Prolonged Disorders of Consciousness
“From scientific discovery to clinical practice:
How the discovery that some vegetative patients are aware has changed our practice”
Thursday 17th October 2019
Fieldfisher, Riverbank House, 2 Swan Lane, London, EC4R 3TT

08:30-09:20 Breakfast and registration

09:20-09:30 Introduction by Eric Reichle CEO of Wellington Hospital and Claire Dunsterville, Director of Rehabilitation

09:30-09:45 Speaker Antonio Incisa della Rocchetta, PhD, Clinical Lead Neuropsychologist, the Wellington Hospital, London UK

Title: From measuring behaviour to observing willful modulation of brain activity, an introduction to the theme of the conference

Abstract: The idea of the theme of the conference came to me when thinking about paradigm shifts in clinical thinking. Following the invention of the artificial respirator in the 1950s, many more patients survived and emerged from acute coma leading to the recognition of a new condition. It was first named apallic syndrome or coma vigil; in 1972 it was named persistent vegetative state and now unresponsive wakefulness syndrome (UWS). For many years it was generally believed that UWS patients were awake, but not aware and the diagnosis was made mainly by observing the patients’ behaviour, initially through clinical consensus, and subsequently refined by the development of behavioural measurement tools. The paradigm shift occurred in 2006. Using functional neuroimaging, Owen and collaborators discovered that a patient in UWS was covertly aware. Many other studies followed and it is estimated that 15-20 percent of UWS patients are covertly aware. This discovery opened a new window into the neuroscience of consciousness and it profoundly influenced clinical practice and ethical thinking. Our approach in the Disorders of Consciousness Unit at the Wellington Hospital is inspired and guided by this discovery.

Bio: Dr Antonio Incisa della Rocchetta is a neuropsychologist at the Wellington Hospital with an interest in cognitive function following acquired brain injury. He did his undergraduate training in Rome at the Sapienza University and in the neurosurgical unit in the Gemelli Hospital in the early 1970s. His post-graduate training was at the Montreal Neurological Institute, Mc Gill University in Canada, where he obtained a PhD in neuropsychology with Brenda Milner. He continued his training in London in the early 1990s at the Institute of Child Health, University College London, and at the National Hospital for Neurology and Neurosurgery, Queen Square. He has published peer-reviewed academic papers on the effects of a variety of brain pathologies on cognitive function. His interests range from executive function, semantic memory and episodic memory, to prolonged disorders of consciousness.
09:45-10:30

**Speaker:** Adrian M. Owen OBE, PhD, Professor of Cognitive Neuroscience and Imaging, Departments of Physiology & Pharmacology and Psychology, University of Western Ontario, Canada

**Title:** Into the Grey Zone: Assessing residual cognitive function in disorders of consciousness

**Abstract:** The thought of being ‘locked in’ following a brain injury or aware during general anaesthesia troubles us all because it awakens the old terror of being buried alive. But what does it mean to be awake, but entirely unable to respond and what can this tell us about consciousness itself? In recent years, rapid technological developments in the field of neuroimaging have provided a number of new methods for revealing thoughts, actions and intentions based solely on the pattern of activity that is observed in the brain. I will describe how we have used some of these methods, including functional magnetic resonance imaging (fMRI), electroencephalography (EEG) and functional near-infrared spectroscopy (fNIRS), to detect covert conscious awareness in patients who are behaviourally entirely non-responsive (e.g. vegetative, comatose) and even to allow some of these individuals to communicate their wishes and thoughts. From this perspective, I will contrast those circumstances in which imaging data can be used to infer awareness in the absence of a reliable behavioural response, with those circumstances in which it cannot. This distinction is fundamental for understanding and interpreting patterns of brain activity in various states of consciousness (including vegetative state, coma, anaesthesia and sleep), and has profound implications for clinical care, diagnosis, prognosis, ethics and medical-legal decision-making after severe brain injury. It also sheds light on more basic scientific questions about how consciousness is measured and the neural representation of our own thoughts and intentions.

**Bio:** Adrian M. Owen OBE, PhD is currently a Professor of Cognitive Neuroscience and Imaging in the Departments of Physiology & Pharmacology and Psychology at the University of Western Ontario, Canada. He also directs the Azrieli program in Brain, Mind, and Consciousness funded by the Canadian Institute for Advanced Research (CIFAR). His research combines structural and functional neuroimaging with neuropsychological studies of brain-injured patients and has been published in many of the world’s leading scientific journals, including Science, Nature, The New England Journal of Medicine and Lancet. He is best known for showing that functional neuroimaging can reveal conscious awareness in some patients who appear to be entirely vegetative, and can even allow some of these individuals to communicate their thoughts and wishes to the outside world. These findings have attracted widespread media attention on TV, radio, in print and online and have been the subject of many TV and radio documentaries. Dr. Owen has played multiple editorial roles, including 8 years as Deputy Editor of The European Journal of Neuroscience. He has published over 300 peer-reviewed articles and chapters and a best-selling popular science book “Into the Gray Zone: A Neuroscientist Explores the Border Between Life and Death. Dr. Owen was awarded Officer of the Most Excellent Order of the British Empire (OBE) in the Queen’s Honours List, 2019, for services to scientific research.

10:30-11:00  **Coffee Break**

11:00-11:45
**Speaker:** Dr Damian Cruse, Senior Lecturer, School of Psychology and Centre for Human Brain Health, University of Birmingham, England.

**Title:** Can they hear me? Electrophysiological studies of speech comprehension in acute and prolonged disorders of consciousness.

**Abstract:** Patients recovering from severe brain injuries must be able to understand speech (and respond appropriately) to successfully demonstrate that they are aware and can participate in rehabilitation efforts. However, a now substantial body of evidence indicates that patients’ cognitive abilities may not be evident from their behaviours alone, but can be further revealed through brain imaging. Accurately detecting whether an unresponsive patient comprehends what is said to them therefore has significant implications for diagnosis and prognosis, while also helping to answer the common question of patients’ family members: “Can they hear me?”. At the neural level, spoken language elicits a rich repertoire of responses in a conscious listener, from basic processing of the amplitude of the speech within focal sensory cortices through to brain-wide processes reflecting conscious comprehension of the speaker’s intended message and its associated emotional content. In this talk, I will present studies of a hierarchy of neural responses to speech in patients in the acute period of coma and in subsequent prolonged disorders of consciousness who show no external evidence of understanding speech. The level of processing achieved by a speech stimulus can help to characterise the complexity of each patient’s residual neural networks and the potential for those networks to support consciousness now and in the future.

**Bio:** Damian Cruse biography: Damian Cruse studied his undergraduate degree in Applied Psychology at Cardiff University from 2002-2006. In 2009 he completed his PhD at Cardiff University under the supervision of Prof. Ed Wilding. From 2009 to 2015, Damian was a Post-Doctoral Fellow at the MRC Cognition and Brain Sciences Unit (Cambridge, UK) and a Research Scientist at The Brain and Mind Institute, University of Western Ontario (Canada) under the supervision of Prof. Adrian M. Owen. In September 2015, Damian began as a Lecturer in Psychology at the University of Birmingham, and in 2018 was promoted to Senior Lecturer. His team focuses on translating research on the neural correlates of consciousness and cognition into biomarkers for use in the clinical assessment of patients after severe brain injury.

**11:45-12:30**

**Speaker:** Dr Davinia Fernández-Espejo, Senior Lecturer, School of Psychology and Centre for Human Brain Health, University of Birmingham, England.

**Title:** The potential for transcranial direct current stimulation to restore motor function in the vegetative and the minimally conscious states

**Abstract:** It is now well accepted that a significant proportion of patients with a prolonged disorder of consciousness (PDOC) retain a much higher level of awareness and cognitive function than could be expected by their clinical diagnoses, but they are simply unable to show it with their behaviours - trapped in their unresponsive bodies. Nevertheless, there are currently no therapeutic interventions that have been proven successful for inducing or accelerating their functional recovery. I have recently demonstrated that the lack of voluntary control these patients exhibit can be explained by specific impairments in structural connectivity within the motor system that result in reduced excitatory coupling between thalamus and the primary motor cortex (M1). In this talk, I will discuss the
potential for transcranial direct current stimulation (tDCS), a non-invasive brain stimulation technique, to modulate thalamo-cortical coupling and assist in the functional recovery of PDOC patients. I will review strengths and limitations of recent tDCS applications in PDOC, and present the first outputs a series of ongoing projects aimed at developing mechanistically-informed stimulation protocols to restore external responsiveness in this clinical group.

Bio: Davinia is a Senior Lecturer and Principal Investigator at the School of Psychology and Centre for Human Brain Health, University of Birmingham. The main goal of her research is to understand how the brain supports consciousness and what goes wrong for patients to become entirely or partially unaware after severe brain injury. Her research is translated into the development of diagnostic and prognostic markers to be used in clinical settings, as well as the development of novel treatment approaches. Her Lab is currently funded by the MRC and the BBSRC. Before joining the University of Birmingham, she was a research scientist at the Brain and Mind Institute, Western University, Canada. She obtained her PhD in the neural basis of consciousness at the University of Barcelona in 2010, after completing two research internships in the Department of Clinical Neurosciences at the University of Cambridge.

12:30-13:30 Lunch

13:30-14:15
Speaker: Professor Steven Laureys, Coma Science Group, GLGA-Research, University and University Hospital of Liège, Belgium

Title: Can science explain consciousness? Lessons from coma and related states

Abstract: Understanding consciousness remains one of the greatest mysteries for science to solve. How do our brains work? Will we ever be able to read minds? How can we know if some patients in coma have any consciousness left and how could we communicate with them? What are near-death experiences? What is brain death? At present, nobody understands how matter (our trillions of neural connections) becomes perception and thought. We will here briefly review some neurological facts on consciousness and impaired consciousness. While philosophers have pondered upon the mind-brain conundrum for millennia, scientists have only recently been able to explore the connection analytically through measurements and perturbations of the brain’s activity. This ability stems from recent advances in technology and especially from emerging functional neuroimaging and electrophysiology studies. The mapping of conscious perception and cognition in health (e.g., conscious waking, dreaming, hypnosis and anesthesia) and in disease (e.g., brain death, coma, near-death, “vegetative” unresponsive wakefulness, minimally conscious state, locked-in syndrome, seizures, hallucinations etc) is providing exiting new insights into the functional neuroanatomy of human consciousness. Our perception of the outside world (sensory awareness; what we see, hear, etc.) and our awareness of an inner world (self-awareness; the little "voice" inside that "speaks" to ourselves) seemingly depend on two separate "awareness" networks. After reviewing the diagnostic, prognostic and therapeutic clinical challenges with regard to disorders of consciousness encountered after coma, will conclude by discussing the ethical consequences of the recent scientific advances which offer the medical community unique ways to improve the clinical management and quality of life in patients with severely injured brains

Bio: Steven Laureys MD PhD, heads the Coma Science Group at the Neurology Department and Cyclotron Research Centre of the University Hospital and University of Liège, Belgium. He is board-certified in neurology and in palliative medicine, clinical
professor and research director at the Belgian National Fund for Scientific Research, invited professor at the Belgian Royal Academy of Sciences and chair of the European Neurological Society Subcommittee on Coma and disorders of consciousness. Steven graduated as a Medical Doctor from the Free University in Brussels in 1993. While specialising in Neurology he entered a research career and, in 1997, he obtained an MSc in Pharmaceutical Medicine, working on pain and stroke using in vivo microdialysis and diffusion MRI in the rat. Drawn by functional neuroimaging, he obtained a PhD at the Cyclotron Research Centre at the University of Liège, studying residual brain function in coma, vegetative, minimally conscious and locked-in states. Steven has (co)authored 12 books in biomedical neurosciences amongst which: The Neurology of Consciousness (with Giulio Tononi, Academic Press, 2008); Coma Science (with Adrian Owen et Nicholas Schiff; Elsevier 2009); Disorders of Consciousness (with Nicholas Schiff, Wiley, 2009) and The Boundaries of Consciousness (Elsevier, 2005). He has published over 340 peer-reviewed scientific papers and is (co)director of 54 PhD students (29 past and 25 ongoing) in their doctoral thesis. He is well appreciated as a speaker for both general, scientific and medical audiences, is regularly invited by Belgian and international media and has given five TEDx talks. He has authored several best-selling popular books, and participated in documentary series (e.g. for National Geographic) and popular movies (e.g. Un Monde Plus Grand) and TV series (e.g. Julia's Hart). Steven’s team at The Coma Science Group studies the neural basis of human consciousness (coma, anaesthesia, hypnosis, meditation and sleep) by assessing the recovery of neurological disability and neuronal plasticity in acquired brain injury (e.g., comatose, "vegetative/unresponsive, minimally conscious and locked-in syndromes). The team is comparing clinical expertise and behavioural evaluation with multimodal neuroimaging (i.e. positron emission tomography and magnetic resonance imaging) and electrophysiology (i.e. electroencephalography coupled to transcranial magnetic stimulation) in order better to characterise the evolution and changes in brain structure and function in comatose, vegetative/unresponsive, minimally conscious and locked in states. The specific research objectives are understanding the natural history of coma and disorders of consciousness, improving the diagnostic accuracy, predicting outcome and disability, understanding neuronal plasticity and improving recovery, searching for the neural correlates of consciousness and, finally, studying the ethical and social implications. Steven is founding chair of the World Federation of Neurology Applied Research Group on Coma and of the European Academy of Neurology Panel on Disorders of Consciousness and was president of the Association for the Scientific Study of Consciousness (ASSC). He serves on the Board of the International Brain Injury Association and Mind and Life Europe, and is member of several international organisations, academies and advisory committees dealing with prolonged disorders of consciousness, such as, for example, the Committee for the Development of Practice Guidelines for the Vegetative and Minimally Conscious State of the American Academy of Neurology. Steven is the recipient of several prestigious prizes, amongst which are the European Academy of Neurology - Brown-Séquard Award, the Max Planck Society Zülch Prize (with Giulio Tononi), the European Academy of Sciences Blaise Pascal Medal of Medicine and the William James Prize (2004) from the Association for the Scientific Study of Consciousness (ASSC).

13:30-14:15
Speaker: Mackenzie Graham

Title: How fMRI is changing the ethics of surrogate decision-making in prolonged disorders of consciousness
Abstract: Patients with prolonged disorders of consciousness lack the capacity to make decisions for themselves, meaning that medical decisions must be made on their behalf by a surrogate decision-maker. In the UK, the Mental Capacity Act 2005 stipulates that “a decision made on behalf of a person who lacks capacity must be done, or made, in his best interests”, while similar requirements exist in other Western countries. Recent discoveries of ‘covert consciousness’ using functional neuroimaging in patients with prolonged disorders of consciousness has the potential to shift our understanding of a patient’s ‘best interests.’ In this presentation, I will examine the relationship between disability and well-being in the context of prolonged disorders of consciousness, and suggest that in at least some cases, continued life may be in the best interests of patients with prolonged disorders of consciousness.

Bio: Mackenzie Graham is a Research Fellow at the Uehiro Centre for Practical Ethics, and the Wellcome Centre for Ethics and Humanities, at the University of Oxford. He received a PhD in Philosophy from the University of Western Ontario in 2016. His current research focuses on how we understand well-being in those with severe brain injury or illness.

15:00-15:30 Coffee Break

15:30-16:15
Speaker: Jill Greenfield

Title: Rebuilding lives through Rehabilitation – a case study examining the pathway for one individual and her family. From Intensive care, to neuro rehabilitation unit to home. The challenges faced.

Abstract: Early decisions impacting long term futures. Jill Greenfield will analyse the ability to use litigation to enable intensive rehabilitation. Accessing funds and introducing the right team to work with the client both in a hospital and home setting. A personal perspective from Mike Jardine regarding his partners pathway through litigation and how difficult decisions led to hope.

Bio: Jill Greenfield is a leading serious injury lawyer and head of the catastrophic injury team at Fieldfisher, representing clients in the UK and internationally. Her experience covers brain, spinal cord and serious orthopaedic injury, amputation and fatal injury following accidents on the roads and at work. She also represents victims of sexual assault, terrorist attack and Ecoli 0157 outbreak. Jill is currently running the UK cases against Harvey Weinstein for alleged historic sexual assaults and representing victims of terrorist attack at Westminster Bridge, London Bridge and the Finsbury Park Mosque. Jill's focus is always to intervene on behalf of clients quickly and effectively to get them the specialist medical care and support to help them recover and rebuild their lives as far as possible. This often marks the difference between achieving quality of life and not. She is known for her dogged determination in pursuing insurers and other professional bodies to achieve the absolute best for her clients. Jill is one of a handful of UK lawyers recognised by Chambers as a 'Star Individual'. In 2018, she was shortlisted as Woman Lawyer of the Year at the Law Society Excellence Awards. Her team won the Solicitors Journal Personal Injury team of the Year in 2017. Jill was included in The Lawyer Hot 100 2019. Jill is also treasurer of APIL (Association of Personal Injury Lawyers) the not-for-profit campaign organisation dedicated to protecting those who have sustained serious and life-changing injuries through no fault of their own.
16:15-17:00
Speaker: Anil Seth
Title: Detecting consciousness in practice and in principle

Abstract: The biological basis of consciousness stands as one of the great unsolved challenges in science – as well as an important challenge for neurological medicine. Great strides have been made in detecting residual awareness in patients with disorders of consciousness, extending even to opening channels of communication despite complete behavioural non-responsiveness. In this talk I will ask how these medically-oriented breakthroughs can inform and develop the neuroscience of consciousness in general. I will compare active and passive approaches, contextualising them within more general frameworks for thinking about the neural basis of conscious experience. Finally I will look ahead to emerging challenges posed by so-called ‘islands of awareness’ and their detection.

Bio: Anil Seth is Professor of Cognitive and Computational Neuroscience at the University of Sussex and Founding Co-Director of the Sackler Centre for Consciousness Science. He is Editor-in-Chief of Neuroscience of Consciousness (Oxford University Press), a Wellcome Trust Engagement Fellow, a Fellow of the Canadian Institute for Advanced Research (Azrieli Programme on Brain, Mind, and Consciousness), and was the 2017 President of the British Science Association (Psychology Section). With his group, he conducts multidisciplinary research on the biological basis of conscious experience, drawing together brain science, psychology, philosophy, computer science and AI, physics and mathematics, and psychiatry and neurology. He has published more than 150 academic papers in a variety of fields, and he holds degrees in Natural Sciences (MA, Cambridge, 1994), Knowledge-Based Systems (M.Sc., Sussex, 1996) and Computer Science and Artificial Intelligence (D.Phil., Sussex, 2000). He was also a Postdoctoral and then Associate Fellow at the Neurosciences Institute in San Diego, California (2001-2006). Anil is Editor and Co-Author of 30 Second Brain (Ivy Press, 2014), was Consultant for Eye Benders (Ivy Press, 2013; winner of the Royal Society Young People’s Book Prize 2014) and Brain Twister (Ivy Press, 2015). He was Conference Chair of the ASSC16 (Brighton, 2012). He contributes regularly to many media including the New Scientist, The Guardian, and the BBC, and he gives regular public lectures on consciousness science. His 2017 TED talk has been viewed more than 8 million times already and he featured in the popular 2018 Netflix feature documentary The Most Unknown. His first single-author book, Being You: A New Science of Consciousness will be published by Faber/Penguin in 2020.

17:00-17:30 Panel discussion
17:30- Drinks and canapés reception