Mouse brain region processes sound and motion at the same time

January 28 2020

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New insight on how information relating to sound and movement is processed in the brain has been published today in the open-access journal *eLife*.

The study in mice suggests that both sound and movement are processed simultaneously in part of the brain called the inferior colliculus (IC), a region that is best known for sound processing only. The findings also show how the brain may prevent movement-related sounds from interfering with the animals' hearing as they travel.

Nearly all cells in the nervous system that carry hearing-related information converge in the IC during sound processing. This helps the brain to accurately determine the timing and location of sounds, which is essential for animal survival. For this reason, the properties of IC cells during sound processing have been well studied, but little is known about how IC cells function while animals move around.

"Animals must be able to distinguish any noise they make from any external sounds they move away from," says lead author Yoonsun Yang, a researcher at the Center for Neuroscience Imaging Research (CNIR) within the Institute for Basic Science, Suwon, Korea. "Previously it was thought that this occurs mainly at the cortex level in the brain, after much of the auditory processing has been done. But evidence that the activity of auditory neurons below the cortex also changes during different motor activities led us to ask if IC cells function differently during movement."

To learn more, Yang and her colleagues recorded the activity of cells in the IC in mice walking on a treadmill. They found that activity in the IC was either enhanced or reduced during the animals' movement and even moments before any movement began. This suggests that the brain region actively processes movement-related information alongside external sound.

They repeated this experiment in deaf mice as they walked on a treadmill and found that movement also enhanced or reduced activity in the IC cells in the absence of hearing. This helped the scientists rule out

the possibility that the sound of the animals' movement was causing changes in IC cell activity.

The team next played sounds to the healthy mice as they walked, and found that responses in the IC were reduced during movement. "While the activity changes caused by movement may allow IC cells to monitor walking, the suppression of the response to external sounds may help prevent the animals' own sounds from drowning out other noises, including those that might signal a threat," explains senior author Gunsoo Kim, Ph.D., who leads the Auditory Processing Laboratory at CNIR.

"These results reveal a crucial role for the IC in processing both sound and movement-related information, rather than just sound," Kim concludes. "This integration means that mice and potentially other animals can respond to external sounds more rapidly and accurately, and adjust their behaviours to promote survival."

More information: Yoonsun Yang et al, Integration of locomotion and auditory signals in the mouse inferior colliculus, *eLife* (2020). DOI: 10.7554/eLife.52228

Provided by eLife