By Richard Louv on July 26th, 2012

NATURE'S NEURONS: Do Early Experiences in the Natural World Help Shape Children's Brain Architecture?

What role do early childhood experiences in nearby nature play in the formation of brain architecture? It's time for science to ask that question.

In January, New York Times columnist Nicholas Kristof reported on the American Academy of Pediatrics' "landmark warning that toxic stress can harm children for life." This was, he wrote, a "'policy statement' from the premier association of pediatricians, based on two decades of scientific research," and he added that the statement "has revolutionary implications for medicine and for how we can more effectively chip away at poverty and crime."

> Understanding the "plasticity" of the brain is a key to this relatively new approach. While genetics are responsible for the brain's basic foundation, its architecture – structure and connections – can literally be shaped by factors outside the body.

From conception through early childhood, brain architecture is particularly malleable and influenced by environment and relationships with primary caregivers, including toxic stress caused by abuse or chronic neglect. By interfering with healthy brain development, such stress can undermine the cognitive skills and health of a child, leading to learning difficulty and behavior problems, as well as psychological and behavior problems, heart disease, obesity, diabetes and other physical ailments later in life.

"We're beginning to get a pretty compelling biological model of why kids who have experienced adversity have trouble learning," according to Jack Shonkoff, a pediatrician and director of the Center on the Developing Child at Harvard. "You can modify behavior later, but you can't rewire disrupted brain circuits," he told Kristof. Does this mean that brain development stops at age three? No. Original circuits may be disrupted, but the brain does have a remarkable ability to create neural detours throughout a lifetime, especially during periodic windows of brain-development opportunity. So don't write off teen-agers or the rest of us. Still, neuroscientists believe that it's vastly better to get brain circuitry right the first time, during the first years of life.

To reduce toxic stress in early childhood, Shonkoff and others call for early intervention, including home visitation by childcare experts to vulnerable women pregnant for the first time. Kristof reports on one such program: "The nurse warns against smoking and alcohol and drug abuse, and later encourages breast-feeding and good nutrition, while coaxing mothers to cuddle their children and read to them. This program continues until the child is 2." In addition, better urban design and public health and economic policies could relieve toxic stresses caused by excessive noise, pollution, traffic, the threat of crime, and unemployment.

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Unfortunately, researchers have not focused on the impact a child's attachment to the natural world may have on brain development. On related fronts, here's what we do know.

A growing body of primarily correlative evidence suggests that, even in the densest urban neighborhoods, negative stress, obesity and other health problems are reduced and psychological and physical health improved when children and adults experience more nature in their everyday lives. These studies suggest that nearby nature can also stimulate learning abilities and reduce the symptoms of attention deficit hyperactivity disorder, and we know that therapies using gardening or animal companions do improve psychological health. We also know that parks with the richest biodiversity appear to have a positive impact on psychological well-being and social bonding among humans.

While we can't say with certainty that these influences play a direct role in early brain development, it's fair to suggest that the presence of nature can soften the blow of toxic stress in early childhood and throughout our lives. It's understandable that researchers have yet to explore the natural world's impact on brain development because the topic itself is rather new. Also, scientists have a hard time coming up with an agreed-upon definition of nature – or of life itself.

Several years ago, I worked with the Center on the Developing Child, then associated with Brandeis University, to help with communications. When I would ask the neuroscientists how the natural world itself affects brain development, they in turn would ask, rhetorically, "How do you define nature?" Ironically, these same scientists were simulating more "natural" conditions for control groups of animal subjects in their labs. Defining nature may be a scientific stumbling block, but it shouldn't be an insurmountable problem.

> For all of human history and prehistory, experience in the natural world has helped shape our species, including our brains. That huge and ongoing influence cannot be ignored.

So here are a few questions to challenge neuroscientists and other researchers to explore these questions: What is nature's role in reducing toxic stress early in life and improving parent-child attachment? Does disconnection from nature help cause toxic stress? What is already being done by people in vulnerable neighborhoods to create more naturally nurturing environments? Are proliferating community gardens, especially in urban neighborhoods, already having a positive impact on early childhood development, including brain development? And could one form of early intervention be to assure early, positive childhood experiences in the natural world?

It's time for science to ask these questions, and more, about the shaping of young brains. Defining nature will be the easy part.