

# PART THREE: National Acoustic Laboratories

Our research division, the National Acoustic Laboratories (NAL), is a world-leading research facility in hearing assessment, hearing loss testing, prevention and rehabilitation. It has been established for 62 years. NAL is renowned both in Australia and around the world and its research is critical to helping people lead more productive lives.

This year, NAL had 31 research papers accepted for publication and presented 36 papers at conferences in Australia and overseas. *See Appendix 3 for a full list of accepted and published papers.*



#### **ELIZABETH'S FAVOURITE SOUND:**

**The 'thwack' of my boxing gloves hitting the pads with maximum power and speed. It's satisfying to hear that powerful, rhythmic sound and to know that I'm getting a workout at the same time!**

*Elizabeth Beach, Research Psychologist, NAL.*

## NATIONAL ACOUSTIC LABORATORIES (CONTINUED)

### New test for auditory processing disorders

After many years of research at NAL, we finalised the development and publicly launched the Listening in Spatialized Noise Sentences (LiSN-S) test in May 2009. Our research showed that an inability of some children to focus on sounds coming from one direction while suppressing sounds coming from other directions was a common cause of listening difficulties in the classroom. This problem can occur despite the child having apparently normal hearing, and was a previously unrecognised disorder.

In collaboration with a commercial distributor (Phonak Communications AG), the LiSN-S test was adapted to make it suitable for public release. Two versions of the test have been developed – one with an Australian accent for use in Australia, New Zealand and the UK; and one with a North American accent for use in the USA and Canada. Availability of the test is expected to have a major impact on the diagnosis and management of children with this disorder and we have received requests to collaborate in developing versions for non-English languages.

Research into treatment methods is also underway, and early results indicate that it is possible to provide a training program to overcome the disorder. Management,

including the provision of wireless assistive devices to provide a clear signal, is already possible.

This year we also commenced collaboration with Macquarie University to use its magneto-encephalography brain scanner to investigate auditory processing mechanisms. The initial experiment is investigating the brain activity involved in integrating hearing with visual information obtained from lip-reading.

### Telephone test of hearing

This year we invented, developed and launched a new version of Australian Hearing's telephone hearing test. The third version of Telscreen™ uses tonal sounds and noises, rather than speech, making it suitable for testing the hearing of people who speak any language. The test uses a specially developed noise that provides a much stronger masking effect for people with hearing loss than for people with normal hearing, making it easier to estimate the degree of loss.

The third version of Telscreen™ also contains a sophisticated test algorithm which alerts the caller to inconsistent responses. It was released with all instructions and notification of the test result in English, Mandarin and Cantonese in March 2009. *For more on the Telscreen™ story, see page six.*

### Audiometry in noisy situations

Increasingly, clinicians need to measure hearing in places other than in sound-attenuating booths. As part of the Hearing Cooperative Research Centre, we set out to evaluate, and if necessary improve, the tools that clinicians could use for this task. To achieve this, we comprehensively measured the performance of different styles of earphones, by themselves or in combination with earmuffs, in artificial ears and with the assistance of participants. We obtained excellent attenuation of background noise using a particular combination of a commercially available insert earphone and an earmuff designed for hearing protection in noisy places. This combination enabled us to obtain accurate hearing thresholds in locations that would currently be thought too noisy for testing to take place.

### Child Outcomes study

This year, we completed recruitment to the Child Outcomes study and we are now monitoring the progress of 475 children in the study. Approximately half of these children had their hearing loss diagnosed at birth, and approximately half were born in a place or at a time when universal newborn screening was not available. Nearly one third of the children have one or



*Left: Professor Graham Clark AC of the Bionic Ear Institute with Dr Sharon Cameron and Professor Harvey Dillon of NAL at the launch of LiSN-S.*

*Right: Children taking part in the NAL Child Outcomes study at National Head Office in Sydney.*

two cochlear implants and the remainder have hearing aids.

Of the children in the study, more than half have reached three years of age, the first major outcomes measurement point. Approximately 50 have reached five years, the second major measurement point. One finding that is already evident is the importance of receiving a cochlear implant early in life. On average, children who receive their implant before their first birthday have close to normal language development, whereas those who receive it later have significantly reduced language ability.

This study is the most comprehensive study of the effect of hearing loss in the world, and as the three and five-year data accumulates over the next year, the relative importance of numerous factors on the children's ability to communicate will become evident.

### Measuring the potential of children to hear speech

This year we conducted research on assessing the cortical potential of infants. Measuring cortical activity while the infant listens to speech sounds (with or without hearing aids being worn) enables our clinicians to infer whether the infant is able to hear speech. We have designed, implemented, and licensed (to Frye Electronics, for manufacture and distribution) the hardware and software needed to perform this measurement.

Commercial release is dependent on gaining regulatory approval from the Food and Drug Administration of the USA. To obtain this, we are gathering additional data so that the accuracy of the test, under typical clinical conditions, can be verified. Our research earlier within the year indicated a high level of accuracy of the test when applied to adults, from whom validating data can be more easily obtained.

This research also has the potential to impact on the decision to fit hearing aids or cochlear implants prior to a child's first birthday.

### New prescription formula for hearing aids

For more than 30 years, we have devised successive methods for prescribing hearing aids and these have been used around the world. Our last version, released in 2000, was the NAL-NL1 (non-linear, version one) prescription formula and rules. Since then, we have accumulated considerable data on the hearing abilities and listening preferences of people with hearing loss and have used this data to derive a new formula, the NAL-NL2. We will release this internationally when its incorporation into software is complete in 2009/10. Our new formula takes into account hearing loss, but also varies the prescription depending on the gender, listening experience, age, type of amplification, and type of language (tonal or non-tonal) spoken by the intended user.

### Leisure noise, workplace noise, and hearing

There has been much publicity, in Australia and internationally, about the danger to hearing posed by MP3 players, particularly for young people. Our researchers share this concern, and have measured exposure levels of randomly selected people in public places on three occasions over a five-year period. Comparison of the data suggests that the proportion of people exposed to dangerous daily noise doses has slightly decreased. We received competitive grant funding from the OHS to study the dangers of leisure noise in more detail, and we look forward to providing considerable community education on this topic when the data becomes available.

We also undertook a study on attitudes to noise exposure within the construction industry. This study provided strong evidence that the dangers of noise are very well understood by workers. Unfortunately, workers were often not effective in limiting their exposure to noise. The study identified that factors behind this were workers' uncertainty about which activities really were dangerous, and an under-appreciation of the consequences of hearing loss once it had happened. Our aim is to devise interventions focused on these two issues, and we will then evaluate whether these interventions lead to more effective prevention by workers in the future.

