

Brain network connections may underlie social behavior linked to autism

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Researchers at Washington University School of Medicine in St. Louis and colleagues from the IBIS network used scans to identify brain networks that play a role when a baby sees an object and — by pointing and/or shifting gaze — gets someone else to focus on the object, too. Such behavior is impaired in children with autism. Understanding the links between the brain and this behavior could allow doctors to begin treatment earlier in children at risk for autism spectrum disorder. Credit: Thinkstock

Evaluating the strength of connections in the brain is one avenue researchers have been exploring to help identify children at risk for autism spectrum disorder earlier in life.

Now, researchers at Washington University School of Medicine in St. Louis, with colleagues from the multicenter Infant Brain Imaging Study (IBIS) network, have found associations between [brain](#) connectivity and a key social behavior that is a central feature of autism. If it becomes possible to identify [children](#) with [autism spectrum disorder](#) earlier in life, such knowledge could jump-start efforts to begin therapies that might help improve a child's language and social skills.

The findings are published online in the journal *Cerebral Cortex*.

The new study from the IBIS network involved scientists at Washington University, the University of North Carolina, The Children's Hospital of Philadelphia and the University of Washington.

The researchers used functional MRI scans to identify brain networks involved in a phenomenon called initiation of joint attention. It occurs when a baby sees an object in his or her environment, such as a dog, a car or a ball, focuses on that object and—by pointing and/or shifting gaze—gets someone else to focus on that object. This behavior has been linked to language development and is impaired in children with autism spectrum disorder.

"By the time most children are diagnosed with autism, they are 4 ½, but in studying the brains of younger children, we have found neural activity that may allow for earlier diagnosis, and that, in turn, may allow us to begin treatment sooner," said John R. Pruett Jr., MD, PhD, co-senior author and an associate professor of child psychiatry at Washington University. "We're excited to link aspects of joint attention behavior to the functional architecture of the brain. This study represents the first

time that has been done in children at an age when joint attention abilities are actually developing."

The researchers evaluated 116 young children at 12 months of age and 98 children who were 24 months old. Some children in the study had an elevated risk of autism because they had older siblings who had been diagnosed with the disorder. About 20 percent of babies with an affected sibling go on to develop autism spectrum disorder.

The toddlers' brains were scanned while they slept. The next day, the children were assessed to see how often they initiated joint attention—that is, drew another person's attention to an object.

The babies less likely to initiate joint attention had strong connections between their brains' visual and dorsal attention networks. The dorsal attention network helps keep attention focused on something while still allowing the brain to respond to other potentially important sensory information.

The researchers also identified stronger functional connectivity between the visual and the default mode networks in babies who were more likely to initiate joint attention. The default mode network is most active during quiet rest or daydreaming but generally shuts down while one is focused on a challenging task.

"When an infant is engaged in initiating joint attention, the visual and default mode regions tend to work together while the visual and attention regions tend to decouple, so in these scans we're seeing something like a fingerprint of how brain networks coordinate activity," said first author Adam T. Eggebrecht, PhD, an instructor in radiology at Washington University's Mallinckrodt Institute of Radiology. "Pointing to direct another person's attention involves identifying an object, focusing one's own attention on it, pointing toward it using the brain's motor system

and, possibly, perceiving that another person orients to that object, too.

"Identifying the brain regions responsible for all of that will leave us better equipped to potentially uncover mechanisms underlying behavioral features of autism as they emerge over the second year of life."

Now that those associations have been identified, the researchers plan to conduct further studies to try to understand how connections between brain networks might influence children's language abilities, as well as their [social skills](#), both of which are impaired in children with autism spectrum disorder.

"This research lays the groundwork for understanding how fundamentally aberrant processes develop in the brain as autism is first emerging in infants," said Joseph Piven, MD, co-senior author on the paper and a professor of psychiatry, pediatrics and psychology at the University of North Carolina and principal investigator of the IBIS Network.

More information: Adam T. Eggebrecht et al. Joint Attention and Brain Functional Connectivity in Infants and Toddlers, *Cerebral Cortex* (2017). [DOI: 10.1093/cercor/bhw403](https://doi.org/10.1093/cercor/bhw403)

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