



Prof Richard Reilly

B.E., M.Eng.Sc., PhD, ScD

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PERSONAL MISSION to fill core gaps in neurological care by providing quantitative neurology and neuroimaging based on neural engineering to better understand underlying pathophysiology and to develop objective biomarkers for monitoring disease progression and the efficacy of interventions.

QUALIFICATIONS

- Honorary Fellow of the Royal College of Physicians of Ireland (RCPI), 2022
- Sc.D (Doctor of Science) (Trinity College, The University of Dublin), 2022
- Fellow of the Institute of Engineering and Technology (IET), 2020
- Fellow of the European Alliance for Medical and Biological Engineering & Science (EAMBES), 2015
- Member of the Royal Irish Academy (RIA), 2012
- Fellow of the Royal Society of Medicine (RSM), 2012
- Fellow of the Royal Academy of Medicine in Ireland (RAMI), 2010
- Fellow of Trinity College Dublin, 2007
- MA *jure officii* (Trinity College Dublin), 2009
- Ph.D.(University College Dublin), 1992 in Biomedical Signal Processing
- M.Eng.Sc (University College Dublin), 1989 in Biomedical Engineering
- B.E. (University College Dublin) 1987 in Electronic Engineering

CURRENT PROFESSIONAL APPOINTMENTS

2008-present	Full Professor, Professor of Neural Engineering and Ageing, School of Medicine School of Engineering (joint appointment in two Schools) Trinity College, The University of Dublin
2008-present	Principal Investigator in the Trinity Centre for Biomedical Engineering (TCBE)
2008-present	Principal Investigator in the Trinity College Institute of Neuroscience (TCIN)
2010-present	Principal Investigator in the Centre for Excellence in Ageing, St James's Hospital, Dublin 8
2024-2029	Visiting Full Professor, School of Medicine, University College Dublin, Dublin 4
2006-present	Visiting Researcher, Department of Neurology, St. Vincent's University Hospital, Dublin 4
2017-present	Visiting Professor, The Royal College of Surgeons in Ireland
2017-present	Member of the Board of the Dublin Neurological Institute, Dublin
2020-present	Member of the Board of the Health Products Regulatory Authority, Dublin
2022-2025	Editor in Chief of the IEEE Journal of Engineering in Health and Medicine

PRIMARY RESEARCH INTERESTS *(see pages 5-7 for an in-depth description)*

- Neural engineering for diagnostic prediction of the human physiological and cognitive state.
- Developing neural signal processing methods to create novel and leading-edge, patient-oriented neurodiagnostics methods but also neural prosthetics and neuromodulation devices.
- Analysis of human sensory and multisensory integration processes using high-density electrophysiological analysis and multimodal fusion of information for neurological diagnosis and assessment.
- Research targeted a better understanding of the underlying pathophysiology of sensory and cognitive processing.

Keywords Neuromodulation; biomedical signal processing; electrophysiology; sensory and cognitive processing; biomedical engineering,

SCIENTIFIC PUBLICATIONS: Over 556 peer-reviewed publications in international scientific journals and conference proceedings (*see pages 15-46 for an in-depth description*). As of March 2024, collectively published work has received over 10386 citations as assessed by Scopus (h index 46) <https://www.scopus.com/authid/detail.uri?authorId=7102935766> and over 16276 citations (h index 59) as assessed by Google Scholar <https://scholar.google.com/citations?user=6ftKkZMAAAJ&hl=en>. ORCID is 0000-0001-8578-1245. Named in the 2023 Stanford's list of World Top 2% scientists.

DESCRIPTION OF MY CURRENT POSITION:

I was appointed Full Professor of Neural Engineering in January 2008. My role entails (1) contributing to the academic discipline of Neural Engineering by publishing original research in high-ranked journals (2) obtaining external funding and maintaining an international research

network; (3) mentoring, supervising and supporting high-performance research at postgraduate level (Postdoctoral, PhD and Master level); (4) contributing to academic production, leadership and governance of the Discipline of Biomedical Engineering in the School of Engineering and the Discipline of Gerontology in the School of Medicine and mentoring of younger faculty members in research strategies; (5) administrative, managerial and financial responsibilities appropriate for the Department, School and research projects; (6) reflecting on the appropriateness of the postgraduate programs and teaching profile along with staffing of Neural Engineering and adjusting and innovating as appropriate; and (7) contributing to the academic professional community. I lecture two undergraduate courses, *Quantitative Physiology* and *Integrative Pathophysiology*, and two at MSc level, *Neural Engineering* and *Active Implanted Devices and Systems*. A list of my research funding appears on Page 4 and a summary of my current research projects on Page 5.

I am also involved in many additional scientific activities external to the university. I am a member of the Board of Health Products Regulatory Authority (www.hpra.ie) and am Chairperson of the HPRA's Medical Devices Advisory Committee. I am a director of the charity Dublin Neurological Institute (<https://neurologicalinstitute.ie/>). I contribute to the university community as a member of the College's Audit Committee and the Steering Committee of TILDA, the Irish longitudinal study of Ageing. I am Editor-in-Chief of the IEEE Journal of Translational Engineering in Health and Medicine and a member of the editorial board of several scientific journals (see Page 10).

PROFESSIONAL EXPERIENCE

2008-2013	Director, Trinity Centre for Biomedical Engineering
2006-2007	Associate Professor, School of Electrical, Electronic and Mechanical Engineering, University College Dublin
2007-2008	Director, Technology and Research for Independent Living Centre (TRILCentre), Dublin
2006-2007	Vice-Chairman, Biomedical Division, Institution of Engineers of Ireland
2005-2006	Chairman, Biomedical Division, Institution of Engineers of Ireland
2006-2007	Director, Rehabilitation Engineering Laboratory, National Rehabilitation Hospital
2005-2006	Vice-Principal for Research and Innovation, University College Dublin
2002-2006	Senior Lecturer, Department of Electronic & Electrical Engineering, University College Dublin
1996-2002	College Lecturer (Tenured), Department of Electronic & Electrical Engineering, University College Dublin
1995-1996	Project Officer, European Commission, Brussels.
1993-1996	Research Fellow, Department of Electronic & Electrical Engineering, University College Dublin
1992-1993	Senior Research Officer, Enterprise Ireland (formerly EOLAS)
1990-1992	Biomedical Engineer, National Rehabilitation Hospital, Dublin
1988-1990	Design Engineer, Space Technology Ireland and the Dept. de Recherche Spatiale (CNRS) Paris. Developed flight equipment for the NASA WIND, SOHO and CLUSTER satellites

SIGNIFICANT AWARDS AND ACKNOWLEDGEMENTS OF ACHIEVEMENT

- Honorary Fellow of the Royal College of Physicians of Ireland (2022)
- IBM Faculty Award (2016)
- Fellow of the European Alliance for Medical and Biological Engineering & Science (EAMBES) (2015)
- Samuel Houghton Silver Medal, Royal Academy of Medicine in Ireland (2013)
- Fellow of the Royal Society of Medicine (2012)
- Member of the Royal Irish Academy (RIA), 2012
- Fellow of the Royal Academy of Medicine in Ireland (RAMI), 2010
- Fellowship of Trinity College Dublin (2009)
- Intel Award for Innovation (2007)
- Excellence in Neural Engineering Award from the IEEE Engineering in Medicine and Biology Society, US National Science Foundation and US Office of Naval Research (2005)
- Fulbright Scholar Award 2004 (multisensory integration with the Cognitive Neuroscience & Schizophrenia Program at Nathan S. Kline Institute for Psychiatric Research, New York)
- President's Research Fellowship for research into biomedical multisensory integration, University College Dublin. (2004/2005)
- Invited Lecturer for the Institution of Electrical Engineers (IEE) the Silvanus P. Thompson lecturer for two years. This is a distinguished Lecture series, alongside the Faraday Lecture and is available to all IEE centres worldwide (1998-2000).
- Bronze Medal, Royal Academy of Medicine in Ireland and Speaker Award at the Annual Bioengineering in Ireland Conference (1995).
- National Hewlett Packard Design Award for Engineering and Science (1987): Monitoring dynamic pressure on the alveolar ridge during speech articulation.

CAREER CONTRIBUTIONS TO HEALTH PRACTICE, TECHNOLOGY, PRODUCT DISCOVERY AND DEVELOPMENT

- My career contributions have been to clinical neural engineering based on signal processing of neuroimaging and electrophysiological data to objectively assess sensory and cognitive processing in clinical cohorts. I have combined my background in electronic engineering with my experience in neuroscience research to develop original signal processing methods in order to devise novel, creative and leading-edge, patient-oriented neurodiagnostics and experimental methods. This contribution has directly filled core gaps in neurological care by providing quantitative neurology and neuroimaging to aid diagnosis and provide biomarkers for monitoring efficacy of interventions. I have developed long lasting clinical collaborations and my lab is the only research hub for quantitative neurology and neuroimaging for all of the Departments of Neurology and Neurophysiology in the five teaching hospitals in Dublin and is unique in Ireland.

- I have contributed to our understanding of sensory processing in the area of movement disorders, specifically in Dystonia and Parkinson's disease. My team have provided evidence that Adult-Onset Dystonia is associated with structural and neurophysiological changes considered to reflect defective inhibitory interneuronal processing within a network, which includes the superior colliculus, basal ganglia, and primary somatosensory cortex.
- I have designed and developed new signal processing methods for neural prosthetics and neuromodulation methods. I have contributed new methods to objectively quantify temporal and spectral processing in cochlear implant users. My team and I have patented research outputs and have licenced these methods to the Medical Device industry (Nurotron Biotechnology Co. Ltd).
- I have contributed in advanced quantitative methods for clinical decision-making in relation to respiratory medicine. This has focused on objective methods for measuring patient adherence to medication and the effect of pharmaceutical interventions. I have contributed new acoustics methods to longitudinally monitor patient adherence, drug deposition and estimate respiratory parameters. My colleague at RCSI and I have patented research outputs and have licenced these methods to the Medical Device industry (Vitalograph Ltd).

I have active clinical collaborations with colleagues in Ireland and in the US, Canada, Germany, France, the Netherlands, Italy, Denmark, Australia, Israel, Spain and the UK.

CONTRIBUTIONS TO SOCIETAL AND HEALTH POLICY ACTIVITIES

Co-Editor of the report *Transforming the Future of Ageing* (2019) written for the European Scientific Advice Mechanism. The European Scientific Advice Mechanism (SAM) provides independent and transparent scientific advice to the European Commission, working with a European Commission Group of Chief Scientific Advisors (GCSA) and the European Academies (SAPEA). The report is available at <https://www.sapea.info/topics/ageing/>

This Evidence Review Report examines how public health aimed at protecting and improving the health of people and their communities can improve the prospects of current and future ageing of EU citizens. In 2016, there were 98 million people in the European Union (EU) aged 65 years or older, compared with 80 million children aged below 16 years. Taking into consideration that the life expectancy of the next generation of older adults is likely to surpass that of their parents, it becomes necessary to foresee and plan for the challenges that they will face. The two combined strategies are:

- promoting healthy lifestyles over the life course, as well as detecting and modifying early and mid-life risk factors of impaired function and chronic diseases, in order to delay age-related disability;
- providing more appropriate health and social care for the aged EU population by offering integrated and holistic care in all-age communities and healthcare facilities.

Technology plays a key role:

- technology will not only transform entire population's attitudes toward life but will also revolutionise care delivery systems;
- whatever the impact of technology, an adequate number of skilled healthcare professionals is essential.

VISITING PROFESSORSHIPS

- Escuela Politécnica Superior at the Universidad de Alcalá from June to August 2006. Activities: Provide a graduate course on biomedical signal processing.
- The Cognitive Neurophysiology Laboratory at the Nathan S. Kline Institute for Psychiatric Research (cogneuro-nki.rfmh.org) from August 2004 to January 2005. Activities: Research into multisensory integration to provide better understanding of the neural processes that underlie multisensory influences on visual attention.
- Cognitive Neuroscience Research Group at the University of Barcelona (www.ub.es/pbasic/sppb/ingl/index.htm) from January 2005 to September 2005. Activities: Research into multisensory audio-visual integration
- Ecole Polytechnique Fédérale de Lausanne, (www.epfl.ch) from November to December 2001. Activities: Presented seminars on Multimodal Signal Processing and aided in setting up a Brain Computer Interface study at EPFL.

RESEARCH LEADERSHIP AND GRADUATE SUPERVISION *(see pages 8-9 for an in-depth description).*

- Have received research funding as Principal Investigator totalling over €13 million *(see page 4)*.
- Have successfully supervised to completion 27 PhD researchers, 130 MSc researchers & over 200 BE/BSc students. Currently supervising 3 PhD and 3 MSc researchers.
- Have made a major contribution to the development of graduate and postgraduate research policies at Trinity College Dublin and University College Dublin, specifically in Biomedical Engineering and Neuroscience.
- As Director of Trinity Centre for Biomedical Engineering (2008-2015) at Trinity College the Centre expanded greatly and now consists of 20 PIs, 27 Postdocs, 75 PhD students, 25 MSc students and experienced administrators.
- As Director of Trinity Centre for Biomedical Engineering, I coordinated a tri-partite agreement in 2011 between Trinity College, University College Dublin and the Royal College of Surgeons in Ireland. The Dublin Biomedical Engineering Research Initiative (DBERI) provides for coordinated biomedical education, research and innovation across Dublin and has resulted in an extensive research collaboration across the three universities in biomedical engineering.

- As Director of Biomedical Engineering at Trinity College, I led the successful Higher Educational Authority PRTL Cycle 5 proposal for Graduate Research Education Program in Biomedical Engineering (awarded €3.5m) and was a member of the proposal development team successfully awarded the Trinity Biomedical Sciences Institute (awarded €55.4m).
- Have examined >50 PhD theses at international universities.

RESEARCH FUNDING

Competitively awarded **€13,085,695** for research as Principal Investigator, with **€3,362,186** in the past 5 years. These funds have been obtained from international and national funding agencies and from industry.

Competitively awarded **€3,222,810** as Co-Investigator.

Competitively awarded **€2,597,084** as Director of Research and a Principal Investigator as infrastructural funds for PhD and MSc educational programs in Biomedical Engineering and Energy Research.

Competitively awarded **€15,000,000** (IDA+Intel) on behalf of colleagues in Trinity College Dublin, University College Dublin and NUI-Galway as the Founding Director of the TRIL Centre for research into ageing.

Member of the proposal development team successfully awarded infrastructural funds for development of the Trinity Biomedical Sciences Institute (awarded €55.4m).

Current and recent research funding as Principal Investigator

- **Investigating Multimodal Neuroimaging for probing brain networks in Cervical Dystonia.** Dystonia Medical Research Foundation,
 - Amount: \$120,000
 - Role: PI
 - Collaborators: Prof Michael Hutchinson (St Vincent's University Hospital), Prof Kristina Simonyean (Harvard School of Medicine)
 - Period of Award: 11/2021 – 10/2023.
- **Multimodal Cardiovascular Modelling for Predicting and Preventing Disability in The Irish Longitudinal Study on Ageing.** Health Research Board, Investigator Lead Project-HSR-2017-021
 - Amount: €370,000
 - Role: PI
 - Collaborators: Prof Rose Anne Kenny, Prof Rob Whelan, Prof Cathal Walsh
 - Period of Award: 12/2019 – 12/2022
- **Development of neural engineering methods to assist individuals with sensorimotor impairments.** Disruptive Technologies Innovation Fund, DT/2018/0128
 - Amount: €645,758
 - Role: PI
 - Collaborators: Dr Neil Fleming (TCD) and Dr Conor Minogue (BMR Ltd.)
 - Period of Award: 09/2018 – 09/2022.
- **The Electrophysiology of Natural Speech Processing.** Science Foundation Ireland, 15/CDA-3316
 - Amount: €488,795
 - Role: PI
 - Period of Award: 03/2017 – 03/2022
- **Implementation of a research project on investigating the impact of hearing aid signal processing strategies on hierarchical cortical processing of speech** Disruptive William Demant Foundation, Case no. 21-0628
 - Amount: €13,394
 - Role: PI
 - Collaborators: Dr Alejandro Lopez Valdes (TCD) and Dr Giovanni Di Liberto (TCD)
 - Period of Award: 09/2021 – 09/2022.
- **VR-based Cognitive Assessment.** Enterprise Ireland Commercialisation Fund, CF/2018/0889-I
 - Amount: €402,448
 - Role: PI
 - Collaborators: Dr Paula Bolger
 - Period of Award: 09/2018 –12/2020.
- **Cognitive Computing to Predict Speech Perception in Paediatric Cochlear Implant Users.** IBM Faculty Award
 - Amount: \$40,000
 - Role: PI
 - Period of Award: 06/2017 – 09/2018.
- **Neurophysiological based objective measures of speech perception in Cochlear Implant users.** Cochlear Research and Development Ltd.
 - Amount: €120,000
 - Role: PI
 - Collaborators: Dr Laura Viani (Beaumont Hospital)
 - Period of Award: 09/2014 – 09/2017.

Current and recent research funding as Co-Principal Investigator

- **Temporal Discrimination Threshold as an endophenotype in adult onset primary Dystonia.** Health Research Board and Dystonia Ireland
 - Amount: €427,706
 - Role: Co-PI
 - Collaborators: Prof Michael Hutchinson (St Vincent's University Hospital)
 - Period of Award: 09/2013 – 07/2018.
- **Development of a system to objectively and longitudinally assess adherence to respiratory medications.** Enterprise Ireland Innovation Partnership with Vitalograph Ltd - CF/2018/0889-1.
 - Amount: €122,457
 - Role: Co-PI
 - Collaborators: Prof Richard Costello (Beaumont Hospital and The Royal College of Surgeons in Ireland)
 - Period of Award: 09/2016 – 07/2018.

CURRENT OR RECENT RESEARCH PROJECTS

My research focus is on how sensory and movement impairments may affect cognitive and physical function. This question necessitates spanning disciplinary areas from biomedical engineering to neurology, neurophysiology, otolaryngology, audiology, and gerontology. The impact is on enhancing our understanding of the mechanisms and potential interventions for optimising cognitive health and physical function. My current research projects are categorised according to three research themes and unified based on Clinical Neural Engineering.

- A. **Active Implantable Devices:** This theme is centred on developing objective measures to assess the performance of implanted devices and caters to the increasing clinical interest in active implantable neural devices. One of the hallmarks of adult CI outcomes is the enormous variability reported in auditory, speech and language functioning after implantation. The reasons for this variation are not clear. The factor with the most consistent significant correlation is the duration of deafness. The amount of variance accounted for by this factor is low, typically less than 25% in outcomes on speech tests. Even when combining additional factors such as age at implantation, degree of residual hearing, and number of active electrodes, this does not explain the variance in speech perception outcomes. The particular emphasis is on research and development of neurophysiological-based objective measures of speech perception in auditory neuroprostheses.
- a. Objective neurophysiological measures of spectral processing following cochlear prostheses
 - b. Objective neurophysiological measures of temporal processing following cochlear prostheses
 - c. Objective spatial sound localisation using a virtual reality tool in bilateral cochlear implant users
 - d. Cognitive effects of stimulation pulse rate in elderly cochlear implant users
 - e. Post-implantation imaging to aid in current steering to improve hearing fidelity in cochlear implant users.
- B. **Neurophysiological of Sensory and Cognition Processing in Movement Disorders:** This theme is centred on developing methods for a greater understanding of the underlying pathophysiology of the movement disorders dystonia, Parkinson's disease and Fragile X Associated Tremor/Ataxia Syndrome (FXTAS). There is increasing recognition that movement disorders are associated with behavioural, psychiatric, autonomic, and other non-motor symptoms. The sensory aspects of movement disorders include intrinsic sensory abnormalities and the effects of external sensory input on the underlying motor abnormality. The basal ganglia, cerebellum, thalamus, and their connections, coupled with altered sensory input, are implicated to play a key part in abnormal sensorimotor integration. However, more investigation into the phenomenology and physiological basis of sensory abnormalities, and about the role of the superior colliculus, basal ganglia, cerebellum, and related structures in somatosensory processing and its effect on motor control, is needed. Concurrently, the paucity of genetic discovery has stimulated the search for endophenotypes. Abnormal temporal discrimination is a mediational endophenotype of cervical dystonia and informs new concepts of disease pathogenesis. Our hypothesis has been that abnormal temporal discrimination and cervical dystonia are due to a disorder of the midbrain network for covert attentional orienting caused by reduced GABA inhibition, resulting from as yet undetermined, genetic mutations. Such disinhibition is (a) subclinically manifested by abnormal temporal discrimination due to prolonged duration firing of the visual sensory neurons in the superficial laminae of the superior colliculus and (b) clinically manifested by cervical dystonia due to disinhibited burst activity of the cephalomotor neurons of intermediate and deep laminae of the superior colliculus. Abnormal temporal discrimination in unaffected first-degree relatives of patients with dystonia represents a subclinical manifestation of defective GABA activity both within the superior colliculus and from the substantia nigra pars reticulata. The neuroimaging protocols and processing methods developed are focused on quantifying and interpreting the underlying neurophysiological processes and their clinical impact.
- a. Functional Neuroimaging of temporal discrimination in dystonia patients and their relatives
 - b. Functional Neuroimaging of the superior colliculus to looming and receding stimuli in dystonia patients and their relatives
 - c. Resting State functional Neuroimaging in dystonia patients and their relatives
 - d. Multimodal Neuroimaging in adult-onset idiopathic focal dystonia
 - e. Intrinsic connectivity of the superior colliculus in adult-onset idiopathic focal dystonia.
 - f. Objective, quantitative acoustic analysis of musical performance of musicians with musician's dystonia
 - g. Non-Conscious Processing of Facial Expressions using electroencephalography in dystonia patients and their relatives.
 - h. Objective methods to measure visual, tactile, and auditory temporal discrimination both in the clinic and at scale.

Fragile X Associated Tremor/Ataxia Syndrome (FXTAS) is a neurodegenerative movement disorder characterized by tremor, ataxic gait, and balance issues resulting from a premutation of the Fragile X Mental Retardation 1 (FMR1) gene. No biomarkers have yet been identified to allow early diagnosis of FXTAS, however, recent studies have reported subtle issues in postural stability of younger premutation carriers, before disease onset. Our focus is on investigating early changes in the motor system of premutation carriers without FXTAS.

- a. Assessment of functional decline in Fragile X premutation carriers through entropy-based measures of postural stability
- b. Characterising cortical theta activity in postural control in Fragile X premutation carriers

Freezing of gait (FOG) is a paroxysmal motor symptom which manifests as episodic reduction or complete absence of effective stepping despite the intention to walk. It is a common and disturbing problem, affecting over 50% of people with Parkinson's disease (PwP), particularly in the later stages, when the disease becomes more complex and severe. In spite of this, the pathophysiology of FOG remains very poorly understood. Associations with sensory and perceptual impairments, motor deficits and cognitive dysfunction have all been described in isolation in FOG, but a common overriding mechanism has not been described to date. Our focus has been to develop quantitative measures of sensory, motor and cognitive function and to compare differences in these measures in PwP with and without FOG to determine whether true deficits in these domains exist. Specifically, we have designed measures that are independent of the slowness of movement that is seen in PwP and would, therefore be independent of the severity of the disease. This is a very important area as the prevalence of PD is increasing in an older population.

- a. Electroencephalography Assessment of perceptual, motor and cognitive Function to Freezing of Gait
- b. Electrophysiological assessment of audio-visual processing in Parkinson's Disease subjects with Freezing of Gait
- c. Dual Motor-Cognitive Virtual Reality Training and its impacts on dual-task performance in Freezing of Gait
- d. Electrophysiological assessment of Dual Tasking on Cognitive Performance in Freezing of Gait
- e. Electroencephalography-based assessment of attention and motor preparation in Freezing of Gait.
- f. Goal directed motor learning to assess motor skill acquisition performance in patients with Idiopathic Parkinson's disease and PARK2- Parkinson's disease
- g. Transcranial alternating current stimulation of the motor cortex in the management of tremor in tremor-dominant Idiopathic Parkinson's disease and Essential Tremor.
- h. Automated detection of Freezing of Gait in patients with advanced Parkinson's disease using a stepping in place paradigm.
- i. Measurement of minimum toe clearance in older adults and people with Parkinson's disease

Multiple sclerosis (MS) is chronic immune-mediated inflammatory and neurodegenerative disease of the central nervous system (CNS). The underlying pathology in relapsing MS is an aberrant proinflammatory response causing microglial activation, secretion of proinflammatory cytokines and activation of T cells and B cells resulting in demyelination plaques in the CNS. Key pathophysiologic features causing progression in MS include chronic microglia activation, chronic oxidative injury, and axonal mitochondrial damage leading to neuronal energy deficit, amplified by accumulated disease burden and age-related iron accumulation, resulting in exhaustion of functional reserve capacity and neuronal death. Typical clinical presentations in early relapsing MS include optic neuritis, transverse myelitis, or brainstem syndrome; meanwhile progression is commonly characterised by loss of bladder control and impaired ambulation. Up to 45-60% of people with MS have cognitive impairment. Domains of memory, attention, executive function, information processing speed and visuospatial abilities most commonly affected. The protocols and processing methods developed are focused on quantifying sensory and cognitive changes, as well characterising deficits in social cognition, prosody and word-finding in people with relapsing and progressive MS compared to age and gender-matched healthy controls.

- a. Postural stability to assess functional decline in subjects with multiple sclerosis
- b. Social cognition, prosody and word-finding in people with multiple sclerosis and healthy controls

C. Technologies for objectively managing chronic disease and disease processes associated with ageing: Identifying markers of cognitive impairment as early as possible is paramount to implement potential prevention strategies and inform patient management. Gait is a complex process found to incorporate neural substrates of executive function, processing speed, and cognitive flexibility. A simple gait assessment, as opposed to lengthy neuropsychological testing, has the potential to quickly screen for cognitive decline. Motoric cognitive risk (MCR) syndrome is characterized by slow gait and subjective cognitive complaints in individuals who are free of dementia and unrestricted in their activities of daily living. A number of risk factors for MCR have been identified, including obesity, physical inactivity, cardiovascular disease, depressive symptoms, and falls. In longitudinal analysis, MCR has been found to be a predictor of vascular dementia and Alzheimer disease. Developments in gait assessment sensor technology have enabled convenient, brief, and objective measurements of many aspects of gait performance. Dual-task gait speed is strongly associated with cognitive outcomes in older persons in population studies including the Irish longitudinal study on ageing (TILDA) cohort. To further our understanding of MCR we have focused on estimating the prevalence of MCR in an ageing Irish population, uncovering associated factors for MCR and to determine the associations between MCR and multiple cognitive domains. Evidence indicates that younger individuals with midlife vascular risk factors such as type 2 diabetes (T2D) have at least a doubled risk of developing cognitive dysfunction and/or dementia in later life. This is significant within the context of an obesity epidemic in developed and developing countries, resulting in ever-increasing numbers of people living with T2D. Early identification of people at high risk for developing dementia is a priority for managing the condition, given the limited impact of treatments once symptoms are established. Our focus is investigating correlations between cognitive and gait function in people with T2D as means of assessing the clinical utility of gait analysis as a brief, and reliable means of identifying individuals at highest risk of developing dementia in people with T2D

- a. Baseline Association of Motoric Cognitive Risk Syndrome with sustained attention, memory, and global cognition.
- b. Investigate performance of different gait tasks in people with T2D without significant peripheral neuropathy in comparison to non-diabetic controls using inertial motion unit (IMU) devices.
- c. Investigate the association between gait task and cognitive performance in patients with T2D attending a specialist diabetes service
- d. Establish the prevalence of motoric cognitive risk syndrome in patients with T2D attending a specialty diabetes service

Mild Cognitive Impairment (MCI) and related psychosocial outcomes can be objectively evaluated by investigating interpersonal communication strategies, i.e. the verbal and non-verbal exchanges between older persons with MCI and their caregivers during

conversational interactions. We have investigated the temporal organisation of speech (reflective of speech production planning) in reading aloud in relation to cognitive impairment, particularly working memory and attention deficits in MCI and AD. The discriminative power of temporal features extracted from a newly designed read speech task is also evaluated for the assessment of early signs of cognitive deficits in MCI and AD. We have studied subjects suffering from MCI and mild-to-moderate AD reading aloud a set of sentences varying in cognitive load, by manipulating sentence length and syntactic complexity. Our results show that mild-to-moderate AD is characterised by a general slowness of speech, attributed to a higher number of speech chunks, silent pauses and dysfluencies, and slower speech and articulation rates. Speech chunking in the context of high cognitive-linguistic demand appears to be an informative marker of MCI, specifically related to early deficits in working memory and attention. The implementation of connected speech-based technologies in clinical settings may provide additional information for the early diagnosis of MCI and early AD.

Correlating speech characteristics with neuronal functional or structural changes would give support to the use of speech in the early diagnosis of MCI. We have recorded functional resting state and structural neuroimaging data from subjects with Mild Cognitive Impairment and mild-to-moderate Alzheimer's disease in order to correlate conversational speech timing, working memory deficits with neural correlates. Our focus is on resting state analysis

Investigating interpersonal communication strategies employed by older persons with non-amnesic MCI and their caregivers is of interest to evaluate the evolution of the disease. Our research is extracting speech characteristics indicating speech adjustments, i.e. the tendency for speakers to adapt their lexicon (words), syntactic structure and prosody (tone of voice, rhythm) to one another, and turn-taking organisation, i.e. the interpersonal coordination that establishes when to talk, listen and take turns. Our focus is on MCI, where individuals who may experience difficulties in adapting their speech and managing turn-taking due to cognitive impairment and/or behavioural changes which may affect speech comprehension and expression at different linguistic levels (lexicon, syntax, prosody). As a result, they may use coping strategies depending on the cognitive resources they have available. For example, if access to lexicon is made difficult, individuals may rely on other components of speech such as prosody to adapt their speaking style. Similarly, to enhance communication, carers may use specific strategies. Carers' strategies may depend on the cognitive resources they believe their interlocutors possess as well as on their own resources, provided that they are aware that communication difficulties exist

- a. Changes in Speech Chunking in Reading Aloud is a marker of Mild Cognitive Impairment and Mild-to-Moderate Alzheimer's Disease
- b. Determine the utility of communication can be used as objective markers of MCI and of the underlying aetiopathology, e.g. Alzheimer's Disease, Frontotemporal Dementia, Lewis Body Dementia.
- c. Conversational speech timing, working memory deficits and structural and neural correlates in Mild Cognitive Impairment and mild-to-moderate Alzheimer's disease
- d. Evaluate the impact of carers' communication strategies on the quality of an interaction and on a person with MCI and their caregivers' psychosocial states.

Sensorimotor impairment is a condition which results in reduced ability to safely move in the world around us. The effects are most commonly seen with increased falls rates in the elderly, stroke related hemiparesis and partial or full paralysis following spinal cord injury. A combination of spinal neuromodulation technology with a closed-loop Brain-Computer Interface may provide the user with real-time feedback of the current physical state of the nervous system, closing the sensorimotor loop and encourage motor learning. We are currently developing an objective real-time brain computer interface feedback system for automated control of a spinal neuromodulator, thus opening the potential for biofeedback from limbs to the brain, forming true closed loop control. EMG activity will be recorded from four lower limbs muscles (rectus and biceps femoris, tibialis anterioris and gastrocnemius). The processed EMG signals will be used as the basis of sensory feedback. Foot sensors will also be attached to the soles of the participants feed to obtain foot placement information. This data will be processed to provide acoustic feedback of simulated walking on different surfaces (gravel, concrete, wood etc.) to improve sensorimotor integration and thus improved prosthesis control EEG data will also be recorded scalp electrodes using a portable high-density EEG system. This data will be used to develop the brain computer interface (BCI), where the subject's modulation of their motor cortical activity activates the neuromodulation strategy. Considerable experience exists on recording EEG data in ambulatory and noisy environments and thus developed algorithms will be enhanced to process the acquired EEG data from these environments. To help the convergence of the machine learning algorithms within the BCI, data will be combined from the subject but also the experimenter (10%:90%), this will provide improved performance of the BCI but importantly increased confidence to the subject on what can be achieved. Over training sessions this fusion of data will be altered so that in time it is 100% from the subject.

- a. Development of objective sensory feedback measures of gait initiation and progression.
- b. Development of objective sensory feedback to somatosensory cortex or other body part to provide haptic feedback during gait
- c. Development of virtual reality environments to increase sensorimotor integration.
- d. Development of real-time artefact removal algorithms and implementation platforms for gait-based neuroimaging using EEG and NIRS
- e. Develop an EEG based Brain-Computer Interface to allow closed-loop control of spinal neuromodulation enabling motor control
- f. Boost performance of sensorimotor BCIs through the use of transfer learning.

POSTGRADUATE SUPERVISION

Currently mentoring 2 postdoctoral fellows, supervising 3 PhDs, 5 MSc researchers, and 2 interns and directing 2 research engineers. I have successfully supervised to completion 156 PhD/MSc and mentored 37 postdoctoral fellows with backgrounds in engineering, medicine and neuroscience. I have always ensured my research group is multidisciplinary, to bring varied skills and perspectives to our research questions. Many of my graduate students have gone on to careers in medicine (neurology and neurophysiology), others in neuroscience (neuroimaging methods, sensory processing, ageing), and others in the medical device industry, building on their direct patient experience and knowledge. Ten (10) of my former PhD students (>40%) have gone on to academic careers in Ireland, Belgium, the UK and the USA.

Current Graduate students

Theme A (Active Implantable Devices)

1. Hartigan T. (2023-2024), MSc: Improving neurosurgical planning in focal epilepsy seizure surgery using StereoEEG-based source localisation and multimodal neuroimaging

Theme B: Neurophysiological of Sensory and Cognition Processing in Movement Disorders

2. Fitzgerald T. (2023-2024) MSc: Multimodal analysis of the biomechanical contributors during the Sit-to-Stand transition contributing to Gait Disorders in Parkinson's Disease
3. Mayuachi, K. (2023-2024) MSc: Perceptual decision-making as a product of impaired Superior Collicular processing with implications to Cervical Dystonia"
4. Saravanba, N. (2023-2024), MSc: Instrumentation for assessing temporal discrimination in clinical cohorts

Theme C (Technologies for objectively managing chronic disease and disease processes associated with ageing)

5. Newman L. (2017-), PhD: Cerebral haemodynamics in an older population: relationship with ageing, disease and health behaviours (co-supervision with Prof. Kenny, School of Medicine).
6. Lundy L (2022-), PhD: Ethnography and exercise physiology of multi-marathoning
7. Fryc B. (2023-2024), MSc: Speech and Gait as a window into cognition in neurodegeneration

Theme D: Biomedical Signal Processing

8. Lungo, L (2018-), PhD: Artefact removal from ambulatory electrophysiological data.

Former Graduate Students

Theme (Active Implantable Devices)

1. Lavelle S. (2022-2023), MSc: Improving neurosurgical planning in focal epilepsy seizure surgery using StereoEEG-based source localisation and multimodal neuroimaging
2. O'Donnell A. (2021-2022), MSc: Neurosurgical Planning based on neuroimaging
3. Rogers A (2021-2022), MSc: Closed loop control for transcutaneous spinal stimulation
4. Thakor R (2021-2022), MSc: Personalized Cervicothoracic Transcutaneous Spinal Cord Stimulation Based On MRI Data
5. O'Reilly O. (2020-2021), MSc: Neurosurgical Planning based on neuroimaging and electrophysiology from implanted electrodes
6. Waechter S. (2018), PhD: Electrophysiological Objective Measures of Auditory Temporal Perception in Cochlear Implants Users
7. Hablani S. (2017), MSc: Electrophysiological Objective Measures of Fine Temporal Processing in Cochlear Implants Users
8. Sechler S (2016), MSc: Electrophysiological Measures of Spatial Awareness in Cochlear Implants Users.
9. Lopez-Valdes A. (2016), PhD: Electrophysiological Objective Measures of Auditory Spectral Perception in Cochlear Implants
10. Lau C. (2016), MAI: Electrophysiological Measures of Speech Perception in Cochlear Implants Users.
11. McNamara, H. (2014), MSc: Neuronal substrate of procedural memory: Ensemble investigation of rodent basal ganglia
12. Leijssen A. (2014), MSc: Spectral Ripple Mismatch Negativity in Speech Perception in Cochlear Implants Users.
13. Krijser L. (2011), MSc: Thin filament electrode design for deep brain recording
14. Van Dort M. (2011), MSc: Closed loop recording and stimulation in implanted devices.
15. Lopez-Valdes A. (2012), MSc: Mathematical processing of audio cues for improve hearing with cochlear implants
16. Chah E. (2012), PhD: Mathematical processing of electrophysiology with applications to implanted electrodes
17. Steinemann, N (2012), MSc: Mathematical modelling of head direction cells
18. Noor S, (2012), MSc: Recording of hippocampal place cells in freely moving animals

Theme Neurophysiological of Sensory and Cognition Processing in Movement Disorders

1. Rafee S. (2019-2023), PhD: Clinical, genetic and neurophysiological features of psychiatric and cognitive symptoms in cervical dystonia and the role of the superior colliculus with Dr Michael Hutchinson)
2. Lloyd R. (2022-2023), MSc: Cognitive Interference in Postural Control as a Novel Biomarker for Parkinsonian Disorders
3. Lakhotiya M. (2022-2023), MSc: A protocol to quantify perceptual decision-making as a product of impaired Superior Collicular processing with implications to Cervical Dystonia
4. Kelly D. (2022-2023), MSc: Social Cognition in Cervical Dystonia: Assessing the Collicular-Pulvinar-Amygdala pathway by functional MRI
5. King R. (2022-2023), MSc: Neural Biomarker-Based Platform for Dystonia Diagnosis using Deep Learning
6. Elliott H. (2022-2023), MSc: Novel Free-Viewing Eye Tracking in Parkinson's Disease and Correlation with Clinical Assessment Scores
7. Cullan K (2021-2022), MSc: Ambulatory EEG, Gait and Neurodegeneration: Using gait to predict cognitive decline
8. Flaterty A. (2021-2022), MSc: Pre-motor syndromes of cervical dystonia: MRI neuroimaging in Neurology
9. O'Connor O (2021-2022), MSc: Postural control in cervical dystonia
10. O'Driscoll M. (2021-2022), MSc: Speech as a window into Social Cognition in Cervical Dystonia
11. Herings C. (2020-2021), MSc: Electrophysiological Based assessment of Emotional Face Processing in Dystonia
12. Coffey C. (2020-2021), MSc: Instrumentation for assessing temporal discrimination in clinical cohorts
13. Kelleher R. (2020-2021), MSc: Neuroimaging Based assessment of Emotional Face Processing in Dystonia

14. Alley M. (2020-2021), MSc: Instrumentation for assessing temporal discrimination in clinical cohorts
15. Franklin C. (2020-2021), MSc: A Methodology for the Analysis of Sensorimotor Network Activity in Spasmodic Dysphonia during Speech Production
16. O'Keeffe C. (2016-2020), PhD: Postural Instability as an Endophenotype for early Dysfunction and Decline in Neurodevelopmental Disorders
17. Etzelmueller M (2019-), MSc A Prospective study of multimodal biomarkers for progressive multiple sclerosis.
18. Kennedy G (2020), MSc: Electrophysiological Based assessment of Emotional Face Processing in Dystonia
19. Bostan S. (2020), MSc: Electrophysiological Based assessment of Emotional Face Processing in Dystonia
20. Breen, N. (2020), MSc: Temporal Discrimination in Cervical Dystonia
21. Gaul, A. (2020), MAI: Postural Instability as an Endophenotype for early Dysfunction and Decline in Neurodevelopmental Disorders
22. Narasimham S. (2019), PhD: Neuroimaging investigations of mid-brain functional activity in Dystonia
23. Perez Denia M. (2019), MSc: Acoustic Analysis of Musicians Dystonia
24. Monahan J (2019), MSc: Electrophysiological Based assessment of Emotional Face Processing in Dystonia
25. Purcell S. (2019), MSc: Electrophysiological Based assessment of Emotional Face Processing in Dystonia
26. Dominguez M (2019), MAI: Postural Instability as an Endophenotype for early Dysfunction and Decline in Neurodevelopmental Disorders
27. Duggan O. (2019), MAI: Neuroimaging investigations of mid-brain functional activity in Dystonia
28. Quinlivan B. (2013-2017), PhD: Neurophysiological Analysis of cortico-basal ganglia interactions in Dystonia
29. Birsanu D. (2017), MSc: Electrophysiological based studies into the pathophysiology of Parkin and Parkinson's Disease
30. Sundararajan V. (2017), MAI: Neuroimaging investigations of mid-brain functional activity in Dystonia
31. Fearon C. (2016), PhD: Electrophysiological based studies into the pathophysiology of Freezing of Gait in Parkinson's Disease
32. Melis E. (2016), MSc: Electrophysiological Connectivity analysis of Neuroimaging data from Neurodevelopmental Disorders
33. Killian O. (2016), MSc: Neurophysiological Analysis of cortico-basal ganglia interactions in Dystonia
34. Baird E. (2016), MAI: Electrophysiological Investigations into Freezing of Gait.
35. Narasimham S. (2015), MSc: Electrophysiological investigations in Looming Stimuli and its relevance to movement disorders
36. Markicevic M (2015), MSc: Neuroimaging of Cancer-related fatigue
37. Waechter S. (2014), MSc: Neuroimaging during ambulation for a study of Freezing of Gait in Parkinson's Disease
38. Abdur R. (2014), MSc: Electrophysiological investigations in Looming Stimuli and its relevance to movement disorders
39. Cheshire R. (2013), MSc: Electrophysiological Investigations into Freezing of Gait.
40. Gallego, J. (2013), MSc: Ambulatory neuroimaging of Freezing of Gait.
41. Anggraini, D. (2013), MSc: Neuroimaging of interactions between motor and cognitive cognition.
42. Bradley D. (2012), PhD: Temporal Discrimination Threshold as an endophenotype in adult onset primary torsion dystonia
43. Dabacan A. (2012), MSc Temporal Discrimination Threshold Assessment in Dystonia
44. Fanning A. (2012), MSc Temporal Discrimination Threshold Assessment in Dystonia

Theme (Neural Signal Processing and Neural Signal Processing with application to ageing)

1. Donders E (2021-2022), MSc: Real Time Joint Angle Calculations and a Visual Feedback System in Rehabilitation for Movement Disorders
2. Gill C (2020-2021), MSc: Closed loop control for transcutaneous spinal stimulation
3. Herings P. (2020-2021), MSc: Nonlinear analysis of gait dynamics
4. Caslin H. (2020-2021), MSc: Calculation of minimum toe clearance in neurodegeneration
5. O'Flatory E. (2017-2020), MSc: Neurophysiology of eye tracking younger cohorts (co-supervision with Dr. J. McHugh, School of Medicine).
6. Doherty K. (2020-2021), MSc: Dynamic gait assessment in elite athletes
7. O'Higgins C. (2019), PhD: Neuroimaging of Cancer-related fatigue (co-supervision with Prof. Walsh, School of Medicine).
8. Oliveira I. (2019), MAI: Multimodal Cardiovascular Modelling for Predicting and Preventing Disability
9. Taylor T. (2017), PhD: Bioacoustic analysis of respiratory function
10. Rice A. (2017), MAI: Neuroimaging of Cancer-related fatigue
11. McNulty J. (2017), MAI: Bioacoustic analysis of respiratory function
12. McDevitt N. (2013-2017), PhD: Electrophysiological analysis of Neurodevelopmental Disorders (co-PI Prof. Gallagher, Sch. of Med.).
13. Creagh A. (2016), MSc: Gait as a window into cognitive function.
14. MacCartan T. (2016), MSc: Bioacoustic analysis of respiratory function.
15. Maguire F. (2016), MSc: Gait as a window into cognitive function.
16. Holmes M. (2015), PhD: Bioacoustic analysis of respiratory function.
17. Foran T. (2015), PhD: Gait Analysis from triaxial accelerometry. (co-supervision with Prof. Kenny, School of Medicine).
18. Killane I. (2014), PhD: Gait as a window into cognitive function.
19. Burke L. (2014) MSc: Speech derived measures of cognitive impairment during chemotherapy
20. Newman L. (2014), MSc: Neuroimaging of Cancer-related fatigue
21. Koller, S (2014), MSc: Speech derived measures of cognitive impairment during chemotherapy
22. Killidil R. (2014), MSc: Neuroimaging of Cancer-related fatigue
23. Taboada L (2017), MSc: Postural Instability as an Endophenotype for early Dysfunction and Decline in Neurodevelopmental Disorders
24. Rapcan V. (2013), PhD: Speech and language processing in cognitive function assessment.
25. Hintze J. (2013), MSc: Bioacoustic analysis of respiratory signals.
26. McDevitt N. (2013), MSc: Electrophysiological analysis of Autism Spectrum Disorder. (with Prof. Gallagher, School of Medicine).
27. Cosgrave N (2023), MSc: Electrophysiological analysis of Autism Spectrum Disorder. (with Prof. Gallagher, School of Medicine).
28. ASM Shamsul Arefin (2012), MSc Quantitative EEG analysis of task induced epilepsy
29. Reynolds N., (2012), MSc Diffusion Tensor Imaging of task induced epilepsy
30. Mooney E. (2012), MSc Tremor Assessment in Neurological Disorders.
31. Kiiski H. (2012), PhD: Neurophysiological Assessment of cognitive impairment in multiple sclerosis.
32. Nolan H. (2012), PhD: Multisensory Integration in the Vestibular System
33. Rueda-Delgado L. (2012), MSc: Quantitative analysis of acute brain injury.
34. Murphy C (2011), MSc: Forced Oscillatory Measurements in Pulmonary Diseases
35. Sobolewski R. (2011), MSc: An investigation of Cognitive Aging: an EEG study.

Theme D: Biomedical Signal Processing

36. Meredith S. (2011), PhD: Diffusion Imaging: A Fast Marching Approach to Tractography (with Dr. Kathleen Curran)
37. Power A. (2011), PhD: Endogenous Auditory Spatial Attention in Auditory Cortex.
38. Nolan D (2011), MSc: Analysis of the aortic valve dynamics using endoluminal measurements.
39. Cheung M (2011), MSc: Assessment kinematic movement in fMRI.

40. Brennan C (2011), MSc: Influence of dual tasking on gait variability
41. Browett G. (2010), MSc: Artefact Rejection in movement based EEG Studies.
42. Moran R.C. (2008), PhD: Neural Mass Models of the Electroencephalogram-a unifying framework.
43. Pitorac D.M. (2009), MSc: Automatically Adapting Mattress for the Prevention of Pressure Sores and Ulceration.
44. Lahart F. (2008), MSc: Home based Stroke Rehabilitation.
45. Roche J. (2008), MSc: Use of Abdominal Pressure for orthostatic tolerance in patients with autonomic failure.
46. Lalor E. (2007), PhD: Neural Engineering Methods in Visual Neuroscience.
47. Greene B. (2007), PhD: Quantification and Classification of Electrophysiological Seizure in the Neonate.
48. Kelly S. (2005), PhD: Electrophysiological studies of the Human Attention System.
49. Scanlon P. (2005), PhD: Audio and Visual Features for Audio-Visual Speech Recognition.
50. Sharma P. (2005), PhD: Face Detection with application to Video Segmentation.
51. Fox N. (2005), PhD: Audio and Video based Person Identification.
52. Maguire C. (2004), MEngSc: Automatic Classification for Vocal Pathology.
53. Smith R. (2004), MEngSc: Signal Processing of EEG for Brain Computer Interfaces.
54. O'Dwyer M. (2004), MEngSc: ECG Pattern Recognition using two level classifiers.
55. Gray M. (2003), MEngSc: Video compression using for Wireless networks.
56. Kat Woon L. (2003), MEngSc: Bluetooth based Video and Image Transmission.
57. McInerney S. (2001), MEngSc: VLSI cores for Pattern Recognition applications.
58. Harper P. (2000), MEngSc: Object Segmentation using Level Sets.
59. McCue M. (2000), MEngSc: EMG Signal Analysis" (with Prof. Mark O'Malley)
60. Bray D. (1999), MEngSc: Abdominal Bowel Sounds" (with Dr Brendan McCormack)

PROFESSIONAL CONTRIBUTIONS

Academic Editorial Board

2022-2025	<i>IEEE Journal of Translational Engineering in Health and Medicine</i> , Editor-in-Chief
2020- to date	<i>Frontiers in Network Physiology-Aging and Frailty</i> , Associate Editor
2020- to date	<i>Frontiers in Bioengineering and Biotechnology</i> , Review Editor
2013 – to date	<i>IEEE Journal of Translational Engineering in Health and Medicine</i> , Associate Editor
2016 – to date	<i>Frontiers in Integrative Neuroscience</i> , Associate Editor
2021 – to date	<i>IEEE Transactions on Medical Robotics and Bionics</i> , Steering Committee
2013 – to date	<i>IET Healthcare Technology Letters</i> , Associate Editor
2011 – 2015	<i>International Journal of Artificial Organs</i> , Editorial Board Member
1996 – 2003	<i>IEEE Journal of Rehabilitation Engineering</i> , Associate Editor

PROFESSIONAL SOCIETY - OFFICER POSITIONS HELD AND ACTIVITIES

Institute of Electrical and Electronics Engineers (IEEE)

Editor-in-Chief and a founder of the IEEE Journal of Translational Engineering in Health and Medicine (2022—2025)

- The IEEE Journal of Translational Engineering in Health and Medicine's unique aim is to publish original work in the intersection of engineering and clinical translation. The journal's focus is interdisciplinary collaborations between researchers, healthcare providers, and industry and aims to publish results and best practices from these translational efforts. The journal's Impact Factor (2023) is 3.40 and a CiteScore of 6.6 <https://www.embs.org/jtehm/>

Royal Irish Academy (RIA)

Vice-Chairman, Engineering and Computer Science Committee (2014-2022)

Member of the Committee for Engineering Sciences (2012-2014)

- In 2013, Prof Reilly, in collaboration with Prof Paul Whelan (Dublin City University) organised an Academy Discourse on Innovation in Healthcare. Innovation has delivered incalculable benefits to billions of people. However, the demands of this century will require even greater change because many health systems are rapidly becoming unsustainable. Not only does the non-communicable disease epidemic threaten to overwhelm health services. The costs of care are also rising, and this is at a time when many countries face perhaps a decade of fiscal consolidation. The discourse and discussion focused on the drivers of innovation, arguing that more of the same will not be enough to restore health systems' sustainability. The main speaker at the event was Professor the Lord Darzi of Denham.

Member of the *Advisory Committee on the Assessment of Candidates for Membership* (2012-2016) with responsibility for assessing nominations for Academy membership from the sciences.

European Alliance for Medical and Biological Engineering & Science (EAMBES)

Council Member of EAMBES (2014-2018)

Member of the *EAMBES Policy Affairs Working Group (2014-2018)*

- Developing policy and strategy to promote Biomedical Engineering as a recognised professional within the International Labour Organisation's ILO International Standard Classification of Occupations.

European Society for Engineering and Medicine (ESEM)

President (2011-2015)

- Professor Reilly led a team which organised three, two-week-long *International Medical and Engineering Summer School* at Trinity College Dublin from in July 2009, 2010 and 2011. These Summer Schools, a cooperation between seven leading universities in medicine and biomedical engineering and were organised in collaboration with the European Society of Engineering and Medicine (ESEM). Thirty students, both medical and engineering, attended each summer school from universities across Europe. The focus was on healthcare challenges, including ageing and cardiovascular disease. The aim of each summer school was to enable students from the two different educational disciplines and different working cultures to work together designing new, novel medical devices targeting specific medical and clinical problems. The Summer Schools were funded by the European Commission's FP7 programme.

Council member of the European Society for Engineering and Medicine (ESEM) (2008-2015)

Engineers Ireland, formerly known as the Institution of Engineers of Ireland (IEI)

Member of Council 2003–2004, 2004–2005 and 2005-2006.

Chairman of the Biomedical Engineering Division for 2005-2006.

- Professor Reilly organised two high-level focus group meetings (March 2005 and November 2005) with representatives from academia, the medical device industry, clinical practice and national agencies. The purpose of these meetings is to propose a new coordinated model for collaborative research and development in biomedical engineering. This activity integrates into the Irish Government's policy on improved Healthcare delivery. To bring this activity to national attention, Professor Reilly chaired a major debate at the Annual National Conference of the Institution on Patient-Focused Technology for Efficient Healthcare Delivery (Dublin 2007). Speakers at the event include leading decision-makers in Irish healthcare and higher education.

Vice Chairman of the Biomedical Engineering Division for 2003-2004 and 2004–2005.

- In 2002, Professor Reilly established the Annual IEI Biomedical Engineering Medal in order to highlight and promote quality biomedical research in Ireland to a wide audience. This award is presented to the PhD researcher of the best paper, as judged by a panel of biomedical engineers from academia, industry and clinical practice. The gold medal prize is accompanied by a €1000 honorarium. The award has attracted a huge following since its inception and is one of the highlights of the annual national conference, Bioengineering In Ireland.

Founder Member of the *Registration Board for Clinical Engineering* at Engineers Ireland.

- *Co-author* of the *Strategic Plan for Professional Development of Clinical Engineering* submitted to the Irish Department of Health and Children 2005. The plan set to establish Clinical Engineering as a recognised career structure in the Irish Health system in order to provide high-quality care but also to develop the profession through high-quality, sustainable research, development and training.

Member of the *Management Committee*, CPD and Education for Clinical and Biomedical Engineers (2006-2010).

Committee member of the Biomedical Engineering Division 1999-2007.

Institute of Electrical and Electronic Engineers (IEEE)

Republic of Ireland Representative (2006-2008) on the Executive Committee of the IEEE's United Kingdom and Republic of Ireland Section.

Institution of Electrical Engineers (IEE)

Faculty representative for the IEE at University College Dublin (2004-2007)

Silvanus P. Thompson Lecturer (1998-2000)

- Invited Lecturer for the 1998-2000 Silvanus P. Thompson International Touring Lecture Series giving 40 lectures worldwide to promote research activities in biomedical and multimodal signal processing.

PROFESSIONAL AND TECHNICAL SOCIETIES, COMMITTEES AND BOARDS

- Member of the Board of the Health Products Regulatory Authority, Dublin (2020-present) - Governmental Appointment
- Chair of the Health Products Regulatory Authority Advisory Committee on Medical Devices (2020-present) - Governmental Appointment
- Director and Member of the Board of the Dublin Neurological Institute (2024-present)
- Member of the Neuroimaging Study Group in Movement Disorders, International Parkinson and Movement Disorder Society (2019-)
- Member of the American Association of Neurology (AAN) (2015-present)
- Member of the European Academy of Neurology (EAN) (2016-present)

- Member of the International Parkinson and Movement Disorders Society (MDS) (2013-present)
- Member of the Board of the National Rehabilitation Hospital, Dublin (2017-2022)
- Director of the Irish Institute of Clinical Neuroscience (2016- 2022)
- Associate Editor & Editorial Board Member of IEEE Journal of Translational Engineering in Health and Medicine (JTEHM) (2013-present)
- Associate Editor & Editorial Board Member of the IET's Healthcare Technology Letters (2013- present)
- Associate Editor & Editorial Board Member of Frontiers in Integrative Neuroscience (2009-present)
- Member, Engineering and Computer Science Committee, Royal Irish Academy (2018- present)
- Member of the Health Products Regulatory Authority Advisory Committee on Medical Devices (2016-present)
- Member of the Board of Directors of the Centre for Advanced Medical Imaging, St James's Hospital (2009-present)
- Council Member of the European Alliance for Medical and Biological Engineering & Science (EAMBES) (2014-2018)
- Member of the Board of Tallaght Hospital, Dublin (2012-2017). State Board Appointment
- Vice-Chairman, Engineering and Computer Science Committee, Royal Irish Academy (2014-present)
- Editorial Board of the International Journal of Artificial Organs (2011-2015)
- Senior Member, Institute of Electrical and Electronics Engineers (IEEE) & Engineering in Medicine and Biology Society (2006-present)
- Member of the Advisory Board Biomedical Engineering, Faculty of Mathematics & Natural Sciences, University of Groningen (2016-2018)
- Fellow of the Institution of Engineering and Technology (IET) (Member since 1998, Fellow 2020-present)
- Member of the Institution of Engineers of Ireland (Engineers Ireland) (1988-present)
- Member of the Biomedical Engineering Society (BMES) (2008-present)
- Council member of European Society for Engineering and Medicine (ESEM) (2008-2015)
- President of the European Society of Engineering and Medicine (ESEM) (2011-2015)
- Member of International Neuromodulation Society and Neuromodulation Society of the United Kingdom and Ireland (2010-present)
- Member of the Society of Neuroscience (SFN) (2010-present)
- Member of the Irish Institute of Clinical Neuroscience (IICN) (2008-present)
- Member Management Committee, CPD and Education for Clinical and Biomedical Engineers, Engineers Ireland (2006-2010)
- Member, Executive Management Committee, Trinity Centre for Bioengineering (TCBE) (2008 – present)
- Member, Executive Management Committee, Trinity Institute for Neuroscience (TCIN) (2009 – present)
- Member, UCD-TCD Innovation Academy Executive Board (2010- 2013)
- Assistant Editor of the IEEE Transactions on Neural Systems and Rehabilitation Engineering (1999-2003)
- Member of Council, Institution of Engineers of Ireland, (2003–2004, 2004–2005 and 2005-2006)
- Founder Member of the Clinical Engineering Voluntary Registration Board, Engineers Ireland (2006-2010)
- Vice-Chairman, Biomedical Division, Institution of Engineers of Ireland (2003-2004 and 2004–2005)
- Chairman, Biomedical Division, Institution of Engineers of Ireland (2005-2006)
- Reviewer for journal including *Journal of Neural Engineering*, *Scientific Reports*, *PlosOne*, *Frontiers in Neuroscience*, *Frontiers in BioEngineering*, *IEEE Transactions on Biomedical Engineering*, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, *IEEE Transaction on Multimedia*, *Physiological Measurement*, *IEEE Transactions on Industrial Electronics*, *Engineering in Medicine and Biology Magazine*, *International Journal of Circuit Theory and Application*, *IEE Journal Electronic Letters*, *Medical and Biological Engineering and Computing*, *IEE Proceedings Vision, Image & Signal Processing*, *IEEE Transactions on Knowledge and Data Engineering*, *IEEE Transactions on Information Technology in Biomedicine*, *IEEE Press*, *ESEM Technology and Health Care*, *Journal of Neuroscience*, *Journal of Applied Signal Processing*, *EURASIP Journal of Applied Signal Processing*, *Pattern Recognition*, *European Journal of Neurology*, *Wiley Publishers*.
- Grant reviewer for *Medical Research Council (UK)*, *Swiss National Science Foundation*, *US Alzheimer's Association*, *Agence Recherche France*, *Parkinson's Disease Society (UK)*, *Enterprise Ireland*, *Chief Scientist Office-Scottish Government*, *European Research Council*, *The US Alzheimer's Association*, *La Caixa Fellowship Program*, *European Joint Program for Rare Diseases*, *CCS Fondation Maladies Rares*,
- External Examiner for the *Technical University of Eindhoven*, *Technical University of Twente*, *Delft Technical University*, *The University of Groningen*, *Universitat de Barcelona*, *University of Vic-Central University of Catalonia*, *The Dublin Institute of Technology*
- PhD External Examiner for the *Czech Technical University in Prague (2010)*, *Universitat Politècnica de Valencia (2009)*, *Ecole Polytechnique Federale de Lausanne EPFL (2008, 2012)*, *Queens University, Belfast (2007, 2012)*, *University of Ulster (2009, 2017, 2019)*, *Universitat of Barcelona (2005, 2016, 2020)*, *University of Cape Town (2003, 2015)*, *Dublin City University (2005, 2002 and 2005)*, *University of Groningen (2015)*, *Universitat Politècnica de Barcelona (2020)*,

CONFERENCE ORGANISATION ACTIVITIES

Note that only major activities related to major conference events are listed.

1. Island of Ireland representative for *43rd IEEE-Engineering in Medicine and Biology Annual International Conference*, 2022.
2. Organizer with the Royal Irish Academy of Music a symposium titled "Musicians, Performance and the Brain", Dublin, November 2018
3. Scientific Committee of the conference of the *European Medical and Biological Engineering Conference (EMBEC)* and the *Nordic-Baltic Conference on Biomedical Engineering and Medical Physics (NBC)*, in Tampere, Finland, in June 2017
4. Associate Editor, *7th International IEEE EMBS Conference on Neural Engineering*, Montpellier, France April 2015
5. Track chair of Neurological disorders and clinical neurophysiology of Neural and Rehabilitation Engineering for *IEEE-EMBS 35th Annual International Conference*, 2013, Osaka.
6. Program Committee member for the *IASTED International Conference on Biomedical Engineering (BioMed 2012)*, Innsbruck, 2012
7. Scientific Committee of the *Irish Gerontology Society*, 59th Annual Meeting, Dubin, 2011
8. Technical Program Committee member, *IEEE-EMBS 33rd Annual International Conference*, Boston, USA, 2011
9. Program Committee member, *Irish Machine Vision and Image Processing Conference (IMVIP)*, September 2011, Dublin, 2011
10. Track Co-chair of the clinical neural engineering, *5th International IEEE-EMBS Conference on Neural Engineering*, Cancun, Mexico, 2011
11. Technical Program Committee member, *Irish Signals and Systems Conference (ISSC)*, Dublin 2011

12. Track chair and Technical Program Committee member, *Bioengineering in Ireland*, 16th Annual Conference, January 2010
13. Technical Program Committee member, IEEE-EMBS 32nd Annual International Conference, Buenos Aires, Argentina, 2010
14. Technical Program Committee member, IEEE-EMBS 31st Annual International Conference, Minneapolis USA, 2009
15. Technical Program Committee member, 4th International IEEE-EMBS Conference on Neural Engineering, Antalya, Turkey, 2009
16. Track Chair for IEEE Engineering, Medicine and Biology Conference 2008, August 2008
17. Scientific Publication and Organisation Program Committee member for EUSIPCO 2008, September 2008
18. Program Committee member, Irish Machine Vision and Image Processing Conference (IMVIP), September 2007, Maynooth, 2007
19. Technical Program Committee, IEEE-EMBS 29th Annual Internal Conference, Lyon, France, 2007
20. Technical Program Committee member, IEEE-EMBS 28th Annual International Conference, New York USA, 2006
21. Organisation Committee and Technical Program Committee member for the International Multisensory Research Forum (IMRF), 2006
22. Program Committee for 18th International Conference on Pattern Recognition, Aug 2006
23. Technical Program Committee member, 2nd International Conference on Neural Engineering, Washington, USA, 2005
24. Technical Program Committee member, IEEE-EMBS 27th Annual International Conference, Shanghai, China, 2005
25. Programme Committee for the 2006 Irish Machine Vision and Image Processing (IMVIP), September 2006
26. Co-chair and Scientific Organiser, International Conference AAATE, September 2003
27. Co-chair, Advances in Investigative and Clinical Diagnosis in Neurology, Dublin, January 2003
28. Technical Program Committee member, IEEE-EMBS 24th Annual International Conference, Houston, USA, 2002
29. Technical Program Committee member, IEEE-EMBS 23rd Annual International Conference, Istanbul, 2001
30. Program and Organisational Committee member Irish Signal and System Conference, June 2000
31. Member of the International program committee for the Biomedical Engineering Society/EMBS international conference, Atlanta, 1999.

INVITED KEYNOTES, ADDRESSES, OR OTHER INVITED LECTURES/PRESENTATIONS in past 10 years

- “Qualitative Assessment of Balance Dysfunction in Parkinson’s Disease”, PD & Movement Disorder Masterclass meeting, Dublin, Nov 2023
- “Role of sensory information in the pathophysiology of dystonia”, hosted by Engineers Ireland, Dublin, June 2021
- Invited seminar on “Cortico-Cerebellar Circuits in Dystonia” at 4th International Congress on Treatment of Dystonia, May 2019 Hannover
- Keynote at the 7th Dutch Bio-Medical Engineering Conference, Jan 2019 “Signal Processing derived Objective Measures to aid Clinical Decisions: examples from Neurology, Otolaryngology and Respiratory Medicine”.
- Centre for Neurology, University of Tuebingen, Germany, July 2017
- “New Developments in Cochlear Implant Technology”, hosted by Electrical and Electronic division in association with IET, Dublin, Feb 2017
- “Assessing Cognition Function with Speech and Gait”, Hospital Clinic Neurology Research Meeting, Barcelona July 2016
- “Can you hear me now?”, Evening Lecture hosted by the Electrical and Electronic division in association with IET, Dublin, Mar 2016
- Dept of Neurology, University Medical Centre Groningen, The Netherlands, Jan 2016.
- Institute fur Physiologie, RWTH Aachen, Germany, Dec 2015.
- Inaugural Lecture for the Program in Biomedical Engineering, Universitat de Barcelona, Sept 2015.
- Universitat de Vic, Universitat Central de Catalunya, April 2015
- Haughton Keynote Lecture, 19th Annual Conference of the Bioengineering Section of the Royal Academy of Medicine in Ireland, Jan 2013
- 6th International Joint Conference on Biomedical Engineering Systems and Technology, BIOSTEC 2013, Barcelona, February 2013
- Invited to deliver international level-10 course on Active Implanted Devices and Systems at RomaTre University, Italy. June 2013
- 59th Annual Irish Gerontology Society Conference, Dublin, September 2011
- 3rd Annual Scientific Meeting of the Faculty of Pain Medicine, College of Anaesthetists of Ireland, Dublin February 2011
- International Workshop on Neuroimaging of Neurodegenerative Disorders, Montreal, November 2010.
- Technology and Dementia Seminar, Dublin October 2010
- 6th European Union Geriatric Medicine Society, September 2010
- European Meeting of the International Psychogeriatric Association, April 2008
- Engineers Ireland Annual Conference, Dublin, April 2007
- Universitat Politècnica de Catalunya, Spain, December 2006
- University of Alcalá de Henares, Spain, June 2006
- The Nathan Kline Institute for Psychiatric Research, New York, March 2005
- Carnegie Mellon University, March 2005
- Universidad de Barcelona, Spain April 2005
- Universitat Pompeu Fabra, Barcelona, Spain April 2005
- Universidad de Sevilla, Spain May 2005
- New York University, October 2004
- Massachusetts General, Boston, September 2004
- Annual Engineers Ireland Conference Biomedical Session, “Translational Research can it influence Public Policy”, April 2007.
- European Governmental Summit, Farmleigh House, Dublin, “Multimodal Biometrics”, June 2004.
- Invited Lecturer for the 1998-2000 S.P.Thompson Touring Lecture. Based on my research work in signal processing, I was awarded by the Institution of Electrical Engineers (IEE) the Silvanus P. Thompson lecturer for 1998 - 2000. This is a distinguished Lecture series, alongside the Faraday Lecture and is available to all IEE centres worldwide.

MEMBERSHIP OF GOVERNMENTAL ADVISORY BOARDS

Acted in a professional capacity for several international and national bodies.

- Co-Editor of the report *Transforming the Future of Ageing* (2019) written for the European Scientific Advice Mechanism. The European Scientific Advice Mechanism (SAM) provides independent and transparent scientific advice to the European Commission, working with a European Commission Group of Chief Scientific Advisors (GCSA) and the European Academies (SAPEA).
- Member of the Health Products Regulatory Authority (2020-2024) *Governmental Appointment*
- Chair of the Health Products Regulatory Authority's Advisory Committee on Medical Devices (2016-present) *Governmental Appointment*
- Member of the Board of the National Rehabilitation Hospital, Dublin (2017-present)
- Member of the Board of Tallaght Hospital, Dublin (2012-2016)
- European Commission's DG Research & Innovation for project evaluation (2005, 2006, 2015, 2015, 2016).
- External Reviewer of COST Action 275 – Pattern Recognition for Biometrics Applications.
- European Commission (2000) Expert as part of a high-level EU mission to Guatemala. Forum titled "EU-Latin America Co-operation in Education, Science and Technology".
- European Commission (1994-2001). Rapporteur to the European Commission for evaluations in the 4th and 5th Framework.
- European Commission (1997). Expert as part of a high-level EU mission led by Sir Leon Brittan, Vice-President of the Commission, to Tokyo, Japan. Forum titled "EU-Japan Co-operation in Education, Science and Technology".
- European Commission (1993-2004) Expert to DG-III and DG-XIII of the European Commission.
- Electro-Technical Council of Ireland (2003-2008) Technical Committee 10 (ECTI TC10).

Professional Directorships

- Director, Irish Institute of Clinical Neuroscience (2017-2021)
- Scientific Advisor, Acton Capital (2016-2019)
- Director, European Biometrics Forum (2003-2011)
- Director, Technology and Research for Independent Living Centre (TRILCentre), Dublin (2006-2008)
- Director, Rehabilitation Engineering Laboratory, National Rehabilitation Hospital, Dublin 2006-2007
- Founder, Scientific Advisor and Non-executive Director non-executive, Voxpilot Ltd, Dublin and Voxpilot SA, Paris (2000-2009)

Scientific peer-reviewed Publications

556 peer-reviewed publications: International peer-reviewed Journal Papers – **204**; International Peer-review Conference Papers – **250**; National Peer-Review Conference Papers – **110**.

Along with Editorials – 2; Booked Edited – 2; Book Chapters – 17 and Patents – 5.

These publications are in Q1 journals (<https://www.scimagojr.com/journalrank.php>), with the majority in the top 10% of biomedical engineering and clinical disciplines.

Indices:

Scopus

H-index 43, Citations: 10,197

<https://www.scopus.com/authid/detail.uri?authorId=7102935766>

Google Scholar

H-index: 59, Citations: 15910 i10-index: 183

<https://scholar.google.com/citations?hl=en&user=6ftKkZMAAAAJ>

NIH iCite

Weighted Relative Curation Ratio (RCR): 254.29, Total Pubs: 197 Mean RCR: 1.35

The weighted RCR is the sum of RCRs for articles in a group, which weights the article count by their influence relative to NIH-funded papers. A

Weighted RCR > the total number of publications indicates an influential set of articles.

<https://icite.od.nih.gov/analysis>

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Research gate

https://www.researchgate.net/profile/Richard_Reilly

PubMed

<https://pubmed.ncbi.nlm.nih.gov/?cmd=DetailsSearch&term=Reilly%20RB%5BAuthor%5D%20OR%20%28reilly%20R%5BAuthor%5D%20AND%20Dublin%5BAll%20Fields%5D%29>

The following publications are categorised according to four research themes. Themes A, B and C describe original work addressing research questions in Neural Engineering. Theme D describes original work in Biomedical Signal Processing.

Theme A: Active Implantable Devices

Theme B: Neurophysiological of Sensory and Cognition Processing in Movement Disorders

Theme C: Technologies for objectively managing chronic disease and disease processes associated with ageing

Theme D: Biomedical Signal Processing

* Indicates publications where I have been the Lead Author, having developed the research question, conceived the experimental design of the study, organised the data acquisition, directed the data analysis, carried out data interpretation, co-drafted the manuscript and approved that manuscript for final submission. Co-authors include my 156 PhD and MSc researchers (listed on pages 8 and 9 my CV) and my clinical colleagues who have kindly provided clinical cohorts for analysis.

2023

- * *Theme C* Loughrey, D; Jordan C., Ibanez A., Parra M., Lawlor B., **Reilly R.B.**, "Age-related hearing loss and the neural correlates of feature binding in visual working memory" *Neurobiology of Aging*, 2023 Dec:132:233-245. doi: 10.1016/j.neurobiolaging.2023.09.016.
- Theme C* Di Liberto G.M., Attaheri A., Cantisani G., Áine Choisealbhá, Sinead Rocha, **Reilly R.B.** Perrine Brusini, Usha Goswami, "Emergence of the cortical encoding of phonetic features in the first year of life", *Nature Communications* 2022-10-16208
- Theme A* Yang Y, Ondrejčák T, Hu N-W, Islam S., O'Rourke E., **Reilly R.B.**, Cunningham C., Rowan M.J., Klyubin I., "Gamma-patterned sensory stimulation reverses synaptic plasticity deficits in rat models of early Alzheimer's disease", *European Journal of Neuroscience*, EJN-2023-02-30231, August 2023.

- Theme B* Moore J., Stuart S., McMeekin P., Walker R., Nouredanesh M., Tung J., **Reilly R.B.**, Godfrey A., "Toward enhanced free-living fall risk assessment: Data mining and deep learning", *Intelligence-Based Medicine*, Vol 8, July 2023. <https://doi.org/10.1016/j.ibmed.2023.100103>
- * *Theme B* O'Keeffe C., Gill C., Etzelmueller M., Taylor C., Hablani, S., **Reilly R.B.**, Fleming N. "Multimodal analysis of the biomechanical impact of knee angle on the Sit-to-Stand transition", *Gait and Posture*, Volume 105, September 2023, Pages 125-131. <https://doi.org/10.1016/j.gaitpost.2023.07.283> PMID: 37542885
- Theme D* Costello RW; MacHale E.; Greene G.; Mulvey C.; Heaney L.G.; Murphy D.; Nanzer Kelly A.; Jackson D.; Kent B.; Counihan I.; **Reilly R.B.** Kerr P.; Brennan V.; Sulaiman I.; Cushen B.; Van Boven J.; Mokoka M.C. "Use of digital measurement of medication adherence and lung function to guide the management of uncontrolled asthma: The INCA Sun randomized clinical trial", *The Lancet Respiratory Medicine*, in press.
- * *Theme D* Lundy L., **Reilly R.B.** "Comparing Predicted Marathon Times based on a comprehensive submaximal treadmill test with Actual Race Times in an Older Multi-Marathon Cohort", *Proc of the 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Conference (EMBC)*, Sydney, July 2023
- * *Theme A* Lavelle S., McDonnell A., O'Reilly O., Sweeney K., **Reilly R.B.** "Minimising the metric distortion in 3D to 2D cortical surface transformations to improve the accuracy of 2D source localisation methods for focal epilepsy seizure surgery planning", *Proc of the 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Conference (EMBC)*, Sydney, July 2023
- * *Theme C* Fleming N., Taylor C., Etzelmueller M., Gill C., O'Keeffe C., Mahony N., **Reilly R.B.**, "Contralateral selectivity of upper limb motor pools via targeted stimulation of the cervical spinal cord", *Biomedicines*. 2023 Jan 24;11(2):332. <https://doi.org/10.3390/biomedicines11020332>
- * *Theme B* Yap S.M., Davenport L., Cogley C., Craddock F., Kennedy A., Gaughan M., Kearney H., Tubridy N., De Looze C., O'Keeffe F., **Reilly R.B.**, McGuigan C., "Word-finding, prosody, and social cognition in multiple sclerosis", *Journal of Neuropsychology*, 2023, Mar;17(1):32-62. doi: 10.1111/jnp.12285.
- Theme D* Carta S, Mangiacotti AMA, Valdes AL, **Reilly R.B.**, Franco F, Di Liberto GM., "The Impact of Temporal Trigger Imprecision on the Temporal Response Function Analysis" *Journal of Neuroscience Methods* 2023 Feb 1;385:109765. doi: 10.1016/j.jneumeth.2022.109765.
- * *Theme B* Rafee S, Hutchinson M, **Reilly R.B.** "The Collicular-Pulvinar-Amygdala Axis and Adult-Onset Idiopathic Focal Dystonias", *Adv Neurobiol.* 2023;31:195-210. doi: 10.1007/978-3-031-26220-3_11
- * *Theme B* Killian O., Hutchinson M, **Reilly R.B.** "Neuromodulation in Dystonia - Harnessing the Network.", *Adv Neurobiol.* 2023;31:177-194. doi: 10.1007/978-3-031-26220-3_11

2022

- * *ThemeC* Wilson F., McHugh C., MacManus C., Baggish A., Tanaayan C., Reddy S, Wasfy M., **Reilly R.B.** "Diagnostic accuracy of a portable ECG device in rowing athletes." *Diagnostics*, September 2022. *Diagnostics* – 1894098
- ThemeC* Curtin H., Simms C., Spirtos M., Kiernan D., **Reilly R.B.**, "Investigating the effect of mobility assistance dogs on gait in children with neurological and physical impairments using 3D gait analysis", *Gait & Posture*, Volume 97, Supplement 1, 2022.
- ThemeB* Simonyan K., Ehrlich S.K., Andersen R., Brumberg J., Guenther F., Hallett M., Howard M.A., del R. Millán J., **Reilly R.B.**, Schultz T., Valeriani D., "Brain-computer interfaces for treatment of focal dystonia" *Movement Disorders*, MDS29178, DOI: 10.1002/mds.2917
- * *ThemeC* Hernandez B., Scarlet, S.; Moriarty, F.; Ortuno, R.; Kenny, R.; **Reilly, R.**, "Investigation of the role of sleep and physical activity risk for chronic disease prevalence in older Irish adults", *BMC Public Health* in press
- * *ThemeC* Herings P.M., Dyer A.H., Kennelly S.P., Reid S., Killane I., McKenna L., Bourke N.M., Woods C.P., O'Neill D., Gibney J., **Reilly R.B.**, "Gait Characteristics and Cognitive Function in Middle-Aged Adults With and Without Type 2 Diabetes Mellitus: Using Deep-Learning to Evaluate the Relationship" *Sensors*, 1790456, August 2022
- ThemeC* Newman L., O'Connor J., Nolan H., Reilly RB, Kenny R, "Age and sex related differences in orthostatic cerebral oxygenation: Findings from 2,764 older adults in the Irish Longitudinal Study on Ageing", *Experimental Gerontology*, EXG-D-21-00428R1
- * *ThemeC* De Looze C., Dehsarvi A., Suleyman N., Crosby L., Hernández B., Coen R.F., Lawlor B.A., **Reilly R.B.** "Structural Correlates of Overt Sentence Reading in Mild Cognitive Impairment and Mild-to-Moderate Alzheimer's Disease", *Current Alzheimer's Research*, July 2022
- * *ThemeB* Yap S.M., Davenport L., Cogley C., Craddock F., Kennedy A., Gaughan M., Kearney H., Tubridy N., De Looze C., O'Keeffe F., **Reilly R.B.**, McGuigan C., "Word-finding, prosody, and social cognition in multiple sclerosis", *Journal of Neuropsychology*, July 2022, JNP.21.0143
- ThemeA*

2021

- ThemeC* Romero-Ortuño R, Martínez-Velilla N, Sutton R, Ungar A, Fedorowski A, Galvin R, Theou O, Davies A, **Reilly RB**, Claassen J, Kelly ÁM and Ivanov PC (2021) Network Physiology in Aging and Frailty: The Grand Challenge of Physiological Reserve in Older Adults. *Front. Netw. Physiol.* 1:712430. doi: 10.3389/fnetp.2021.712430
- ThemeC* Hernandez B., Voll S., Lewis N.A., McCrory C., White A., Stirland L., Kenny RA, PhD; **Reilly R.B.**, Hutton C.P., Griffith L.E., Kirkland S., Terrera G.M., Hofer S.M., "Comparisons of disease cluster patterns, prevalence and health factors in the USA, Canada, England and Ireland", *BMC Public Health*, 2021 Sep 15;21(1):1674. doi: 10.1186/s12889-021-11706-8
- * *ThemeB* Rafee S, O’Keeffe F., O’Riordan S, **Reilly R.B.**, Hutchinson M. "Adult onset dystonia: a disorder of the collicular-pulvinar-amygdala network" *Cortex*, 2021 Jun 1;S0010-9452(21)00198-2. doi: 10.1016/j.cortex.2021.05.010
- ThemeB* Smit M., Albanese A., Benson M., Edwards M., Graessner H., Hutchinson M., Jech R., Krauss J.K., Morgante F., Pérez Dueñas B., **Reilly R.B.**, Tinazzi M., Fiorella Contarino M., Tijssen M. "Dystonia Management: what to expect from the future? The perspectives of patients and clinicians within DystoniaNet Europe", *Frontiers in Neurology*, 2021 Jun 3;12:646841. doi: 10.3389/fneur.2021.646841
- ThemeC* Newman L., O’Connor J., Nolan H., **Reilly RB**, Kenny RA, "Supine hypertension is associated with an impaired cerebral oxygenation response to orthostasis: Findings from the Irish Longitudinal Study on Ageing (TILDA)", *Hypertension*, 2021;78:210–219. doi.org/10.1161/HYPERTENSIONAHA.121.17111
- * *ThemeB* Yap, S.M.; Eitzelmueller, M S; O’Keeffe, C; Gaughan, M; **Reilly, R**; McGuigan, C, " Postural stability is a valid and meaningful disability metric in progressive MS with potential for use in neuroprotective therapy trials", *Multiple Sclerosis and Related Disorders*, 2021 Apr 11;52:102946. doi: 10.1016/j.msard.2021.102946. PMID: 33901968
- * *ThemeB* De Looze C., Dehsarvi A., Crosby L., Vourdanou A., Coen R.F., Lawlor B., **Reilly R.B.**, "Cognitive and structural correlates of speech timing in Mild Cognitive Impairment and Mild-to-Moderate Alzheimer’s Disease: relevance for early detection approaches.", *Front. Aging Neurosci.*, 27 April 2021 | doi.org/10.3389/fnagi.2021.637404
- ThemeC* Maguire F., Romero-Ortuno R., O’Connor J.D, **Reilly RB**, Knight S.P., Kenny RA "One-dimensional statistical parametric mapping identifies impaired orthostatic cerebrovascular and cardiovascular response in frailty " *J Gerontol A Biol Med Sci.* 2021 Apr 30;76(5):885-892. doi: 10.1093/gerona/glaa315. PMID: 33355652
- ThemeC* O’Dowd A., Cooney SM., Sorgini F., O’Rourke E.,**Reilly R.B.**, Newell F.N., Hirst RJ. The role of development on visuo-tactile interactions in the discrimination of sequences of events", *Journal of Experimental Child Psychology*. 2021 Mar 10; Vol.207:105094 doi.org/10.1016/j.jecp.2021.10509
- ThemeB* Yap, S.M.; Eitzelmueller, M.S.; O’Keeffe, C.; Gaughan, M.; **Reilly, R.**; McGuigan, C., "Postural facilitation can occur during dual-task performance in people with progressive multiple sclerosis and is related to upper extremity function", *Proceedings of the 2021 Annual Meeting American Academy of Neurology*, San Francisco, April, 2021
- * *ThemeB* Yap, S.M.; Eitzelmueller, M.S.; O’Keeffe, C.; Gaughan, M.; **Reilly, R.**; McGuigan, C., "Static posturography measures enhance the clinical validity of the multiple sclerosis functional composite as a disability marker for progressive multiple sclerosis", *Proceedings of the 2021 Annual Meeting American Academy of Neurology*, San Francisco April, 2021
- ThemeC* McMackin R, Dukic S, Costello E, Pinto-Grau M, Keenan O, Fasano A, Buxo T, Heverin M, **Reilly RB**, Pender N, Hardiman O, Nasserolelami B., "Sustained attention to response task-related beta oscillations relate to performance and provide a functional biomarker in ALS", *J Neural Eng.* 2021 Jan 4, 2021 Jan 4. doi: 10.1088/1741-2552/abd829 PMID: 33395671
- * *ThemeB* Rafee S, **Reilly R.B.**, O’Riordan S, Hutchinson M. "We must talk about sex and focal dystonia: sexual dimorphism in dystonia", *Movement Disorders MDS*-20-1442.
- ThemeC* Dyer A. McKenna L., Gramage A., Bourke N., Killane I., Widdowson M., Woods. C., Gibney J., **Reilly RB**, O’Neill D. Kennelly S. "Cognitive Performance in Midlife Type 2 Diabetes Mellitus: Results from the ENBIND Study", *Diabetic Medicine*, 2021 Jun;38(6):e14412.

2020

- * *ThemeB* Fearon C, Butler JS, Waechter SM, Killane I, Kelly SP, **Reilly RB**, Lynch T. "Neurophysiological correlates of dual tasking in people with Parkinson's disease and freezing of gait", *Exp Brain Res.* 2020 Nov 2. doi: 10.1007/s00221-020-05968-8. PMID: 33135132
- ThemeC* Dyer A. McKenna L., Gramage A., Bourke N., Widdowson M., Woods. C., Gibney J., **Reilly RB**, O’Neill D. Kennelly S "Peripheral Inflammation and Cognitive Performance in Middle-Aged Adults With and Without Type 2 Diabetes:

Results from the ENBIND Study”, *Frontiers Aging Neuroscience*, Nov. 2020; 12: 605878. doi: 10.3389/fnagi.2020.605878

- * *ThemeB* Yap, Siew Mei; Etzelmueller, Mark S; O’Keeffe, Clodagh; Gaughan, Maria; **Reilly, Richard**; McGuigan, Chris, "Preliminary validation of static posturography as a disability outcome measure in progressive multiple sclerosis", *Proceedings of the 8th Joint ACTRIMS-ECTRIMS*, Sept 2020
- * *ThemeB* Yap SM, Etzelmueller M, O’Keeffe C, Gaughan M, **Reilly RB**, McGuigan C., "Preliminary validation of static posturography as a disability outcome measure in progressive multiple sclerosis", *Proceedings of the 56th Annual Meeting of the Irish Neurological Association*, Dublin October 2020.
- * *ThemeB* Gaul, A., O’Keeffe, C., Dominguez, M.C., O’Rourke, E., **Reilly, R.B** "Quantification of Neural Activity in FMR1 Premutation Carriers during a Dynamic Sway Task using Source Localization", *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS, 2020, 2020-July*, pp. 2909-2912, 9176566
- * *ThemeB* O’Keeffe, C., Dominguez, M.C., O’Rourke, E., Lynch, T., **Reilly, R.B**, "Decreased Theta Power Reflects Disruption in Postural Control Networks of Fragile X Premutation Carriers", *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS, 2020, 2020-July*, pp. 2845-2848, 9176289
- * *ThemeB* Etzelmueller, M.S., Yap, S.-M., O’Keeffe, C., ...McGuigan, C., **Reilly, R.B** "Multiscale entropy derived complexity index analysis demonstrates significant mediolateral sway in persons with multiple sclerosis compared to healthy controls", *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS, 2020, 2020-July*, pp. 5176-5179, 9175672
- ThemeC* S O’Dwyer, G Greene, E MacHale, B Cushen, I Sulaiman, F Boland, Bosnic-Anticevich A., Mokoka M., **Reilly R.B.**, Taylor T., Ryder S., Costello R.W. "Personalized Biofeedback on Inhaler Adherence and Technique by Community Pharmacists: A Cluster Randomized Clinical Trial", *The Journal of Allergy and Clinical Immunology: In Practice*, Volume 8, Issue 2, 2020, Pages 635-644.
- * *ThemeC* O’Connor J.D. O’Connell M.D.L., Romero-Ortuno R., Hernández B. Newman L., **Reilly RB**, Kenny RA, Knight S.P., Functional Analysis of Continuous, High-Resolution Measures in Ageing Research: A Demonstration using Cerebral Oxygenation Data from The Irish Longitudinal Study on Ageing," *Frontiers Human Neuroscience*, July 2020
- * *ThemeA* Simões-Franklin C. Flood I., Sechler S., Lopez Valdea A., Waechter S., Thapa J., Glynn G., Walshe P., **Reilly R.B.**, Viani L., "Sequential Bilateral Implantation in Older Children: Inter Implant Map Differences and their Effects on Functional Outcomes" *Clinical Otolaryngology*, 2020 Mar 6. doi: 10.1111/coa.13523, PMID 32144881
- ThemeC* McMackin R, Dukic S, Costello E, Pinto-Grau M, Fasano A, Buxo T, Heverin M, **Reilly R**, Muthuraman M, Pender N, Hardiman O, Nasserolelami B., "Localization of Brain Networks Engaged by the Sustained Attention to Response Task Provides Quantitative Markers of Executive Impairment in Amyotrophic Lateral Sclerosis", *Cereb Cortex*. 2020 Jun 30;30(8):4727. doi: 10.1093/cercor/bhaa152.
- * *ThemeB* Williams L, Butler J, Thirkettle M, Stafford T, Quinlivan B, McGovern E, O’Riordan S, Redgrave P, **Reilly R.B.**, Hutchinson M, "Slowed luminance reaction times in cervical dystonia: Disordered superior colliculus processing", *Movement Disorders*, 2020, Vol.35, Issue5, pp877-880. doi.org/10.1002/mds.27975
- * *ThemeB* Maguire F., **Reilly R.B.**, Simonyan K., "Normal temporal discrimination in musician’s dystonia is linked to aberrant sensorimotor processing", *Movement Disorders*, 2020 Vol.35, Issue5, pp800-807, 13. doi: 10.1002/mds.27984.

2019

- ThemeB* Junker J., Paulus T, Brandt, V., Weissbach A., Tunc S., Löns S., **Reilly R.B.**, Hutchinson M., Bäumer T. "Temporal discrimination threshold and blink reflex recovery cycle in cervical dystonia – two sides of the same coin?", *Parkinsonism and Related Disorders* 68 (2019) 4–7. doi.org/10.1016/j.parkreldis.2019.09.028. PMID: 31621616.
- ThemeC* Hernandez B., **Reilly RB**, Kenny RA "Investigation of multimorbidity and prevalent disease combinations in older Irish adults using network analysis and association rules", *Scientific Reports*, 9, No.:14567, September 2019, PMID: 31601959.
- * *ThemeB* Killian O., Ndukwe I., Narasimham S., O’Riordan S., Hutchinson M., **Reilly R.** "Transcranial neuromodulation of the Frontal Eye Fields: targeting Temporal Discrimination Thresholds (TDT) in Adult Onset Primary Torsion Dystonia (AOPTD)", *Proceedings of 23rd International Congress of Parkinson’s Disease and Movement Disorders*, 2019; 34 (suppl 2).
- * *ThemeB* Fearon C., Llamas-Osorio Y., Williams L., Laffan A., Moloney P., Field R., **Reilly R.**, Lynch T. "Quantitative Assessment of Saccadic Eye Movements in Progressive Supranuclear Palsy and Idiopathic Parkinson’s Disease" *Proceedings of 23rd International Congress of Parkinson’s Disease and Movement Disorders*, 2019; 34 (suppl 2).
- * *ThemeB* Narasimham S., Valeriani D., O’Riordan S., Hutchinson M., Simonyan K., **Reilly R.** "Evaluating Multimodal Integration of Abnormalities in Adult Onset Idiopathic Focal Dystonia (AOIFD) via Multivariate Pattern Analysis

(MVPA) and Ensemble Learning (EL)", *Proceedings of 23rd International Congress of Parkinson's Disease and Movement Disorders*, 2019; 34 (suppl 2).

- * *ThemeB* Perez Denia M., Killian O., Ndukwe I., Narasimham S., O'Riordan S., Hutchinson M., **Reilly R.B.**, "A software framework for objective and quantitative audio-analysis of Embouchure Dystonia (ED)", *Proceedings of 23rd International Congress of Parkinson's Disease and Movement Disorders*, 2019; 34 (suppl 2).
- * *ThemeB* Purcell S., Monahan J., Ndukwe I., Killian O., Narasimham S., Perez Denia M., Duggan O., O Riordan S., Hutchinson M., Reilly R.B., "A protocol to probe the mechanisms underlying disordered sub-cortical processing in cervical dystonia using emotional faces", *Proceedings of 23rd International Congress of Parkinson's Disease and Movement Disorders*, 2019; 34 (suppl 2).
- * *ThemeB* O'Keefe C., Carro Domínguez M., O'Rourke E., Feerick N., Lynch T., **Reilly R.B.**, "Probing Error Signals of Postural Control in Fragile X Premutation carriers", *Proceedings of 23rd International Congress of Parkinson's Disease and Movement Disorders*, 2019; 34 (suppl 2).
- * *ThemeB* O'Keefe C., Taboada L.P., Feerick N., Gallagher L., Lynch T., **Reilly R.B.**, "Complexity Based Measures of Postural Stability Provide Novel Evidence of Functional Decline in Fragile X Premutation Carriers", *Journal of NeuroEngineering and Rehabilitation* 2019 Jul 12;16(1):87. doi: 10.1186/s12984-019-0560-6. PMID: 31299981
- * *ThemeB* Fearon C., Butler J., Waechter S., Killane IMagennis B., **Reilly R.B.**, Lynch T. "Current source density approaches improve spatial resolution in event related potential analysis in people with Parkinson's disease", *Clinical Neurophysiology*, 2019 Jul 22. pii: S1388-2457(19)31154-X. PMID: 31377118
- ThemeA* Wijaya C., Simões-Franklin C., Glynn F., Walshe P., **Reilly R.**, Viani L., "Revision cochlear implantation: The Irish experience", *Cochlear Implants International*, 1-7, August 2019.
- * *ThemeC* O'Connor B, Markicevic M, Newman L, Poduval RK, Tiernan E, Hanrahan E, Cuffe S, **Reilly R.B.**, Walsh D. Clinical utility of portable electrophysiology to measure fatigue in treatment-naïve non-small cell lung cancer. *Support Care Cancer*. 2019 Jul;27(7):2617-2623. doi: 10.1007/s00520-018-4542-1. PMID: 30467793
- * *ThemeC* Taylor T., Zigel Y., O'Rourke E., Kelly E., Keane F., Costello R.W., **Reilly R.B.** "Estimating Inspiratory Flow Rate and Volume of Inhalation in the Ellipta Using Audio-Based Methods", *American Journal of Respiratory and Critical Care Medicine* 2019;199:A4688
- * *ThemeB* Hutchinson M, McGovern EM, Narasimham S, Beck R, **Reilly R.B.**, Walsh CD, Malone KM, Tijssen MAJ, O'Riordan S. "The premotor syndrome of cervical dystonia: Disordered processing of salient environmental stimuli. *Mov Disord*. 2018 Feb;33(2):232-237. PMID: 29205495
- ThemeC* Newman, L., Nolan, H., **Reilly, R.B.**, Kenny, RA, "Age and sex differences in frontal lobe cerebral oxygenation during an active stand: Findings from the Irish Longitudinal Study on Ageing (TILDA)" *Proceedings of the International Association of Gerontology and Geriatrics*, Gothenburg, 2019
- * *ThemeC* McNulty, J, **Reilly R.B.**, Taylor R., Blazquez B, O'Dwyer S., Costello R.W. Zigel Y. "Objective Assessment of Inhaler Adherence within Community Pharmacy Respiratory Patients using Audio-Based Classification", *Proceedings of the 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2019:2606-2609, Berlin, Germany. PMID: 31946430
- * *ThemeB* Narasimham, S., McGovern, E., Killian, O., Beck, R., Farrell, M., O'Riordan, S., Hutchinson, M., & **Reilly RB**, "Exploring Brain Network Topology and Characteristics via Graph Theory in Cervical Dystonia Patients and Unaffected Relatives", *Proceedings of the 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, July 23-27, 2019, Berlin, Germany
- * *ThemeB* Duggan O., Narasimham, S., Killian, O., McGovern, E., O'Riordan, S., Hutchinson, M., & **Reilly RB**, "A Study of the Midbrain Network for Covert Attentional Orienting in Cervical Dystonia Patients using Dynamic Causal Modelling", submitted to *41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, July 23-27, 2019, Berlin, Germany
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