

# **Brain Development in Children: Making the Most of Brain Neuroplasticity**

## Brain Neuroplasticity and Brain Development in Children

Did you know that 90% of a child's brain develops during the first 5 years of life? Baby brain development sets the stage for the child's intelligence, emotional stability and personality.

Research also shows that parental involvement with a child during these early years is directly related to the child's vocabulary development, reading readiness and eventual academic achievement.

In fact, a baby's brain begins development in the early embryo when cell division proliferates into millions of neurons in the brain. Soon after birth, billions of neurons begin making connections with each other to create neural pathways within the nervous system.

Each neuron has the ability to make as many as 15,000 new connections. In a strong healthy brain, these connections become the wiring or circuitry that defines the child's experiences and capabilities. An infant's brain at birth has 100 billion neurons. If the brain is not stimulated from birth, these neurons wither and die, impeding the child's ability to learn and develop properly.

The brain of a 6 month old infant is at least 25% the size of an adult brain. By 3 years, a child's brain is about the size of an adult brain.

It is during these early years of neuronal growth and proliferation that the brain is most neuroplastic.

This means the brain is most malleable and formative during these early years.

### The Role the Environment Plays in Brain Development in Children

Environmental factors such as nurture, love, stimulation, and proper nutrition have a direct impact on the psychological, physiological and cognitive development of the child.

Emerging research shows the importance of essential fatty acids like DHA in promoting the cognitive functions and development of children. Their intelligence and mental stability can be enhanced with brain food.

In fact the environment can change gene function and determine how the brain develops. Social and emotional factors like nurturing and love can also alter genetic expression.

That's why early stimulation is crucial for brain development in children.

The brain grows like a sponge as it absorbs input from the world around it.

Animals in the wild have much greater brain volumes than animals raised in captivity. Why? Animals in the wild are exposed to greater stimulation.

Similarly, children exposed to opportunities for stimulation in early life make more synaptic connections in the brain.

Stimulation provides opportunities for these connections to occur. And the more these connections are made, the greater the cognitive and social intelligence of the child.

Music, for example, stimulates the cognitive, verbal and emotional centers of the brain. Music is vital to brain development in children.

Social interaction is critical to brain development in children.

### What Kind of Activities Promote Cognitive Stimulation?

Music, Art, Exercise, Books, Play-- all these activities stimulate the child's mind. Babies should also be encouraged to explore and play safely.

Allowing an 8 month old baby to crawl safely around a room nurtures the development of his brain.

Toys are also means for safe exploration.

By the same token, a toxic environment can kill brain cells. Alcohol, drugs, anger, stress, abuse produce high levels of cortisol ( stress hormones) in the child's brain.

Cortisol can cause brain cells to wither, thus reducing the connections between cells in the brain.

New research suggests that loss of brain connectivity is the cause of aging. Do we want our children's brains to age even before they have a chance at life?

Babies who grow up in a loving, nurturing environment develop strong emotional bonds with their nurturers. These emotional bonds can become buffers protecting them from the negative impact of stress.

I cannot emphasize enough how much the early environment of a baby's experience is critical to brain development in children.

Because of brain neuroplasticity, our direct impact on the child's development is critical. A new study done by a team of researchers at McGill University shows that traumatic experiences in childhood can

alter the genetic profile of the brain. Known as "epigenetic alterations," these changes in DNA can occur even before birth--during gestation.

Researchers also found epigenetic alterations in the stress response genes of suicide victims who had suffered abuse or neglect during childhood. These alterations had compromised their ability to deal with stress.

Research also shows that the expression of "violent" genes in youth can be moderated through family and social interventions. Something as simple as having a daily meal with parents can alter the way a child with the genetic DNA for violence actually behaves.

As parents and grandparents, we have a responsibility for the well-being of our children. This wellbeing

goes beyond food and shelter. This well-being is the security that allows them to grow into independent, confident human beings who will in turn pass on this Light to their children.

Why is Gamma Wave Activity Important During Brain Development in Children?

Gamma wave activity in brains of infants provides a window into their cognitive development and language skills. The first 36 months of a child's life are crucial for laying the groundwork of a healthy, intelligent, curious and creative mind. From 16 to 36 months, the child experiences a tremendous growth spurt in language, increasing vocabulary to more than 1000 words.

Dr. April Benasich, Professor of Neuroscience at Rutgers University in Newark and her colleagues have recently identified the role gamma wave activity in the frontal cortex plays in the brain development in children during the first 3 years of life.

What Are Gamma Waves?

Gamma waves are fast, high-frequency rhythm brain waves associated with higher level mental activity when higher cognitive functions are engaged. In general, gamma waves are associated with insight and consciousness, when the brain comes to a higher form of information such as the "aha moment", precognition or intuition. The gamma brain wave state corresponds to frequencies of 40 Hz or higher.

Studies have found that seasoned meditators (like Tibetan monks) produce high-frequency gamma waves during their meditative state. Many researchers account for this unusual level of gamma waves to the mental training of the monks.

What Do Gamma Wave Activity Mean For Brain Development in Children?

In her study of children 16, 24 and 36 months old, Dr. Benasich found that those with higher language and cognitive abilities showed higher gamma power than those with poorer cognitive and language scores. She also found that high gamma power was evident in children with better attention and executive functions control. These children had the ability to moderate their behavior when told to do so.

By contrast, infants with low cognition and language skills showed below average gamma activity. Through her research, Dr. Benasich has identified a window during which dramatic linguistic and mental growth can be seen to correlate with gamma wave activity.

This window can be used to identify children at risk of language problems. By measuring gamma activity in the frontal cortex, doctors will be able to evaluate the status of brain development in children; they will also be able to make necessary interventions at critical points to ensure proper mental functioning.

What are the effects of trauma and stress on brain development in children?

Early brain development sets the stage for the child's physical, emotional and mental health in later life. In the past 15 years, we have discovered much about the brain's plastic and malleable nature, specifically its ability to develop new circuitry in response to experience.

Contrary to the well-used adage that you can't teach an old dog new tricks, neuroscientists are discovering that the immense formative power of the brain is infinite; it can change, even in old age, if it is given proper encouragement and stimulation.

A child's brain is even more malleable, which means that every experience in early life has a significant impact on brain development. Growth in the brain is predicated on neural connections that create neural pathways within the nervous system. Connections evolve into wiring or circuitry that define the experiences and potential of a child.