

# Make Way for Dendrites

## How Brain Research Can Impact Children's Programming

*Betsy Diamant-Cohen, Ellen Riordan,  
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"Among the overwhelming number of neuroscience facts lies a portal through which we might find a way to enhance the gift of education for every child. A vital collaboration between educators and neuroscientists is the way to get there."—*Kenneth S. Kosik, Professor of Neurology, Harvard Medical School*

In the last decade, the field of cognitive neuroscience, which focuses on how the different areas of the brain receive, process, retain, and retrieve information, has evolved. Developments in computer science, which allow computers to model how brain processes work and the ability to scan the brain through functional MRIs, have given cognitive neuroscientists a clearer picture of how our brains work and the significance of varied brain functions that affect learning, memory, emotion, and sensory perception. Libraries are positioned to play an important role in modeling optimal learning environments based on this new understanding of brain function.

Educators have been exploring the implementation of brain research for the classroom since 1995. Experience changes the way the brain functions. The more positive experiences children have, the more likely they will acquire knowledge and learn. Libraries can benefit from this proven research because it is primary to the mission of libraries. Literally illustrated by the technology available to cognitive neuroscientists, the results become a powerful rationale for public support of public libraries.

As children's services librarians, we believe that it is also important for librarians to be aware of the new information and to plan services for children accordingly. By applying what we already know with the most recent findings in the field of brain research, we have developed a formula for children's programming in public libraries that will help create optimal learning environments. Some of these ideas have been part of children's programming in public libraries for decades,

but now through research we have the scientific evidence to support their implementation. These basic concepts are *creating environment, using repetition and ritual, including movement in literary experiences, working in a group, and building positive personal connections between children and librarians.*

### Background

The state of Maryland has created a supportive and progressive library environment promoting emergent literacy.<sup>1</sup> One of the critical pieces is providing support to staff who wish to explore topics related to but outside of their own professional organization. The Enoch Pratt Free Library Children's Programming Specialist, Children's Services Coordinator, and Assistant Children's Services Coordinator are all involved with programming for very young children and have attended professional conferences in related fields such as the National Association for the Education of Young Children and Zero to Three. The most recent conference was the Learning and the Brain Conference.<sup>2</sup> What the authors discovered was exciting new evidence that the basic tenets of library service to children and program planning actually affect brain function in a positive, lasting way.

Experience affects the brain and can change the way in which the brain functions. Environment, repetition, ritual, movement, and personal connection shape experience. Therefore what public librarians do in relation to these critical aspects of children's library service will impact the effectiveness of their customers' brain function and the learning process.

### Creating Environment

As early as 1905, Frances Jenkins Olcott, head of the children's department of Pittsburgh's Carnegie Library, described the ideal children's room as one that was "beautifully proportioned and decorated, and presided over by a genial and sympathetic



Caption?

woman who has a genuine interest in the personalities and the preferences of the boys and girls.”<sup>3</sup> Recent research on emotions shows that a safe, welcoming, and nurturing environment is important in terms of how the brain develops and how children learn. If library experiences are pleasurable, children will remember and learn from them.

Words and songs used in a supportive, friendly environment are easier for children to integrate and remember. Most children’s librarians naturally like to welcome classes with a cheerful hello and to say something positive at the end such as, “Goodbye, I hope you come back soon.” Brain research provides scientific evidence that being warm and welcoming helps the child’s brain grow in a positive way. Before providing books, helping with homework, or running programs, the main job of the children’s librarian should simply be to welcome children and their caregivers in a genuinely enthusiastic and warm way.

Neurobiologist Carla Hannaford said, “Most neural pathways develop through stimulation and multisensory experience gained from interaction with the environment.”<sup>4</sup> However, timing is critical. Some abilities are acquired more easily during windows of opportunity. The brain develops certain portions of itself during specific periods. From birth through the first eight months of life, the brain is busy creating specific potential receptors for certain kinds of stimuli. When the environment provides the specific infor-

mation, the brain is now wired to accept the data, to integrate it, and to make connections between other brain cells. This creates efficient neural pathways in which learning occurs.

Whether or not a child grows up in an enriched or an impoverished environment determines how easily he or she will be able to learn and retain information in their brain later on. For exam-

ple, if a child is born with cataracts, which prevent the receiving of optical stimuli by the brain, and the cataracts are removed early enough, the child’s brain will be able to process optical information, and the child will be able to see. However, if the cataracts are not removed until after the window of opportunity for vision integration in the brain is closed, even though the physical impediments to clear vision have been removed, the child will remain functionally blind because the neural pathways, which interpret sight from the optic nerve, have not been created.

Thus, even if a child is living in an impoverished neighborhood in an “at-risk environment,” regular visits to the public library and participation in library programs will provide the very young child with the type of enriched environment needed in order to make learning easier later on in life.

In the words of Susan Frey, “An *enriched* environment offers an experience that cultivates our potentialities for learning and well-being through the mind, body, and spirit.”<sup>5</sup> Medical science supports that “brain and environment are so continuously and inextricably intertwined that they are inseparable.”<sup>6</sup> Neuro-anatomist Marian Diamond conducted studies proving that sensory-enriched environments are imperative to learning. Laboratory animals developed structural changes in the brain when put in enriched environments, thus demonstrating that environment has the power

to improve intelligence. Responses of the human brain to enriched environments include improvements in emotional stability, emotional adaptation, immune systems, stress management, behavior, memory and learning, and life extension. The public library can provide such an enriched environment through providing colorful children’s rooms with child-sized furniture, exposure to art via posters, pictures, and book illustration, the use of music and musical instruments, and nurturing librarians.

## Using Art in Library Programs

The brain changes physiologically because of experience. A healthy developing brain springs from genetic inheritance and environmental experience that feed off each other in a systemic way. The environment affects how the genes work, and the genes affect how the environment is interpreted. Color is an important part of the environment. Using picture books during programs with children helps to shape their brains into healthy organs. A picture-book story does not have to be read in order to create positive interactions with the pictures. Very young children do not have the attention spans to hear most picture-book stories. However, creating art-based activities such as singing a song about animal sounds while showing animals from Eric Carle’s *The Very Busy Spider* helps to create healthy brains in youngsters.

Music and art develop the brain and enhance learning across all disciplines.

“Both of my children have long attention spans and I think it’s because of being involved in library programs that have a beginning, middle, and an end. They know what to do.”—*Kim, mother of Noah and Eli.*

However, in some areas, school boards have cut funding for the arts, maintaining that it is more beneficial scholastically to focus on reading, writing, and arithmetic. As librarians, we can make it a point to include art and music in programs.

Many of us have heard the argument of nature vs. nurture. Often public librarians serve children from print-poor environments. We can help enrich the minds of these children. Scientific evidence proves that children from socially impoverished backgrounds will benefit through experiences with art in picture books, music, and group activities run in the nurturing atmosphere of the public library.

The fruits of repetition and the value of exposure to picture-book illustrations were recently observed by Regina. A few months ago, she began presenting Mother Goose on the Loose programs for the three-year-olds at the Canton Branch of the Enoch Pratt Free Library. Here is her account of what occurred:

For the last five weeks, my program included “You are My Sunshine,” “Twinkle Twinkle Little Star,” and “Oh Mister Moon,” leading up to reading Eric Carle’s *Papa, Please Get the Moon for Me*. The children love this book, with its warm story of wishes granted by an attentive father, and the moveable illustrations such as papa carrying a loooooong ladder to reach the moon. Children love the repeated reading of this book.

Last Tuesday, we did not read *Papa, Please Get the Moon for Me*. Lying on a bench at child tummy height, left over from an earlier toddler class were some display books, including Eric Carle’s *The Very Busy Spider*. As the other children were putting on sweaters and raincoats and lining up to exit the room, Zachary came over to the bench, opened the book, traced the “wooden” frame around the spider web with his finger, and said musingly, “Papa, please get the moon for me.”

I had just observed three-year-old Zachary making the cognitive leap of identifying the style of an illustrator

(the colorful collage technique of Eric Carle) and associating the page in *The Very Busy Spider* with the remembered illustrations from *Papa, Please Get the Moon for Me*. It felt like such a privilege for me to be observing that moment.

## Using Repetition and Ritual

How many librarians run storytime series where they work hard to plan six totally different sessions with new books, finger plays, and songs each session? Relax a bit! Studies in the way the brain absorbs information show that repetition increases children’s enjoyment, helps them feel safe, and enables them to better retain the information absorbed. So make sure there is plenty of repetition in your programs.

Jerome Kagan asserts that learning is enhanced by the element of a known thing changing patterns or routines.<sup>7</sup> The element of surprise in something known enhances the ability to retain and understand. If something is simply repeated the exact same way numerous times, it will become boring and the child will often tune out. Therefore, repetition does not mean rote, and librarians should not be doing the same thing in the same way week after week.

### Repeat Finger Plays from One Session to the Next

Rather than finding new finger plays and songs for each storytelling session, repeat at least two or three of them from week to week. Children will recognize them as old friends and will learn all of the words. When new finger plays are used in each session, retention rate is not very high. Studies have shown that memorized material that is not consistently reinforced will quickly be forgotten. Real learning takes place when there is repetition even beyond the point of mastery, so that the information can be retained in the long-term memory (LTM).

Betsy always starts her preschool programs with “Alligator, Alligator,” a rhyme she learned twenty years ago in New Jersey. She recently traveled on our Book Buggy, presenting preschool storytimes at

Head Start centers throughout Baltimore City. She began each session by asking the children to put their hands together to make an alligator’s mouth. One of her last stops was the Jonestown Daycare Center, which had attended her library programs on a monthly basis in 2000 and 2001. The old director was gone, the children from then had all graduated, and most of the teachers were new.

At an assembly for the entire daycare center, however, as soon as Betsy began instructions for “Alligator, Alligator,” all of the children cupped their hands together and began reciting the rhyme. How surprised and pleased she was when the children chimed right in. Obviously, the repetition had made an impact; the current staff had learned the rhyme from previous and continuing staff who had learned it over two years ago from Betsy’s programs. What a delight it was for her to see them carrying on her alligator tradition!

### Repeat Books from One Session to the Next

Choose your favorite book in a program, and think of variations in which it can be presented in the following session. For example, read the book in the first session. Act it out with the children in the second session. Play a game with that story in the third session. Use a flannel board to tell the story in the fourth session. Children will not tire of the story; they will grow to love it as an old friend. You will stimulate their multiple intelligences by letting them experience the book on many different levels. The more ways in which children can sense new information, the more likely the information is to be learned and retrieved efficiently and accurately. Libraries provide an essential link to the learning process by providing additional sensory information of critical literacy skills.

Ritual gives structure to the mind. It is a practice of symbolic significance, regularly repeated in a set manner.<sup>8</sup> In the library world, ritual can be the greeting and ending activities of a program. If these remain constant, the child will learn to identify the library as a place of constancy, safety, and familiarity.

## Start with Same Rhyme and End with Same Rhyme

Each week, start with the same rhyme and end with the same rhyme. This will give the children a reassuring structure. They will recognize when the program is beginning and when it is over, and will recognize it within the defining rhymes. Each of the storytelling sessions will be connected in the child's brain because of the structural repetition. By the end of the series, participating children will know all of the words to the rhyme (or both rhymes if you use a different one for starting and stopping) and will most likely have that rhyme ingrained in their long-term memory.

## Use Variety in Programs and Provide Positive Reinforcement.

It has been proven that there are many different learning styles. Instead of just visual and auditory learning, include kinesthetic activities. Children will remember better if they use actions with real objects; they can remember better if they are physically involved. Memory increases if a topic is something that is personal or relevant to them and provides some type of good feeling. In Enoch Pratt Free Library's award-winning Mother Goose on the Loose program for babies and toddlers, children are asked to do something physical, such as throw a pig puppet up in the air, tap on a tambourine, or pull Humpty Dumpty off of his wall on the flannel board. Parents are asked to applaud when the child does any of the above activities, thus providing immediate positive reinforcement. Babies as young as two-and-a-half months old who are brought up to the flannel board with their caregiver reach out their hands to pull Humpty off of his wall. They connect the visual object with the physical motion each time. They look forward to the ritual and enjoy repeated recognition for a job well done.

Librarians can see responses even in very young babies when positive reinforcement is present. By creating this environment of positive feedback through rituals and repetition, librarians are also modeling nurturing behavior patterns for parents.

## Movement and literary experiences

Carla Hannaford documents the research of many experts on the benefits of incorporating movement into all learning experiences.<sup>9</sup> From the start, babies explore the world by moving. Eyes follow objects and faces and voices. Babies move their eyes to follow the movements of their hands and feet. They explore space, balance, and the effects of gravity by moving. Through movement, they constantly develop more and more control of their bodies in space and in relationship to still and moving objects in their environment. The tongue and mouth move to speak, hands and arms move coordinated with the eyes to draw and write, the entire body moves while telling the story of an incident that has been personally experienced. Older children are very active, constantly moving to explore the world around them. However, school-age children are often restricted as they work and study. This is contrary to research suggestions that movement is a necessary component of all learning.<sup>10</sup>

Movement is an important way of cementing knowledge in the brain. At the Learning and the Brain Conference, Jeb Schenck cited research proving that movement creates physiological changes in attention; in one study, 45 percent of material was retained when learned by listening, 43 percent by imagining, and 65 percent after performing.<sup>11</sup> When a concept or a song is learned, if movement accompanies it, it will more easily be absorbed and integrated into the brain. Schenck's studies have also shown that movement creating an accelerated heart rate appears to correlate with increased attention level.

Greater attention correlates with greater memory performance. For young children, acting out a story in a vigorous way will result in longer retention of the sounds, words, patterns, storyline, and



Caption?

story structure than simply listening to a book being read. For school-age children, movement focuses attention and integrates and anchors new experiences within the memory. Movement reduces stress by removing chemical blocks to learning. Coordinated, balanced movements create a sense of pleasure activating the limbic system and creating an emotional tone in which memory works more efficiently. Movement also wakes up the senses increasing sensory information received by the brain.

The lymph system, blood, and liquids are constantly in action inside the human body. Neuropsychologist James Prescott conducted studies at the National Institute of Child Health and Human Development proving that certain kinds of brain stimulation lead to an increase of dendritic connections and other types of brain growth, while the lack of movement leads to actual physiological deterioration of brain neurons.<sup>12</sup> In addition, movement increases levels of serotonin, which is a neurotransmitter that gives people a sense of well-being.

Moving the body activates the brain by increasing oxygen flow to brain cells. It affects the flow of spinal fluid to the brain and stimulates the production of neurotrophins which stimulate the growth of nerve cells and neural connections. Until recently, it was believed that brain cells could not regenerate, and the older one got, the less one could learn and retain.

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*Mary, mother of Kennedy*

However, recent studies have shown that aerobic exercise helps brain cells to regenerate. When people exercise and move, they make more of a demand on their bodies and the brain responds by making more pathways. The brain can actually regenerate neurons but only in the hippocampus, the sensing part of the brain that takes in information.

John Rady states that angiogenesis, the growth of new capillaries from pre-existing vessels, is a natural consequence of heightened physical activity and the associated increase in neural activity, and can be induced by exposure to a complex environment and/or aerobic exercise.<sup>13</sup> In a fascinating slide show at the Learning and the Brain Conference, viewers were shown brain cells filled with fluorescent dye. One hour after aerobic exercise, the same brain cells were shown again. This time, they were sprouting new dendritic spines to connect to neighboring nerve cells! These slides clearly proved that exercise promotes structural changes leading to regeneration of brain cells.

Since exercise increases blood flow to the heart and brain, some type of movement should always be included in programming for children. This can include whole body activities such as “Head, Shoulders, Knees, and Toes,” or smaller movements such as finger plays like “Two Little Monkeys Jumping on the Bed.” Programs for older children could include poems or songs in sign language, with motions or

even stretches. The more natural, joyful movement incorporated into library programming for children, the more learning will take place, whether it is learning to enjoy a story, remember a poem, or creating memories of the library as a wonderful part of life.

## Brain Gym

Brain Gym is a series of simple and enjoyable movements that can enhance children’s experiences of whole-brain learning. Developed by Paul E. Dennison and Gail E. Dennison, founders of Edu-Kinesthetics in Ventura, California, the activities can easily be incorporated as stretches in programs or post-program activities. These simple exercises actually stimulate certain portions of the brain, thus making learning easier. They empower learners of any age by using movement activities to draw out hidden potential and make it readily available. For example, one exercise is called “Foot Flex.”<sup>14</sup> It involves grasping the ankle, calf, and under the knee one at a time while slowly pointing and flexing the foot. It helps to restore the natural length of tendons in the feet and lower legs. It also activates the brain in the areas of expressive speech and language skills.

This particular exercise is related to brain function due to a connection between the calf muscles and the brain. Before beginning, the calf muscles are usually very tight. After performing this exercise, accumulated tension in the calf muscles and tendons is released. There is a direct correlation between the relaxation of those tendons and an increase in the ability to pay attention, listen, learn, and respond orally. This correlation was discovered when Dennison was working with speech-delayed hyperactive children. One result was that children who had not formerly been comfortable with speech began to talk!

Librarians could incorporate this activity into programs, explaining its value and purpose to school-age children. Perhaps they could then be encouraged to use this exercise in school before taking an English exam. Or, the exercise could simply be performed before a nonfiction-type program to help children be better

listeners and to enable them to better retain facts.

## Mother Goose on the Loose

In Baltimore, there are more than 46,000 children under the age of four.<sup>15</sup> More than 60 percent of children have mothers in the work force.<sup>16</sup> Almost 15 percent of Baltimore City children live in poverty.<sup>17</sup> In addition, fewer than 20 percent of children in third grade read at grade level or better. In 1998, the Enoch Pratt Free Library joined the statewide effort to increase the number of children who enter school ready to learn by providing high quality programming that fostered emergent literacy skills in children under the age of two.<sup>18</sup>

Mother Goose on the Loose (MGOL) is an interactive nursery rhyme program for parents and their children from infancy to age three. Developmentally appropriate activities are incorporated into nursery rhymes with music, games, and puppets, encouraging emergent literacy.<sup>19</sup> Since 1999, this program has been addressing the pressing needs of Baltimore’s birth-to-four community weekly at the Enoch Pratt Free Library. In November 2002, Enoch Pratt Free Library’s Mother Goose on the Loose was recognized as an outstanding program with a comprehensive set of library goals relating to children’s services.<sup>20</sup>

The Mother Goose on the Loose program is book-based but is not a storytime. The program was created with the attention span of babies in mind; it provides activities that complement the recent findings in cognitive neuroscience. It evolved from a free-flowing library nursery rhyme program into a thirty-minute structured program based on the learning theories of the Canadian educator, Barbara Cass-Beggs. Cass-Beggs, a retired Canadian opera singer, had developed a program called “Your Baby/Child Needs Music” which used her “Listen, Like, Learn” method.

The main ideas behind “Listen, Like, Learn” for very young children is that first, children need to learn to listen. From listening, they become familiar with the works of music. And once the



The authors (l-r) Regina Wade, Ellen Riordan, and Betsy Diamant-Cohen with (l-r) Guava Duck, Mango Duck, and Papaya Duck. **QY: explain briefly who these characters are?**

music is something they recognize, they start to like it—as if it is an old friend. Once they like it, their minds are open to learn concepts related to the music such as high and low, fast and slow, tones, notes, and rhythms. In addition, Cass-Beggs felt that security and stability, curiosity, feelings and emotions, imitation, and variety were essential parts of her program. The environment of Listen, Like, Learn programs was one full of optimal learning conditions.

Betsy studied with Cass-Beggs in 1988. She integrated the “Listen, Like, Learn” theories into a babies and books program and chose “Mother Goose on the Loose” as the name.

Mother Goose on the Loose programs are now offered on a weekly basis throughout the library system, and training workshops have been held in library systems throughout the state of Maryland and in Texas.

### How It Works

In this thirty-minute program, the librarian leads parents to interact with their children through rhymes, songs, finger plays, movement, manipulation of common objects, music and musical instruments, puppets, and colored scarves.

There is a structure to follow, but within the structure there is room for variation and creativity. All MGOL leaders contribute their own unique talents and personality. For example, the same program can vary widely with successful results if the leader is energetic or moves at a slow pace. Each week, 80 percent of the program’s content is repeated, giving very young children the sense of stability that comes from knowing what to expect. The 20 percent of new activities introduced each week keeps the program fresh and exciting.

Parents sit in a semi-circle around the flannel board with their children on their lap. The librarian announces that children this age are not expected to sit perfectly still, giving them permission to make noise, get up, or wander around as long as they do not block the flannel board or remove props. Parents are asked to remove children from the program if they are disruptive but are encouraged to bring them back whenever they are ready to try again, even if it is in the middle of the session. This creates an atmosphere of warmth and acceptance, letting parents know that they and their children are truly welcome in the library, and that the librarians understand that babies cannot conform to specific rules of behavior. This introduction is very important to at-risk

parents, who may not realize that their babies are not in control of how and when they cry.

The programs begin with librarians, parents, and children reciting the same rhymes and are then divided into six five-minute sections. The first involves reading picture books and/or singing songs. The next engages in “body activities” where children learn through interactive songs about the parts of the body. The third section is devoted to “stand up actions” including songs and dances that teach about syllables. Then, children learn about different animals through illustrations, songs, or puppets. It includes matching animal sounds to book illustrations, puppets, and flannel board characters. At the end of this segment, each child has a chance to throw a pig up into the air. This provides the synthesis between movement, knowledge, sound, and written word. Finally, nursery rhymes that allow children to physically interact are recited such as “Jack be Nimble,” where children take turns jumping over the candlestick. In the last activity, children are invited to come up to the flannel board and pull Humpty Dumpty off of his wall. After participation in this activity, each child is rewarded with applause. Then, two ending songs are sung.

### Expanding Mother Goose on the Loose

In March 2001, due to parent requests, a program called “Terrific Twos” was cre-

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ated for children between the ages of two and three. The program expanded on the basic skills and format of Mother Goose on the Loose, using more complicated activities and advanced vocabulary.

Since May 1 is traditionally known as Mother Goose Day, the Enoch Pratt Free Library held a Mother Goose Week from

April 27–May 3, 2002. Throughout the system, twenty-one branches held Mother Goose-related activities, including a Mother Goose Weekend at the Baltimore Children’s Museum with live sheep, a write-your-own-nursery-rhyme contest, and candlestick jumping. Four thousand one hundred and forty-five people participated in the programs sponsored by the

Exploration Center there.

In January 2003, the Enoch Pratt Free Library began offering parent-training sessions once every two months, run concurrently with Mother Goose on the Loose programs. While one parent is in one of the programming rooms participating in the nursery rhyme program, the

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other parent is across the hall with Regina and Betsy, learning about recent findings in baby brain research and how they can be translated into activities in the home. These sessions have included "Transition Magician" and "Brain Gym."

## Community Building

All public library programs provide a place where people from different economic, social, racial, religious, and educational backgrounds can come together. Children's programs for infants bring together the children as well as the parents. By bringing together people from different backgrounds and creating a community through library programs, the public library helps to create a healthy, safe, diverse, and friendly world. One father who often comes to Mother Goose on the Loose commented, "Where else can adults go to sing together?"

## Group Activities

Studies tell us that the brain is very social; offering group programs such as storytime in the public library makes sense. Children learn more if they interact with each other and with the librarian than by looking at a book by themselves, by watching television, or by reading books online from digital libraries. Older children need opportunities for learning together too. In one study on brain development and memory, different groups of fourth-grade students were asked to look at pictures that were not relevant to them. Some of the students did this individually, and some had a forced one-minute discussion about the pictures. There was a big difference in memory retentions. In the group that had the one-minute discussion, 20 percent of memory was retained after three months, and only 13.4 percent of the memory was retained in the group with no discussion after the same period of time.<sup>21</sup>

In 1995, Enoch Pratt Free Library developed a computer literacy service for children called Kids Corner. These PC workstations were preloaded with age-appropriate educational software for children from age two to ten. The workstations are equipped with a "buddy chair" to encourage children to explore

the software together and with their caregivers. The group experience of participating in programs such as Mother Goose on the Loose and Terrific Twos provides an added benefit in brain development. The social aspect of the group experience provides a solid argument for the continued existence of public libraries and library programs for all ages, even in the wake of digital libraries and easily accessible online information.

## Challenges Ahead

Ann Richardson rightly cautions educators that brain research is not a cure for the challenges of public education that have plagued our country.<sup>22</sup> The failings of public education that have spilled into our public libraries, such as lower reading levels of children, poor understanding of basic literacy concepts, lack of parental involvement, and underfunding, will not be cured by this new attention to an emerging science. Brain research is a complex scientific discipline and scientists are debating the implications of their findings in terms of comparing laboratory results with classroom and real life situations. In the same way that brain research will not cure public education's ills, brain research will not make up for poor library administrative support, lack of funding, or lack of qualified children's librarians.

There is also a disconnect between public policy and recent findings in cognitive neuroscience. Legislation such as No Child Left Behind focuses on the use of yearly standardized tests to measure how much students learn. Yet brain research suggests that the learning process is too complex and varied to be accurately measured for all children by a standardized test. Cognitive neuroscience makes the case for careful evaluation of school environment, teacher training, and the inclusion of art and music as an important piece of the curriculum and not a secondary frill.

Despite the fact that we are living in a technological age when children often find information online that does not require personal interaction with a librarian, ongoing scientific research illustrates that personal connections in a stress-free

environment are essential to learning. Library programs with group interaction, repetition, and ritual are of critical importance to the learning process. Children's librarians must continue doing more of what they have always done. In addition, educators, neuroscientists, public policy administrators, and librarians need to collaborate to increase opportunities for free-choice learning in their communities. In the meantime, libraries can use well-documented tenets of cognitive neuroscience to improve and create optimal learning environments in their branches and their programming to facilitate the brain potential of the children they serve. ☺

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## References and Notes

1. Through the work of the Maryland State Department of Education, Division of Library Development and Services, and Maryland Libraries Birth to Four Task Force headed by Kathleen Reif.
2. In early 2003, Stephanie Shauck from Maryland's State Department of



*At the Learning and the Brain Conference VII, the authors attended the following sessions:*

Welcome Address by Kenneth S. Kosik, M.D., Professor of Neurology and Neuroscience, Director, Kosik Laboratory of Cellular Neurobiology, Harvard Medical School

A Sense of Self in Children, Thomas Cottle, Ph.D.

Brain/Body Connection: Creating Enriched Learning Environments, Susan Frey, Ph.D., ND, R.N., LMT

Connecting Mind and Music to Enhance Learning, Todd Machover, Ph.D.

Creating Optimal Learners, Gessner Geyer, M.A., Ed. M.

Emotional Experiences and Emotional Intelligence, Lisa Barrett, Ph.D.

How Art Affects the Brain, Margaret Livingstone, Ph.D.

How Memory Works and Ways to Improve It, Philip De Fina, Ph.D., ABPdN, ABSNP

How Mental Images Can Change Child Behavior, Robert Greenleaf, Ed.D.

How Surprise/Uncertainty Shape Emotion and Behavior, Jerome Kagan, Ph.D.

Introduction to Brain Anatomy, Jean Williams, RN., M.A.

MBMI Relaxation Response: How Stress Reduction Can Improve Memory, Performance and Behavior, Herbert Benson, M.D., and Marilyn Wilcher, Sr. VP, MBMI

Movement and Decision-Making in Memory, Jeb Schenck, Ph.D.

Neurology of Learning: Practical Classroom Applications of Cortical (Brain) Timing, Neal Alpiner, M.D.

Styles, Brain Research and Multiple Intelligence, Harvey Silver, Ed.D.

The Value of Arts in Education, Jessica H. David, Ed.D.

Using Brain Research to Leave No Child Behind, Gerald N. Tirozzi, Ph.D.

Using Exercise, Movement and the Arts in the Classroom, Roberts Pasternack, Ed. M

Why Exercise and Movement are Critical to Learning, John Ratey, M.D.

9. Hannaford, *Smart Moves*.
10. Gerald Tirozzi, "Using Brain Research to Leave No Child Behind." Learning and the Brain Conference, [location?], 2003.
11. Jeb Schenck, "Movement and Decision Making in Memory." Learning and the Brain Conference, [locaton?], 2003.
12. Michael Hutchison, *Megabrain: New Tools and Techniques for Brain Growth* (New York: Ballantine, 1987).
13. John Ratey, "Why Exercise and Movement Are Critical to Learning." Learning and the Brain Conference, [location?], 2003.
14. Paul E. Dennison and Gail E. Dennison, *Brain Gym: Simple Activities for Whole Brain Learning* (City??: Publisher??, 1992), page reference?What page is foot flex on?
15. Advocates for Children and Youth, *Maryland 2001 Kids Count Fact Book* (Baltimore, Md.: Advocates for Children and Youth, 2000), 43.
16. Ibid.
17. Advocates for Children and Youth, *Maryland 2001 Kids Count Fact Sheet*, www.kidscount@acy.org. QY: does not seem to be a correct URL. Last accessed May 22, 2003.
18. Led by Kathleen Reif and the Maryland Association of Public Library Administrators (MAPLA) Birth to Four Task Force.
19. Note: The term "parents" in this article refers to caregivers, grandparents, and guardians.
20. The Enoch Pratt Free Library received the second annual Godfrey Award for Excellence in Public Library Services for Families and Children. Created and funded by PROVIDENCE Associates Inc, Library Consultants and Planners, the award was administered by School of Library and Information Studies, Texas Woman's University.
21. Jeb Schenck, "The Role of Movement and Decision Making in Creating Memory." Learning and the Brain Conference, [location?], 2003.
22. Ann Richardson, "Building a Bridge: Finding a Firm Footing for Brain-Based Learning," *The Reporter* (spring 1999): 12.

Education, Division of Library Development and Services, sent an e-mail on the Maryland library youth coordinators listserv apprising them of an upcoming conference called "Learning and the Brain: Using Brain Research to Leave No Child Behind.™" The administration of the Enoch Pratt Free Library saw the potential value in this conference and supported conference attendance by the three authors of this article.

3. Virginia Walter, *Children and Libraries: Getting It Right* (Chicago, ALA, 2001) 3.
4. Carla Hannaford, *Smart Moves* (Arlington, Va.: Great Ocean Pub.,

1995).

5. Susan Frey, "Brain/Body Connection: Creating Enriched Learning Environment" Learning and the Brain Conference, [location?], 2003.
6. Vernon H. Mark and Jeffrey P. Mark, *Brain Power: A Neurosurgeon's Complete Program to Maintain and Enhance Brain Fitness Throughout Your Life* (Boston: Houghton, 1990).
7. Jerome Kagan, "How Surprise/Uncertainty Shape Emotion and Behavior." Learning and the Brain Conference, [location?], 2003.
8. Webster's Third International Dictionary. [complete citation, please]