



# Huh?!

## HEARING CONNECTIONS

BY CHRIS BERDIK

“**S**OUND HAS POWER!” The audiologist Deanna Meinke holds a tuning fork in one hand and a Ping-Pong ball on a string in the other. Her demonstration is well rehearsed: A professor at the University of Northern Colorado, Meinke is also the co-director of Dangerous Decibels, a nationwide initiative encouraging kids to safeguard their hearing.

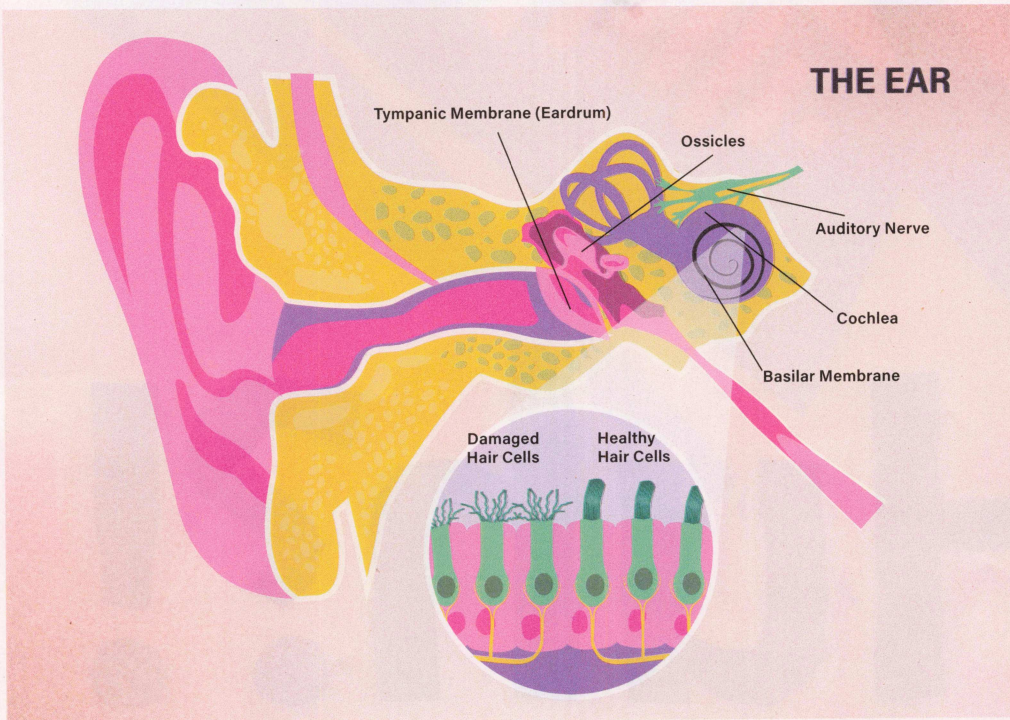
Meinke strikes the tuning fork against a desk and raises it to the Ping-Pong ball, which springs away, falls back, and springs away again, dancing spastically until the fork’s hum fades. When she makes her declaration, her voice lingers on the word “power” as if casting a spell.

Sounds are essentially waves of energy that trigger cascades of molecular collisions. These waves can certainly be powerful — damaging our inner ears and causing hearing loss. This alone makes exposure to noise a large public-health problem. According to the Centers for Disease

Control and Prevention, about 40 million American adults have noise-induced hearing loss, and by 2060, the number could exceed 73 million. Meanwhile, research increasingly suggests that noise starts to erode hearing well before standard screenings detect any deficit.

Noise harms more than just our hearing, however. Adults with hearing loss are at an increased risk of social isolation, depression, and dementia. The damage is so profound that it can affect what matters most — our connections with others and with the world itself.

## THE EAR



**THERE ARE** many components that make up the ear, including the tympanic membrane (or eardrum), the ossicles, the basilar membrane, and the cochlea. When sounds enter the ear, energy transfers through each of these components, bending the hair cells that line the cochlea and triggering the electrical signals that travel to the brain through the auditory nerve. But the loudest sounds don't bend hair cells; they break them, destroying their connections to the auditory nerve.

**ANY EXPLORATION OF** noise must begin with a sound hitting your ear. A pulse of energy passes through the air until it vibrates your eardrum, the membrane at the boundary to your middle ear. There, three tiny bones, the ossicles, transfer that energy to a smaller membrane at the entrance to your inner ear and another bone, the cochlea. Inside your cochlea, fluid wavelets triggered by the vibrations jostle thousands of "hair cells," which line the length of the bone and are named for the tufts of hairlike stereocilia protruding from their tips.

A hair cell bent by acoustic energy releases the chemical neurotransmitter glutamate into neural connections at its base. These synaptic ribbons then fire off electrical impulses to the auditory nerve, which ferries the acoustic signals to the brain, allowing you to hear.

This is where loudness, measured in decibels, can start to cause trouble. Louder sounds carry more acoustic energy and trigger a larger release of glutamate. Too much high-decibel excitement causes hair cells to overfill their synaptic ribbons with glutamate, to the point where they swell and pop — a grisly process known as excitotoxicity. Eventually, the battering caused by noise will kill off entire hair cells, but the first

to go are these synaptic connections to the auditory nerve, disrupting the flow of neural messages between ear and brain.

How much loudness is too much is a matter of ongoing debate. The National Institute for Occupational Safety and Health (NIOSH) suggests a limit of 85 decibels, which is as loud as heavy traffic, over an eight-hour workday. But that doesn't mean that 85 decibels is "safe"; it's simply the threshold that a 50-year-old study links with a 15-percent rise in the risk of hearing loss for workers. The Environmental Protection Agency, meanwhile, recommends that people cap their exposure at 70 decibels, or about as loud as a dishwasher, over the course of 24 hours.

Most of us have no idea how close we are to these decibel danger zones because almost all the loudness in our lives goes unmeasured. The best data comes from workplaces, and even that's limited. In the United States, NIOSH has traditionally focused on a handful of industries in which the most noise hits the most ears, namely, manufacturing, construction, and mining. There, workers' rates of hearing loss

hover between 20 and 25 percent. But in the mid-2010s, the agency launched a broad hunt for occupational hearing loss and found it everywhere, including among 19 percent of healthcare workers and 17 percent of service workers.

Even less is known about our exposure to non-occupational noise. Spot checks of New York City's subway platforms have found that trains screeching into stations emit up to



111 decibels. In 2016, Boston researchers visited 17 local spin classes and found an average of 100 decibels there — a loudness NIOSH recommends we endure for no more than 15 minutes without ear protection — and a peak of 116 decibels, which can damage hearing in seconds. A 2021 analysis of 10 Nashville music venues found that they averaged 112 decibels and exceeded 101 decibels 90 percent of the time.

Among the fallout from this growing din are rising rates of hearing loss. A 2016 study found, for instance, that between 6 and 24 percent of American adults show signs of hearing loss in one or both ears, specifically from their exposure to noise.

Some loudness is unavoidable, some is forced upon us, and some we choose. But it all adds up. Your ears don't care if the decibels come from your job, your local bar, or your power tools. They don't care whether the music blasting from your earbuds is rock, country, or hip-hop. If the sound is loud enough, it will cause damage, and a tiny piece of your sonic world will be lost.

**WHILE THE NUMBERS** from NIOSH and other agencies are alarming enough, there's reason to believe that hearing loss is even more widespread, and its harms even more extreme, than previously understood.

Audiograms have long been the standard for diagnosing hearing loss. They work by pinging a person's ears with beeps of increasing loudness. The beeps start soft and grow louder until the listener detects them. The adult threshold for "normal hearing" is 25 decibels, and hearing loss is defined as a "threshold shift" when the tone must be turned up to 30 decibels or more to be heard.

"An audiogram is a very simple task," explains Charles Liberman, a senior scientist at Massachusetts Eye and Ear in Boston.

"Is there a stimulus there or not? It doesn't require discrimination and understanding."

As it is, most people don't complain to audiologists about missing sounds at a particular decibel level. They're instead distressed by struggles to converse with friends and family in crowded places. They miss out on stories and can no longer engage in banter. They're embarrassed by their need to constantly ask others to repeat themselves.

When people can no longer follow conversations, they start withdrawing from social activities and isolate themselves, a risk factor for dementia. A study from 2011 followed more than 600 adults over 12 years and found that mild hearing loss doubled their chance



of developing dementia, while severe hearing loss quadrupled it. Meanwhile, a 2020 meta-analysis found that hearing loss raised the risk of depression by nearly 50 percent.

Nevertheless, up to 1 in 5 people who report difficulty with hearing in noisy environments have unblemished audiograms. In fact, Liberman has found that noise can cause profound inner-ear damage long before standard screenings find anything amiss.

The evidence of this "hidden hearing loss" can be discovered in the deceased, whose inner ears can be examined closely. Studying the ears of around two dozen dead, none of whom had any history of diagnosed hearing loss, Liberman and colleagues have found that the auditory nerve fibers of people with ostensibly healthy ears disappear over time — a pattern that's caused by a combination of age and noise. By age 60, no ear had less than a 30 percent decrease in nerve fibers, and the majority had lost double that amount.

Even that much damage can easily be missed by an audiogram, Liberman stresses. The ear retains enough nerve connections to successfully detect a beep, but is overwhelmed by anything more complicated, experiencing the sonic equivalent of a pixelated image.

This loss of precision matters because hearing isn't always easy. Just to chat with a friend in a busy coffee shop, our brains must separate all the sounds buzzing around us, distinguishing one voice from the others. In that way, it's the hearing that connects us to others that is most vulnerable to noise, which causes harm that begins before anything surfaces on an audiogram and extends well beyond anything it can measure.



**SINCE NOISE-INDUCED** hearing loss is irreversible, the only effective antidote is prevention. Liberman doesn't know how many hair cells and synapses we could save if we took better care of our ears, but he always keeps some earplugs handy for using the snowblower, mowing the lawn, or working with power tools. "They're so cheap and easy," he says. "It'd be crazy not to use them."

Yet judging by NIOSH numbers alone, protecting our ears remains a hard sell, despite decades of noise guidelines and awareness campaigns. The majority of America's noiseexposed workers don't wear hearing protection, and even in the noisiest industries about a third of workers still say, "No, thanks." Outside of work, the idea of hearing protection barely registers. A nationwide study in 2018 revealed that a mere 8 percent of Americans made an effort to safeguard their ears at loud concerts or sporting events.

"We protect what we value," says Meinke, "and I don't think people value their hearing consciously."

She and other audiologists suggest that this apathy is driven by two main factors. First, many people falsely assume that hearing loss is simply part of growing old, like graying hair and wrinkles. In truth, hearing acuity does degrade naturally with age, but studies show that a lot of "age-related" loss is likely due to a persistent auditory assault over the years, rather than the years themselves. Second, hearing loss is usually incremental; hearing erodes gradually, with the slow decay disguising the true extent of what we lose.

As a conversation starter, Meinke routinely asks people a deceptively simple question: What's your favorite sound? Ask somebody about their favorite color, and the answer will be automatic. But when Meinke asks patients, or audiences at her talks on noise, to volunteer their favorite sounds, people hesitate as if they've never considered the idea.

These inquiries started a couple decades ago, when Meinke was trying to cajole a patient to wear the hearing protection his company provided. He was a middle-aged factory worker who figured that noise was just part of his job and not something to worry or complain about.

Wearing hearing protection at the factory was voluntary, but annual screenings for hearing were mandatory. Every year, Meinke would tell the patient that his hearing was deteriorating, and every year, he would decline to do more to protect his ears. Then, one time she asked him if he had a favorite sound. The patient loved to fish and said his favorite noise was the high-pitched kiss of a trout taking the fly at the end of his line. "I said, 'You will lose that sound. It won't be part of your life if you don't protect your ears,'" Meinke recalls. From then on, the man wore hearing protection without fail.

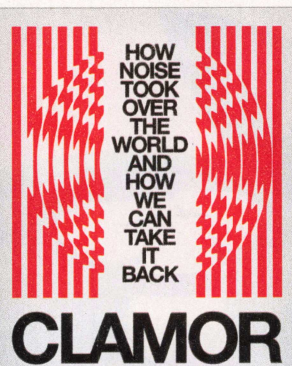
Over the years, Meinke has amassed some 3,300 favorite sounds. A whopping 70 percent of kids pick animal sounds. Human sounds are also popular, as are nature's elemental tones, from crashing waves to rustling trees. About 2 percent of people prefer silence, but they rarely mean the absence of sound.

"They say, 'Silence is when I'm skiing, and it's the end of the day, and everybody's already down the mountain, and I stop and listen.' Or 'When I'm home, my roommates are gone, the TV's off, and everything is still,'" Meinke explains. "It's more about their quiet time, somewhere removed from everyday life."

Meinke's experience illustrates that getting people to care about their hearing will take more than scary statistics and stricter regulations. Instead, it will require a deeper appreciation of everything we are protecting. Hearing, like our other senses, connects us to our world, and severing those connections cuts deep.

Simply put, ear protection is pro-sound. "Our intention is never to tell people to stop doing noisy things," Meinke says. "We want to equip them with the strategies to make healthy choices." Sometimes that means using earplugs. Sometimes it's turning down the volume. Other times, it's knowing when to walk away. Meinke preaches flexibility. Some protection is better than no protection. Sooner is better than later, and it's never too late. ■

*Chris Berdik is a freelance journalist and author who writes about science, health, technology, and education. He lives near Boston, Massachusetts.*



**Chris Berdik**



Excerpted from *Clamor: How Noise Took Over the World — and How We Can Take It Back*. Copyright © 2025 by Chris Berdik. Used with permission of the publisher, W. W. Norton & Company, Inc. All rights reserved.