October 2012

NEWS YOU CAN USE

News for Head Start, Early Head Start, & Migrant/Seasonal Programs

INSIDE:

FOUNDATIONS OF SCHOOL READINESS SERIES: EARLY EXPERIENCES BUILD THE BRAIN

The content is also presented in "Hablemos de… cerebro y su relación con la preparación escolar."

"We now know that when brain architecture has a strong foundation in the early years, infants and toddlers are more likely to be robust learners throughout their lives."

Brain Development

Science has shown that the relationships with the important people in a baby's life literally shape and form the architecture of the infant's brain.[i] Deceptively simple, moment-to-moment interactions with responsive caregivers build the brain, creating or strengthening it one connection at a time. By the time children are two years old, the structures of their brain that will influence later learning are mostly formed.[ii] This means that the most important brain growth and development, the kind that will physically form the brain, begins long before a child ever picks up a pencil, reads a book, or goes to school.[iii]

We now know that when brain architecture has a strong foundation in the early years, infants and toddlers are more likely to be robust learners throughout their lives. In this *News You Can Use*, we explore how the connections within the brain are created and made strong, the negative effects of chronic stress at an early age, and how caring adults can help even in difficult situations.

Building Connections

Although the brain looks like a gray blob, it is, in fact, made up of billions of cells called **neurons** that make electrical connections with each other. Each new experience, each piece of information releases chemicals called **hormones** that create a new connection, or synapse, in the brain. More connections are formed in the brain prenatally and in the first few years of life than at any other time. After early childhood, the connections that are not used as frequently will be **pruned**, or removed, to allow for more useful connections to grow stronger. Sometimes this process is referred to as "use it or lose it," since the parts of your brain you use the most become stronger, while the parts you use less die off.

Two-month-old Elijah is crying. His father, Daniel, goes to him and says, "Ohh, what's going on, little one?" When Elijah sees his father's face and hears his voice, he immediately begins to calm down. At two months old, he already knows that when he cries, his father responds.

For newborns and young infants, most of their emotional experiences happen in moments of interaction with their caregivers. Newborn and caregiver interactions usually occur around activities such as comforting, feeding, and holding.[iv] As Elijah is calmed, hormones are released that help him be more alert and able to learn.[v] The synapses in the brain that respond to and expect caring behavior from others will grow strong. This allows Elijah to feel safe and fully able to learn about the many interesting things in the world. Repeated many times during Elijah's first years of life, moments like these build the neural connections that will support learning for the rest of his life.

Serve and Return

Two-month-old Amelia begins a "conversation" with her mother. She babbles, makes faces, gestures, and eventually cries when she has had enough. Her mother responds by echoing the sounds she makes, mirroring her facial expressions, and comforting her when she cries.

Thirteen-month-old Ethan brings his teacher a toy tiger. He hands her the tiger, and she says, "Thank you." Ethan then holds his hand out, and she gives the tiger back. He says, "Da du." They repeat this exchange half a dozen times before Ethan goes to find a new toy and they start again.

Thirty-month-old Miguel is playing in the backyard. When he reaches the crest of a small hill, he turns to his family child care provider and shouts, "Look at me!!" She looks at him and says, "You climbed to the top of the hill. Now what will you do?" He grins and says, "Roll!" After he rolls down the hill, he runs to her and touches her shoulder. She smiles at him, and he runs off again.

These vignettes illustrate typical interactions throughout the day of an infant or toddler. Each vignette provides an example of a common quality in relationships that is often repeated, called "**serve and return.**"[vi] Although the kind of exchanges that occur might differ depending on a child's age, each infant or toddler reaches out to a trusted adult, who then responds. The adult's response acknowledges the child's intention or need and also encourages further interactions. Amelia is only two months old, yet she is able to engage her mother's attention, bring out her mother's smile, and elicit comfort. Ethan is engaged in a give-and-take game with his teacher. Miguel is much more independent but still checks with his caregiver as a secure base. These serve-and-return interactions build and strengthen neural connections that support feelings of safety and of being an effective communicator. These strong connections build a foundation for all later learning.

Toxic Stress and the Brain

Jonah, a two-year-old who grew up in a chronically stressful environment, is playing with some blocks. Aiden comes over to join his play. As Aiden picks up a block, Jonah reacts impulsively by hitting and attempting to bite Aiden.

The strongest connections in Jonah's brain, those that warn him of danger, react first. He strikes Aiden to protect himself and his belongings.

When infants and toddlers are regularly ignored, frequently experience violence, or spend much of their time in highly stressful environments, they are considered to be exposed to **toxic stress**.[vii] While normal life stressors are not dangerous, and can even be healthy for a developing brain, toxic stress occurs when the body's response system to stress is activated much of the time. Our bodies produce a hormone called **cortisol** as part of the natural reaction to stress. In moderation, cortisol can contribute to a healthy brain structure. In extreme situations where a young child is feeling stressed much of the time, constant exposure to cortisol can alter the way the brain might otherwise develop. For example, a baby exposed to chronic stress is more likely to develop strong connections in the areas of her brain that are on alert for danger. Their brains may expect the world to be a dangerous place. When these babies are older, their brains interpret neutral events as more negative.[viii] When they become children and adults, their brains may spend more energy figuring out if they are in danger and have less attention for things their peers are focused on and learning.

The great news is that you can reduce the effects of toxic stress experienced by babies and young children. The loving, nurturing relationship that parents, family members, and teachers provide can act as a buffer to the effects of toxic stress. Consistent adult support can help a young child come through such difficulties with a brain that is still fully able to learn.

Conclusion

Parents, families, teachers, home visitors, policymakers, and anyone who works with or for infants and toddlers who have a solid understanding of how young brains develop and grow can make informed choices in their work for infants and toddlers. Adults who have the knowledge and skills to provide responsive interactions will help to shape the physical architecture of a child's brain so that he or she will be fully able to learn now, in school, and beyond.

Words You Can Use

- **Cortisol** Cortisol is the name of the hormone, or chemical, released when someone is experiencing a situation that feels stressful to him or her. In small doses, cortisol is actually helpful to a developing brain. In extreme circumstances, too much cortisol can adversely affect brain architecture.

- **Hormones** Hormones are chemicals that the body creates as a way to send "messages" or information throughout the nervous system. Some hormones are specific to positive feelings, and some are specific to stressful feelings.
- **Neurons**[ix] Neurons are cells that are specific to the nervous system. Their job is to carry information in the form of chemicals.
- **Pruning**[x] Pruning occurs as people age and the brain figures out which connections are most important, those that are used most frequently, and which connections are not. The less frequently used connections will be "pruned" or die off, leaving more room for the stronger connections to continue to grow.
- **Synapse**[xi] A synapse is the space between two neurons where "messages" are sent through hormones.
- **Serve and return**[xii] Serve and return is a way to describe the types of interactions that are most helpful for infants' and toddlers' early learning and brain development. This describes the type of responsive interaction in which a child reaches out through vocalizations, gestures, or facial expressions and an adult responds appropriately to the child. This may be repeated many times and, for newborns and young infants, occurs most frequently during routines.
- **Toxic stress** Toxic stress is the term used to describe the amount of stress that causes so much cortisol to be created and released in the body that it can cause damage to the architecture of the brain. The effect of toxic stress can be lessened when a baby or young child has at least one stable, secure relationship.

[i]National Scientific Council on the Developing Child, "Young Children Develop in an Environment of Relationships," Working Paper No. 1 (2004), retrieved from http://developingchild.harvard.edu/index.php/resources/reports_and_working_papers/working_papers/wp1/.

[ii]J. Ronald Lally, "School Readiness Begins in Infancy: Social Interactions During the First Two Years of Life Provide the Foundation for Learning," *Phi Delta Kappan* 92 (November 2010): 17–21.

[iii]National Scientific Council on the Developing Child, "The Timing and Quality of Early Experiences Combine to Shape Brain Architecture," Working Paper No. 5 (2007), retrieved from http://developingchild.harvard.edu/index.php/resources/reports_and_working_papers/working_papers/wp5/.

[iv]National Scientific Council on the Developing Child, "Children's Emotional Development Is Built Into the Architecture of Their Brains," Working Paper No. 2 (2004), retrieved from http://developingchild.harvard.edu/index.php/resources/reports_and_working_papers/working_papers/wp2/.

[v]National Scientific Council on the Developing Child, "InBrief: The Science of Early Childhood Development," InBrief Series, retrieved from http://developingchild.harvard.edu/index.php/resources/briefs/inbrief_series/inbrief_the_science_of_ecd/.

[vi]Ibid.

[vii]Ibid.

[viii]Jonathan Cohn, "The Two Year Window: The New Science of Babies and Brains—and How It Could Revolutionize the Fight Against Poverty," *The New Republic* 242 (December 2011): 10–13, retrieved from http://www.developingchild.net. http://www.newrepublic.com/article/economy/magazine/97268/the-two-year-window.

[ix]Eric H. Chudler, "Neuroscience for Kids," National Center for Research Resources (November 29, 2011), retrieved from http://faculty.washington.edu/chudler/neurok.html.

[x]Ibid.

[xi]Ibid.

[xii]National Scientific Council on the Developing Child, "InBrief."

STUDY GUIDE for

NEWS YOU CAN USE

FOUNDATIONS OF SCHOOL READINESS: EARLY EXPERIENCES BUILD THE BRAIN

SUMMARY:
This *News You Can Use* (NYCU) describes the basics of brain development for infants and toddlers. So much of brain development depends on the relationships and interactions between very young infants and the important adults in their lives. Parents, family members, teachers, family child care providers, and home visitors can all have a positive impact on a child's developing brain.

Key Messages:

- Interactions with important adults create physical connections in the brain.
- Responsive interactions, referred to as serve and return interactions, create the kind of neural (brain) foundation that contributes to lifelong learning, positive relationships, and school success.
- Prolonged exposure to extremely stressful situations, called toxic stress, can be very harmful to brain development.

Think:

- How do you support healthy brain development in your work with infants, toddlers, and their families?
- Think of a time when you and a child engaged in serve and return. What does the NYCU description of that process tell you about what that time meant for the child?

Reflect:

- Reflect on the role of stress in your own life. When has it been too much, and how or what has helped bring it back to a more manageable state?
- Recall a time when you noticed a child or a family in a stressful situation. Think about what you might do differently as a result of reading this newsletter.

Discuss:

- How does understanding brain development, especially the concept of serve and return, influence your understanding of the kinds of interactions adults should have with infants and toddlers?
- How might your understanding of the way connections are made in the brain change how you work with young children?
- Think about how toxic stress can affect the developing brain. Discuss how you might share this information with parents and families in ways that are nonjudgmental and respect that they are doing the best they can.

Next Steps:

- Try a multimedia experience to learn more about brain development! Watch these videos: http://developingchild.harvard.edu/topics/science_of_early_childhood/.

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