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# Brain imaging study eliminates differences in visual function as a cause of dyslexia

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A new brain imaging study of dyslexia shows that differences in the visual system do not cause the disorder, but instead are likely a consequence. The findings, published today in the journal *Neuron*, provide important insights into the cause of this common reading disorder and address a long-standing debate about the role of visual symptoms observed in developmental dyslexia.

Dyslexia is the most prevalent of all learning disabilities, affecting about 12 percent of the U.S. population. Beyond the primarily observed reading deficits, individuals with dyslexia often also exhibit subtle weaknesses in processing visual stimuli. Scientists have speculated whether these deficits represent the primary cause of dyslexia, with visual dysfunction directly impacting the ability to learn to read. The current study demonstrates that they do not.

"Our results do not discount the presence of this specific type of visual deficit," says senior author Guinevere Eden, PhD, director for the Center for the Study of Learning at Georgetown University Medical Center (GUMC) and past-president of the International Dyslexia Association. "In fact our results confirm that differences do exist in the visual system of children with dyslexia, but these differences are the end-product of less reading, when compared with typical readers, and are not the cause of their struggles with reading."

The current study follows a report published by Eden and colleagues in the journal Nature in 1996, the first study of dyslexia to employ

functional Magnetic Resonance Imaging (fMRI). As in that study, the new study also shows less activity in a portion of the visual system that processes moving visual information in the dyslexics compared with typical readers of the same age.

This time, however, the research team also studied younger children without dyslexia, matched to the dyslexics on their reading level. "This group looked similar to the dyslexics in terms of brain activity, providing the first clue that the observed difference in the dyslexics relative to their peers may have more to do with reading ability than dyslexia per se," Eden explains.

Next, the children with dyslexia received a reading intervention. Intensive tutoring of phonological and orthographic skills was provided, addressing the core deficit in dyslexia, which is widely believed to be a weakness in the phonological component of language. As expected, the children made significant gains in reading. In addition, activity in the visual system increased, suggesting it was mobilized by reading.

The researchers point out that these findings could have important implications for practice. "Early identification and treatment of dyslexia should not revolve around these deficits in visual processing," says Olumide Olulade, PhD, the study's lead author and post-doctoral fellow at GUMC. "While our study showed that there is a strong correlation between people's reading ability and brain activity in the visual system, it does not mean that training the visual system will result in better reading. We think it is the other way around. Reading is a culturally imposed skill, and neuroscience research has shown that its acquisition results in a range of anatomical and functional changes in the brain."

The researchers add that their research can be applied more broadly to other disorders. "Our study has important implications in understanding the etiology of dyslexia, but it also is relevant to other conditions where

cause and consequence are difficult to pull apart because the brain changes in response to experience," explains Eden.

Provided by Georgetown University Medical Center