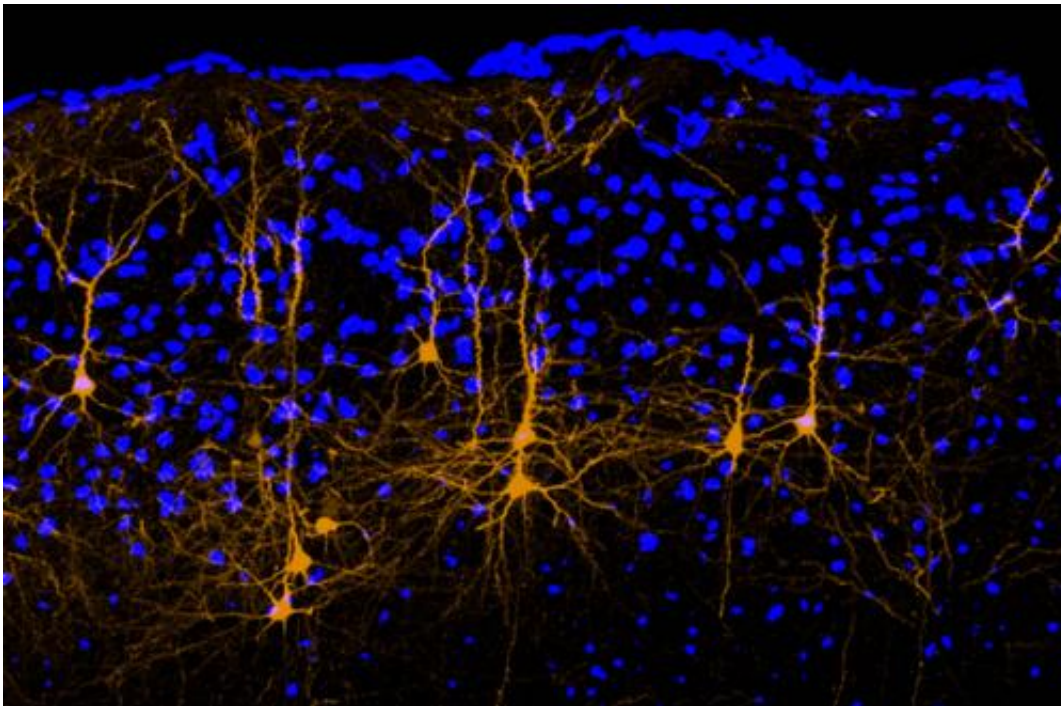


Brain wiring quiets the voice inside your head

September 3 2013



A mouse brain's motor cortex shows a subset of neurons, labeled in orange, that have long axons extending to the auditory cortex. These neurons convey movement-related signals that can alter hearing. Blue dots in the background show brain cells that do not send axons to the auditory cortex. Credit: Richard Mooney Lab, Duke University

During a normal conversation, your brain is constantly adjusting the volume to soften the sound of your own voice and boost the voices of others in the room.

This ability to distinguish between the sounds generated from your own movements and those coming from the outside world is important not only for catching up on water cooler gossip, but also for learning how to speak or play a [musical instrument](#).

Now, researchers have developed the first diagram of the [brain circuitry](#) that enables this complex interplay between the motor system and the [auditory system](#) to occur.

The research, which appears Sept. 4 in *The Journal of Neuroscience*, could lend insight into [schizophrenia](#) and [mood disorders](#) that arise when this circuitry goes awry and individuals hear voices other people do not hear.

"Our finding is important because it provides the blueprint for understanding how the [brain](#) communicates with itself, and how that communication can break down to cause disease," said Richard Mooney, Ph.D., senior author of the study and professor of [neurobiology](#) at Duke University School of Medicine. "Normally, motor regions would warn auditory regions that they are making a command to speak, so be prepared for a sound. But in [psychosis](#), you can no longer distinguish between the activity in your motor system and somebody else's, and you think the sounds coming from within your own brain are external."

Researchers have long surmised that the [neuronal circuitry](#) conveying movement—to voice an opinion or hit a piano key—also feeds into the wiring that senses sound. But the nature of the [nerve cells](#) that provided that input, and how they functionally interacted to help the brain anticipate the impending sound, was not known.

In this study, Mooney used a technology created by Fan Wang, Ph.D., associate professor of [cell biology](#) at Duke, to trace all of the inputs into the [auditory cortex](#)—the sound-interpreting region of the brain. Though

the researchers found that a number of different areas of the brain fed into the auditory cortex, they were most interested in one region called the secondary motor cortex, or M2, because it is responsible for sending motor signals directly into the brain stem and the spinal cord.

"That suggests these neurons are providing a copy of the motor command directly to the auditory system," said David M. Schneider, Ph.D., co-lead author of the study and a postdoctoral fellow in Mooney's lab. "In other words, they send a signal that says 'move,' but they also send a signal to the auditory system saying 'I am going to move.'"

Having discovered this connection, the researchers then explored what type of influence this interaction was having on auditory processing or hearing. They took slices of brain tissue from mice and specifically manipulated the neurons that led from the M2 region to the auditory cortex. The researchers found that stimulating those neurons actually dampened the activity of the auditory cortex.

"It jibed nicely with our expectations," said Anders Nelson, co-lead author of the study and a graduate student in Mooney's lab. "It is the brain's way of muting or suppressing the sounds that come from our own actions."

Finally, the researchers tested this circuitry in live animals, artificially turning on the motor neurons in anesthetized mice and then looking to see how the auditory cortex responded. Mice usually sing to each other through a kind of song called ultrasonic vocalizations, which are too high-pitched for a human to hear. The researchers played back these ultrasonic vocalizations to the mice after they had activated the motor cortex and found that the neurons became much less responsive to the sounds.

"It appears that the functional role that these neurons play on hearing is

they make sounds we generate seem quieter," said Mooney. "The question we now want to know is if this is the mechanism that is being used when an animal is actually moving. That is the missing link, and the subject of our ongoing experiments."

Once the researchers have pinned down the basics of the circuitry, they could begin to investigate whether altering this circuitry could induce auditory hallucinations or perhaps even take them away in models of schizophrenia.

More information: "A Circuit for Motor Cortical Modulation of Auditory Cortical Activity," Anders Nelson, David M. Schneider, Jun Takatoh, Katsuyasu Sakurai, Fan Wang, Richard Mooney. *The Journal of Neuroscience*, Sept. 4, 2013. [DOI: 10.1523/JNEUROSCI.2275-13.2013](https://doi.org/10.1523/JNEUROSCI.2275-13.2013)

Provided by Duke University

Citation: Brain wiring quiets the voice inside your head (2013, September 3) retrieved 28 December 2022 from <https://medicalxpress.com/news/2013-09-brain-wiring-quiets-voice.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--