
Mechanosensory hair cells are the receptor cells of hearing and balance. Hair cells are sensitive to death from exposure to therapeutic drugs with ototoxic side effects, including aminoglycoside antibiotics and cisplatin. We recently showed that the induction of heat shock protein 70 (HSP70) inhibits ototoxic drug-induced hair cell death. Here, we examined the mechanisms underlying the protective effect of HSP70. In response to heat shock, HSP70 was induced in glia-like supporting cells but not in hair cells. Adenovirus-mediated infection of supporting cells with Hsp70 inhibited hair cell death. Coculture with heat-shocked utricles protected nonheat-shocked utricles against hair cell death. When heat-shocked utricles from Hsp70/- mice were used in cocultures, protection was abolished in both the heat-shocked utricles and the nonheat-shocked utricles. HSP70 was detected by ELISA in the media surrounding heat-shocked utricles, and depletion of HSP70 from the media abolished the protective effect of heat shock, suggesting that HSP70 is secreted by supporting cells.

Together our data indicate that supporting cells mediate the protective effect of HSP70 against hair cell death, and they suggest a major role for supporting cells in determining the fate of hair cells exposed to stress.


Objectives/Hypothesis: To examine the relationship between hearing and connexin 43, a dominant gap junctional protein in the central nervous system. Study Design: Original research.

Methods: Connexin 43 heterozygous mice are used to assess its mutational effect on hearing. Results are compared to controls consisting of connexin 43, wild type and CBA/J mice. Hearing is assessed using auditory brainstem response and distortion product otoacoustic emissions tests. Distribution of connexin 43 in the organ of Corti and the retrocochlear auditory centers (eighth nerve, cochlear nucleus, olivary complex, lateral lemniscus, and inferior colliculus, respectively) is examined. Fluorescent markers are used to elucidate cell type.

Results: Mean click auditory brainstem response threshold for the young connexin 43 heterozygous mice (3-4 months) was 36.7 ± 12.6 dB compared to 25 ± 0 dB for control mice (P < 0.05). Mean threshold difference became more pronounced (68 ± 7.5 dB vs. 31 ± 2.2 dB) at 10 months (P < 0.05). Tonal auditory brainstem response testing showed elevated thresholds (> 60 dB) at all frequencies (4-32 kHz) compared to the controls. Distortion product otoacoustic emissions (DPOAE) were present in all the mice, although the older connexin 43 heterozygous mice responded at higher thresholds. The pattern of connexin 43 immunoreactivity was distinctive from connexin 26 and 30, showing minimal presence in the organ of Corti but robustly present in the retrocochlear centres.

Conclusion: Connexin 43 heterozygous mice demonstrated greater degree of hearing loss compared to age-matched controls. It is abundantly found in the retrocochlear auditory centres. The mechanism of hearing loss in these mice does not appear to be related to hair cell loss.


In this study, the authors examined the ability of subjects with cochlear implants (CI) to discriminate voice gender and how this ability evolved as a function of CI experience. The authors presented a continuum of voice samples created by voice morphing, with 9 intermediate acoustic parameter steps between a typical male and a typical female. This method allowed for the evaluation of gender categorization not only when acoustical features were specific to gender but also for more ambiguous cases, when fundamental frequency or formant distribution were located between typical values.

Results showed a global, though variable, deficit for voice gender categorization in CI recipients compared with subjects with normal hearing. This deficit was stronger for ambiguous stimuli in the voice continuum: Average performance scores for CI users were 58% lower than average scores for subjects with normal hearing in cases of ambiguous stimuli and 19% lower for typical male and female voices. The authors found no significant improvement in voice gender categorization with CI experience.