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Levels of key brain chemicals predict children's reading ability

New Haven, Conn. – Reading-impaired young children have higher levels of the metabolites glutamate and choline in their brains, and these higher levels continue to be indicative of difficulties in developing typical reading and language skills, a Yale study has found. The study appears in the *Journal of Neuroscience*.

Although anatomical and functional brain networks involved in reading disabilities have been well characterized, the underlying chemical bases of these differences in reading development have been poorly understood. This study is believed to be the first to examine neurochemistry in a longitudinal study of children during the critical period when they are considered “emergent readers” — the age at which neurocircuits that support skilled reading and speaking are still developing.

The Yale team measured levels of glutamate, choline, and other metabolites in 75 children, aged 6 to 10, whose reading abilities ranged from what is considered impaired to superior. The researchers conducted behavioral testing to characterize the children’s reading, language, and general cognitive skills, and used MR spectroscopy to assess metabolite levels.

They found that children with higher glutamate and choline levels in their brains tended to have lower composite scores for reading and language. In follow-up testing two years later, the same correlation still existed for initial glutamate levels.

“Reading disabilities affect significant numbers of children,” said first author Kenneth Pugh, associate professor of linguistics and president and director of research in the Haskins Laboratories at Yale. “Our findings suggest new pathways for research into the connection between genes, brain development, and behavioral outcomes in children who struggle with reading.”

The researchers also note that higher glutamate and choline levels have been implicated in hyperexcitability in children, another possible factor in cognitive impairment. “Further research may show whether there is a chemical basis that contributes to learning deficits among the reading-disabled children,” said senior author Robert Fulbright, also of the Haskins Laboratories, and associate professor of diagnostic radiology at Yale School of Medicine.

Other authors are Stephen Frost, Douglas Rothman, Fumiko Hoefl, Stephanie Del Tufo, Graeme Mason, Peter Molfese, Einer Mencl, Elena Grigorenko, Nicole Landi, Jonathan Preston, Leslie Jacobsen, and Mark Seidenberg.

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