

# New Brain Development Research— A Wonderful Window of Opportunity to Build Public Support for Early Childhood Education!

Julee J. Newberger

**M**ore than 20 years of brain development research is finally making news. Articles have appeared recently in *Time* (see Nash 1997), *Working Mother* (see Jabs 1996), *The Chicago Tribune*, *Newsweek* (see Begley 1996), and *The Washington Post*. A special edition of *Newsweek* focusing on learning in the early years is on the newsstands this spring in conjunction with the April 28, ABC-TV special "I Am Your Child." Receiving unprecedented attention, they kick off a massive three-year campaign to engage the public. What is the significance of this new research on the brain, and what does it mean for early childhood professionals?

New brain-imaging technologies have enabled scientists to investigate how the brain develops and works. Stimulated in part by growing concern about the overall well-being of children in America, the findings affirm what many parents and caregivers have known for years: (1) good prenatal care, (2) warm and loving attachments between young children and adults, and (3) positive, age-appropriate stimulation from the time of birth really do make a difference in children's development for a lifetime.

In addition to giving us a glimpse of the complex activity that occurs in the brain during infancy, the new research tools have stimulated dialogue between scientists and educators. In June 1996 Families and Work Institute sponsored a conference, "Brain Development in Young Children: New Frontiers for Research, Policy, and Practice," at the University of Chicago (see Families and Work Institute 1996). Convening professionals from the media, human services, business, and public policy, the conference explored how knowledge about the brain can inform our efforts to make better beginnings for

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*Julee J. Newberger, M.F.A., is a communications specialist in the NAEYC public affairs division. She is the primary author of "Early Years Are Learning Years" news releases.*

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children and families. One month later, a workshop sponsored by the Education Commission of the States and the Charles A. Dana Foundation brought together 74 neuroscientists, cognitive psychologists, and education researchers and practitioners to foster communication and bridge a "historical communications gap" (ECS 1996). Similar events have followed, such as President Clinton's White House Conference on Early Childhood Development and Learning on April 17, 1997.

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## What we know about how children learn

Although the scientists of all varieties who have been researching biology-versus-environment issues for much of this century have long agreed that both are enormously important influences on growth and development, only about 20 years ago neuroscientists believed that the genes we are born with determine the structure of our brains. They held that this fixed structure determines the way we develop and interact with the world. But recent brain research, enabled by new technologies, disproves this notion. Heredity may determine the basic number of neurons (brain cells) children are born with, and their initial arrangement, but this is merely a framework. A child's environment has enormous impact on how the circuits of the brain will be laid. Nature and nurture together—not nature or nurture alone—determine the outcome of our lives.

Beginning even before birth, the kind of nourishment and care a child receives affects not only the "wiring" of her brain but also the qualities of her experiences beyond the first few years of life. Many parents and caregivers have understood intuitively that warm, everyday interaction—cuddling infants closely or singing to toddlers—actually helps prepare children for learning throughout life. More and more we begin to understand the biological reasons behind this.

When a child is born, the brain produces trillions more neurons and synapses (connections between the brain cells) than she will ultimately need. Positive interactions with caring adults stimulate a child's brain profoundly, causing synapses to grow and existing connections to be strengthened. Those synapses in a child's brain that are used tend to be-



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come permanent fixtures; those that are not used tend to be eliminated. If a child receives little stimulation early on, synapses will not sprout or develop, and the brain will make fewer connections. Therefore, a child's experiences during the first few days, months, and years may be more decisive than scientists once believed.

We now know that during the early years the brain has the greatest capacity for change. Neural plasticity, the brain's ability to adapt with experience, confirms that early stimulation sets the stage for how children will continue to learn and interact with others throughout life.

### **Neural plasticity: The brain's ability to adapt**

Particularly during the first three years of life, brain connections develop quickly in response to outside stimulation. A child's experiences—good or

bad—influence the wiring of his brain and the connections in his nervous system. Thus, when we snuggle a baby or talk to him in a singsong, undulating rhythm, we are contributing to the growth of his brain. How do we know this?

Recent research examining one of the body's "stress-sensitive" systems demonstrates how outside experiences shape a child's developing brain (Gunnar et al. 1996). One stress-sensitive system in particular is activated when children are faced with physical or emotional trauma. Activation of this system produces a steroid hormone called *cortisol*. High levels of cortisol cause the death of brain cells and a reduction in connections between the cells in certain areas of the brain. Research in adults who have experienced chronic or intense activation of the system that produces cortisol shows shrinkage

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of a certain brain region that is important in learning and memory. Clearly, a link exists between physical or emotional trauma and long-term impairments to learning and development.

But nature has provided a way of buffering the negative effects of these stress systems in the brain: strong attachments between children and their parents or caregivers. Studies measuring the levels of cortisol in children's saliva showed that those who received warm and responsive care were able to turn off this stress-sensitive response more quickly and efficiently. Babies with strong emotional bonds to their caregivers showed consistently lower levels of cortisol in their brains.

While positive, nurturing experiences can help brighten a child's future, negative experiences can do the opposite. Children who are emotionally neglected or abandoned early in life not only are more likely to have difficulty in learning but also may have more trouble experiencing empathy, attachment, and emotional expression in general. An excess of cortisol in the brain is linked to impaired cognitive ability and difficulty in responding appropriately or productively in stressful situations. Healthy relationships during the early years help children create a framework for interactions with others throughout life.

### **Windows of opportunity**

Studies have increased our understanding of "windows of opportunity" or critical periods in children's lives when specific types of learning take place. For instance, scientists have determined that the neurons for vision begin sending messages back and forth rapidly at two to four months of age, peaking in intensity at eight months. It is no coincidence that babies begin to take notice of the world during this period. A well-known experiment conducted in the 1970s prompted research on the window of opportunity in development of vision in children. The original study demonstrated that sewing shut

one eye of a newborn kitten caused the kitten's brain to be "rewired." Because no synapses were created in the brain to allow the kitten to see with the eye that had been closed, the kitten was blind in that eye even after scientists reopened it. The results could not be repeated in adult cats, whose brains were already wired for sight in both eyes. We now know that by the age of two these synapses in the human brain have matured as well. The window of opportunity for vision has already closed.

Scientists believe that language is acquired most easily during the first decade of life. Infants under six months respond with equal interest to the sounds of all languages, but they soon develop "perceptual maps" that direct them toward the sounds of the language they hear most frequently and away from the sounds of other languages. They start by forming connections for specific vowel sounds they hear repeatedly. The circuits in children's brains then become wired for those sounds that are significant in their own language, diminishing their ability to discern sounds that are not. As a result, the brains of babies in Japan, for example, begin to develop differently than those of babies in the United States. These perceptual maps eventually account for regional accents—and the increasing difficulty in acquiring new languages as we grow older.

Studies well-known to early childhood educators make one thing clear: Talking to an infant increases the number of words she will recognize and eventually come to understand. She also will learn better when spoken to in brief phrases, preferably in singsong tones. Researchers report that infants whose parents and caregivers frequently speak to them recognize far more words later on than do infants whose parents are less vocal or less engaged. An infant's repeated exposure to words clearly helps her brain build neural circuitry that will enable her to learn more words later on. For infants, individual attention and responsive, sensitive care-giving are critical for later language and intellectual development.



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Many reports on brain research point to the implications for the introduction of second-language learning during the early years (ECS 1996). We now know that if children are to learn to speak a second language like a native, they should be introduced to the language by age ten. Mastering an additional language is still possible after this point, but the window of opportunity for easy acquisition is gone.

Research does not suggest drilling children in alphabet songs from different languages or using flash cards to promote rote memorization of letters and numbers. Rather, it reinforces the principles of developmentally appropriate practice. Children learn any language best in the context of meaningful, day-to-day interactions with adults or other children who speak the language.

More windows of opportunity in children's learning may exist. Studies show that the most effective time to begin music lessons, for instance, is between the ages of three and ten. Few professional musicians began later in life. Music also seems to be linked to spatial orientation, so providing a child with the opportunity to play an instrument and using basic music education to spark her interest may do more than help her become musically inclined. With such knowledge, scientists and educators can work together to create the best plans for developing the whole child during the early years of life.

### ***Implications for early care and education programs***

Now that scientific research has reinforced what many already knew about early childhood education, what impact will this knowledge have on programs and centers across the country? We know that enriched home and school environments can help make the most of children's mental capacities. We also know that when we bring an understanding of child development to our interactions with children, we can meet their developmental needs more than just adequately. Parents and the general pub-

lic, having children's best interests in mind, may raise issues about early education practices. Here are some questions that are likely to arise.

#### **1. Should new parents put off employment and stay at home?**

The relationship between secure attachment and healthy brain development makes this a reasonable question, although working parents should not be blamed for any and every developmental obstacle their children encounter. At a time when 55% of women provide about half or more of their families' income, decisions as to whether parents should put off employment remain a personal, family matter (Families and Work Institute 1996). Research shows that the best scenario for children and families if child care is used involves high-quality parenting and access to high-quality, affordable child care and early education that enhances—not disrupts—attachments between parents and children. Flexible workplace policies can help accommodate and support modern family life.

#### **2. Is it too late for children to develop cognitive skills after the early years?**

While scientists have found that the early years may be even more important than anticipated, human development continues throughout the life span. It may not be as easy to acquire a second language at the age of fifty, but learning new skills is always possible. A meaningful context and the desire to develop new skills make learning more likely at any age.

The significance of this new research, according to Harry Chugani (1997) of Wayne State University, is for all of us to "be aware and take advantage of these critical periods nature has provided us with." Chugani says, "We must create innovations to make learning fun." Parents and educators should focus on ways to take advantage of windows of opportunity that remain open.

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**3. To take advantage of the early years of learning, should I invest more in toys and new products for my child?**

New developments in research may prompt manufacturers to market products that claim to make the most of children's learning potential. Remember that scientific evidence does not change the fundamental principles of developmentally appropriate practice. In fact, research supports the theory that learning must take place in a meaningful context and in an environment of love and support. A developing brain doesn't know the difference between an inexpensive set of measuring cups and a pricey set of stackables purchased at a toy store.

The key to fostering early childhood learning is understanding that there will be a range in the amount of stimulation children are comfortable with and can tolerate. Before children can move on to new skills, they must have time to practice and master those they have already learned. Parents or caregivers who push children too fast or too hard can do as much damage as those who do not challenge children at all. Chugani recommends, "Be rigorous, but be aware of early signs of overload" (1997). Continue to respect the child as a human being and use common sense in determining when he enjoys what he is learning and when he is resistant.

***Bridging the gaps***

The ECS workshop on neuroscience and education outlined the following conflicts between research and current education practice (ECS 1996):

- While we know that development of children's capacity to learn is crucial in the first few years of life, children during these years receive the least attention from the educational world.
- Interactive environments enhance development, but many children are in child care programs today with staff who are underpaid, lack training in early childhood and brain development, and may be responsible for too many children.

- Although some adverse effects can be reversed or prevented for much less than it costs to provide special services later on, our educational system waits for children to fall behind, then places them in special education programs at high costs to states.

In light of this research, shouldn't parents have more options to stay home with children during the years in which this critical learning takes place? Parental leave policies must be put on the table for discussion. And what about new welfare reform policies that push single mothers into the workforce without guaranteeing high-quality child care to promote children's optimum development and learning? The concerns raised and the dialogue generated at this workshop and other conferences may be timely in preventing more children from growing up without the benefit of the kind of education that early childhood professionals, utilizing years of research and practice, can provide.

***Where we go from here***

The Families and Work Institute conference on brain development offered the following recommendations for parents, caregivers, policymakers, and the public to institute policies and practices that improve the day-to-day experiences of all young children and families.

**First, do no harm.**

- Allow parents to fulfill their all-important role in providing and arranging sensitive, predictable care for their children.

**Parents or caregivers who push children too fast or too hard can do as much damage as those who do not challenge children at all.**

- Work to reform policies that prevent parents from forming strong, secure attachments with their infants in the first months of life.
- Mount intensive efforts to improve the quality of child care and early education so that families can be sure their young children's learning and emotional development are being fostered while parents are at work.

**Prevention is best, but when a child needs help, intervene quickly and intensively.**

- Ensure consistent and responsive care to help cushion children against the stresses of everyday life.
- Provide timely, intensive, sustained assistance to help children recover from serious trauma or overcome developmental problems.

**Promote healthy development and learning for every child.**

- Be aware that missed opportunities to promote healthy development may result later on in more expensive and less effective attempts at remediation.
- Support ongoing efforts to enhance the cognitive, emotional, and social development of children and adults in every phase of the life cycle.

**Improve health and protection by providing health care coverage for expectant and new parents and their young children.**

- Medical care, including preventive health screening, well-baby care, timely immunization, and attention to children's emotional and physical development, is cost-effective and provides a foundation for lifetime development.

**Promote responsible parenthood by expanding proven approaches.**

- Identify parent education and family support programs that promote the healthy development of children, improve the well-being of parents, and are cost-effective.

**Safeguard children in early care and education from harm and promote their learning and development.**

- Ensure that children will learn and thrive by improving the quality of early childhood programs and centers.

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**Enable communities to have the flexibility and resources they need to mobilize on behalf of young children and their families.**

- Bring together leaders from business, media, community organizations, and religious institutions to develop goals and strategies for achieving the kind of community that supports all children and families.

Increased public awareness prompted by news-breaking reports on brain research may represent a window of opportunity in the early childhood field. With plans to make further links between science and education, early childhood professionals and advocates may find increased support for our cause—public understanding and support for child care that guarantees proper nutrition, well-planned physical environments, and developmentally appropriate practices to ensure the most promising future for all young children and families. The window of opportunity is open and the time for action is now.

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