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The big picture: Long-term imaging reveals intriguing patterns of human brain maturation

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Neuroimaging has provided fascinating insight into the dynamic nature of human brain maturation. However, most studies of developmental changes in brain anatomy have considered individual locations in relative isolation from all others and have not characterized relationships between structural changes in different parts of the developing brain. Now, new research describes the first comprehensive study of coordinated anatomical maturation within the developing human brain. The study, published by Cell Press in the December 8 issue of the journal *Neuron*, reveals that functionally connected brain regions mature together and uncovers fascinating sex-specific differences in brain development.

"Understanding patterns of structural change in the developing human brain is a challenge because the types of change that we can detect using neuroimaging unfold rather slowly," explains lead study author, Dr. Armin Raznahan, from the National Institutes of Mental Health in Bethesda, Maryland. "So, we drew from the largest and longest-running longitudinal neuroimaging study of human brain maturation, where brain changes were tracked for over several years in the same set of individuals, to analyze patterns of correlated anatomical change across the sensitive developmental window of late childhood, adolescence, and early adulthood."

Dr. Raznahan and colleagues examined the thickness of the cortex

because it can be reliably measured and its developmental changes have been described in detail. The cortex is a sheet of neural tissue that covers the surface of the brain and plays a key role in thought, language, memory and consciousness.

The researchers discovered that rates of structural maturation were highly coordinated in the cortex and that regions which were functionally connected to each other also exhibited tightly coupled patterns of maturation. Interestingly, the researchers also observed that maturational coupling within the brain regions crucial for complex decision making differed between males and females.

"Our study represents the first ever investigation of correlated anatomical maturation in the developing human brain and shows that rates of structural cortical development in different cortical regions are highly organized with respect to one another," concludes Dr. Raznahan. "By providing the first link between cortical connectivity and the coordination of cortical development, we reveal a previously unseen property of healthy brain maturation, which may represent a target for neurodevelopmental disease processes and a substrate for sexually dimorphic behavior in adolescence."

Provided by Cell Press