

Researchers gain insight into protective mechanisms for hearing loss

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Researchers from the Eaton-Peabody Laboratories of the Massachusetts Eye and Ear and Harvard Medical School have created a new mouse model in which by expressing a gene in the inner ear hair cells—the sensory cells that detect sound and sense balance—protects the mice from age-related hearing loss (ARHL) and noise-induced hearing loss (NIHL), the two most common forms of deafness.

Their research, described in the *Journal of Neuroscience*, provides new insight into protective mechanisms for hearing loss and suggests the potential for future molecular approaches, which may include gene therapy or medicine, to treat ARHL and NIHL.

Hearing loss is a serious public health issue. Nearly one-third of adults 64 and older have significant ARHL. After age 85, that number almost doubles to 64 percent. NIHL, also a common complaint, is one of the most self-reported occupational injuries. The irreversible loss of inner ear outer cells is a cause of both types of hearing loss. Hearing aids and cochlear implants help those suffering from hearing loss in some cases, but there is no device that works for everyone and no cure.

Mass. Eye and Ear researchers set out to understand if both types of hearing loss share a common underlying mechanism by studying certain inbred strain of mice. They investigated whether overexpression of *Isl1*, an inner ear progenitor gene with roles in development and differentiation, could be effective in protecting the inner ear.

The team found that *Isl1* expression protected hair cells from degeneration in aging and promoted hair cell survival after exposure to loud noise. As a result, the hearing in aged mice or in mice exposed to intense noise was significantly better than their siblings without the gene.

"The *Isl1* gene further preserved the connections between hair cells and neurons, which is necessary for hearing," said senior author Zheng-Yi Chen, D.Phil., Mass. Eye and Ear researcher and Associate Professor of Otolaryngology, Harvard Medical School.

Future research can evaluate if *Isl1* is protective from ARHL and NIHL in other mouse strains. The investigators hope to eventually study if such protection can be extended to the human condition.

"To our knowledge, our model is the first in which expression of a single gene in postnatal hair cells results in hair cell survival and hearing preservation in mice that otherwise suffer from age-related and noise-induced hearing loss," Dr. Chen said.

Provided by Massachusetts Eye and Ear Infirmary

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