Traveling Exhibit
Activity Guide for Parents and Teachers

Welcome to ***Little Builders***, an interactive exhibition created to help young children develop science process skills through play and exploration. This *Activity Guide* provides resources for your visit to ***Little Builders,*** including activities designed to help you get the most from your visit.

TABLE OF CONTENTS

This guide was developed at OMSI in conjunction with ***Little Builders***, an OMSI exhibit. It was adapted from *The Busy World of Richard Scarry™: Busytown™ Activity Guide for Parents & Teachers*.

OMSI

INTRODUCTION TO *LITTLE BUILDERS*

Little Builders is a hands-on science exhibition for children (ages 2–7) and their parents and other caregivers. Children create, play, and learn as they explore concepts related to building, playing with air, and using simple machines. Throughout ***Little Builders***, the open-ended nature of the materials and activities allows creativity to flourish. Children are encouraged to use the exhibit in their own unique ways to personalize the learning experience. ***Little Builders*** is also a learning laboratory for parents, teachers, and other care providers to observe, understand, and interact with their little builders.

Little Builders provides rich opportunities for role-play. Children enter the exhibit and get ready to work by putting on a hardhat and construction vest. They can see how they look in a full-length mirror and then grab a little truck pushcart and some orange rubber cones before heading off to play.

EXHIBIT OVERVIEW

Little Builders was developed and designed around three primary themes: building, playing with air, and using simple machines. Activities in the exhibition include:

BUILDING

Children discover important concepts involved in building: size, weight, shape, balance, gravity, and stability as they design and build structures. They also can practice fine-motor and gross-motor skills as they turn gears and climb in, out, over, and under the four levels of the **Construction Site**. Activities include:

Pattern Wall
Design and build a "brick" wall with large plastic blocks in a variety of colors. Use different sizes and colors of interlocking blocks to create patterns and construct a wall inside a molded frame.

Building Blocks
Discover the concepts involved in building while designing and creating structures out of wooden blocks in many shapes and sizes. Build a mini-community on a soft carpet displaying a grid of city streets.

PVC Pipe House
Build three-dimensional structures using a variety of PVC pipes and connectors at the four-sided PVC Pipe House.

Latch Houses
Crawl into miniature Latch Houses. Practice fine-motor skills by hooking and unhooking latches while opening and closing doors and shutters.

Big Building
Build pathways, houses, or anything else imaginable with soft, oversized blocks.

Gear & Duplo® Table
Create a plan and build patterns with gears and Duplo® blocks of different colors.

Dump Truck
Climb on board a stationary dump truck and "drive" construction materials to their destination. A fantastic opportunity for role-play and for photos, too!

PLAYING WITH AIR

Children experience and play with the characteristics of air and wind and how they affect objects.

Power Toss & Catch
Insert balls into vertical air chutes. Watch the balls shoot through the clear pipes and pop into a basket.

Air Effect
Watch in amazement as plastic balls mysteriously float, bobbing up and down, at the Bernoulli blower. Feel the force and pressure of air by experimenting with balls and the stream of air that flows up through the hollow cone.

USING SIMPLE MACHINES

Children have opportunities to explore and experiment with simple machines.

Mini-crane
Turn a crank to operate a pulley system to raise and lower objects, use a friction brake to hold or release lifted objects, and use a set of pedals to rotate the crane on its base. Discover how the crane enables workers to move objects around the construction area.

Gantry Crane and Flatbed Car
Use a gantry crane to move block cargo to a waiting flatbed car.

Pulley & Conveyer Belt
Transport objects in buckets to all four levels of the Construction Site using a hand-operated pulley. Move materials by manipulating a hand-operated conveyer belt.

Ball and Pipe Plumbing
Drop plastic balls through a series of clear “plumbing” pipes and watch as they travel down a twisty path. Work with pipes, balls, and levels to explore the fundamentals of plumbing and gravity.

Paint Wall and Rollers
Pretend to paint a wall. Experiment with real painting equipment to master the craft. Use fuzzy paint rollers and dip them into trays with imaginary “paint.”

Tool Wall
Pound oversized nails, turn oversized screws, and twist oversized bolts with plastic hammers, screwdrivers, and wrenches.

THINGS TO THINK ABOUT BEFORE YOUR VISIT TO *LITTLE BUILDERS*

> "Science is a way of doing things and solving problems. It is a style which leads a person to wonder, to seek, to discover, to know, and then to wonder anew." Bess-Gene Holt, author, *Science with Young Children*.

1. What Is Science?

Some people think of science as merely a body of knowledge. But that's too limiting! Science is *not* a collection of moldy facts to memorize or a bunch of historic discoveries to bang the drum about. *Science is a dynamic process of thinking, acting, and finding out about the world.* By focusing on the skills and attitudes that have moved science forward through the centuries, we can help our children become willing to take risks and experiment for themselves. Thus new scientists, and new scientific discoveries, are born!

The activities in ***Little Builders*** encourage children to **observe, predict, classify, experiment, question,** and **communicate**—all of which are important science process skills. Children use these skills naturally as they make discoveries about the world and their place in it.

Children need to know that it's okay to be curious, okay to experiment, okay to take risks, and okay to express their ideas. It doesn't matter so much if a child's theory of why the gear moves is right or wrong. What's more important is that he or she *has* a theory or at least has the curiosity and the opportunity to try to develop such a theory and to change and refine it over time.

2. Open-Ended Questions Stimulate Thought

We're all familiar with questions that call for a single right answer or a simple "yes" or "no" response. When you ask a question like "What color is the block?" or "Is the block bigger than the ball?" you already know the answer. You're simply testing the child's knowledge.

Open-ended questions, on the other hand, **have many possible answers**. "What can you do with these things?" "What will happen if you do that?" "Do you have some ideas about why that happened?" "Can you think of another way to do that?" "How could we find out about that?" These questions lead to further learning. They encourage children to experiment, to take risks, to make predictions, to develop theories, to solve problems, to find out about the world, and to ask more questions—in other words, *to engage in the scientific process!*

When thinking about asking open-ended questions, be observant. Look to see what your child is actively exploring. If she's using her body to explore the various sizes of doors, try asking her who she thinks might be able to fit through each door. (Or perhaps you'll see that she's so engrossed in her own experimentation that the best question is no question at all!)

When you ask a child an open-ended question, remember that *there are no wrong answers!* An open-ended question is not a quiz. It's a tool that helps a child try out different ways of thinking and talking about the world.

In a way, ***Little Builders*** itself is one big open-ended question. It's filled with materials that can be used in an almost infinite number of ways.

3. Every Child Is Unique!

Every child who comes to ***Little Builders*** displays a one-of-a-kind personality. A child brings his or her own unique *behavior style* or *temperament* to every situation—whether it is an activity, a relationship, or an opportunity for learning. Here's a list of **traits to watch for as you observe children in *Little Builders*** and, indeed, in life itself!

- **Activity Level:** Some children are highly active and seem to have boundless energy. Others display a balance of active and inactive periods. And others are relatively calm and quiet most of the time.
- **Persistence and Attention Span:** Some children don't spend very long at any one activity, and they move on when they encounter an obstacle too frustrating for them. Other children tend to stay with the same activity for a long period, even if faced with difficulty.
- **Reaction to New Experiences:** Some children seem comfortable when they encounter new places, new people, new foods, new situations, etc. Others are more cautious when faced with newness and change.
- **Reaction to Stimuli:** Children display different levels of tolerance to such environmental stimuli as light, noise, odor, temperature, and touch.
- **Depth of Response:** Some children express both pleasure and unhappiness with great intensity. Others express their feelings and needs in a more low-key way.
- **Social Preference:** Some children like to be around lots of people. Others prefer just one or two playmates. Still others prefer to be alone.

No one way is better than another. Understanding each child's unique behavior style can help parents and teachers to better understand and appreciate every child. (It's useful for you to be aware of your own tendencies, too. If they're very different from your child's, this may cause conflicts.)

DURING YOUR VISIT

We've designed ***Little Builders*** to encourage each child to freely experiment with whatever is most interesting to him or her. If you'd like to focus your child's activity further, here are a few challenges (in the form of open-ended questions) that you might offer:

- Find things that move something from one place to another. Can you build something that will move things around?
- Which things will move with air?
- How many different things can you find to build with? Can you mix any of these building materials when you build something? How? Why or why not?
- How many different ways can you sort the items in ***Little Builders***? By shape, color, etc.

During your visit, take note of what your child or children are most interested in. Then be sure to expand upon that afterwards. The activities that follow are designed to be done after your visit to reinforce the scientific principles of the exhibit. They can be done with fairly basic home or school materials.

> "A one-time activity is almost useless. Only upon repeated exposure, with opportunities to reinvestigate and refine one's ideas, does one actually come to understand anything!" John Dewey

ACTIVITIES FOR BEFORE AND AFTER YOUR VISIT

Building Activity 1: Box Collage

Learning objective
As children construct with boxes, they will work with some of the same principles that architectural engineers deal with: size, shape, weight, stability, gravity, and balance. Older children may attempt to make a small representation of a house, a neighborhood, or an imaginary town. They will use the science process skills of observation, prediction, comparison (of size, shape, color, and other attributes of the boxes), experimentation, and communication.

What you need
- small cardboard boxes and containers of all shapes: cereal boxes, cracker boxes, toothpaste boxes, toilet paper tubes, etc.
- a large, flat piece of cardboard
- glue, and maybe some brushes to spread it with

How to begin
Start with an open-ended question, such as "What could you do (or make) with all of these things?" Then stand back and be prepared for a variety of responses. Just as children go through a number of stages in their block play, so do they go through a number of stages in their box collage construction. Very young children may simply be fascinated with the boxes themselves—looking at all the sizes and shapes, opening them up, perhaps using them as "presents." Children may try to glue them randomly onto the cardboard base or glue them all into one tall stack. Only after much of this kind of exploration are children ready to use the boxes to make actual replicas of buildings or towns. Notice what your child does and appreciate the learning that goes on in each stage. Gear your open-ended questions to whatever your child's interest seems to be.

Open-ended questions
- What could you make with all of these boxes?
- What would these rectangular boxes be good for? What would these tubes be good for?
- How can you attach them to the cardboard?
- Why do you think that box didn't stay on top of the other box?
- Can you think of another way to attach those two boxes?
- What else could we add to this structure?

Follow-up activities
- Turn this into a large group project lasting for a week or more.
- After the children are finished with the boxes, let them add other materials such as cutout paper shapes, popsicle sticks, stickers, paint, etc.
- Provide larger boxes, stuffed with newspaper and taped shut, and a large indoor or outdoor space for temporary box-block construction.

Building Activity 2: Box Structure

Learning objective
This activity is for the slightly older child who has already shown an ability to make something that "looks like something. This child can be challenged to think about what items a house or other building really needs and how to construct each item. In doing so, he or she will be using the science process skills of observing, predicting, experimenting, and problem solving.

What you need
- at least one really large box (such as a refrigerator or other large appliance box) that one or more children can fit into (You can usually get this size box at an appliance store.)
- pens, paint, carpet, cloth scraps, and other materials for decorating the building
- a utility knife or other blade for an adult to use to cut a door, windows, or other shapes that children have drawn onto the cardboard

How to begin
Ask your child what kind of building he or she would like to make out of the big box. Continue your open-ended questions accordingly and allow plenty of time. Buildings are rarely finished in one afternoon!

Open-ended questions
- If this box were going to be a building, what kind of building would you want it to be?
- How many people could fit in it?
- Is there a way we could make it bigger?
- What does your building need?
- How could we make a door? Windows? A roof? A mailbox? Furniture?
- Would it be possible to construct a second story on this building? How would you make stairs? Who could go up there? Who couldn't?

Other Building Activities

- Start noticing all the features that buildings *do* have.
- Connect boxes together to make rooms, neighborhoods, towns, etc.
- Use Duplo® or Lego® blocks, Tinkertoy® construction pieces, and other commercial building materials.
- Set up free-form carpentry projects.
- Make collages out of any three-dimensional materials.
- Play with good old-fashioned wooden blocks!

Playing with Air Activity 1: Blowing Objects through a Maze

Learning objectives
As children attempt to move various objects with air, they learn about the powers of air and the effect of weight, shape, and size on the movement of objects. They learn to control their own breath. They use the science process skills of observation, prediction, classification (what moves and what doesn't), experimentation, and communication.

What you need
- a table top or other flat surface
- blocks or other sturdy objects to build a maze
- feathers, cotton balls, corks, Styrofoam™ pieces, marbles, small Lego® blocks, and a variety of other objects that will or won't move through the block maze when blown with a straw (Make sure objects are not small enough to inhale through the straws!)
- drinking straws
- two distinct, labeled containers—one for the clean straws and one for the used straws

How to begin
Ask your child to help you construct a maze on a tabletop, using blocks to make the sides of the pathways. Designate one end as the start and the other end as the finish line. Ask children open-ended questions to stimulate experimentation with blowing objects through the maze.

Open-ended questions
- Which objects do you think you can move by blowing on them? Which ones won't move? Why?
- What do you think will happen when you blow on the [*object*]?
- Why do you think it moved? Why didn't it move?
- Can you think of another way to make it move?
- What happens if you put your straw closer to the object? Further away? What if you blow on it from above? From the side? Are there any other ways to blow on it?
- What would happen if you didn't use the straw but just blew on it with your mouth?
- What other materials could you find around the room that will (or won't) move when you blow on them?

Follow-up activities
- Try blowing through empty paper towel rolls for variety.
- Use an empty squeeze bottle, a simple paper fan, an electric fan, or a bellows to move the objects along.
- Try building the maze on a bumpy surface (perhaps the carpet?) and see how that changes the movement of the objects.
- Try blowing floating objects across a water table, bathtub, or wading pool filled with water.
- Attach paper sails to toy cars with a stick and a lump of clay. Try blowing these vehicles through the maze or along a racetrack.

Playing with Air Activity 2: Blow Painting

Learning objective
As children control their breath to move paint blobs, they learn about the powers of air. They may also make some observations about color mixing. They use the science process skills of observation, prediction, experimentation, and communication.

What you need
- tempera paints—two simple colors may be enough
- paper and straws
- medicine droppers or spoons

How to begin
Give each child a sheet of paper, some straws, and access to the containers of paint with the medicine droppers or spoons in them. Tell them to use the medicine droppers or spoons to put a drop or blob of paint on the paper. Then have them blow through the straws and watch what happens to the paint. (Be careful not to inhale the paint!) Encourage further experimentation with some of the open-ended questions suggested below.

Open-ended questions
- What happens to the paint when you blow on it?
- What happens if you put your straw closer to the paper? Further away? What if you blow on it from up above? From the side? Are there any other ways to blow on it?
- What would happen if you didn't use the straw, but just used your mouth to blow the paint?
- What would happen if you blew with two straws in your mouth at the same time?
- If you had two drops of paint at opposite ends of your paper, how could you get them to both move at the same time?
- What would happen if we used thicker paint? Thinner paint? (If your child seems interested, don't just talk about it—try it!)

Follow-up activities
- As suggested above, try thicker or thinner paint.
- Use an empty squeeze bottle to move the paint along.
- Attach paper sails to toy cars with a stick and a lump of clay. Run the wheels through some paint and then blow the cars along the paper to make paint tracks.

Other “Playing with Air” Activities

- Blow bubbles.
- Pump up bicycle tires and other inflatable toys.
- Blow up balloons.
- Make your own pinwheels.
- Observe or make windsocks and weather vanes.
- Act out the story of “The Three Little Pigs” with model houses made from various materials. “Huff” and “puff” on them to “blow the house down.”
- Attach small paper or cloth parachutes to various objects and drop them from up high.
- Fly kites!

Use these activities as opportunities to ask open-ended questions, encouraging children to experiment, to make predictions, and to develop and express *their* theories about the effects of air and wind on various objects!

Simple Machines Activity 1: Making Ramps

Learning objective
In this activity, children learn how different angles of inclined planes and different properties of objects affect movement. They use the science process skills of observation, comparison, classification, prediction, experimentation, and communication.

What you need
- a long wooden plank that can serve as a ramp. Be sure that it is sanded smooth to prevent splinters.
- wooden blocks or other supports to hold up the ramp at one end
- a variety of objects that will roll and some that won't

How to begin
Set up a ramp with a block under one end of the board. Encourage experimentation with the following open-ended questions.

Open-ended questions
- What do you think will happen if you let this [*object*] go down the ramp?
- What will happen if we make the ramp higher? Lower?
- Why didn't the [*object*] roll on its own?
- Is there some way we could make it move?
- What else can you find that will roll down the ramp?
- What else can you find that will slide down the ramp?
- What else can you find that won't go down the ramp?
- What do you think caused that cone shape to roll off the *side* of the ramp?

Follow up activities
- Make another ramp and encourage comparisons.
- Measure the distance that various objects roll.
- Cover the surface of the ramp with sandpaper, cloth, or a rubber mat and see how that affects the rolling objects.
- Experiment with slides at the park.
- Try sliding down a grassy slope while sitting on some cardboard or ride a sled down a snowy hill.

Simple Machines Activity 2: Make Your Own Gravitram Wall

Learning objective
In this activity, children make further discoveries about inclined planes and the pathways of rolling objects. They use the science process skills of observation, prediction, experimentation, and communication.

What you need
- empty toilet paper and paper towel tubes, most of them cut in half lengthwise
- small blocks or other items to act as props for the tubes
- blunt-tipped scissors
- masking tape
- marbles
- a large expanse of floor or table space

How to begin
Show your child the materials and ask him if he has any ideas about how to use the tubes, tape, and blocks to make a pathway for the marbles. Encourage further experimentation with some of the following open-ended questions.

Open-ended questions
- How could you get the marble to roll onto another tube?
- How could you make it roll in a different direction?
- What do you think will happen if you bend the tube?
- Is there a way to make the marble roll more quickly?
- Is there a way to slow it down?
- What other things could we use for the marble to roll along?
- Is there anything we could add that would make a sound as the marble rolls by it?

Follow-up activities
- Make a permanent marble path by taping the tubes to a large, flat cardboard base. Use small cardboard boxes for propping up the ramps.
- Try making a vertical marble path by taping the tubes onto the cardboard base that's attached to the wall.
- Let your children construct a permanent marble maze or a marble tilt board with a large wooden base, small scraps of wood, and wood glue or nails.

Simple Machines Activity 3: Pulley Boards

Learning objective
This activity lets children control the movement of pulleys and belts to better understand how they work. They use the science process skills of observation, prediction, experimentation, and communication.

What you need
- a piece of ¾ inch plywood or particleboard, at least 10 inches square
- several empty thread spools
- several rubber bands of different widths and lengths
- nails and a hammer

How to begin
Make sure that the edges of the board are sanded smooth to prevent splinters. Place the spools on the plywood in a random design and nail them in place so that they turn easily. Place a rubber band over spools #1 and #2. Then place another rubber band over spools #2 and #3, and so on in a sort of dot-to-dot progression until all of the spools are connected. Try turning the first spool and see if it activates the others. If not, try rearranging the rubber bands or the spools. Encourage further experimentation with some of the following open-ended questions.

Open-ended questions
- How can you get all of the spools to move?
- What would happen if you put a rubber band over three spools? Four? More?
- Does it seem to make any difference whether we use thick or thin rubber bands? Short or long rubber bands?
- What would happen if you twisted one of the rubber bands into a figure-8 shape before putting it on the spools?
- What would happen if we attached some colored decorations or pinwheels to the tops of these spools?
- What else could we attach to the spools that will show the spools' movement?

Follow-up activities
- A very sturdy toy pegboard, with the pegs holding the rubber bands, might serve as a substitute.
- Observe real pulleys and belts in common machines such as vacuum cleaners and car engines.
- Make your own vertical and horizontal pulleys using simple pulley mechanisms from the hardware store. Make a game out of moving the laundry from the dryer to the bedroom via pulley! Ask your children what else you could move with a pulley.

Machines and Tools in Real Life
As you're going around town, point out the various machines you see that are helping to move objects from one place to another: shopping carts and conveyor belts at the grocery store, cranes and bulldozers at construction sites, book return chutes at the library, etc.

ADDITIONAL RESOURCES

Science and Children

Chaille, Christine and Lory Britain. ***The Young Child as Scientist: A Constructivist Approach to Early Childhood Science Education.*** Allyn & Bacon. 2002. Describes how teachers can act as facilitators of children's natural scientific explorations and theory building.

Gopnik, Alison; Meltzoff, Andrew N. and Patricia K. Kuhl. ***The Scientist in the Crib: What Early Learning Tells Us about the Mind.*** Harper Paperbacks. 2001. Written by three childhood-development scientists for a lay audience. Addresses what's known about children's minds and how they learn.

Science Activities for Children

Chalufour, Ingrid and Karen Worth. ***The Young Scientist Series: Building Structures with Young Children.*** Redleaf Press. 2004. A curriculum that looks at the science behind exploring, designing, and building structures. While intended for teachers, parents may find it an interesting resource.

Moomaw, Sally and Brenda Hieronymous. ***More Than Magnets: Exploring the Wonders of Science in Preschool and Kindergarten.*** Redleaf Press. 1997. Lots of science activities for preschool through primary students, includes a chapter on machines and pendulums.

Worth, Karen and Sharon Grollman. ***Worms, Shadows, and Whirlpools: Science in the Early Childhood Classroom.*** Heinemann. 2003. Identifies important inquiry skills and concepts appropriate for very young children, includes a chapter on physical science that addresses the motion of objects and building.

Children's Unique Temperaments and Learning Styles

Gardner, Howard. ***Intelligence Reframed: Multiple Intelligences for the 21st Century.*** Basic Books. 2000. Gardner continues to refine his influential theory of Multiple Intelligences, contending that each of us is equipped with eight or more separate types of intelligence (including linguistic, logical-mathematical, musical, bodily-kinesthetic, spatial, interpersonal, and intrapersonal).

Greenspan, Stanley I. and Nancy Breslau Lewis. ***Building Healthy Minds: The Six Experiences That Create Intelligence and Emotional Growth in Babies and Young Children.*** Perseus Publishing. 2000. Greenspan identifies six crucial developmental stages and the healthy interactions babies need in each with their caretakers. He also shows how to adapt the principles to infants with different temperaments.

Kurcinka, Mary Sheedy. ***Raising Your Spirited Child: A Guide for Parents Whose Child Is More Intense, Sensitive, Perceptive, Persistent, Energetic.*** Harper Paperbacks. 1998. Kurcinka, a parent of a spirited child herself and a parent educator for 20 years, provides tools to understanding your own temperament as well as your child's.

Story Books

Barton, Byron (illustrator). ***Machines at Work*****.** HarperCollins. 1987. Barton takes youngsters through an entire day at a construction site, showing people actively working with machines.

Crosbie, Michael J. and Steve Rosenthal. ***Architecture, Shapes*****.** John Wiley & Sons. 1993. Explores shapes through the composition and arrangement of windows.

Fowler, Allan. ***Rookie Read-About Science: Simple Machines.*** Children's Press (CT). 2001. Fowler discusses the nature and applications of four simple machines: the lever, the inclined plane, the wheel and axle, and the pulley.

Gibbons, Gail. ***How a House Is Built*****.** Holiday House. 1996. Beginning with the architect who draws the plans, readers meet the surveyors, equipment operators, carpenters, plumbers, and other people who produce a building.

Rockwell, Ann and Harlow Rockwell (illustrator). ***The Toolbox*****.** Walker Books for Young Readers. 2004. Look inside this well-loved toolbox—a treasure trove for curious young builders.

Well, Robert E. ***How Do You Lift a Lion?*** Albert Whitman & Company. 1996. As two children lift a lion, pull a panda, and deliver a basket of bananas to a baboon party, Wells offers explanations for how and why levers, wheels, and pulleys work.

