TITLE: With gene therapy, ears grow new sensory cells
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J. TRAVIS

Whether it's the whisper of a lover or the shouts of rapper Eminem, the hearing process works the same. Sound waves bend lashlike projections on cells within the inner ear, and these so-called hair cells respond by sending electrical impulses to the brain.

Conventional wisdom holds that once damaged, hair cells in people and other mammals don't regenerate. But by using a virus to deliver a gene into the inner ear, scientists have now coaxed the ears of adult guinea pigs to sprout new hair cells.

"It's the first time anyone has shown new hair cells can be grown in a mature mammalian ear," says Yehoash Raphael of the University of Michigan in Ann Arbor, who led the study.

Even though the study didn't determine whether the new hair cells detect sound or properly connect with the brain, other investigators hail the work and suggest it will one day lead to treatments for many types of hearing loss, including the kind commonly suffered by elderly people. "It's another major step toward hair cell regeneration in the human ear," says Wei-Qiang Gao of Genentech in South San Francisco, Calif.

In the 1970s and 1980s, scientists got their first inklings of such regeneration in vertebrates when they observed that sharks grow hair cells throughout life and that birds can regrow the sensory cells. No mammal exhibits similar regenerative powers.

In 2000, Gao and his colleagues reported growing new hair cells in inner ear tissue taken from newborn rats and then kept alive in laboratory dishes (SN: 5/27/00, p. 342). The scientist infected the tissue with a virus engineered to carry a gene called Math1. Earlier studies had shown that an active Math1, which encodes a protein that turns on other genes, triggers an immature ear cell to become a hair cell.

This gene "seems to be the one that gets the ball rolling," says Douglas Cotanche of Children's Hospital in Boston, who studies hair cell regeneration in birds.

It wasn't obvious, however, that Math1 could transform adult cells of live animals, so Raphael's team injected a virus carrying the gene into the inner ear fluid of guinea pigs. A month or two later, the scientists examined tissue slices from each animal's ear and saw what looked like hair cells at places where the sensory cells normally don't grow.

Since there was no way to distinguish between any Math1-induced hair cells and preexisting ones, Raphael's team couldn't prove that new hair cells had grown within the part of the inner ear that usually holds them, the organ of Corti. Still, there were immature hair cells within this area in the treated guinea pigs but not in the untreated animals, the scientists report in the June 1 Journal of Neuroscience.

Raphael and his colleagues also found nerve fibers extending toward the fresh hair cells that were outside the organ of Corti. That's "exciting," says Cotanche, because it suggests that new hair cells may naturally integrate themselves into an ear's auditory system and be able to send signals to the brain.

To gauge whether gene therapy can restore hearing, Raphael and his colleagues plan to work with animals whose hair cells have been destroyed. The researchers will also test the strategy on guinea pigs older than those in the current experiments, to see whether aging inhibits the ability to grow new hair cells.

ADDED MATERIAL

LISTEN UP Guinea pig hair cells, the ear's sensory cells, sport bristles (white) that bend when sound waves strike them. Inset: After gene therapy, new hair cells grew in a guinea pig's ear. K. KAWAMOTO AND Y. RAPHAEL/UNIV. OF MICHIGAN MEDICAL SCHOOL