GETTING KIDS *excited* ABOUT SCIENCE

# ScienceMatters!

*A Family Science Guide*

## Easy Ways TO HELP KIDS EXPLORE SCIENCE EVERY DAY

## 16 Do-It-Yourself ACTIVITIES

## 50+ Resources and More

SPECIAL SECTION PRODUCED BY
MPLS.ST.PAUL MAGAZINE WITH
SPONSORSHIP ASSISTANCE FROM

# Medtronic: **Science At Work**

**EVERY FIVE SECONDS, A MEDTRONIC THERAPY HELPS SOMEONE WHO IS SICK FEEL BETTER. ELECTRONIC PACEMAKERS, THE SIZE OF A COIN, HELP PEOPLE WITH WEAKENED HEARTS. ELECTRIC STIMULATION HELP PEOPLE WITH SEVERE BACK PAIN. AUTOMATIC INSULIN PUMPS HELP KIDS WITH DIABETES.**

Many of these medical marvels were at one time never thought possible. But scientists invented them and tested them to make sure they work.

Today, more than 9,000 engineers, scientists, computer experts, and doctors continue to fuel Medtronic's innovation engine. These employees continually improve existing technologies as well as develop new ones that help even more people.

Because innovation is so important for Medtronic in fulfilling its mission, the company supports activities geared to inspire the next generation of scientists, engineers, and doctors . . . students today that will change the world tomorrow.

***Science Matters*** is one way for families to continue to have fun with science outside the classroom. Visit medtronicfoundation.org to request additional copies.

*Left*: Science matters at Medtronic, where more than 9,000 engineers, scientists, computer experts, and doctors continue to fuel Medtronic's innovation engine.

## Thank You to Our Experts

Specialists interviewed for this publication include: Karen Klinzing, assistant commissioner of education for the state of Minnesota; Lisa Regalla, science editor for Twin Cities Public Television (TPT); Kirsten Ellenbogen, director of evaluation and research in learning, Science Museum of Minnesota; John Olson, science specialist for the Minnesota Department of Education; Kelly Finnerty, deputy director of programs, The Bakken Museum. Science fair information from Science Buddies, sciencebuddies.com. Select DIY science projects inspired by examples from TPT-produced DragonflyTV (pbskids.org/dragonflytv); TPT's SciGirls (scigirls.org), a new PBS Kids program premiering early 2010, and the Science Museum of Minnesota website (smm.org). Contributing writers include Sara Gilbert Frederick, Seth Hendrickson, and Mike Knight.

# Why Science Matters **Even More**

Science makes front-page news almost every day. It's often the lead story on national newscasts and a hot subject on radio and television talk shows.

Every time you hear about global warming or about the United States' dependence on foreign oil, you're hearing about issues that scientists are working to solve. When you read about the rush to stop the spread of the H1N1 virus, you're reading about scientists in action. When experts talk about the president's plans for clean air standards, fuel-efficient automobiles, and even economic recovery, they're discussing the same subjects that many scientists also are talking about and researching to find solutions.

Science plays a critical role in the changes and advances we experience in the world around us. In the future, many now unimaginable innovations we will enjoy could well be created by scientists who are sitting in grade school and middle school classrooms right now. And the task of inspiring and preparing those future scientists is shared by parents and teachers alike.

Studies have shown that the number-one factor in student success is parent involvement—regardless of how much those parents know about a certain subject. Parents who take their children to museums, who volunteer in their classrooms, and who encourage their children's natural curiosity are giving them a leg up in science.

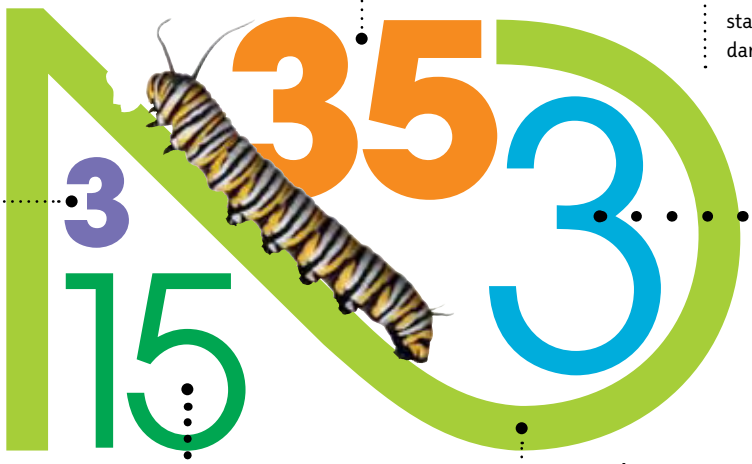
In the end, no matter what children decide to do with the rest of their lives, a strong science background will serve them well. The skills they pick up—from research and problem solving to organization and communication—will come in handy in any profession they pursue.

## SCIENCE IS EVERYWHERE

Designed with you and your child in mind, *Science Matters* explores the important and exciting role science plays in your child's life–both now and in the future. You are a key ingredient when it comes to inspiring your child's curiosity about the science that surrounds us every day. You can help foster an interest that will fuel success in school and inspire a broader outlook on future careers. In this fun resource, you'll find easy, do-it-yourself at-home science projects, games, cool factoids about everyday science for kids along with insights, tips, and resources for you. Dig in and enjoy!

## By the Numbers

The number of states with schedules for reviewing and revising their math and science standards; as of the 2006-07 school year, all states had issued content standards in both subjects.




The number of years of both science and math that high school students in more than half of the states were required to complete in 2006. Most of the remaining states required two years in both; very few states required four years in either subject, and only one state required four years in both.

The number of every five Americans who said they had visited an informal science institution—such as a zoo or museum—in 2006.

The percentage of fourth graders in the United States who performed at or above the advanced benchmark in science in 2007, compared to the international median of 7 percent.

The number of countries that had higher percentages of fourth graders performing at or above the advanced international science benchmark than the United States: Chinese Taipei (19 percent) and Singapore (36 percent).

STATS PROVIDED BY THE NATIONAL SCIENCE FOUNDATION AND THE NATIONAL CENTER FOR EDUCATION STATISTICS

# The Essential Skill Set

Here are some basic skills that will help shape your children's success as they go through school and ways you can encourage them.

**Remember: keep it fun!**

## Observation

Encourage kids to notice things in the everyday world. Challenge them to find patterns and point out deviations from the norm.

## Investigation

Asking questions and engaging curiosity is a crucial component of science and an easy skill to foster at home. Offer your child experiences that will lead to questions–trips to the zoo, for example, or walks in the woods–and raise a few questions of your own as well.

## Problem Solving

Instead of providing instant answers to their questions, you can encourage children to find the answers on their own. The more they can physically investigate something to find those answers, the better.

## Keeping an Open Mind

Sometimes kids come to school with understandings of the natural world that may or may not be correct. That's okay–as long as they recognize that it's okay to change their minds and to accept new answers to old questions.

Create a backyard weather station: ✸ Use a jar to measure rain. ✸ Use ribbons to show wind direction. ✸ Keep a daily journal of the changes.

tip

### OLD BECOMES NEW

Don't be reluctant to revisit museums, parks, libraries, and other special places several times during a child's life. Children develop rapidly, and these places and activities will continue to inspire curiosity and exploration whether it's been a month, a year, or more since your last visit. In a children's museum, for example, a child may play with an exhibit one way and then approach the activity in a whole new way only a month later.

tip

## EXPERT LEARNER

Science is an act of discovery—for both your children and you. Sometimes you won't have the answer, and you'll all be on the learning curve. The beauty is you can show your children how you learn and help them see your process for figuring out something new. Then next time you come across a mystery, you can let them take the lead in figuring it out. In the end, you've helped them build a skill, and your new discovery will be something you share.

## Did You Know?

**STEM** = **s**cience + **t**echnology + **e**ngineering + **m**athematics

These are core ingredients in your child's science education and may be the key to a career in science down the road.

# 4 THREADS

In school, children have a chance to explore four key areas of science that together build a strong, comprehensive foundation. In the process, they also will tap other disciplines, from reading and writing to math and more, enhancing not only their science skills but also their overall academic experience.

STRAND 1

**THE NATURE OF SCIENCE AND ENGINEERING** emphasizes the "built" world and how engineering is used to invent new things and to solve problems; this thread flows through the other three threads as well.

STRAND 2

**PHYSICAL SCIENCE** studies matter, motion, energy, and the influence of human interaction.

STRAND 3

**EARTH AND SPACE SCIENCE** looks at the Earth's structure and processes, the interdependence within Earth's systems, the universe, and the impact of human interactions on Earth and space.

STRAND 4

**LIFE SCIENCE** focuses on structure and function, the interdependence in living systems, evolution, and human interactions within life sciences.

# Setting the Wheels in Motion

Science happens at the playground. It happens at waterparks, in grocery stores, even in the kitchen. Here are several suggestions for engaging children in science—without them even realizing it.

## Encourage observation

If you watch long enough, you'll notice that there's a pattern to the flashing of the fireflies. When you wonder why, that's the start of the scientific process. Finding the answer can be as simple as logging on to the Internet—or, even better, watching a little longer to make a guess (maybe they're communicating?) and then test it (does another come close to the first and flash a reply?).

## Enjoy experimentation

Will you go faster on a waterslide with your legs out straight or tucked in to your chest? Does it matter if your swimming suit is wet or dry? You don't have to tell your children they are learning about variables, friction, and measurements—but you can bet that when those subjects come up in school later on, they'll be better able to understand them.

## Identify skills

Instead of turning a play date at the park into a flashcard moment by pointing out the incline planes, levers, and other simple machines, choose to point out what a smart scientist your child is. Tell him that he's a great observer when he notices something new—and mention that that's what scientists do too.

## Offer experiences

Make cookies together—and let your child measure the ingredients. Go to the zoo—and notice which animals are awake and which are sleeping. Walk through the woods, play at the beach, camp at a local park. Wherever you go and whatever you do, be sure to model curiosity and ask lots of questions.

**{ tip } DON'T FORGET TO ASK** Stay up to speed with your child's school science projects. Ask him about the topic he's studying, how he's exploring it, and what he's learning.

## Magic in Everyday Things

You can turn everything into a teaching moment, if you're clever about it.

DIY SCIENCE

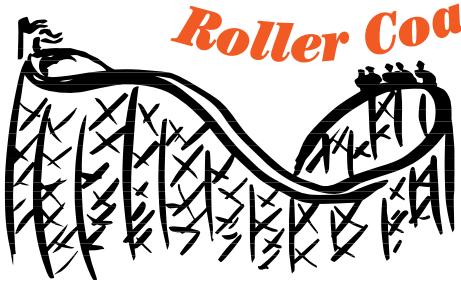
### PENNY SPIN

All you'll need for this is a clear or light-colored balloon and a penny. Push the penny inside the balloon, inflate the balloon, and secure the end. Shake the balloon and the penny will begin to roll around the inside of the balloon on its edge (where there is less friction). Once it gets going, the penny will continue to roll for some time. Is it any different if you try a dime or nickel instead of a penny? Try it with a friend and see who can make the spin last the longest. What made it spin longer?


Chart the phases of the moon: How long does one cycle take? What time of day do you see the moon? What color is it?

SCIENCE IN ACTION

## Roller Coasters



With little help from anything but momentum, gravity, and good design, roller coasters turn basic principles of physics into exhilarating thrill rides. Most start with a slow climb (powered by a motorized chain or cable) up to the track's highest point. Once the rollercoaster reaches the peak, the chain releases the car and gravity takes over. The car races down the hill and gains enough speed to defy gravity and push up the next hill or into a loop, then gravity takes over again. This give and take between motion and gravity happens repeatedly until the ride is finished.

SCIENCE + LIFE:

# Bike Racer Lance Armstrong

HOW HARD IS IT TO WIN THE TOUR DE FRANCE? THINK ABOUT IT: THE RACE IS 1,550 MILES LONG, OR MORE THAN HALF THE DISTANCE FROM NEW YORK TO SAN FRANCISCO. THROW IN SOME LUNG-BURSTING MOUNTAIN CLIMBS, SCREAMING FANS, AND A BUNCH OF OTHER RACERS GETTING IN THE WAY, AND IT'S NO WONDER THAT RIDERS LIKE LANCE ARMSTRONG TURN TO SCIENCE AND TECHNOLOGY TO GAIN AN EDGE.

start

Water bottles, helmets, brakes, and bike suits are all created to slip through the wind, and are put through tests in wind tunnels to measure their aerodynamic properties.

Rear wheels frequently sport dimples–like golf balls do–to reduce drag.

Electronic gear shifting lets riders change gears faster and gain a competitive advantage, and satellite transponders, attached to the bike, help teams keep track of their riders.

Racers also follow a specific diet aimed at providing a steady stream of energy (and power) throughout a long ride. During the Tour de France, Armstrong consumes between 6,500 and 7,000 calories daily –most of us eat fewer than 3,000 calories a day!

Riders follow a grueling training regimen that's scientifically designed to force their heart, lungs, and muscles to work harder, hour after hour.

From head to toe, racers like Armstrong use equipment that's been designed, tested, and manufactured to reduce their resistance to the wind (called "drag") or to be lighter so it requires less energy to go faster than competitors.

Once made from steel, bike frames and gears are now made from much lighter composite materials including layered carbon fiber. Today an entire bike may weigh as little as 15 pounds.

Power meters attached to racers measure heart rate and power output, which aids in training.

finish!

***Looking Back:*** THE FIRST TOUR DE FRANCE TOOK PLACE IN 1903. BACK THEN, THE BICYCLES HAD ONLY A SINGLE GEAR AND, BELIEVE IT OR NOT, THE RIDERS WERE EXPECTED TO PEDAL THROUGH THE NIGHT.

KIDS' CORNER

# Science Speak

| B | R | A | I | N | S | T | O | R | M | F | H | Y | L | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V | A | R | I | A | B | L | E | S | N | G | I | S | E | D |
| M | E | G | K | L | C | O | N | T | R | O | L | V | D | A |
| E | T | O | C | P | R | O | T | O | T | Y | P | E | O | T |
| A | A | R | L | W | I | E | I | T | O | A | M | O | M | A |
| S | C | E | A | T | S | Z | N | N | Q | C | B | N | Y | D |
| U | I | S | S | T | N | J | T | E | X | P | L | O | R | E |
| R | N | E | S | H | A | R | E | M | T | G | J | A | D | T |
| E | U | A | I | T | V | U | R | I | V | D | W | D | E | A |
| Q | M | R | F | D | H | N | P | R | X | R | D | I | S | R |
| T | M | C | Y | D | T | H | R | E | H | O | H | S | C | E |
| J | O | H | D | R | P | J | E | P | U | C | D | C | R | P |
| T | C | I | D | E | R | P | T | X | X | E | Y | U | I | O |
| U | J | A | N | A | L | Y | Z | E | V | R | E | S | B | O |
| I | N | V | E | S | T | I | G | A | T | E | S | S | E | C |
| R | H | R | S | D | I | S | C | O | V | E | R | P | L | P |

Regardless of your child's age, she is already using the language of science every day. Here's what it sounds like:

| PRE K - 2ND GRADE | 3RD - 5TH GRADE | 6TH - 8TH GRADE |
|---|---|---|
| Share | Communicate | Discuss |
| Try | Experiment | Interpret |
| Draw | Brainstorm | Investigate |
| Explore | Discover | Data |
| Observe | Describe | Analyze |
| Question | Plan | Variables |
| Measure | Test | Control |
| Classify | Predict | Research |
| Cooperate | | Prototype |
| | | Design |
| | | Model |
| | | Record |

Now see if your budding scientist can find these words on the WORD FIND.

Make paper parachutes: ✶ Cut 16-inch squares of paper, fabric, or plastic wrap. ✶ Punch corner holes, add strings, anchor with paper clips.

DIY SCIENCE

## DISTINGUISHING DETAILS

Study your region from afar using Google Earth. How close do you need to get before you can detect some of the area's natural landmarks and those made by humans? What kinds of regular and unusual shapes and patterns do you see? What happens when you get closer? Now study an area of the world that you don't know well and see how natural and human influence have impacted that place. How is it similar to or different from your region? What does the Mojave Desert or the polar ice cap look like? How are they different or the same?

## BALLOON HOVERCRAFT

Start with an empty thread spool, a 4-inch square of cardboard, glue or glue gun, a pencil, and a balloon. Glue the flat part of the spool to the center of the cardboard square. Use the pencil to punch a hole in the cardboard that lines up with the spool's hole. Blow up the balloon, twist the neck several times to hold in the air, ease the neck of the balloon over the spool (you may need a partner to hold the spool), then let go and watch it hover. Try using other shapes and sizes of cardboard. What makes the spool hover the best? What happens if you shove it across a smooth, rough, or bumpy surface?*

## BOUNCING BALLS

Gather a collection of balls of all sizes and materials from golf balls and super balls to ping-pong balls, basketballs, and soccer balls. Create a series of tests, such as rolling them on a flat surface or incline or bouncing them on pavement or grass, to see how each responds differently. Predict, test, and assess height and speed of bouncing or rolling balls. Which ones are easier to throw, roll, or kick in the grass or bounce on the grass and why? Set up a makeshift bowling alley or pool table in your driveway with all of the different balls and find out which one has the most impact when you roll it into the group.

*INSPIRED BY SCIGIRLS, PBSKIDS.ORG/DRAGONFLYTV/PARENTSTEACHERS
**INSPIRED BY THE SCIENCE MUSEUM: THINKING FOUNTAIN, THINKINGFOUNTAIN.ORG

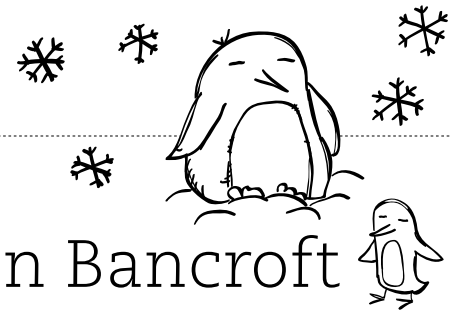
## SCIENCE IN ACTION
# Fireworks

**Fireworks wouldn't be possible without understanding how chemicals react with each other. First, gunpowder launches a tightly packed firework into the sky. Then more gunpowder sets off the firework. This explosion ignites pellets of chemical compounds inside the firework. Different chemicals burn different colors—calcium burns orange, barium burns green, and copper burns blue—creating dazzling 4th of July displays.**

✸ Try different combos and loads.**

## METAL MOUTH

Does your cereal contain iron? Blend heavily iron-fortified cereal and a cup of water in the blender. Pour the mixture in a cup. Swirl a very strong magnet in the mixture then remove it. Have any small iron particles attached to the magnet? Can you do this with crushed dry cereal? Can you do this with less fortified cereals? Why do we have iron-fortified foods?



## SCIENCE + LIFE:
# Polar Explorer Ann Bancroft

OKAY, FOR STARTERS, JULY IS THE WARMEST MONTH OF THE YEAR IN THE ARCTIC, WHEN TEMPERATURES AVERAGE A STEAMY 32 DEGREES FAHRENHEIT. THEN THERE'S THE 4,000-METERS-DEEP ARCTIC OCEAN (THAT'S 40 FOOTBALL FIELDS OR ABOUT 2.5 MILES). IN THE SUMMER IT'S LIGHT 24 HOURS A DAY, AND FROM EARLY OCTOBER TO EARLY MARCH IT'S DARK ALL DAY LONG. AND THAT'S JUST THE WAY ARCTIC EXPLORER ANN BANCROFT LIKES IT. BANCROFT HAS TRAVELED VIA DOGSLEDS, SKIS—EVEN SKI-SAILS—TO MAKE MULTIPLE EXPEDITIONS INTO THE ARCTIC AND ANTARCTICA. SCIENCE AND TECHNOLOGY PLAY ROLES IN JUST ABOUT EVERY STEP (OR STROKE—BANCROFT ONCE SWAM PART OF ONE EXPEDITION) ALONG THE WAY.

Bancroft consults meteorologists to understand how weather patterns might influence (or determine) the route she wants to take.

Though technological advancements to clothing—including the development of GORE-TEX®—help keep Bancroft and others warm, moisture from sweat is often a bigger problem. New "super wools" containing microfibers draw moisture away from the body and maintain body temperature too.

Bancroft uses a hand-held computer and satellite phone to keep in touch with the rest of the world, study the weather, take pictures, and report data to scientists who are using her as a frozen guinea pig (she also was once the subject of a psychological evaluation for NASA).

Bancroft doesn't eat any frozen dinners while she's in the Arctic. Instead, she eats rehydrated meals out of a bag: Just add water to a meal in a pouch, stir, wait five minutes, and voila! Dinner is served. Rehydrated meals reduce the weight of her sled or backpack by eliminating pots, pans, and utensils, and save Bancroft (or her dogs) precious energy.

Because expeditions often rely on ice floes for crossing the Arctic Ocean, she also calls on oceanographers to make sure she doesn't end up on thin ice—literally.

Other measurements she collects are stored in handheld data-loggers or simply written down.


***Looking Back:*** BANCROFT MADE HER FIRST EXPEDITION IN 1986, AND KNOWS FIRSTHAND HOW TECHNOLOGY HAS CHANGED ARCTIC EXPLORATION AND TRAVEL. "WE HAD THIS BEAT-UP OLD RADIO, AND WE'D HAVE TO THROW THE 'D' BATTERIES INTO BOILING SOUP WATER AT THE END OF THE DAY TO HEAT THEM UP SO THEY'D WORK!"

## SCIENCE + LIFE:
# Meteorologist Mike Bettes

**ANYONE WHO'S SEEN A TORNADO KNOWS THESE POWERFUL STORMS ARE CAPABLE OF CAUSING SERIOUS DAMAGE. WHICH MAKES SPOTTING, TRACKING, AND DOCUMENTING THEM ESPECIALLY IMPORTANT–AND POTENTIALLY VERY DANGEROUS. ENTER METEOROLOGISTS LIKE THE WEATHER CHANNEL'S MIKE BETTES. BETTES AND OTHER STORM CHASERS USE SOPHISTICATED TECHNOLOGY, TOOLS, OBSERVATION, AND AN UNDERSTANDING OF METEOROLOGY–THE SCIENCE OF WEATHER AND WEATHER CONDITIONS–TO FIND TORNADOES.**

Chasers have plenty of cool gear to record and document storms including video- and still cameras; weather balloons that measure winds, pressure, temperature, and other variables; and even sticknets and tornado PODs that are purposefully stuck in the storm's path to retrieve more data.

Using computer models and severe weather outlooks, storm chasers first search for weather forecasts predicting the necessary ingredients for a tornado–a combination of moisture, instability, lift, and wind shear.

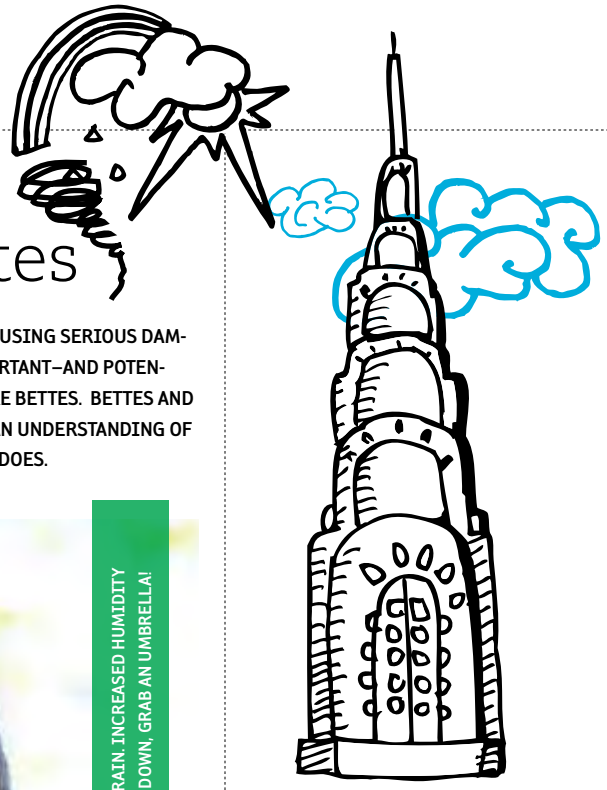
Once the severe weather materializes, storm chasers use a cell phone, PDA, or laptop–anything that connects to the Internet–to get online satellite maps and radar to help them find the storm.

A global positioning system (GPS) unit helps them figure out how to get to the storm.

Someone still has to observe a tornado to report its actual location. Overcast skies can reduce surface heat and instability–which decreases the likelihood of a tornado. A sudden increase in wind (called a gust front) and hail indicate both lift and moisture–and possibly a giant thunderstorm (called a supercell) capable of producing a tornado. And both conditions–a cloudy sky and high winds–are easily observed without the aid of any equipment.

Once the storm passes, chasers observe and examine the damage left behind. Data collected from storms helps explain how storms develop. It also helps in the study of climates (climatology) and to verify (or nullify) theories about global warming.

***Looking Back:*** BEFORE RADAR, STORM CHASERS WERE "FLYING BLIND," SAYS BETTES, THOUGH THEY COULD COUNT ON COWS TO FORECAST RAIN. INCREASED HUMIDITY (OFTEN A SIGN RAIN'S COMING) CAN CAUSE COWS' JOINTS TO ACHE–SOME LIE DOWN TO ALLEVIATE THE PAIN. IF YOU SEE A BUNCH OF COWS LYING DOWN, GRAB AN UMBRELLA!



## SCIENCE IN ACTION
# Skyscrapers

**Tall buildings used to require large bases for support. Now engineers, using innovative construction including strong steel beams to handle a building's weight, can create tall and skinny skyscrapers. The unique way they connect all these beams–the "bones" of the building–prevents the towers from tipping over, and even keeps them from wobbling in the wind. For a long time, the Willis Tower in Chicago at 1,450 feet was the world's tallest building. Once it is complete, the Burj Dubai in the Middle East will be the tallest at 2,684 feet. That's more than half a mile high!**

**tip**

## STUMPED?

Don't be afraid if kids ask questions and you don't know the answers. You don't have to have all of the answers. Science is all about discovery—find the answers together!


INFINUVO IMAGE © METAPO, INC.

SCIENCE IN ACTION

## Robotic Vacuums

Vacuuming is a real chore, but, thanks to robotic vacuums, doing it yourself may be a thing of the past. These small, disc-shaped robots emit ultrasonic pings, which are tiny sound waves that bounce off any object in their path (including the dog). When the pings bounce back, the robot can determine where the objects are and how to avoid them, just like bats, whales, and ships do. They can "see" the furniture in your living room without actually having eyes!

## START IN YOUR OWN BACKYARD

When it comes to everyday science, Dorothy in the *Wizard of Oz* said it best, "There's no place like home." Many of the tools you need for everyday science can be found in and around your home. Cooking is not only a great lifeskill but also requires the attention to detail and creativity that will serve future scientists well. **Your backyard has loads of potential for exploration and experimentation** by kids of any age–from simple scavenger hunts to highly involved gardening and composting projects. Looking for more ideas? Check out the resource list at the back of this publication to get started.

Discover crystals: ✶ Sprinkle salt (table, kosher, rock, epsom) on black paper. ✶ Examine with magnifying glass. ✶ How are they different?

DIY SCIENCE

### HOMEMADE BAROMETER

Barometers detect shifts in pressure and help predict weather. Make your own: Cut off the bottom of a balloon, stretch the top part over the top of an empty jar, and secure it with a rubber band. Tape one end of a straw to the balloon's center (the straw's other end becomes a pointer). Tape an index card to a cereal box so the pointer can touch it. Mark that spot. As pressure shifts (expanding balloon = high pressure and fair weather; contracting = changing weather) the pointer will move up and down. Track your results every few hours for a couple days and note the weather. Can you predict tomorrow's weather?

### PAPER BRIDGE

Create two towers of books of equal height side-by-side with only a small gap in between. Lay a recipe card across the gap and see how many pennies you can stack on the card before it gives in. Next try folding the card in half lengthwise and then stacking the pennies. Is this stronger? What if you fold the card lengthwise accordion style? Is it stronger or weaker? Which approach allows you to stack the most pennies? Now try cards of other shapes—triangles, squares, tubes—and see what design is the strongest.*

### FOG IN A JAR

With a large clear jar, a piece of black paper, warm water, matches (ask an adult for help), and a large bag of ice, you can create fog. Cover the back half of the jar with black paper and fill the jar 1/3 full with warm water. Have an adult hold a lit match halfway into the jar for a few seconds and then drop it into the water. Cover the jar with the bag of ice. Watch fog appear as the warm water evaporates, rises to the cold ice, and then cools, allowing water molecules to collect on the bits of ash from the match.

*INSPIRED BY SCIGIRLS, PBSKIDS.ORG/DRAGONFLYTV/PARENTSTEACHERS

# The Future Is Now

What is one of the most common ingredients found in virtually all scientists? A healthy amount of curiosity. Does your child ask lots of questions? Could be the sign of a budding scientist, and the future looks bright when it comes to careers with a scientific twist.

The Bureau of Labor Statistics projects that between 2004 and 2014, employment in fields related to science and engineering will continue to increase, in some areas by as much as 50 percent. Almost all of the fastest growing careers will require a degree in science, technology, engineering, or math (also known by the acronym STEM)—and even those that don't will be better served by someone with a strong background in science.

Future STEM graduates may be working on iPods, laptops, and cell phones—but they'll also be designing the next generation of must-have gadgetry. Some may find scientific careers in the most unlikely fields—such as fashion design. Consider clothing designer Lucy Dunne, an assistant professor of design at the University of Minnesota's College of Design. Her creations are about more than simply fabric. She's trying to develop clothing that can comfortably carry electronic sensing devices that can detect medical problems. By fusing design and science, she is solving problems on a whole new level. That's what scientists do, whether they wear white lab coats or not.

## DIY SCIENCE

### BUBBLE GEOMETRY

Create a bubble solution using dish soap and water. Then construct a series of three-dimensional shapes based on triangles, circles, and squares using pipe cleaners. Dip them in the solution and see what kinds of bubbles they create. Study how the solution looks when it forms a thin film creating a series of surfaces on the framed shape you've made. Using other objects—straws, recycled strawberry baskets, funnels, utensils, coat hangers—create unusual bubble wands and note the size and number of bubbles each creates. **

**INSPIRED BY THE SCIENCE MUSEUM: THINKING FOUNTAIN, THINKINGFOUNTAIN.ORG

### CARTESIAN DIVER

Fill a large soda bottle to the neck with water, add in a packet of fast-food ketchup, and cap the bottle tightly. Does the packet float? (If it doesn't, replace it with another one that does.) Now squeeze the bottle and watch what happens to the packet. Release the bottle and see where the packet goes. Squeezing the bottle increases pressure inside the bottle and compresses the little air bubble inside the ketchup packet so much that the packet becomes more dense and sinks. Will the same thing happen if you place the bottle in a bowl of warm or cold water?*

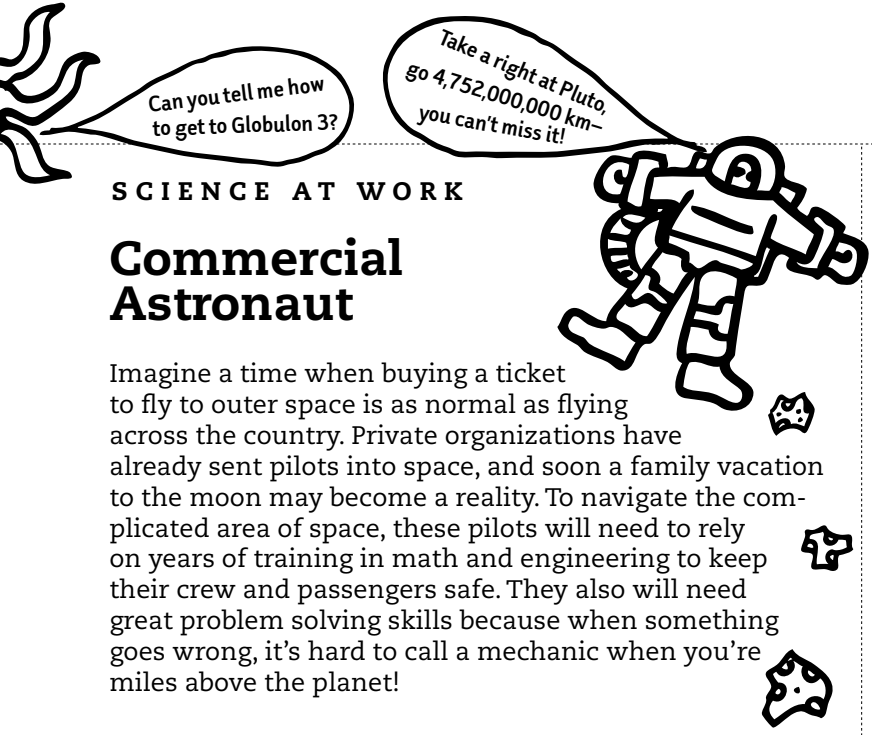
*INSPIRED BY SCIGIRLS AND PBSKIDS.ORG/DRAGONFLYTV/PARENTSTEACHERS

Float a marble: ✶ Put a marble in a small jar. ✶ Fill jar halfway with salt and cover it. ✶ How should you shake to make the marble appear?*

## SCIENCE AT WORK

## *Race Car Designer*

**To win an IndyCar race, you need a good driver. But before you even get to the track, you need a lightning quick car–that's where car designers come into play. They examine all the physical properties of the car to maximize speed. This includes monitoring complex data while the car is in motion to make it as aerodynamic as possible so it flows smoothly through the air instead of pushing against it. They also need to be able to solve problems at lightning speed, because once the race starts, the only time to fix something is during pit stops. And sometimes tweaking just one little thing will make all of the difference between winning and losing a race.**




SCIENCE AT WORK

## Commercial Astronaut

Imagine a time when buying a ticket to fly to outer space is as normal as flying across the country. Private organizations have already sent pilots into space, and soon a family vacation to the moon may become a reality. To navigate the complicated area of space, these pilots will need to rely on years of training in math and engineering to keep their crew and passengers safe. They also will need great problem solving skills because when something goes wrong, it's hard to call a mechanic when you're miles above the planet!

SCIENCE AT WORK

## *Forensic Scientist*

AT THE SCENE OF THE CRIME, A FORENSIC SCIENTIST PLAYS AN IMPORTANT PART IN SOLVING THE MYSTERY BY CAREFULLY SEARCHING FOR AND COLLECTING EVIDENCE. EVIDENCE CAN BE ANYTHING FROM BROKEN GLASS OR FINGERPRINTS TO TIRE TRACKS OR A SINGLE STRAND OF HAIR. THESE CRIME SOLVERS TAKE ALL THE EVIDENCE TO A LAB, WHERE THEY ANALYZE IT USING A VARIETY OF HIGH-TECH INSTRUMENTS. WITH DNA EVIDENCE ALONE, A SINGLE STRAND OF HAIR CAN TELL THEM WHO THE CRIMINAL MIGHT BE.

Lava lamp: ✷ Fill a jar half full with water. ✷ Add an inch of vegetable oil. ✷ Add one spoon of salt. ✷ Watch! ✷ Test flour, sugar, and sand.*

KIDS' CORNER

# What Do You Like to Do?

SCIENCE IS AT THE FOUNDATION OF **all kinds of cool careers** AND YOU MAY BE MORE INTERESTED IN SCIENCE AND TECHNOLOGY THAN YOU THINK. CHECK THIS OUT:

**IF YOU LIKE CAPTURING AND COLLECTING INSECTS . . .** entomologists use botany, entomology, and the natural sciences to study insects and their behavioral patterns so they can learn how to control 'em.

**IF YOU LIKE TAKING YOUR TOYS APART (AND PUTTING THEM BACK TOGETHER AGAIN!) . . .** mechanical engineers research, design, manufacture, and test all kinds of mechanical creations to make sure they do what they're supposed to do.

**IF YOU LIKE PLAYING WITH YOUR FOOD . . .** food scientists use chemistry, biochemistry, microbiology, and engineering to turn grains, fruits, livestock, and vegetables into new food products.

**IF YOU HAVE THE NEED FOR SPEED . . .** materials engineers use science and engineering to turn sophisticated materials including metals, plastics, and ceramics into advancements in other places (like lighter, faster, and more flexible boards, bikes, and skis).

**IF YOU LIKE CATCHING FISH, SEARCHING FOR SEASHELLS OR PLAYING IN THE WATER . . .** oceanographers use engineering, biology, zoology, and special equipment to study the oceans and how they function as ecosystems.

**IF YOU LIKE BEING AROUND ANIMALS (LOTS OF ANIMALS) . . .** zoo curators use zoological and veterinary sciences to understand animals, how to keep them healthy and happy, and how to create habitats for them too.

**IF YOU LIKE LISTENING TO MUSIC . . .** acoustic engineers use math, physics, computer skills, electronics, and an understanding of music to design and build sound systems and equipment.

### Did You Know?

**Gecko Toes**

So impressed with a gecko's sticky feet, scientists took a microscopic look and learned nature's secret: Gecko toes are covered with microscopic hairs that stick and release as they go along any surface. Inspired, they used this research to create new adhesive tapes that can stick, hold, and let go like gecko toes.

## SCIENCE COMPETITIONS + YOU = FUN

Part science project, part team contest, science competitions are exciting events where student teams try to solve challenges in earth, physical, and life sciences, and engineering faster or better than their competition. Teams are divided by grade level and normally guided by a coach. Some competitions–like Earth Science Week–take place online, others–including the Future City Competition–take months to complete and include a chance to win trips to national competitions. Besides the thrill of competition and solving the problems, you'll have a chance to meet other kids who share the same interests as you!

For a list of competitions, see the resource listing at the end of this publication.

### Did You Know?

**Light Sticks**

A glow stick is really a tube inside a tube. When you crack it, you break a small glass tube inside filled with a chemical that mixes with and energizes the liquid and dye in the larger tube. The result is light. Different dyes make different colors.

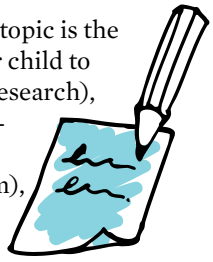

# Science Fairs **101**

**Face it:** Science fairs can be intimidating for newcomers (parents and children alike). But they are great—all you need to do is get your bearings. Here are some easy tips to help everyone enjoy these fun and rewarding events.

### FOR PARENTS:

1. **Getting started:** Your child will enjoy the project and fair more if he or she chooses a topic he or she finds interesting. Hobbies often provide clues when they can't!

2. **Fair they well (not you):** Choosing an interesting topic is the first step toward empowering your child. Lead your child to resources and next steps (ex: take him to the library for research), but don't do anything yourself (ex: researching and printing articles from the Internet). A great place to start the research effort is at Science Buddies (sciencebuddies.com), a site filled with science fair ideas.



### FOR KIDS:

1. **Raise the bar:** Science fair judges aren't easily impressed, so choose a topic that's interesting—but challenging. You may even want to go beyond the patented approach and find a new spin to make it more interesting and unique.

2. **Persistence is key:** It's not unusual for your experiment to become complicated, bogged down, or for a hypothesis to prove incorrect. That's what experiments are all about—so don't give up!

3. **Presentation is, um, also key:** The judges will learn about your experiment and hypotheses from a display board and you—make sure the board is well-organized, easy to read, and neat and tidy (the same goes for you . . . and no jeans or mumbling).

# The Science Zone

[ What to do and where to go to learn more... ]

## MINNESOTA SCIENCE CONNECTIONS

**THE BAKKEN LIBRARY AND MUSEUM**
3537 Zenith Ave. S., Minneapolis
612-926-3878, thebakken.org

**BELL MUSEUM OF NATURAL HISTORY**
10 Church St. SE, Minneapolis
612-624-7083, bellmuseum.org

**COMO ZOO & MARJORIE MCNEELY CONSERVATORY**
Como Park, 1225 Estabrook Dr., St. Paul
651-487-8200,
comozooconservatory.org

**GREAT LAKES AQUARIUM**
353 Harbor Dr., Duluth
218-740-3474, glaquarium.org

**INTERNATIONAL WOLF CENTER**
1396 Hwy. 169, Ely
218-365-4695, wolf.org

**LAKE SUPERIOR ZOO**
72nd Ave. W. and Grand Ave., Duluth
218-730-4900, lszoo.org

**LEONARDO'S BASEMENT**
4301 Nicollet Ave. S., Minneapolis
612-824-4394,
leonardosbasement.org

**MILL CITY MUSEUM**
704 S. 2nd St., Minneapolis
612-341-7555,
millcitymuseum.org

**MINNESOTA CHILDREN'S MUSEUM**
10 W. 7th St., St. Paul
651-225-6000, mcm.org

**MINNESOTA LANDSCAPE ARBORETUM**
3675 Arboretum Dr., Chaska
952-443-1400,
arboretum.umn.edu

**MINNESOTA PARKS**
For a list of Minnesota state and national parks, visit exploreminnesota.com

**MINNESOTA ZOO**
13000 Zoo Blvd., Apple Valley
952-431-9200, mnzoo.com

**THE RAPTOR CENTER AT THE UNIVERSITY OF MINNESOTA**
1920 Fitch Ave., St. Paul
612-624-4745,
raptor.cvm.umn.edu

**SCIENCE MUSEUM OF MINNESOTA**
120 W. Kellogg Blvd., St. Paul
651-221-9444, smm.org

**THE WORKS**
5701 Normandale Rd., Edina
952-848-4848, theworks.org

## GREAT PLACES TO EXPLORE ON THE ROAD

**ADLER PLANETARIUM & ASTRONOMY MUSEUM**
Chicago, Illinois
adlerplanetarium.org

**AMERICAN MUSEUM OF NATURAL HISTORY & HAYDEN PLANETARIUM**
New York, New York
amnh.org

**EXPLORATORIUM**
San Francisco, California
exploratorium.edu

**THE FIELD MUSEUM**
Chicago, Illinois
fieldmuseum.org

**KENNEDY SPACE CENTER**
Orsino, Florida
kennedyspacecenter.com

**THE MAMMOTH SITE**
Hot Springs, South Dakota
mammothsite.com

**MONTEREY BAY AQUARIUM**
Monterey, California
mbayaq.org

**MUSEUM OF SCIENCE AND INDUSTRY**
Chicago, Illinois
msichicago.org

**MUSEUM OF SCIENCE, BOSTON**
Science Park, Boston
mos.org

**SAN DIEGO ZOO**
San Diego, California
sandiegozoo.org

**SHEDD AQUARIUM**
Chicago, Illinois
sheddaquarium.org

**SMITHSONIAN NATIONAL AIR & SPACE MUSEUM**
Washington, D.C., and Chantilly, Virginia
202-633-1000, nasm.si.edu

**SMITHSONIAN NATIONAL MUSEUM OF AMERICAN HISTORY**
Washington, D.C.
americanhistory.si.edu

**SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY**
Washington, D.C.
mnh.si.edu

**SMITHSONIAN NATIONAL ZOOLOGICAL PARK**
Washington, D.C.
nationalzoo.si.edu

**U.S. NATIONAL PARK SERVICE**
nps.gov

**THE WILDLIFE EXPERIENCE**
Parker, Colorado
thewildlifeexperience.org

## COOL SCIENCE WEBSITES FOR KIDS

**BRAINCAKE**
braincake.org

**BRAINPOP**
brainpop.com

**DID YOU EVER WONDER**
lbl.gov/wonder

**DISCOVERY KIDS**
kids.discovery.com

**DRAGONFLYTV**
pbskids.org/dragonflytv

**ENGINEER GIRL!**
engineergirl.org

**EXTREME SCIENCE**
extremescience.com

**GIRLS GO TECH**
girlsgotech.org

**HOW STUFF WORKS**
howstuffworks.com

**NASA FOR KIDS ONLY**
kids.earth.nasa.gov/

**NATIONAL GEOGRAPHIC KIDS**
kids.nationalgeographic.com

**NATIONAL PARK SERVICE WEB RANGERS**
webrangers.us

**SCIENCE BUDDIES**
sciencebuddies.com

**SCIENCE MUSEUM OF MINNESOTA ONLINE ACTIVITIES**
smm.org/explore

**SCIGIRLS**
scigirls.org

**THE WORLD ALMANAC FOR KIDS**
worldalamanacforkids.com

**TRY ENGINEERING**
tryengineering.org/play.php

**TRY SCIENCE**
tryscience.org

**WOLF QUEST**
wolfquest.org

## SCIENCE COMPETITIONS & CLUBS

**FIRST LEGO LEAGUE**
firstlegoleague.org

**FIRST ROBOTICS COMPETITION**
usfirst.org

**FUTURE CITY COMPETITION**
futurecity.org

**HIGH TECH KIDS**
hightechkids.org

**MINNESOTA ACADEMY OF SCIENCE**
mnmas.org

**MINNESOTA SCIENCE FAIR**
fair.mnmas.org

**MINNESOTA SCIENCE OLYMPIAD**
minnesotaso.org

**SCIENCE BUDDIES**
sciencebuddies.com

**SCIENCE OLYMPIAD**
soinc.org

**TOSHIBA/NSTA EXPLORAVISION AWARDS**
exploravision.org

**TRONIX TEAM**
tronixteam.org

**YOUNG INVENTORS PROGRAM**
successbeyond.org/YIF.htm

## SCIENCE INFORMATION, NEWS & ADVOCACY

**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE**
aaas.org

**ASSOCIATION FOR WOMEN IN SCIENCE**
awis.org

**ENGINEERING IS ELEMENTARY**
mos.org/eie

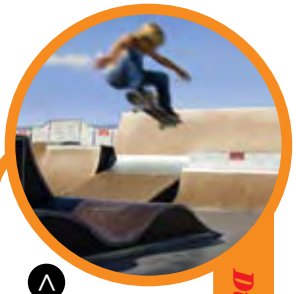
**MINNESOTA DEPARTMENT OF EDUCATION**
education.state.mn.us

**NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS**
nctm.org

**NATIONAL EDUCATION ASSOCIATION**
nea.org

**NATIONAL SCIENCE TEACHERS ASSOCIATION**
nsta.org

**WOMEN IN TECHNOLOGY**
womenintechnology.com



Did You Know?

### Skateboard Parks

Behind all of those great bowls and spine tingling ramps at your favorite skateboard park is a team of engineers, architects, and construction specialists (who are often skateboard fanatics as well) who uses high level science to study and design every angle, dip, and curve to ensure you get all the air you want.

tip

### BUDDING SCIENTISTS

Local science and nature museums are a great source of ideas about a range of science-related careers. Summer camps and after school programs are another great way to expose your child to a variety of careers.

# The Science Zone

**[ What to do and where to go to learn more... ]**

## TENNESSEE SCIENCE CONNECTIONS

**ADVENTURE SCIENCE CENTER**
800 Fort Negley Blvd., Nashville
615-862-5160
adventuresci.com

**CHILDREN'S MUSEUM OF MEMPHIS**
2525 Central Ave., Memphis
901-458-2678
cmom.com

**COON CREEK SCIENCE CENTER**
901-320-6320
2985 Hardin Graveyard Rd., Adamsville
memphismuseums.org/coon_creek-overview

**LICHTERMAN NATURE CENTER**
5992 Quince Rd., Memphis
901-767-7322 ext. 100
memphismuseums.org/lichterman-overview

**MEMPHIS BOTANIC GARDEN**
750 Cherry Rd., Memphis
901-576-4100
memphisbotanicgarden.com

**MEMPHIS ZOO**
2000 Prentiss Pl.
Memphis
901-276-WILD
memphiszoo.org

**PINK PALACE MUSEUM**
Including: Sharpe Planetarium, Crew Training International IMAX Theater
3050 Central Ave., Memphis
901-320-6320
memphismuseums.org/

## GREAT PLACES TO EXPLORE ON THE ROAD

**ADLER PLANETARIUM & ASTRONOMY MUSEUM**
Chicago, Illinois
adlerplanetarium.org

**AMERICAN MUSEUM OF NATURAL HISTORY & HAYDEN PLANETARIUM**
New York, New York
amnh.org

**EXPLORATORIUM**
San Francisco, California
exploratorium.edu

**THE FIELD MUSEUM**
Chicago, Illinois
fieldmuseum.org

**KENNEDY SPACE CENTER**
Orsino, Florida
kennedyspacecenter.com

**THE MAMMOTH SITE**
Hot Springs, South Dakota
mammothsite.com

**MONTEREY BAY AQUARIUM**
Monterey, California
mbayaq.org

**MUSEUM OF SCIENCE AND INDUSTRY**
Chicago, Illinois
msichicago.org

**MUSEUM OF SCIENCE, BOSTON**
Science Park, Boston
mos.org

**SAN DIEGO ZOO**
San Diego, California
sandiegozoo.org

**SHEDD AQUARIUM**
Chicago, Illinois
sheddaquarium.org

**SMITHSONIAN NATIONAL AIR & SPACE MUSEUM**
Washington, D.C., and Chantilly, Virginia
202-633-1000, nasm.si.edu

**SMITHSONIAN NATIONAL MUSEUM OF AMERICAN HISTORY**
Washington, D.C.
americanhistory.si.edu

**SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY**
Washington, D.C.
mnh.si.edu

**SMITHSONIAN NATIONAL ZOOLOGICAL PARK**
Washington, D.C.
nationalzoo.si.edu

**U.S. NATIONAL PARK SERVICE**
nps.gov

**THE WILDLIFE EXPERIENCE**
Parker, Colorado
thewildlifeexperience.org

## COOL SCIENCE WEBSITES FOR KIDS

**BRAINCAKE**
braincake.org

**BRAINPOP**
brainpop.com

**DID YOU EVER WONDER**
lbl.gov/wonder

**DISCOVERY KIDS**
kids.discovery.com

**DRAGONFLYTV**
pbskids.org/dragonflytv

**ENGINEER GIRL!**
engineergirl.org

**EXTREME SCIENCE**
extremescience.com

**GIRLS GO TECH**
girlsgotech.org

**HOW STUFF WORKS**
howstuffworks.com

**NASA FOR KIDS ONLY**
kids.earth.nasa.gov/

**NATIONAL GEOGRAPHIC KIDS**
kids.nationalgeographic.com

**NATIONAL PARK SERVICE WEB RANGERS**
webrangers.us

**SCIENCE BUDDIES**
sciencebuddies.com

**SCIENCE MUSEUM OF MINNESOTA ONLINE ACTIVITIES**
smm.org/explore

**SCIGIRLS**
scigirls.org

**THE WORLD ALMANAC FOR KIDS**
worldalamanacforkids.com

**TRY ENGINEERING**
tryengineering.org/play.php

**TRY SCIENCE**
tryscience.org

**WOLF QUEST**
wolfquest.org

## SCIENCE COMPETITIONS & CLUBS

**FIRST LEGO LEAGUE**
firstlegoleague.org

**FIRST ROBOTICS COMPETITION**
usfirst.org

**FUTURE CITY COMPETITION**
futurecity.org

**HIGH TECH KIDS**
hightechkids.org

**TENNESSEE SCIENCE OLYMPIAD**
chattanoogastate.edu/Science_Olympiad

**TENNESSEE SCIENCE BOWL**
orau.gov/sciencebowl

**SCIENCE BUDDIES**
sciencebuddies.com

**SCIENCE OLYMPIAD**
soinc.org

**TOSHIBA/NSTA EXPLORAVISION AWARDS**
exploravision.org

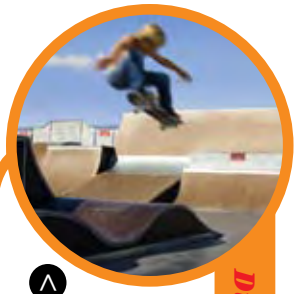
**TRONIX TEAM**
tronixteam.org

**YOUNG INVENTORS PROGRAM**
successbeyond.org/YIF.htm

## SCIENCE INFORMATION, NEWS & ADVOCACY

**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE** aaas.org

**ASSOCIATION FOR WOMEN IN SCIENCE**
awis.org



**Did You Know?**

### Skateboard Parks

Behind all of those great bowls and spine tingling ramps at your favorite skateboard park is a team of engineers, architects, and construction specialists (who are often skateboard fanatics as well) who uses high level science to study and design every angle, dip, and curve to ensure you get all the air you want.

**ENGINEERING IS ELEMENTARY**
mos.org/eie

**NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS**
nctm.org

**NATIONAL EDUCATION ASSOCIATION**
nea.org

**NATIONAL SCIENCE TEACHERS ASSOCIATION**
nsta.org

**TENNESSEE DEPARTMENT OF EDUCATION**
tennessee.gov/education.

**WOMEN IN TECHNOLOGY**
womenintechnology.com

**tip**

### BUDDING SCIENTISTS

Local science and nature museums are a great source of ideas about a range of science-related careers. Summer camps and after school programs are another great way to expose your child to a variety of careers.