

Research finds differences in the brains and behavior of girls and boys with autism

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Quinn, an autistic boy, and the line of toys he made before falling asleep. Repeatedly stacking or lining up objects is a behavior commonly associated with autism. Credit: Wikipedia.

New research conducted by the UC Davis MIND Institute on a large cohort of preschoolers with autism spectrum disorder has found differences in the underlying biology of their brains, and in their behavior, that may help explain how the condition affects a little-studied and poorly understood population of children: girls.

Autism spectrum disorder is diagnosed much more frequently in boys than [girls](#), at a ratio of 4 to 1. Despite recent efforts, little research has been done on girls—there are fewer of them, so fewer are represented in autism research. An estimated 1 in 42 boys has autism; in girls the statistic is 1 in 189.

The U.S. Centers for Disease Control and Prevention currently estimates the overall incidence of autism at 1 in 68 children born today.

In a brain study, the researchers found differences

in the corpus callosum, the region of the brain that connects the left and right hemispheres.

That study is published online today in the journal *Molecular Autism*, as part of a special issue devoted to gender differences. It adds to the growing body of evidence that suggests that, in autism, there are underlying biological differences between boys and girls.

In separate research presented at the International Meeting for Autism Research (IMFAR) in Salt Lake City May 13 - 16, the researchers find that the behavioral differences between girls who have autism and typically developing same-age girls are much greater than the differences between boys with autism and typically developing same-age males. The finding suggests that girls with autism have greater social impairments than do boys.

The research was led by Christine Wu Nordahl, assistant professor in the UC Davis Department of Psychiatry and Behavioral Sciences and principal investigator of the Girls with Autism Imaging of Neurodevelopment (GAIN) study.

"It's important to identify differences in underlying biology in boys and girls, because this could help us determine whether there are different etiologies of autism, and that potentially could lead us to different treatments and interventions," Nordahl said.

Brain Study

The [magnetic resonance imaging](#) (MRI) study of brain structure was conducted in a large sample of 3- to 5-year-old children, 112 boys and 27 girls—a large number for girls with autism—and 53 boys and 29 girls who were developing typically and served as control subjects.

"Previous studies have found alternations in the corpus callosum in children and adults with autism,

but most were focused on males only, or had very small female sample sizes," Nordahl said.

The study used a technique called diffusion tensor imaging (DTI), a type of magnetic resonance imaging that allowed the researchers to neuroanatomically subdivide the [corpus callosum](#), based on where in the cerebral cortex the fibers projected.

"We found that the organization of callosal fibers was different in boys and girls with autism, particularly those projecting into the frontal lobes," she said. "The frontal lobes are involved in many aspects of functioning, including social behavior, goal-directed behavior and executive functioning. Differences in the patterns of callosal fibers projecting to these areas may lead to differences in how autism manifests in boys and girls."

Behavioral Study

For the preliminary research presented at IMFAR, "Sex differences in social impairment in preschool-aged children with [autism spectrum disorder](#)," Nordahl explored behavioral differences in boys and girls with autism. Previous research in the area has been inconsistent.

"Most behavioral studies of gender differences directly compare males and females with autism. Our approach was to evaluate social impairments in a large group of children that included girls and boys with both autism and typical development," Nordahl said. "We were interested not only in directly comparing boys and girls with autism, but also in assessing how boys and girls with autism compare in relation to their typically developing peers."

"We found that the [behavioral differences](#) between girls with autism and typically developing girls are much larger than differences between boys with autism and typically developing boys," she said. "In other words, girls with autism deviate further from typically developing girls than boys with autism relative to typically developing males, suggesting that girls with autism have more severe social impairments than boys."

Nordahl said that much more work needs to be done to understand the [sex differences](#) between male and female children with autism, and particularly, increasing the numbers of female children who participate in [autism research](#).

Future studies in Nordahl's laboratory will include targeted recruitment of girls with autism, in order to carry out a comprehensive evaluation of behavioral and neurobiological differences in boys and girls with autism in relation to each other, as well as to their typically developing peers.

"There definitely is a need to evaluate more girls with autism, to fully understand the differences between [boys](#) and girls," she said.

Nordahl said that the GAIN Study hopes to evaluate an additional 100 preschool-aged girls with [autism](#) during the next three years.

Provided by UC Davis

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