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Rewired visual input to sound-processing part of the brain leads to compromised hearing

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Scientists at Georgia State University have found that the ability to hear is lessened when, as a result of injury, a region of the brain responsible for processing sounds receives both visual and auditory inputs.

Yu-Ting Mao, a former graduate student under Sarah L. Pallas, professor of neuroscience, explored how the brain's ability to change, or neuroplasticity, affected the brain's ability to process sounds when both visual and auditory information is sent to the auditory thalamus.

The study was published in the *Journal of* Neuroscience.

The auditory thalamus is the region of the brain responsible for carrying sound information to the auditory cortex, where sound is processed in detail.

When a person or animal loses input from one of the senses, such as hearing, the region of the brain that processes that information does not become inactive, but instead gets rewired with input from other sensory systems.

In the case of this study, early brain injury resulted in visual inputs into the auditory thalamus, which altered how the auditory cortex processes sounds.

The cortical "map" for discriminating different sound frequencies was significantly disrupted, she explained.

"One of the possible reasons the sound frequency map is so disrupted is that visual responsive neurons are sprinkled here and there, and we also have a lot of single neurons that respond to both light and sound," Pallas said. "So those strange neurons sprinkled there probably keeps the map from forming properly."

Mao also discovered reduced sensitivity and slower responses of neurons in the auditory cortex to sound.

Finally, the neurons in the auditory cortex were less sharply tuned to different frequencies of sound.

"Generally, individual neurons will be pretty sensitive to one sound frequency that we call their 'best frequency,'" Pallas said. "We found that they would respond to a broader range of frequencies after the rewiring with visual inputs."

While Pallas' research seeks to create a basic understanding of brain development, knowledge gained from her lab's studies may help to give persons who are deaf, blind, or have suffered brain injuries ways to keep visual and auditory functions from being compromised.

"Usually we think of plasticity as a good thing, but in this case, it's a bad thing," she said. "We would like to limit the plasticity so that we can keep the function that's supposed to be there."

More information: The study is "Compromise of Auditory Cortical Tuning and Topography after Cross-Modal Invasion by Visual Inputs," Mao, Y. and Pallas, S. L., Journal of Neuroscience, 32(30):10338-10351.