NEWS

Study unfolds brain structure changes in children with autism

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Certain regions of the brain's bumpy shell become unusually thick and convoluted over time in children with autism, suggests a new study[1]. The findings hint that the brain expansion known to occur in infants and toddlers with autism continues throughout their childhood.

In the past decade, numerous studies have pointed to telltale changes in the shape of the brain in autism. The bulk of these findings indicate that parts of brain's outer layer, called the cerebral cortex, **expand faster than usual** in affected infants and toddlers and **shrink faster than usual** during adolescence and adulthood.

The new study, published 25 January in *Molecular Autism*, shows what happens to the brain's structure in the intervening years. Researchers found that certain parts of the brain in 4- to 12-year-old boys with autism become thicker and more intricately folded with age than in typically developing children. Some regions are also more folded in the autism group regardless of age.

"This is quite a dynamic process," says lead investigator **Roger Jou**, assistant clinical professor at the Yale Child Center.

The new study was cross-sectional, meaning the researchers estimated the effects of age on the brain by comparing scans from children of different ages. Still, it fills an important gap in the literature, says **Greg Wallace**, assistant professor of speech and hearing sciences at George Washington University in Washington, D.C., who was not involved in the study.

"Brain imaging studies fairly consistently show brain enlargement in early childhood but not adulthood," Wallace says. Looking at the space between these two periods "is very important," he adds.

Buckling brains:

Jou and his colleagues scanned the brains of 60 boys with autism and 41 typically developing boys, all of whom have intelligence quotients above 70. From the scans, the researchers measured the thickness, surface area, volume and degree of folding at approximately 140,000 points in the brain's cortex, focusing on the part called the gray matter, which consists of neuron cell bodies.

The researchers found that five regions of the cortex become thinner with age in typically developing children, but not in the children with autism. This thinning is pronounced in areas of the cortex that are involved in memory, attention and movement.

Similarly, two areas shrink in volume in the controls, but not in those with autism. One of these is the right **superior temporal sulcus** (STS), a groove along the side of the head that processes social stimuli and is thought to be altered in autism.

Given that the surface area of the cortex shows similar age-related changes in both groups, disparities in thickness probably underlie these volume measurements, says study investigator **Daniel Yang**, a postdoctoral fellow who works with Jou at the Yale Child Center.

What's more, some areas, including portions of the STS, actually increase in thickness and volume with age in children with autism, the study found.

Revisiting regions:

The researchers also found that five brain regions involved in social skills and language acquire more folds over time in children with autism than they do in controls. This trend is most pronounced in children whose autism symptoms are the most severe, and is far less apparent in those with the mildest symptoms.

Overall, the study pegged many brain regions that have been previously implicated in autism. "It is incredibly interesting that many of the regions they report as having significant differences have been previously reported," says **Brandon Zielinski**, assistant professor of pediatric neurology at the University of Utah, who was not involved in the study.

When the researchers controlled for differences in age between the two groups, they found no differences in overall surface area, volume or thickness of the cortex between children with autism and controls. But the brains of the children with autism did show more pronounced folding.

The results require confirmation, however. Inferring changes in brain structure over time from brain scans of participants of different ages can be misleading. Brain structure is known to change with age, but its size and shape at any particular age can vary widely from person to person.

"Although these findings are intriguing, this really highlights the need for longitudinal studies that track the same children over time to confirm that how the brain is developing is different in kids with

autism," says **Christine Nordahl**, assistant professor of psychiatry and behavioral sciences at the University of California, Davis, who was not involved in the study.

Still, the work emphasizes the potential importance of cortical folds in autism, as the degree of folding was the only measure that differed between the two groups of children overall and also showed an altered trajectory with age in autism.

"This measure is very under-studied," Yang says. "I think it's quite telling that we definitely need to understand more about it."

REFERENCES:

1. Yang D.Y. *et al. Mol. Autism* **7**, 11 (2016) **PubMed**