A published report...

Study reveals how human brains grow

UCLA researchers' findings may help determine best way to teach mental skills to children

By Robert Lee Hotz, LA Times-Washington Post Service
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Opening a new window into the mental mysteries of youth, researchers at the University of California at Los Angeles for the first time have directly mapped growing human brains, revealing a cascade of unsuspected physical changes.

The scientists recorded neural growth spurts that coincide with important leaps in early learning ability.

The findings, made public in *Nature* today, may help lay the foundation for a reassessment of how best to teach language, mathematics and other crucial mental skills.

Every human brain, the researchers determined, experiences rapid, distinct waves of almost explosive growth that may determine when it is physically most receptive to learning new skills or ways of thinking.

"Our biggest surprise was how much the brain is changing," said Jay Gieddes, chief of brain imaging at the National Institute of Mental Health child psychiatry branch, who helped perform the study. "It is much more tumultuous, much more dynamic, much busier than we ever guessed."

To map the changing structure of the developing brain, scientists at UCLA's neuro-imaging laboratory invented a technique that allows them to precisely track millions of physical landmarks in the growing brain, keeping it in focus as it morphs into new shapes over the years of childhood.

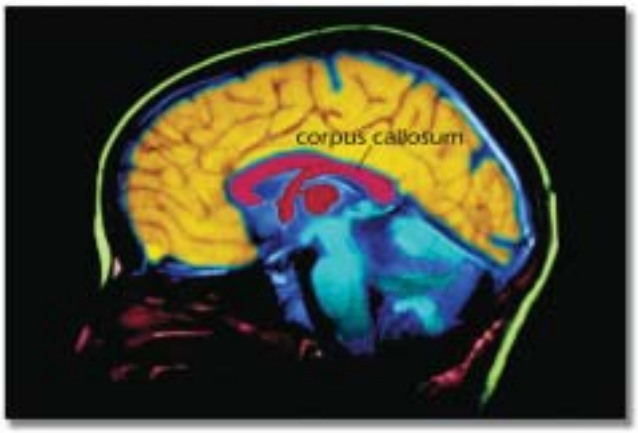
The technique harnesses conventional magnetic resonance imaging, or MRI, which can take detailed, three-dimensional anatomical images of living brain tissue, to the power of a graphics supercomputer and three dozen computer workstations. The end result is a neural journey through time that allows researchers to track three-dimensional changes from one year to the next in an individual with a precision never before possible.

"You are looking at a very sensitive measure of how the brain is changing and how rapidly it is changing," said UCLA neurologist Arthur W. Toga, director of the neuro-imaging laboratory and the senior researcher overseeing the study.

The team followed a half dozen children between the ages of 3 and 15, imaging the children repeatedly over the years to create a unique fingerprint of their maturing brains. The children were scanned at intervals ranging from two weeks to four years.

Much of the most intense growth was concentrated in a bundle of nerve tissue called the *corpus callosum* that serves as the central communications conduit connecting the two hemispheres of the brain.

In the youngest children studied (between 3 and 6 years old) the researchers discovered extremely rapid growth spurts in brain regions responsible for learning new skills and for learning to think ahead. The scans showed peak growth rates in frontal circuits of the brain that help focus attention, maintain alertness and to plan new actions.



"In the very youngest children, there really is this furious growth going on in the frontal circuits of the brain," said UCLA neurologist Paul Thompson, who helped develop the new mapping technique. "You see this extraordinary wave of peak growth that proceeds from the front of the brain to the back."

Among the youngest children, these communications lines grew fastest where they are linked to the frontal cortex. "Those are areas that would handle the learning of new behaviors, the planning of new actions, the overall organization of new skills," he said.

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