

Researchers discover how the brain balances hearing between our ears

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Credit: Rice University

UNSW researchers have answered the longstanding question of how the brain balances hearing between our ears, which is essential for localising sound, hearing in noisy conditions and for protection from noise damage.

The landmark animal study also provides new insight into [hearing loss](#) and is likely to improve cochlear implants and [hearing](#) aids.

The findings of the NHMRC-funded research are published today in the prestigious journal *Nature Communications*.

UNSW Professor Gary Housley, senior author of the research paper, said his team sought to understand the biological process behind the 'olivocochlear' hearing control reflex.

"The balance of hearing between the ears and how we discriminate between sounds versus noise is dependent upon this neural reflex that links the cochlea of each ear via the brain's auditory control centre," Professor Housley said.

"Until now we haven't fully understood what drives the olivocochlear reflex."

"Our hearing is so sensitive that we can hear a pin drop and that's because of the 'cochlear amplifier' in our inner ear. This stems from outer [hair cells](#) in the cochlea which amplify [sound](#) vibrations."

"When sound intensity increases, the olivocochlear reflex turns down the 'cochlear amplifier' to dynamically balance the input of each ear for optimal hearing, sound localisation and to protect hearing."

The study found that the cochlear's outer hair cells, which amplify sound vibrations, also provide the sensory signal to the brain for dynamic feedback control of this sound amplification, via a small group of auditory nerve fibres of previously unknown function.

In mice lacking the sensory fibre connection to the cochlear outer hair cells, loud sound presented to one ear had no effect on hearing sensitivity in the other ear. In normal control mice this produced an almost instant suppression of hearing.

Similarly, the olivocochlear reflex normally causes a rapid reduction in hearing in the ear receiving an increase in sound. This hearing adaptation was also absent in the mice lacking the sensory fibre connection.

The researchers speculate that some of the hearing loss that humans experience as they age may be related to the gradual breakdown of this sensory fibre connection to the [outer hair cells](#).

"A major limitation of [hearing aids](#) and cochlear implants is their inability to work in tandem and support good hearing in noisy conditions," Professor Housley said

"The ultimate goal is for [cochlear implants](#) in both ears to communicate with each other so that the brain can receive the most accurate soundscape possible. This research will help us move closer to that goal."

More information: *Nature Communications*, [DOI: 10.1038/ncomms8115](#)

Provided by University of New South Wales

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