Biology of Dyslexia Varies With Culture, Study Finds

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Published: September 7, 2004

Reading may be a uniquely human talent, but it is not an innate skill. Writing systems differ vastly from one culture to the next. Chinese, for example, is composed of thousands of logographic symbols, while English has a mere 26 alphabetical building blocks.

A new study suggests that the biology underlying reading disorders may also vary by culture. Chinese speakers who suffer from dyslexia, the study found, have different brain abnormalities than English speakers who are dyslexic. The report was published last week in the journal Nature.

The results suggest that the treatments for English speakers with dyslexia might not be effective for those who speak other languages and have the disability.

"Until now, the main theory in the literature was that dyslexia in all languages would have a single universal biological origin," said Dr. Li-Hai Tan, a research fellow at the National Institute of Mental Health and an author of the study. "But the Chinese language is so different from English and other alphabetical languages that we assumed that the neurobiological basis could not be the same."

Dyslexia affects up to 15 percent of Americans, and about 7 percent of people in China. Most brain imaging studies of children with the disorder have identified anomalies in the left temporoparietal region of the brain, an area that helps attribute blocks of sound - called phonemes - to different letters and decodes their meaning.

But those studies looked only at dyslexics who spoke alphabet-based languages, like English, German and French. Learning to speak Chinese is a different mental task, Dr. Tan said, requiring the memorization of about 5,000 to 6,000 characters, each corresponding to a different word. As a result, dyslexic Chinese speakers
have trouble converting symbols into meanings, not letters into sounds.

"If you think about Chinese, it requires much more visual processing than English, which relies more on stringing sounds together," said Dr. Guinevere Eden, director of the Center for the Study of Learning at Georgetown University, who was not involved in the study. "In English, we learn that words are made up of chunks and that you can come across a word you've never seen before and apply the rules. That doesn't work in Chinese; you really have to memorize the characters to master the language."

In an earlier study, Dr. Tan found differences in patterns of brain activity between normal Chinese readers and English readers. Speculating that the contrasts might hold for learning disorders as well, Dr. Tan, in research carried out at the University of Hong Kong, did brain scans on 16 children as they studied Chinese characters on a screen. Half of the subjects were normal readers, the other eight were dyslexic.

In one task, they had to decide whether two different characters had the same pronunciation. In a second test, they were shown real and fake characters and asked about their meanings.

Both groups had normal activity in the left temporoparietal cortex. But the dyslexic children showed glitches in a separate region, the left middle frontal gyrus, which helps coordinate shape, meaning and pronunciation.

The findings suggest that a person can be dyslexic in one language but not in another. At least one case study supports that: In 1999, researchers found that a boy with dyslexia in English had no problems reading in Japanese.

Dr. Tan, however, has found evidence that bilingual speakers use one brain region for different languages. He showed that Chinese speakers who learn English use the left middle frontal cortex - not the left temporoparietal cortex, which native English speakers use. Based on this, he said, a person who is dyslexic in Chinese should also have difficulty reading in English, but it is too soon to tell.

"What we know is that dyslexics tend to be quite a heterogeneous group," Dr. Eden said. "With English dyslexics, the areas of the brain affected are multiple. And with Chinese, we're probably looking at several different areas that are affected as well."
