wire, designating north as south, when placed near certain rocks. No satisfactory explanation of the aberration was forthcoming until 1963. That year, writes Banerjee, two separate research groups, from the U.S. Geological Survey and the Australian National University, concluded that the strange rocks were "'fossil magnets' that . . . recorded the intensity and direction of the global magnetic field prevailing at the time they cooled and hardened."

Scientists believe that the Earth's magnetic field is generated by the movement of molten iron—itself magnetized billions of years ago by the sun or some other celestial body—thousands of miles beneath the planet's surface. As the liquid metal rises, it gradually cools and begins sinking back toward the Earth's core, creating "eddies" some 100 miles in diameter. There may be as many as 50 of them. The rotation of the Earth on its axis makes most (but not all) of the eddies point either north or south. "The net direction of the magnetic field," Banerjee states, "depends simply on which type of eddy is more populous."

This explains why the Earth's magnetic and geographic poles are not identical: Fluctuations in the eddies make the magnetic poles wobble.

Geologists and geophysicists do not know why there are currently more northerly eddies than southerly ones, but the evidence suggests that polar flips are not sudden. Banerjee's own work in Minnesota shows that the magnetic field there is at roughly 40 percent of the peak strength it reached 4,000 years ago.

If a switch occurred tomorrow, it would disrupt everything from missile guidance systems to the migratory habits of birds. But if Banerjee's calculations are correct, mankind will not have to worry about such imponderables for another 2,000 years.

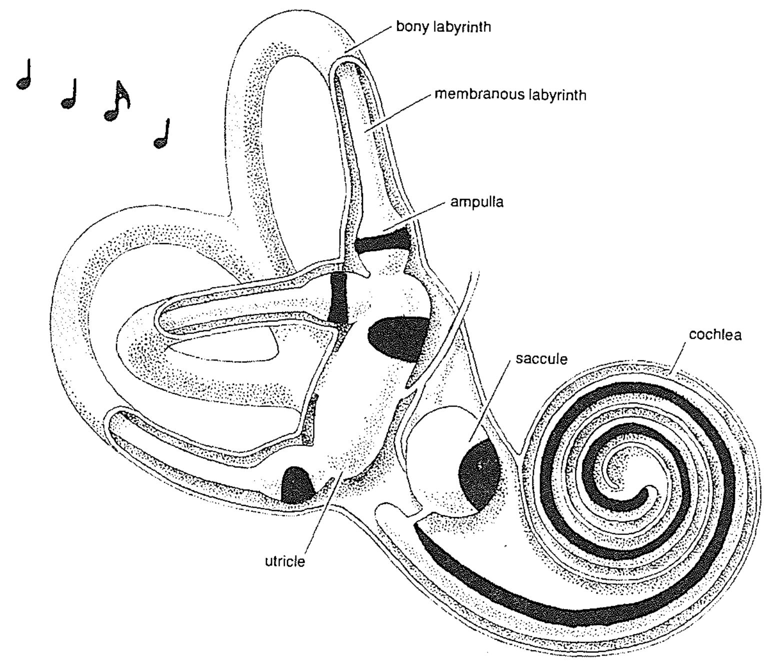
Hairs That Hear

"Crafting Sound from Silence" by Deborah Franklin, in *Science News* (Oct. 20, 1984), 231 West Center St., Marion, Ohio 43306.

Scientists have long known that there is more to the ear than meets the eye, but exploring the recesses of the inner ear is a difficult business. Today, they are finally beginning to understand how mysterious "hair cells" convey sounds to the auditory nerve.

This much is known: Sounds from the outside world stimulate the eardrum, whose vibrations are picked up and converted into hydraulic pressure waves by a bone called the stapes. The waves then travel the length of the cochlea—long, spiral-shaped chambers lined in places with hair cells. They are so named because of the "thin, hairlike appendages, called stereocilia, at their tips," reports Franklin, a *Science News* correspondent. When these extraordinarily sensitive stereocilia are tweaked, they release electrical impulses that signal the hair cell to secrete a chemical that stimulates the auditory nerve.

Humans are born with some 20,000 hair cells in each ear. In a lifetime of normal wear and tear, the hairs thin out and, thus, the hearing



Hair cells line several parts (darkest areas, above) of the inner ear. Those in the cochlea detect sound; those elsewhere govern the sense of balance.

of the elderly deteriorates. Some 200,000 other Americans suffer profound deafness due to damage to the inner ear, mostly involving the hair cells. Both groups could be helped by medical research.

One line of inquiry is the search by biochemists for ways to repair damage to the hair cells and to help disabled cells synthesize the chemical neurotransmitters that trigger the auditory nerve. Accustomed to working with millions or billions of cells, biochemists have been stymied by the fact that they must extract the elusive chemical from a paltry 20,000 cells—barely enough to analyze.

Physiologists, meanwhile, are exploring the structure of the hair cells. Lewis Tilney, of the University of Pennsylvania, has discovered that the cells are often supported by a lattice of protein molecules. A loud burst of sound, Tilney has found, can destroy the lattice, leaving the cells, which usually wave gracefully, to "flop about like wet noodles." Tilney's discovery may help explain episodes of temporary hearing loss.

The chief products of research up to now are experimental electronic implants that, like the hair cells, stimulate the auditory nerve and help the deaf to hear. The next goal: a biochemical fix for the one person out of 15 who suffers from seriously impaired hearing.