animal model. However, due to changes in our understanding of the problem over the last 15 years, we now have more solid animal models of tinnitus.

Through your generous contributions and the support of the American Tinnitus Association, we have taken animal models of tinnitus to the level where we can begin to look at areas of the brain that change when tinnitus is present and to evaluate potential treatments. Evidence from limited human studies demonstrates that the brains of people with chronic tinnitus may have more hyperactivity in quiet environments and in response to sound than those without tinnitus. At the State University of New York at Buffalo, we are evaluating hyperactivity associated with tinnitus in the brains of rats, using a sophisticated animal Positron Emission Tomography (PET) camera known as MicroPet — a high-resolution imaging system similar to that used with humans. First, we use special training to teach the animals to behave one way when they hear soft or moderate level sounds and another way when they are in quiet. When animals experience tinnitus induced by drugs or noise, they can no longer reliably detect quiet because quiet becomes filled with the sounds of tinnitus.

Comparing quiet, startling sounds and aspirin-induced tinnitus

In the first part of our imaging study, we looked at three conditions. The first was a brain scan in quiet; the second was a scan following repeated presentations of a real sound; and the third was a scan after a high dose of aspirin (sodium salicylate) that we confirmed induced tinnitus. Fig. 1 shows the brain activity patterns of one of the animals in the study. The gray color shows areas of low activity; red areas show levels of increased activity. In the figure on the left side, there are low levels of activity in an area of the auditory system known as the inferior colliculus (IC) and in the main region of the brain that processes sound known as the auditory cortex (AC). The middle top and middle bottom images show increased activity in both the IC and the AC when a sound is present. On the right we see that aspirin-induced tinnitus increases the activity in both the IC and the AC, and that the level of activity is higher than that of a real sound even though no sound was presented.

We also found increased activity in a part of the brain known as the thalamus. In Fig. 1, the activity in the thalamus can be seen in the middle of the AC brain slice on the bottom right. This increased activity is important because the thalamus has a role in relaying sensory information and in regulating one’s level of awareness. The hyperactivity we observe here could be related to tinnitus and tinnitus awareness. Thus far, we have been able to replicate these results across eight animals. In Fig. 2, we have superimposed the PET image activity on a high-resolution scan performed with Magnetic Resonance Imaging (MRI).