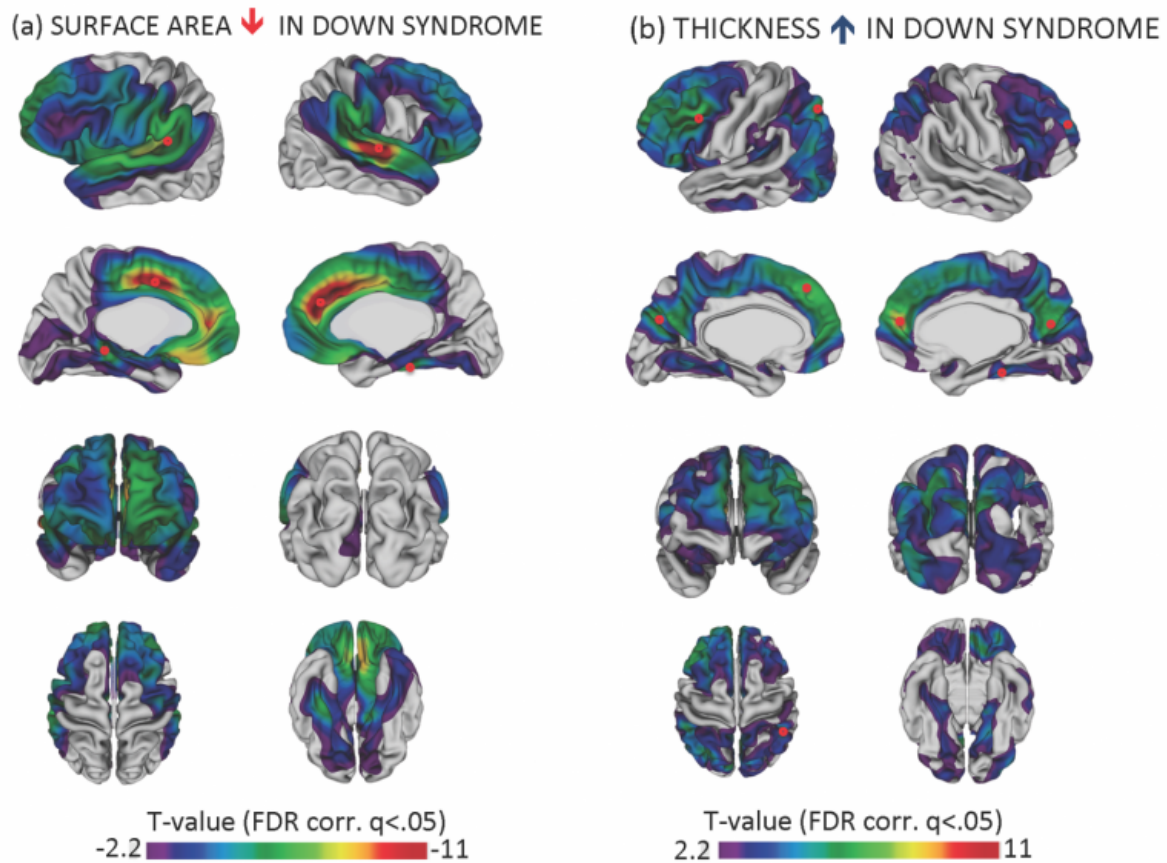


Thick cortex could be key in Down syndrome

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Reductions in cortical surface area and increases in cortical thickness in Down syndrome relative to typical controls. Panel A shows that the cortex surface area is lower in Down syndrome; panel B shows that the cortex is thicker in Down syndrome brains. Small red circles indicate the approximate locations where cortical surface area and thickness were most different between brains of participants with Down syndrome and brains of typically developing participants. Credit: Lee et al., National Institute of Mental Health

The thickness of the brain's cerebral cortex could be a key to unlocking answers about intellectual development in youth with Down Syndrome. It could also provide new insights to why individuals with this genetic neurodevelopmental disorder are highly susceptible to early onset Alzheimer's Disease later in life.

New brain-imaging research published in the journal *Cerebral Cortex* and led by Nancy Raitano Lee, PhD, an assistant professor at Drexel University, has found that the cortex is thicker on average in youth with Down Syndrome than in typically developing youth, even though the overall volume of the cortex is lower in those with Down Syndrome.

The [cerebral cortex](#) is the outer layer of brain tissue, a folded region about 2-4 millimeters thick, that is involved in many important aspects of brain function including sensory and cognitive processes.

Lee, a psychologist in Drexel's College of Arts and Sciences, conducted the research with colleagues at the National Institute of Mental Health who perform structural magnetic resonance imaging (MRI) of the brains of children and youth to better understand aspects of [brain development](#). They compared MRI measurements from 31 youth with Down Syndrome and 45 typically developing peers.

Lee is particularly interested in brain development in youth with Down Syndrome, the most common genetic cause of intellectual disability (occurring in 1 in 700 live births), because there is surprisingly little known about childhood brain development in this condition. What has been established is that the brain volume of the cortex is lower on average in people with Down Syndrome than in people who are typically developing.

"Volume is a gross measure that can mask differences between thickness and [surface area](#) in the cortex," said Lee. "We wanted to learn more about how the brain is different in Down Syndrome compared to typical development, so we measured surface area and thickness, which both contribute to cortical volume but are determined by different genetic factors."

She wasn't surprised to find that the cortex's surface area was lower in the youth with Down Syndrome because surface area is a component of the total volume, which was lower.

"The part that was surprising was our finding that the thickness of the cortex was greater in many regions in the group with Down Syndrome," she said.

The cause of the increased [cortical thickness](#) in Down Syndrome is still uncertain, but one possibility is that the brain in Down Syndrome doesn't prune excess neural connections as effectively as in typical development, a process believed to occur during childhood and young adulthood as part of reaching cognitive maturity.

Some of the brain regions with increased cortical thickness were nodes in the Default Mode Network (DMN), the part of the brain that is active when a person is at rest. Because deterioration in the DMN has been associated with Alzheimer's Disease, Lee said the difference found between Down Syndrome and typical development in youth could turn out to be an early indicator of susceptibility to Alzheimer's later in life. Individuals with Down Syndrome are more likely to develop early-onset Alzheimer's disease than the general population.

Lee hopes that her finding will highlight the importance of the cortex for understanding developmental processes in Down Syndrome and spur further research on animal models. Such studies could more clearly draw

the connection of how genetic abnormalities cause brain abnormalities—knowledge that could inform potential biomedical treatment approaches for [intellectual disability](#).

More information: *Cereb. Cortex* (2015). First published online: June 17, 2015. [DOI: 10.1093/cercor/bhv107](https://doi.org/10.1093/cercor/bhv107)

Provided by Drexel University

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