



HEARING COOPERATIVE RESEARCH CENTRE ANNUAL REPORT 2016/17



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: Lego man holding 3M ClearEAR filtered earplugs, with special thanks to Thom and Alistair's lego collection.



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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 2016 to June 2017.

This has been a significant year of achievement in research outcomes across our four program themes: The Listening Brain, The Intelligent Interface, Individualised Solutions and Enhanced Service Capacity, and in the translation of outcomes into clinical practice.

In particular, the world-unique Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study following a cohort of some 480 children since birth has confirmed the advantages of early device-fitting (both hearing aids and cochlear implants) in children at five years. These results will be published in a supplement to the International Journal of Audiology, made possible by the generous support of the Oticon Foundation, as well as being posted on HEARnet® and National Acoustic Laboratories websites. This will provide information for government in support of universal newborn screening programs, for parents of children with a hearing loss to assist in making decisions on the future of their child, for device manufacturers including Cochlear Ltd and Sivantos Pty Ltd, and for hearing healthcare professionals worldwide.

While publication in peer-reviewed journals and presentation at conferences is a cornerstone of our translation, we are increasingly using digital and social media to translate research findings into practice with particular emphasis on HEARnet Learning® and HEARsmart® initiatives.

It is also pleasing to report the progress in PhD completions and a range of Master of Clinical Audiology research projects. In particular, Ms Julie Beadle, one of our PhD students at Western Sydney University, won the prestigious CSIRO Early Career Researcher Award at last year's CRC Association conference. Julie is the third HEARing CRC PhD to have won this award, testament to the value-add of our PhD program. In collaboration with Cochlear Ltd, we have continued the Cochlear Student Mentoring Program, providing Master of Clinical Audiology students with opportunities to work alongside industry and clinical professionals. In partnership with Audiology Australia, we have expanded HEARnet Learning®, our accredited online training platform, providing Continuing Professional Development modules to upskill hearing healthcare professionals.

These achievements speak to the high quality of our research staff and students, the work of our Project Leaders and Key Scientist Group, as well as our dedicated management team and Board of Directors. The HEARing CRC is well supported by our legal advisor, Dr Jenni Lightowlers (FAL Commercial Lawyers), by our IP attorneys Mr Lorne Wood-Roe (Adams Pluck) and Mr Steven Borovic (Churchill Attorneys), and by our auditors KPMG, and we thank them for their efforts.

This past year has marked several changes to the Board of the HEARing CRC. We would like to formally recognise the enormous contributions of Mr Neville Mitchell as a Director of both HEARing CRC and HEARworks, and as Chair of our Finance and Audit Committee, and his Alternate, Adj Prof Jim Patrick AO, who has had numerous roles in this and previous HEARing CRCs dating back to 1992. Mr Jan Janssen, Chief Technology Officer at Cochlear Ltd, has now joined the Board as a nominee Director, with Mr Derek Minahane, Cochlear's Vice President of Sound Processors and Clinical Care, as his Alternate. The Board was also pleased to welcome Dr Marlene Kanga AM as a new independent Director during the year - Marlene brings a wealth of experience as both an engineer and successful entrepreneur.

Finally, we thank the Directors, the researchers, and our management team for their contribution 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, AO
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 – delaying language development and impacting on educational achievement;
- in adults – reducing productivity, employment prospects and impacting on leisure and social participation; and
- in the elderly – contributing to cognitive decline and its associated health challenges.

The HEARing Cooperative Research Centre (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's evidence-based research underpins implementation of a new model of hearing healthcare delivering:

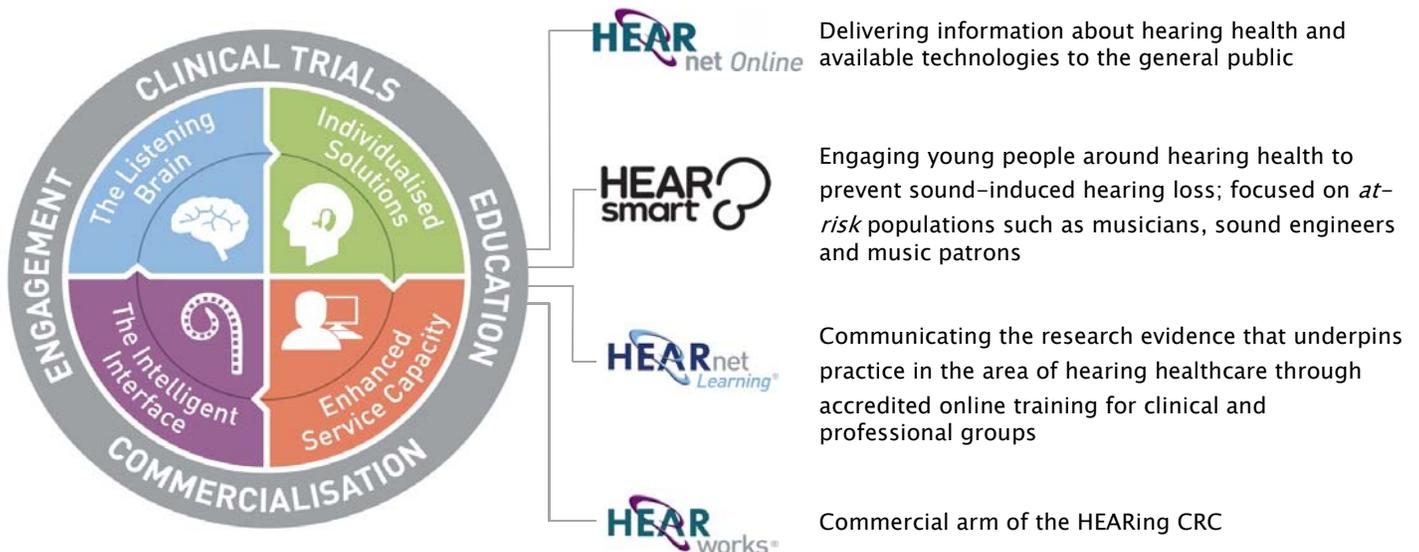
- disability prevention – intervention before irreversible degradation of the auditory system;
- integrated intervention – addressing both sensory and cognitive elements of hearing loss;
- patient-centric approaches – tailoring of hearing healthcare services to individual needs; and
- effective outreach – 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 research and translational work is driven by the end-user, for the end-user - towards the goal of a new model of hearing healthcare. Activity is carried out across four core Themes:

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

Our research outcomes are applied through an integrated Translation and Commercialisation Program, including Clinical Trials, supported by our commercial arm, HEARworks Pty Ltd®. A strong focus is on implementation through initiatives aimed at the wider community (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 provide access to 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 providing 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 translational/commercial activities on a project-by-project basis.

The 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. During the reporting period, the following changes occurred:

- Mr Neville Mitchell, Nominee Director for Cochlear Ltd, retired in February 2017, together with his Alternate Adj Professor Jim Patrick AO;
- Mr Jan Janssen was appointed as Nominee Director for Cochlear Ltd in February 2017, and Mr Derek Minihane was appointed as his Alternate;
- Independent Director Dr Michele Allen retired 1st July 2016; and
- Dr Marlene Kanga was appointed as an Independent Director in November 2016.

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'.

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.

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



Katherine Woodthorpe, AO

Chair

BSc, PhD, FAICD, FTSE

Dr Woodthorpe. AO, 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.

She is the Chair of 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.



Bill Davidson

Nominee Director – Australian Hearing

Mr Davidson was appointed as a 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 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.



Jan Janssen
MScEE

Nominee Director –
Cochlear Ltd

Appointed 16/02/17

Mr Janssen was appointed a Director of the HEARing CRC Limited in February 2017. Mr Janssen joined Cochlear in 2000 as their General Manager of the Cochlear Technology Centre based in Belgium. He was subsequently appointed as Senior vice President, Design and Development in 2005, and is currently Cochlear Ltd's Chief Technology Officer.

Mr Janssen has more than 15 years' experience in research and development in the fields of high technology electronics and cochlear implants.



Marlene Kanga AM
BTech, MSc, PhD,
FAICD

Appointed
25/11/16

Dr Kanga, AM, was appointed Director of the HEARing CRC Limited in November 2016. Dr Kanga is an experienced company director and was President of Engineers Australia in 2013 and is President Elect of the World Federation of Engineering Organisations. She has been a champion for innovation and is a director of Innovation Science Australia and chairs the government's R&D Incentive Committee, Dr Kanga is a director of the Sydney Water Corporation, International Network for Women Engineers and Scientists, Airservices Australia and iOminiscent Pty Ltd, a company that has commercialised intelligent video analytics technologies.



Neville Mitchell
BComm, CA(SA)

Nominee Director –
Cochlear Ltd

Retired 16/02/17

Mr Mitchell was appointed a 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 Ltd'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 as a 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.

He 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 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 Chairman 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.

He 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 (ASSR) which can accurately measure hearing in infants. Professor Rickards concluded his role as Dean of the Melbourne Graduate School of Education at The University of Melbourne in July 2017, and continues his focus on education reform through the Melbourne School of Government and the Melbourne Graduate School of Education as the Dean Emeritus.



Lisa Springer
BSc, PhD, GAICD

Independent Director

Dr Springer was appointed as a 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 is a Fellow of Audiology Australia, The International Collegium of Rehabilitative Audiology, and the American Academy of Audiology. He is a Graduate of the Australian Institute of Company Directors.

Prof Cowan is a Past President and an Executive Board Member of the International Society of Audiology and serves on a range of professional advisory committees including: Eye and Ear Hospital Human Research Ethics Committee; The Shepherd Centre Research Advisory Committee; Standards Australia HE-012 Technical Committee; Western Sydney University MARCs Institute Advisory Board; and ARC Centre of Excellence for Electromaterials Science International Advisory Committee.

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 / Jan Janssen	Jim Patrick AO , Chief Scientist, Cochlear Ltd - retired May 2017 Derek Minihane , Vice President of Sound Processors and Clinical Care, Cochlear Ltd – appointed May 2017
Sakkie Pretorius	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 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. Members include:

- Mr Neville Mitchell (Chair), replaced May 2017 by Dr Lisa Springer;
- Dr Katherine Woodthorpe AO; and
- Dr Marlene Kanga AM.

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. Members include:

- Mr Paul Guthrie (Chair);
- Dr Lisa Springer; and
- Dr Katherine Woodthorpe AO.

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 international experts as required. This group meet quarterly to review 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 Dornan AO - Hear and Say Centre
- Professor Richard Dowell - The University of Melbourne
- Professor Louise Hickson - The University of Queensland
- Professor Linda Hood - Vanderbilt University, USA
- Professor Greg Leigh AO - Royal Institute for Deaf and Blind Children
- Associate Professor Catherine McMahon - Macquarie University
- Adjunct Professor Jim Patrick AO - 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:

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



Members

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 completed his PhD in Audiology under Professor Graeme Clark, and 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, translation/commercialisation and management programs.



Executive Assistant: Ms Amanda Campbell

- **Background:** Amanda has a tertiary qualification in Psychology/Market Research and almost 20 years of experience in administration. Over the last 12 years, she has focused on Executive 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 almost 30 years of financial experience in industry and not-for-profit organisations. She has spent the last 17 years working with CRCs. Her qualifications include Certified Practicing 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 has a PhD in Molecular Oncology and over 15 years of experience in research communications and project management. She has worked across University, Government and research sectors, and recently undertook training with Leadership Victoria.
- **Responsibilities:** Responsible for the HEARing CRC's internal/external communication strategies; managing higher degree research student activities and more recently HEARsmart.



Intellectual Property and Commercial Officer: Ms Katarzyna D'Costa

- **Background:** Kathy has almost 15 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 almost 20 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 both a researcher and a clinical audiologist, with extensive experience managing projects across multiple organisations in the field of hearing. She completed her PhD with the HEARing CRC in 2012 and has combined research program coordination with a research fellow role since then.



- **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) acted in the role of a maternity leave replacement for Dr Paterson until December 2016, 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 prevention, 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 – illustrated 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, all directed at providing the evidence base underpinning our new model.

To support 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 which 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 based on advice or recommendations of the Key Scientists and management. 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.



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 3D sound simulator, one of only a few similar resources world-wide, specially designed to simulate real-life sound environments; and
- the Magneto-encephalographic (MEG) imaging capabilities of the ARC Centre for Excellence in Cognition 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 how laboratory-based assessment of hearing ability and device benefit can most accurately predict real-life performance. Our aim is to create a more realistic acoustic environment in a controlled laboratory setting, and to develop new hearing tests/tasks within that environment to optimally assess the real-life benefits and performance of hearing technologies for clients. A range of different acoustic environments have been recorded using specialist microphones, creating a library (and associated database) of sound environments with different complexities. The environments have already been utilised for a range of research purposes, and are currently being used to develop more realistic speech test materials for cochlear implant recipients.

Another area of research is developing a better understanding of the interface between auditory and cognitive systems in the brain. The team are interested in changes that occur at this interface with both hearing loss and clinical interventions, to enable more sensitive evaluation of devices and therapies. A series of studies are utilising MEG imaging and electrophysiological technologies, to assess brain function in these situations. Additional studies include:

- how imaging and electrophysiology could guide surgical choice for cochlear implant implantation, and be used to evaluate implantation outcome;
- whether experimental tests of listening effort are clinically viable;
- how attending to an auditory task modulates neural connection to the cochlea (the organ of hearing) and how this impacts hearing; and
- whether we can identify a neural marker for speech processing in the auditory cortex.

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 to the brain. Hearing problems arising in this region are referred to as Auditory Neuropathy Spectrum Disorders (ANSD), and these disorders are relatively common, with 1 in 7,000 children affected. We are investigating imaging techniques to objectively evaluate the auditory nerve/brain stem to enable better prediction of long term outcome for babies newly diagnosed with ANSD. Fibre-tractography is being used to differentiate between different pathologies which can lead to ANSD – enabling a better understanding that could lead to more personalised management strategies.

The auditory cortex of the brain is the area primarily responsible for auditory processing. Our studies are investigating the nature of problems in auditory processing and developing a better understanding of its association with children’s reading skill. Due to the complexity of interacting variables, studies are investigating APD in association with established predictors such as statistical learning (a likely contributor to prosodic awareness – understanding stress and intonation in a language), attention (likely contributing to working memory), as well as oral language and word retrieval.

Findings from these projects will drive novel approaches to optimisation of diagnosis, fitting and remediation to 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

3) Hearing loss and language development in infants and children: despite early detection of hearing loss through universal newborn screening programs, and provision of sound amplification and/or intervention at an early age, many children experience language delays during preschool years. Using specialised facilities at the MARCS Baby Lab (Western Sydney University) and those previously identified at 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, and brain mechanisms that may contribute to deficits in these areas;
- what factors in infancy influence language development;
- how to detect hearing-impaired children that are likely to develop poor language skills at the earliest time so that intervention/remediation can be optimised to meet the individual needs; and
- how the brain reacts to and uses input supplied by hearing aids and cochlear implants.

The Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study is an ongoing world-first investigation systematically following a cohort of over 400 hearing-impaired children from first identification of a hearing deficit through to early adulthood. Five-year data has now been compiled for publication, and from this, a series of seven presentations have been released on the HEARnet Learning platform. These include the advantages of earlier intervention for improved language outcomes – highlighting the importance of streamlined clinical pathways for device fitting post diagnosis, as well as reports about the parents’ journey, psychosocial development in hearing-impaired children, and links between ANSD and speech perception (see: <https://hearnetlearning.org.au/mod/page/view.php?id=551>).

Our studies investigating language development in hearing-impaired children have suggested a clinical tool using “cortical auditory-evoked potentials” would be valuable in assessing young children’s ability to discriminate different sounds. This tool is currently under development as part of the HEARlab platform (see section 4.1 Testing our Research – Clinical Trials and Commercial Activity for more information) through a grant received from the NSW Government’s Medical Devices Fund. Interim data suggests the clinical tool is both more practical and can be used at an earlier time point than behavioural approaches currently used for this type of sound discrimination testing. This is encouraging, as LOCHI data has confirmed the benefits of earliest possible audiological diagnosis and intervention for children. The specialist facilities of the Baby Lab at the MARCS Institute are being used to identify the components of infant-directed speech that impact on early language development in hearing-impaired infants. This project is informing intervention programs in how to support early parent-infant interactions to optimise parental linguistic input, for the best possible language development for hearing-impaired children. A third aligned project is using detailed analysis methodology to directly explore how the perception and production of grammatical morphemes develops in children using hearing aids and cochlear implants as compared to normal-hearing children, and how this might differ for children using tonal languages. Finally, the Infant Discrimination and Early Acquisition of Language (IDEAL) study is focused 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, that can be altered in hearing-impaired children. We hope to use this study to develop a tool that clinicians can use to determine whether the child would be likely to benefit more from cochlear implantation or hearing-aid amplification.

World-wide, there has been new interest in the provision of devices to adults and/or children with single-sided hearing loss (i.e. who have normal hearing in the opposite ear). To investigate whether the fitting of a hearing device improves outcomes for this group, a cohort of children with unilateral hearing loss are currently being assessed in the Children with Unilateral Hearing Loss (CUHL) study.

	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. This will include enhanced performance in background noise, as well as specialised 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:** research is developing new approaches to sound processing to improve listening in noisy environments. Hush4 is the latest generation of algorithms for our super-directional beamformer (for more information about this technology, see 4.1 Testing our Research – Clinical Trials and Commercial Activities). Hush4 seeks to optimise speech perception in noise without losing of spatial awareness, an issue that can arise with “directional microphones”. In testing, results for Hush4 are very promising, with a range of assessments showing Hush4 to be significantly better than traditional directional microphones and other commercially available beamformers. Results have also indicated that hearing-impaired listeners using hearing aid and cochlear implant Hush4 test devices experience intelligibility and acceptable noise levels that are equivalent to normal-hearing peers. Current studies are investigating Hush4 performance in our 3D acoustic environment for applications in cochlear implants and hearing aids, as well as hearing protectors and assistive listening devices for individuals without impairments.

Previous HEARing CRC research developed ‘trainability’, an approach that allows hearing devices to automatically adapt sound processing to their changing acoustic environment - having been ‘trained’ by the individual user regarding their preferred settings. In collaboration with Industry Members, our ultimate goal is to incorporate trainability into our super-directional beamformer, to deliver near-normal speech understanding in noise and more accurate localisation of sound for users.

To address the need for improved pitch perception another area of research has developed a new sound processing strategy called Optimised Pitch and Language (OPAL) (note: referred to as eTone in previous reports). OPAL is specifically designed to enhance cues to pitch in the cochlear implant signal, thereby improving music enjoyment and understanding of tonal languages, and is now implemented into Cochlear Ltd’s clinical processor. Non-inferiority trials have been successfully completed in Melbourne, and a clinical trial will soon commence in China.

	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 actively managing the interface between the cochlear implant electrode array and the nerve cells in the organ of hearing (cochlea). 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 of Cochlear Ltd, The University of Melbourne, and the ARC Centre of Excellence for Electromaterials Science at the University of Wollongong is investigating how electrodes can be produced that will have a better combination of biocompatibility, impedance, stability, electrode decomposition and manufacturability than is possible using current materials and processes. In partnership, additional work is investigating

how to reduce current leakage in order to better target nerve cells with each electrode contact. A key area of interest relates to protein build up or ‘fouling’ on the electrode surface. Whilst this does afford protection from corrosion to the platinum electrode surface, it also increases electrical impedance, meaning that higher voltage (and therefore power from the cochlear implant) is required to deliver the same amount of charge required to stimulate the hearing nerves.

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

3) **Hearing preservation in implant users:** working closely with Cochlear Ltd’s electrode design and development team, a number of projects are developing and trialling new designs of cochlear implant electrode arrays. These new designs are aimed at maximising a recipient’s retention of residual acoustic hearing by: (i) minimising insertion trauma; (ii) providing real-time feedback on insertion to guide surgeons; and (iii) eluting pharmacological agents to reduce the impact of insertion.

A first-time-in-human study of a drug-eluting electrode developed by the HEARing CRC has shown significant benefit to cochlear implant electrical performance. This electrode passively releases a small concentration of anti-inflammatory agent into the cochlear environment from its surface. A second, multicentre international research study, positively evaluated a slim cochlear implant electrode designed to minimise trauma on insertion. This is now commercially released as the Nucleus CI522 electrode array.

Based on the positive findings from the first-time-in human electrode drug-delivery studies, early phase research was also carried out into development of drugs for delivery into the cochlear environment to prevent the death of “hair cells”. Molecular biology research has investigated the basic processes involved with loss of these hearing hair cells in age-related hearing loss and has implicated specific cell death pathways. Research findings have provided proof of principal that hair cell death can be prevented by blocking these specific cell death pathways. Work on this project has now concluded.

	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 (including new cochlear implants designs aimed at preserving residual hearing or better positioning, combination electroacoustic devices, middle-ear devices, acoustic and bone-anchored hearing aids) places significant pressure on clinicians and surgeons in terms of recommending the best technology for any individual client. Analysing pooled patient data to identify what is reliably known about candidacy and intervention criteria for different clients and devices will lead to the development of an evidence base for unilateral and bilateral device candidacy criteria for children, adults and the elderly with different types of hearing loss. From this data, we will develop clinical tools/ processes that can be updated as new information is collected to assist clinicians in decision making. Additional information is being garnered to develop a means of assessing which clients can benefit from and effectively use trainability functions in devices, as well as a test to determine whether a patient will function better with one or two hearing aids.

	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 / Taegan Young

2) Individualised fitting of devices: different hearing devices use different methods to enable optimal fitting. Device fitting also needs to be adjusted over time to best complement differing cognitive and hearing abilities of their users as they age. A number of projects are investigating optimal fitting:

- objective testing using “cortical auditory evoked potentials” in lieu of reliance on only behavioural responses (discussed in Theme 1) has been shown to be valuable in device prescription and fine fitting of hearing devices. This is of particular interest to non-verbal adults (such as dementia clients) and young children, including those with multiple disabilities, and a challenging group with auditory-neural sensory disorders;
- The Hush4 super-directional beamformer research (discussed under Theme 2) being carried out in collaboration with Sivantos Pty Ltd has shown that Speech Reception Threshold and Acceptable Noise Level are the two criteria most important for predicting which individuals are likely to benefit from this technology; and
- new electroacoustic hearing devices blend electric (from an implant) and acoustic (natural) hearing for the user. In collaboration with Cochlear Ltd research is being carried out to determine how these devices should be fitted to best suit individual users, and to minimise complexity and time taken for clinicians.

	Project title	Project Leader
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: to support parent-led interventions for hearing-impaired children, studies are focused on phonological awareness in pre-school children. This aims to improve subsequent literacy development, and also to assess the role of ehealth initiatives in optimising parental input to support language development in this group. Aligned activities are investigating children with auditory processing disorders (APDs), specifically those showing temporal deficits, literacy difficulties and poorer cognitive skills. Research has used an adapted version of aTune, a pitch perception training game (developed by the HEARing CRC) that specifically targets patterning and musical discrimination. Early results indicate improvements in this group in both temporal patterning and reading fluency. If the complete data set is conclusive, aTune may be made commercially available as a computer-based auditory training program for children.

The issue of APD and cognitive decline in older adults has received little attention. Our research is examining attention and working memory in cognitive aging, and how this relates to hearing and speech. As part of this work, a training tool is being developed to assist elderly listeners to better pay attention to speech and remember spoken words/concepts.

In collaboration with Member organisation The Shepherd Centre, the HEARing CRC has developed the Functional Listening Index (FLI™) as a tool to enable clinicians to measure functional hearing and communication outcomes for children with hearing loss. The FLI includes a checklist of questions, a database of de-identified aggregated results from hearing and hearing-impaired children, and a methodology to benchmark a patient's performance against a normative curve. The FLI has been licenced to Cochlear Ltd, and a multicentre international study is currently being planned.

A key initiative aimed at a new model of hearing healthcare is focused on implementing patient-centred care in adults as best practice in audiology. Researchers are working with Australian Hearing on this project to develop a HEARhelp AUD™ (Ask, Understand, Deliver) toolkit for audiologists that will be trialled with new audiology interns.

	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: outcomes of research in Theme 3 are being applied in this project area to explore patient/family-centred approaches in eHealth, with the aim of engaging professionals via HEARhelp (tele). A large scale analysis of current approaches to hearing ehealth care as compared to traditional “clinician in person” delivery has been completed. From this, a decision aid for use in assisting prospective and current cochlear implant recipients and their families to decide on mode of service delivery has been developed and is currently being evaluated.

Aligned to hearing ehealthcare, development of the on-line version of the Infant Monitor for vocal Production (IMP) has been completed. The IMP tool promotes parent education and informs parent-professional decision making in early intervention for neonatal hearing loss.

	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	Telehealth package for remote assessment of the clinical population with hearing loss <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 <i>(work in this Project merged into development of HEARnet Learning)</i>	Catherine McMahon

2) Empowering users: establishing the advantages of a fully automated self-fitted hearing aid that eliminates any dependency on internet linkages or computer-based interfaces. Research extends to situations in which self-fitted 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: hearing loss associated with excessive sound exposure (typically referred to as noise-induced hearing loss [NIHL]), affects a significant portion of the population and is almost completely preventable. While work-based noise is the largest cause of NIHL, workplace regulations are in place to minimise this. However, such regulations do not extend to exposure to leisure noise, or the noise we are all exposed to in our everyday environments.

A research and outreach campaign has been launched under the name HEARsmart (<http://hearsmart.org/> to target populations shown in our research to be *at-risk* of NIHL, in particular young people (18-35 year olds) interested in music. An informative website provides information about the risk posed by exposure to loud sound and has a number of offerings to increase awareness and provide advice to prevent NIHL, including:

- Know Your Noise: an online hearing test and interactive lifetime noise risk exposure calculator to help individuals better understand personal risk and strategies to reduce risk.
- iPhone app ‘Sound Log’ to measure and track sound exposure, available through iTunes (<https://itunes.apple.com/us/app/id1063941394>).
- Bee HEARsmart - an animation about Tinnitus and WhatPlug? An independent review of filtered earplugs carried out in association with Choice. Both of these were released outside the reporting period.

Research looking at approaches to minimising sound doses over the course of an evening without impacting patron enjoyment has been undertaken with six music venues, supported by grant funding from the Deafness Foundation Victoria and with the support of distributors of the 10EaZy decibel banking system. In addition, audiological studies looking at hearing in sound engineers are being undertaken and work is being done with audiologists to better understand how they are working with individuals from the music industry, and how this could be optimised for this high risk population.

	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 taken up and used by appropriate stakeholders.

Every HEARing CRC research project must consider the likely benefit of the research to each of our end-users, and detail this in an 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.

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 project 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:** conducting clinical trials for new technologies and/or tools developed within HEARing CRC research. To ensure that cochlear implant research is end-user focused, a strong link has been established with Cochlear'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 CRCs clinical resources and expertise. These studies extend from small first-time-in-human trials to multicentre international clinical trials.

2) **HEARLab technology development:** a clinical need has been identified for an objective procedure to assess hearing and to fit hearing devices. Initially this was aimed at infants and elderly patients who cannot respond verbally, but may also be valuable for use with broader populations, particularly in countries that do not have a base of resident audiologists. In collaboration with NAL, the HEARing CRC has developed HEARLab, a PC-based audiological test platform employing specific tests as software modules. HEARLab has been licenced to US-based Frye Electronics Inc.

HEARLab and its first module that delivers Aided Cortical Assessments (ACA) is currently being used across Australia, Europe and the USA. Two additional modules have been developed to expand the functionality of HEARLab:

- Auditory Brainstem Response (ABR) module: to record auditory brain stem responses; and
- Cortical Automated Threshold Estimation (CATE): to automatically record cortical thresholds and produce an audiogram. The software enables fast and accurate hearing threshold estimation, and is largely funded through a NSW Medical Device Fund Grant.

A fourth HEARLab module, Auditory Cortical Discrimination (ACORD), aimed at assisting clinicians in deciding what hearing technology to recommend to parents of hearing-impaired infants is currently under development. This work is largely funded through a second grant from the NSW Government's Medical Device Fund.

3) **Applications of binaural technology:** this project is focused on integration of "binaural signal processing strategies" into hearing aids, cochlear implants, hearables, assistive listening devices and hearing protectors. The Hush4 super-directional beamformer algorithm is an innovative mathematical formula developed through the HEARing CRC that combines sound recorded by two microphones, often 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, improving understanding of speech in noisy environments.

Work is currently being carried out with several commercial end-users.

4) **Hearing loss prevention:** Speech Reference Limiting, a novel application developed by the HEARing CRC controls the loudness of unwanted incoming signals, and has been demonstrated to significantly 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 licencee.

	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

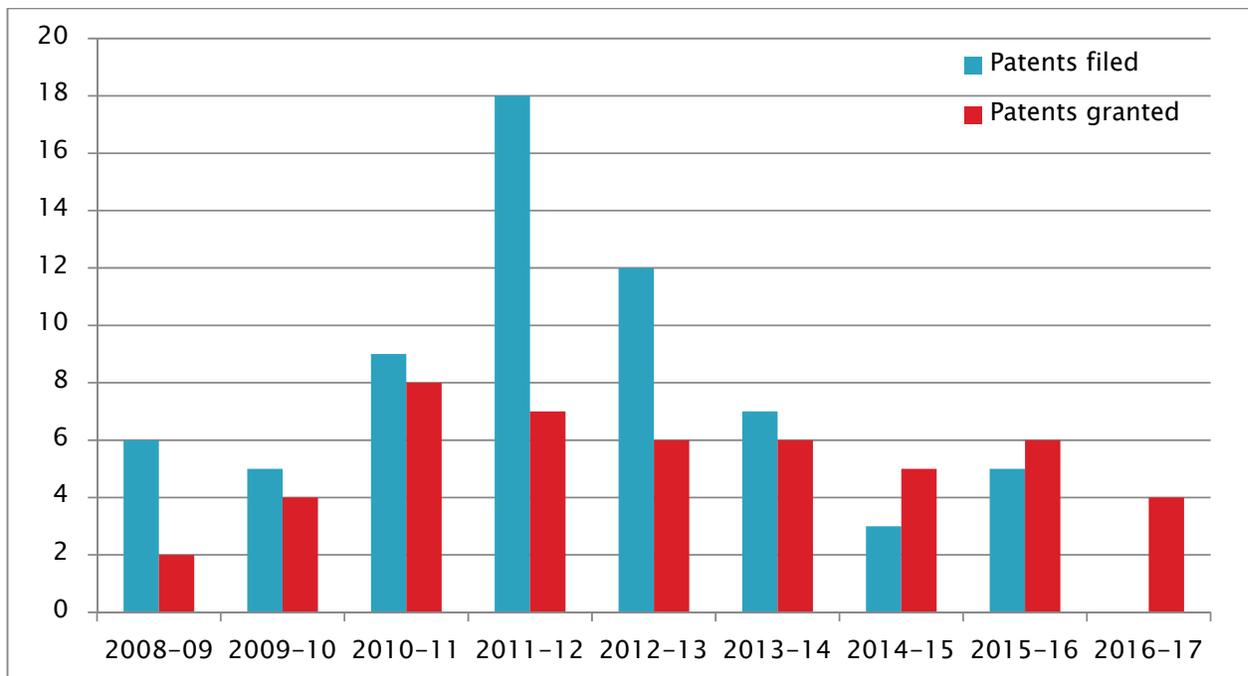
The HEARing CRC is focused on achieving maximum value and impact from the translation and application of its Intellectual Property (IP) into commercial and/or clinical use.

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 2016-17, 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:

- Active low pass electrode – A signal processing device for use in electroencephalography and a cable system incorporating the device
- Bardy tones – Efficient objective measurement of frequency-specific hearing thresholds by evoked cortical responses
- Bilateral beamformer – A system and method for producing a directional output signal
- Hush – A noise reduction method and system
- MinP – Systems and methods for reducing unwanted sounds in signals received from an arrangement of microphones

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

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

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

- Di-EL® Early Language
- eHEAR®
- FLI® (Functional Listening Index)
- HEARhelp®
- HEARing CRC®
- HEARLab®
- HEARMyChoice®
- HEARnet Learning®
- HEARnet®
- HEARsmart®
- HEARworks Shriek Rejection®
- MOSI® (Musician Oriented Sound Index)
- Sound Value®

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 2016-17 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 licensees	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. HEARing CRC end-users are more diverse than this however, also including:

- the research community;
- patients and the public;
- hearing health professionals / clinicians; and
- 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 by young people.

Our approach is tailored to deliver key information and messages from our research to our different end-users. 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 41 peer-reviewed publications, plus three published conference proceedings and 102 oral or poster presentations at national and international conferences, many invited.

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 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, detailing findings of clinical studies for research and development staff. They may 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 is 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 28 mentions of the HEARing CRC in the public arena, largely in newsletter and website articles, but also including radio and podcast media.

Participating in events such as Hearing Awareness Week (HAW, August 2016) and the World Health Organisation's International Ear Care Day (March 2017) provides opportunity to engage directly with public audiences. HAW this year again spanned Melbourne and Sydney, with Melbourne staff sharing a marquee in Federation Square with other hearing organisations and sponsoring a second fabulous

Musicians 4 Hearing gig. The Sydney staff ran a silent disco, gave presentations and serviced a booth at the Australian Hearing Hub HAW open day.

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 a strong online and social media presence, 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 both. This has also been supported by integrated social media activity to attract and drive

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

Launched: 2012

Aimed at: public (with and without hearing loss)

Also useful: for hearing health professionals, media, government

Visits 2016-17: 76,467



Hearing Education and Research Network (HEARnet) Online was launched to increase the impact of 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.

5.2.2 HEARsmart (www.hearsmart.org)

Launched: 2014

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

Also useful: for musicians, live sound engineers, music venues

Visits 2016-17: 3,365



HEARing CRC research has identified that young people with an interest in music have one of the highest risks for recreational noise-induced hearing loss. It has also suggested that this group may be most open to changing their behaviour to better look after their ears.

The HEARsmart initiative has been developed to reach out to these young people as well as the broader music industry to increase understanding and awareness of problems associated with how LONG, how LOUD and how OFTEN ears are exposed to dangerous sound. In addition, it is engaging with live music venues and their sound engineers 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. Key achievements include:

- Know Your Noise website: released in November 2014, includes an online hearing test and a calculator to estimate risk to hearing from every day activities. Since launch it has received over 89,000 users across 105,000 sessions (to June 2017).
- 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; co-hosted a Hearing Health Symposium: tips for musicians, industry and punters (June 2016).
- Music venue research: co-funded by the Deafness Foundation, trialling decibel banking software with sound engineers in six live music venues in Melbourne, alongside sound measurements, staff and patron surveys. Is this a tool that can be used to implement safe sound practices? Sound engineer x hearing health module: developing a learning module with SAE Creative Media Institute to add to sound engineer curriculum. This activity is ongoing, with the aim of making it available to other tertiary education providers upon completion. Module may also be reworked for continuing professional development in this field.
- Audiologists and music industry professionals: research and tools for audiologists working with musician and sound engineers.

Visibility/social media: During 2016-17 the HEARsmart website has been updated and optimised for search engines to increase its online visibility, this is being carried out 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. 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. VISTA was held in Sydney for a group of Italian attendees in November 2016.

Our most important channel for the clinical community 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, see below for more information.

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

Launched: 2012

Registered users: Over 2,000

Accredited content: 23 modules and 13 webinars

Aimed at: Hearing health professionals

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



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 worked 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. Content is also 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 entities with their own branding, 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, providing direct access to interested members of the public, as well as many CRC Members and other interested professional groups.

Social media channels are complimentary communication networks that are used 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:

* cumulative, ** per period

HEARnet	 Twitter handle: @HEARingCRC				 Facebook	 SlideShare	 YouTube	 LinkedIn	
Time period	followers *	mentions **	retweet **	clicks ** (up to 2016) impressions ** (2017 +)	likes *	views *	views *	subscribers *	followers *
2011-12	172	56	21	158	25				
2012-13	340	73	57	420	69				
2013-14	1,055	156	163	1,430	84	676	836		
2014-15	1,321	84	185	1,105	145	1,470	3,345	19	
2015-16	1,603	34	102	3,308	307	2,090	7,218	30	138
2016-17	1,729	45	143	41,481	400	4,388	11,568	41	171

HEARsmart	 Twitter handle: @HEARsmart_				 Facebook	 Instagram
Time period	followers *	mentions **	retweet **	Clicks** (up to 2016) Impressions ** (2017 +)	likes *	
2014-15	188	23	80	263	93	
2015-16	217	12	44	516	112	
2016-17	305	6	26	5,209	115	27

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. 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.

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; 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 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, National Acoustic Laboratories, The Royal Eye and Ear Hospital and The University of Melbourne.

6.2 Domestic and International Collaborations

The HEARing CRC is involved with a range of local and international collaborations. Through these collaborations the HEARing CRC supplements its skills and capabilities to ensure milestones and outputs are met, and increases the potential for CRC outcomes to be applied more broadly. During the reporting period, HEARing CRC researchers were involved with 63 domestic collaborations and 38 international collaborations.

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 2016-17 reporting period our PhD student numbers remained stable at 31, in addition, we had 31 Masters of Clinical Audiology project students working on projects within the research Themes. During this time period, two PhD students have submitted.

Supporting activities: to ensure students at the HEARing CRC gain additional skills during their tenure regular Training and Symposium events are delivered. In October 2016, PhD students attended a workshop on presentation skills held at the Australian Hearing Hub. This was aimed at gaining skills in presenting to both traditional researcher audiences as well as non-traditional audiences such as the general public, commercial and philanthropic. Students also attended the HEARing CRC's Annual Research Symposium and those with project responsibilities presented their work – whilst the main group presented their research during an extended poster session. Students were also invited to participate in a mentoring program to link them with experienced individuals from Member and non-Member organisations.

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 2013-16 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.

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 40 students have taken part. During this reporting period the Program provided the opportunity for 20 students (seven in 2016 and 13 in 2017) to gain the opportunity for hands-on industry experience in the Melbourne and Sydney Cochlear Implant Clinics. This program is supported financially by Cochlear Ltd.

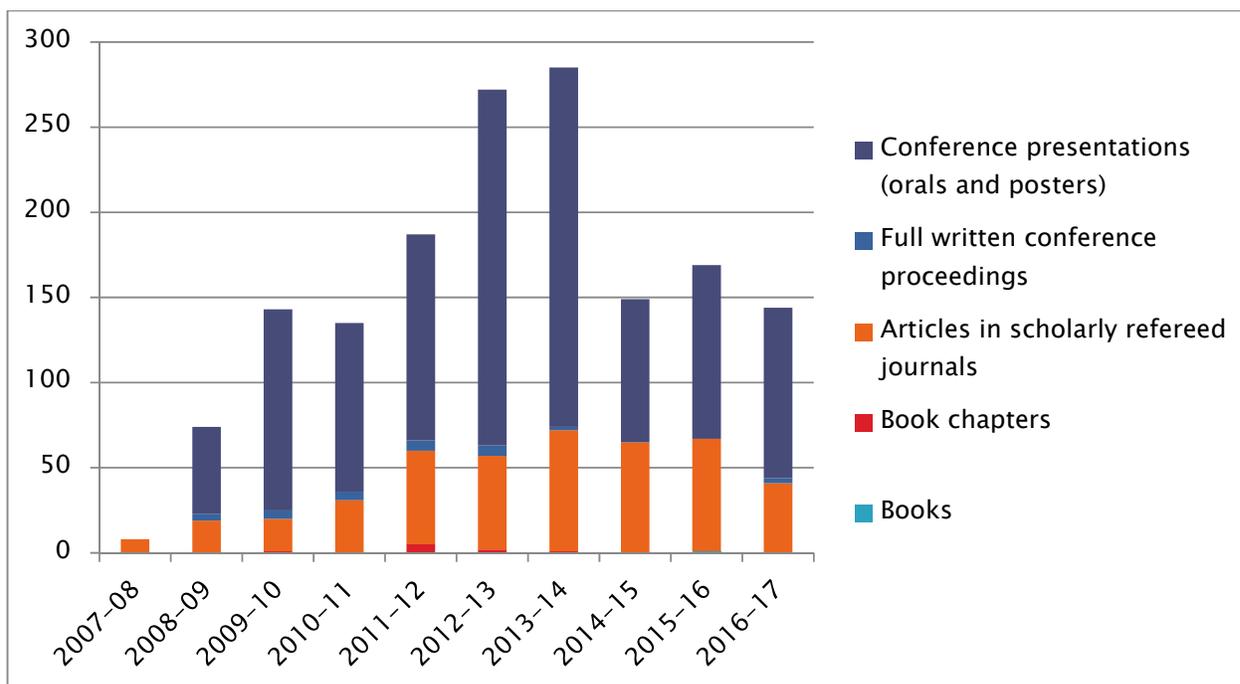
Through the CEO, a specialised hearing technology and research lecture series is provided for the University of Western Australia's Masters in Clinical Audiology program. In addition, Prof Robert Cowan also took part in the Cancer Therapeutics CRC (CTx) STEMM Bootcamp for early career medical researchers during the reporting period, an activity built on the successful Molecules to Medicine Program curated by CTx.

Several HEARing CRC staff members also provide lectures to courses within the Master of Clinical Audiology programs at The University of Melbourne, Macquarie University and The University of Queensland.

8. GLOSSARY OF TERMS

2D / 3D	2 dimensional / 3 dimensional	HEAR IP	The Intellectual Property arm (entity) of the HEARing CRC
ABR	Auditory Brain Response	HEARhelp	AUD – Ask, Understand, Deliver tele – telehealth
ABN	Australian Business Number	HEARnet	Hearing Education and Research Network
ACN	Australian Company Number	HEARsmart	Hearing health promotion, advocacy; hearing loss prevention
ACA	Aided Cortical Assessment (HEARlab module)	HEARworks	The commercial arm (entity) of the HEARing CRC
ACORD	Auditory Cortical Discrimination (HEARlab module)	HIMPP	Hearing Instrument Manufacturers Patent Partnership
AHH	Australian Hearing Hub	IDEAL	Infant Discrimination and Early Acquisition of Language (study)
AICD	Australian Institute of Company Directors	IMP	Infant Monitoring of vocal Production (tool)
AM	Member of the Order of Australia	IP	Intellectual Property
ANSD	Auditory Neuropathy Spectrum Disorder	KPMG	Klijnfeld, Peat, Marwick and Goerdeler (auditors)
AO	Officer of the Order of Australia	LiSN-S	Listening in Spatialized Noise - Sentences Test
APD	Auditory Processing Disorder	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
ASX	Australian Securities Exchange	MTP Connect	MedTech and Pharma Growth Centre
CATE	Cortical Auditory Threshold Estimation (HEARlab module)	MRI	Magnetic Resonance Imaging
CEO	Chief Executive Officer	NAL	National Acoustic Laboratories
CFO	Chief Financial Officer	NAL-NL1 & NL2	National Acoustic Laboratories hearing aid fitting software
CRC	Cooperative Research Centre	NGO	Non-Governmental Organisation
CRCA	Cooperative Research Centre Association	NIHL	Noise-induced hearing loss
CSIRO	Commonwealth Scientific and Industrial Research Organisation	OPAL	Optimised Pitch And Language (sound processor and system, previously e-Tone)
CUHL	Children with Unilateral Hearing Loss (study)	PhD	Doctor of Philosophy
EEG	Electroencephalography	R&D	Research and Development
FAL	Francis Abourizk Lightowlers (Lawyers)	SME	Small to Medium Sized Enterprise
FLI	Functional Listening Index (tool)	STEMM	Science, Technology, Engineering, Mathematics and Medicine
GPs	General Practitioners	VISTA	Visiting Implant Specialists to Australia (cochlear Ltd)
HAW	Hearing Awareness Week	WHO	World Health Organisation

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18. Cattle Moore, R, 2016. 'UHL IMPact: Examining the effect of unilateral hearing loss on infant vocal development', 28th Australian and New Zealand Conference for the Educators of the Deaf / 12th Asia Pacific Congress on Deafness, Christchurch, New Zealand.
19. Ching T Y C, Zhang, V, & LOCHI team, 2017. 'The Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study', Beijing International Audiology Conference, Beijing, China.
20. Ching, T Y C, 2017. 'Benefits of early implantation: evidence from the LOCHI study', Cochlear Global Research Symposium, Sydney, Australia.
21. Ching, T Y C 2016. 'Effectiveness of early intervention for long-term outcomes of children with congenital hearing loss', Healthy Hearing Symposium, Brisbane, Australia.
22. Ching, T Y C, 2016. 'Management of children with unilateral hearing loss: preliminary findings from the CUHL study', Healthy Hearing Symposium, Brisbane, Australia.
23. Ching, T Y C, 2016. 'Developing an evidence base for management of children with unilateral hearing loss: the CUHL study', 28th ANZCED and 12th APCD, Christchurch, New Zealand.
24. Ching, T Y C, 2016. 'Effectiveness of early intervention for improving population outcomes of children with congenital hearing loss'. 28th ANZCED and 12th APCD, Christchurch, New Zealand.
25. Ching, T Y C, Zhang, V, & the LOCHI team, 2017. 'Speech perception outcomes of 5-year-old children using hearing aids or cochlear implants: findings of the LOCHI study', 9th Australasian Newborn Hearing Screening Conference, Melbourne, Australia.
26. Ching, T Y C, Dillon, H, Button, L, Seeto, M, Zhang, V, & Van Buynder, P, 2017. 'Predicting outcomes of children with cochlear implants: findings from the LOCHI study', ESPCI2017, Lisbon, Portugal.
27. Ching, T Y C, Wong, C, Zhang, V, Scarinci, N, Erbas, E, Moore, E, & Marnane, V, 2017. 'Early intervention following early detection is key to better language outcomes: update on the LOCHI study. 9th Australasian Newborn Hearing Screening Conference, Melbourne, Australia.
28. Ching, T Y C, Wong, C, Zhang, V, Scarinci, N, Erbas, E, Moore, E, & Marnane, V, 2017. Psychosocial development hinges on good language and functional performance: update on the LOCHI study. 9th Australasian Newborn Hearing Screening Conference, Melbourne, Australia.
29. Ching, T, Van Dun, B, Zhang, V, Wong, C, Bardy, F, Rance, G, Chisari, D, Zanin, J, King, A, Xu, N, Demuth K, & Cowan, R, 2017. 'Evaluating auditory discrimination in infants using the acoustic change complex to predict language outcomes at the age of 3', International Evoked Response Audiometry Study Group Conference, Warsaw, Poland.
30. Choo, D, Dettman, S, Dowell, R, & Cowan, R, 2017. 'Engaging parents in their children's early communicative experiences with mobile and wearable (LENA) technology: A pilot study', Speech Pathology Australia National Conference 2017, Sydney, Australia.
31. Choo, D, Dettman, S, Dowell, R, Cowan, R, & Leigh, J, 2017. 'Preliminary findings of a parent-focused intervention using mobile and wearable technology to enrich the everyday language environments of children', CI2017 Paediatric 15th Symposium of Cochlear Implants in Children, San Francisco, USA.
32. Citton Padilha dos Reis, M, Reis, M, Boisvert, I, & McMahon, C, 2017. 'Auditory and visual training in adult cochlear implant users', 4th International Conference on Cognitive Hearing Science for Communication, Linköping, Sweden.
33. Convery, E, Keidser, G, 2017. 'Left to their own devices? What the evidence tells us about self-fitting hearing aids', The American Auditory Society Scientific and Technology Meeting, Scottsdale, USA.

34. Convery, E, Hickson, L, Meyer, C, & Keidser, G, 2016. 'Self-fitting hearing aids: Issues of candidacy and support', University of Queensland SHRS Postgraduate Research Conference, Brisbane, Australia.
35. Costa, I M, Silva, P B, Moore, R C, & Jesus, L M T, 2017. 'Assessing the vocal productions of infant cochlear implant candidates: Validating the Infant Monitor of Vocal Production (IMP) – Versao Portuguesa'. European Symposium of Paediatric Cochlear Implantation (ESPCI), Lisbon, Portugal.
36. Cowan, RSC, 2017. 'Cognitive and event-related potentials'. XXV IERASG meeting, Warsaw Poland.
37. Cowan, R, Newbold, C, Stathopoulos, D, Risi, F, Briggs, R, O'Leary, S, Birman, C, Plant, K, Gavrilis, J, 2017. A combination device delivering targeted drug therapy to the inner ear via a cochlear implant. 12th Annual International Electromaterials Science Symposium, University of Wollongong.
38. Cowan, R, 2016. 'Research, Technology and Audiology – Enablers and Disruptors'. Audiology Australia WA Chapter Conference "Putting the Science Back in Audiology, Perth, Western Australia.
39. Cowan, R, Briggs, R, O'Leary, R, Birman, C, Stathopoulos, D, Plant, K, Gavrilis, J, 2016. A first time in human investigation of a combination device delivering a targeted drug therapy to cochlear implant recipients. XXXIII World Congress of Audiology, Vancouver, Canada.
40. Cowan, R, 2016. 'Fitting and evaluating electro-acoustic fittings in adults'. XXXIII World Congress of Audiology, Vancouver, Canada.
41. Cowan, R, Newbold, C, Stathopoulos, D, Miller, C, Risi, F, Briggs, R, 2016. 'Safety studies for a combination device delivering therapeutics to the inner ear via a cochlear implant'. XXXIII World Congress of Audiology, Vancouver, Canada.
42. Cowan, R, 2016. 'Recording cortical auditory evoked potentials (CAEPs) with a single-channel clinical device in cochlear implant users'. XXXIII World Congress of Audiology, Vancouver, Canada.
43. Cowan, R, Ching, T Y C, Van Buynder, P, Button, L, Seeto, M, & Dillon, H, 2017. 'Predicting outcomes of children with cochlear implants: findings from the LOCHI study', 13th Congress of the European Federation of Audiology Societies, Interlaken, Switzerland.
44. Cubick, J, Buchholz, J M, Best, V, Lavandier, M, & Dau, T, 2017. 'Spatial perception and speech intelligibility in aided listeners', Meeting of the German Acoustical Society (DAGA), Kiel, Germany.
45. Cubick, J, Buchholz, J M, Best, V, Lavandier, M, & Dau, T, 2017. 'Spatial perception and speech intelligibility in aided listeners', Meeting of the Acoustical Society of America, Boston, USA.
46. Cupples, L, Ching, T Y C, Button, L, Seeto, M, Zhang, V, Whitfield, J, Gunnourie, M, Martin, L, & Marnane, V 2017. 'Variables that influence language and speech outcomes in 5-year-old children with hearing loss and additional disabilities', National Conference of Speech Pathology Australia, Sydney, Australia.
47. Cupples, L, Ching, T Y C, Button, L, Leigh, G, Marnane, V, Whitfield, J, Gunnourie, M, & Martin, L 2017. 'Language, speech and everyday functioning in 5-year-old children using hearing aids or cochlear implants', National Conference of Speech Pathology Australia, Sydney, Australia.
48. Dettman, S J , 2016. 'Early implantation and the importance of maternal input', NCFIE 2016 Nordic Conference, Barnplantorna, Sweden.
49. Dowell, R C, 2016. 'Improvement in auditory performance in adults receiving cochlear implants', XXXVIII World Congress of Audiology, Vancouver, Canada.
50. Fullerton, A, McMahan, C, Ibrahim, R, Savage, G, & Johnson, B, 2017. 'Examining the relationship between cognitive abilities and auditory-visual cross-modal activation', 4th International Conference on Cognitive Hearing Science for Communication, Linkoping, Sweden.
51. Gilliver, M, 2017. 'At home with PA: A comparison of outcomes from parent - and therapist-led interventions for pre-schoolers with hearing loss', Society for the Scientific Study of Reading Annual meeting 2017, Halifax, Nova Scotia.
52. Gokula, R, Lo, C Y, & Sharma, M, 2016. 'Breaking down the invisible barriers between the deaf and the hearing', In Macquarie Minds Showcase, Sydney, Australia.
53. Gunnourie, M, Westerveld, M, Trembath, D, Ching, T Y C, 2017. 'The oral narrative performance of children with hearing loss: Results from the LOCHI study at 9 years of age', Speech Pathology Australia National Conference 2017, Sydney, Australia.
54. Harris, A R, Carter, P, Newbold, C, Cowan, R, & Wallace, G, 2017. 'The Effect of Protein Adsorption on Platinum Electrodes', ACES International Electromaterials Science Symposium, Wollongong, Australia.
55. Harris, A, & Wallace, G, 2016. 'Measuring effective electrode area and charge density of platinum electrodes for cochlear implants', Meeting of Australasian Neuroscience Society 2016, Hobart, Australia.
56. Harris, A, 2016. 'From electrochemistry to electrophysiology', Electrochemistry Symposium for Alan Bond, Melbourne, Australia.
57. Harris, A R, Carter, P, Newbold, C, Cowan, R, & Wallace, G, 2016. 'Measuring effective electrode area and charge density of platinum electrodes for cochlear implants', ACES Electromaterials Symposium International Conference, Wollongong, Australia.

58. Harris, A R, Carter, P, Newbold, C, Cowan, R, & Wallace, G, (2016). 'The effect of protein adsorption on platinum electrodes', 25th Anniversary meeting of the Australasian Society for Biomaterials and Tissue Engineering (ASBTE) International Conference, Canberra, Australia.
59. Hernandez Perez, H, McMahon, C, Dhar, S, & Monaghan, J, 2016. 'Effects of auditory attention on otoacoustic emissions', Fifth Joint Meeting of the Acoustical Society of America and the Acoustical Society of Japan, Honolulu, Hawaii, USA.
60. Hernandez-Perez, H, McMahon, C, Monaghan, J, Dhar, S, Boothalingam, S, & Poeppel, D, 2017. 'How far down does the top down control of speech processing go?', Association for Research in Otolaryngology 40th MidWinter Meeting, Baltimore, USA.
61. Hughes, S, Hutchings, H, Peters, S, Boisvert, I, McMahon, C M, & Rapport, F, 2017. 'A systematic review and narrative synthesis of the measurement properties of patient-reported outcome measures (PROMs) used to assess listening effort in hearing loss', Harrogate, UK.
62. Hughes, S, Rapport, F, Hutchings, H, McMahon, C, & Boisvert, I, 2017. 'Qualitative data supporting the FUEL: Perceived listening effort in cochlear implantation', Linköping, Sweden.
63. Incerti, P V, Ching, T Y C, Hou, S, Van Buynder, P, & Cowan, R, 2017. 'Programming characteristics of cochlear implants in young children: findings from a population-based prospective study', ESPCI2017, Lisbon, Portugal.
64. Kasisopa, B, Onsuwan, C, Tantibundhit, C, Klangpornkun, N, Techacharoenrungrueang, S, Luksaneeyanawin, S, & Burnham, D, 2016. 'Auditory-visual lexical tone perception in Thai elderly listeners with and without hearing impairment', Interspeech 2016, San Francisco, USA.
65. Keidser, G, & Convery, E, 2016. 'Management of and outcomes with a commercial self-fitting hearing aid (SFHA)', International Hearing Aid Research Conference, Lake Tahoe, California, USA.
66. Keidser, G, & Convery, E, 2016. 'Self-fitting hearing aids. 33rd World Congress of Audiology', Vancouver, British Columbia.
67. Keidser, G, & Convery, E, 2017. 'When left to their own devices: management and outcomes with self-fitting hearing aids', 21st ENT World Congress, Paris, France.
68. Keidser, G, 2017. 'WG on developing new laboratory tests that better predict real-life performances; General activities and future plans', NAL/CRC activities, ICRA meeting, Glasgow, UK.
69. Keidser, G, Freeston, K, Best, V, & Buchholz, J M, 2017. 'Comprehension vs sentence recognition and their relation to cognition for verbal processing', 4th International Conference on Cognitive Hearing Science for Communication, Linköping, Sweden.
70. Lavandier, M, Buchholz, J M, & Rana, B, (2017). 'A model predicting the effect of audibility on speech reception thresholds and spatial release from masking'. Meeting of the Acoustical Society of America, Boston, USA.
71. Leigh, J, Dowell, R, & Dettman, J, 2016. 'Communication outcomes for young children receiving cochlear implants and implications for cochlear implant candidacy', XXXIII World Congress of Audiology, Vancouver, Canada.
72. Marchand, R, Buchholz, J, Dillon, H, & Looi, V, 2017. 'Hearing aids and music: an analysis of the factors influencing user satisfaction', Visit Sivantos, Erlangen, Germany and Hearing Aids for Music Conference, Leeds, UK
73. McCarthy, M, Leigh, G, & Arthur-Kelly, M, 2017. 'Widening horizons: A study on the use of telepractice to deliver family-centred early intervention', Presentation at 9th Australasian Newborn Hearing Screening Conference, Melbourne, Australia.
74. McGinnity, S, Cowan, R, Beach, E, & Mulder, J, 2017. 'Hearing in the Music Industry, National Hearing Conservation Association, San Antonio, Texas, USA.
75. McMahon, C, 2017. Global Implementation Conference, Toronto, Canada.
76. Meyer, C, 2016. 'Client and family-centred approaches to hearing healthcare for adults with hearing loss: A focus on eHealth', Neurosensory Clinical Conference, Noosa, Australia.
77. Meyer, C, Grenness, C, Khan, A, & Hickson, 2016. 'Does patient-clinician communication influence patients' decisions to obtain hearing aids?', 2016 GSA Annual Scientific Meeting, New Orleans, USA.
78. Miles, K, Boisvert, I, McMahon, C, & Beath, C, 2017. 'Pupillometry as a measure of listening effort: methodological considerations for data and statistical analysis', 4th International Conference on Cognitive Hearing Science for Communication, Linköping, Sweden.
79. Nickbakht, M, Meyer, C, Scarinci, N, & Beswick, R, 2016. 'Family-centred care for children with hearing loss: Professionals' perspective', Healthy Hearing Symposium 2016, Brisbane, Australia.
80. Rana, B, & Buchholz, J. 'Effect of audibility, frequency region, and hearing loss on better-ear glimpsing', Joint meeting of the Acoustical Society of America/Japan, Hawaii, USA.

81. Reis, M, Beedell, E, Boisvert, I, & McMahon, C, 2017. 'Beliefs and benefits: clinical approaches towards auditory training for adult cochlear implant users', British Society of Audiology's 2017 Annual Conference, Harrogate, UK.
82. Reis, M, Boisvert, I, & McMahon, C, 2017. 'Auditory and visual training for adult cochlear implant users', Poster presented at Cognitive Hearing Science for Communication Conference, Linkoping, Sweden.
83. Reis, M, Boisvert, I, & McMahon, C, 2016. 'Effectiveness of training for adult cochlear implant users', Oral presentation at the Macquarie University Linguistics HDR showcase, Sydney, NSW.
84. Reis, M, Boisvert, I, & McMahon, C, 2016. 'Training in adult cochlear implant users', Poster session presented at the HEARing CRC Symposium, Sydney, Australia.
85. Scarinci, N, Erbas, E, Moore, E, Ching, T Y C, Marnane, V, 2017. 'The Parents' perspective of the early diagnostic period of their child with hearing loss: information and support', 9th Australasian Newborn Hearing Screening Conference, Melbourne, Australia.
86. Scarinci, N, Yanbay, E, Hickson, L, Ching, T Y C, 2016. 'Parental involvement in the intervention of children with hearing loss: How are parents involved and what influences their involvement', 30th World Congress of the IALP, Dublin, Ireland.
87. Scarinci, N, Knight, J, Marnane, V, Ching, T Y C, 2017. 'The longitudinal impact of shared book reading on language development for children with hearing loss', Speech Pathology Australia National Conference 2017, Sydney, Australia.
88. Waite, M, Scarinci, N, Meyer, C, Ekberg, K, Rushbrooke, E, Arnott, W, Cowan, R, & Hickson, L, 2017. "'Even the dog got involved" - How telepractice can promote family-centred early intervention for children with hearing loss and their families', Speech Pathology Australia National Conference 2017, Sydney, Australia.
89. Scarinci, N, Waite, M, Ekberg, K, & Meyer, C, 2016, 'Working with families through their journey from diagnosis of their child's hearing loss to habilitation and beyond: How is family-centred care being implemented?', Healthy Hearing Symposium 2016, Brisbane, Australia.
90. Sharma, M, 2017. IERASG, Warsaw, Poland.
91. Tai, S, Barr, C, & Woodward-Kron, R, 2017. 'Patient-centred communication in an audiological teaching clinic: An exploration of student-patient communication', ANZAHPE2017 Conference, Adelaide, Australia.
92. Valderrama, J T, Beach, E, Yeend, I, Pang, J, Sharma, M, Van Dun, B, & Dillon, H, 2017. 'Noise exposure modulates auditory brainstem response wave amplitudes', International Evoked Response Audiometry Study Group (IERASG) 2017, Warsaw, Poland.
93. Van Dun, B, Chong-White, N, & Cowan, R, 2017. 'Reduction of CI artefacts in single-channel CAEPs recorded to 400-ms narrow-band noise stimuli in the free field', International Evoked Response Audiometry Study Group Conference, Warsaw, Poland.
94. 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', Poster presented at the 33rd World Congress of Audiology, Vancouver, Canada.
95. Waite, M, Scarinci, N, Hickson, L, Rushbrooke, E, Arnott, W, Dornan, D, Grenness, C, Ekberg, K, & Cowan, R, 2016. 'An exploration of how eHealth can promote a family-centred model of care for children with hearing loss and their families', Healthy Hearing Symposium 2016, Brisbane, Australia.
96. Walvarens, Keidser, G, & Hickson, L, 2016. 'Trainable hearing aids: Clinical impact and reliability of training', International Hearing Aid Research Conference IHCON 2016, Lake Tahoe, California, USA.
97. Weisser, A, & Buchholz, J. 'Subjective attributes of realistic sound fields: What makes acoustic environments complex?', Joint meeting of the Acoustical Society of America/Japan, Hawaii, USA.
98. Whitfield, C, & McMahon, C M, 'Using the Evidence Base for Hearing Aids in Adults', Paper presented at XXXVIII World Congress of Audiology, Vancouver, Canada.
99. Wong, C L, Ching, T Y C, Leigh, G, Cupples, L, Button, L, Marnane, V, Gunnourie, M, Whitfield, J, Martin, L, 2017. 'The psychosocial and language development of 5-year-old children using hearing aids or cochlear implants', Speech Pathology Australia National Conference 2017, Sydney, Australia.
100. Yhun Lo, C, McMahon, C, Looi, V, & Thompson, W, 2017. 'Music training and its effects on speech perception for children with cochlear implants', Conference on Implantable Auditory Prostheses (CIAP) 2017, California, USA.

CONFERENCE WORKSHOPS – 4:

1. Davis, C, Kim, J, Tuomainen, O, & Hazan, V, 2017. 'Partner-directed gaze in communicative task: the effects of age and communication barrier', Workshop on Speech Perception Production across the lifespan, Chandler House, UCL, UK.
2. Dowell, R C, 2016. 'Making recommendations for cochlear implantation: evidence-based audiological criteria', Invited workshop presented at XXXVIII World Congress of Audiology, Vancouver, Canada.
3. Kalashnikova, M, Carignan, C, & Burnham, D, 2017. 'The original of babytalk: Electromagnetic articulography analyses of maternal infant directed speech', Workshop on Infant Language Development, Bilbao, Spain.
4. Meyer, C, 2016. 'Client and family-centred approaches to hearing healthcare for adults with hearing loss: A focus on eHealth', Workshop presented at Neurosensory Clinical Conference, Noosa, Australia.

NON- PEER REVIEWED ARTICLES AND MEDIA COVERAGE – 28:

Month	Title	Where?
July 2016	Overcharged for hearing aids? Australia's audiology industry isn't rogue, but needs improvement	http://theconversation.com
	Hearing Health – why it's needed and what you need to know	http://www.amin.org.au/hearinghealth/
Aug 2016	Is your child having trouble learning? They may have auditory processing disorder	http://theconversation.com
	Auditory Processing Disorders Diagnosed via Combined Tests	www.hearingreview.com
	HEARing CRC Researchers Develop New Tests to Accurately Diagnose Children with Listening Difficulties	www.audiologyonline.com
	Kids who struggle at school may have auditory processing disorder	http://health.thewest.com.au
	New tests to accurately diagnose children with ADP	http://www.audiology-worldnews.com
	Cochlear implant electrodes improve hearing	http://sciencemeetsbusiness.com.au
	You Am I Guitarist Issues Warning To Young Musos & Fans	http://www.tonedeaf.com.au
	You Am I guitarist warning to young musicians and fans	http://www.dailytelegraph.com.au
Sept 2016	Melbourne electrode trial builds on cochlear implant success	http://www.heraldsun.com.au
	Melbourne electrode trial builds on cochlear implant success	http://www.dailytelegraph.com.au
	Cochlear Implant Performance May Improve with Anti-inflammatory Drugs	http://hearinghealthmatters.org
	New Research Shows Drug-Releasing Electrodes Likely to Improve Cochlear Implant Performance	www.audiologyonline.com
	New research shows benefits of drug-releasing electrodes for cochlear implant recipients	http://www.audiology-worldnews.com
	Better outcomes for cochlear implant patients	http://www.electromaterials.edu.au
Oct 2016	Elastagen wins \$4m from NSW Medical Devices Fund stretch marks vanish	http://www.afr.com
	Grant to help infants with hearing loss	http://www.mq.edu.au
	Four Healthtech Startups Awarded \$8.6 million by NSW Department of Health	http://thetechportal.com

Nov 2016	Grant to help infants with hearing loss	www.mq.edu.au
	Four Healthtech Startups Awarded \$8.6 Million by NSW Department of Health	www.thetechportal.com
Dec 2016	World first study of drug-releasing cochlear implant electrode	Inspire Magazine, Summer 2016
Feb 2017	Online training module: The Listening Environment	www.hearinghub.edu.au
May 2017	Professor Robert Cowan was interviewed about the Commonwealth Government's Parliamentary Inquiry into Hearing Health and Wellbeing.	http://www.abc.net.au/radio/hobart/
	An ear for opportunity	http://www.refractionmedia.com.au/knowhow/
	Growth Centres	http://www.refractionmedia.com.au/knowhow/
	Experts warn of hearing loss from playing music too loud and too long on Smartphones	http://www.heraldsun.com.au/
June 2017	Music can boost your child's ability to learn language and reading	http://www.heraldsun.com.au/



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