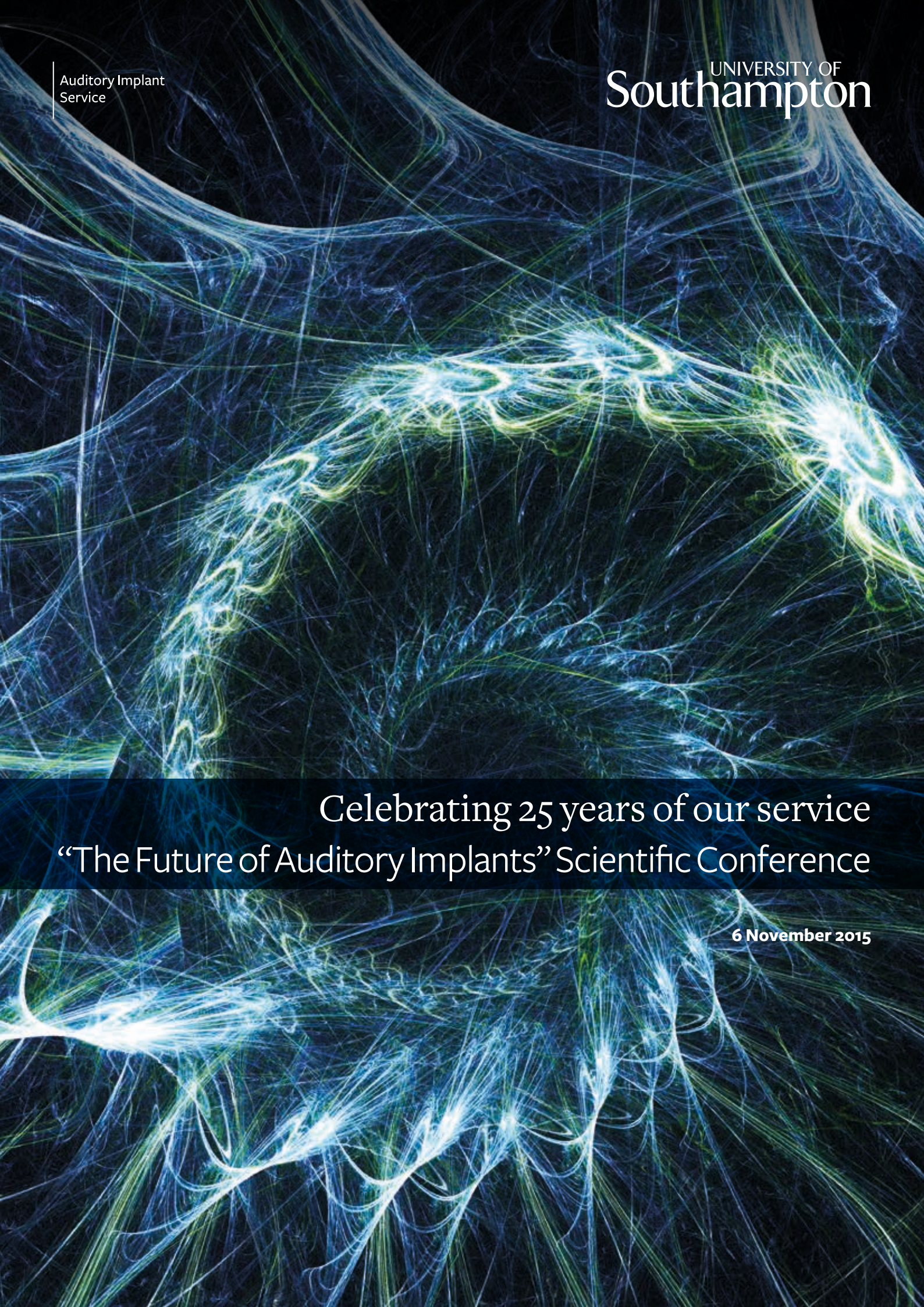
Auditory Implant Service

UNIVERSITY OF Southampton



Celebrating 25 years of our service
"The Future of Auditory Implants" Scientific Conference

6 November 2015

“The Future of Auditory Implants” Scientific Conference

Chilworth Manor Hotel, Southampton
Friday 6 November 2015 | 9.15am – 4.00pm

9.15 - 9.30	Coffee and Registration
9.30 – 9:45	**Welcome and Introduction** Carl Verschuur, Auditory Implant Service
Session 1	**Chair: Carl Verschuur**
9.45 – 10.15	**Vibrant Effectiveness & Reliability Study (Soundbridge and Bonebridge)** Deborah Vickers, University College London (UCL)
10.15 – 10.45	**Research into bilateral bone conduction and the future of bilateral BAHA** Daniel Rowan, University of Southampton
10.45 – 11.15	Tea/coffee
Session 2	**Chair: Mike Pringle**
11.15 – 11.45	**Vestibular implantation** Nils Guinand, Geneva University Hospital
11.45 – 12.15	**Hearing preservation and novel cochlear diagnostics** Carl Verschuur, University of Southampton
12.15 – 13.15	Lunch
Session 3	**Chair: Julie Eyles**
13.15 – 13.45	**Drug-eluting and coated cochlear implant electrodes** Thomas Stark, Technical University of Munich
13.45 – 14.15	**New developments in cochlear implant signal processing** Robert Morse, Aston University
14.15 – 14.45	Tea/coffee
Session 4	**Chair: Helen Cullington**
14.45 – 15.15	**“Have cochlear implant, won’t have to travel”: Future remote care models** Helen Cullington, University of Southampton
15.15 – 15.45	**Clinical applications of cochlear modelling** Steve Elliott and Guangjian Ni, University of Southampton
15.45 – 16:00	**Final Remarks and Feedback Forms**
16:00	Close

We would like to take the opportunity to welcome you to Southampton for our 25th anniversary scientific conference on ‘The Future of Auditory Implants’.

This meeting will be dedicated to cutting edge science relating to auditory implants (including non-cochlear implants) and novel forms of stimulation, with ample time for discussion.

This is a special year for the Auditory Implant Service as we celebrate 25 years of our service as well as implanting our 1000th patient. We look forward to the next 25 years of our service and all the new advances which will be introduced in the future.

This conference has an exciting academic programme with some exceptional speakers from the UK and overseas. We would like to thank the CI manufacturers (Advanced Bionics, Cochlear, Med-EL and Oticon medical) for their generous sponsorship for this event. A very big thank you also goes out to all members of the USAIS team who have worked so hard to ensure this meeting is a great success.

We hope you enjoy the conference.

Carl Verschuur
Director of University of Southampton Auditory Implant Service

The Venue:

Best Western Chilworth Manor Hotel
Chilworth
Southampton
Hampshire
SO16 7PT
England

Best Western Chilworth Manor Hotel lies just 4 miles from Southampton, amongst 12 acres of beautifully landscaped grounds. Right next door to a conservation area, this wonderful retreat is worlds away, but not far away, from the city centre. An Edwardian Manor house, the hotel is an ideal place to get away from it all and is particularly peaceful for romantic breaks!

Sponsors

Advanced Bionics

Cochlear
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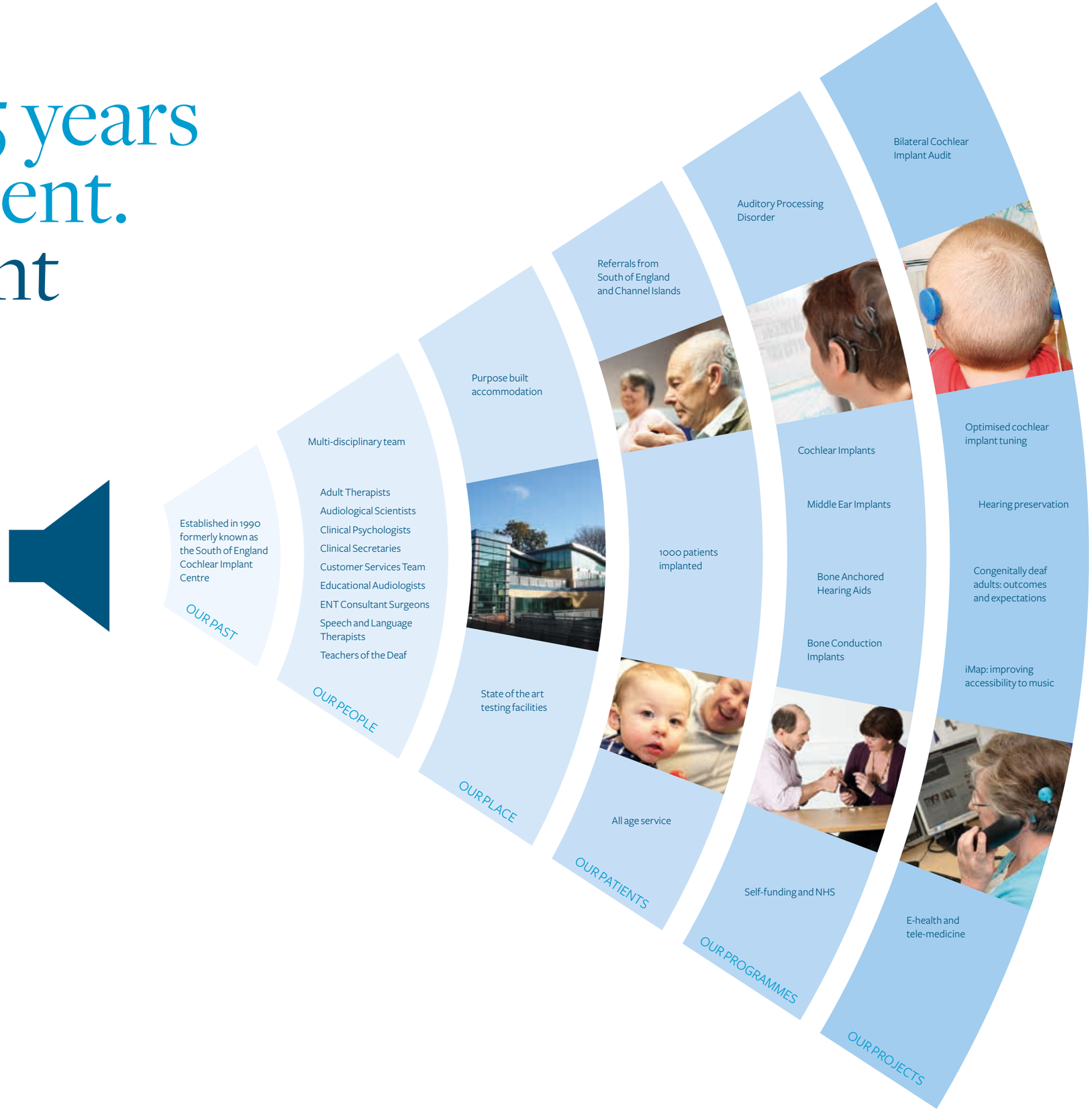
MED EL

Celebrating 25 years of achievement. Auditory Implant Service

The first individual received a cochlear implant at the Institute of Sound and Vibration Research in late 1990. Since then the service has grown and developed, first as the South of England Cochlear Implant Centre then later as the University of Southampton Auditory Implant Service, reflecting the provision of new types of auditory implant device and hearing services in addition to cochlear implantation.

We are now housed in a state-of the art purpose-built clinic which sits within the University of Southampton campus, just next to our previous home in the Institute of Sound and Vibration Research.

During the last 25 years, we have continued to innovate and develop, providing a range of clinical services to support the needs of hearing impaired people and working with colleagues to undertake research, education and development in new technologies and rehabilitative methods to enable those with hearing impairment to flourish and participate fully in all area of daily life.



Speaker biographies and abstracts

Deborah Vickers

University College London

Dr Deborah Vickers is Head of the Human Function and Audiology Research Unit, and a Principal Investigator at the University College London (UCL) Ear Institute. Her Research Group focuses predominantly on two areas: 1. Outcomes, candidacy and fitting for hearing-aid and cochlear implant recipients and 2. Optimising speech perception in the classroom. Deborah is a Senior Lecturer in Research Methods and Statistics and teaches many different quantitative and qualitative research methods courses at UCL. Prior to working at UCL Deborah was a researcher for many years with Professor Brian Moore at the University of Cambridge, which followed on from her PhD studies with Dr Andrew Faulkner at UCL. Deborah also spent seven years in industry managing European Clinical Studies for Advanced Bionics.

Assessing the Reliability and Effectiveness of Vibrant Bone Conduction Devices

Deborah Vickers[1], Aneeka Degun[1], Huw Cooper[2], Marion Atkin[2], Rob Gardner[3], Mark Chung[4], Abi Asher[4], Rachel Andrew[5], Terry Nunn[6], Stacey Cooper[6], Sarah Flynn[7], Patrick Spielman[8], Mina Bingham[9], Konstance Tzifa[10], Kate Hanvey[10], Joe Toner[9], Shakeel Saeed[1], Angela Canas[1], Sarah Humphreys[11] and John Briggs[12]

[1]University College London, [2]Queen Elizabeth Hospital Audiology Centre, [3]Bradford Teaching Hospital, 4Addenbrooke's Hospital, [5]Manchester Royal Infirmary, [6]Guys and St Thomas' Hospital, [7]University of Southampton Auditory Implant Service, [8]Ninewells Hospital, [9]Belfast Auditory Implant Centre, [10]Birmingham Children's Hospital, [11]MEDEL UK Ltd, [12]Consultant to MEDEL UK Ltd.

Bone conduction devices are designed to utilise bone conduction to transmit information directly to the inner ear bypassing the outer and middle ear. The MEDEL Vibrant systems are implantable systems and currently there isn't large scale data available on long-term survival and effectiveness. The goal of this work is to evaluate the long-term survival and surgical-medical factors that might influence it and to develop an effective assessment protocol for evaluating speech perception and audiological outcomes and quality of life changes with these devices.

This project is a multi-site (nine centres) study with a retrospective and a prospective component. The study is ethically approved and National Institute for Health Research portfolio adoption.

This paper will outline the study protocol for the project that was developed by the research team and the assessment measures that have been selected for use and how they have been adapted for different study populations.

Daniel Rowan

University of Southampton

Daniel is a Lecturer in Audiology at the University of Southampton. His goal is to develop knowledge and technologies that will allow people with sensory impairments to optimally use their hearing to achieve the independence, prosperity and fulfilment they desire.

Daniel is the Director of Programmes (Audiology) covering the MSci/BSc Healthcare Science (Audiology) and MSc Audiology course, teaches on them and looks after clinical placements. He is also an Audiologist registered with the Registration Council for Clinical Physiologists (RCCP).

Daniel began his training as an Audiologist in the National Health Service in 1995. In 2000, he embarked on the MSc in Audiology at the Institute of Sound and Vibration Research (ISVR), graduating in 2002. Daniel conducted his PhD research, funded by the Royal National Institute for the Deaf (now Action On Hearing Loss), under the supervision of Prof Mark Lutman and graduated in 2006. In 2004 he joined the Hearing and Balance Centre as a member of staff. Daniel is the lead member of a team of scientific advisors from the University of Southampton to the International Committee of Sports for the Deaf, which includes the Deaflympics.

Research into bilateral bone conduction and the future of bilateral Baha

Nils Guinand

Geneva University Hospital

Nils Guinand is a Medical Doctor, Senior Resident in Neurootolgy at the ENT Department of the University Hospitals of Geneva. He graduated at the medical school of the University of Bern. His ENT residency was completed in Bern, Lausanne and Geneva, in Switzerland. He spent two years as a research fellow in the vestibular lab of Professor Kingma in Maastricht, in The Netherlands. Since 2009 he has focused his research interests on the development of a vestibular implant for patients with a bilateral vestibular loss. He is the recipient of the Schuhknecht Travel Award 2013 and the Academy Award 2014 of the European Academy of Otology and Neurootology for the work on the artificial restoration of the vestibulo-ocular reflex.

Vestibular implantation

The vestibular system plays a crucial role in tasks such as postural control, gaze stabilization, and spatial orientation. Currently, there is no effective treatment for a bilateral loss of the vestibular function (BVL). The quality of life of affected patients is significantly impaired. During the last decade, our group has explored the potential of using electrical stimulation to artificially restore the vestibular function. Our vestibular implant prototype consists of a custom modified cochlear implant featuring one to three vestibular electrodes implanted in the proximity of the ampullary branches of the vestibular nerve; in addition to the main cochlear array. Special surgical techniques for safe implantation of these devices have been developed. We have developed stimulation strategies to generate bidirectional eye movements as well as the necessary interfaces to capture the signal from a motion sensor (e.g., gyroscope) and use it to modulate the stimulation signals delivered to the vestibular nerves. To date, 12 BVL patients have been implanted without complications. We could show that it is possible to partially restore the vestibulo-ocular reflex and to improve the visual acuity in dynamic conditions. This shows that the vestibular implant has the potential to restore the vestibular function and could in the near future improve the quality of life of BVL patients.

Carl Verschuur

Auditory Implant Service, University of Southampton

Dr. Carl Verschuur is Director of the University of Southampton Auditory Implant Service (USAIS) and combines an academic role in research and teaching with a clinical and clinical management role as service director. His research interests include the link between inflammation and loss of hearing, both after cochlear implantation and with age; developing new bio-markers to improve individualised tuning and other interventions with cochlear implants; and qualitative research into experience of particular sub-groups using cochlear implants. He has worked as both clinical audiologist and academic in the field of hearing science since 1991.

Hearing preservation and novel cochlear diagnostics

Recent advances in cochlear implant technology have not been matched by advances in the understanding of how the device interfaces with the inner ear to produce the sensation of hearing, and what local biological factors influence this. There is a need to better understand and measure individual differences in factors such as cochlear size and shape, degree of cochlear health, inflammatory and mechanical response to electrode insertion and the distance between the electrode and neural elements. I will review the current methods used to evaluate the biological interface between electrode array and cochlea and present some new data showing that existing measures, in particular impedance data, in addition to novel bio-markers (including clinical measures of the inflammatory response and some new approaches to assessing electrode performance), can all be useful in optimising and predicting individual clinical outcomes.

Helen Cullington

Auditory Implant Service, University of Southampton

Helen Cullington is a clinician and researcher working at the University of Southampton Auditory Implant Service. She has more than 22 years' experience in cochlear implants, having worked on several implant programmes within the United Kingdom and the United States, including House Ear Institute in Los Angeles.

Helen's first degree was in Physics followed by an MSc in Audiology at the University of Southampton in 1993. Helen was captivated by cochlear implants – the use of technology to improve people's lives. She began working in cochlear implants immediately, as an Audiological Scientist on the implant programme in Middlesbrough initially and then from 1997 at the University of Southampton. She then worked in House Ear Institute in California, USA from 2001 to 2004, leaving House to begin a PhD at University of California, Irvine. Helen returned to the University of Southampton Auditory Implant Service in 2007; she splits her time between seeing patients and working on research projects.

Helen has special interests in bilateral implants and the use of telemedicine to follow up cochlear implant users.

"Have cochlear implant, won't have to travel": Future remote care models

Many resources are required to provide post-operative care to cochlear implant patients. The implant service commits to lifetime follow-up, which may be up to 100 years for a baby. These services are provided at specialist tertiary centres which may be several hours away from the patient's home necessitating travelling expense, time off work and family disruption. Currently UK implant centres review patients on a clinician-led schedule; this means that review appointments can occur that provide little benefit to the patient. Making this care pathway patient-centred instead will provide a more efficient service and allow more timely identification of issues.

I am working on a project to design, implement and evaluate a person-centred long-term follow-up pathway for cochlear implant users offering a triple approach of remote and self-monitoring, self-adjustment of devices and a personalised online or smartphone intervention package for testing their own hearing at home, information and self-rehabilitation.

Potential benefits for the patient are:

- more stable hearing (problems identified and resolved quicker)
- convenience of not travelling to routine appointments
- reduction of travel cost and time, time off work and disruption to family life
- increased confidence to manage own hearing

It may mean that the clinic has greater resources (time, money, space) to see complex cases and the expanding population of new patients.

Thomas Stark

Technical University of Munich

PD Dr. Thomas Stark developed the cochlear implant program at the Department of Otorhinolaryngology Head and Neck Surgery, Ruhr University Bochum, Germany from 1995 to 2008. In 2008 he established the hearing implant Center rechts der Isar in Munich and is responsible for the cochlear implant program since then. Currently he is vice director at the Department of Otorhinolaryngology Head and Neck Surgery, Technical University Munich, Germany.

One of his major scientific interests is binaural hearing and the benefits of bilateral cochlear implantation, which he started with more than 15 years ago. His scientific interest is also focused on preservation of residual hearing following cochlear implantation. In several research studies he investigated drug eluting electrodes and developed a 3D-model of the cochlea. Furthermore he attended as principal investigator in multiple clinical studies on implantable hearing devices as well as on cochlear implants.

He works as a surgeon with emphasis on middle ear surgery and cochlear implantation. Beside his surgical skills he is engaged counseling of hearing impaired subjects especially candidates for implantable hearing devices as well as medical and audiological testing.

He teaches Otorhinolaryngology at the Medical school of Technical University Munich, Germany.

Drug-eluting and coated cochlear implant electrodes

The cochlear implant research continuously strives for improving the electrodes and inventing new electrode types to enable the best possible performance of cochlear implant (CI) recipients. One crucial goal is to minimize intracochlear chronic inflammation and fibrosis due to foreign body reaction after implantation as it may provoke a progressive increase in electrode impedance and a decrease of the dynamic fitting range of loudness levels. Furthermore, the functional cochlear mechanics as well as the sound transmission to the auditory nerve may be affected by fibrosis. Moreover, chronic inflammatory processes may lead to a continuing destruction of sensorineural structures. The pharmacological intervention with glucocorticoids like dexamethasone is a promising approach to dampen postoperative inflammatory reactions, prevent fibrosis, and preserve residual hearing. Dexamethasone-eluting electrodes may be an effective method of administering corticosteroids into the cochlea at a constantly high drug level over an extended and defined period of time. Another forward-looking method to reduce the encapsulation reaction after implantation is the modification of the surface chemistry of the implant. One approach could be a passivating coating for the electrode array, which makes its surface undetectable for the immune system.

Robert Morse

Aston University

Robert Morse is a Principal Research Fellow at the University of Warwick. Robert graduated in Cybernetics in 1987, after which he worked for four years in industry as an electronics engineer. In 1991 he returned to further education to do an MSc in Machine Perception and Neurocomputing at Keele University, where he started his research on animal and computational models for cochlear implants. Rather than returning to industry, he was lured into continuing this research for his PhD.

Robert was the first to propose that adding noise to cochlear implant signals could enhance speech coding – research associated with stochastic resonance. The goal for this cochlear-implant research has been to understand how information in the normal auditory system is represented at the cochlear nerve level, how nerves respond to artificial electrical stimulation, and how these insights can be exploited to design better cochlear implants.

Between 2006 and 2014, Robert was a Lecturer and then Senior Lecturer in Audiology at Aston University. He moved to Warwick University in May 2014 and is currently researching methods to increases the affordability and accessibility of hearing aids in lower- income countries.

Noise helps cochlear implant listeners to distinguish between speech sounds

Robert P. Morse[1], Stephen D. Holmes[2] and Nigel G. Stocks[1],
[1]School of Engineering, Warwick University, Coventry
[2]School of Life and Health Sciences, Aston University, Birmingham

Sensory systems must transmit sufficient information to enable discrimination and recognition of a continuous stream of complex signals. In human hearing, for example, sufficient information must be transmitted to enable the sounds of speech to be distinguished. One means by which transmission might be enhanced is through the action of stochastic neural noise, which can more efficiently distribute the information represented in a population code. However, whilst behavioural evidence suggests endogenous sensory noise can improve detection for hearing and touch, it remains unknown whether sensory noise can improve the ability of a person to discriminate between complex stimuli. In other words, it remains unknown whether or not we are "hard-wired" to make use of the putative benefits of noise that are most relevant to communication. Here, we demonstrate that the human auditory system – at the first neural stage – does indeed contain the requisite decoding mechanisms to exploit stochastic encoding of sensory information. By processing English vowels through a single channel of a cochlear implant, we demonstrate behavioural increases in information transmission (improved vowel discrimination) for profoundly deaf people when noise is added to the signal. The data support the notion that noise is an essential part of normal neural coding.

Steve Elliott

University of Southampton

Steve Elliott graduated with first class joint honours BSc in physics and electronics from the University of London, in 1976, and received the PhD degree from the University of Surrey in 1979 for a dissertation on musical acoustics.

After a short period as a Research Fellow at the ISVR and as a temporary Lecturer at the University of Surrey, he was appointed Lecturer at the Institute of Sound and Vibration Research (ISVR), University of Southampton, in 1982. He was made Senior Lecturer in 1988, Professor in 1994, and served as Director of the ISVR from 2005 to 2010. His research interests have been mostly concerned with the connections between the physical world, signal processing and control, mainly in relation the active control of sound using adaptive filters and the active feedback control of vibration. This work has resulted in the practical demonstration of active control in propeller aircraft, cars and helicopters. His current research interests include modular systems for active feedback control and modelling the active processes within the cochlear.

Professor Elliott has published over 250 papers in refereed journals and 500 conference papers and is co-author of Active Control of Sound (with P A Nelson 1992), Active Control of Vibration (with C R Fuller and P A Nelson 1996) and author of Signal Processing for Active Control (2001). He is a Fellow of the Acoustical Society of America, the IET and the IOA and a senior member of the IEEE. He was jointly awarded the Tyndall Medal from the Institute of Acoustics in 1992 and the Kenneth Harris James Prize from the Institution of Mechanical Engineers in 2000.

He was made a Fellow of the Royal Academy of Engineering in 2009

Guangjian Ni

University of Southampton

Guangjian Ni graduated with a joint bachelor degree in Thermal Energy and Dynamic Engineering and Industrial Engineering from Tianjin University in China in 2003 and received the Ph.D. degree from the University of Southampton for a thesis on fluid coupling and waves in the cochlea in 2012. In October 2012, he was appointed as a research fellow at the Institute of Sound and Vibration Research (ISVR) at the University of Southampton.

His research interests focuses on cochlear mechanics, wave propagation in structures and the cochlea, and modelling the human hearing system using analytic and numerical methods. Dr Ni has published over 20 peer reviewed papers. He was awarded the Spoendlin Award at 51st Inner Ear Biology and the Sir James Lighthill Best Paper Award at 21st International Congress on Sound and Vibration.

Clinical Applications of Cochlear Modelling

Two aspects of cochlear modelling will be highlighted in this talk: concerning either the electrical or the mechanical behaviour of a cochlear implant. In the first, it will be shown how the voltage spread due to current injection at individual electrodes can be calculated throughout the cochlea and used to predict the effect of various strategies for current focusing. In the second, modelling of the mechanical wave motion along the cochlea will be discussed, concentration on the different ways that this wave propagation may be influenced by the presence of a cochlear implant.

Contact

Please feel free to contact us for further information.
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