

When the brain switches from hearing to listening

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What happens in the brain when simply hearing becomes listening? To answer this question, researchers at the University of Basel have traced the neuronal fingerprint of the two types of sound processing in the mouse brain.

It is intuitively clear that there is a difference between passive [hearing](#)

and active listening. Attention and an animated state, but also movement, play a role in how [sound](#) processing in the brain adjusts accordingly. Neuroscientists Professor Tania Rinaldi Barkat and Dr. Gioia De Franceschi from the Department of Biomedicine at the University of Basel have provided an accurate account of what happens in this process in the journal *Cell Reports*.

For their study, the researchers examined the activity of neurons in four different areas in the brains of mice known to be involved in increasingly complex sound processing. During the experiment, the animals were either passively hearing the sounds played to them, or actively listening to them to receive a reward for detecting the sounds.

Activity pattern depends on various factors

It was shown that the majority of neurons changed their activity when switching between hearing and listening. "But this doesn't mean that all neurons behaved the same way," explains De Franceschi. "We actually found 10 distinct and specific types of activity change."

While most of the [neurons](#) showed a change that was probably related to varying levels of attention, some of them also showed patterns of activity that were related to the arousal level of the mice, their movement, the availability of a reward, or a combination of these factors.

Impact on all processing levels

The auditory pathway in the brain consists of a number of different nuclei that relay acoustic information from the cochlea to the [primary auditory cortex](#). Two of the four areas along the auditory pathway studied by the researchers are thought to be at a "higher level" in terms of processing complexity.

"At the beginning of our study, we suspected that these were the areas particularly affected by attention to sounds," said Barkat. "Surprisingly, however, this wasn't the case." Attention also alters activity in [brain areas](#) previously thought to perform only basic forms of sound processing.

"The results make it clear that even the detection of a simple sound is a cognitive process that profoundly and extensively shapes the way the [brain](#) works, even at very early stages of sensory processing."

More information: Tania RinaldiBarkat, Task-induced modulations of neuronal activity along the auditory pathway, *Cell Reports* (2021). [DOI: 10.1016/j.celrep.2021.110115](#). [www.cell.com/cell-reports/full...2211-1247\(21\)01609-0](#)

Provided by University of Basel

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