Helping Your Child

Learn Science

No Child LEFT BEHIND

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Helping Your Child Learn Science

with activities for children in preschool through grade 5

U.S. Department of Education
Office of Intergovernmental and Interagency Affairs

Foreword

Why is the sky blue?
Why do things fall to the ground?
How do seeds grow?
What makes the sound and music?
Where do mountains come from?

Young children ask their parents hundreds of questions like these. In search of answers, we use science to both enlighten and delight. Being "scientific" involves being curious, observing, asking how things happen and learning how to find the answers. Curiosity is natural to children, but they need help understanding how to make sense of what they see and to relate their observations to their existing ideas and understandings. This is why parental involvement is so important in children's science education. When we encourage children to ask questions, make predictions, offer explanations and explore in a safe environment, we lend them the kind of support that they need to become successful science students and scientific thinkers.

As a parent, you don't have to be a scientist or have a college degree to help your child learn science. What's far more important than being able to give a technical explanation of how a telescope works is your willingness to nurture your child's natural curiosity by taking the time to observe and learn together.

Science "happens" all around us every day, and you have endless opportunities to invite your child into the wonders of science. Without expensive chemistry sets, equipment or kits, a child can be introduced easily to the natural world and encouraged to observe what goes on in that world. When you least expect it, a moment for learning will occur: A bit of ice cream drops on the sidewalk and ants appear; some cups float and some sink when you're washing dishes; static electricity makes your hair stand on end when you put on a sweater.

Through the *No Child Left Behind Act of 2001*, President George W. Bush has made clear his commitment to the goals of raising standards of achievement for all children and of providing all children with highly qualified teachers and with instruction that is based on scientific research. *Helping Your Child Learn Science* is part of the president's efforts to provide parents with the latest research and practical information designed to support children's learning at home, at school and in the community. It reflects the importance of inquiry processes and content in science achievement as described in the *National Science Education Standards*, released in 1996 by the National Research Council of the National Academy of Sciences.

This booklet includes a range of activities for families with children from preschool age through grade 5. The activities use materials found in your home and make learning experiences out of everyday routines. The activities are designed for you to have fun with your child while developing and reinforcing science skills. We hope you and your child will enjoy the activities suggested in this booklet and develop many more of your own.

Contents

Quality education is a cornerstone of America's future and my administration, and the knowledge-based workplace of the 21st century requires that our students excel at the highest levels in math and science.

—President George W. Bush

Introduction

As a parent, you are preparing your child for a world vastly different from the one in which you grew up. Our increasingly technological society will need citizens who have received far more advanced instruction in science and technology than most of us received when we were in school. Even children who don't want to become physicists, chemists, engineers or computer technicians will need some knowledge of science and technology just to conduct their everyday lives. Every citizen needs to be scientifically literate in order to make informed decisions about health, safety and citizenship. Our children need our help and guidance to prepare for the world that awaits them.

Scientific knowledge is cumulative: To learn new things, you must build on what you already know. So, it's important that your child start learning early—and at home. A good way for you to begin the learning process is by sharing your own interest in science. How you view and talk about science can influence your child's attitudes toward science—and how she[1] approaches learning science. It's easy to undermine a child's interest and attitudes by saying things such as, "I was lousy in science, and I've done OK," or "I always hated science when I was in school. It's boring." Although you can't *make* your child like science, you can encourage her to do so, and you can help her to appreciate its value both in her everyday life and in preparing for her future.

In everyday interactions with your child, you can do many things—and do them without lecturing or applying pressure—to help her learn science. Here are a few ideas:

- See how long it takes for a dandelion or a rose to burst into full bloom.
- Watch the moon as it appears to change shape over the course of a month and record the changes.
- Look for constellations in the night sky.
- Bake a cake.

1. Please note: In this booklet, we refer to a child as "she" in some places and "he" in others. We do this to make the booklet easier to read. Please understand, however, that every point that we make is the same for boys and girls.

- Solve the problem of a drooping plant.
- Figure out how the spin cycle of the washing machine gets the water out of the clothes.
- Take apart an old clock or mechanical toy—you don't need to put it back together!
- Watch icicles melt.
- Observe pigeons, squirrels, butterflies, ants or spider webs.
- Go for a walk and talk about how the dogs (or birds or cats) that you see are alike and different.
- Discover what materials the buildings in your community are made of. Wood? Concrete? Adobe? Brick? Granite? Sandstone? Steel? Glass? Talk about the reasons for using these materials.

Learning to observe carefully is an important step leading to scientific explanations. Experiencing the world with your child and exchanging information with him about what you see are important, too.

Finally, encourage your child to ask questions. If you can't answer all of her questions, that's all right— no one has all the answers, not even scientists. For example, point out that there's no known cure for a cold, but that we do know how diseases are passed from person to person—through germs. Some of the best answers you can give are, "What do *you* think?" and "Let's find out together." Together, you and your child can propose possible answers, test them out and check them by using reference books, the Internet, or by asking someone who is likely to know the correct answers.

How to Use This Booklet

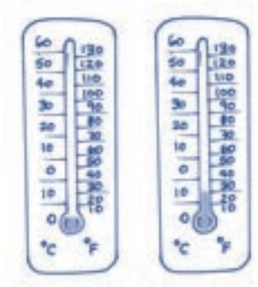
This booklet makes available to you information that you can use to help your child to learn science. It includes:

- Some basic information about science;
- Activities for you and your child to do, both in the home and the community;
- Practical suggestions for how to work with teachers and schools to help your child succeed in science; and
- A list of science-related resources, including federal sources of information, publications for parents, science-related children's magazines and books, and information about science camps.

What Is Science?

Science is not just a collection of facts. Of course, facts are an important part of science: Water freezes at 32 degrees Fahrenheit (or 0 degrees Celsius), and the earth moves around the sun. But science is much, much more. Science involves:

- Observing what's happening;
- Classifying or organizing information;
- Predicting what will happen;
- Testing predictions under controlled conditions to see if they are correct; and
- Drawing conclusions.



Science involves trial and error—trying, failing and trying again. Science doesn't provide all the answers. It requires us to be skeptical so that our scientific "conclusions" can be modified or changed altogether as we make new discoveries.

Children Have Their Own "Scientific Concepts"

Very young children can come up with many interesting explanations to make sense of the world around them. When asked about the shape of the earth, for example, some will explain that the earth has to be flat because, if it were round like a ball, people and things would fall off it. Presented with a globe and told that this is the true shape of the earth, these children may adapt their explanation by saying that the earth is hollow and that people live on flat ground inside it.

Even older children can come up with unique "scientific" explanations, as in the following examples provided by middle-school students:

"Fossils are bones that animals are through wearing."

"Some people can tell what time it is by looking at the sun, but I've never been able to make out the numbers."

"Gravity is stronger on the earth than on the moon because here on earth we have a bigger mess."

"A blizzard is when it snows sideways."

Asking Questions

As mentioned earlier, it's important to encourage your child to ask questions. It's also important to ask your child questions that will get him talking about his ideas and to listen carefully to his answers. Keep in mind that children's experiences help them form their ideas—ideas that may, or may not, match current scientific interpretations. Help your child to look at things in new ways. For instance, in regard to the blizzard, you could ask, "Have you ever seen it snow sideways?" or "What do you think causes it to snow sideways sometimes?"

Such conversation can be an important form of inquiry or learning. Encourage your child by letting him know that it's OK to make mistakes or admit he doesn't know something. Rather than saying, "No, that's wrong," when he gives an incorrect explanation, give him accurate information or help him to find it. Going back to the blizzard, you could ask your child, "How could you check your definition?" "How does the dictionary's definition of "blizzard" fit with what you said about snow moving sideways?"

Knowing that you are willing to listen will help your child to gain confidence in his own thinking and encourage his interest in science. And listening to what he says will help him to figure out what he knows and how he knows it.

Hands-On Works Well

Investigating and experimenting are great ways for children to learn science and increase their understanding of scientific ideas. Hands-on science can also help children think critically and gain confidence in their own ability to solve problems. Young children especially are engaged by things they can touch, manipulate and change; and by situations that allow them to figure out what happens—in short, events and puzzles that they can investigate, which is at the very heart of scientific study. While hands-on science works well, it can also be messy and time-consuming. So, before you get started, see what is involved in an activity—including how long it will take.

Less Is More

It's tempting to try to teach children just a little about many different subjects. Although children can't possibly learn everything about science, they do need and will want to learn many facts. The best way to help them learn to think scientifically is to introduce them to just a few topics in depth.

Finding the Right Activity for Your Child

Different children have different interests and will respond differently to science activities. A sand and rock collection that was a big hit with an 8-year-old daughter may not be a big hit with a 6-year-old son.

Fortunately, children whose interests vary greatly can find plenty of science activities that are fun. If your son loves to cook, let him observe how tea changes color when lemon is added or how vinegar curdles milk.

Knowing your child is the best way to find suitable activities for him. Here are some tips:

- Encourage activities that are neither too hard nor too easy for your child. If in doubt, err on the easy side, because something too difficult may give him the idea that science itself is too hard. Adults often assume that children need spectacular demonstrations to learn science, but this isn't true.
- Consider your child's personality and social habits. Some projects are best done alone, others in a group; some require help, others require little or no adult supervision. Solitary activities may bore some children, while group projects may not appeal to others.
- Select activities that are appropriate for where you live. Clearly, a brightly lighted city isn't the best place for stargazing.
- Allow your child to help select the activities. If you don't know whether she would rather collect shells or plant daffodils, ask her. When she picks something she wants to do, she'll learn more and have a better time doing it.

Unifying Concepts and Processes

Children can be introduced gradually to basic scientific concepts that will provide a framework for understanding and connecting many scientific facts and observations. In this booklet, we will focus on five concepts and processes taken from the *National Science Education Standards*, released in 1996 by the National Resource Council of the National Academy of Sciences.[2] You can easily introduce your child to the following five concepts through the activities in this booklet and many other simple science-related activities that you and your child can do at home or in the community.

1. Systems, Order and Organization

The natural world is so large and complicated that scientists break it down into smaller parts in order to study it in depth. These smaller units are called systems. Scientists look for patterns through which they can classify—or organize—things into systems. For instance, animals that have fur or hair are classified as mammals. When you encourage your child to gather and organize objects according to their size or color—for example, leaves or insects—you are helping prepare her to think in terms of systems. Furthermore, scientists believe that nature is understandable and predictable—that there is an order to it. For instance, low barometric pressure is often followed by storms. Challenging your child to make reasonable predictions such as this will further prepare her to look at the world in a scientific way.

2. The standards outline what students need to know, understand and be able to do in order to be scientifically literate at different grade levels. For more information, visit this Web site: www.nap.edu/readingroom/books/nses/html/.

2. Evidence, Models and Explanations

Scientists test the explanations they come up with, and the results of their tests are evidence on which to base their explanations. Sometimes they call their explanations "theories" or "models" or "hypotheses". Children can test their theories about the world too: Is it the baking soda that makes my pancakes thick? Can I make thicker pancakes with more soda?

3. Change, Constancy and Measurement

The natural world changes continually. Some objects change rapidly and some at a rate too slow for us to observe. You can encourage your child to look for changes by asking him to observe and talk about:

- What happens to breakfast cereal when we pour milk on it?
- What happens over time when a plant isn't watered or exposed to proper sunlight?
- What changes can be reversed? Once water is turned into ice cubes, can it be turned back into water? Yes. But if an apple is cut into slices, can the slices be changed back into the whole apple?

Children can observe change more carefully through measurement. Keeping a growth chart or making a graph of the temperature each day will give your child practice looking for differences and measuring them—and help him to understand how he'll need to use math skills in learning science.

4. Evolution and Equilibrium

It's hard for children to understand evolution (how things change over time) and equilibrium (how things attain a steady and balanced state of being). During these early years, you can, however, talk about how things

change over time and point them out to your child. For instance, show your child a series of photos of himself from birth to the present and talk about the many ways he's changed. And, you can talk about balance and the work it often takes to achieve it: Learning to ride a bicycle or walk with a book on his head are good examples.

5. Form and Function

One of the simplest themes in science is all around: The shape of a natural thing is almost always related to its function. Begin with man-made objects. Can your child guess the use of a thimble, a corkscrew, a phonograph record? When you are looking at animals, ask him questions such as: "What might those plates do on the stegosauros's back?" "What sort of habitat would a web-footed platypus like?" His best guess will almost always be correct.

Scientific Integrity

Science fiction writer Isaac Asimov describes science as a "way of thinking."[3] It is a way to look at the world that involves special principles of conduct, and the early years of elementary school are a good time to start teaching children scientific ethics. We should help them understand how important it is to:

- Observe carefully;
- Record accurately;
- Try to look for patterns in an objective, unbiased way;
- Share their observations (or results) honestly and in a way that allows others to test what they've said;
- Realize that they might make mistakes;
- Respect curiosity; and
- Stay open to criticism and change.

3. Asimov, 5

Activities

Children learn by doing, by trying new ideas and challenging old ones. This doesn't just happen in school. You can help your child learn by providing him with safe, interesting learning experiences in a supportive atmosphere.

The activities that follow are designed for you to use with your child at home and in the community. The activities are intended to show your child that science plays a part in many everyday activities and that it is used in many places and environments. They also show that learning science doesn't require expensive equipment and complicated experiments.

For each activity, you'll see a grade span—from preschool through grade 5—that suggests when children should be ready to try it. Of course, children don't always learn—or become interested in—the same things at the same time. And they don't suddenly stop enjoying one thing and start enjoying another just because they are a little older. You're the best judge of which activity your child is ready to try. For example, you may find that an activity listed for children in grades 1 or 2 works well with your preschooler. On the other hand, you might discover that the same activity may not interest your child until he is in grade 3 or 4. Feel free to make changes in an activity—shorten or lengthen it—to suit your child's interests and attention span.

Safety First

Read through each activity before you try it with your child. In particular, look for this sign: <!> It highlights any activity that requires adult supervision, such as those that involve heat, chemicals or sharp instruments.

Also make sure that your child understands any safety precautions that may be necessary for these—or any—science activities. In particular, you should:

- Teach your child not to taste anything without your supervision;
- Insist that he wear goggles whenever something could splash, burn, or shatter and endanger his eyes;
- Teach him to follow warnings on manufacturers' labels and instructions for toys and science kits;
- Keep toxic or other dangerous substances out of the reach of your child;
- Teach him what he can do to avoid accidents; and
- Teach him what to do if an accident occurs.

In a box near the end of each activity are a few facts and explanations for reinforcement and further teaching. But exploring, questioning and having a good time are more important than memorizing facts.

Recording Results

Keeping records is an important part of science. It helps us remember what did (and didn't) work. Before starting the activities, give your child a notebook—a science journal—in which she can record her observations. Remember that seeing isn't the only way to observe. Sometimes we use other senses: We hear, feel, smell or taste some things (of course, your child should be careful about what she tastes—and she shouldn't taste anything without your permission).

If your child cannot write yet, she can tell you what to write for her or draw pictures of what she sees. In addition, you may want to use a simple camera to help record observations.

As a parent, you can help your child *want* to learn in a way no one else can. That desire to learn is a key to your child's success. And, of course, enjoyment is an important motivator for learning. As you choose activities to use with your child, remember that helping him to learn doesn't mean that you can't laugh or that you have to be serious. In fact, you can teach your child a lot through play. We hope that you and your child enjoy these activities and that they inspire you to think of additional activities of your own.

Science in the Home

Your home is a great place for you to begin to explore science with your child. Incorporating science activities and language into familiar routines will show your child how science works in his everyday life and provide him with a safe environment in which to explore and experiment.

A Science Walk

Preschool–Kindergarten

Even a walk around the yard can provide many opportunities to introduce children to scientific concepts and processes by helping them to gain the scientific habit of observing what's around them.

What You Need

- A magnifying glass
- Science journal

What to Do

- Take a walk outside with your child—around the yard, to the end of the block, in the park—anywhere that's convenient. Invite her to bring along her science journal and show her how to use a magnifying glass. As you walk, stop and—depending on the season—ask her to use the lens to examine things such as the following:

  —dirt
  —leaves (from the same tree, one on the ground and one on the tree)
  —a flower
  —snowflakes
  —icicles
  —bugs
  —a mud puddle
  —a rock

- Ask her to talk about what she observes. Ask, for example:

  —What's on each side of this leaf?
  —How is this leaf on the ground different from the one on the tree?
  —Are all the petals on this flower the same size and color?
  —Are these snowflakes exactly alike? How are they different?
  —How many legs does this bug have?
  —How many colors can you see in this mud puddle?

- Other questions you might ask as she observes and examines things along the way include the following:

  —Is it smooth or rough?
  —Is it hard or soft?
  —Is it dry or wet?
  —Is it alive? How do you know?
  —What shape is it?

- Give your child two different kinds of rocks or flowers and ask her to tell you how they are alike and different.
- Make sure she records her observations, reactions, findings and opinions in her science journal. Drawing pictures and taking photos are good ways to record observations, and you can help her to write appropriate captions. Encourage her to share her journal with others and to talk about her experiences.

> Observing closely is an important part of science, and tools such as a magnifying glass help scientists—even young ones—to observe, measure and do things that they otherwise could not do.

Breaking the Tension

Preschool–Kindergarten

These simple activities demonstrate *surface tension*.

What You Need

- Index card
- Safety scissors
- Sink filled with water
- Glass half filled with water
- Liquid dishwashing detergent
- Ground pepper <!>
- Toothpicks

What to Do

- From an index card, cut out a boat shape, like the one on this page. Make the boat about 2-1/2 inches long and 1-1/2 inches wide. Have your child place the boat gently on the water in the sink. Have him pour a little detergent at the notch end of the boat. Ask him to describe what happens. (**Note:** To repeat this experiment, you'll need to use fresh water to make the boat move.)

- Next, sprinkle a little ground pepper on the water in the glass. Give your child a toothpick and tell him to dip it in the middle of the pepper. Ask him what happens. Then tell him to put a drop of the detergent on another toothpick and dip it into the pepper. Now what happens?

Surface tension results when the hydrogen in water molecules stick to one another as well as to the water below them. This creates a strong but flexible film on the water's surface. The detergent disrupts the molecules and "breaks the tension," making the boat go forward and the pepper move to the sides of the glass.

Bubbles

Preschool–Kindergarten

Children can learn more about surface tension and about change just by blowing bubbles!

What You Need

- 8 tablespoons of dishwashing liquid
- 1 quart water
- 1 drinking straw
- A shallow pan

What to Do

- Mix the dishwashing liquid with the water and pour it into the pan. Give your child a straw and tell him to blow through it as he moves it slowly across the surface of the solution. Ask him to notice the size of the bubbles that he makes.
- Next, have your child try to make a very big bubble that covers the surface of the pan. Have him do the following:
  - —Dip one end of the straw into the solution. Then hold the straw slightly above the surface. Blow into it very gently. He may have to try several times to make a really big bubble.
  - —When he's made a bubble, have him touch it gently with a wet finger to see what happens.
  - —Have him make another big bubble, then touch it with a dry finger. What happens?
- Ask him to look closely at the bubbles he makes. How many colors does he see? Do the colors change?

Bubbles are bits of air or gas trapped inside a liquid ball. The surface of a bubble is very thin. Bubbles are particularly fragile when a dry object touches them. That's because soap film tends to stick to the object, which puts a strain on the bubble.

Bugs!

Kindergarten–Grade 1

Children can improve their understanding of the natural world and their classification skills by observing bugs.

What You Need

- Books about insects and spiders—preferably with photographs (for titles, see the list of children's books in the **Resources** section at the end of this booklet)
- A magnifying glass

What to Do

- With your child, search your home and neighborhood for bugs. <!> Look for bugs:
  - —around your front door
  - —in cracks in the sidewalk
  - —in gardens
  - —at picnic areas
  - —on lights
  - —in corners of rooms
- Using the guides, help your child to identify each type of bug that you find, such as ants, spiders, beetles, crickets, bees, flies, butterflies, mosquitoes, moths, wasps or ladybugs.
- If you find ants, point out that ants work together as a community. Have her observe, for example, what an ant does when it finds a bit of food. Explain that when an ant finds food, it doesn't eat it on the spot. It runs back to the hill to "tell" the other ants. As it runs, it leaves a trail that the other ants can smell. These ants can then find the food by smelling their way along the trail.

- Find out about spiders:
  - —Why do spiders spin webs?
  - —What are webs made of?
  - —How many pairs of legs do they have?
- Help your child to think of other ways that she might classify the bugs—for example, by color or by size or by whether they have wings or antennae.

Bugs do what they do to survive. They're constantly looking for food. Bugs can be both helpful and harmful. Termites, for example, have a bad reputation because they destroy houses by eating the wood. But termites have a good side, too. In a forest, they break down dead trees, which keeps the forest floor from becoming too cluttered.

Float or Sink?

Kindergarten–Grade 1

Learning to make and test predictions is a good first step toward making and testing *hypotheses*.

What You Need

- 1 block of solid wood
- 1 plastic bottle cap
- 2 pieces of heavy-duty aluminum foil
- 1 piece of modeling clay
- Sink filled with water

What to Do

- Tell your child to hold the wood block in one hand and the plastic cap in the other hand. Ask him to answer the following questions:

  —Which one feels heavier?
  —Do you think the wooden block will float or sink?
  —Will the plastic cap float or sink?

  Have your child test his predictions by carefully placing the block of wood and the cap on the water. What happens? Next, have him put both under the water. What happens now?

- Give him a piece of aluminum foil and tell him to squeeze it tightly into a solid ball then drop it in the water. Does it float or sink? Give him another piece of foil. Help him to shape it into a little boat, then have him carefully place it on top of the water. Does the foil float now?

- Help him to try the same experiment with the clay. Have him make a ball and drop it in the water. What happens? Then have him shape the clay into a boat and put it on the water. Does it float now?

The clay and foil balls sink because they are squeezed into small shapes and only a small amount of water is trying to hold up the weight. When the clay or foil is spread out, it floats because the weight is supported by a lot more water.

Slime Time

Grades 1–2

When one object moves against another, the result is *friction*.

What You Need

- Mixing bowl
- 4 envelopes of unflavored gelatin
- Hot water
- Square baking pan
- Vegetable oil
- Liquid dishwashing detergent
- 2 small bowls
- Stopwatch or a watch with a second hand
- Measuring cup

Don't let your child eat the gelatin cubes after they've been handled or after they're covered with lubricant. <!>

What to Do

- In a mixing bowl, dissolve the gelatin in two cups of hot tap water. Coat the inside of the pan with vegetable oil. Pour the gelatin mixture into the pan and put it in the refrigerator until firm. Cut the gelatin into cubes about 1 inch x 1 inch. You should have about 64 cubes. Place 15 cubes into one bowl. Place the second bowl about 6 inches (about 15 centimeters) away from the cube bowl.

Place the watch so that your child can see it. Tell her that when you say *go*, you want her to start picking up the gelatin cubes one at a time with her thumb and index finger (caution her not to squeeze them!). Tell her to see how many cubes she can transfer to the other bowl in 15 seconds.

Tell your child to put all the cubes back in the first bowl. Pour 1/4 cup dishwashing liquid over the cubes. Gently mix the detergent and the cubes so that the cubes are well-coated. Have her use the same method as before to transfer as many cubes as possible in 15 seconds.

- Throw away the cubes and detergent and wash and dry both bowls. Put 15 new cubes into one bowl and pour 1/4 cup water over the cubes, again making sure the cubes are thoroughly coated. Tell your child to see how many cubes she can transfer in 15 seconds.
- Again, throw away the cubes and water. Put 15 new cubes into one bowl. Pour 1/4 cup of vegetable oil over the cubes. Make sure they are well coated. Have her see how many cubes she can transfer in 15 seconds.
- Ask your child to answer the following questions:
  - —With which liquid was she able to transfer the most cubes?
  - —With which liquid was she able to transfer the fewest cubes?
  - —Which liquid was the best lubricant (the slipperiest)? Which was the worst?

Cars, trucks, airplanes and machines all have parts that rub against one another. These parts would heat up, wear down and stop working if we didn't have *lubricants*. Lubricants reduce the amount of friction between two surfaces that move against each other.

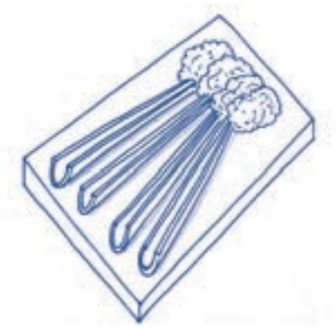
Celery Stalks at Midnight

Grades 1–2

Capillary action is the name for the process that takes place when a paper towel soaks up a spilled liquid or when a plant transfers water from its roots to its leaves.

What You Need

- 4 same-size stalks of fresh celery with leaves
- 4 cups of the same size
- Knife <!>
- Vegetable peeler <!>
- Red and blue food coloring
- Measuring cup
- Paper towels
- Ruler
- Old newspapers
- Water



What to Do

- Lay the four stalks of celery in a row on a cutting board or counter so that the place where the stalks and the leaves meet matches. Cut all four stalks of celery 4 inches (about 10 centimeters) below where the stalks and leaves meet.
- Use 10 drops of red and 10 drops of blue food coloring for each 1/2 cup of water to make purple water. Pour the colored water in equal parts into the four cups. Have your child put one stalk each in the cups of purple water.

- Label four sheets of paper towels: “2 hours,” “4 hours,” “6 hours,” and “8 hours.” (You may want to put newspapers under the towels.) Every two hours, have him remove one of the stalks and put it on the correct towel.
- Each time he removes a stalk from the water, help him to carefully peel the rounded part with a vegetable peeler to see how far up the stalk the purple water has traveled.
- Help your child to measure the distance the purple water has traveled for each stalk and record the information in his science journal. Talk with him about what he has observed.
- Work with your child to make a list of other objects around the house or in nature that illustrate capillary action. Have him look for paper towels, sponges, old sweat socks, brown paper bags and flowers.

Capillary action happens when water molecules are more attracted to the surface they travel along than to each other. In paper towels, the molecules move along tiny fibers. In plants, they move through narrow tubes that are actually called *capillaries*. Plants couldn't survive without capillaries because they use the water to make their food.

Icky Sticky Stuff

Grades 2–3

Adhesives are used to stick things together. Many adhesives occur in nature and have important uses for plants and animals.

What You Need

- Flour
- Measuring cup
- Egg white <!>
- Food coloring
- 4 small bowls
- 4 plastic spoons
- Aluminum foil
- Cotton balls
- Toothpicks
- Small pieces of cloth
- Glitter
- Safety scissors
- Colored yarn or ribbon
- Colored paper

What to Do

- Help your child to make a poster or collage using adhesives by doing the following:

  —Make three bowls of flour-and-water paste. In each bowl, add 1/4 cup water to 1/2 cup flour and mix until smooth. Add a different-colored food coloring to each of the three bowls and mix. Use the pastes to make colored shapes on a poster board or heavy paper.

—Crack open an egg and separate the white into a bowl. Use the white as a clear glue to attach aluminum foil, cotton balls, toothpicks, cloth, glitter, ribbon, yarn and colored paper—whatever works to create a collage.

- Help your child to search your home to track down everything that she can that is sticky. See how many of the following she can find:
  - —Tape
  - —Peanut butter
  - —Postage stamps
  - —Envelopes
  - —Honey
  - —A decal on a t-shirt
  - —Spackle
  - —An adhesive bandage
- Ask your child to make a list of things in nature—animals, plants and so forth—that have adhesive properties or are sticky. For example:
  - —Spiders that use sticky threads to create webs to catch their food
  - —Tree sap
  - —Barnacles that stick to boats, ships and rocks
- Next, ask her to think of adhesives that are used in hospitals? in offices? in auto repair shops?

What makes glue, paste or tape stick to things? Wood, paper and many other materials have tiny cracks and holes in them. When we glue things together, sometimes the glue seeps into the tiny openings and hardens, making the materials stick together. Other times, the molecules on the surface of an object get tangled up with the glue molecules, making the objects stick together.

Splish Splash

Grades 2–3

This activity introduces children to the scientific concepts of *volume* and *measurement*.

What You Need

- Measuring spoons and cups of different sizes
- Milk containers of different sizes—e.g., pint, quart, half-gallon and gallon (or 1/2 liter, 1 liter, 2 liter and 4 liter)
- Funnel
- 2 containers that hold the same amount but have different shapes—e.g., one tall and thin, one short and squat (try a 1-quart pitcher and the same-sized storage bowl)
- 1 sink filled with water

What to Do

- Have your child fill a quart-sized container with water. Then help him to use the funnel to pour the water into a gallon-sized container. Ask him to observe how many small containers it takes to fill the larger one.
- Continue by having him use the different measuring devices to answer question such as the following:
  - —How many tablespoons does it take to make half a cup?
  - —How many cups does it take to make a quart?
  - —How many pints make a gallon?

- Set the short squat container next to the tall thin one. Ask your child to predict whether one container will hold more water than the other. Let him fill the short squat container with a given amount of water—for example, four cups if you're using quart containers. Then have him pour this water into the tall thin container. Was his prediction correct? Ask him why he thinks both containers held the same amount.

Water and other liquids take the shape of whatever container they're in. Containers of certain sizes have names—cup, pint, quart, liter or gallon, for example. This activity provides an introduction to *volume* and *measurement*.

Hair-Raising Results

Grades 3 and up

Here are some great hands-on ways to learn about *static electricity*.

What You Need

- A cool dry day
- 2 round balloons (inflated and tied)
- 2 20-inch pieces of string
- Wool or acrylic sock
- Mirror

What to Do

- Have your child tie a string to each inflated balloon. Then tell her to rub a balloon on her hair for about 15 seconds—help her to rub around the whole balloon. Have her take the balloon away and see what happens to her hair! Then have her observe what happens when she brings the balloon back close to her hair.

- Next, stand a few feet away from and facing your child. Have her rub the balloon on her hair again as you do the same with the other balloon. Tell her to hold the string to her balloon, letting it hang freely but without letting it touch anything. (You do the same with your balloon.) Slowly move the two balloons toward each other, but don't let them touch. Have your child tell you what's happening: Do the balloons push away from each other, or do they pull toward each other? Have her place her hand between the two hanging balloons. What happens?
- Give your child a sock to place over one hand. Tell her to rub her balloon with the sock, then let the balloon hang freely. Have her move her sock-covered hand near the balloon. What happens? Have her try rubbing both balloons with the sock and then letting them hang near each other. What happens now?

All materials contain millions of tiny particles, called protons and electrons, that have electric charges. Protons have positive charges, and electrons negative ones. Usually, they balance each other, but sometimes when two surfaces rub together, some of the electrons rub off one surface onto the other, and we can have static electricity. Materials with like charges (all positive or all negative) move away from each other; those with opposite charges attract each other.

Plants

Grades 3 and up

A few seeds and household plants can teach children about *cause and effect* and *change*.

What You Need

- Household plants
- Plant fertilizer <!>
- Paper
- Safety scissors
- A magnifying glass
- Seeds
- Permanent markers: green, red, blue, black
- Paper towels
- Water
- Sandwich bags (without zip locks)

What to Do

- With your child, take two clippings from one houseplant. Have him put one clipping in a glass of water and the other clipping in a glass without water. Tell him to check each day to observe and record how long the one without water can survive.
- Have your child water all of the plants for several weeks. In addition, have him choose one or two of the plants to fertilize during this time. Have him label the plants to be fertilized. Tell him to record the following in his science journal:

  —Did any of the plants start to droop?
  —Did any of the plants have yellow leaves that fell off?
  —Did any of the plants grow toward the light?

- Next, have your child observe what happens when a plant (or part of a plant) doesn't get any light. Help him to do the following:

  —Cut out three pieces of paper, each about 2 inches x 2 inches in size.
  —Clip the pieces to different leaves of a plant, preferably one that has large leaves.
  —Leave one piece of paper on a leaf for one day, a second for two days and a third for a week.

  Ask your child to record how long it takes for the plant to react and how long it takes for the plant to return to normal once the paper is removed.
- To show your child how seeds germinate, have him divide some seeds of the same kind into four equal batches. Tell him to spread each batch of seeds on a wet paper towel folded into quarters, and then put each batch into a separate sandwich bag. Give him the markers and tell him to color one bag red, one green, one yellow and one black. Have him put the bags in the sun for a week. Tell him to check each day to make sure the paper towels are still wet.

  After a week, have him examine the bags. Ask him which color light was the best for seed germination.

  Ask your child to explore what other things can make seeds germinate faster. Have him, for example, put a little soapy water on one batch of seeds and clear water on another.

Photosynthesis means to "put together using light." Plants use sunlight to turn carbon dioxide from the air and water into food. When the plant gets enough food, it produces a simple sugar, which it uses immediately or stores in a converted form of starch. We don't know exactly how this happens. But we do know that *chlorophyll*, the green substance in plants, helps it to occur.

Crystals

Grades 4 and 5

A crystal is a special kind of solid. Growing crystals introduces children to *change* and *variation*.

What You Need

- A magnifying glass
- Table salt
- Epsom salt
- Honey container
- Measuring cups and spoons
- Paper cut into circles
- Safety scissors
- Pencil

What to Do

- Help your child to use a magnifying glass to look for crystals. Inspect the table salt, Epsom salt and honey container (particularly if it has been open for awhile). Ask your child to draw pictures in her journal of what she observes. Do all of the crystals look the same? If not, how are they different?
- Have your child try dissolving salt crystals and forming new ones. Help her to do the following:

  —Dissolve 1 teaspoon of salt in 1 cup of water.
  —Heat the mixture over low heat to evaporate the water. <!>

  What's left? What shape are these crystals?

- Snowflakes are made of ice crystals. They're beautiful, but hard to see clearly. Making paper snowflakes will give your child an idea of what snowflakes look like. Have her:

  —Take a circle of paper (use thin paper) and fold it in half.
  —Fan-fold it.
  —Make cuts along all the edges.
  —Unfold them.

When certain liquids and gases cool and lose water, crystals are formed. Crystals are made up of molecules that fit neatly together in an orderly package. All crystals of the same material have the same shape, regardless of their size.

Let 'Em Make Cake!

All ages

Making cakes is an enjoyable way to help children of all ages learn about *chemical reactions* and *change*.

What You Need

- 3 small bowls
- Several sheets of aluminum foil
- Pie pan
- Cooking oil

- Measuring spoons
- Ingredients for one cake: (You'll need to measure and mix this set of ingredients four times—with the exceptions that are given below.)
  - —6 tablespoons flour
  - —3 tablespoons sugar
  - —1 pinch of salt
  - —2 or 3 pinches of baking powder
  - —2 tablespoons milk
  - —2 tablespoons cooking oil
  - —1/4 teaspoon vanilla
  - —Part of an egg (Break egg into a cup; beat until mixed. Use 1/3 of it. Save the rest for 2 of the other cakes.) <!>

What to Do

- With your child do the following:
  - —Wrap several sheets of aluminum foil around the outside of a small bowl to form a mold.
  - —Remove your foil "pan" and put it in a pie pan for support.
  - —Oil the "inside" of the foil pan with cooking oil so the cake doesn't stick.
  - —Turn the oven on to 350 degrees. <!>
  - —Mix all of the dry ingredients together.
  - —Add the wet ones (only use 1/3 of the egg; save the rest for later use).
  - —Stir the ingredients until smooth and all the same color.
  - —Pour batter into the "pan."
  - —Bake for 15 minutes.

- Help your child to make three more cakes, but tell him to do the following:
  - —Leave the oil out of one.
  - —Leave the egg out of another.
  - —Leave the baking powder out of the third.
- After baking, have him cut each cake in half and look inside.
  - —Do the cakes look different from each other?
  - —Do they taste different from each other?
- Tell your child to write about, or draw pictures of, what he observes.

Here are some chemical reactions that occur as a cake bakes:
—Heat helps baking powder produce tiny bubbles of gas, which makes the cake light and fluffy (*leavening*).
—Heat causes protein from the egg to change and make the cake firm.
—Oil keeps the heat from drying out the cake.

Science in the Community

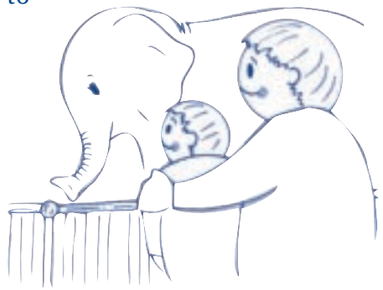
Our communities offer many opportunities and resources to help children learn science, including

- Zoos;
- Museums;
- Planetariums;
- Aquariums;
- Farms;
- Science at Work;
- Community Science Groups and Organizations; and
- Other Community Resources.

To find out more about resources in your community: Check your local newspaper, a local guidebook or your telephone directory. Or, go online and search the Internet. (The **Resources** section has more information about science-related Web sites for children.) Other good sources of information and ideas might be your child's teacher, the school librarian or the children's librarian at your local public library. *Before* you pay a visit to a museum, planetarium, or the like, be sure to check the hours it's open and what cost—if any—is involved. Note that some places may charge entrance fees at certain times and grant free admission at other times.

Zoos

Zoos are great places for you to encourage your child's interest in the natural world and to introduce him to exotic animals that he might not otherwise ever see. Here are a few suggestions to help make your visit to a zoo worthwhile:



Discuss expectations with your child. What does he think he'll find at the zoo? A very young or insecure child may go to the zoo with a more positive attitude if you assure him that it has food stands, water fountains and bathrooms.

Don't try to see everything in one visit. Zoos are such busy places that they can overwhelm children, particularly preschoolers and kindergarteners.

Try to visit zoos at off hours or times of the year (very early on a Saturday morning, for example, or in winter). Choosing less crowded times to visit will allow your child unobstructed views of the animals, as well as a more leisurely tour of the exhibits.

Look for special programs that are set up just for children, such as petting zoos, exploring local habitats and getting involved with conservation projects. Such programs provide children with hands-on opportunities that are otherwise prohibited by most zoos and allow families to learn about wildlife by getting involved in conservation efforts and exploring local habitats together.

As you tour the zoo, keep your child interested and focused.
Try the following activities:

- **Play a guessing game**. Guessing games can help your child understand form and function. You might, for example, ask questions such as the following:
  - —Why do you think seals have flippers? (*Seals use flippers to swim through the water.*)
  - —Why do you think these gibbons have such long, strong arms? (*Their arms help them swing through the trees.*)
  - —Why does that armadillo have a head that looks like it's covered with armor? Why is its body covered with those bony plates? (*The armor and the bony plates protect it from other animals that want to eat or kill it.*)
  - —Why is that snake the same brown color as the ground? (*As snakes evolved, the brown ones didn't get eaten as quickly.*)

- **Match the animals**. Children can learn about organization by seeing related animals. Have them compare the sizes, leg shapes, feet, ears, claws, feathers or scales of various creatures. Ask them, "Does the lion look like a regular cat?" "How are they the same?" "Does the gorilla look like the baboon?" (**Caution**: Take time to read any signs that provide descriptions and classifications of animals and use this information in your discussions. Dolphins, for example, are not fish; they're mammals. Asking children to compare a dolphin to a shark might reinforce children's wrong ideas.)

  As your child gets older, he will understand more complex answers to these questions.

After the visit, have your child do follow-up activities and projects.
A child who particularly liked the flamingos and ducks may enjoy building a birdhouse for the back yard. One who liked the mud turtle may enjoy using a margarine tub as a base for making a papier-mâché turtle.

Museums

In museums, both you and your child can have fun and learn science together. Science and technology museums, natural history museums and children's museums can be found in many middle-sized and smaller communities, as well as in large cities.

Museums vary in quality. If possible, try to find museums that have special areas, exhibits and "hands-on" programs just for children. In these programs, children are often able to use scientific equipment that is far too expensive or specialized for their schools to own. Look for museums that have:

- Levers to pull;
- Lights to switch on;
- Buttons to push;
- Animals to stroke; and
- Experiments to do.

Many museums offer special science classes. Look for IMAX theaters. These enable visitors to see giant-screen movies on subjects ranging from space launches to exploring the Antarctic.

Many of the tips for visiting the zoo are also helpful when you visit museums. For example, don't try to cover too much on one visit, and do try visiting at off hours when the crowds won't seem overwhelming.

Planetariums

Planetariums have wonderful exhibits and activities for youngsters. There are over 1,000 planetariums in the United States, ranging from small ones that hold about 20 people to giant facilities with hundreds of seats. These facilities are particularly useful for children who live in urban areas, where city lights and air pollution obstruct the view of the sky.

Inside a planetarium, your child may be able to:

- Use a telescope to view the rings of Saturn;
- See details of the "sky" from inside the planetarium's dome; and
- Step on scales to learn what she would weigh on the moon or on Mars.

Aquariums

Aquariums enable youngsters to see all kinds of marine life, from starfish to sharks to electric eels, and to learn about their special habitats.

Your child may particularly enjoy feeding times. Before visiting an aquarium, call ahead to find out when the penguins, sharks and other creatures get to eat. Also check for special shows that feature sea lions and dolphins.

Farms

A visit to a farm can be a wonderful trip for you and your child. If you don't know a farmer, ask for a referral from your county extension office, farm bureau or local agriculture office.

If you visit a dairy farm, encourage your child to ask questions about the cows and their care. What do they eat? Do they sleep? Where is their food kept? What happens to the milk when it leaves the farm? How does it get to the grocery store? Many dairy farmers will let your child try her hand at milking a cow; others will explain how the equipment is used and the way milk makes its way from the farm to the grocery shelf.

If you visit a farm that grows crops, encourage your child to look at the crops and ask questions about what she sees. What crops are grown? How are they planted? How are they harvested? What are they used for? How do they get to the grocery store? If your child grew up in a city, she may have no idea what corn, soybeans, potatoes or pumpkins look like as they grow in a field. **Caution:** Don't let your child eat vegetables of fruit unless they have been carefully washed—and the farmer has given permission!

On any kind of farm, farmers use special machines such as tractors, harvesters, balers and so forth. Encourage your child to ask about any machines that she sees, including what they're used for and how they work.

Science at Work

Your child may recognize that many people use science to do their jobs—chemists, doctors, science teachers, computer technicians and engineers, for example. However, she may not realize that many other jobs also require science skills.

To show your child how important science is for many jobs, try to arrange for her to spend part of a day—or even an hour—with a park ranger, pharmacist, veterinarian, electrician, plumber, dry cleaner, cook, mechanic, architect, mason or anyone else whose job involves some kind of science.

Before any visit, encourage your child to read about the job so she'll be able to ask good questions. For example, she might ask a dry cleaner questions such as the following:

- What chemicals do you use to clean clothes?
- How are stains removed?
- What happens to the chemicals after you use them?

Community Science Groups and Organizations

Many communities have groups and organizations that include science programs as part of their services for children. Some may sponsor local summer science camps—focusing on areas that range from computers and technology to natural science to space. Check out, for example:

- the Boy Scouts, Girl Scouts, or similar groups;
- YMCAs and YWCAs;
- 4–H groups;
- Audubon; or
- local colleges and universities.

Other Community Resources

Botanical gardens, weather stations, hospital laboratories, sewage treatment plants, newspaper plants, recycling centers, and radio and television stations are only a few of the kinds of places in your community where your child can learn more about all kinds of science. Try the following:

Arrange a tour of a recycling center or landfill to show your child what happens to the community's trash. Before the visit, ask him to think about questions such as the following:

- Where does the trash go when it leaves our home?
- What happens to it?
- How much trash does our community produce each year?
- What kinds of materials are recycled?
- What kinds of things can't be recycled?

As you tour the facility, have your child ask the questions; then compare his earlier thoughts to what he has learned.

Contact your local water department or sewage treatment center to arrange a tour of its facilities. Before the visit, ask your child to think about where the water comes from that he drinks and where it goes when it has been used. Is anything added to the water to make it safe to drink? Does all the water used in the community come from the same place? Does all the sewage in the community go to the same place? What happens to the sewage? Again, have him compare his earlier answers to what he learns on the tour.

Finally don't overlook your **local public library** as a rich resource for books and magazines on science; videos and DVDs; free Internet access; special programs—such as book talks—that relate to science; and much more.

Working With Teachers and Schools

Research has shown that children at all grade levels do better in school, feel more confident about themselves as learners and have higher expectations for themselves when their parents are supportive of and involved with their education.[4] Here are some ways that you can stay involved in your child's school life:

Visit your child's school. During your visit, look for clues as to whether the school values science.

- Do you see science learning centers? Displays related to science? Science-related drawings on the bulletin boards? Are there plants, terrariums, aquariums or collections (of rocks or insects, for example) in the classrooms, front hall or library?
- Do you see any science equipment in evidence? Are there magnifiers? Magnets? Pictures? Videos? Is the equipment up-to-date?
- Does the school library contain science books? If so, are they recent publications?
- Is there enough space in the classrooms or elsewhere in the school for students to conduct science experiments?

Find out about the school's science curriculum. Ask for a school handbook. If none is available, meet with the school's principal and ask questions such as the following:

- What methods and materials does the school use for science instruction? Are these methods based on sound research evidence about what works best? Are the materials up-to-date? Can students do hands-on science projects? Does the science curriculum follow state science standards and guidelines?
- Are the science teachers highly qualified? Do they meet state certification and subject-area knowledge requirements?

4. Hoover-Dempsey and Sandler, 3-42.

- What facilities and resources are available to teach science? If the school budget for science instruction is inadequate, what has the school or district tried to do to obtain resources from other sources, such as businesses and service organizations?
- How much time is spent on science instruction?
- How does the school measure student progress in science? What tests does it use?
- How do the students at the school score on state assessments of science?
- Are activities available that parents can use at home to supplement and support instruction?

Meet with your child's teacher. Schedule an appointment and ask how your child approaches science. Does he enjoy it? Does he participate actively? Does he understand assignments and do them accurately? If the teacher indicates that your child has problems with science, ask for specific things that you can do to help him.

Visit your child's classroom. In the classroom, look for the following:

- Do students have opportunities for hands-on experiences working with materials? Do students discuss their ideas, make predictions and offer explanations? Do they have opportunities to talk and work with each other as well as with the teacher?
- Does the instruction show students how to connect the science concepts they're learning to their personal experiences and to explore how science and technology affect their lives?
- Does instruction include activities in which students apply their science skills and knowledge to real problems and situations?
- Do students have opportunities to use science equipment and technology?
- Does the teacher expect *all* students to succeed? Does he help them set high goals for themselves? Does he listen to their explanations and ideas?
- Do science tests and assessments match state and local standards? Do they match what has been taught? Are they used appropriately to plan instruction and evaluate student understanding?

Find out if the school has a Web site and, if so, get the address. School Web sites can provide you with ready access to all kinds of information, including homework assignments, class schedules, lesson plans and test dates.

Find out how your child's school is performing by checking its annual report card required under the *No Child Left Behind Act*. Prepared by your school district, this report card shows how students at your school performed on state assessments and how their performance compares to that of other schools in the district. The law currently requires regular assessments in reading and math; and science assessments to be in place by the school year 2007-08. (For more information on *No Child Left Behind*, see the **Resources** section.)

Get actively involved. Attend parent-teacher meetings. If you're unable to attend, ask that the minutes of the meetings be sent to you, or that they be made available on the school's Web site. If your schedule permits, volunteer to help with the science program. Teachers often send home lists of ways in which parents can get involved, including the following:

- Assisting with classroom science projects;
- Chaperoning science-related field trips;
- Offering to set up a science display in the school's front hallway or in your child's classroom;
- Leading hands-on lessons (if you have a good science background yourself);
- Helping in a computer laboratory or other area requiring adult supervision; and
- Starting a drive to raise money for computers, science equipment, books or field trips.

Even if you can't volunteer for work *at* the school, you can help your child learn when you're at home and contribute a great deal to his success at school. The key question is, "What can I do at home, easily and in a few minutes each day, to reinforce and extend what the school is teaching?"

Resources

Federal Sources of Information

U.S. Department of Education
Mathematics and Science Initiative
Toll Free: 800–USA–LEARN
www.ed.gov/inits/mathscience/

No Child Left Behind
Parents Tool Box
Toll Free: 888–814–NCLB
www.nclb.gov/parents/index.html

National Science Foundation
www.nsf.gov

National Institutes of Health
Office of Science Education
http://science-education.nih.gov/homepage.nsf

Federal Resources for Educational Excellence (FREE)
www.ed.gov/free/index.html

Publications for Parents

American Association for the Advancement of Science. *A Family Guide to Science*. Washington, DC, 2003. (Available online at www.scienceeverywhere.org)

American Association for the Advancement of Science. *Ten Questions to Ask Your Neighborhood School about Local Science Education*. Washington, DC, 1998. (Available online at www.project2061.org/research/questions/10questions.htm)

Barber, Jacqueline, Parizeau, Nicole, Bergman, Lincoln and Lima, Patricia. *Spark Your Child's Success in Math and Science: Practical Advice for Parents*. Berkeley, CA: Great Explorations in Math and Science (GEMS), 2002.

Barry, Dana M. *Science Fair Projects: Helping Your Child Create a Super Science Fair Project*. Huntington Beach, CA: Teacher Created Materials, 2001.

Children's Partnership. *Parent's Guide to the Information Superhighway*: *Rules and Tools for Families Online*, 2nd ed.. Washington, DC, 1998. (Available online at www.childrenspartnership.org/pub/pbpg98/pg98.pdf)

Milbourne, Linda A. and Haury, David L. *Helping Students With Homework in Science and Math*. ERIC Digest, 2003. (Available online at www.ericse.org/digests/dse99-03.html)

National Research Council. *Every Child a Scientist*. Washington, DC: National Academy Press, 1997. (Available online at www.nap.edu/books/0309059860/html/index.html)

National Science Foundation. *New Formulas for America's Workforce: Girls in Science and Engineering*. Washington, DC, 2003.

National Science Teachers Association. *Help Your Child Explore Science*. Washington, DC, 2000. (Available online at www.nsta.org/explore)

National Urban League. *Science and Math at Home for Young Children*. New York, 1994. (Available online at www.nul.org/)

Pearce, Querida L. *How to Talk Dinosaur With Your Child*. Los Angeles: Lowell House, 1991.

SciMathMN. *What Should I Look for in the Science Program in My Child's School*? Minneapolis, MN: SciMathMN, 2000. (Available online at www.scimathmn.org/parent_science.htm)

Sherwood, Elizabeth A., et. al. *More Mudpies to Magnets*: *Science for Young Children*. Beltsville, MD: Gryphon House, 1991.

U.S. Department of Education. *Helping Your Child With Homework*. Washington, DC, 2002. (Available online at www.ed.gov/pubs/parents/)

U.S. Department of Education. *Parents Guide to the Internet*. Washington, DC, 1997. (Available online at www.ed.gov/pubs/parents/internet/index.)

Walthall, Barbara (Ed.). IDEAAAS: *Sourcebook for Science, Mathematics, and Technology Education*. Washington, DC: American Association for the Advancement of Science, 1995.

Zeman, Anne. *Everything You Need to Know About Science Homework*. New York: Irving Place Press, 1994.

Books for Children

Libraries and bookstores now have available an enormous number of excellent science-related books for children. When making selections, you may want to consider questions that the National Science Teachers Association uses in evaluating books. For instance:

- Does the author have a good science background and reputation?
- Is the content interesting to children?
- Is the sequence of events logical?
- Is the format (the placement of pictures, photographs and text) pleasant and easy to follow?
- Are the pictures, photographs and illustrations accurate, and do they match the text?
- Is the vocabulary appropriate? (Big words are OK if they are explained and used in context.)
- Are controversies handled fairly?
- Are the suggested activities safe? Practical?

When selecting books, also keep in mind:

- Children can learn science from "non-science" books too, such as fictional stories, biographies and historical accounts.
- Recommended age or grade levels are usually printed on a book's back cover, but they are recommendations only. You're the best judge of which books are appropriate for your child, regardless of age. Just take special care with age-level recommendations for those books that could pose potential safety hazards, such as the use of certain equipment or chemicals.

The following list is only a small sample of the many excellent science-related books that your child might enjoy. Many of the books listed here appear on the recommended lists prepared jointly by the National Science Teachers Association and the Children's Book Council and the lists prepared the American Association for the Advancement of Science. For additional titles or for titles about specific science-related topics, go to the Web sites of these organizations or ask your local or school librarian for recommendations. Many of the following books also are available in languages other than English, and your librarian can help you locate them.

The books are arranged according to subject. For each book, you'll see a suggested age range: **P** indicates books that are most appropriate to read with preschoolers and children in grades K through 2; **E** indicates those books that will appeal to children in grades 3 and up, who read independently.

Anatomy and Medicine

Baeuerle, Patrick and Landa, Norbert. *The Cell Works: Microexplorers: An Expedition Into the Fantastic World of Cells*. New York: Barrons Juveniles, 1997. **(E)**

Balestrino. Philip. *The Skeleton Inside You*. New York: Harper Trophy, 1991. **(P)**

Balkwill, Frances R. and Rolph, Mic. *Enjoy Your Cells*. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory, 2002. **(E)**

Berger, Melvin. *Why I Sneeze, Shiver, Hiccup, and Yawn*. New York: HarperCollins Juvenile Books, 2000. **(P)**

Cobb, Vicki. *Feeling Your Way: Discover Your Sense of Touch*. Brookfield, CT: Millbrook Press, 2001. **(P)**

Davidson, Sue and Morgan, Ben. *Human Body Revealed*. New York: DK Publishing, 2002. **(E)**

DeGezelle, Terri with Hogan, Marjorie. *Your Bones*. Mankato, MN: Bridgestone Books, 2002. **(E)**

Farndon, John. *The Human Body*. Tarrytown, NY: Benchmark Books, 2002. **(E)**

Gordon, Sharon. *Bruises*. Danbury, CT: Children's Press, 2002. **(P)**

Manning, Mick. *Wash, Scrub, Brush!* Morton Grove, IL: Whitma, 2001. **(P)**

Romanek,Trudee. *ZZZ!: The Most Interesting Book You'll Ever Read About Sleep*. Tonawanda, NY: Kids Can Press, 2002. **(E)**

Showers, Paul. *Hear Your Heart*. New York: Harper Trophy, 2001. **(P)**

Archaeology, Dinosaurs and Prehistoric Times

Aliki. *Digging Up Dinosaurs*. New York: Thomas Y. Crowell, 1981. **(P)**

Baquebado, Elizabeth. *Aztec, Inca & Maya*. New York: Knopf, 1993. **(E)**

Barrett, Paul. *National Geographic Dinosaurs*. Washington, DC: National Geographic Society, 2001. **(E)**

Beshore, George W. *Science in Ancient China*. London: Orchard Books, 1998. **(E)**

Bishop, Nic. *Digging for Bird Dinosaurs: An Expedition to Madagascar*. Boston: Houghton Mifflin, 2000. **(E)**

Camper, Cathy. *Bugs Before Time: Prehistoric Insects and Their Relatives*. New York: Simon & Schuster, 2002. **(P)**

Cork, Barbara, Reid, Struan and McEwan, Joe. *The Usborne Young Scientist: Archaeology*. New York: EDC Publications, 1985. **(E)**

Duke, Kate. *Archaeologists Dig for Clues*. New York: Harper Trophy, 1997. **(P)**

Fisher, Leonard Everett. *The Great Wall of China*. New York: Aladdin Library, 1995. **(E)**

Kerley, Barbara. *The Dinosaurs of Waterhouse Hawkins*. New York: Scholastic Press, 2001. **(P)**

Lauber, Patricia. *Dinosaurs Walked Here and Other Stories Fossils Tell*. New York: Bradbury Press, 1987. (**P)**

Miller, Debbie S. *A Woolly Mammoth Journey*. Boston: Little, Brown, 2001. **(E)**

Pemberton, Delia. *Egyptian Mummies: People From the Past*. New York: Harcourt Children's Books, 2001. **(E)**

Sattler, Helen. *Dinosaurs of North America*. New York: Lothrop, Lee & Shepard, 1981. **(E)**

Slone, Christopher. *SuperCroc and the Origin of Crocodiles*. Washington, DC: National Geographic Society, 2002. **(E)**

Taylor, Barbara. *Oxford First Book of Dinosaurs*. New York: Oxford, 2001. **(E)**

Walker, Sally M. *Fossil Fish Found Alive: Discovering the Coelacanth*. Minneapolis: Carolrhoda, 2002. (**E)**

Zoehfeld, Kathleen Weidner. *Dinosaur Parents, Dinosaur Young: Uncovering the Mystery of Dinosaur Families*. New York: Clarion Books, 2001. **(P)**

Astronomy and Space Science

Allan, Jerry and Allan, Georgiana. *The Horse and the Iron Ball: A Journey Through Time, Space, and Technology*. Minneapolis: Lerner, 2000. **(E)**

Asimov, Isaac. *The Birth and Death of Stars*. New York: Dell, 1989. **(E)**

Challoner, Jack with Muirden, James. *The Atlas of Space*. Brookfield, CT: Copper Beech Books, 2001. **(E)**

Cole, Michael D. *The Moon: Earth's Companion in Space*. Springfield, NJ: Enslow, 2001. **(P)**

Farndon, John. *The Giant Book of Space*. Brookfield, CT: Copper Beech Books, 2000. **(E)**

Jackson, Ellen. *Looking for Life in the Universe*. Boston: Houghton Mifflin, 2002. **(E)**

Kerrod, Robin. *Asteroids, Comets, and Meteors*. Minneapolis: Lerner, 2000. **(E)**

Krupp, E. C. *The Big Dipper and You*. New York: William Morrow, 1989. **(P)**

Nicolson, Cynthia Pratt. *Exploring Space*. Tonawanda, NY: Kids Can Press, 2000. **(P)**

Simon, Seymour. *Destination*: *Jupiter*. New York: William Morrow, 1998. **(P)**

Wunsch, Susi T. *The Adventures of Sojourner: The Mission to Mars That Thrilled the World*. New York: Mikaya Press, 1998. **(E)**

Nicolson, Cynthia Pratt. *Exploring Space*. Tonawanda, NY: Kids Can Press, 2000. **(E)**

Earth Science

Aulenbach, Nancy Holler and Barton, Hazel A., with Delano, Marfé Ferguson. *Exploring Caves: Journeys Into the Earth*. Washington, DC: National Geographic Society, 2001. **(E)**

Dewey, Jennifer O. *Antarctic Journal: Four Months at the Bottom of the World*. New York: HarperCollins Children's Books, 2001. **(E)**

De Paola, Tomie. *The Cloud Book*. New York: Holiday House, 1975. **(P)**

DeWitt, Lynda. *What Will the Weather Be?* Glenview, IL: Scott Foresman, 1991. **(P)**

Gentle, Victor and Perry, Janet. *Earthquakes*. Milwaukee: Gareth Stevens, 2001. **(P)**

Graf, Mike. *Lightning and Thunderstorms*. New York: Simon Spotlight, 1998. **(E)**

Gray, Susan H. *Coral Reefs*. Minneapolis, MN: Compass Point Books, 2001. **(P)**

Kahl, Jonathan D. *National Audubon Society First Field Guide: Weather.* Washington, DC: National Audubon Society, 1998. **(E)**

Kramer, Stephen. *Hidden Worlds: Looking Through a Scientist's Microscope*. Boston: Houghton Mifflin, 2001. **(E)**

Levinson, Nancy S. *Death Valley: A Day in the Desert*. New York: Holiday House, 2001. **(P)**

Lingelbach, Jenepher and Purcell, Lisa (Eds.). *Hands-On Nature*. Woodstock, VT: Vermont Institute of Natural Science, 2000. **(E)**

Markle, Sandra. *A Rainy Day*. London: Orchard Books, 1993. **(P)**

Morrison, Gordon. *Pond*. Boston: Houghton Mifflin, 2002. **(P)**

Ricciuti, Edward R. *Rocks and Minerals*. New York: Scholastic, 2001. **(E)**

Robson, Pam. *Maps and Plans*. Brookfield, CT: Copper Beech Books, 2001. **(P)**

Ryon-Quiri, Patricia. *Seasons*. Minneapolis, MN: Compass Point Books, 2001. **(P)**

Silver, Donald. M. *Backyard*. New York: McGraw-Hill/Contemporary Books, 1997. **(P)**

Tagliaferro, Linda. *Galápagos Islands: Nature's Delicate Balance at Risk*, Minneapolis: Lerner, 2001. **(E)**

Weidner, Kathleen. *What Is the World Made of? All About Solids, Liquids, and Gases*. New York: Harper Trophy, 1998. **(P)**

The History and Nature of Science

January, Brendan. *Science in the Renaissance*. Danbury, CT: Franklin Watts/Grolier, 1999. **(E)**

Jones, Lynda. *Great Black Heroes: Five Brilliant Scientists*. New York: Scholastic, 2000. **(E)**

Lehn, Barbara. *What Is a Scientist?* Brookfield, CT: Millbrook, 1998. **(P)**

Martin, Jacqueline Briggs. *Snowflake Bentley*. Boston: Houghton Mifflin, 1998. **(P)**

Ripley, Catherine. *Why? The Best Ever Question and Answer Book About Nature, Science and the World Around You*. New York: Firefly Books, 2001. **(E)**

Life Science

Arnold, Caroline. *Animals That Migrate*. Minneapolis: Carolrhoda, 1982. **(P)**

Brown, Ruth. *Ten Seeds*. New York: Knopf/Random House Children's Books, 2001. **(P)**

Dewey, Jennifer O. *Paisano, the Roadrunner*. Brookfield, CT: Millbrook Press, 2002. **(P)**

DuQuette, Keith. *They Call Me Woolly: What Animal Names Can Tell Us*. New York: Sterling, 2002. **(P)**

George, Jean Craighead. *The Tarantula in My Purse: And 172 Other Wild Pets*. Glenview, IL: Scott Foresman, 1996. **(E)**

Gibbons, Gail. *Giant Pandas*. New York: Holiday House, 2002. **(P)**

Glover, David. *How Do Things Grow?* New York: DK Publishing, 2001. **(E)**

Goodman, Susan. E. *Claws, Coats and Camouflage: The Ways Animals Fit Into Their World*. Brookfield, CT: Millbrook Press, 2001. **(E)**

Lerner, Carol. *Butterflies in the Garden*. New York: HarperCollins, 2002. **(P)**

Llewellyn, Claire and Watts, Barrie. *Earthworms*. Danbury, CT: Franklin Watts, 2002. **(P)**

Montgomery, Sy. *Encantado: Pink Dolphin of the Amazon*. Boston: Houghton Mifflin, 2002. **(E)**

Powzyk, Joyce. *Tracking Wild Chimpanzees*. New York: Lothrop, Lee & Shephard, 1998. **(E)**

Rockwell, Anne. *Bugs Are Insects*. New York: HarperCollins Children's Books, 2001. **(P)**

Simon, Seymour. *Animals Nobody Loves*. New York: North-South Books, 2001. **(P)**

Stonehouse, Bernard. *The Poles*. New York: Crabtree, 2001. **(E)**

Walker, Sally M. *Fireflies*. Minneapolis: Lerner, 2001. **(P)**

Winer, Yvonne. *Birds Build Nests*. Watertown, MA: Charlesbridge, 2002. **(P)**

Yolen, Jane. *Welcome to the River of Grass*. New York: G. P. Putnam's Sons, 2001. **(P)**

Physical Science, Engineering and Technology

Adler, David A. *How Tall, How Short, How Far Away*. New York: Holiday House, 1999. **(P)**

Barr, George. *Sports Science for Young People*. Mineola, NY: Dover, 1990. **(E)**

Bradley, Kimberly Brubaker. *Pop! A Book About Bubbles*. New York: HarperCollins Children's Books, 2001. **(P)**

Curlee, Lynn. *Brooklyn Bridge*. New York: Atheneum Books for Young Readers, 2001. **(E)**

Farndon, John. *Flight*. Tarrytown, NY: Benchmark Books, 2002. **(P)**

Fredericks, Anthony D. *Science Discoveries on the Net*: *An Integrated Approach*. Englewood, CO: Libraries Unlimited, 2000. **(E)**

Graham, Ian. *Going Digital*. Austin, TX: Raintree Steck-Vaughn, 2001. **(P)**

Hooker, Saralinda, Ragus, Christopher and Salvidori, Mario G. *The Art of Construction: Projects and Principles for Beginning Engineers and Architects*. Chicago: Chicago Review Press, 1990. **(E)**

Old, Wendie. *To Fly: The Story of the Wright Brothers*. New York: Clarion, 2002. **(E)**

Pipe, Jim. *What Does a Wheel Do?* Brookfield, CT: Copper Beech Books/Millbrook, 2002. **(P)**

Shapiro, Mary J. *How They Built the Statue of Liberty*. New York: Random House, 1985. **(E)**

Vanderwarker, Peter. *The Big Dig*: *Reshaping an American City*. Boston: Little, Brown, 2001. **(E)**

Welsbacher, Anne. *Inclined Planes*. Mankato, MN: Bridgestone Books, 2001. **(E)**

Young, Ruth M. *Matter*. Huntington Beach, CA: Teacher Created Materials, 2002. **(E)**

Science Activities and Experiments and Science Fair Projects

Cobb, Vicky. *Don't Try This at Home! Science Fun for Kids on the Go.* New York: Harper Trophy, 1998. **(P)**

Cook, James G. *The Thomas Edison Book of Easy and Incredible Experiments*. New York: Dodd Meade, 1988. **(E)**

DiSpezio, Michael. *Flying Things: Simple Experiments in the Science of Flight*. Parsippany, NJ: Dale Seymour Publications, 2000. **(P)**

Franklin Institute Science Museum. *The Ben Franklin Book of Easy and Incredible Experiments*. New York: John Wiley & Sons, 1995. **(E)**

Fredericks, Anthony D. *Exploring the Universe: Science Activities for Kids*. Golden, CO: Fulcrum, 2000. **(E)**

Mebane, Robert C. and Rybolt, Thomas R. *Adventures With Atoms and Molecules: Chemistry Experiments for Young People*. Springfield, NJ: Enslow, 1995. **(E)**

Nankivell-Aston, Sally and Jackson, Dorothy. *Science Experiments With Color*. Danbury, CT: Franklin Watts, 2000. **(P)**

Potter, Jean. *Science in Seconds for Kids*: *Over 100 Experiments You Can Do in Ten Minutes or Less*. New York: John Wiley & Sons, 1995. **(E)**

Rhatigan, Joe and Smith, Heather. *Sure-To-Win Science Fair Projects*. New York: Sterling, 2002. **(E)**

Robinson, Tom Mark. *The Everything Kids' Science Experiments Book: Boil Ice, Float Water, Measure Gravity—Challenge the World Around You*. Holbrook, MA: Adams Media Corp, 2001. **(E)**

Rybolt, Thomas R. and Rybolt, Leah M. *Science Fair Success with Scents, Aromas, and Smells*. Springfield, NJ: Enslow, 2002. **(E)**

Toney, Sara D. *Smithsonian Surprises: An Educational Activity Book*. Washington, DC: Smithsonian Institution, 1985. **(E)**

Wiese, Jim. *Sports Science: 40 Great Goal-Scoring, High-Flying, Medal-Winning Experiments for Kids*. New York: John Wiley & Sons, 2002. **(E)**

Magazines for Children

Ask. Cobblestone Publishing Company. Toll-free: (800) 821-0115. www.cobblestonepub.com. (*grades 2-4*)

ChickaDEE. Bayard Canada. Toll-free: (800) 551-6957. www.owlkids.com/chickadee/. (*preschool-grade 4*)

Click. Cricket Magazine Group. Toll-free: (800) 821-0115. www.cricketmag.com. (*grades 1-3*)

Dig. Cobblestone Publishing Company. Toll-free: (800) 821-0115. www.cobblestonepub.com. (*grades 4 and up*)

Dolphin Log. Cousteau Society. Toll-free: (800) 441-4395. www.dolphinlog.org. (*grades 2 and up*)

Kids Discover. (212)-677-4457. www.kidsdiscover.com. (*grades K and up*)

Muse. Cricket Magazine Group. Toll-free: (800) 821-0115. www.musemag.com. (*grades 3 and up*)

National Geographic Kids. National Geographic Society. Toll-free: (800) 647-5463. www.nationalgeographic.com. (*grades 3-5*)

Odyssey. Cobblestone Publishing Company. Toll-free: (800) 821-0115. www.cobblestonepub.com. (*grades 4 and up*)

OWL. Bayard Canada. Toll-free: (800) 551-6957. www.owlkids.com/owl/. (*grades 3-5*)

Ranger Rick. National Wildlife Federation. Toll-free: (800) 611-1599. www.nwf.org. (*grades 1-5*)

Your Big Backyard. National Wildlife Federation. Toll-free: (800) 611-1599. www.nwf.org. (*preschool-grade 1*)

WonderScience. American Chemical Society. Toll-free: (800) 227-5558. www.chemistry.org. (*grades 4 and up*)

Zoobooks. Wildlife Education. Toll-free (800) 992-5034. www.zoobooks.com. (*grades K and up*)

Science Toys

Children don't need fancy science toys or kits to learn science. However, if you want to buy them for your child, you'll find that toy stores, hobby shops and science specialty shops have a large selection of kits and toys to choose from. It's beyond the scope of this booklet to recommend specific toys. However, the following tips can guide you in making good choices:

- Make sure that the toy you choose matches your child's interests. If she's interested in animals and how they live, she may not benefit from—or use—a chemistry kit.
- Learn what the toy can and cannot do before you buy it. If your child is interested in astronomy, he may be disappointed if he looks through the toy telescope you gave him and finds out he can't see bumps and craters on the moon.
- Make sure the toy is appropriate for your child's age group. Toys that are too complicated—or too simple—can frustrate or bore children.
- Read the instructions that come with the toy carefully so you understand how it works and how it should be used.

Science on TV

Even though the quality of the science programming seen on TV varies a lot, some programs are able to provide accurate science information in a way that both informs children and captures and holds their interest.

Good science programs can be found on broadcast networks, on cable or satellite channels (such as the Discovery Channel, the Learning Channel, the National Geographic Channel, Nickelodeon and the Disney Channel), as well as on public television stations. To find the best programs for your child, ask her science teacher to make recommendations or check your local listings.

Children can learn science from other TV programs as well. For example, as you watch TV with your child, call her attention to news stories that involve scientific discoveries or scientists. Have her identify characters on favorite TV shows who have science-related jobs, such as emergency medical personnel, pharmacists or engineers. If you watch science-fiction programs, talk with her about the science involved—Is it accurate? What different kinds of science can she identify? If you watch sports events, ask her how science plays a part in the things athletes do—throwing a football, hitting a baseball or tennis ball, kicking a soccer ball. For cooking shows, talk with her about the changes and chemical reactions that take place as part of preparing a meal. The possibilities are endless!

If possible, record some of your own favorite science programs so that you and your child can watch them together. Stop—or replay—parts of the program that are particularly interesting or hard to understand and talk with her about what is happening.

Science on the Internet

Through the Internet, your child can have access to a vast array of science resources. Many of these resources are both educational and entertaining. Others, however, are inappropriate for children or provide inaccurate information. Here are some suggestions for helping your child use Internet resources appropriately.

- Monitor your child's use of the Internet by visiting Web sites with her. Check the kinds of information available to see if it is age-appropriate and the activities to see if they are dangerous or inaccurate.
- Look into software or online services that filter out offensive materials and sites. Options include stand-alone software that can be installed on your computer and devices that label or filter content directly on the Web. In addition, many Internet Service Providers and commercial online services offer site blocking, restrictions on incoming e-mail and children's accounts that access specific services. Many of these can be obtained for free or for modest costs at your local electronics store.

- Make sure that your child knows not to give out personal information over the computer, such as his real name, phone number, address or computer password.
- Help your child to tell the difference between "real" science activities and information and advertisements for toys, kits and games.

Web Sites

The following Web sites are some of the many that contain great links for both you and your child, in addition to the federal Web sites given on page 47. Most of these listings provide information about how to search for specific information and links to other age-appropriate sites for children.

—American Association for the Advancement of Science: **www.scienceeverywhere.org**

—Annenberg/CPB Math and Science Project: **www.learner.org/**

—Educational REALMS: **www.stemworks.org**

—Family Education Network: **http://fen.com**

—The Franklin Institute Science Museum: **http://sln.fi.edu/**

—Howard Hughes Medical Institute (Cool Science for Curious Kids): **www.hhmi.org/coolscience/index.html**

—Lawrence Hall of Science, University of California, Berkeley: **www.lhs.berkeley.edu/**

—Miami Museum of Science: **www.miamitaxi.net/attractions/miamimuseumofscience.htm**

—National Aeronautics and Space Administration (NASA) **www.nasa.gov/audience/forkids/home/index.html**

—National Geographic Society: **www.nationalgeographic.com**

—National Science Education Standards: **www.nap.edu/readingroom/books/nses/html/**

—National Science Teachers Association: **www.nsta.org/parents**

—National Wildlife Federation: **www.nwf.org/kids/**

—Science for Families: **http://scienceforfamilies.allinfo-about.com/**

—A Science Odyssey: **www.pbs.org/wgbh/aso/**

—Smithsonian Institution: **www.si.edu/kids/**

—U.S. Department of Agriculture for Kids Science Links and Resources **www.usda.gov/news/usdakids/index.html**

—U.S. Geological Survey Learning Web: **http://interactive2.usgs.gov/learningweb/fun/map.asp**

Science Camps

Camps that focus on many different fields of science and technology are available across the country for children of elementary school age and up. Some of the organizations listed in the section above may provide information. In addition, check the following:

—Audubon (**www.audubon.org/educate/cw/**) runs ecology camps in various locations.

—The U.S. Space and Rocket Center in Huntsville, Alabama, runs the U.S. Space Camp (**www.spacecamp. com**).

—The National Atomic Museum in Albuquerque, New Mexico, (**www.atomicmuseum.com**) holds science summer camps across the city each summer.

—The YMCA and YWCA (check for local addresses) hold a variety of camps, including computer camps, for both boys and girls.

Your child's science teacher, school counselor or the children's librarian at your local public library may be able to help you locate the names and contact information for both local and national science camps.

Bibliography

In addition to those listed in the **Resources** section, the following publications were used in preparing this booklet:

American Chemical Society/American Institutes of Physics. *Wonder Science*. Washington, DC: American Chemical Society, 1990.

Asimov, Isaac. "Science and Children," Introduction in *Science Fare* by Wendy Saul and Alan R. Newman. New York, Harper & Row, 1986.

Berger, Melvin. *Simple Simon Says*: *Take One Magnifying Glass*. New York: Scholastic Inc., 1980.

Cobb, Vicki. *Science Experiments You Can Eat*. New York: Harper & Row, 1972.

Herbert, Don. *The Wild Inside; Mr. Wizard's Experiments for Young Scientists*. Garden City, N.Y.: Doubleday, Inc., 1959.

Hoover-Dempsey, Kathleen and Sandler, Howard. *"Why Do Parents Become Involved in Their Children's Education?"* Review of Educational Research 67(1): 1997.

Katz, Phillis. *Exploring Science Through Art*. New York: Franklin Watts, 1990.

Lewis, James. *Learn While You Scrub: Science in the Tub*. New York: Meadowbrook Press, 1980.

Lowery, Lawrence F., (Ed.). *NSTA Pathways to the Science Standards: Guidelines for Moving the Vision into Practice, Elementary School Edition*. Arlington, VA: National Science Teachers Association Press, 1997.

National Center for Improving Science Education. *Getting Started in Science: A Blueprint for Elementary School Science Education*. Andover, MA: The NETWORK, Inc., 1989.

National Research Council Staff, National Academy of Sciences. *National Science Education Standards: Observe, Interact, Change, Learn*. Washington, DC: National Academy Pres, 1996.

U.S. Department of Education. *Papers Presented at the Secretary's Summit on Mathematics, February 6, 2003 in Washington, D. C.* (available online at www.ed.gov/rschstat/research/progs/mathscience/index.html), 2003.

Zubrowski, Bernie, *Bubbles*. Boston: Little, Brown and Company, 1979.

Zubrowski, Bernie. *Messing Around With Baking Chemistry*. Boston: Little, Brown and Company, 1981.

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No Child Left Behind

On January 8, 2002, President George W. Bush signed into law the *No Child Left Behind Act of 2001* (NCLB). This new law represents his education reform plan and contains the most sweeping changes to the Elementary and Secondary Education Act since it was enacted in 1965. It changes the federal role in education by asking America's schools to describe their success in terms of what each student accomplishes. The act contains the president's four basic education reform principles:

- Stronger accountability for results;
- Local control and flexibility;
- Expanded options for parents; and
- An emphasis on effective and proven teaching methods.

In sum, this law—in partnership with parents, communities, school leadership and classroom teachers—will ensure that every child in America receives a great education and that no child is left behind.

For more information on *No Child Left Behind*, visit the Web site at www.nochildleftbehind.gov or call 1–800–USA–LEARN.

U.S. Department of Education
Office of Intergovernmental
and Interagency Affairs

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