

Bird song study gives clues to human stuttering

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Researchers at the Methodist Neurological Institute in Houston and Weill Cornell Medical College in New York City used functional MRI to determine that songbirds have a pronounced right-brain response to the sound of songs, establishing a foundational study for future research on songbird models of speech disorders such as stuttering, as reported today in *Proceedings of the National Academy of Sciences*.

This is the first functional MRI study to determine how vocal sounds are represented within the brain of an awake zebra finch, a well-studied animal model of vocal learning. Because of many similarities between birdsong and human speech, this research could lead to a better understanding of the cause of stuttering and other speech problems.

By using specifically-tailored high-resolution fMRI in awake, mildly sedated zebra finches, scientists were able to look at the activity in the entire avian brain during song stimulation.

"While we found that both sides of the brain were activated by sounds in the songbirds, our research showed that the right side of their brains discriminated sounds better," said Santosh A. Helekar, M.D., Ph.D., lead author of the paper. Helekar is associate research professor of neuroscience at the Methodist NI and Weill Cornell. "If we can link what we find in birds to what we already know about human brains, then we could better understand the causes of speech disorders and, in the long-run, be able to provide treatments to patients."

Helekar has long collaborated with Dr. David Rosenfield, director of the speech and language center at the Methodist NI and a nationally-renowned language expert, to study stuttering and other speech disorders.

Using the blood oxygenation level-dependent (BOLD) fMRI method, researchers observed brain response patterns in 16 adult zebra finches during playback of the birds' own song, their tutor's song, an unfamiliar zebra finch's song, and a synthetic sound of a single frequency. The songbirds' own song caused a stronger response in the auditory areas of the brain. The overall findings suggest that vocal sounds may be better represented on the right side of the brain in these songbirds.

"We don't know exactly what goes wrong with the human brain when a patient stutters or has a particular speech problem. But, if we can understand the neurobiology of the brain of this animal model and how sounds are processed by birds that produce normal and variant songs, then we may be able to translate these findings into treatments for patients with disorders such as stuttering and verbal dyspraxia," said Henning U. Voss, Ph.D., first author on the PNAS paper and assistant professor of physics in radiology at Citigroup Biomedical Imaging Center of Weill Cornell Medical College.

The vocal learning process in the zebra finch offers a model system to study the neural and behavioral mechanisms by which humans learn to produce sounds. Songbirds such as zebra finches have specialized areas of their brains devoted to communication. That is why they have been used as animal models to study speech disorders, such as stuttering. It is estimated that more than 3 million Americans stutter.

Source: New York- Presbyterian Hospital

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