

Research at the BNCD: The Actifier

By Karen Henry, Life Span Institute

Babies who are born prematurely are often in grave danger. They may not be able to suck, swallow or breathe on their own. Some "preemies" suffer strokes or hemorrhage during or shortly after birth. Many more have subtle brain injuries that affect the development of intelligence and speech.

But a new high-tech pacifier being developed by the University of Kansas to train babies to suck at the right time, in the right way, may allow them to feed, thrive and leave intensive care units earlier. The pacifier also may reduce the incidence or severity of certain developmental disabilities that appear in early childhood and beyond as well as possibly boost IQ.

The Actifier, invented by Steven Barlow, KU professor of speech-language-hearing, and Donald Finan of the University of Colorado, becomes an active diagnostic and treatment device once it is plugged into a rolling crib-side laboratory. KU has

applied for a patent on the device.

Barlow and his colleagues will be testing it on 390 infants in neonatal intensive care units at Stormont-Vail Regional Health Center in Topeka and the KU Medical Center in Kansas City, Kan. The study will continue for three years. A \$2 million National Institutes of Health grant supports basic research and clinical trials of the Actifier to diagnose and correct infants' sucking problems and to explore underlying nerve and brain processes.



Infant using the Actifier

For Barlow, director of the Communi-

About this Newsletter:

The BNCD newsletter is designed to keep you informed about the ongoing research projects that are being conducted by BNCD researchers at the University of Kansas. Participants who have been part of recent research projects done by BNCD researchers will receive this newsletter from time to time to keep them up to date about the research activities at the BNCD. You are receiving this newsletter because your child participated in a research study which was conducted by a researcher at the University of Kansas who is affiliated with the BNCD, or you expressed interest in participating in future research. Research at the BNCD is supported in part by grant number 5 P30 DC05803 from the National Institutes of Health (NIH) at the University of Kansas.

cation Neuroscience Laboratories at KU, the Actifier is the culmination of more than 15 years of collaboration with physicians, engineers and physiologists to produce a technology that would both measure and treat threats to infants' brain development.

"A baby's ability to suck is about more than getting nourishment," Barlow said. "This motor behavior generates sensory flow that nurtures the brain to form and strengthen nerve connections and path-

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KU Team Shows Nutritional Compound in Mothers Linked to Infant Development

By Karen Henry, Life Span Institute

Infants whose mothers have higher levels of an essential omega-3 fatty acid show more advanced cognitive development, researchers at the University of Kansas have found.

Docosahexaenoic acid (DHA), which affects brain and eye development, is derived by fetuses from their mothers and accumulates in the brain primarily

in the third trimester. DHA levels appear to be affected by diet, and the DHA intake of U.S. adults, including pregnant women, is very low compared to most cultures in the world, points out Susan Carlson, professor of nutrition at the KU Medical Center in Kansas City, Kan.

"Although there is individual variability within a culture, we know from worldwide studies of breast milk that women

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ways."

Sucking is a "sensorimotor" skill that normally begins in the womb and is an important stimulus for babies' developing brains. "When babies come too early, we have to figure out ways to augment and supplement those stimulation patterns," Barlow said. Furthermore, Barlow and others believe that early problems with sensorimotor skills like sucking may influence later brain development, including speech.

From the baby's perspective, the Actifier is just a pacifier to latch onto for a few minutes before feeding time. But behind a comforting silicone nipple is an array of specially designed computer-controlled sensors and motors that stimulate and record neuromuscular responses while the baby sucks. A gently pulsing motor stimulates nerve endings in the soft tissues of the baby's lip that transmit signals to circuits in the brain that coordinate and time muscle contractions.

The Actifier returns information to

researchers on how well the brain stem circuits and other parts of the brain are connected. It tells doctors and nurses how the baby is responding when it is sucking, including the organization of its motor system, suck pressure and frequency, and muscle reflexes—all in real time on the device's display panel.

The Actifier becomes a rehabilitative device when it gives the baby model suck patterns to imitate through the movement of the nipple. "We can begin therapy with the Actifier as early as two and half months pre-term while neural pathways are migrating and forming connections," Barlow said.

He and other neuroscientists believe that by reinforcing such model patterns of nerve activation, new connections in the developing brain are strengthened.

Barlow said physicians are particularly excited about the Actifier's potential to help two groups of babies in the study: those with respiratory distress syndrome (RDS) and those who have vascular strokes, or intraventricular hemorrhage (IVH).

Babies with RDS need to learn to suck

after they get off ventilators or they may not thrive and develop as expected. Doctors need better functional measures of IVH in babies as well as a way to retrain stroke-damaged brains. By 2007, when the study concludes, Barlow hopes to have diagnostic and treatment guidelines for these babies and other preemies with feeding disorders. "The Actifier should help those babies be more proficient feeders and get their sensorimotor systems organized," he said.

The babies will continue to use the Actifier at regular intervals until their second birthdays. At that time, Barlow will turn them over to John Colombo, a KU professor of psychology who is an expert at testing the intelligence of very young children. If Barlow is right, these children will have higher IQs than their counterparts who were not treated with the Actifier.

Information for this article came from the Sept. 2004 online article *KU testing high-tech pacifier in KC, Topeka that may help preemies, boost IQ* published by the **Office of Univ. Relations**. To read the original text visit: <http://www.ur.ku.edu/News/04N/SeptNews/Sept15/barlow.html>. Karen Henry may be reached at ka-henry@ku.edu or (785) 864-0756.

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who live in countries whose diets are rich in fish and other marine sources such as Norway have much higher DHA levels in milk and probably have more DHA to transfer to the fetus than American women," she says.

Carlson; John Colombo, KU professor of psychology and associate director for cognitive neuroscience at the Life Span Institute at KU; and Kathleen Kannass, research associate at the Life Span Institute, measured the DHA levels of 70 mothers' blood when their infants were born. The researchers then followed the infants for the first two years of their lives, evaluating them on different tests of attention during the first and second years.

"The most striking thing we found was that infants from mothers who had high levels of DHA consistently showed more advanced forms of attention all the way out into the second year of life," Colombo said.

Previous studies of the effect of DHA-enhanced infant formula on infants' cognitive development were mixed, Colombo explained, because some studies showed that the effects of DHA were present at early ages but then disappeared at older ages.

In this study, toddlers were tested at 4 months, 6 months and 8 months on a simple type of visual attention, and although infants from high-DHA mothers were ahead at 4 months and 6 months, the differences disappeared at 8 months.

However, the same infants were tested again at 12 months and 18 months, when a different kind of attention, more closely related to attention span,



John Colombo,
BNCD Researcher

begins to develop and the advantage for the high-DHA group reappeared. The infants with high-DHA mothers were more engaged with complicated toys and less distractible during play.

Carlson and Colombo each have been previously involved in research on DHA. In 2002, their prior research efforts helped convince the Ross Products and Mead Johnson Nutritionals infant formula companies to add the compounds to their Similac and Enfamil brand formulas.

Colombo and Carlson hope to be able to increase DHA levels in pregnant mothers through dietary or nutritional supplements and then study the development of those mothers' infants.

The study was published in the July 2004 issue of the scientific journal *Child Development*.

This article was originally published online by the **Office of University Relations** in July of 2004. To read the original text visit: <http://www.ur.ku.edu/News/04N/JulyNews/July20/dha.html>. Karen Henry may be reached at ka-henry@ku.edu or (785) 864-0756.

KU Gets \$1.25 Million Grant to Help Children Who Are Deaf and Blind Communicate

By Karen Henry, Life Span Institute

Researchers at the University of Kansas Life Span Institute will adapt and test a communication strategy for children who have both deaf-blindness and cognitive disabilities with a \$1.25 million Department of Education grant.

"Children with deaf-blindness often have little or no communication -- no way to control their world," said Susan Bashinski, research assistant professor, who will co-direct the five-year study with Nancy Brady, associate research professor. An individual may be considered as having deaf-blindness even if he or she has some limited function in hearing and vision abilities that cannot be corrected to normal limits.

Deaf-blindness is rare, with only about 12,000 children and youths affected nationwide, and in Kansas, about 134. Children who have both deaf-blindness and cognitive disabilities are even more rare and are among those most in need of research-validated treatments, according to Bashinski.

Bashinski and Brady, along with Joan Houghton, project coordinator, compose the team of researchers who will adapt a communication strategy called Prelinguistic Milieu Training. PMT was developed to improve the communication of children with cognitive disabilities by Steven Warren, director of the Life Span Institute, and Paul Yoder, a professor at Vanderbilt University, beginning in the early 1990s.

PMT emulates what typically developing babies do -- such as grabbing, pointing and touching -- to begin the exchange with others that is the beginning of intentional communication, Brady explained. This stage in a child's development of nonsymbolic communication typically occurs before symbolic communication with pictures, letters or objects.

"Physical therapists would never try to teach a child how to walk if she or he hadn't sat up yet," Brady pointed out, "but speech clinicians often try to teach a child with deaf-blindness and cognitive disabilities to communicate using Braille or sign language even if they aren't gesturing."

In PMT, the adult follows the child's lead in an activity that a child enjoys, such as rocking on a toy horse, then looks for cues that the child wants to continue the activity, such as a rocking gesture, Brady explained. "Eventually the child may learn to request the activity by producing the gesture," she said.

The Brady-Bashinski study will adapt PMT for children who are deaf-blind by relying more on hand-under-hand support and touch and object cues. "We might give a child a card with a piece of rubber tread on it that she could use to ask for a ride in a tire swing, or a backpack strap could be used to signal that it was time to go home," Bashinski explained. "Such textural and object cues can be critically important communication elements for children with deaf-blindness."

Twenty-seven children, ages 3 to 7, will be recruited, beginning with 18 in northeast Kansas. The study will be replicated in the Wichita area with three children and with six children in Indiana through collaboration with Indiana State University. Although by most standards this is a small sample, it is large for a study of children with deaf-blindness, Brady said.

If the adapted PMT is effective, the researchers will disseminate the results to teachers and clinicians through conferences, technical assistance and publications. "Professionals may adopt PMT relatively quickly because of the urgent need for effective strate-

gies with children who have deaf-blindness and cognitive disabilities," Bashinski said.

The Life Span Institute is one of the largest research and development programs in the nation for the prevention and treatment of developmental disabilities, aging, and human and community development.

The institute is looking for children to participate in the initial, northeast Kansas area study. To qualify, the children must be 3 to 7 years of age, must not use speech or an augmentative communication system to interact with others, and must have both a vision and hearing loss.

Contact Nancy Brady at (785) 864-0762 or nbrady@ku.edu, or Susan Bashinski at (785) 864-2459 or sbashins@ku.edu. A TTY line is available at (785) 864-3434.

This article was originally published online by the **Office of University Relations** in December of 2003. To read the original text visit: <http://www.ur.ku.edu/News/03N/DecNews/Dec29/lsi.html>. Karen Henry may be reached at kahenry@ku.edu or (785) 864-0756



Nancy Brady,
BNCN Researcher

PARC News:

The Participant Recruitment and Management Core (PARC) welcomes a new member, Jill Shaddy! Jill will coordinate participant recruitment efforts for researchers' various studies in the BNCD.

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The American Library Association's Recommended Books for Children

12 -18 Months

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| ◆ <i>The Bear Went Over the Mountain.</i> Rosemary Wells, 1998 | ◆ <i>My First Action Rhymes.</i> Pics. by Lynne Cravath, 2000 |
| ◆ <i>Big Dog, Little Dog.</i> Dav Pilkey, 1997 | ◆ <i>Pat the Bunny.</i> Dorothy Kunhardt, 1942 |
| ◆ <i>Count with Maisy.</i> Lucy Cousins, 1997 | ◆ <i>Rabbit's Bedtime.</i> Nancy Elizabeth Wallace, 1999 |
| ◆ <i>Eating the Alphabet: Fruits and Vegetables from A to Z.</i> Lois Ehlert, 1989 | ◆ <i>Sheep in a Jeep.</i> Nancy Shaw, 1986 |
| ◆ <i>The Everything Book.</i> Denise Fleming, 2000 | ◆ <i>Ten, Nine, Eight.</i> Molly Garrett Bang, 1983 |
| ◆ <i>Five Little Monkeys Jumping on the Bed.</i> Eileen Christelow, 1989 | ◆ <i>Tom and Pippo Read a Story.</i> Helen Oxenbury, 1998 |
| ◆ <i>Freight Train.</i> Donald Crews, 1978 | ◆ <i>Where Is My Baby?</i> Harriet Ziefert & Simms Taback, 2002 |
| ◆ <i>Itsy Bitsy Spider.</i> Rosemary Wells, 1998 | ◆ <i>Where's Spot?</i> Eric Hill, 1980 |
| ◆ <i>Jamberry.</i> Bruce Degen, 1992 | ◆ <i>Zoom City.</i> Thatcher Hurd, 1998 |

18 Months - 3 Years

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| ◆ <i>Be Gentle!</i> Virginia Miller, 1999 | ◆ <i>Jesse Bear, What Will You Wear?</i> Nancy White Carlstrom, 1986 |
| ◆ <i>Book!</i> Kristine O'Connell George, 2001 | ◆ <i>Little White Duck.</i> Bernard Zaritsky & Walt Whippo, 2000 |
| ◆ <i>Chicka Chicka Boom Boom.</i> Bill Martin Jr. and John Archambault, 1989 | ◆ <i>Maisy's ABC.</i> Lucy Cousins, 1995 |
| ◆ <i>Color Zoo.</i> Lois Ehlert, 1989 | ◆ <i>Max's First Word.</i> Rosemary Wells, 1998 |
| ◆ <i>Come Along, Daisy!</i> Jane Simmons, 1998 | ◆ <i>Mouse Mess.</i> Linnea A. Riley, 1997 |
| ◆ <i>Construction Zone.</i> Tana Hoban, 1997 | ◆ <i>On Mother's Lap.</i> Ann Herbert Scott, 1992 |
| ◆ <i>Dinosaur Roar!</i> Paul & Henrietta Stickland, 1994 | ◆ <i>Silly Little Goose!</i> Nancy Tafuri, 2001 |
| ◆ <i>Dinosaurs, Dinosaurs.</i> Byron Barton, 1989. | ◆ <i>The Tale of Peter Rabbit.</i> Beatrix Potter, 1999 |
| ◆ <i>Hello, Lulu.</i> Caroline Uff, 1999 | ◆ <i>The Wheels on the Bus.</i> Raffi, 1998 |
| ◆ <i>How Do Dinosaurs Say Good Night?</i> Jane Yolen, 2000 | ◆ <i>You're Just What I Need.</i> Ruth Krauss, 1998 |