# Train your brain to hear your friends at a party

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A major science prize was today awarded to a researcher who is looking for the region of the brain that helps us to hear someone in a noisy place, such as a party or bar, and is responsible for "training" the brain to hear better in these situations.

Not being able to hear a person's voice in a noisy room and follow conversations is one of the most common problems for Britain's nine million people with a hearing impairment.

Deafness Research UK, the leading medical charity, has awarded the 2007 Pauline Ashley Prize to Sam Irving, a young researcher at the MRC Institute for Hearing Research in Nottingham.

The Pauline Ashley Prize, established in memory of the charity's founder, Lady Ashley of Stoke, is awarded annually to a talented young scientist near the beginning of their career and undertaking research into deafness, or a related condition such as tinnitus.

Most people with a hearing impairment have trouble picking out what someone is saying when they're in a noisy room. Parties or bars are some of the worst places because the level of background noise is high, and so scientists call this the "cocktail party effect".

To see what this was like, Irving wore an earplug in one ear for a week which gave him a one-sided hearing loss. He said: "It was hell - especially when I was in the pub with friends. The background hubbub

of the bar seemed to be the same level as the people I was talking to so I could barely hear what they were saying and it took a huge effort of concentration to follow any conversation. During the week, I gave up and spent a lot of time at home on my own because it was so distressing and tiring to be with lots of people or in a noisy place."

Our ability to detect a particular sound in the middle of lots of noise relies on the fact that we have two ears, and each detects an individual sound at a slightly different time (a sound coming from the left will reach the left ear slightly faster than it reaches the right ear). This is known as binaural or "spatial" hearing because it helps us identify where a sound is coming from and to concentrate or focus our hearing on that particular sound.

But, if you have some form of hearing problem in at least one ear, this ability is disrupted and the brain struggles to tell one sound from another.

The key to understanding this ability lies in the brain. Scientists are currently trying to work out exactly what part of the brain is responsible and how it allows us to distinguish one sound from lots of noise. Early research has had some remarkable results.

Most mammals also have this ability and in 2006, scientists working in the Oxford Auditory Neuroscience Group found that spatial hearing in ferrets has the ability to bounce-back or adapt to a hearing loss over time. Their brains are being "trained" to cope with the hearing loss and distinguish sounds much better.

The Oxford study placed healthy ferrets in a "ring of sound" where a sound is played from one of 12 speakers placed in a circle around the ferret and their response is monitored to see if they can detect which speaker the sound is coming from. Ferrets with normal hearing are very good at this and have excellent spatial hearing.

The team then fitted each of the ferrets with a small earplug in one ear which blocks some of the sound and so mimics a hearing loss. They then got the ferrets to perform the same task twice a day for two weeks and made a startling discovery. At first, the ferrets' ability to identify where the sound was coming from was dramatically reduced (because their spatial hearing had been disrupted by the earplug) but after two weeks they regained their ability and by the end of the period were as good at detecting the location of the sounds as they were before being fitted with an earplug.

Something in their brain was changing or adapting to the new situation and they were learning to compensate for the hearing loss.

Irving said: "When we switch on a bright light our eyes detect the increase in light levels and the brain sends a message to the eye to tell it to contract the pupil and let in less light. This is a feedback system where the brain is getting information from the eye about its surroundings, processing that information, and sending messages back to the eye to help it cope with different situations. We think something very similar is happening with the ear in spatial hearing."

"The brain is constantly monitoring the sounds around us and so knows what normal sound levels it would expect. When we introduce an earplug, it can detect the reduction in sound being received and we think it is actively sending messages back to the ear telling it how to cope with the new hearing loss, perhaps by stimulating or increasing the signal which is being blocked. It's compensating for the problem in a really clever way."

Irving is trying to locate the place in the brain which is channeling these feedback messages back to the ear.

"We already have a likely candidate called the OCB, the Olivocochlear

Bundle, which is a part of the brain that we know is a centre of feedback information being transmitted from the brain back to the ear. We're now trying to work out if the OCB is responsible for spatial hearing in ferrets."

The Pauline Ashley Prize will allow Irving to work with a team led by Professor Charles Liberman at the Eaton Peabody Lab at MIT/Harvard, leading experts on the OCB system. His study will compare the performance of ferrets which have had their OCB removed with normal ferrets in the "ring of sound".

At the same time, Irving is conducting a study with human subjects who have volunteered to wear an earplug for five days. These subjects will be tested in a similar ring of sound and their performance measured over time. Early results show that humans also have the same ability to train their brain to cope with the hearing loss and become better at the task the longer they're wearing the earplug.

Irving said: "Understanding how this system works is fairly basic science, but will be vital in the future for engineering new ways of helping people with hearing impairment cope with difficult situations. They could be helped by computer generated training programs which run like regular computer games, but can target weaknesses in listening skills. By incorporating training exercises much like those performed by the ferrets, they can lead to auditory learning and an improved ability to listen."

Source: Deafness Research UK