



HEARING
COOPERATIVE
RESEARCH
CENTRE

ANNUAL REPORT 2015/16



Australian Government
Department of Industry,
Innovation and Science

Business
Cooperative Research
Centres Programme

The HEARing CRC is supported by the Commonwealth Government CRC Programme.

The CRC Programme supports industry led end-user driven research collaborations to address the major challenges facing Australia. Australia's network of CRCs operates across all sectors of Australia's economy and society. Further information about the CRC programme is available www.business.gov.au.

Image on front page: Prof Rob Briggs with Ben Clewer, courtesy of Royal Victorian Eye and Ear Hospital and stock image



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Foreword

On behalf of the Board, we are pleased to report on the achievements of The HEARing Cooperative Research Centre from July 2015 to June 2016. During this year, we have progressed our research, education, commercial and implementation agendas under our four core Themes: The Listening Brain, The Intelligent Interface, Individualised Solutions and Enhanced Service Capacity. It is pleasing to report progress in achievement of outcomes that are making a difference to hearing healthcare, not only in Australia, but also world-wide.

Our world-unique Longitudinal Outcomes of Children with Hearing Impairment study, conducted in partnership with the National Acoustic Laboratories, has followed some 480 children since birth. Analysis of data at five years has confirmed the advantages of early device-fitting in children, using both hearing aids and cochlear implants. These results, published in a special supplement of the International Journal of Audiology, provide valuable information for government in support of universal newborn screening programmes, for parents of children with a hearing loss, for device manufacturers including Cochlear Ltd and Sivantos Pty Ltd, and for hearing healthcare professionals.

In parallel, The HEARing CRC's evidence-based studies evaluating candidature for cochlear implants, for different groups of potential end-users, has also been published in another special supplement of the International Journal of Audiology. From these data, The HEARing CRC is now developing guidelines to assist hospital clinics, as well as implementation tools for use by clinicians and families in making informed decisions about potential benefits from different device options.

As detailed in this report, HEARing CRC research has been published internationally in peer-reviewed journals, and presented at both national and international conferences. Communication activities in public forums have also increased, in particular through our HEARnet and HEARsmart initiatives.

We have now enrolled 31 PhD students through our university Members, and our Cochlear Student Mentoring Program provides an opportunity for Audiology students to work alongside industry and clinical professionals. For professionals, The HEARing CRC has expanded HEARnet Learning® in collaboration with Audiology Australia, providing Continuing Professional Development modules to up-skill hearing healthcare professionals and serving as a vehicle for translation of research outcomes into clinical practice.

These outcomes are testimony to the quality of our research staff and students, the work of our Project Leaders and Key Scientists, as well as our management team and Board of Directors. The HEARing CRC is well supported by our legal advisor, Dr Jenni Lightowers (FAL Commercial Lawyers), our IP attorneys Mr Lorne Wood-Roe (Adams Pluck) and Mr Steven Borovic (Churchill Attorneys), and our auditors KPMG.

Good governance underpins this success and the Board would like to acknowledge the enormous contribution made by our retiring Chair, Mr Richard Searby AO. Richard served as Chair of The HEARing CRC and HEARworks from 2007 until this year, overseeing award-winning commercial and research successes, as well as extension of The HEARing CRC. The Board also extends its thanks to Dr Michele Allan, who recently retired as an Independent Director. The business acumen and support provided by Michele has been critical to our ongoing strategic planning and commercial successes. We thank them both, as well as all of our Directors for their willingness to contribute to better hearing healthcare for all Australians.

As ever, special thanks are given to the adults, children and their families, who give so generously of their time to participate in our research.



Dr Katherine Woodthorpe
Chair



Professor Robert Cowan
Chief Executive Officer

1. INTRODUCTION

Hearing loss is a significant global issue, affecting 5.3% of the world's population, and over 80% of adults over 80 years of age (World Health Organisation, 2015). In Australia, hearing loss affects one in six people, and is projected to affect one quarter of the population by 2050. It reduces people's ability to communicate and in turn impacts on education, employment and relationships; it is often overlooked in the community but remains a significant issue affecting people across their lifespan:

- in children – through delaying language development and impacting on educational achievement
- in adults – reducing productivity, employment prospects, and impacting on leisure and social participation in the community
- in the elderly – by contributing to cognitive decline and its associated health challenges.

The HEARing CRC focuses an internationally unique, interdisciplinary consortium of research, clinical, industry and educational organisations on the *twin challenges of maximising lifetime hearing retention, and reducing productivity losses from hearing loss*, through improved remediation and better take-up of technology. The HEARing CRC proposes implementation of a new model of hearing healthcare that delivers:

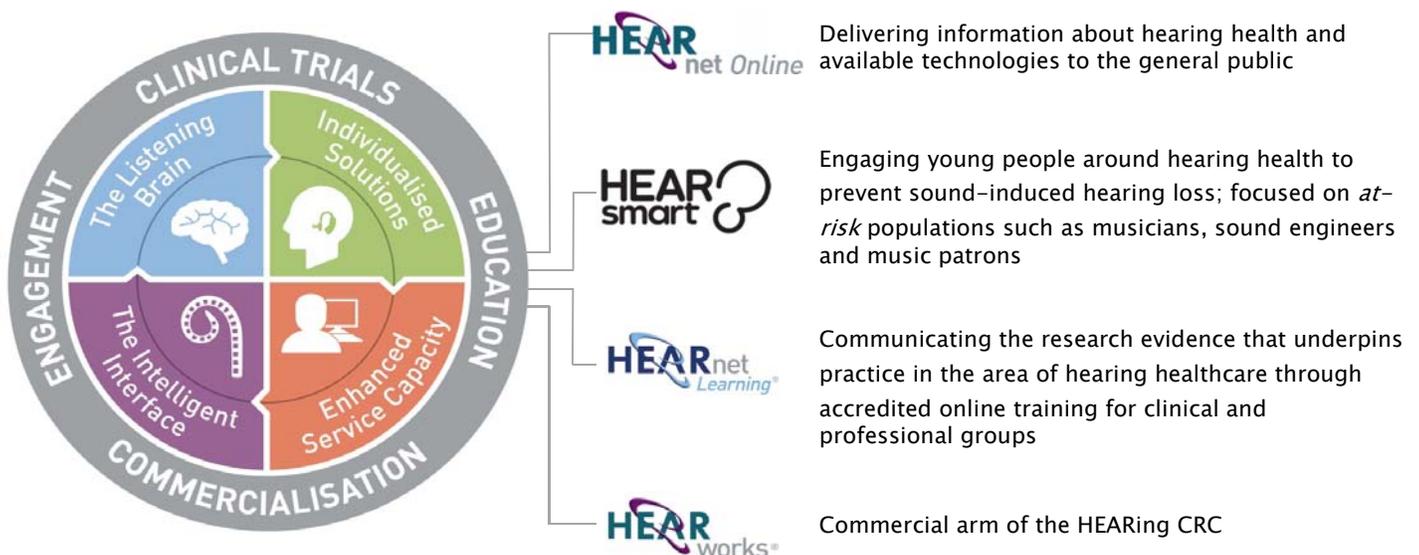
- Disability Prevention – intervention before irreversible degradation of the auditory system
- Integrated Intervention – though addressing both sensory and cognitive elements of hearing loss
- Patient-centric Model – tailoring of hearing healthcare services to individual needs
- Effective Outreach – enabling equally accessible, efficient, tailored healthcare services for all Australians of all ages regardless of their geographic location.

1.1 HEARing CRC Activities

Building on over two decades of internationally-competitive research and innovation, our work is driven by the end-user, for the end-user towards our new model of hearing health care. Activity is carried out across four core Themes:

- The Listening Brain
- The Intelligent Interface
- Individualised Solutions
- Enhanced Service Capacity.

Our research outcomes are translated into application through an integrated Commercialisation/Clinical Trials Program supported through HEARworks Pty Ltd®, our commercial arm. A strong focus is on implementation through initiatives aimed at the public (via HEARnet Online® and HEARsmart®), and professionals (via HEARnet Learning®).

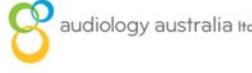


1.2 HEARing CRC Members

The HEARing CRC is a multidisciplinary collaboration of 21 Member organisations, each of which contributes specific expertise and infrastructure to the strategic program of activities. Members of the HEARing CRC are located in Melbourne, Sydney and Brisbane, and comprise a range of organisations with expertise in research and/or clinical service delivery to the hearing impaired.

Individual Members of the HEARing CRC bring specific infrastructure and/or capabilities necessary for our research and implementation, as well as in many cases being agencies directly servicing end-users of hearing healthcare technology or clinical services.

The Members of the HEARing CRC are shown in the following table.

Member logos include the National Acoustic Laboratories, a research division of Australian Hearing and the Sydney Cochlear Implant Clinic, now a service provided through the Royal Institute for Deaf and Blind Children.

In addition to the Member organisations, other Australian and international agencies and institutions are involved in research, educational or commercial activities on a project-by-project basis.

In particular, HEARing CRC has created a broadly-based clinical trials network incorporating both service providers of hearing aids and/or cochlear implants that enable multiple clinical studies to be conducted simultaneously. The further development of this clinical trials network through the HEARnet initiative is in line with strategies mapped out for growth in medical technology by the Innovation Growth Centre for Medical Technology and Pharmaceuticals (MTP Connect), and will be critical to Australia maintaining its international standing for cutting edge hearing healthcare research.

2. GOVERNANCE AND MANAGEMENT

2.1 HEARing CRC Board of Directors

The Board of Directors (the Board) is responsible for setting strategic goals and objectives, and oversight of the activities of the HEARing CRC, including Intellectual Property and commercial operations as managed through HEAR IP Pty Ltd and HEARworks Pty Ltd. The Board is accountable to the Commonwealth and the Members for the strategic planning, governance, management and control of the business and affairs of the Company.

The HEARing CRC Board comprises of:

- an independent Chair
- a nominee Director appointed from each of the five Essential Members (Australian Hearing, Cochlear Ltd, Macquarie University, Sivantos Pty Ltd, and The University of Melbourne)
- two or more independent Directors, and
- the Chief Executive Officer (CEO).

Each of the five nominee Directors has the right to appoint an Alternate. Nominee Directors are nominated by the Essential Members, whereas independent Directors and the Chair are elected by the Members, and may be re-elected/replaced every three years.

The Board and Management follow good corporate governance principles and practices as recommended by the Australian Securities Exchange (ASX), the Australian Charities and Not-for-profit Commission (ACNC) and the Australian Institute of Company Directors (AICD) guidelines.

The HEARing CRC operates under the terms and guiding doctrines of:

- its Constitution
- the Commonwealth Agreement: 'The Agreement between the Commonwealth of Australia and the HEARing CRC', and
- the Members' Agreement (between each of the individual Members and HEARing CRC Ltd): 'The Members' Agreement for the establishment and operation of the HEARing CRC'.

During 2015-16, the Board comprised the following Directors:



Richard Searby
AO, QC,
MA (Oxon),
Hon LLD (Deakin)

Chair

Resigned: 10/6/2016

Mr Searby was appointed as Chair of The HEARing CRC Limited in April 2007. He is a leading member of Australia's legal profession and has held a wide range of directorships of Australian and international corporations. Mr Searby is a Director of Times Newspapers Holdings Limited (wholly-owned subsidiary of The News Corporation Limited). He has advised the Australian government on various occasions and has drafted amendments to Australian and Victorian legislation. He was Chancellor of Deakin University from 1997 through 2005. Amongst a long list of corporate activity, he was a Director of News Corporation from 1979 to 1992, and Chair from 1981 to 1991, and a Director of Rio Tinto Ltd from 1977 to 1997. He was awarded the Order of Australia in 2006 for his services to education, as a contributor to the programs of major cultural institutions, business and the law.



Katherine Woodthorpe

Chair

BSc, PhD, GAICD,
FAICD, FTSE

Appointed: 10/6/2016

Dr Katherine Woodthorpe was appointed Chair of The HEARing CRC Limited in June 2016. Katherine has a strong track record of achieving outcomes in a range of technology-oriented industries, including medical devices and health services, and also a deep knowledge of private equity and the financial sector. In 2013, she was cited by the Australian Financial Review as one of the "100 Women of Influence" for her active roles in innovation.

Dr Woodthorpe is the Chair, Antarctic Climate & Ecosystems CRC; Chair, Fishburners Ltd; Director Sirtex Medical Ltd (ASX listed); Director, Deep Exploration Technologies CRC Ltd; Director, Capital Markets CRC Ltd; Director, Bioplatforms Australia Ltd; Director, Olivia Newton-John Cancer Research Institute Ltd; Director, Australian Renewable Energy Agency (ARENA); and Chair, People & Innovation Corporate Advisers Pty Ltd



Michele Allan
BSc, PhD,
GAICD, FAICD

Independent Director

Resigned: 1/7/2016

Dr Allan was appointed Director of The HEARing CRC Limited in December 2009. She holds a wide range of appointments, including Chair, Grains and Legumes Nutrition Council Limited; Director, Board of Innovation Australia; Director, Meat and Livestock Australia Board; Director, Grain Growers; Chancellor, Charles Sturt University; Chair, Apple and Pear Australia Limited; Member, CRC Program Advisory Committee; Director, Growth Centre Food & Agriculture; Chair, CSIRO Food & Nutrition Business Unit; and Director, Nuffield Australia.

Until 2008, Dr Allan was Chief Executive Officer and Managing Director of the listed food manufacturer and marketer Patties Foods. Prior to that role she was Group General Manager Risk and Sustainability for Amcor Limited. Dr Allan has held executive roles with Kraft Foods, Bonlac Foods Limited, ICI and Nestle. Dr Allan has a Bachelor of Applied Science from University of Technology Sydney, Master of Management of Technology from The University of Melbourne, Master Commercial Law Deakin University and Doctorate from RMIT. She is a graduate of the AICD and a Fellow.



Bill Davidson

Nominee Director –
Australian Hearing

Mr Davidson was appointed Director of The HEARing CRC Limited in October 2013. Mr Davidson is the Managing Director of Australian Hearing. Mr Davidson was formerly the CEO of Job Futures, a leading social enterprise committed to finding jobs for the more disadvantaged members of our community. Previously, he has operated at senior management levels in the Managed Services industry, both within the private and public sectors. He has extensive experience of the delivery of contracted, outsourced services both here in Australia, and also overseas in the UK, and South East Asia. Mr Davidson serves on the Board of CHOICE as Deputy Chair and as a member of the Audit and Risk Committee; a Director of Streetwise Publications Limited an Indigenous youth magazine; and Chair of Pat and Sticks Homemade Ice Cream Co.



Paul Guthrie
B. App. Sc.

Nominee Director –
Sivantos Pty Ltd

Mr Guthrie was appointed Director of The HEARing CRC Limited in February 2014. Mr Guthrie has extensive commercial and clinical experience in the healthcare sector. He has worked with Siemens Hearing Instruments and Sivantos Pty Ltd from 2008.

Mr Guthrie is a Director of Sivantos Pty Ltd.



Neville Mitchell
BComm, CA(SA)

Nominee Director –
Cochlear Ltd

Mr Mitchell was appointed Director of The HEARing CRC Limited in April 2007. Mr Mitchell has been CFO and Company Secretary of Cochlear Ltd since its listing in 1995, and was Cochlear's Financial Controller since joining the company in 1990. Mr Mitchell is Governor of the Warren Centre for Advanced Engineering, a member of the National Executive for the Group of 100 and a member of ASIC Accounting and Auditing Standing Committee. Mr Mitchell is a non-executive director of Osprey Medical Inc; and Expert Panel Member on NSW Government's Office for Health and Medical Research Medical Devices Fund.

Mr Mitchell was formerly a Senior Manager with KPMG in Johannesburg, South Africa.



Sakkie Pretorius
BSc, MSc, PhD

Nominee Director –
Macquarie University

Professor Pretorius was appointed Director of The HEARing CRC Limited in August 2013. He is Deputy Vice Chancellor and Vice President: Research at Macquarie University. Professor Pretorius began his career in South Africa and became the founding Director of South Africa's Institute for Wine Biotechnology. He conducted research into molecular yeast genetics in New York, Germany and Belgium. He is internationally recognised as a pioneer in molecular microbiology and biotechnology, and the translation of research outcomes to industry.

Professor Pretorius is a director of: Access Macquarie Limited; Australian Proteome Analysis Facility Ltd; Risk Frontiers Flood (Aust) Pty Ltd; Risk Frontiers Group Pty Ltd; Sydney Institute of Marine Science; and LAMS Foundation Limited.

Professor Pretorius was the Managing Director and CEO of the Australian Wine Research Institute and held the position of Deputy Vice-Chancellor and Vice President: Research and Innovation at the University of South Australia. Professor Pretorius holds adjunct professorships at the University of Adelaide and the University of British Columbia. Professor Pretorius is committed to academic excellence that creates value and opportunity for students, staff, industry and the wider community. He is highly interested in authentic leadership principles and has completed an executive leadership course at Harvard University in February 2013.



Field Rickards
BSc (Hons) MEd
(Manc), PhD

Nominee Director –
The University of
Melbourne

Professor Rickards was appointed Director of The HEARing CRC Limited in July 2014. Professor Rickards is Chair of Asia Education Foundation Board; Governor of the Deafness Foundation Victoria; Director of the Royal Children's Hospital Education Institute; and Director of the Bionics Institute.

Professor Rickards is the Dean of the Melbourne Graduate School of Education at The University of Melbourne, and served four years on the Academic Board. He was appointed to the Foundation Chair in Education of Hearing Impaired Children at The University of Melbourne in 1994. His research in the 1980s led to the commercial development of an automatic evoked response audiometer which can accurately measure hearing in infants.



Lisa Springer
BSc, PhD, GAICD

Independent Director

Dr Springer was appointed Director of The HEARing CRC Limited in December 2009. Dr Springer is currently the Principal of Maia Partners, an independent corporate advisory firm which assists biotechnology and medical device companies to outperform. She is a Director of Neuromodics Pty Ltd, Executive of Australian Aphasia Association, Consumer Representative of Cancer Australia, Consultant to Tipa Tinnitus and a member of the Commonwealth R&D Tax Concession Committee.

Dr Springer has significant investment banking and investment analysis experience and has also held a strategic role at Johnson and Johnson, a multinational pharmaceutical company. Dr Springer has raised several hundred million dollars and provided corporate and strategic advice for several Australian life sciences companies

enabling them to continue to develop their drug products and devices for the global market. She holds a PhD in physiology and molecular biology. She is a graduate member of the AICD.



Robert Cowan
BSc (Hons), MSc,
MBA, PhD(Melb),
DipAud, GrCert
HlthEcon, GrDip Tech
Mgt, FAudA (CCP),
GAICD, FICRA, FAAA

CEO HEARing CRC

Professor Cowan is CEO and Director of The HEARing CRC Limited and its associated companies HEARworks Pty Ltd and HEAR IP Pty Ltd. He is a Professorial Research Fellow at The University of Melbourne, and an Adjunct Professor at Macquarie University. He has published extensively in the fields of audiology, cochlear implants, and biomedical management, and holds a number of Australian and international technology patents and trademarks. He holds Fellowships in Audiology Australia, the International Collegium of Rehabilitative Audiology, and the American Academy of Audiology. In addition to academic qualifications, he is a Graduate Member of the Australian Institute of Company Directors.

Professor Cowan is a Director and Treasurer of Audiology Australia, and Chair of its Finance Audit and Risk Committee, and National Conference Committee. He is a Past President and an Executive Board Member of the International Society of Audiology. He serves on the Human Research Ethics Committee, Eye & Ear Hospital; Research Advisory Committee, The Shepherd Centre; HE-012 Technical Committee of Standards Australia; Advisory Board, The MARCS Institute, University of Western Sydney; and the Hearing Services Expert Reference Group.

Governing Board: Alternate directors

Director	Alternate
Field Rickards	Richard Dowell , Graeme Clark Chair in Audiology and Speech Science, The University of Melbourne
Bill Davidson	Harvey Dillon , Research Director, National Acoustic Laboratories (Australian Hearing)
Neville Mitchell	Jim Patrick , Chief Scientist, Cochlear Ltd
Sakkie Pretorius	Mark Wiggins , Professor of Organisational Psychology at Macquarie University David McAlpine , Professor of Hearing, Language and the Brain and Director of Hearing Research, Macquarie University
Paul Guthrie	Dominic Jenkins , Chief Financial Officer, Sivantos Pty Ltd

2.2 HEARing CRC Board's Committees and Groups

The Board has established two Committees to assist in fulfilling its duties.



Finance and Audit Committee

The Finance and Audit Committee assists the Board by providing oversight of the financial operations of the HEARing CRC and its associated companies. This Committee also oversees the relationship with the external auditor, and the process of identification and management of business, commercial and financial risks.

Membership includes Neville Mitchell (Chair) and Michele Allan. The third member of this committee was Mr Richard Searby, who upon retirement was replaced by Dr Katherine Woodthorpe. It is Company practice that the CEO and Chief Financial Officer (CFO) are in attendance for all meetings.



Nominations and Appointments Committee

The Nominations and Appointments Committee assists the Board by making recommendations on the appointment and remuneration of directors to the Boards of the HEARing CRC and HEARworks. If required, this Committee also assists in the appointment of a Chair, or CEO, and making recommendations on remuneration of these officers and other senior management.

Membership includes Paul Guthrie (Chair) and Lisa Springer. The third member of this committee was Mr Richard Searby, who upon retirement was replaced by Dr Katherine Woodthorpe. It is Company practice that the CEO is in attendance for all meetings.

In addition to its Committees, the Board has established three special groups to provide advice and assistance to the Board in its corporate, research and commercial activities.



Science Advisory Group / Key Scientists

The Science Advisory Group was established during the 2007-2014 term of the HEARing CRC to assist the Board and CEO in the annual review of research. During the HEARing CRC extension term (2014-19) the advisory group has been revised to include Key Scientists drawn from across the Member organisations, supplemented by a small number of additional Australian and international experts as required. This revised group meet on a regular basis to review of progress of individual projects against research milestones and implementation plans. It includes:

- Professor Dennis Burnham – MARCs Institute, Western Sydney University
- Professor Robert Cowan - The HEARing CRC
- Adjunct Professor Harvey Dillon - National Acoustic Laboratories (Australian Hearing)
- Professor Dimity Dorman AO – Hear and Say Centre
- Professor Richard Dowell - The University of Melbourne
- Professor Louise Hickson - The University of Queensland
- Professor Linda Hood – Vanderbilt University (International Expert)
- Professor Greg Leigh AO – Royal Institute for Deaf and Blind Children
- Associate Professor Catherine McMahon - Macquarie University
- Adjunct Professor Jim Patrick - Cochlear Ltd



Commercial Working Group

The Commercial Working Group was established during the 2007-2014 term of the HEARing CRC. It capitalises on the commercial knowledge and expertise of the HEARing CRC's independent Directors,

providing advice when requested on commercial and technology transfer strategy and plans. It includes:

- Dr Michele Allan – Director, HEARing CRC
- Ms Katarzyna D'Costa – IP and Commercial Officer, The HEARing CRC
- Professor Robert Cowan – CEO, The HEARing CRC/HEARworks (Chair)
- Adjunct Professor Harvey Dillon – Director, National Acoustic Laboratories (Australian Hearing)
- Dr Jenni Lightowlers – Partner, FAL Commercial Lawyers
- Mrs Lisa Norden – CFO, The HEARing CRC/HEARworks; and
- Dr Lisa Springer – Director, The HEARing CRC.



Members Group

The Members meet at least once per year for the Annual General Meeting. In addition, the Board has encouraged regular meetings of the Member organisations, in particular the Members not represented by a nominee Director to the Board. These meetings are intended to provide a forum for the Members to meet to identify needs and/or end-user issues for discussion with the Board and Management.

2.3 HEARing CRC Management Team

Day-to-day management of the HEARing CRC and its associated company HEARworks has been delegated to the CEO and through him, the Management team.



Chief Executive Officer and Director: Professor Robert Cowan

- **Background:** Bob has over 30 years of experience in leadership roles in the fields of audiology, cochlear implantation, and technology transfer and implementation.
- **Responsibilities:** Responsible to the Commonwealth and Governing Board for implementation and conduct of research, education, commercialisation and management programs.



Executive Assistant: Ms Amanda Campbell

- **Background:** Amanda holds a tertiary qualification in Psychology and Market Research and has over 15 years of experience in administration. Over the last 11 years, Amanda has focused on Personal / Executive assistant roles.
- **Responsibilities:** Direct support to the CEO, Board (as Secretary) and Committees as well as broad support to the Management team.



Chief Financial Officer and Company Secretary: Mrs Lisa Norden

- **Background:** Lisa has over 25 years of financial experience in industry and not-for-profit organisations. She has spent the last 16 years working with CRCs. Her qualifications include Certified Practising Accountant, Governance Institute of Australia Corporate Governance Graduate Diploma and Australian Institute of Company Directors Course Diploma.
- **Responsibilities:** Co-ordinating financial, statutory and operational activities. Preparation of all financial reports as required by the Commonwealth, Board, CEO and Program Leaders.



Communication and Education Manager: Dr Jane Sewell

- **Background:** Jane completed a PhD (Molecular Oncology), and has extensive experience in science communication/translation from work in research, commercial and government settings.
- **Responsibilities:** Overseeing the HEARing CRC's internal/external communication strategies; managing higher degree research student activities and more recently HEARsmart outreach.



Intellectual Property and Commercial Officer: Ms Katarzyna D'Costa

- **Background:** Kathy has 13 years of experience in academic biomedical research and early drug discovery. She holds a Bachelor of Science (Hons) degree and a Masters in Biotechnology and Business, and has also completed a Business Development Internship at The Walter and Eliza Hall Institute of Medical Research.
- **Responsibilities:** Administration of intellectual property (IP) and commercial registers, liaison with patent attorneys to manage patent strategies and maintenance.



Digital Assets and Marketing Manager: Mr Greg Lawrence

- **Background:** Greg has skills and experience from tertiary qualifications in multimedia, geology, environmental science and policy, along with more than 15 years of experience providing communication services to research-based organisations.
- **Responsibilities:** Management of the HEARing CRC's digital assets, marketing and promotional activities, including HEARnet online and HEARnet Learning and media liaison.

Research Project Coordinators: The Research Coordinators work with the Project Leaders and Key Scientists to ensure effective collaboration across projects, and within Member organisations.



- **Dr Isabelle Boisvert** (Macquarie University) is a research/clinical audiologist, and completed her PhD (Audiology) with The HEARing CRC.



- **Ms Pamela Jackson** (National Acoustic Laboratories) has tertiary qualifications in Business and Book Editing and Publishing, with many years administrative experience across a range of industries.



- **Dr Adrienne Paterson** (Melbourne) brings significant postdoctoral research and pharmaceutical industry experience to this role.



- **Dr Mehrnaz Shoushtarian** (Melbourne). From October 2015, Mehrnaz has acted in the role of a maternity leave replacement for Dr Paterson, and has extensive medical device research and technology development experience.

3. Research

The HEARing CRC is undertaking a program of research that addresses the twin challenges of **maximising lifetime hearing retention**, and **reducing productivity losses from hearing loss**, through improved remediation and better take-up of technology.

To address these challenges, the HEARing CRC has developed a new model of hearing healthcare and is conducting a coordinated program of research and innovation under four Themes – shown in the research wheel opposite. Within each theme, research is delivered and managed through a number of discrete projects, supported by a Clinical Trials network.

To support the implementation of a new model of hearing healthcare, a primary focus of the HEARing CRC is ensuring the translation of research into clinical application. To achieve this, we have Member organisations who together provide a significant subject pool for evidence-based clinical trials. This not only enables us to undertake studies evaluating a range of research and technology at the earliest stage, but also involves potential end-users in our activities. Additionally, our HEARnet Learning professional education platform enables us to disseminate findings to hearing healthcare professionals, driving implementation and use of new approaches, technologies and services.

The overall research project portfolio for each year of activities is regularly reviewed by the Board, and any changes are made based on advice or recommendations by management in consultation with the Key Scientists. The Board also considers any new information from Members and/or changes in the field, commercial or clinical environment that indicate either improved or decreased potential for the projects' application. This approach ensures that resources remain focused on projects with the most significant commercial potential and greatest overall end-user impact. Based on these strategies, a number of projects have been consolidated during the past year.



All projects have research ethics approved by an NHMRC accredited Animal Ethics Committees and/or a Human Research Ethics Committee. These committees abide by the terms of the NHMRC's Australian code for the care and use of animals for scientific purposes, 8th edition (2013) or the National Statement on Ethical Conduct in Human Research (2007)(Updated May 2015).

3.1 Research Theme 1: The Listening Brain

The Listening Brain is focused on developing new tools that will enable clinicians and teachers to accurately diagnose and target remediation to specific deficits, based on new insights into how the brain’s processing of sound is affected by hearing loss and auditory processing disorders (APD). Research is across three key projects:



1) Assessing the real-life impact of hearing disorders: focusing in particular on adults and elderly listeners, this project uses specialist infrastructure at the Australian Hearing Hub (AHH):

- the complex 3D environment simulator, one of only a few similar resources world-wide, specially designed to simulate actual noise environments; and
- the Magneto-encephalographic (MEG) imaging capabilities of the ARC Centre for Excellence in Cognitive and its Disorders, which features MEG units designed specifically for adults, children, and the world’s only unit designed for use with cochlear implant patients.

Research is investigating current laboratory-based assessment of hearing and device-benefit to ensure that it most accurately predicts real-life performance. Studies are focused on creating a more realistic acoustic environment in a controlled laboratory setting - a number of different acoustic environments have been recorded using specialist microphone technology, creating a library of environments for real-world simulation. These are being used as settings in which new hearing tests/tasks can be developed. These tests will be used to better assess the real-life benefits and performance of devices and new technology. They will also be used to enable more accurate assessment of “communication effort”, derivation of realistic speech levels and signal-to-noise ratios for tests. This work has also enabled development of more realistic speech test materials with environmental-specific behaviour such as redundancy and echo. Outcomes from this project are valuable in other CRC projects, and will also be useful for other research laboratories and more widely in the hearing industry.

Another area of research is aimed at developing a better understanding of how the brain responds to speech, opening up the potential to develop cortical measures that enhance the sensitivity of speech perception tests. This is important because the current hearing technology device “boom” is exceeding the assessment capability of existing speech perception tests. In turn this limits our ability to understand which factors are important in fitting new hearing devices.

Findings from these projects are helping to guide design of devices, sound coding and intervention therapies in Research Themes 2 and 3.

	Project title	Project Leader
XR1.1.1	Measurement of real-life impact of hearing disorders	Jorg Buchholz
XR1.1.3	Brain processes after intervention	Catherine McMahon

2) Auditory Processing Disorder (APD) and communication: the auditory nerve and brain stem transmit information from the cochlea (the organ of hearing) to the brain for processing; hearing problems resulting from this region are referred to Auditory Neuropathy Spectrum Disorders (ANSD) and are relatively common, with 1 in 7,000 children affected. Studies are investigating imaging techniques that can objectively evaluate the auditory nerve/brain stem to predict long term outcomes for babies newly diagnosed with ASND. As there are at least six different pathological mechanisms that can produce ANSD, a neuro-diagnostic tool would be beneficial for targeting remediation for this cohort.

The auditory cortex of the brain is responsible for auditory processing. Studies are aimed at investigating Auditory Processing Disorders (APD) to better understand variables that impact children’s phonological ability, reading development and comprehension skills (auditory processing is

thought to make a significant contribution to these skills). Because there are many interacting variables, studies are investigating APD in association with established predictors such as statistical learning (likely contributing to prosodic awareness – understanding stress and intonation in a language), attention (likely contributing to working memory) as well as oral language and word retrieval/rapid automatic naming.

Allied studies are investigating use of Magnetic Resonance Imaging (MRI) as a prognostic marker for speech and language outcomes. Data for this analysis has come from the LOCHI study conducted by the HEARing CRC and NAL, as well as utilising information from the Early Language in Victoria Study (ELVS) and VicChild studies managed through the Murdoch Childrens Research Institute.

Previous HEARing CRC brain-based research in subjects experiencing tinnitus found only a weak association between an objective clinical measure (alpha power oscillations) and reported tinnitus. This measure was not sensitive enough to be used as a clinical tool and this approach will not be pursued further.

Findings from all of these studies will drive the optimisation of diagnosis, fitting and remediation, these novel approaches will be trialled in Research Theme 3.

	Project title	Project Leader
XR1.2.1	Methods for identifying and diagnosing hearing disorders in children	Mridula Sharma
XR1.2.2	Developing a neurodiagnostic technique for children with ANSD	Gary Rance
XR1.2.3	Development of a clinical objective measure of tinnitus perception (no further work on this project)	Catherine McMahon

3) Hearing loss and language development in infants and children: many children with hearing loss exhibit delays in language during preschool years, despite early detection of hearing loss (through universal newborn screening programs), and where appropriate, early provision of amplification and/or intervention. Using specialised facilities at the MARCS Baby Lab (Western Sydney University) and the AHH, the early precursors of linguistic development are being investigated by studies evaluating:

- how speech, language and literacy abilities of hearing-impaired children change over time as the child develops, and what brain mechanisms underlie;
- what factors in infancy influence language development, and how hearing-impaired children (who are more likely to develop poor language skills) can be detected as early as possible; and
- how the brain reacts to and uses input supplied by hearing aids and cochlear implants.

Longitudinal and cross-sectional studies are being used to identify subjective (e.g. parent reports on infant vocal production) and objective (e.g. electrophysiological responses) approaches to predicting future speech perception and language abilities in infants. This includes identifying the components of infant-directed speech that impact on early language development in hearing impaired infants. This data will underpin intervention programs, for example those focused on supporting parent-infant interactions to optimise linguistic input.

There are a number of individual studies also contributing to knowledge in this Theme:

- The Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study is a continuation of a world-first study that is systematically following a cohort of over 400 hearing-impaired children from first identification of a hearing deficit shortly after birth through to adulthood. To date, large scale data collection from five year olds has confirmed the advantages of early cochlear implant fitting; it has also identified the impact of hearing loss on phonological awareness as a key challenge. Data collection and analysis for seven year olds is now underway.
- The Children with Unilateral Hearing Loss (CUHL) study investigates whether the fitting of a hearing device can improve outcomes for children with single-sided hearing loss
- The Infant Discrimination and Early Acquisition of Language (IDEAL) study focuses on hearing impaired children's ability to extract information from the sound signals they receive. This is an

essential skill that underpins spoken language development in typically developing children. The early phase of the study with normally-hearing children is complete and data is currently being assessed; 150 hearing-impaired children are now being recruited to the study that will run across two sites in Victoria and New South Wales over the next four years. We hope to use this study to develop a tool that can determine an impaired child's ability to extract information from sound signals, such that a clinician can determine whether the child would be likely to benefit more from cochlear implantation or hearing-aid amplification.

	Project title	Project Leader
XR1.3.1	Longitudinal outcomes of children and neuroimaging studies: <i>1.3.1a – LOCHI continuation</i> <i>1.3.1c – Child language imaging study</i> <i>1.3.1d – Long-term phonological and reading outcomes</i>	Teresa Ching Angela Morgan Shani Dettman
XR1.3.2	Seeds of language development: <i>1.3.2a – Early auditory speech discrimination as predictor of language of hearing impaired infants</i> <i>1.3.2b – Development of hearing impaired infants speech perception and vocalisation over the first three years of life</i> <i>1.3.2c – Perception and production of grammatical morphemes by children with hearing aids and/or cochlear implants</i> <i>1.3.2d – Influence of maternal education on spoken language development</i>	Teresa Ching Denis Burnham Katherine Demuth Teresa Ching
XR1.3.3	Children with unilateral hearing loss	Teresa Ching

3.2 Research Theme 2: The Intelligent Interface

The Intelligent Interface is focused on improving hearing in noisy environments and overcoming the need for manual adjustment of device settings. Outcomes from this research will be applied through our commercial partners in next-generation hearing aids and cochlear implants with enhanced performance in background noise, as well as special processing for those with single-sided hearing loss or tonal language speakers. A key focus of this research is to address enhanced manufacturability of new approaches in technology.



Research is being carried out across three key projects:

- 1) **Intelligent signal processing:** there are several projects investigating signal processing with the aim of improving specific listening conditions, these include:
 - noisy environments - to reduce the concentration required of end-users: our bilateral sound coding scheme (algorithm Hush3, the next generation of the super-directional beamformer) seeks to optimise speech perception and spatial awareness for people with cochlear implants and hearing aids. Research is also investigating application in hearing protection devices.
 - pitch perception for music and tonal languages: a new sound processing strategy called Optimised Pitch and Language (OPAL, previously named Enhanced Tone or eTone) has been specifically designed to enhance the perception of tonal language, and is currently being implemented in Cochlear Ltd's clinical processor for specific clinical trials in Melbourne. If successful, these will be expanded to China and Hong Kong.

Previous research by the HEARing CRC has developed 'trainability', an approach that is widely used and allows hearing devices to automatically adapt processing to their acoustic environment - having been 'trained' by the individual user about their preferred settings. In collaboration with industry Members, our ultimate goal is to include trainability of our super-directional beamformer (Hush3), to deliver near-normal speech understanding in noise and more accurate localisation of sound. This has application in hearing aids, cochlear implants and hearing protection technology and will be further developed under the Clinical Trials and Commercialisation program.

	Project title	Project Leader
XR2.1.1	Super-directional and spatial preserving hearing aids and cochlear implants	Richard van Hoesel
XR2.1.2	Pitch and inter-aural time-preserving implants	Andrew Vandali

- 2) **Electroneural interface:** focusing on the interface between implanted technology and the auditory nervous system, this project is investigating the feasibility of using new materials and automated manufacturing processes to: (i) produce electrodes with increased capacity and reliability; (ii) reduce power usage; and (iii) increase precision of electrical current distribution in the cochlea.

A cross disciplinary project employing specialist skills and infrastructure from Cochlear Ltd, The University of Melbourne and the ARC Centre of Excellence for Electromaterials Science is investigating how to improve cochlear implant electrodes that have a better combination of biocompatibility, impedance, stability, electrode decomposition and manufacturability. In partnership with this work, research is investigating ways to reduce 'leakage' of current between electrode and neurons, target a smaller number of neurons with each electrode and reduce electrode failures. A key area of interest at present relates to protein build up or 'fouling' on the electrode surface. While on one hand this seems to protect the electrode surface from corrosion – it increases electrical impedance, meaning that more voltage (and therefore power from the

cochlear implant unit) is required to deliver the same amount of charge to stimulate neurons. These projects work closely with Cochlear Ltd's electrode design and development team.

	Project title	Project Leader
XR2.2.1	Innovative electrode and array manufacture	Alex Harris
XR2.2.2	Interface optimisation and assessment	Carrie Newbold

3) Hearing preservation in implant users: patients with a partial hearing loss can benefit from a cochlear implant across sound frequencies they can no longer hear, enabling them to combine electric and acoustic hearing. However there is a risk that the process of cochlear implantation can result in loss of that existing (also called residual) hearing. A number of projects are developing and trialling new designs of cochlear implant electrode arrays designed to maximise retention of residual hearing by: minimising insertion trauma, providing real-time feedback on insertion to guide surgeons, and eluting pharmacological agents to reduce the degree of inflammation associated with insertion.

A first-time-in-human study of a drug-elution electrode developed by the HEARing CRC (2007–2014) has shown significant benefit to cochlear implant electrical performance. The electrode was designed to release a small concentration of anti-inflammatory agent directly into the cochlear environment from the surface of the electrode array, thereby minimising inflammation and tissue growth post-implantation. Results showed reduced impedance – a measure of electron flow from electrode to neurone - thereby reducing demand for power from the cochlear implant unit and improving battery life. A second study in this project has evaluated a slimmer cochlear implant electrode, designed to minimise trauma on insertion. This design has had controlled market release in Europe and USA during this reporting period.

Based on the feasibility of drug-delivery into the cochlear environment, we are investigating delivery of molecules that appear to prevent hair cell death as a means of reducing or preventing post-implantation loss of residual hearing. Underpinning this application is biomedical research that investigates the basic processes involved with loss of hearing (hair) cells in age-related hearing loss. Recent findings have provided proof of principal that hair cell death can be prevented by blocking programmed death pathways (apoptosis) in these cells.

	Project title	Project Leader
XR2.3.1	Hearing preservation electrode design	Rob Briggs
XR2.3.2	Delivery systems for molecular therapeutics	Rachel Burt

3.3 Research Theme 3: Individualised Solutions

Individualised Solutions focuses on fostering a patient-centric approach to hearing healthcare through development of evidence-based guidelines for candidature, fitting and rehabilitation. These guidelines will enable clinicians to match technology and services to identified individual needs, optimising outcomes for the user as well as increasing overall cost-effectiveness.



Research is being carried out across three key projects:

1) Optimising candidacy: the advent of new hearing technologies and approaches (including cochlear implants, combination electroacoustic devices, middle-ear devices, acoustic and bone-anchored hearing aids) means that recommending the best technology for an individual client has become increasingly complex. To better understand which clients are best suited to each of the different devices and intervention approaches, we are analysing existing patient data to provide an evidence base for unilateral and bilateral device fitting for children, adults and the elderly. From this data, we will be able to develop clinical tools or processes for clinicians (that can be updated as new information is collected) to assist in decision making. This will be extended to look at which patients would benefit from trainable devices and how they can be best supported during the training process.

Appropriate provision of hearing healthcare to our ageing population is a growing area of need. We are investigating approaches that can support increased numbers of clients, as well as investigating how to identify, pre-fitting, whether elderly hearing aid wearers would optimally benefit from one or two devices.

	Project title	Project Leader
XR3.1.1	Determining candidacy for different types of hearing devices	Isabelle Boisvert
XR3.1.2	An evidence-based clinical guideline for selecting and managing candidates for trainable devices	Els Walraven
XR3.1.3	An evidence-based strategy for providing amplified sound to one or two ears	Helen Glyde

2) Individualised fitting of devices: based on insights from Research Theme 1, this project is determining the most effective fitting methods for fitting of:

- combinations of hearing devices (e.g. electroacoustic, trainable, bilateral)
- devices for use in different acoustic settings
- infants and patients not able to cooperate (e.g. those with additional disabilities or advanced cognitive decline).

In the current environment, clinicians prescribe electroacoustic stimulation for their clients, either through a cochlear implant and hearing aid used in opposite ears (the bimodal solution) and/or a cochlear implant and hearing aid used together in the same ear (the hybrid solution). Our research is addressing how these devices should be fitted to the same or opposite ears to best suit individual users. A module on study findings has been developed and released through HEARnet Learning, accredited by Audiology Australia.

To assist hearing in noise, we are investigating how to control and prescribe directional characteristics of microphones, and how these should be adjusted for different users and different listening situations. Under this project, collaborative studies with Sivantos Pty Ltd are investigating user preferences for microphone characteristics, including directional microphones, and user acceptability.

The prescription and fitting of devices to infants is challenging, in particular for those infants with auditory processing and additional disabilities. Developing use of cortical auditory evoked potentials (CAEPs) for use in cochlear implant mapping and fitting for infants is a promising approach to this problem, which would also be applicable to elderly adults with cognitive decline.

A key element of the project is investigating how the functioning of hearing aids can be adjusted over time to best complement differing cognitive and hearing abilities of their users as they age.

	Project title	Project Leader
XR3.2.1	Determining candidacy for different types of hearing devices (this project has been merged with Project xR1.1.1)	Gitte Keidser
XR3.2.2	Controlling and prescribing directional characteristics in hearing devices	Jorge Mejia
XR3.2.3	Adjusting cochlear implants for infants and adults with cognitive decline	Bram Van Dun
XR3.2.4	Prescribing electroacoustic stimulation	Paola Incerti
XR3.2.5	Prescribing for children with ANSD	Kirsty Gardner-Berry

3) Individualised therapies: focusing on developing guidelines and tools for novel “patient- and family-centric” approaches to (re)habilitation of language and literacy deficits.

Development of best-practice guidelines for implementing patient-centred hearing healthcare for adults and children is a key activity in this area. We are also comparing the effectiveness of researcher-led versus parent-led interventions - results to date suggest that parent-led interventions can be more beneficial. This work is being carried out in tandem with research investigating how parent-led intervention may be best supported and structured through use of digital technology tools.

Improving speech perception in children with Auditory Processing Disorders (APD) is being targeted by developing deficit-specific remediation of temporal auditory processing deficits, literacy difficulties and cognitive skills. We are trialling a computer-based auditory training program based on an adapted version of OPAL that specifically targets patterning and musical discrimination for children with APD. If successful, this could be made available as an online tool with associated clinical guidelines. Cognitive decline and APD in adults has received little attention to date, we are working to identify targets for remediation that might slow down the degeneration of cognitive skills in this age group.

A different type of instrument has been developed in the Functional Listening Index (FLI), a tool that has recently been licenced to Cochlear Ltd to enable clinicians to measure functional hearing outcomes of patients with hearing loss. The FLI includes a checklist of questions, a database of de-identified aggregated results from hearing and hearing impaired persons, and a methodology to benchmark a patient’s performance against a normative curve.

The models developed through this project will be trialled in Research Theme 4 through e-health applications.

	Project title	Project Leader
XR3.3.1	Therapies to improve language and literacy in hearing-impaired children <i>3.3.1a – Phonological awareness training at age four years</i> <i>3.3.1c – LENA applications</i>	Megan Gilliver Dawn Choo
XR3.3.2	Therapies to improve speech perception in children with auditory processing disorder	Dani Tomlin
XR3.3.3	Therapies to improve speech perception in elderly adults with auditory processing disorders	Chris Davis
XR3.3.4	Therapies to improve speech perception in cochlear implant patients	Aleisha Davies
XR3.3.5	Developing best-practice guidelines for implementing patient-centred hearing healthcare for older adults	Caitlin Barr

3.4 Research Theme 4: Enhanced Service Capacity



Enhanced Service Capacity focuses on delivering new models of hearing e-healthcare to:

- ensure equal access for regional/rural/remote client populations;
- provide career support and training for non-urban based hearing healthcare professionals;
- engage end-users in managing their hearing protection and remediation; and
- promote lifelong healthy hearing habits to at-risk groups.

Research is being carried out across three key projects:

1) Enabling equal access: developing a validated e-Health package that reflects best-practice patient-led / family-centred interventions/early interventions, and incorporates home-based or remote assessment, mapping and (re)habilitation of clients.

Remote approaches are being assessed in comparison to traditional “clinician in person” delivery to provide an evidence base for government authorities and end-user agencies responsible for implementation. Ultimately this will deliver comprehensive procedural guidelines for long-term audiology care delivered through an e-Health model.

To support this work, three sub-projects are aimed at:

- development of an interactive, online version of a widely used Infant Monitoring of Vocal Production (IMP) tool as a clinical assessment instrument and also for parent education;
- assessing e-health applications in a dedicated facility at the Royal Institute for Deaf and Blind Children; and
- developing an on-line assessment tool that can be used to assess speech discrimination.

	Project title	Project Leader
XR4.1.1	(a) Improving hearing healthcare access and outcomes for adults and children	Carly Meyer / Monique Waite
XR4.1.2	<i>Telehealth package for remote assessment of the clinical population with hearing loss</i> <i>XR4.1.2a – Infant Monitor of Vocal Production (IMP) on-line version and training for professionals</i> <i>XR4.1.2b – Early intervention for children with hearing loss: comparison of telepractice and in person settings</i> <i>XR4.1.2c – Development of on-line assessment of speech discrimination</i>	Greg Leigh Robyn Cattle Moore Melissa McCarthy Colleen Psarros
XR4.1.4	Telehealth clinician support and education (work in this Project merged into development of HEARnet Learning)	Catherine McMahon

2) Empowering users: focusing on how to best empower individuals (and their families) in managing their own hearing loss. We are working to establish the advantages of a fully automated self-fitted hearing aid that eliminates any dependency on internet linkages or computer-based interfaces, information that will be critical in providing evidence for government authorities and end-users. Research extends to situations where self-fitting hearing aids should be complimented by teleaudiology/telemedicine with the aim of identifying opportunities to reduce costs associated with the provision of hearing services.

	Project title	Project Leader
XR4.2.1	The place of self-fitting hearing aids in hearing rehabilitation	Elizabeth Convery

3) Novel approaches to hearing loss prevention: this project builds on findings from hearing loss prevention research in the HEARing CRC (2007-2014). Some of this activity has been carried out in association with the Young and Well CRC looking at best practice in engaging “young people” in safe listening behaviours to promote hearing health and prevent hearing loss and tinnitus.

In November 2014, the HEARing CRC launched a new initiative called HEARsmart (further information under section 5). HEARsmart provides an ongoing umbrella for campaigns targeted at *at-risk* populations, in particular young people (18-35) interested in music. Activities include the popular Know Your Noise (KYN) website that delivers an online and interactive lifetime-noise-risk-exposure-calculator to help individuals better understand personal risk and strategies to reduce risk. An independent review of filtered earplugs has recently begun to facilitate user selection – this will be developed as a unique ‘choice-style’ review that will be directly promoted to live music patrons. An iPhone app ‘Sound Log’ to measure and track sound exposure has been released to the iTunes stores during the reporting period (<https://itunes.apple.com/us/app/id1063941394>).

With grants funding from the Deafness Foundation Victoria, a Live Music Venue Study is also ongoing with three venues in Melbourne to consider different approaches to minimising sound doses over the course of an evening without impacting patron enjoyment. Work is being undertaken with sound engineers who work in the live music space to investigate their hearing and introduce them to decibel banking as another approach to managing sound doses in live music venues.

Relationships have been developed with Music Victoria and Live Performance Australia to help influence the responsible service of sound at live music venues in the future.

	Project title	Project Leader
XR4.3.1	Early indicators of noise injury	Elizabeth Beach
XR4.3.2	HEARSmart- Noise prevention outreach	Jane Sewell / Elizabeth Beach

4. Research translation: Commercialisation

The HEARing CRC has developed a number of different approaches to ensure that the outcomes of our research are translated into uptake and use by our broad array of end-users.

Every HEARing CRC research project must consider the likely benefit of the research to each of our end-users, and detail this in a Utilisation Strategy. This strategy must also consider how to best translate and deliver that information for the end-user to maximise its impact. There are two key approaches to this, which often work hand-in-hand to achieve best possible outcomes:

- Commercialisation – detailed below;
- Dissemination and implementation, focused on communication and education activities – detailed in section 5 of this report.

Utilisation Strategies are reviewed regularly by the Board of Directors and commercial aspects may include product development or upgrade as well as development of new technologies. In most cases, commercialisation is anticipated through commercial arrangements with industry Members directly involved as project participants. Distribution occurs via:

- direct sales and licensing through our commercial arm, HEARworks Pty Ltd (some innovations are provided under pre-agreed licences to Cochlear Ltd or to Sivantos Pty Ltd);
- partnership with our Members (e.g. Australian Hearing) in joint activities; or
- the involvement of third parties (e.g. Frye Electronics Inc).

Engagement of end-user organisations that are described as Small to Medium Enterprises (SMEs) is another important element of activity in this area. In the hearing healthcare field, SMEs include not only small industry firms that licence technology, but also the audiology service providers, audiologists and companies, many of which are small businesses providing clinical services to adults and children throughout Australia. Through HEARnet Online and HEARnet Learning, we are ensuring that these small businesses are made aware of research outcomes that can improve their clinical practice and so ultimately benefit the end-user.

HEARworks Pty Ltd
ABN 37 089 900 676



HEARworks Pty Ltd operates under a Management Deed and Trust Deed with the HEARing CRC Ltd and its Members. It is a proprietary company limited by shares, created by the Members, for the purposes of acting as Trustee for intellectual property and is responsible for implementing and managing commercial activities and application of technology on behalf of the HEARing CRC

Commercialising research outcomes enables CRC innovations to be delivered to people who need them most – this includes tools for researchers and clinicians, as well as devices for clients.

Recently HEARworks has launched a website (www.hearworks.com.au) to market smaller digital technologies that can be sold via secure purchases providing instant access to downloadable products. It has also enabled greater visibility of technologies available from the HEARing CRC. HEARworks is currently developing its activity as a service provider for clinical trials and contract research, the online interface is central to developing these activities for commercial gain.

4.1 Testing our Research – Clinical Trials and Commercial Activities

The Clinical Trials/Commercialisation activity of the HEARing CRC is in effect managed as a fifth Theme, viewed as a critical component of many utilisation strategies. In this area technologies and outcomes developed in our research projects (across the R1 to R4 themes) can be tested in a clinical setting or further developed for commercial application.

The Clinical Trials and Commercialisation Theme relies heavily on the platforms and infrastructure accessible through the HEARing CRC and its Members. These include:

- an international clinical trials network creating a large pool of paediatric and adult subjects with different degrees of hearing loss and using different hearing technologies/devices;
- a unique Magnetoencephalographic (MEG) imaging unit designed for use with cochlear implant patients;
- 2D and 3D acoustic spaces that can be used to reproduce and evaluate real-world sound environments - valuable in psychoacoustics, audiology and hearing aid work;
- an array of sound-treated rooms and a large anechoic chamber for spatial awareness testing; and
- microfocus radiographic imaging and fluorescence Magnetic Resonance Imaging (fMRI) capabilities for real-time imaging.

Current activities include:

1) **Clinical trials and product validation:** this includes clinical trial studies arising from the projects undertaken in research Themes 1 to 4, as well as technology development studies identified as collaborative projects with Cochlear Ltd. To ensure that cochlear implant research is end-user focused, a strong link has been established with Cochlear Ltd's Product Technology and Development Department and with the communication teams responsible for global guidelines and clinical recommendations. New cochlear implant devices, sound coding strategies, algorithms, programming approaches and electrode designs are evaluated and tested using the HEARing CRC's clinical resources and expertise. These studies involve small group, first-time-in-human trials. For example, work is ongoing with the development of a novel prescription procedure for hybrid devices incorporating both acoustic and electric hearing in the same ear. In addition, a novel approach to preserving residual hearing was reported during this period using elution of Active Pharmaceutical Ingredients (APIs) from the silicone matrix in the intra-cochlea electrode of a cochlear implant. This approach potentially offers a simple and effective method for servicing the inner ear with anti-inflammatory agents such as Dexamethasone, and appears to be effective in mediating electrode insertion trauma, possibly aiding preservation of residual acoustic hearing in implant recipients.

2) **HEARLab technology development:** a clinical need has long been identified for an objective procedure to assess hearing and to fit hearing devices to infants and elderly patients who cannot respond verbally. In collaboration with the National Acoustic Laboratories (NAL), the HEARing CRC (2007-2014) developed the multi award winning HEARLab, a PC-based audiological testing platform to which testing modules can be deployed as software. It has been licenced to US-based Frye Electronics Inc. for production and distribution, and is used clinically across Australia, Europe and the USA to perform Aided Cortical Assessments. Two additional HEARLab modules are currently under development to expand the functionality of HEARLab. Once complete, these will be available to deploy in the existing hardware; the new modules include:

- Auditory Brainstem Response (ABR) module: to record auditory brain stem responses. Work on this has focused primarily on de-bugging the completed software during the reporting period;
- Cortical Automated Threshold Estimation (CATE): to record cortical thresholds and produce an audiogram. The software will enable fast and accurate threshold estimation including use of complex tones as stimuli, randomised inter-stimulus intervals, randomised test ear, automatic response detection and adaptive level change. Data has been collected for 20 normal-hearing and 27 hearing impaired subjects and results are showing a good agreement between the hearing

thresholds obtained behaviourally (i.e. current clinical practice) and those obtained objectively using the newly developed automatic detection algorithm. This work is largely funded through a NSW Medical Device Fund Grant.

3) **Applications of binaural signal processing:** trainability was a technology developed by the HEARing CRC (2007-2014) that has been already licenced to Sivantos Pty Ltd and Cochlear Ltd. To further advance this technology, the HEARing CRC is now integrating trainability with directionality – incorporating the super-directional beamformer signal processing algorithm. The beamformer is an innovative mathematical formula developed through the HEARing CRC (2007-2014) that combines sound recorded by microphones on either side of the user’s head (mounted discreetly on the hearing device’s earpiece). The approach is not in itself unusual, but the formula is, as it successfully reduces unwanted noise and creates what’s known as a “super-directional output” for the listener. It has been integrated into a second generation trainable hearing aid research platform as well as cochlear implant technology and a hearing protection device. The hearing aid and cochlear implant platforms have both shown benefit from introduction of the beamformer.

Further improvements to the beamformer/trainability algorithms, developed during the reporting period, have improved signal quality and led to better preservation of spatial cues for the listener (e.g. being able to determine the direction sound is originating from). These benefits have been particularly helpful in social listening conditions in which talker location often varies dynamically. In everyday listening conditions, 30 hearing-impaired participants rated the improvement with the beamformer compared to traditional directional microphones as having the same effect as lowering the noise level by roughly 5dB (it is worth noting that dB is a logarithmic scale, for every 3dB reduction the sound energy is halved).

4) **Hearing loss prevention:** a novel Speech Reference Limiting (SRL) application was developed by the HEARing CRC (2007-2014) that controls the loudness of unwanted incoming signals. This has demonstrated significant potential to improve the comfort, safety and intelligibility of acoustic headsets and other listening devices. This technology has been patented internationally and efforts are currently focused on securing a licensee.

	Project title	Project Leader
XC1	Clinical Trials and Product Validation	Kerrie Plant
XC3	HEARLab Technology Development	Teck Loi
XC4	Applications of Binaural Signal Processing	Jorge Mejia / Richard Van Hoesel
XC5	Hearing Loss Prevention Technology Developments	Michael Fisher

4.2 Protecting and Applying our Research

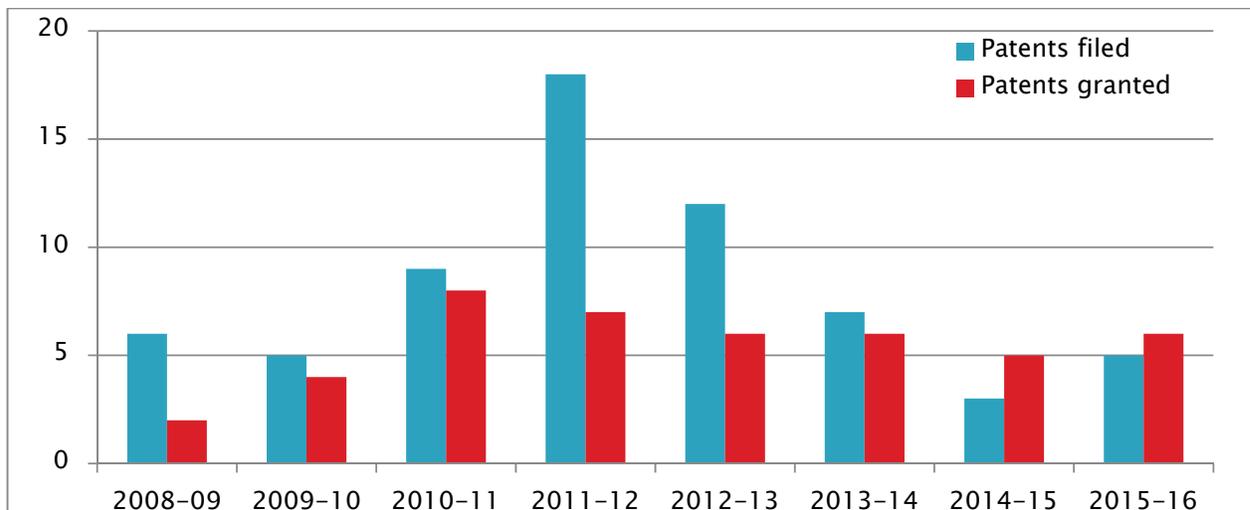
The HEARing CRC is focused on achieving maximum value and impact from the translation and application of its Intellectual Property (IP) into commercial and/or clinical use.

The HEARing CRC follows the National Principles of IP Management for Publicly Funded Research as promulgated by the Australian Research Centre and IP Australia. To ensure adherence to these principles, the Management team and Project Leaders work closely with our legal advisors and patent attorneys to ensure freedom to operate for all research projects, and to provide advice on IP management, patent prosecution and patenting strategy.

4.2.1 Patents

The HEARing CRC Members' Agreement clearly outlines the ownership of IP, rights of application and the procedures and processes for sharing of economic returns with the Members and the HEARing CRC. Commercial application of all CRC IP is managed through HEARworks Pty Ltd.

The following table shows the number of patents granted and filed during the HEARing CRC (2007-14) and its extension period (2014 to date). In 2015-16, the number of patents filed and granted is consistent with the HEARing CRC's position in the business cycle, with the entry of Patent Cooperation Treaty into the national phase.



IP protection is maintained by HEAR IP Pty Ltd (the Trustee of the HEARing CRC IP Trust) for the following innovations:

- Speech referenced limiting (SRL) - A method and system for controlling potentially harmful signals in a signal arranged to convey speech
- Precedence effect - A method and system for enhancing the intelligibility of sounds
- Tuneable direction - A system and method for estimating the direction of arrival of a sound
- Occlusion reduction - Acoustically transparent occlusion reduction system and method
- OPAL – Optimised Pitch and Language sound processor and system (previously eTone)
- Bilateral beamformer - A system and method for producing a directional output signal
- Active low pass electrode - A signal processing device for use in electroencephalography and a cable system incorporating the device
- MinP - Systems and methods for reducing unwanted sounds in signals received from an arrangement of microphones
- Thick Film - Fabrication method for flexible thick film electrode array for cochlear implants
- Hush – A noise reduction method and system

- Bards tones – Efficient objective measurement of frequency-specific hearing thresholds by evoked cortical responses.

IP protection is maintained by HEARworks Pty Ltd (the Trustee for the CRC HEAR IP Trust) for the following innovations:

- Sound exposure - A method and system for reproducing an audio signal
- Shriek rejection - Digital signal processing system and method for a telephony interface apparatus
- Frequency transposition - Apparatus and method for frequency transposition in hearing aids
- Implantable sensor - Implantable acoustic sensor
- Tone perception - Modulation depth enhancement for tone perception
- TESM - Emphasis of short-duration transient speech features
- Contour electrodes - Control of shape of an implantable electrode array
- Pitch perception - Pitch perception in an auditory prosthesis
- HEF - Harmonic emphasis filterbank (selective resolution speech processing)
- PDT - A peak-derived timing stimulation strategy for a multi-channel cochlear implant
- ADRO - Adaptive dynamic range optimisation sound processor
- Trainable hearing aid - Programmable auditory prosthesis with trainable automatic adaptation to acoustic conditions

4.2.2 Trademarks

In addition to the registered IP as defined in patents, the HEARing CRC holds a number of trademarks and design registrations in regards to its activities and products, including:

- HEARing CRC®
- HEARLab®
- Di-EL® Early Language
- HEARnet®
- HEARnet Learning®
- eHEAR®
- Sound Value®
- HEARworks Shriek Rejection®
- HEARhelp®
- HEARsmart®.

As a general strategy, trademarks are filed in Australia. Trademarks have been granted for HEARnet in Europe and HEARsmart in the USA.

4.2.3 Licences

Translating our research into clinical practice often involves licencing to our Industry Members or third parties for application in their technology platforms. Royalty revenues from licencing are reinvested in HEARing CRC research, enabling additional research and educational activities to be conducted, and providing funding for specialist infrastructure such as the MEG and 3D environment installed at the Australian Hearing Hub.

License arrangements issued in the 2015-16 year are outlined in the following table:

Technology	Licensee	Item/Status
Computer-Aided Speech and Language Assessment (CASALA) software	Multiple individual and group licencees	Licence fee
HEARLab and NAL-ACA ABR module	Frye Electronics Inc	Royalty from licence
NAL-NL1 & NL2	Multiple licenseees	Licence fee
Speech tests used in LiSN-S	NAL – Phonak AG	Royalty from licence
Trainable Hearing Aid	Sivantos Pty Ltd	Royalty from licence
Functional Listening Index	Cochlear Ltd	Licence Fee

5. Research translation: Communication and education for dissemination and implementation

Section 4 of this report considered research translation through commercial activities to drive uptake and use, primarily through industry groups. Our end-users are more diverse than this however, also including:

- the research community
- patients and the public
- hearing health professionals / clinicians
- not-for-profit organisations, and government.

Hand-in-hand with our commercial activities, the HEARing CRC is driving broader dissemination and implementation of all of our research findings through wide-ranging communication, engagement and education activities. These activities are essential to achieve the greatest impact from our research outcomes, and are often used to affect attitudinal or behavioural change so the 'best practices' determined by our research, as well as new innovative technologies, can be appropriately adopted. For example, altering clinical/referral practices for audiologists and general practitioners, or uptake of safe hearing practices for young people.

Our approach is tailored to deliver key information and messages from our research to our different end-users, and it also recognises that appropriate channels are needed for each end-user group – this is to ensure the most effective dissemination and implementation of knowledge and information generated by the HEARing CRC. While there is an increasing focus on digital communications, more traditional communication activities remain a cornerstone of the CRC's activity in this space.

5.1 Research community

For researchers to communicate their research findings with peers, conference presentations and invited keynote addresses at Australian and international scientific meetings are essential, as too are publication of peer-reviewed journal articles and conference proceedings. During this reporting period the HEARing CRC recorded 66 peer-reviewed publications and 102 oral or poster presentations at national and international conferences, many invited.

Contribution to special supplements of Journals is also valuable. In June 2016, the International Journal of Audiology released a special supplement, sponsored by the HEARing CRC, focused on cochlear implantation with a series of articles reporting on how evidence-based clinical decisions optimise patient outcomes.

Dependant on the research finding and the Members involved, HEARing CRC research may be released through internal industry communications such as Cochlear Ltd's Technical Reports (for activity in the field of cochlear implants) or Sivantos Pty Ltd's White Papers (activity in the hearing aid field). These reports are used to disseminate research project outcomes in the case of trade secrets and other commercially-sensitive information where Intellectual Property (IP) is not of a nature that can be codified into patent applications, but rather forms know-how and show-how. These publications feature research alerts that are distributed throughout the companies, which detail findings of clinical studies for research and development staff, and can also be used to provide training information or address specific product related issues.

5.2 Patients and the public

Gaining media coverage (print, radio or television) and comment remains an important way to disseminate research findings and news about HEARing CRC activities to people with hearing loss and the wider public, as well as to the government. During the reporting period there were a total of 40 mentions of the HEARing CRC in the public arena, largely in newsletter and website articles, there was also one radio piece and one podcast.

Participating in events such as Hearing Awareness Week (HAW, August 2015) and the World Health Organisation's International Ear Care Day (March 2016) provides opportunity to engage directly with public audiences. HAW this year spanned Melbourne and Sydney with staff sharing a marquee in Federation Square with other hearing organisations, the CRC sponsored a fabulous *Musicians 4 Hearing* gig, and also gave presentations and serviced a booth at the Australian Hearing Hub HAW open day. In addition, contributions to community newsletters and magazines (e.g. Royal Institute for Deaf and Blind Children e-newsletter), as well as in publications managed by member-based organisations (e.g. CRC-A's Know How) provide us with additional opportunities to deliver more targeted communication to interested members of the public and government representatives.

The HEARing CRC has developed two vehicles for dissemination of information and engagement with the general public – HEARnet Online and HEARsmart are described below. Both entities have strong online presences and in late 2014, the HEARing CRC was awarded a Google NGO Adwords Grant to assist in attracting online visitors to these websites (and others in the CRC suite). Since the implementation of the Google Adwords Campaign, there has been a significant increase in the amount of visitors to each of the sites.

5.2.1 HEARnet Online (www.hearnet.org.au)

Aimed at: Public (with and without hearing loss)

Also useful: as resource for hearing health professionals, media, government

Visits 2015-16: 42,000



Hearing Education and Research Network (HEARnet) Online was launched in late 2012 to achieve high level impact for HEARing CRC research outcomes. The site has become a recognised provider of independent information about hearing technologies and clinical management of hearing loss, informed by the latest evidence-based research in these areas.

The Interactive Ear is a central element of the site - an interactive animation that provides informational overviews on different hearing technologies and how they can be used to manage hearing loss. In May 2015, it received an Excellence in Innovation Award from the CRC Association.

Visibility/social media: HEARnet Online has been optimised for search engines to increase its online visibility. This has led to the website being featured prominently on the first page of Google's organic search ranking for many hearing loss and hearing technologies related topics. A new version of HEARnet Online was launched in February 2016 to further improve its Search Engine Optimisation through the addition of targeted content.

Social media has remained an essential engagement tool to promote content on HEARnet Online. During 2015-16, HEARnet Online Social media accounts (Facebook, Twitter and LinkedIn) generated more than 3,300 click-throughs via content posts.

5.2.2 HEARsmart (www.hearsmart.org)

Aimed at: Public –young people (18-35 year olds) interested in music

Also useful: for musicians, live sound engineers, venues

Visits 2015-16: 4,500



HEARing CRC research has identified groups who are at the greatest risk of developing noise-induced hearing loss through recreational activities. It has also suggested groups most likely to change their behaviour and the types of changes they may be willing to take on.

The HEARsmart initiative, launched in late 2014, has been developed to reach out to these young people and the music industry in order to increase their understanding and awareness of problems associated with how LONG, how LOUD and how OFTEN people are exposed to dangerous sound. It is also engaging with live music venues and their sound engineers, as well as groups such as Live Performance Australia to investigate approaches to reducing overall sound dose during an evening, without negatively impacting patron experience.

HEARsmart aims to encourage individual and organisational behavioural change to reduce and prevent noise-induced hearing loss and tinnitus. Launched in late 2014, its key achievements include:

- Know Your Noise website: released in November 2012, it includes an online hearing test and a calculator to estimate risk to hearing from every day activities. Since launch it has received very positive feedback and over 13,000 individual users across 16,000 sessions (to June 2016);
- Music venue research project: co-funded by the Deafness Foundation Victoria, to date this project has collected sound measurements, staff and patron surveys from three live music venues in Melbourne. These venues are currently implementing changes to address findings. Measurements and surveys will be repeated to determine what, and how best, to implement safe sound practices;
- Music Victoria (MV): HEARsmart contributed to MV's Best Practice Guidelines for Live Venues (April 2016) adding a page on sound management and limiting staff exposure, and co-hosted a Hearing Health Symposium: tips for musicians, industry and punters (June 2016). HEARsmart also contributed to MV's symposium during Melbourne Music Week to discuss hearing loss in the context of live music (Nov 2015);
- Outreach: Sponsorship of a Musicians4Hearing gig (August 15), radio appearance on PBS (August 2015), attendance at the Brunswick Street Music Festival (March 2016).

Visibility/social media: The HEARsmart website will be optimised for search engines to increase its online visibility, but this needs to go hand-in-hand with other activities to raise awareness of the problems of hearing loss and tinnitus in association with music. Social media is a key engagement tool to promote HEARsmart to its discrete and discerning audience.

5.3 Clinical community

Contribution to professional newsletters, such as Audiology Australia's *Audiology Now!* ensures that HEARing CRC activities and research findings are communicated to practicing audiologists. In addition, Audiology Australia's biennial conference (held May 2016) provided an opportunity to feature HEARing CRC research at Australia's only dedicated Audiology Professional conference. Internationally, the maturing relationships with the Canadian Audiologist magazine and US-based Audiology Online website is also enabling our activities to be communicated to a broader, international audience of audiologists.

The HEARing CRC has worked closely with Cochlear Ltd on the Visiting Cochlear Implant Specialists to Australia (VISTA) Program for nearly two decades. VISTA provides the opportunity for ENT surgeons and clinicians from around the world to receive updated information regarding research and development in the field of cochlear implants and to exchange ideas and strategies during a week-long tour in Sydney and Melbourne. VISTA was held in Sydney for a group of Danish attendees in March 2016.

Our most important channel is our Professional Education Program which is essential for communicating with, and educating, hearing health professionals and clinicians. It has been developed to increase clinical capacity for the hearing healthcare industry, through provision of innovative online and face-to-face programs for healthcare professionals from Australia, Asia-Pacific and world-wide. HEARnet Learning is our engagement vehicle for ongoing professional development - simultaneously translating our research findings and up-skilling professionals working in the hearing field. We continue to work closely with relevant Members in developing this resource, there is more information below.

5.3.1 HEARnet Learning (www.hearnetlearning.org.au and lms.hearnetlearning.org.au)



Aimed at: Hearing health professionals, including clinicians

Also useful: for clinical organisations, hearing and communication researchers, GPs, teachers

Registered users: Over 1,600

Accredited content: 18 modules and three webinars

HEARnet Learning delivers online professional development training that enables the HEARing CRC to communicate the clinical significance of research findings to clinicians and professionals active in hearing healthcare. This flexible and growing resource builds upon the HEARing CRC's reputation for delivering face-to-face training for more than a decade through its highly-regarded Cochlear Implant Workshops. It also provides the platform for the CRC to deliver targeted, needs-based training.

HEARnet Learning is a specialised extension to HEARnet that has become a well-recognised and award-winning cross-platform online training resource. It remains a key vehicle for the translation of research findings from the HEARing CRC, ensuring that audiologists across Australia and Internationally can access current research outcomes and tools, and utilise them as evidence-based best practice in their clinics.

HEARnet Learning has begun working with one of its key supporters - Audiology Australia - to develop a suite of online training materials focused on diagnostic infant audiology, an area that requires additional information and support post introduction of newborn screening in 2010. Additional content from the resource continues to be supplied by other HEARing CRC Members, including: Cochlear Ltd through its HOPE lecture series run in association with the Royal Institute for Deaf and Blind Children's Renwick Centre.

In the future, the HEARing CRC will extend its working relationship with existing Members and other third-parties to develop new content for HEARnet Learning that is more 'needs-based' and expand its module accreditation to other hearing health and communication professions in Australia.

5.4 Digital communication

The internet provides a wealth of opportunity for communication and engagement with, and education of the broad community. The HEARing CRC has developed a series of discrete websites and sub-strategies to promote information across:

- HEARsmart
- HEARnet Online
- HEARnet Learning, and
- HEARworks Ltd Pty.

The four elements exist both on- and off-line and are integral to delivering tailored information to defined audiences as part of the overall communication, engagement and education plan to drive dissemination and implementation of our research. All four of these elements are referenced and linked through the HEARing CRC's 'parent site' that details overall research activity and corporate structure.

5.4.1 Social Media

The HEARing CRC uses a variety of social media platforms to promote its activities and outcomes in the areas of hearing loss and hearing remediation. Platforms including Twitter, Facebook, Pinterest, SlideShare, Google+ and YouTube provide direct access to interested members of the public, as well as many CRC Members and other interested professional groups.

Social media channels provide complimentary communication networks to promote the activities of the HEARing CRC through HEARnet (Online and Learning) and HEARsmart. In addition, they enable the HEARing CRC to act as an information aggregator in the hearing health and hearing technology spaces. An important side benefit from the use of social media is the creation of data that provide insights into stakeholder behaviour, the popularity of topics and their interest in the broader HEARing CRC outcomes.

Current details of our social media engagements are below:

HEARnet	 Twitter @HEARingCRC				 Facebook	 SlideShare	 YouTube	
Time period	followers (cumulative)	mentions (per period)	retweet (per period)	clicks (per period)	likes (cumulative)	views (cumulative)	views (cumulative)	subscribers (cumulative)
2011-12	172	56	21	158	25			
2012-13	340	73	57	420	69			
2013-14	1055	156	163	1430	84	676	836	
2014-15	1321	84	185	1105	145	1470	3,345	19
2015-16	1603	34	102	3308	307	2090	7218	30



Linked In added during 2015-16– 138 followers; 4332 impressions

HEARsmart	 Twitter @HEARsmart				 Facebook
Time period	followers (cumulative)	mentions (per period)	retweet (per period)	clicks (per period)	likes (cumulative)
2014-15	188	23	80	263	93
2015-16	217	12	44	516	112

6. Collaboration

6.1 Collaborating within the HEARing CRC

To facilitate collaboration within the HEARing CRC, three Research Project Coordinators are employed and located at three Essential Members (The University of Melbourne, Macquarie University and Australian Hearing). Their role is to coordinate quarterly and annual project reporting to the Management team and Board, and to facilitate regular research meetings.

Most HEARing CRC projects involve a range of geographically dispersed, interdisciplinary research and end-user focused Members. Member involvement ranges from the direct provision of personnel or infrastructure, through to an individual's availability to provide specialist advice or expert input. To effectively manage this collaboration, each project is directed by a Project Leader employed through or by a Member. Communication is key to keeping projects on track and our approach involves support for the Project Leader in holding regular meetings with their teams, where possible using tele- and videoconferencing as well as cloud technologies to facilitate data sharing and storage. Travel funds are also made available to assist researchers working across geographically-separate nodes where tele- and videoconferencing is not available or insufficient to meet communication needs.

Communication between researchers and end-users working on a project ensures that relevant questions are addressed and that outcomes are rapidly translated. Where organisations or individuals involved in the projects are not affiliated with the HEARing CRC, external linkage are managed with legal documentation to ensure that information flow is not interrupted and maximum benefit can be obtained for all parties. This is being enhanced through the broader implementation of HEARnet partners.

The HEARing CRC (both 2007-2014 and 2014-2019), and its predecessor CRCs, have established strong, ongoing collaborative relationships with Members. Many of these collaborations are complex and multi-faceted:

- collaboration with Australian Hearing/National Acoustic Laboratories on a broad range of projects including the work around a hearing loss prevention campaign – now realised through HEARsmart (launched in November 2014); development of the 2012 Citizen Science Project (Sound Check Australia); and joint research projects such as the HEARLab;
- active engagement with the Audiology Australia in provision of professional education activities for audiologists through HEARnet Learning, and release of joint media statements;
- supporting Cochlear's VISTA Program and Technology Research Laboratory (involving The University of Melbourne, The Bionics Institute and the Royal Victorian Eye and Ear Hospital); and
- HEARnet Online and HEARnet Learning have provided a range of opportunities to connect and collaborate with Member's communication and outreach personnel – this includes webinar content from Cochlear's HOPE lecture series (run in association with the Royal Institute for Deaf and Blind Children's Renwick Centre), modules developed in association with Sivantos Pty Ltd and other materials shared with Australian Hearing, NAL, The Royal Eye and Ear Hospital and the University of Melbourne.

6.2 Domestic and International Collaborations

The HEARing CRC maintains a range of Australian and international collaborations relevant to specific projects (see table following). Through involvement of new partnerships, the HEARing CRC supplements its skills and capabilities to ensure milestones and outputs are met, and increase the potential for CRC outcomes to be applied internationally.

Within Australia:

Institution	Project	Relationship/topic of collaboration
Better Hearing Australia	xR4.1.1 and xR3.3.4	Clinical referral pathways
CISCO	xC4	Speech Reference Limiting software
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	xR1.1.3	MEG for cochlear implant technology
Curtin University	xR4.3.1	Noise exposure
Deafness Forum	xR4.1.1	Clinical referral pathways
Deafness Foundation Victoria	xR4.3.2	Venue study funding
Florey Institute of Neuroscience and Mental Health	xR1.3.1	Central auditory processing abnormalities
Hear For You NSW	xR3.3.4	Public training
Hearing Aid Audiometrist Society of Australia	xR4.1.1	Clinical referral pathways
Medical Devices Fund, Office of Medical Science and Research, NSW Government	xC3	Grant funder for development of third HEARLab software module
Music Victoria	xR4.3.2	Relevant to HEARsmart demographic; Attendance at MMW15 symposium; contribution to Best Practice guidelines 2016, co-hosting of symposium 2016, joint EOI of MMW16
National Information Communications Technology Research Centre of Excellence (NICTA)	xR1.2.3	Data analysis
Office of Hearing Services	xR4.1.1	Adult hearing rehabilitation
Parents of Deaf Children	xR3.3.4	Information provision
People with Disability Australia	xR3.3.4	Information provision
Sensaphonics	xR4.3.2	Hearing friendly network
SoundWorld Solutions	xR4.2.1	Providing the hearing aids and app being used in the current study
The University of Canberra	xR4.3.1	Noise exposure
Victorian Deaf Education Institute	xR3.3.1	Grant to extend parent-led intervention in Victoria
Victorian Infant Hearing Screening Program	xR3.1.1	Device selection
Walter and Eliza Hall Institute of Medical Research	xR2.3.2	Medicinal chemistry support for research with partner MCRI
WorkCover Independent Review Office (NSW)	xR4.2.1	Noise exposure

Internationally:

Institution	Country	Project	Relationship/topic of collaboration
The University of British Columbia	Canada	xR1.2.1	Auditory processing abilities in babies using ERPs
The University of Ottawa	Canada	xR3.3.4	ERPs to sentence processing in bilingual adults
The University of Toronto, Sick Children's Hospital Cochlear Implant Clinic	Canada	xR2.1.1	Bilateral Cochlear Implant collaborator, SPEAR system licensee
Beijing Culture and Language University	China	xR1.1.3	Partner in Australia-China Science Research Fund application and MEG for cochlear implant technology
The University of Hong Kong	China	xR4.1.1	Self-fitting and trainable hearing aids
Tong Ren Hospital	China	xR1.3.2c	Providing input on clinical audiology, local research needs, assist with recruitment and providing testing space
Czech Technical University	Czech Republic	xC3	Data analysis and Artefact detection algorithm
Eriksholm Research Centre	Denmark	xR3.2.1	Test improvement
GN Netcom	Denmark	xC4	Speech Reference Limiting software
Oticon Ltd & Oticon Foundation	Denmark	xR1.3.1a	LOCHI study financial support
Jade University, Oldenburg	Germany	xR1.1.1	Acoustic collaborator
Kanazawa Institute of Technology	Japan	xR1.1.3	MEG for cochlear implant technology
The University of Auckland	New Zealand		Variety of collaborations
Russian State Medical University	Russia	xR3.2.3	Data collection in CI adults and children.
The University of Pretoria	South Africa	xR3.2.1	Self-fitting and trainable hearing aids
Linkoping University	Sweden	xR1.1.1	Test improvement
Phonak Ltd	Switzerland	xC4.1	Beamformer performance
MED-EL	Turkey	xR3.2.3	Data collection in CI adults and children.
Frye Electronics Corp	USA	xC3	HEARLab licensee
National Institutes of Health	USA	xR1.3.1a	LOCHI study financial support
Bezos Family Foundation	USA	xR3.3.1	Use of Daily Vroom App
The University of Pittsburgh	USA	xR3.1.3	Conducting concurrent data collection to speed up the project and improve generalizability of the results.
The University of Washington	USA	xR2.3.1	Assistance with the Radiology image analysis for Evaluation of Scala Location and Modiolar Proximity of the Slim Modiolar Electrode array

7. Postgraduate Education

Educating the next generation of leaders in the field of research audiology is an important activity for the HEARing CRC.

During the 2015-16 reporting period we enrolled 17 PhD students, taking the total number of HEARing CRC (2014-19) students to 31, in addition, we had 35 Masters of Clinical Audiology project students working on projects within the research Themes.

During this time period, seven PhD students have submitted their individual thesis and of these three also graduated. Graduates took up positions with both academic and clinical organisations, often at the location they had undertaken their research.

Supporting activities: to ensure students at the HEARing CRC gain additional skills during their tenure a Training and Symposium event is planned for each year. The event gathers the students together for a formal research symposium as well as providing a day of hands-on skills training. The theme of the training has been non-traditional in nature (with traditional subject areas served by University training programs), and is largely driven by students' interests. Both training and symposium activities are attended by highly respected academics from the field and high level industry professionals.

Previous training themes have included:

- 2010-11: communicating research to different audiences (including peers, lay and commercial)
- 2011-12: the impact of research (including IP) - clinical, commercial and community
- 2012-13: leadership, networking and careers

The student event was not conducted during the 2013-14 or 2014-15 year as student numbers were smaller and the majority of students were either reaching the end of their PhD studies or starting up new studies. In October 2016 the new student cohort were brought together for the first time, this was held in association with the whole of CRC research symposium to ensure the students benefited from immersion in this annual research meeting. A mentoring program is also being made available to interested students, looking at linking them with relevant individuals from Member and non-Member organisations.

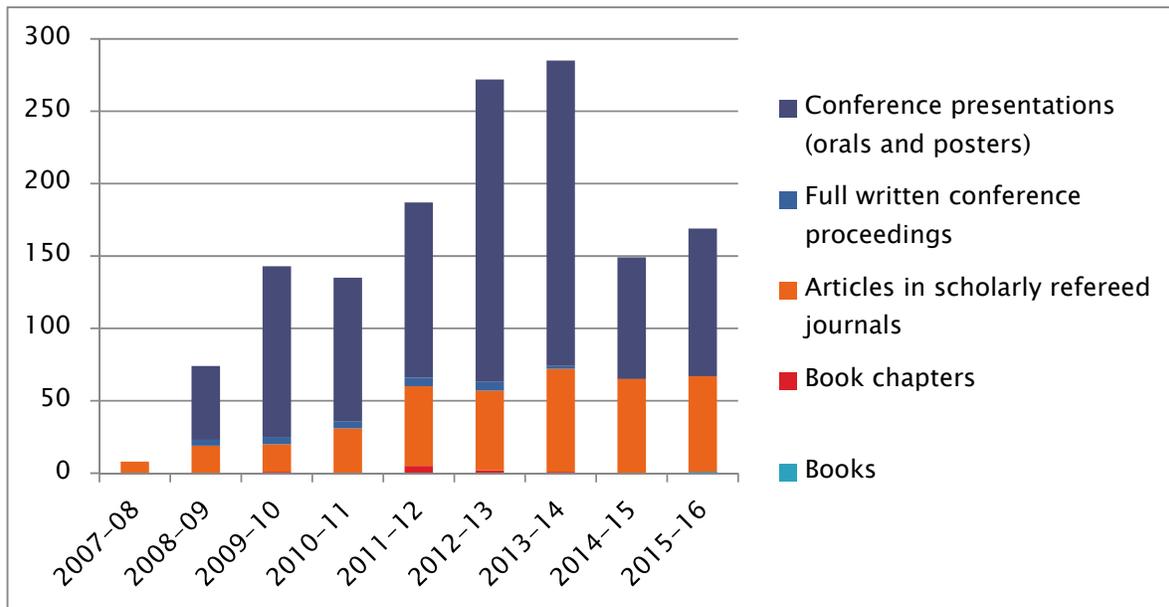
Non-PhD activities: Since 2013, HEARing CRC, in collaboration with Cochlear, has offered a Student Mentoring Program to second year Master of Clinical Audiology students. To date over 30 students have taken part. During this reporting period the Program provided the opportunity for 14 students (seven in 2015 and seven in 2016) to gain the opportunity for hands-on industry experience in the Melbourne and Sydney Cochlear Implant Clinics. This program is supported financially by Cochlear.

Through the CEO, a specialised hearing technology and research lecture series is provided for the University of Western Australia's Masters in Clinical Audiology program.

8. GLOSSARY OF TERMS

2D / 3D	2 dimensional / 3 dimensional	HEARnet	Hearing Education and Research Network
ABR	Auditory Brain Response	HEARsmart	Hearing health promotion, advocacy; hearing loss prevention
ABN	Australian Business Number	HEARworks	The commercial arm (entity) of The HEARing CRC
ACN	Australian Company Number	IDEAL	Infant Discrimination and Early Acquisition of Language (study)
ANSD	Auditory Neuropathy Spectrum Disorder	IMP	Infant Monitoring of vocal Production (tool)
APD	Auditory Processing Disorder	IP	Intellectual Property
API	Active Pharmaceutical Ingredient	KPMG	Klijneveld, Peat, Marwick and Goerdeler (auditors)
AHH	Australian Hearing Hub	LiSN-S	Listening in Spatialized Noise - Sentences Test
AICD	Australian Institute of Company Directors	LMS	Learning Management System
AO	Officer of the Order of Australia	LOCHI	Longitudinal Outcomes of Children with Hearing Impairment (study)
ARC	Australian Research Council	MEG	Magnetoencephalography
ASIC	Australian Securities and Investments Commission	MPhil	Masters of Philosophy
CATE	Cortical Auditory Threshold Estimation	MV	Music Victoria
CEO	Chief Executive Officer	NAL	National Acoustic Laboratories
CFO	Chief Financial Officer	NAL-ACA	National Acoustics Laboratories - Aided Cortical Assessment
CPD	Continuing Professional Development	NAL-NL1 & NL2	National Acoustic Laboratories hearing aid fitting software
CRC	Cooperative Research Centre	NGO	Non-Governmental Organisation
CRC-A	Cooperative Research Centre Association	NH&MRC	National Health and Medical Research Council
CT	(x-ray) Computed Tomography	NICTA	National Information Communication Technology Australia
CUHL	Children with Unilateral Hearing Loss (study)	OPAL	Optimised Pitch And Language (sound processor and system, previously e-Tone)
dB	Decibel	PCT	Patent Cooperation Treaty
ENT	Ear, Nose and Throat	PhD	Doctor of Philosophy
FAL	Francis Abourizk Lightowlers (Lawyers)	QC	Queens Counsel
FDA	Food and Drug Administration (US)	RMIT	Royal Melbourne Institute of Technology
FLI	Functional Listening Index (tool)	SME	Small to Medium Sized Enterprise
GPs	General Practitioners	TGA	Therapeutic Goods Administration
HAW	Hearing Awareness Week	VISTA	Visiting Implant Specialists to Australia
HEAR IP	The Intellectual Property arm (entity) of The HEARing CRC	WEHI	Walter and Eliza Hall Institute of Medical Research
HEARLab	A clinical device that measures hearing using Cortical Auditory Evoked Potentials	WHO	The World Health Organisation

Appendix 1: Bibliography



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FULL WRITTEN CONFERENCE PAPERS – REFEREED PROCEEDINGS – 0:

CONFERENCE PRESENTATIONS (ORAL AND POSTER) – 102:

1. Alnafjan F, Da Cruz M, & McMahan CM, 2016. 'Determination of outer and inner cochlear wall length using cone beam computed tomography in cochlear implant users', *14th International Conference on Cochlear Implants and Other Implantable Technologies*, Toronto, Canada. Oral.
2. Alnafjan F, McMahan CM, & Da Cruz M, 2016. 'Normative Data for Electrical Auditory Brainstem Responses', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
3. Arora K, Plant K, Dawson P, & Cowan R, 2016. 'Clinical metrics for assessing audibility, comfort and performance in cochlear implant recipient MAPs', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
4. Bardy F, Van Dun B, Loi T, Sjahalam-King J, Lee C, Cowan R, & Dillon H, 2016. 'Cortical automatic threshold estimation', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
5. Bardy F, Van Dun B, Loi T, Sjahalam-King J, Lee C, & Dillon H, 2016. 'Automatic hearing threshold estimation using cortical auditory evoked potentials', *14th International Conference on Cochlear Implants and Other Implantable Technologies*, Toronto, Canada. Oral.
6. Bardy F, Van Dun B, Sjahalam-King J, Lee C, Cowan R, & Dillon H, 2016. 'Automatic hearing threshold estimation using cortical auditory evoked potentials', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy. Oral.
7. Beach E, Sewell J, McGinnity S, & O'Halloran P, 2016. 'Bringing HEARSmart™ to music venues in Victoria', *Audiology Australia National Conference 2016*, Melbourne, Australia. Poster.
8. Briggs R, O'Leary S J, Birman C S, Miller C, Plant K, Gavrilis J, Risi F, Newbold C, Strathopoulos D, Chambers S, & Cowan R, 2016. 'A First Time in Human investigation of a Combination Device

- delivering a targeted drug therapy to cochlear implant recipients', *CI 2016 International Meeting, Toronto*, Toronto, Canada. Oral.
9. Burt R A, 2016. 'Apoptotic regulators in the auditory system: Key factors in hearing loss', *53rd Inner Ear Biology Workshop and Symposium*, Montpellier, France. Oral.
 10. Button L, Ching TYC, Cupples L, Marnane V, Thomson J, Martin L, & Gunnourie M, 2016. 'Longitudinal outcomes of children with hearing impairment (LOCHI): 5-year outcomes', *Hearing Across the Lifespan (HEAL) 2016*, Como, Italy. Poster.
 11. Button L, Ching TYC, Cupples L, Marnane V, Thomson J, Martin L, & Gunnourie M, 2016. 'Longitudinal outcomes of children with hearing impairment (LOCHI): 5-year outcomes', *Speech Pathology Australia National Conference 2016*, Perth, Australia. Poster.
 12. Button L, Ching TYC, Cupples L, Marnane V, Thomson J, Martin L, Gunnourie M, Dillon H, & Cowan R, 2016. 'Longitudinal outcomes of children with hearing impairment (LOCHI): 5-year outcomes', *Speech Pathology Australia National Conference 2016*, Perth, Australia. Poster.
 13. Button L, Ching TYC, Cupples L, Marnane V, Thomson J, Martin L, Gunnourie M, Dillon, H, & Cowan R, 2016. 'Longitudinal outcomes of children with hearing impairment (LOCHI): 5-year outcomes', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy. Poster.
 14. Button L, Ching TYC, Martin L, Thomson J, Yanbay E, Scarinci N, & Hickson L, 2016. 'Parental involvement in early intervention for children with hearing impairment; A sub-study of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study', *Hearing Across the Lifespan (HEAL) 2016*, Como, Italy. Oral.
 15. Button L, Ching TYC, Martin L, Thomson J, Yanbay E, Scarinci N, & Hickson L, 2016. 'Parental involvement in early intervention for children with hearing impairment; A sub-study of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study', *Speech Pathology Australia National Conference 2016*, Perth, Australia. Oral.
 16. Button L, Ching TYC, Martin L, Thomson J, Yanbay E, Scarinci N, Hickson L, Dillon H, & Cowan R 2016. 'Parental involvement in early intervention for children with hearing impairment; A sub-study of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study', *Speech Pathology Australia National Conference 2016*, Perth, Australia. Oral.
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19. Ching TYC, Dillon H, Button L, Van Buynder P, Seeto M, et al, 2016. 'Population outcomes for children with hearing loss: Early treatment is crucial but not sufficient', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
20. Ching TYC, Gardner-Berry K, Bardy F, Van Dun B, Hou S, Wong C, & Zhang V, 2016. 'How do you know what they are hearing? Cortical assessment and functional evaluation for management of infants with hearing loss', *World Congress of Audiology 2016*, Vancouver, Canada. Oral.
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23. Chu C, Choo D, Dettman SJ, Leigh J, Lettieri S, Traeger G, & Courtenay D, 2016. 'Addressing the 'type' and 'dose' of early intervention provided to children using cochlear implants: How much is enough?' 14th International Conference on Cochlear Implants, Toronto, Canada. Oral.
24. Chu C, Choo D, Dettman SJ, Leigh J, Lettieri S, Traeger G, Courtenay D, & Dowell R, 2016. 'Early intervention and communication development in children using cochlear implants: The impact of service delivery practices and family factors', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
25. Convery E, Hickson L, Meyer C, & Keidser G, 2016. 'A service delivery model for self-fitting hearing aids', *School of Health and Rehabilitation Sciences Postgraduate Research Conference*, University of Queensland, Brisbane, Australia. Oral.
26. Convery E, Keidser G, Hickson L, & Meyer C, 2016. 'Is the future of hearing aids in a flatpack? The ability to self-fit and predictions of a successful outcome', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
27. Convery E, Keidser G, Meyer C, & Hickson L, 2016. 'Who wants a self-fitting hearing aid? Issues of candidacy and clinical support', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy. Oral.
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29. Cowan RSC, 2016. Rubber on the road: 'Real-Life experiences in hearing loss'. *Audiology Australia National Conference*, Melbourne, Australia. Special Round Table
30. Cowan RSC, 2015. 'Disruption beyond apps and IT'. *MedTech 2015*, Sydney, Australia. Oral.
31. Cowan RSC, 2015. 'Preservation of residual hearing and its use in hybrid/bimodal fitting'. *International Collegium of Rehabilitative Audiology*, Berkeley CA, USA.
32. Cowan RSC, Briggs RJ, Birman CS, O'Leary SJ, Miller C, Risi F, Gavrilis J, Newbold C, Stathopoulos D, S Chambers, B Zhang & Wallace G, 2016. Safety studies for an electrode

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 37. Dettman S, Dowell R, Choo D, Arnott W, Abrahams Y, Davis A, Dornan D, Leigh J, Constantinescu G, Cowan R, & Briggs R, 2016. 'Long term communication outcomes for children who receive cochlear implants younger than 12 months: A multi-centre study', *Audiology Australia National Conference 2016*, Melbourne Australia. Oral.
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 42. Dowell R, Leigh J, & Dettman S, 2016. 'Speech, language and hearing outcomes for deaf children using cochlear implants: A prospective long-term study', *Hearing Across the Lifespan*, Cernobbio, Italy.
 43. Ekberg K, Grenness C, & Hickson L, 2016. 'The elephant in the room: Talking about cost in audiology consultations with older adults', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
 44. Ekberg K, Grenness C, & Hickson L, 2016. 'Identifying older clients' readiness for hearing rehabilitation during history-taking in audiology appointments', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.

45. English R, Plant K, & Cowan R, 2016. 'Optimisation of Hybrid Fittings', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
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47. English R, Plant K, Maciejczyk M, & Cowan R, 2016. 'Fitting recommendations and clinical benefit associated with use of the NAL-NL2 hearing aid prescription in Nucleus cochlear implant recipients', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
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50. Graydon K, Rance G, Dowell R, & Van Dun B, 2016. 'The long-term effects of conductive hearing loss', *Hearing Across the Lifespan*, Lake Como, Italy. Oral.
51. Grenness C, Ekberg K, & Hickson L, 2016. 'Improving audiologists' psychosocial communication with adults seeking help for hearing loss', *European Association for Communication in Healthcare*, Heidelberg, Germany. Oral.
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53. Grenness C, Ekberg K, & Hickson L, 2016. 'Improving audiologists' psychosocial communication with adults seeking help for hearing loss', *Academy of Rehabilitative Audiology*, Vancouver, Canada. Oral.
54. Incerti P, Ching T, Cowan R, & Dillon H, 2015. 'Fitting and evaluating electric acoustic fittings in adults', The University of Melbourne, Melbourne, Australia. Oral.
55. Incerti P, Ching TYC, & Cowan R, 2016. 'Fitting and evaluating electric acoustic fittings in adults', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
56. Incerti P, Ching TYC, & Cowan R, 2016. 'Fitting and evaluating electric acoustic fittings in adults', *14th International Conference on Cochlear Implants and Other Implantable Technologies*, Toronto, Canada. Oral.
57. Incerti P, Cowan R, & Ching TYC, 2016. 'Fitting and evaluating electric-acoustic fittings in adults', *World Congress of Audiology 2016*, Vancouver, Canada. Oral.
58. Incerti P, Cowan R, & Ching TYC, 2016. 'Fitting and evaluating electric-acoustic fittings in adults', *World Congress of Audiology 2016*, Vancouver, Canada. Poster.

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60. Kasisopa B, Klangpornkun N, & Burnham D, 2015. 'Auditory-visual tone perception in hearing impaired Thai listeners', *Interspeech 2015*, Dresden, Germany. Poster.
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62. Keidser G, & Convery E, 2016. 'Management of and outcomes with a commercial self-fitting hearing aid', *The International Hearing Aid Research Conference*, Lake Tahoe, CA, USA. Oral.
63. Leigh J, Dettman S, Choo D, & Dowell R, 2016. 'Before and after Newborn Hearing Screening (NHS) in a large unselected cohort of children using cochlear implants: Impact of NHS on age at intervention and long term communication outcomes', *Hearing Across the Lifespan*, Cernobbio, Italy. Oral.
64. Lo CY, McMahon CM, Looi V, & Thomson WF, 2016. 'Melodic contour training improves consonant discrimination and prosody perception for adult cochlear implant recipients', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
65. McMahon CM, Boisvert I, de Lissa P, Granger L, Ibrahim R, Lo CY, & Miles K, 2016. 'Towards an objective measure of listening effort', *American Audiology Society Meeting 2016*, Phoenix, Arizona, USA. Oral.
66. McMahon CM, Boisvert I, Ibrahim R, De Lissa P, Miles K, Lo CY, & Granger L, 2016. 'Towards and objective measure of listening effort', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
67. Mejia J, Fisher M, Van Hoesel R, MacLlend M, Nguyen CV, Galloway J, Dillon H, & Cowan R 2016. 'A binaural noise reduction system with speech-referenced loudness control and improved preservation of spatial cues', *International Hearing Aid Research Conference IHCON 2016*, Lake Tahoe, CA, USA. Poster.
68. Mejia J, McLelland M, Van Hoesel R, & Dillon H, 2016. 'Examining the benefit of a binaural beamformer when listening to static and dynamic speech', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
69. Meng D, McMahon CM, & Johnson B, 2015. 'A MEG system for Cochlear Implants Recipients', *Brain Imaging Symposium - principals and applications of MEG*, Melbourne, Australia. Oral.
70. Meyer C, 2015. 'Client-centered hearing care: Are we listening to our clients?', *Neurosensory Clinical Conference*. Oral (invited).
71. Meyer C, Grenness C, Khan A, & Hickson L, 2016. 'Does patient-clinician communication influence patients' decisions to obtain hearing aids?', *GSA Annual Scientific Meeting 2016*, New Orleans, USA. Oral.

72. Meyer C, Waite M, Grenness C, Scarinci N, & Hickson L, 2016. 'A first step towards developing an ICT-enabled model of patient- and family-centred care for older adults with hearing loss', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy.
73. Miles K, McMahon CM, Boisvert I, & Lyxell B, 2016. 'Increasing assessment sensitivity using an objective measure of listening effort', *Audiology Australia National Conference 2016*, Melbourne, Australia. Poster.
74. Psarros C, Cowan R, Leigh G & McMahon C, 2016. An "APP" for measuring speech perception through telepractice: considerations and preliminary results. *14th International Conference on Cochlear Implants & Other Implantable Technologies, Toronto, Canada*. Poster.
75. Psarros C, Cowan R, Leigh G & McMahon C, 2016. Considerations for measuring speech perception through telepractice: Preliminary results. *14th International Conference on Cochlear Implants & Other Implantable Technologies, Toronto, Canada*. Oral
76. Sharma M, 2015. 'Short term auditory training in adults with unilateral hearing loss', *Cochlear*. Oral.
77. Sharma M, 2015. 'Speech perception in noise: Language, cognition and auditory processing', *University of Auckland 25th Anniversary Celebrations: Celebration and Showcase of Hearing and Vestibular Research in New Zealand*, Auckland, NZ. Oral
78. Sharma M, 2015. 'Auditory processing through the life span', *2015 Frontiers in Hearing Symposium*, Colorado, USA. Oral.
79. Sharma M, 2016. 'The role of auditory processing in the functional outcomes', *Cincinnati Children's Hospital*, Cincinnati, Ohio, USA. Oral.
80. Sharma M, 2016. 'Auditory processing and its role in listening and reading', *University of British Columbia*, Vancouver, Canada. Oral.
81. Sharma M, 2016. 'The benefits of time-frequency', *Graduate Centre, City University of New York*, New York, USA. Oral.
82. Sharma M, 2016. 'Auditory training: What's that and why do we need it? *Cochlear*. Oral.
83. Sharma M, Alston V, Lower M, Mandikal Vasuki PR, Ibrahim R, Valderrama J, & Small S, 2016. 'Auditory selective attention and P300', *World Congress of Audiology*, Vancouver, Canada. Oral.
84. Tai S, Grenness C, & Woodward-Kron R, 2016. 'Patient-centred communication in an audiological teaching clinic: An exploration of student-patient communication', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
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86. Valderrama J, Yeend I, Pang J, Beach E, Sharma M, Van Dun B, & Dillon H, 2016. 'Auditory brainstem response wave I correlates with speech perception in noise', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.

87. Van Dun B, Chong-White N, & Cowan, R 2016. 'Determining free field detection thresholds in cochlear implant users using a clinical single-channel cortical auditory evoked potential recording device', *Objective Measures in Auditory Implants (OMAI) Conference*, Szeged, Hungary. Oral.
88. Van Dun B, Chong-White N, & Cowan R, 2016. 'Recording cortical auditory evoked potentials (CAEPs) with a single-channel clinical device in cochlear implant users', *World Congress of Audiology 2016*, Vancouver, Canada. Oral.
89. Van Dun B, Chung M, Chong-White N, Cowan R, & Dillon H, 2016. 'Cortical auditory evoked potential recordings in cochlear implant users using the clinical HEARLab system', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
90. Van Dun B, Punch S, Ching TYC, King A, & Dillon H, 2016. 'Use of Cortical Auditory Evoked Potentials (CAEPs) in Assessment of Hearing and Evaluation of Hearing Aids: Current and future national clinical CAEP protocols at Australian Hearing', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy. Oral.
91. Van Dun B, Punch S, Ching TYC, King A, & Dillon H, 2016. 'Use of Cortical Auditory Evoked Potentials (CAEPs) in Assessment of Hearing and Evaluation of Hearing Aids: Current and future national clinical CAEP protocols at Australian Hearing', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy. Oral.
92. Waite M, Meyer C, Scarinci N, Grenness C, Cowan R, & Hickson L, 2016. 'Covering a continent: An exploration of eHealth services for children with hearing loss in Australia', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy. Poster.
93. Waite M, Meyer C, Scarinci N, Grenness C, Cowan R, & Hickson L, 2016. 'Family and service provider experiences of eHealth in early intervention services for children with hearing loss', *Hearing Across the Lifespan (HEAL) 2016*, Cernobbio, Lake Como, Italy. Oral.
94. Walravens E, Keidser G, & Hickson L, 2016. 'Perception and use of trainable hearing aids by clinicians and hearing aid users and candidates', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
95. Whitfeld C, & McMahon CM, 2016. 'A systematic review of the evidence base for hearing aids in adults', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
96. Williams W, 2016. 'Leisure noise and hearing health: A survey of the hearing health and noise exposure of young adults', *National Hearing Conservation Association 2016*, San Diego, USA. Oral.
97. Williams W, Carter L, & Seeto M, 2015. 'Hearing Loss and Leisure Noise', *Australian Acoustical Society Conference*, Hunter Valley, Australia. Oral.
98. Yanbay E, Scarinci N, Hickson L, & Ching TYC, 2016. 'Parental involvement in the intervention of children with hearing loss: are parents involved and what influences their involvement?', *International Association of Logopedics and Phoniatrics*, Dublin, Ireland. Oral.

99. Yeend I, Beach E, Sharma M, Pang J, & Dillon H, 2016. 'Delving into 'hidden hearing loss': Results from a large-scale behavioural investigation', *33rd World Congress of Audiology*, Vancouver, Canada.
100. Yeend I, Beach E, Sharma M, Pang J, & Dillon H, 2016. 'Does musical training protect noise-exposed musicians from the consequences of 'hidden hearing loss'?', *33rd World Congress of Audiology*, Vancouver, Canada.
101. Yeend I, Beach E, Sharma M, Pang J, Valderrama JT, Van Dun B, & Dillon H, 2016. 'An investigation of musicians and hidden hearing loss', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.
102. Yeend I, Beach E, Sharma M, Pang J, Valderrama JT, Van Dun B, & Dillon H, 2016. 'The role of noise exposure in hidden hearing loss', *Audiology Australia National Conference 2016*, Melbourne, Australia. Oral.

CONFERENCE WORKSHOPS – 6:

1. Boisvert, I, 2016. 'Determining candidacy for the different types of hearing devices', *Audiology Australia National Conference 2016*, Melbourne, Australia. Workshop.
2. Ching, T Y C, Gardner-Berry, K, Hou, S, Zhang, V, Van Dun, B, Van Buynder, P, 2016. 'How do you know what they are hearing? Cortical assessment and functional evaluation for management of infants with hearing loss', *Audiology Australia National Conference 2016*, Melbourne, Australia. Workshop.
3. Ching, T Y C, Porter, A, Buton, L, Gardner-Berry, K, Scarinci, N, Yanbay, E, Hickson, L, 2016. Parents' journey from diagnosis to intervention, involvement in early intervention, and shared decision making: What do parents want?', *Audiology Australia National Conference 2016*, Melbourne, Australia. Workshop.
4. Grenness, C, Ekberg, K, Meyer, C, Hickson, L, 2016. 'From concept to clinical practice: Implementing a client-centred approach when working with adults who have hearing loss', *Audiology Australia National Conference 2016*, Melbourne, Australia. Workshop.
5. Meyer, C, 2015. 'Patient-centred care in rehabilitative audiology: Theory and practice', *Lions Hearing Clinic clinical workshop*, Lions Hearing Clinic. Workshop.
6. Meyer, C, Sciacca, A, Ekberg, K, Grenness, C, Hickson, L, 2016. 'Audiologists' talk and clients' decisions to obtain hearing aids', *Audiology Australia National Conference 2016*, Melbourne, Australia. Workshop.

NON- PEER REVIEWED ARTICLES AND MEDIA COVERAGE – 40:

Month	Title	Where?
July 2015	Early hearing loss detection improves children's development -	www.hear-it.org
	Cooperative Research Centres -	www.bulletpoint.com.au
	New Australian Initiative Puts the Spotlight on Personal Leisure Noise Risk	Canadian Audiologist Vol 2 Issue 4

	Australian HEARsmart Targets Unhealthy Listening Habits	Canadian Audiologist Vol 2 Issue 4
	The Big Business of Hearables	www.sciencemeetsbusiness.com.au
July 2015	Cooperative Research Centres Association Excellence in Innovation Award	Better Hearing Australia, The National Spotlight, Edition 6
	HEARsmart puts Dangerous Leisure Noise To The Test	www.werhumansbeing.com
August 2015	Musician/Audiologist Founder of Musicians for Hearing	www.alantichearing.com
	What's that? Its hearing awareness week?	www.australianmusician.com.au
	2015 Hearing Awareness Week Profile - Melbourne Musician Making a Difference to Australia's Hearing Health	www.audiologyonline.com
	2015 Hearing Awareness Week Profile - Melbourne Musician making a difference to Australia's Hearing Health	www.viddeaf.com.au
	More than a third of hearing problems are avoidable, so stop going out without earplugs	www.themusic.com
	2015 Hearing Awareness Week Profile - Melbourne Musician making a difference to Australia's Hearing Health	www.listenhearaudiology.com
	2015 Hearing Awareness Week Profile - Melbourne Musician making a difference to Australia's Hearing Health	www.drfoust.com
	2015 Hearing Awareness Week Profile - Melbourne Musician making a difference to Australia's Hearing Health	www.aberdeenhearing.com
	2015 Hearing Awareness Week Profile - Melbourne Musician making a difference to Australia's Hearing Health	www.audiologyprofessionals.com
	Interview with Siobhan MCGinnity	PBSFM Breakfast Spread show (25 th August)
	September 2015	Melbourne Musician-Audiologist Founds 'Musicians for Hearing'
Early intervention in children's hearing health is key		Media statement - Senator Marise Payne
October 2015	2015 Hearing Awareness Week Profile - Melbourne Musician Making a Difference to Australia's Hearing Health	Canadian Audiologist. Vol. 2, Issue 6, 2015
January 2016	Creative Mornings: Siobhan McGinnity - Musicians for Hearing	www.creativemornings.com
	Creative Mornings: Musicians for Hearing [Melbourne]	www.auslanstageleft.com.au
Month	Title	Where?
February 2016	Siobhan McGinnity – Musicians for Hearing (podcast)	creativemornings.com
March 2016	Study Reveals How Hearing Technology Helps Children	http://www.hearingreview.com/
	Study Reveals How Hearing Technology Helps Children	www.siemenshearingaids.com
	Study Reveals How Hearing Technology Helps Children	http://myinforms.com
	Australian Study Leads the Way in Showing How Hearing Technology Is Associations	www.audiologyonline.com
	Australian Study Leads the Way in Showing How Hearing Technology Is Associations	www.hearing-aid-news.com

	Study Reveals How Hearing Technology Helps Children	www.atlantichearing.com
	Australian Study Leads the Way in Showing How Hearing Technology Is Associations	www.healthyhearing.com
	Australian study shows how hearing technology is improving the lives of children with hearing loss	www.audiology-worldnews.com
	LOCHI Reaches Phase II Trials	www.journals.lww.com/thehearingjournal
April 2016	Safer Sound and Healthy Hearing Becomes Part of Victorian Live Music Best Practice	www.audiologyonline.com
May 2016	Australian study highlights impact of early intervention for children with hearing loss	www.hearing-aid-news.com
	Australian study highlights impact of early intervention for children with hearing loss	www.healthyhearing.com
	Australian research on self-fitting hearing aids status	www.audiology-worldnews.com
	The MARCS Institute/The HEARing CRC Postdoctoral Fellow Hearing and Cognitive Aging Available	www.talkingbrains.org
	National Practice Standards for Hearing Care Practitioners (Draft For Consultation)	www.ahaconsulting.com.au
June 2016	Life begins at 60 – Peter’s story	http://breakthesoundbarrier.org.au
	Music Victoria PODCAST Hearing Health: Tips for musicians, industry and punters	https://soundcloud.com/music_victoria



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