs to be cut in half prior to the event. Place the Build a Cell instruction sheet on the table along with the 6-inch pipe cleaners, plastic capsules, and plastic bags.

It's showtime!

As families approach, invite them to make a simple model of a cell. Remind them that cells are the basic building blocks of all living things and that there are 50 trillion cells in their bodies! Explain that each cell is made up of three basic parts:

- the cell membrane is the outer lining of the cell and will be represented by the plastic bag.
- the nucleus is like the "brain" or "boss" of the cell because it has all the instructions for the cell to do its job. It will be represented by the plastic capsule
- the cell's instructions are located in DNA which is found in genes that are linked together in structures called chromosomes. This is the genetic material for a cell and will be represented by the pipe cleaners. Chromosomes come in pairs - one from the biological mother and one from the biological father.

Give each student one plastic bag, one plastic capsule, and six 6-inch pipe cleaners to make their cell model. Have them use a permanent marker to write "cell membrane" on the plastic bag and "nucleus" on the plastic capsule.

Remind them that chromosomes come in pairs, so they should work with their pipe cleaners in pairs. They will notice that the pipe cleaners are longer than the capsules. Point out that in the cells in their body, the genetic material is in a special shape or form to fit into the nucleus - a spiral shape called a helix. The students will need to twist their pairs of pipe cleaners into spirals and press them down so that they fit into the nucleus. (This can be done by twisting the pipe cleaners around a pencil or a finger.)

Continued ›

SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Build a Cell

Why is this science?

Cells are the basic building blocks of all living things. We're all made up of cells: we have about 50 trillion cells in our bodies, and each has over 20,000 genes inside! A cell is so tiny that you can only see it by using a strong microscope. Each cell is made up of three basic parts:

- The cell membrane is the outer lining of the cell. It is represented by the plastic bag in our model.
- The nucleus is like the "brain" or "boss" of the cell. It holds all the instructions for the cell to do its job. It is represented by the plastic capsule in our model.
- The cell's instructions are located in DNA which is found in genes that are linked together in long structures called chromosomes. This is the genetic material for a cell and is represented by the pipe cleaners in our model.

All living things get their genes from their parents. The chromosomes containing the genes come in matching sets of two (or pairs) and there are hundreds, sometimes thousands, of genes in just one chromosome. In humans, a cell contains 23 pairs of chromosomes inside its nucleus. One chromosome in each pair comes from the mother and one chromosome in each pair comes from the father. This is how people inherit traits, or characteristics, from their parents.

Different animals and plants have different numbers of chromosomes: Our cell model has 3 pairs of chromosomes, which is how many a mosquito has! Carrots have 9 pairs, giraffes have 31 pairs, and a kind of fern plant called "adder's tongue" has more chromosomes than any other living thing - 630 pairs!

Chromosomes are so tiny they are not visible in the cell's nuclues - not even under a microscope! Even though they are so small, in order to fit into the nucleus, the genetic material is in a special shape or form - a spiral shape called a helix.

North Carolina connection

Did you know that scientists can change or "genetically engineer" the instructions in the DNA of a plant cell? New instructions in the cell's genetic material can help plants like farm crops resist frosts, droughts, insects, diseases and other things that can prevent them from growing well. Other instructions can help to increase the yield (the amount grown) or the nutritional value of the crop. Many universities and companies throughout North Carolina are involved in this important research because agriculture is an important industry for our state. Today, most of the field corn, soybeans, and cotton grown in NC are genetically engineered.

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

DUKE ENERGY SCIENCE NIGHT

Capillary Flowers

Big idea

Explore capillary action while making a colorful paper flower.

You will need

WHAT WE GAVE YOU:

- plastic cups
- coffee filters (round, "basket style")
- washable markers
- pipe cleaners
- Capillary Flowers instructions

STUFF YOU PROVIDE:

- water (to fill and refill the plastic cups)
- paper towels (to clean up any spills)

Fun options

Place a live white carnation in water containing food coloring and have it on display in order to demonstrate capillary action in real-life botany. The water will travel up the stem and color the petals of the flower!

Set it up

This activity would work best with 3 tables; the first for preparing the filter paper and observing the capillary action, second for drying the filter paper after removing from the water, and third for creating the flowers with the pipe cleaners.

Prior to the event, pour a small amount of water (approximately one-quarter inch) into each of the plastic cups. It's a good idea to make a capillary flower before the event begins. This way, you will become familiar with the process, and your sample will serve as an example for others to follow.

It's showtime!

As families approach, invite them to learn about capillary action by making a colorful paper flower.

Instruct them to stretch open the circular coffee filter and draw a circle about an inch away from the center of the filter. Next, they will fold the paper in half and then in quarters, so that it looks like a pizza slice.

Make sure the marker line is above the water. To test this, place the quartered filter paper next to the OUTSIDE of the cup, point down. If the ink is below the water, the ink will simply wash into the water and this experiment won't work as well.

Place the filter paper point down in the water and watch as capillary action pulls the water – and ink – up the paper. Have them observe the paper while the water is moving the entire length of the quartered filter paper, which will take a few minutes.

Some may prefer to use multiple colors, or to have the filter in the water for shorter times. This is fine, too.

When the water has nearly reached the top, lift the filter out of the water and let any extra water drip back into the cup. Gently open the filter paper and allow it to dry 5-10 minutes. (Perhaps suggest they go do another activity and then come back!)

When the paper is dry enough to handle without ripping, gently fold the filter paper back into quarters and wrap a pipe cleaner around the point of the filter paper to make a flower stem.

Continued ›

DUKE ENERGY SCIENCE NIGHT

Capillary Flowers

Why is this science?

While making your paper flower, you were observing **capillary action**. Capillary action occurs because water is "sticky", thanks to the forces of **cohesion** (water molecules like to stay close to each other) and **adhesion** (water molecules are attracted and stick to other substances.) This allows water to flow in narrow spaces without the help of forces like a pump or gravity. In fact, with capillary action, liquid can flow against gravity (like the water rising up the paper in this activity.) Paper towels use capillary action to help clean up spills by pulling liquid into the porous paper. Plants use capillary action to pull water up from the ground.

During this activity, the water flowed up the porous coffee filter paper, moving the water soluble marker pigments with it. If you used a marker that was a primary color (i.e., red, blue, or yellow) you saw the color pigments moving up the paper along with the water. If you used a marker that was not a primary color, then you may have also seen separation of the color pigments into the primary colors. This is because the color pigments move at different rates with the water.

North Carolina connection

Biomedical engineering researchers from North Carolina State University and the University of North Carolina at Chapel Hill have developed inexpensive paper "pumps" that use capillary action to move very small amounts of fluids. Their device uses pieces of paper that are 125 microns thick, a little more than the width of a single hair, to move fluid volumes of one microliter or less... much smaller than a single teardrop! By changing the shape of the paper they are able to control how much liquid is pulled through an attached device – and how quickly that happens. These devices hold promise for being small, portable, and inexpensive for testing bodily fluids like blood. The work is published in the journal *Technology*.

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

Computer Vision

Big idea

Computers use data to find patterns which they can use to identify objects.

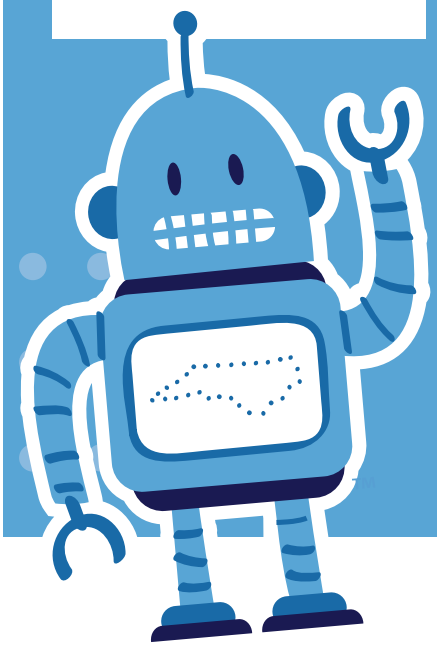
You will need

WHAT WE GAVE YOU:

- Computer Vision instruction sheet

STUFF YOU PROVIDE:

- a computer with internet access and a web cam
- 3-5 random objects such as pencils, pens, markers, cups, erasers - anything!
- different versions of the same object (e.g., pencils of different color and length)



Set it up

Place the Computer Vision instruction sheet next to the computer.

Sign in to the computer and use a web browser to navigate to this site: **https://teachablemachine.withgoogle.com/train/image**

Click the “webcam” button to ensure you can see an image; adjust computer settings as necessary. (Don’t worry: recorded images are not sent to the internet!)

It’s a good idea to go through the activity ahead of time in order to make sure you understand the instructions as well as anticipate any issues children may have.

It’s showtime!

Encourage families to have fun training the "Teachable Machine" to recognize objects, faces, and hand gestures. Instructions are included for them to follow. The website has additional resources if families want to experiment with voice or pose recognition.

Families may have fun getting the computer to recognize different versions of the same thing - such as a yellow pencil versus a red one, or a short pencil versus a long one.

Can families train the computer to correctly identify three different groups of objects? What happens when you introduce a 4th item?

Fun options

HAND SIGNALS

Train the computer to recongize your hand making "rock, paper, and scissors".

EMOTION RECOGNITION

Train the computer to recognize your emotions by smiling, frowning, and looking excited.

Continued ›

SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Computer Vision

If they love it

Challenge families to think broadly about how computers identify objects.

Could your program identify all kinds of dogs, for example?

How about different types of drink holders?

Try training the system to recognize sounds and poses as well!

Why is this science?

Computer Vision is a type of **Artificial Intelligence (or AI)** where people train a computer to recognize objects. Artificial Intelligence is a growing segment of Computer Science. These identification systems are used in law enforcement, at the grocery store, and as part of search programs, such as when you use Google to look for a picture.

North Carolina connection

North Carolina is home to many companies that use Artificial Intelligence in their everyday business. Did you see Watson the AI robot win at Jeopardy? That was built by IBM, which calls North Carolina home. Even our farmers are using AI to water and fertilize our crops more effectively. AI is part of our state's economic future!

This activity produced in partnership with:

North Carolina School of Science and Mathematics

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

Fingerprints

Big idea

Explore the 3 main fingerprint patterns and discover which type(s) you have.

You will need

WHAT WE GAVE YOU:

- ink pads
- latex balloons (caution: allergy warning)
- hand wipes
- magnifying glasses
- Fingerprint Patterns instruction sheet

STUFF YOU PROVIDE:

- garbage bag
- optional: paper

To consider

Police fingerprinting may come up during this activity. Keeping in mind that 1 in every 28 children has an incarcerated parent, remain sensitive to any issues that may arise and redirect students to the fun science behind this fingerprint activity!

Set it up

Set out the ink pads, balloons and hand wipes on your table. Display the pictures of different fingerprint types where they can be easily seen. You may want to tape these to the table or on a wall.

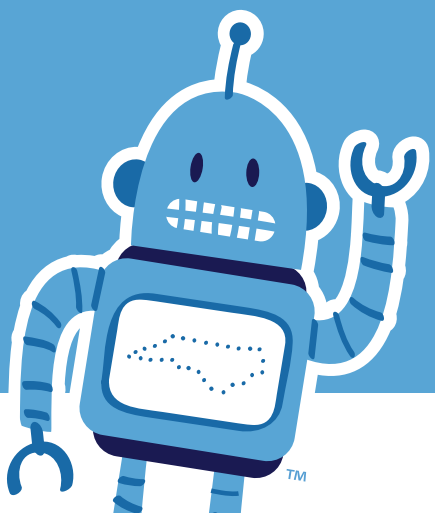
It's showtime!

As families approach your table ask them to look at the tip of one of their fingers. Ask: Can you see any lines on your fingertip? Explain that those lines that make up the pattern of their fingerprints are called friction ridges. Forensic scientists classify these patterns into three different types: arch, loop and whorl. Direct the families to the enlarged images of each type of fingerprint pattern. Explain the characteristics of each type of print:

- Arch – ridges form a hill or tent-shaped pattern
- Loop – ridges form an elongated loop pattern
- Whorl – ridges form a circular pattern

Let them know that they have the opportunity to take a closer look at their fingerprint and determine which type it is. To do this they will carefully roll one finger on the ink pad and then transfer the print to the surface of a balloon. Rolling their finger from one side to the other works best to evenly coat it with ink and transfer the print. Caution them not to press too hard or they might smudge their fingerprint. Once they have transferred their fingerprint they may blow up their balloon – this will enlarge the print so that they can see it more easily and determine its pattern. When they are finished, they may use a hand wipe to remove the ink from their finger(s).

Continued ›



SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Fingerprints

Fun options

DURING SCIENCE NIGHT

Allow participants to make impressions of other fingerprints on a sheet of paper. Most people should have some combination of the different fingerprint patterns among their 10 fingers.

Take it back to the classroom

Measure how your students' fingerprints compare to the national population. Have students analyze their fingerprints to determine each pattern type. Then, create a graph showing the distribution of different patterns within your class. A version of this activity can be found online at:

www.forensics.rice.edu/en/materials/activity_ten.pdf

Why is this science?

Every person has tiny raised ridges of skin on the inside surfaces of their hands and fingers and on the bottom surfaces of their feet and toes, known as "friction ridge skin." The friction ridges provide a gripping surface in much the same way that the tread pattern of a car tire does. No two people have exactly the same arrangement of ridge patterns – not even identical twins who share the same DNA! Although the exact number, shape and spacing of the ridges changes from person to person, fingerprints can be sorted into three general categories based on their pattern type: arch, loop and whorl.

During the third to fourth month of fetal development, ridges are formed on the epidermis, which is the outermost layer of skin, on your fingertips. Fingerprints are static and do not change with age, so an individual will have the same fingerprint from infancy to adulthood. The pattern changes size, but not shape, as the person grows (just like the fingerprint on the balloon in this activity). Since each person has unique fingerprints that do not change over time, they can be used for identification. For example, forensic scientists use fingerprints to determine whether a particular individual has been at a crime scene. Fingerprints have been collected, observed and tested as a means of unique identification of persons for more than 100 years.

Fun Fact: Loops are the most common type of fingerprint; on average 65% of all fingerprints are loops. Approximately 30% of all fingerprints are whorls, and arches only occur about 5% of the time.

N C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

Galilean Cannon

Big idea

Use the law of conservation of energy to make your own "Galilean Cannon".

You will need

WHAT WE GAVE YOU:

- seismic accelerator (Astro Blaster)
- 3 bouncy balls
- safety glasses
- Galilean Cannon instructions

STUFF YOU PROVIDE:

- a large area to serve as the launch zone*
- basketball and tennis ball (see fun options)

*Safety notes

This experiment requires adult supervision and an area with a lot of space and high (or no) ceilings.

It may be a good idea to mark the area as a launch zone.

The top ball can shoot off at high speeds; wear the safety glasses when using the seismic accelerator and perform the demonstration away from students.

Set it up

Mark off an area with plenty of open space - preferably with high ceilings or outdoors. Lay out the instruction sheet. It's a good idea to practice a time or two before the event begins so you will become familiar with the process.

It's showtime!

As families approach, ask them what happens when they drop a bouncy ball. They'll probably say it falls down, hits the ground, and bounces back into the air. You can demonstrate with one of the bouncy balls. Ask the students to observe that the ball bounces a little bit lower every time. Have them make predictions about what will happen when we try dropping the bouncy ball on top of a stack of other larger balls. Add the bouncy ball to the top of the seismic accelerator, then drop the entire contraption. Stand back - the top ball will shoot higher into the air!

Fun options

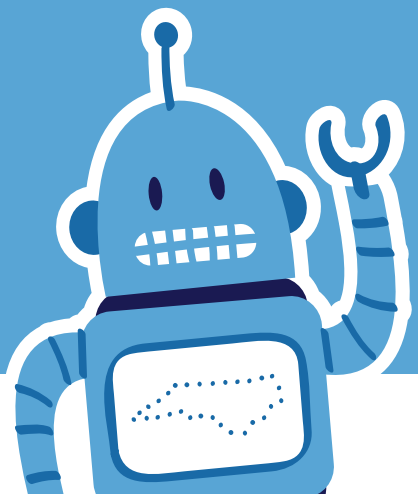
Before using the accelerator and the bouncy ball, demonstrate using a tennis ball to discuss the "law of conservation of energy" discussed on the back. You can then drop the tennis ball on top of a basketball to discuss the "elastic collision" and the Galilean Cannon.

If they love it...

Set up a mechanism to measure the height of the bounces.

Try this with different types and sizes of balls to see which Galilean Cannon bounces the top ball the highest.

Continued ›



SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Galilean Cannon

Why is this science?

In this experiment, we are using something called the law of conservation of energy, which states that energy cannot ever be created or destroyed, but it can be transformed. When we lift up a ball, we are giving it potential energy - the force of gravity will pull it back towards Earth, so we call this "gravitational potential energy." As the ball falls downwards, the potential energy changes into kinetic (or moving) energy. When the ball hits the ground and bounces back up, that kinetic energy changes back into potential energy. The ball bounces a little bit lower every time because some of the energy is lost to friction, sound, and heat as the ball changes shape when it hits the ground.

When we placed the bouncy ball on top of a stack of balls, we created a Galilean Cannon! When the largest ball hits the ground, it starts bouncing up into the air, but there's a smaller ball in the way. This creates comething called an "elastic collision" and energy from the bottom ball is transferred to the next ball. When you stack more than two balls, you can transfer even more energy. This means that the top ball bounces upwards with its own energy plus extra energy from all the balls below it - allowing it to bounce way higher than it normally would!

North Carolina connection

The NC Science Festival team worked with members of the Department of Physics and Astronomy at the University of North Carolina at Chapel Hill to set the world record for the highest launch from a Galilean Cannon. We used a similar stack of 4 rubber balls (called a “Seismic Accelerator”) to transfer all the energy into the smallest ball and designed a special device to help us maximize the results by ensuring the stack dropped perpendicular to the ground so the ball would launch straight up into the air.

When we did this experiment, we were able to launch the ball over 13 meters – or 42 feet!

Do you think you can break that record? Try experimenting with your Galilean cannon and use #NCSciFest to share your results with us on social media!

Learn more about the Guinness World Record:

www.guinnessworldrecords.com/world-records/428375-highest-launch-from-a-galilean-cannon

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

Garden In A Glove

Big idea

Explore what seeds need to grow by "planting" five different kinds of seeds in the fingers of disposable gloves.

You will need

WHAT WE GAVE YOU:

- disposable gloves
- markers
- cotton balls
- containers for water
- 5 different kinds of seeds
- craft sticks
- twist ties
- Garden in a Glove instruction sheet

STUFF YOU PROVIDE:

- water
- paper towels

Fun Options

AHEAD OF TIME:

Provide additional types of seeds for families to choose from when planting their Garden in a Glove, like herbs or wildflowers.

Set it up

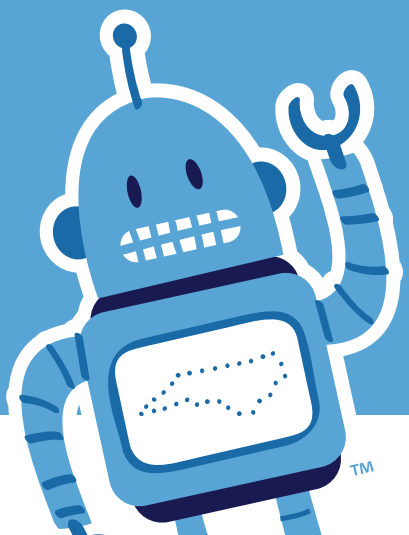
Fill the empty containers halfway with water. Lay out the materials in order from left to right: disposable gloves, markers, cotton balls, water, seeds, craft sticks, and twist ties. Place the Garden in a Glove instructions on the table. It's a good idea to make your own Garden in a Glove as an example. This way the students can see the finished product, and you get a chance to make sure you understand the instructions as well as anticipate any issues children may face when "planting" their gardens. If you expect a large crowd, it's a good idea to pre-label gloves to help speed up the process.

It's showtime!

As families approach your table, ask them: What do you think seeds need in order to grow into plants? They will probably say things like water, sunlight and dirt. Let them know that they are going to plant a garden without using any soil. Explain that most seeds only need water and a warm place to begin to grow. Seeds have their own food stored inside of them, a tissue rich in starch and protein called endosperm, so they do not need sunlight or nutrients from soil until they have sprouted and developed roots. Help students "plant" their Garden in a Glove according to the instructions.

Note: Younger children may have trouble getting the cotton ball into specific fingers of the glove. Encourage an adult or an older sibling to help them by rolling down the top of the glove and holding it open for them (as if putting on a sock).

Continued ›



SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Garden In A Glove

Why is this science?

Most plants begin their life cycle as seeds. While seeds come in many shapes and sizes, they all pretty much serve the same function. Most seeds only need water and a warm place to begin to grow. Seeds have their own food stored inside of them, a tissue rich in starch and protein called endosperm, so they do not need sunlight or nutrients from soil until they have sprouted and developed roots.

Each seed contains a baby plant that will start to grow under the right conditions. The first stage in seed growth is called germination, which is when a tiny root(s) emerges from the outer seed covering. After the root(s) emerge, the stem and leaves begin to grow upward. Once a seed has germinated, the tiny growing plant is usually called a seedling.

There are several external factors which can affect seed germination. The most important external factors include: temperature, water, oxygen and sometimes light or darkness. Common garden seeds, like those used in this activity, germinate with water and warmth.

North Carolina connection

North Carolina is the native habitat of many plants, including the Venus Flytrap. Venus Flytraps (Dionaea muscipula) are unique because they are carnivorous plants. The Venus Flytrap consumes mostly insects and arachnids after catching them between two hinged lobes. Small prey are able to escape, but large prey are trapped and digested over the next ten days. After digestion, the trap reopens and is ready to catch another unsuspecting victim. Venus Flytraps flower in the spring and produce small, shiny, black seeds. Venus Flytrap seeds can be purchased online if you're inspired to grow your own bug catcher!

Did you know: The 60-mile radius around Wilmington, NC is the only place in the world the Venus Flytrap plant grows naturally?!

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

DUKE ENERGY SCIENCE NIGHT

Genetic Trait Bracelet

Big idea

See what genetic traits you have and represent them with a personalized bracelet.

You will need

WHAT WE GAVE YOU:

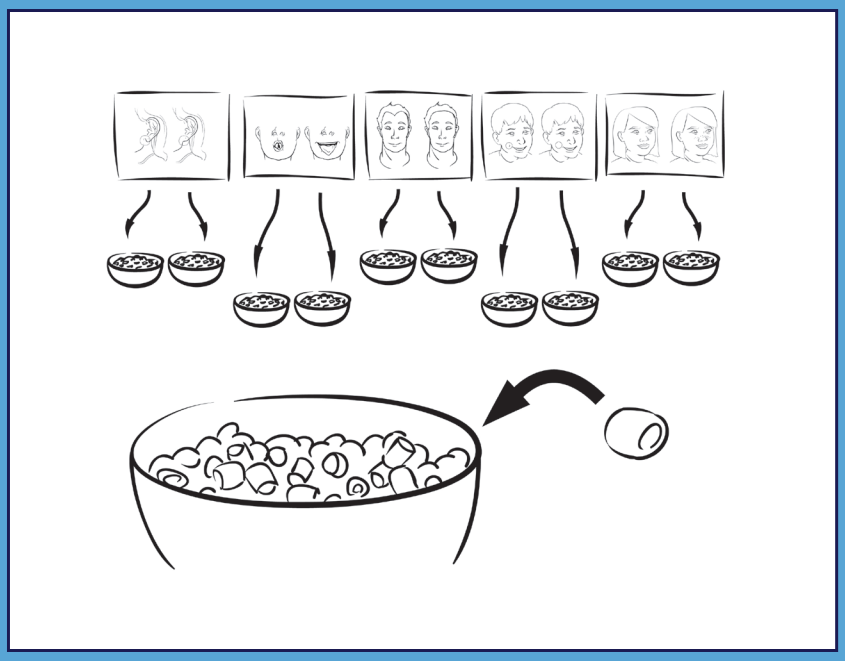
- 10 colors of pony beads
- pipe cleaners
- Genetic Trait Bracelet instruction sheets

STUFF YOU PROVIDE:

- optional: mirror

Set it up

Lay out the trait cards in the order shown in the diagram. Open each container of beads and place the corresponding colors below each of the trait cards. Put the pipe cleaners on the left side of the table. Participants will start at the left and work their way to the right, adding beads to their pipe cleaners as they go.



It's showtime!

As families approach, invite them to learn about genetic traits. These are observable characteristics that are passed down from parent to child. Each person will have many traits they have in common with others, but their overall combination of traits makes them unique.

Ask participants to look at the pictures on each trait card and decide which trait they have, and then add a bead of the corresponding color to their pipe cleaner. They should end up with five beads representing their five traits. Then, they can twist the pipe cleaner around their wrist and wear it as a bracelet.

Encourage students to compare their bracelets with their family members and friends. They may notice that there are usually similarities within biological families.

Continued ›

DUKE ENERGY SCIENCE NIGHT

Genetic Trait Bracelet

Why is this science?

Each of these traits is controlled by **genetics**, meaning that the trait you show on the outside is the result of your genes on the inside. **Genes** play an important role in determining **physical traits** — how we look —and lots of other stuff about us. They carry the information that makes us who we are and what we look like: curly or straight hair, long or short legs, even how we might smile or laugh. Many of these traits are passed from one generation to the next - or inherited - in a family by genes. For example, if your mom has freckles, you might have freckles too because you inherited the trait for freckles.

Genes are so small you can't see them. They are found on tiny spaghetti-like structures called **chromosomes**, which are found inside cells. Each cell in the human body contains about 25,000 to 35,000 genes. **Cells** are the very small units that make up all living things and your body is made of billions of them. A cell is so tiny that you can only see it using a strong microscope. The chromosomes inside the cell come in matching sets of two (or pairs) and there are hundreds — sometimes thousands — of genes in just one chromosome. In humans, a cell contains 23 pairs of chromosomes inside its nucleus. Half of the chromosomes come from one parent and half come from the other parent.

The chromosomes and genes are made of **DNA**. The DNA in a gene spells out specific instructions for making proteins in the cell. Proteins are the building blocks for everything in your body. Bones and teeth, hair and earlobes, muscles and blood, are all made up of proteins. Like chromosomes, genes also come in pairs. Each of your parents has two copies of each of their genes, and each parent passes along just one copy to make up the genes you have. The genes that are passed on to you help to determine many of your traits, such as those in this activity. **Source: https://kidshealth.org/en/kids/what-is-gene.html**

North Carolina connection

Genetic or DNA Testing is the analysis of the chromosomes (DNA) found in a sample of blood, hair or skin from a person. Tissue from the inside surface of the cheek is also commonly used. The testing can provide information about a person's genes and chromosomes and is done for various reasons, such as:

- Diagnostic testing -To diagnose or rule out a specific genetic or chromosomal condition
- Forensic testing – to identify a person for legal purposes
- Paternity testing – to establish biological relationships between people
- Genealogical testing – to determine ancestry or ethnic heritage

The variety of genetic tests and the availability of them has expanded throughout the years. In fact, now genetic test kits are available to purchase and use without even going through a health care professional. LabCorp, headquartered in Burlington, NC, was an early pioneer of genomic testing and develops genetic testing methods. LabCorp operates one of the largest clinical testing laboratory networks in the world and tests genetic test kit samples there. They perform all the testing for 23andMe DNA Test Kits, for example.

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

I Spy with my Microscope Eye

Big idea

Microscopes help us to see more than we can with our eyes alone.

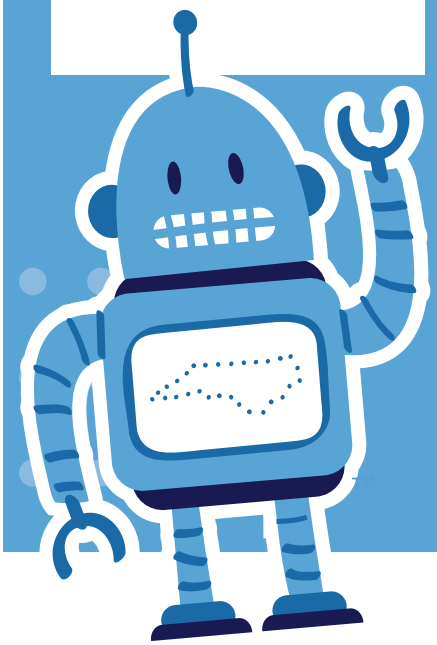
You will need

WHAT WE GAVE YOU:

- Digital Microscope
- I Spy with my Microscope Eye instruction sheet

STUFF YOU PROVIDE:

- a computer with a USB type interface
- objects to view - For example: paper, fabric, a coin, dollar, leaf, flower, seashell, anything you find interesting!



Set it up

Plug the Digital Microscope into the USB port on the computer and open the Camera (PC) or Photo Booth (Mac) application. The scope can be used when held in your hand or clipped into the stand. If using the stand, it is a good idea to tape it to the table. The buttons on the scope will not work with most computers. You can use the application to take pictures of images, if desired.

Remove the plastic cap from the end of the plastic tip. Take care to ensure objects (including fingers) do not come into contact with the microscope lens. The clear plastic tip is designed to help protect it.

Place the objects to view and the I Spy with my Microscope Eye instruction sheet next to the microscope.

It is important to review the instruction sheet and practice using the microscope so that you feel comfortable assisting participants.

It's showtime!

As families come up, ask them if they have ever seen or used a microscope before. Ask them, "what does a microscope do?" Explain that a microscope is a tool that magnifies things - makes them look bigger - so we can see tiny details that are too small to notice with our naked eyes.

This microscope may look a little different than one they have seen before. This is a digital microscope that connects to a computer, so we look at the magnified image on the computer screen instead of through an eyepiece.

Demonstrate how to use the scope, then let participants try it themselves. In addition to the gathered objects, encourage them to look at their skin, fingerprint, fingernail, hair, and clothing.

Fun options

Print photos of magnified objects to have on the table. Participants can look at them and guess what each object is while they are waiting to use the microscope.

Continued ›

SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

I Spy with my Microscope Eye

Why is this science?

A microscope allows you to look more closely at a specimen and see more than you could with your eyes alone. This microscope works by shining light onto an object. The light is reflected off the surface of the object and captured by the camera lens inside the scope to produce an enlarged digital image. The magnification level is determined by the distance of the object and the focus point set by the big silver focus wheel. This microscope can enlarge the image of a grain of salt (which is only approximately 0.3 millimeters) between 40 to 1000 times it's size, allowing you to see it much better!

With this microscope you are able to zoom in on the outside of objects. Stronger microscopes can magnify even more and be used to get an inside, closer look - making it possible to view cells and even atoms! There are multiple kinds of microscopes that can be used for all sorts of things!

Microscopes help many types of scientists. For example: doctors use microscopes to see bacteria, viruses, and other germs so they can figure out what is making their patient sick; forensic scientists use microscopes to get a closer look at evidence from a crime scene; and engineers use microscopes to help them build the tiny microchips that go inside computers.

North Carolina connection

Speaking of computer chips: Did you know that the Appalachian Mountains are very important to the computer industry? Spruce Pine, NC is the source of the purest natural quartz ever found on Earth! This deposit of quartz (which is a form of silicon dioxide) plays a key role in manufacturing the silicon used to make computer chips. In fact, there's an excellent chance the chip that makes your laptop or cell phone work was made using sand from this area of NC!

North Carolina is home to many companies and universities involved in high tech microelectronics and biotechnology research. The life sciences industry is also prevalent within the state. As a result, many scientists, engineers, and technicians that work throughout NC use microscopy in their work.

To help prepare future scientists, the North Carolina Community College System has a Life Science Training Initiative called BioNetwork. Their website contains a fully interactive virtual 3D microscope! Check it out at: www.ncbionetwork.org/educational-resources/elearning/interactive-elearning-tools/virtual-microscope

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

Parachutes

Big idea

Explore properties of gravity and drag by designing and building a parachute with a few simple household materials.

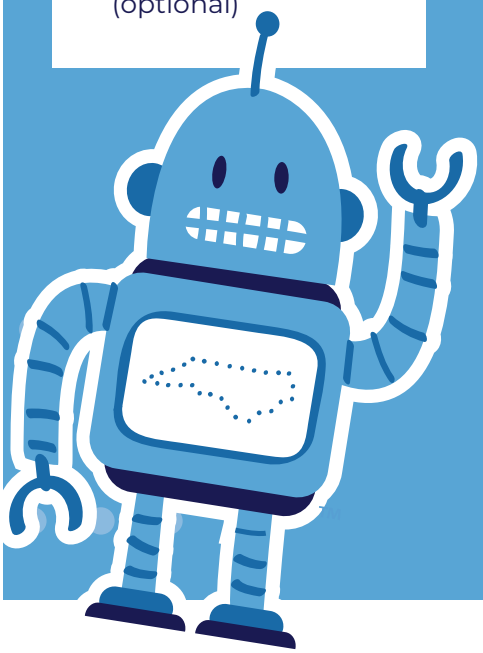
You will need

WHAT WE GAVE YOU:

- napkins
- paper clips
- string
- masking tape
- Parachutes instruction sheet

STUFF YOU PROVIDE:

- scissors
- markers and small sticky notes (optional)



Set it up

Use masking tape to create a bullseye target on the floor. Start with the center ring about the size of a paper plate and move outward in concentric rings. Make each new ring a foot or so larger than the previous. The target should consist of 3 or 4 rings. You may choose to provide additional targets depending on space available.

Lay out the materials in order from left to right: string, scissors, napkins, masking tape, paper clips. Place the Parachutes instruction sheet on the table. It's a good idea to make your own parachute beforehand. This way the students can see the finished product, and you get a chance to make sure you understand the instructions as well as anticipate any issues children may face when constructing and testing their parachutes.

It's showtime!

Show families how your example parachute works. Help families make a parachute according to the instructions. Challenge them to drop it so that their passenger, a paper clip, lands as close to the center of the target as possible. If you'd like to track where parachutes land, have each participant put their name or initials on a small sticky note – each time they drop their parachute they can place the sticky note where their paper clip landed. Encourage them to explore different variables when testing and building their parachutes. For example: the height from which it is dropped, where they are standing when they drop their parachute, the angle at which it is released, the length of the strings, etc.

If they love it?

After participants have successfully built one parachute, challenge them to change the design (one element at a time!) to see how it impacts the descent of their parachute.

Continued ›

SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Parachutes

Fun options

AHEAD OF TIME

If you want, you can provide additional materials like coffee filters, newspaper, tissue paper, etc. Small plastic animals make fun parachute passengers while providing a little extra challenge to the parachute design.

DURING SCIENCE NIGHT

If you have an additional volunteer, you can add a ladder to the activity to make the parachute launches more dramatic. The volunteer can "spot" children while on the ladder to ensure safety.

Why is this science?

When you throw something into the air, like your parachute, it falls because the force of **gravity** pulls it to the ground. As something falls or moves through the air it experiences another force called **drag**, which is caused by the air pushing back against that object. Have you ever put your hand outside a car window as it was moving? The air rushing past the car pushes your hand backwards. Drag slows the object down and the more drag, the slower the object will move. As a parachute falls, the part that fills with air is called the canopy. A parachute works because air gets trapped in the canopy, increasing the force of drag on the parachute and slowing its descent to the earth. Successful parachutes will increase drag enough to allow the object to land safely.

North Carolina connection

A North Carolina native, Georgia Ann Thompson, made history for her role in parachuting and is known as "The First Lady of Parachuting." At the age of fifteen she attended a carnival in Raleigh and watched Charles Broadwick jump from a hot air balloon with a parachute. She joined his traveling show, the World Famous Aeronauts, and parachuted from hot air balloons at fairs, carnivals, and parks around the country.

In 1913, she became the first woman to jump from an airplane with a parachute. The following year, she demonstrated the technology to Army officials but the line of her parachute became tangled in the tail of the plane. She cut off the line and opened her chute manually, paving the way for ripcord technology that is used today. Throughout World War I, she worked as an advisor for the U.S. Army Air Corps, now known as the U.S. Air Force. She retired from parachuting in 1922 after more than 1,100 jumps! You can still see her parachutes on display at the North Carolina Museum of History in Raleigh.

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER

NC SCIFEST
PRESENTED BY BIOGEN FOUNDATION

DUKE ENERGY SCIENCE NIGHT

Ring Gliders

Big idea

It doesn't need to look like an airplane in order to fly! Build a ring glider to experiment with the four forces of flight.

You will need

WHAT WE GAVE YOU:

- paper
- transparent tape
- Ring Glider instructions

STUFF YOU PROVIDE:

optional: hula hoop for target

Fun options

Use hula hoops as targets: have one family member hold the ring and challenge the students to throw their glider through it! Or, have larger paper or paper of different thickness or weight, like construction paper or card stock, so participants can experiment with different materials. Which makes the best glider?

Set it up

Ahead of time, cut 8.5"x11" sheets of paper in half to make 8.5"x5.5" sheets.

Lay out Ring Glider instructions, paper and tape on table. Make sure you have a large open space for throwing ring gliders, as they can travel pretty far!

It's a good idea to make your own ring glider as an example. This way the students can see the finished product, and you get a chance to make sure you understand the instructions as well as anticipate any issues children may have with building their own ring glider.

It's showtime!

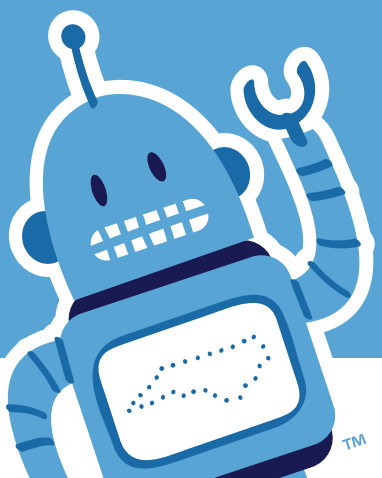
Encourage families to have fun making and flying their ring gliders according to the provided instructions. Straight, crisp folds make for better flight.

There are a few ways to throw the ring glider. Participants can wrap their hand around the glider, nose side facing out and pitch it underhand. Alternatively, participants can wrap both their hands around the glider, hold above their head, and then push forward and release. Because the gliders can fly quite far, it is fun to play catch with them, or compete to see whose glider can travel the furthest.

If they love It...

Challenge families to adapt the designs – what's the biggest ring glider they can make that still works? What happens if you connect multiple rings? Or, what other designs can they create and fly?

Continued ›



SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Ring Gliders

Why is this science?

In order to fly, an object needs to overcome the force of gravity. The earth's gravity pulls things down, so these ring gliders have to take advantage of other forces that temporarily override gravity's pull. Lift is a force created by air flowing over the curved surface of the ring, and thrust is the force given to the glider when you throw it. Both lift and thrust help keep the ring glider in the air. Drag is the resistance met when the ring glider moves through the air; it slows forward motion, which reduces lift. The ring glider is a very compact design, which helps decrease drag. So because lift and thrust are stronger than drag and gravity, the glider will fly.

North Carolina connection

North Carolina is the "First in Flight" state because the Wright brothers flew the first sustained, powered, heavier-than-air human flight in Kill Devil Hills in 1903. The Wright brothers' achievement began aviation as we know it today. People have always been fascinated with the idea of flying. While ring gliders like these wouldn't work for carrying people, they help demonstrate that there is a huge variety of shapes that will fly.

N&C SCIFEST

PROUDLY PRODUCED BY

MOREHEAD PLANETARIUM+ SCIENCE CENTER