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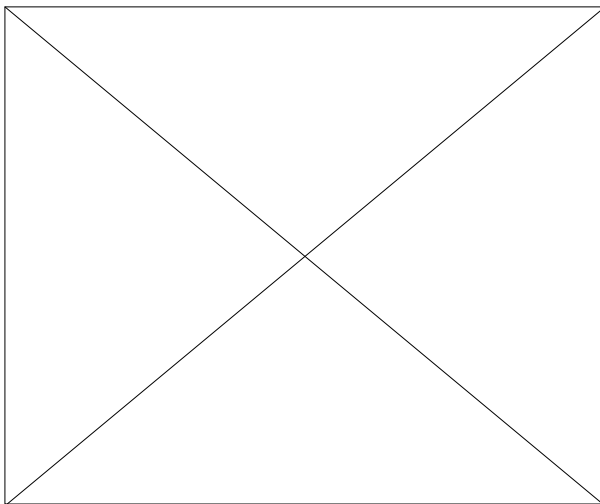
## Ringling in ears resides in brain, new findings suggest

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**By Joe Rojas-Burke**  
Newhouse News Service

When it's quiet, Elliott Berger's ears sense a cacophony: ringing, hissing and a rough, cricketlike blaring.

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The virtual noises began plaguing the 55-year-old hearing-protection researcher after an accidental exposure to a loud blast from a starter pistol heard through a malfunctioning electronic device.

"It was debilitating," Berger said. "I had trouble working, concentrating, thinking -- it was incredibly difficult to sleep, to work, to relax, to enjoy life."

An estimated 40 million Americans suffer from chronic "ringing in the ears," or tinnitus. Despite decades of research and hundreds of clinical trials of potential treatments, researchers still haven't found an effective way to stop the noise.

But recent discoveries challenge long-standing assumptions about what causes tinnitus. The new findings suggest that for many sufferers, the problem resides more in the brain than in the ears. That insight has sparked promising treatment ideas being tested in clinical trials. Among them:

Using drugs to target brain neurotransmitters, which might restore a balance of signaling in hyperactive brain areas linked to tinnitus.

Applying powerful electromagnets to the scalp to suppress those same overactive brain areas.

Implanting devices, for the most severe cases, that directly stimulate the brain to stop tinnitus.

"In the past, we've always approached it as an ear issue," says Billy Martin, a professor at Oregon Health and Science University and director of the medical school's tinnitus clinic. "Now a lot of the research is starting to look at what's going on in the brain. There's lots of new tracks being pursued."

OHSU researchers recently launched a clinical trial testing a drug called acamprosate, marketed since 2004 as treatment for alcoholism. Brazilian researchers, the first to study the drug for tinnitus, reported in 2005 that it improved symptoms in a majority of patients with few side effects. But the preliminary study included only 50 patients and tracked symptoms for only three months.

Martin says the drug might work by restoring a balance of brain neurotransmitters.

"There is evidence from basic science research that tinnitus is probably related to an increase in abnormal spontaneous activity in the brain," he says. One brain-signaling molecule that puts the brakes on brain activity is depleted in people and animals that have this increase in spontaneous activity, Martin says.

Richard Salvi, a tinnitus researcher at the State University of New York at Buffalo, long doubted that the cause could reside entirely in the ears. The biggest clue: Tinnitus persists in patients who've had tumors removed from the inner ear, even though the surgery cuts the nerves between the ear and brain.

"You lose all your hearing, but you still have tinnitus," Salvi says.

To understand what was going on, Salvi and fellow researchers recruited patients who could provoke more intense ear-ringing symptoms by clenching their jaws or shifting their gaze.

"We could have the same brain, with tinnitus active or inactive, and show the changing pattern of brain expression," he says. "Patients loved it." They had a picture to show others and validate their symptoms.

In silence, but while experiencing sounds of tinnitus, the brain scans lit up with activity in the brain's hearing center -- but only on one side of the brain. That was significant, Salvi says, because real sounds propagating from the ear activate both sides of the brain.

"Since tinnitus only activated one side, it couldn't have come from the inner ear," he says.

When the researchers played sounds during brain scanning, they found that the hearing centers in the brains of people with tinnitus overreacted compared to the brains of people without tinnitus.

The emerging picture suggests that tinnitus might be akin to phantom-limb syndrome, in which amputees experience itching or pain from a limb that no longer exists.

Damage from too much loud noise -- rock concerts, gunfire, machinery -- is the most common cause of tinnitus. Sensitive hearing tests show that most people with tinnitus also have some degree of hearing loss.

Salvi and fellow researchers speculate that in some people, the brain goes overboard trying to compensate for the lost hearing, like a driver turning up the volume on the car radio.

"The ear is no longer sending information to the brain," Salvi says. "The lack of information causes the brain to turn up its volume control. When the brain turns up its volume control, noise or static increases as well."

Elliott Berger didn't know how he could endure the onslaught of virtual noise disrupting his work, relaxation and sleep when he developed severe tinnitus last year.

"I've been a meditator for years," he says. "I'm used to dealing with difficulties that arise by relaxing and breathing, going into a silent place. That was no longer available to me."

But the 55-year-old says he's found a way to endure it.

"There is no cure," he says. "The best you can do is learn to put it in the background and develop coping strategies to live with it."

If you are troubled by tinnitus, get a thorough checkup by a physician, says Billy Martin, director of the tinnitus clinic at Oregon Health and Science University. Some cases have a readily treatable cause, such as an infection, high blood pressure or an abnormal growth in the ear.

The next step is to avoid situations that worsen symptoms. Most importantly, protect your ears from further noise assaults by wearing protective gear. Reducing stress also can help, Martin says.

If symptoms persist, find an ear doctor or clinic offering individualized support. Berger traveled from his home in Indianapolis to get care at the OHSU tinnitus clinic. "No one thing works for everyone," Martin says. "You really need to work with each individual and adapt the support to their needs."

Many patients get some relief from sound-generating devices that mask tinnitus. Others benefit from counseling or prescription drugs for depression, anxiety and insomnia -- conditions that often form a vicious cycle of worsening tinnitus that fuels more depression and sleeplessness.

One of the first obstacles Berger had to overcome was learning how to sleep again. "I've never had trouble sleeping, and all of a sudden I couldn't sleep."

He used sleep medications to get over the hump but since has managed with the help of soothing background sounds that mask the tinnitus.

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Without a cure, sufferers struggle to cope