Surviving dance club music (noise) with hearing intact

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By tweaking a system in the ear that limits how much sound is heard, a global team of researchers has discovered one alteration that shows that the ability of the ear to turn itself down contributes to protecting against permanent hearing loss. The report appears this week in *PLoS Biology*.

"There's some uncertainty in the field about what this sound-limiting system is used for," says Paul Fuchs, Ph.D., an author on the paper and professor of otolaryngology-head and neck surgery and co-director of the Center for Sensory Biology at the Institute for Basic Biomedical Sciences at Johns Hopkins. "Now we've definitively shown that this system functions in part to prevent acoustic trauma."

To get a better handle on this sound-limiting system in the ear, the research team built on previous findings in the field and focused their efforts on the nAChR protein found on so-called sensory hair cells in the ear. Nerve cells from the brain release signals that are picked up by nAChR and turn down these sensory hair cells.

The team genetically altered a single building block in the nAChR protein and tested mice for their ability to hear. "This point mutation was designed to produce a so-called gain of function in which the inhibitory effect of ACh should be greater than normal," says Fuchs.

The altered mice were less able to hear soft sounds than normal mice, showing that the genetic alteration made in the nAChR protein did indeed further "turn down" the ear. The team then asked if the alteration

in nAChR, and therefore the improved sound-blocking ability of these altered mice, also could protect from sound damage.

The team blasted 100-decibel sound at mice and again measured their ability to hear. "One hundred decibels, for me, is painfully loud, and conversation is impossible," says Fuchs. "But sound levels in night clubs or rock concerts can be that high, and extended exposure to sound at that volume can cause hearing loss."

They found that mice with the altered, gain-of-function nAChR suffered less permanent hearing damage compared to normal mice. "We think this pathway could be a therapeutic target for protecting from sound damage," says Fuchs. "So far, there is little or no specific pharmacology of hearing. We're still learning how the inner ear works. The encouraging news is that molecular mechanisms like the hair cell's nAChR frequently involve unique gene products, so there is a real chance of finding ear-specific drugs in the future."

Until then, Fuchs suggests limiting time spent at rock concerts, and wearing earplugs, to protect your hearing.

On the web: biology.plosjournals.org/perls … -html&issn=1545-7885

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