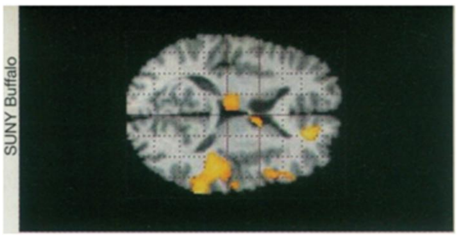
Tinnitus location found in the brain


SUNY Buffalo

This statistical composite of PET scans pinpoints the area (large yellow patch) where tinnitus registers in the auditory area of the brain. Smaller yellow spots show motor activity linked to jaw clenching.

The chronic sensation of loud ringing in the ears, or tinnitus, plagues roughly 12 million people in the United States, including about 10 percent of the elderly. An additional 40 million people have a milder form of the disease. Loud noise or other injury to the cochlea, a portion of the inner ear, can trigger the disorder, which often accompanies hearing loss. The progression of tinnitus is poorly understood, and there is no cure.

Now, scientists have located the area of the brain that seems to register this ringing sound—a first step, they hope, toward treating the condition.

The finding emerged from a study of unusual tinnitus patients, who hear changes in the ringing when they move their jaws. Researchers used positron emission tomography (PET) to examine the brains of four such people and compared the images produced when the people clenched and relaxed their jaws.

PET scans showed that jaw clenching changed blood flow, an indicator of neural activity, to certain regions of the brain—mainly an area of the temporal lobe associated with hearing. In three of the patients, who had tinnitus only in the right ear, blood flow changes showed up on the left side of the brain. Blood flow also increased somewhat in the hippocampus, a part of the brain that controls emotions. Other, more predictable activation occurred in parts of the brain responsible for motor activity, in this case the jaw clenching, the researchers report in the Jan. 22 NEUROLOGY.

Six people without tinnitus showed no blood flow change in auditory regions, whether they clenched their jaws or not.

The researchers then exposed all of the participants to a tone in the right ear. This activated responses in auditory portions of the brain on both the right and left sides, says study coauthor Alan H. Lockwood, a neurologist at the State University of New York and at the Veterans Administration Western New York Health Care System, both in Buffalo. The findings suggest that sound, even in one ear, is processed on both sides of the brain, whereas the tinnitus arose on one side only.

The result indicates that "this form of tinnitus is not cochlear," because a disturbance arising in the ear would register on both sides of the brain, says Kenneth A. Gruber, a scientist at the National Institute on Deafness and Other Communications Disorders in Bethesda, Md. In these people, tinnitus apparently originates within the brain, Lockwood agrees.

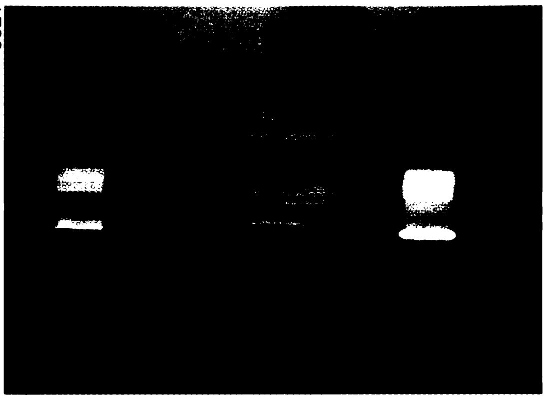
Just as some amputees feel pain in a limb they no longer have, people with tinnitus experience sounds they don't actually hear. "We think that tinnitus may be a sort of sensory analog to phantom limb pain," Lockwood says.

Although the brain appears to be largely "hard-wired" for sensory input, it "is capable of undergoing some fairly substantial reorganization, especially in altered sensory perception," says Lockwood, whose current work focuses on this brain remodeling, or plasticity.

The researchers also consider activation of the hippocampus unusual. In the control group, PET scans showed no hippocampal activation. The findings support past research hinting that the frustration of tinnitus can induce emotional problems, Lockwood says.

Counseling helps some tinnitus patients, whereas others find relief from devices that mask the ringing with more soothing sounds. Few drugs ease tinnitus. Lidocaine, an anesthetic, works only when given intravenously and then only for a short time. Knowing the location of tinnitus processing in the brain may enable researchers to test the effects of new medications, Gruber says. —*N. Seppa*

Mercury mystery solved when sparks fly


UCLA

Where the mercury and the rotating glass cylinder meet, the barometer light (orange line) is triggered by static electricity associated with mercury's stick-slip motion. The orange color comes from neon, an inert gas that researchers used to replace air in the flask.

Swirling mercury around in a glass container from which the air has been removed generates light. This curious glow—first described almost 325 years ago—came to be known as barometer light, taking its name from the scientific instrument invented in 1644 by filling a glass tube with the dense liquid metal.

Scientists at the University of California, Los Angeles have now shown that barometer light is an unusual consequence of static electricity, a familiar, but still poorly understood, phenomenon.

The flashes of light are associated with the so-called stick-slip behavior of mercury as it moves over a glass surface, says physicist Seth J. Putterman. His team reports its findings in the Jan. 15 NATURE.

When mercury comes into contact with glass, large numbers of electrons hop from the liquid metal to the solid surface, which thereby acquires a negative charge. This transfer of electrons leaves the mercury with a net positive charge and results in an attraction between the two materials.

The UCLA researchers slowly spun a horizontal glass cylinder containing mercury. As the flask rotated, the positively charged liquid metal stuck to the negatively charged glass and was dragged along with it. Eventually, gravity overcame the attraction between the materials, and the mercury suddenly slipped back, Putterman says. An electric discharge lasting only a few picoseconds and a more prolonged flash of light occurred just before each slipping event.

The interval between events, as well as the size of events, varied, but the reasons are not clear. The researchers' data show that the two are linked—the longer the period after a particular slipping event, the larger the subsequent event is likely to be. This pattern also characterizes earthquakes, another large-scale, stick-slip phenomenon, Putterman says.

In a separate phase of the study, the scientists bolstered the static electricity explanation for mercury's behavior even further. By shining an ultraviolet light on the surface of the liquid metal, they produced a photoelectric effect that prevented the separation of charges between the two materials. Because the mercury would no longer stick to the glass as it rotated, the liquid metal remained at rest, and no barometer light was seen.

"This desktop demonstration may help us understand the transfer of charges between surfaces and the origins of friction, two everyday phenomena that no one really understands," Putterman says. —*S. Perkins*