

Brain growth, development and Autism

The number of children diagnosed with Autism Spectrum Disorder (ASD) is rising. The CDC now estimates that 1 in 68 children are affected with an ASD.

Autism spectrum disorder is a serious neurodevelopmental disorder that impairs a child's ability to communicate and interact with others. Some children have repetitive behaviors, interests and activities. These children are impaired in social, occupational and other areas of childhood development and functioning.

ASD is now defined by the American Psychiatric Association's Diagnosis and Statistical Manual of Mental Disorders (DSM-5) as a single disorder that includes disorders that were previously considered separate — autism, Asperger's syndrome, childhood disintegrative disorder and pervasive developmental disorder not otherwise specified.

The term "spectrum" in ASD refers to the wide range of symptoms and severity. Although "Asperger's syndrome" is no longer a diagnosis, it is generally thought that this condition is a mild form of the disorder.

Doctors and scientists don't know if this is due to better detection and reporting or a real increase in the number of children identified. However, more people than ever before are being diagnosed with ASD. By studying the number of children with ASD at different points in time, the Centers for Disease Control (CDC) in Atlanta can find out if the number is truly on the rise. This information is important because it will help families identify children at risk. Also, scientists can compare the number of children with ASD in different areas of the country and among different groups of people. This information can help direct research into potential factors that might put children at risk for ASD and help them identify potential environmental factors that can affect brain development.

Children and adolescents with autism have a surplus of synapses in the brain, and this excess is due to a slowdown in a normal brain "pruning" process during development, according to a study by neuroscientists at Columbia University Medical Center (CUMC). Because synapses are the points where neurons connect and communicate with each other, the excessive synapses may have profound effects on how the brain functions.

Scientists do not know what causes ASD, but the current focus is on synapse formation during brain development. Synapses are formed between neurons – the basic building blocks of the brain. There are more neurons and neural synapses than there are stars in the Milky Way Galaxy. This fact underscores the complexity of human brain development.

During normal brain development, there is a burst of synapse formation that occurs in infancy, particularly in the cerebral cortex, a region involved in autistic behaviors. With normal growth and experience, the brain's synapses undergo pruning to eliminate about half of these cortical synapses by late adolescence. Many genes that are linked to autism regulate the process of synaptic pruning. Some researchers have hypothesized

that people with autism may have too many synapses, perhaps because the pruning process fails. Neuroscientists at Columbia University Medical Center, report their findings in the September 2014 issue of the journal *Neuron*.

Scientists have known that synapse formation exceeds pruning at early ages, causing excitatory synapses to form a normal wiring diagram of the brain. Synaptic pruning occurs with experience and learning, but this outpaces synaptic growth, resulting in net pruning back of the “wires” from childhood through adolescence until it reaches the normal adult brain levels. This delicate process regulates the maturation of synapses and neural circuitry to form the brain’s landscape.

An understanding of autism will be accelerated by investigations of donated human brain tissue from children, adolescents and adults diagnosed with ASD. Given the high incidence reported by the CDC, these answers cannot come fast enough.

The lack of brain tissues from children and young adults is a major barrier to research. In fact, there are very few brains of children with ASD that have ever been donated for research. The National Institutes of Health and private groups like the Simons Foundation are now working together to help families recognize the importance of brain donation after death.

Pediatric brain donation presents obstacles that are not seen with older populations affected by brain disorders like Alzheimer’s and Parkinson’s disease. *Autism Speaks actively supports autism brain banking through Autism BrainNet. While the decision may be especially difficult for a family, the gift of brain and tissues after death can make the difference and lead to the next scientific breakthrough in autism research.*

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The UM Brain Endowment Bank is networked with the BrainNet Autopsy Program to help families with donor registration and anatomic gifts.

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