

**Media contact**

Rhiannon Bugno

+1 214 648 0880

BPCNNI@utsouthwestern.edu

Brain circuits for successful emotional development established during infancy

A study in Biological Psychiatry: Cognitive Neuroscience and Neuroimaging examines the growth of emotion-related brain circuits and their relationship with behavioral outcomes

Philadelphia, October 10, 2018 – Researchers at Cedars-Sinai, Los Angeles, CA and University of North Carolina Chapel Hill, NC, USA, have tracked the development of the brain's emotion circuitry in infancy, and report that adult-like functional connections for emotional regulation emerge during the first year of life.

The growth of these brain circuits predicted the IQ and emotional control of the children at four years old, suggesting new avenues for early detection and intervention for children who are at risk for emotional problems. The [study](#) was published in [Biological Psychiatry: Cognitive Neuroscience and Neuroimaging](#).

“Through the lens of functional MRI, this study shows that the brain circuits that are essential for successful emotional regulation in adults are absent in neonates but emerge in one and two-year-olds, providing the foundation for successful emotional development,” said co-senior author Wei Gao, PhD. Connections unique to the newborns disappeared as the adult-like connections emerged.

Growth rates of the emotion circuitry during the second year of life predicted anxiety and emotional regulation in the children at four years old. Growth also predicted IQ at four years old, indicating its importance not just for the development of emotional control later in life, but also cognition.

“This study reflects the rapid advancement that we are witnessing in the use of functional brain imaging to understand the development of functional brain connections in early childhood. The results linking age two connectivity with age four emotion processing highlight the implications that understanding developmental trajectories in brain function have for predicting adaptive and potentially maladaptive individual differences in emotional functioning,” said Cameron Carter, MD, Editor of *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*.

In the assessment of brain imaging findings, which included 223 infants from the UNC Early Brain Development Study, Dr. Gao and colleagues focused on a core hub of emotion processing in the brain—the amygdala—and its connections with other emotion-related brain areas. Atypical processing in the amygdala is linked to disorders such as depression, anxiety, and schizophrenia in adults. The new findings that track the development of the emotional control system during infancy provide a clue as to when atypical development may lead to enduring effects on emotion and cognition later in life.

“If confirmed in future studies, [the findings] suggest that it may be possible to identify children at risk for behavioral difficulties associated with psychiatric disorders very early in life, allowing early intervention to reduce risk and improve long term behavioral outcomes,” said co-senior author John Gilmore, MD.

Notes for editors

The article is "Development of amygdala functional connectivity during infancy and its relationship with 4-year behavioral outcomes," by Andrew Paul Salzwedel, Rebecca Stephens, Barbara D. Goldman, Weili Lin, John H. Gilmore, and Wei Gao (<https://doi.org/10.1016/j.bpsc.2018.08.010>). It appears in *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, published by [Elsevier](#).

Copies of this paper are available to credentialed journalists upon request; please contact Rhiannon Bugno at BPCNNI@UTSouthwestern.edu or +1 214 648 0880. Journalists wishing to interview the authors may contact Wei Gao at Wei.Gao@csmc.edu or +1 310 423 6699, or John Gilmore at jgilmore@med.unc.edu or +1 919 445 0209.

The authors' affiliations and disclosures of financial and conflicts of interests are available in the article.

Cameron S. Carter, MD, is Professor of Psychiatry and Psychology and Director of the Center for Neuroscience at the University of California, Davis. His disclosures of financial and conflicts of interests are available [here](#).

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Rhiannon Bugno, Editorial Office
Biological Psychiatry: Cognitive Neuroscience and Neuroimaging
+1 214 648 0880
BPCNNI@UTSouthwestern.edu