Scientists search for brain center responsible for tinnitus

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For the more than 50 million Americans who experience the phantom sounds of tinnitus -- ringing in the ears that can range from annoying to debilitating -- certain well-trained rats may be their best hope for finding relief.

Researchers at the University at Buffalo have studied the condition for more than 10 years and have developed these animal models, which can "tell" the researchers if they are experiencing tinnitus.

These scientists now have received a $2.9 million five-year grant from the National Institutes of Health to study the brain signals responsible for creating the phantom sounds, using the animal models, and to test potential therapies to quiet the noise.

The research will take place at the Center for Hearing and Deafness, part of the Department of Communicative Disorders and Sciences in the university's College of Arts and Sciences. Richard Salvi, Ph.D., director of the center, is principal investigator. Scientists from UB's Department of Nuclear Medicine and from Roswell Park Cancer Institute in Buffalo are major collaborators on portions of the project.

Tinnitus is caused by continued exposure to loud noise, by normal aging and, to a much lesser extent, as a side effect of taking certain anti-cancer drugs. It is a major concern in the military: 30 percent of Iraq and Afghanistan combat veterans suffer from the condition.

“For many years it was thought that the buzzing or ringing sounds heard by people with tinnitus originated in the ear,” Salvi said. “But by using positron emission tomography [known as PET scanning] to view the brain activity of people with tinnitus at UB, we’ve been able to show that these phantom auditory sensations originated somewhere in brain, not in the ear. That changed the whole research approach.”

Salvi and colleagues discovered that when the brain’s auditory cortex begins receiving diminished neural signals from the cochlea, the hearing organ, due to injury or age, the auditory cortex “turns up the volume,” increasing weak neural signals from the cochlea. Increasing the volume of these weak signals may be experienced as the buzzing, ringing, or hissing characteristic of tinnitus. Currently there is no drug or treatment that can abolish these phantom sounds.

Over the past decade, Salvi’s team has developed the animal models, allowing the researchers to explore the neurophysiological and biological mechanisms associated with tinnitus, the major focus of this new study. Ed Lobarinas, Ph.D., and Wei Sun, Ph.D., in the Department of Communicative Disorders and Sciences, developed the models.

One of the major goals of the project is to try to identify the neural signature of tinnitus -- what aberrant pattern of neural activity in the auditory cortex is associated with the onset of tinnitus. In another study phase, the researchers will assess neural activity throughout the entire brain using a radioactive tracer, fluorodeoxyglucose (FDG), which is taken up preferentially into regions of the brain that are highly active metabolically.

The third phase of the study involves the use of potential therapeutic drugs to suppress salicylate- or noise-induced tinnitus. In early studies, the researchers have been able to modulate some ion channels with one unique compound, and have been able to completely eliminate aspirin-

induced tinnitus using the highest doses of the compound. This phase involves collaboration with scientists at NeuroSearch Pharmaceuticals in Denmark.

Source: University at Buffalo