

Loss of auditory nerve fibers uncovered in individuals with tinnitus

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A new study from Mass Eye and Ear investigators shows that individuals who report tinnitus, which presents as a ringing in the ears in more than 1 out of 10 adults worldwide, are experiencing auditory nerve loss that is not picked up by conventional hearing tests.

This work comes from researchers within the Eaton-Peabody Laboratories (EPL) study cochlear synaptopathy, which is commonly referred to as "hidden [hearing](#) loss." The results from this study provide a better understanding of the origins of tinnitus and are published in *Scientific Reports*.

"Beyond the nuisance of having persistent ringing or other sounds in the ears, tinnitus symptoms are debilitating in many patients, causing [sleep deprivation](#), [social isolation](#), anxiety and depression, adversely affecting work performance, and reducing significantly their quality of life," said senior author Stéphane F. Maison, Ph.D., CCC-A, a principal investigator at Mass Eye and Ear, a member of Mass General Brigham, and clinical director of the Mass Eye and Ear Tinnitus Clinic. "We won't be able to cure tinnitus until we fully understand the mechanisms underlying its genesis. This work is a first step toward our ultimate goal of silencing tinnitus."

Many individuals with hearing loss report a buzzing, humming, ringing or even roaring sound in their ears. It's been a longstanding idea that these symptoms, known as tinnitus, arise as a result of a maladaptive plasticity of the brain. In other words, the brain tries to compensate for the loss of hearing by increasing its activity, resulting in the perception of a phantom sound, tinnitus. Until recently though, this idea was disputed as some tinnitus sufferers have normal hearing tests.

However, the discovery of cochlear synaptopathy back in 2009 by Mass Eye and Ear investigators brought back to life this hypothesis, as it was evidenced that patients with a normal hearing test can have a significant loss to the auditory nerve.

In view of this paradigm shift in the way researchers and clinicians think about hearing loss, Maison and his team sought to determine if such hidden damage could be associated with the tinnitus symptoms experienced by a cohort of normal hearing participants. By measuring the response of their auditory nerve and brainstem, the researchers found that chronic tinnitus was not only associated with a loss of auditory nerve but that participants showed hyperactivity in the brainstem.

"Our work reconciles the idea that [tinnitus](#) may be triggered by a loss of

auditory [nerve](#), including in people with normal hearing," said Maison.

In terms of future directions, the investigators aim to capitalize on recent work geared toward the regeneration of [auditory nerve](#) via the use of drugs called neurotrophins.

"The idea that, one day, researchers might be able to bring back the missing sound to the brain, and perhaps, reduce its hyperactivity in conjunction with retraining, definitely brings the hope of a cure closer to reality," Maison added.

More information: Evidence of cochlear neural degeneration in normal-hearing subjects with tinnitus, *Scientific Reports* (2023). [DOI: 10.1038/s41598-023-46741-5](#)

Provided by Massachusetts Eye and Ear Infirmary

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