NEWS

Extra-thick connections mark brains of toddlers with autism

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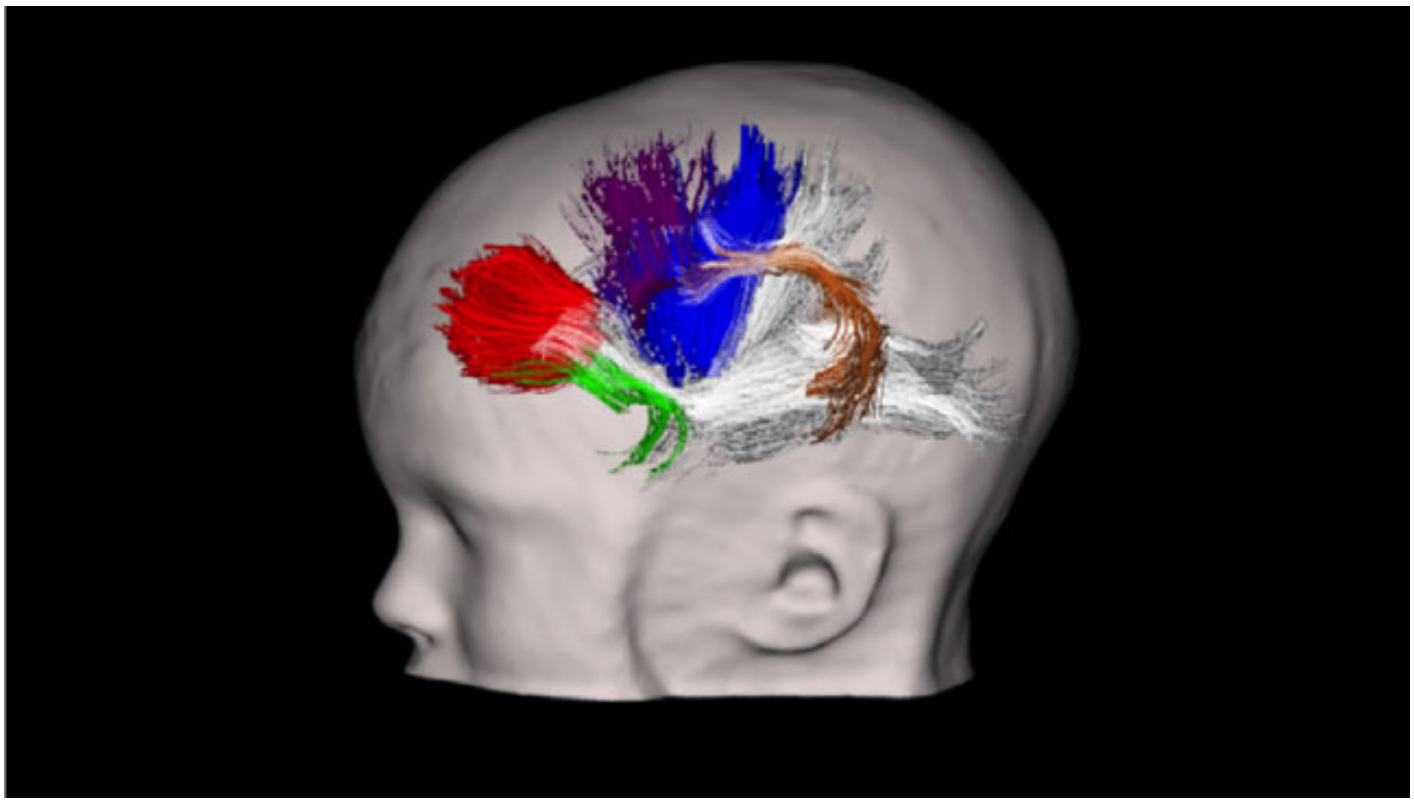

Toddlers who are later diagnosed with autism have abnormally thick connections between some brain regions, a new study has found[1]. The excess wiring may disrupt the development of social and language circuits.

The findings, published 4 July in *Biological Psychiatry*, suggest that an early overgrowth of neurons in pathways involving frontal regions of the brain contributes to autism. This result jibes with others that indicate the presence of **excess neurons in the postmortem brains** of people with autism. It

also meshes with the head enlargement associated with **autism-related genetic mutations**.

“It looks like it’s a persistent neuropathology,” says lead researcher **Eric Courchesne**, professor of neuroscience at the University of California, San Diego.

Courchesne and his team studied the brains of 61 toddlers ranging from 1 to 3 years old, whom pediatricians had flagged as being at risk for autism (and who were eventually diagnosed with the disorder). They also examined brain structure in 33 toddlers who did not show any signs of autism.

Using **diffusion tensor imaging** (DTI), which measures how water molecules travel along bundles of neuronal projections, or axons, the researchers mapped nerve tracts connecting the frontal lobe to brain regions involved in social, emotional and language functioning. A year later, they scanned 14 of the children with autism and 13 controls again to identify developmental changes in these tracts.

Studies like these that follow children over time are the best way to characterize how brain connections differ in people with autism, says **Kevin Pelphrey,** Harris professor of psychology at Yale University, who was not involved in the study. “When you look at longitudinal trajectories, findings that used to be inconsistent and piecemeal across the literature suddenly come into sharp focus,” he says.

Symptom connection:

Between the ages of 1 and 2 years, children with autism have denser nerve tracts, filled with tightly compacted axons, than controls do in connections involving frontal regions of the brain, the study found. The tracts also take up more space in the brain than the tracts in controls. Together, these measurements hint at an excess of axons in these pathways.

The measurements also tracked with the severity of autism symptoms: 1- and 2-year-olds who had broader, denser nerve tracts had more serious social and communication deficits when they were diagnosed than did toddlers with thinner tracts.

Interestingly, the thickening disappeared when the researchers scanned children as they neared 3 or 4 years of age. These tracts typically become thicker and denser with age, but in the children with autism, their nerve tracts eventually look slightly thinner than in controls.

This suggests that nerve tracts that are initially overcrowded with axons, like jammed highways, become less functional over time and therefore fail to develop properly. These findings link up with Courchesne’s earlier work showing that the brains of children with autism **start out too large, but later become smaller** than the brains of controls.

One of the most affected tracts is the uncinate fasciculus, which connects the frontal lobe to the

amygdala, the brain's emotion center. This pathway is crucial for social and emotional functioning, Courchesne says. The arcuate fasciculus, which interconnects key language areas in both the frontal lobe and the temporal lobe (at the side of the head), is also initially packed with an unusually large number of axons.

"Those two pathways are important players in driving the emergence of autistic early symptomatology," Courchesne says.

Courchesne cautions against using these findings as a **biomarker** — a sign to determine whether a child has autism. As is **common in many DTI studies**, the magnitude of the difference between the autism and control groups is small, he says.

Still, the findings agree with those from a 2012 study that found that children with a family history of autism who were later diagnosed themselves **have more mature nerve tracts** at 6 months of age than those who were never diagnosed[2].

REFERENCES:

1. Solso S. *et al. Biol. Psychiatry* Epub ahead of print (2015) **PubMed**
2. Wolff J.J. *et al. Am. J. Psychiatry* **169**, 589-600 (2012) **PubMed**