LND2019

Liverpool Neuroscience Group

Liverpool Neuroscience Day 2019
Speaker Abstracts

S1.1

Modelling cell therapies for Hirschsprung's patients

Bettina Wilm

University of Liverpool

We aim to improve treatment of babies with Hirschsprung's disease by generating new nerves from stem cells present in the bowel of these patients. We have previously found that the aganglionic distal segment of the bowel in Hirschsprung's patients contains precursor cells of the enteric nervous system. Therefore we aim to develop an approach to compensate the lacking ENS through autologous therapy.

We have recently started to analyse in more detail the histological and molecular changes that can be found in the transition zone between ganglionic and aganglionic bowel, especially with respect to ganglia, extrinsic innervation, and precursor cells. Our research involves the ex vivo culture of bowel-derived cells and generation of neurospheres both from ganglionic and aganglionic segments. These spheroid cultures allow us to perform detailed analysis of signalling mechanisms that regulate neuronal differentiation and proliferation in normal and aganglionic bowel, and therefore could help in the development of treatments by serving as therapeutic vehicles.

Biography

Currently a Senior Lecturer at the University of Liverpool, my research is focused on improving our understanding in the processes that are involved in abnormal tissue development, and in the mechanisms of repair of organs and tissues in models of human diseases.

In my lab, we are interested in developing approaches to prevent scar formation in the peritoneum, and in developing safe and efficacious regenerative therapies in preclinical models of renal injury / acute kidney injury. Recently, I have become interested in Hirschsprung's disease, particularly in the underlying mechanisms that result in the formation of aganglionic segments of the bowel, as well as in developing therapies to overcome the aganglionosis.

S1.2

Creating a faster path to better drugs for epilepsy

Nasir Mirza

The Walton Centre NHS Foundation Trust & University of Liverpool

TBC

Biography

I studied medicine at King's College London, where a charismatic neurologist sparked my interest in neurology. I did an intercalated BSc in neurosciences, which included research with the world-renowned Parkinsons Disease investigator Professor Jenner, with further research on PD during an elective at the Johns Hopkins in Baltimore. I came to Liverpool to complete an Academic Clinical Fellowship in epilepsy research. After the ACF, I won an MRC Research Training Fellowship through national competition to do my PhD, and then a prestigious MRC Centenary Award to further develop on my PhD research. I have recently been appointed an Academic Clinical Lecturer in Neurology.

S1.3

Genomics and machine learning approaches to study the ageing brain

J Pedro Magalhaes

University of Liverpool

Ageing is arguably the major biological and biomedical challenge of the 21st century with the incidence of age-related diseases, and neurodegenerative diseases in particular, expected to increase dramatically in the coming decades. Brain ageing frequently underlies cognitive decline and is a major risk factor for neurodegenerative conditions such as Alzheimer's disease. Mental health is also a major concern of ageing adults. In this talk, I will present genomics and machine learning approaches for studying the ageing brain. Specifically, we have been employing whole transcriptome profiling (RNA-seq) to gather insights on the ageing brain and study the influence of diet. I will also present integrative, multi-dimensional approaches that provide insights into longevity pathways and their role in age-related diseases, including neurodegenerative diseases.

Biography

Ageing has a profound impact on human society and modern medicine, yet it remains a major puzzle of biology. The goal of my work is to help understand the genetic, cellular, and molecular mechanisms of ageing. In the long term, I would like my work to help ameliorate age-related diseases and preserve health. No other biomedical field has so much potential to improve human health as research on the basic mechanisms of ageing. Please visit our lab website for further details about our work and publications, or see my TEDx talk.

You can find more about me in my personal website. http://jp.senescence.info/

twitter: @jpsenescence

S1.4

Walking faster is associated with increased cortical activity in older adults

Lisa Alcock [1] , Rodrigo Vitorio[2], Samuel Stuart[3], Lynn Rochester[1], Annette Pantall[1]

1. Institute of Neuroscience, Newcastle University
2. Institute of Biosciences, Sao Paulo State University
3. Department of Neurology, Oregon Health and Science University

BACKGROUND: Walking speed has been described as the "sixth vital sign" reflecting health status and physical function. Walking speed reduces with age and is predictive of life expectancy and mortality. Fast walking is considered to reflect maximal capacity and may be more useful than preferred gait speed when understanding age-related changes in the neural control of locomotion. Previous studies have identified an increased cortical activity with faster walking speeds however the effect of age is unknown.

METHODS: 17 young adults (YA) and 18 older adults (OA) walked on a motorised treadmill for five minutes. Oxygenated haemoglobin (HbO2), was measured using a tethered 40 channel functional near-infrared spectroscopy system (LABNIRS, Shimadzu). The following regions were monitored for each hemisphere; prefrontal cortex (PFC), premotor cortex (PMC), supplementary motor area (SMA) and primary motor area (M1). Treadmill speed was altered every 30-seconds between a preferred and fast (120% preferred) speed for five trials. fNIRS signals were filtered and detrended to remove physiological noise. Linear mixed effect models evaluated the effect of task, group and trial repetition on HbO2.

RESULTS: OA walked significantly slower than YA (2.8km/hr vs. 3.8km/hr). A significantly higher HbO2 was observed in the RSMA, LM1 and RM1 in OA during fast walking compared to preferred walking. A significantly higher HbO2 was observed in the left PFC and right M1 in OA compared to YA. No significant effects for Trial were found.

CONCLUSIONS: Walking faster is associated with increased cortical activity in OA despite walking slower. Considering the age-related changes that occur in brain structure and function, one factor that may restrict walking speed in older adults is limited cortical capacity. This enhances our understanding of one of the many factors contributing to a reduced walking speed in older age.

Biography

I firstly trained as a biomechanist and now work within a multidisciplinary Brain and Movement (BAM) team to continue with research in ageing and neurodegenerative disorders such as Parkinson's disease. My research interests involve: (i) characterising the functional (visual, cognitive and motor) demand of activities of daily living in ageing and disease, (ii) to understand the relative task demand in falling and non-falling cohorts to inform falls risk and (iii) inform the development of interventions designed to optimise locomotor safety.S

2.1

The Manchester Brain Bank: A resource for basic, translational and clinical research

Federico Roncaroli, Andrew Robinson

Division of Neuroscience and Experimental Psychology, Faculty of Biology, Medicine and Health, University of Manchester

The Manchester Brain Bank (MBB) was established in 1986 by Professor David Mann. In 30 years, it has accrued more than 1,000 brains from patients with various neurodegenerative conditions, mainly with Alzheimer's disease (AD) and frontotemporal dementia (FTD) and from healthy, but elderly, controls. A considerable number of brains have formalin-fixed and frozen tissue available for use in approved research. Detailed clinical notes are also available. Tissue collected by MBB underpinned much of the basic and clinical research into the spectrum of frontotemporal dementia that Manchester has pioneered over the last three decades.

Brains are recruited through tissue donation programmes including the Brains for Dementia Research initiative, the Cerebral Function Unit at Salford Royal and the Manchester and Newcastle Longitudinal Ageing Cohort. Under the new ethical approval, and in order reach a much wider scientific community, recruitment is now expanding to brains from patients with stroke, neuroinflammatory diseases, traumatic brain injury, tumours and epilepsy. MBB is part of the MRC Brain Bank network and closely collaborate with the other brain banks in the UK, and similar repositories oversea. Researchers can apply for use of tissue by completion of a tissue request form and a material transfer agreement. Applications are assessed by MBB Management Committee on their scientific merit and ethical use of tissues. Tariffs in line with MRC guidelines and the UK Brain Bank Network are applied to cover the costs of supplying tissue.

Useful links

https://www.bmh.manchester.ac.uk/research/domains/neuroscience-mental-health/manchester-brain-bank/
http://www.brainsfordementiaresearch.org.uk/
https://www.alzheimersresearchuk.org/
https://www.alzheimers.org.uk/

Biography

Dr Roncaroli qualified in medicine and trained as histopathologist at the University of Turin in Italy. He moved to Bologna, Italy as a consultant in an academic department of Histopathology where he developed his interest in neuropathology. After a period at Mayo Clinic, Rochester USA with Professor Bernd Scheithauer, he was appointed clinical senior lecturer in neuropathology at Imperial College, London. He moved to the University of Manchester in September 2015, where he has created a dedicated brain and pituitary tumour biobank, established the molecular diagnostic service for brain tumours and joined the Manchester Brain Bank chaired by Professor David Mann.

Dr Roncaroli's field of expertise is neuropathology encompassing the examination of brain and pituitary tumours, muscle and nerve biopsies, cerebrospinal fluid cytology, and post-mortem brains. His group applies quantitative immunohistochemical techniques, 3D tissue reconstructions, confocal scanning laser microscopy and laser microdissection to human brain tissue from surgical samples and post-mortem brains and integrate tissue analysis with cell culture models and gene expression studies.

S2.2

Preclinical imaging in neuroscience research: what's not to like about it?

Harish Poptani

University of Liverpool

The talk will introduce preclinical imaging technologies available at the University of Liverpool and how these can be used for neuroscience research. Specific example studies will be shown to demonstrate the asessment of neurochemistry, neuro-anatomy, diffusion tensor imaging for white matter abnormalities and stem cell tracking.

Biography

Dr Poptani is a Professor and Chair of the Center for Preclinical Imaging at the University of Liverpool, UK. After completing his PhD from India, his fist postdoc in Kuopio, Finland and his second postdoc with Dr Jerry Glickson at the University of Pennsylvania, USA where he became an independent faculty and continued his academic career for another 15 years before moving to the University of Liverpool in December 2014. Dr Poptani's publications include over 130 peer reviewed papers, book chapters and review articles. His research focus is on development and application of advanced magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) methods, with specific applications in neuroimaging and cancer. His group was among the first to demonstrate the utility of diffusion weighted imaging and spectroscopy to assess response to gene therapy for brain tumors and for detection of apoptotic cell death in vivo. His group has also been credited for developing small animal neuroimaging methods including high-throughput methods for MR microscopy, stem cell tracking as well as diffusion tensor imaging in rodent models of memory disorders, schizophrenia and autism. His research group at the University of Liverpool focuses on the development of multi-modal imaging methods for better understanding of tumour microenvironment and monitoring early treatment response as well as assessing the safety and efficacy of regenerative medicine.

S2.3

Learning from the neural correlates of anorexia nervosa about how we might treat addictive disorders

Samantha Brooks

Liverpool John Moores University

Prefrontal cortex executive functions, such as working memory, interact with limbic processes to foster impulse control. Such an interaction is referred to in a growing body of publications by terms such as cognitive control, cognitive inhibition, affect regulation, self-regulation, top-down control, and cognitive–emotion interaction. Against this background, I take a novel approach using an impulse control spectrum model – where anorexia nervosa (AN) and substance use disorder (SUD) are at opposite extremes – to examine how some of my neurocognitive research over the last fifteen years has contributed to an understanding of the neural mechanisms of control of appetite. With this aim, I summarise data from cognitive tasks, and brain imaging data (structural and functional MRI) in adolescents and young adults with anorexia and bulimia nervosa, adults with obesity and adults being treated for substance use disorders. I do this in order to inform some of the assumptions of the impulse control spectrum model, and to explore some of the brain processes associated with cognitive control. I also consider the link between working memory and cognitive control, and will briefly introduce the working memory training intervention my students, collaborators and I are currently working on, including the potential of the intervention to reach a broad range of people aiming to improve their impulse control.

Biography

Dr. Samantha Brooks is a Chartered member of the British Psychological Society, her research specialises in the neural mechanisms of impulse control in various psychiatric conditions (e.g. addiction, eating disorders). Dr Brooks is currently a Lecturer in Cognitive Neuroscience at Liverpool John Moores University, UK. Previously, Dr Brooks worked as a lecturer for six years in the Department of Psychiatry, University of Cape Town, South Africa. Before working in South Africa, she completed her postdoctoral fellowship at Uppsala University, Sweden, where Dr Brooks continues to collaborate on projects examining the brain processes underlying eating disorders. She gained her Ph.D. at the Institute of Psychiatry, King's College, London, where she learned clinical neuroimaging techniques, such as structural and functional Magnetic Resonance Imaging. Dr Brooks has published book chapters and over 70 papers to date in high impact journals, and continues to present at international conferences. Her work on impulse control in eating disorders and addiction has so far attracted over 1 million Euros in international funding and collaborations with experts in the United Kingdom, Sweden, Italy, South Africa and United States.

S2.4

Social prescribing for people with motor neurone disease in Liverpool: Enabling access to local well-being activities to prevent social isolation and mental ill health

Suzanne Simpson [1], Clarissa Giebel[2, 3], Sandra Smith[2], Moira Furlong[2, 4], Janet Ireland[2, 5]

1. The Walton Centre NHS Foundation Trust
2. NIHR CLAHRC NWC
3. University of Liverpool
4. MND Association
5. The Brain Charity

Background: Motor neurone disease (MND) affects around 5,000 people in the UK. People living with MND emphasise the importance of psychological support and wellbeing in helping them manage their condition. Social prescribing is a process of referring patients to a link worker, to co-design a plan to improve their health and wellbeing. The aim of this implementation project is to enable people with MND from any socio-economic background to access social prescribing in the Liverpool and Sefton area.

Method: This project is part of the NIHR CLAHRC NWC Partner Priority Programme, enabling partner organisations to implement services collaboratively with academics and the public. Recruitment is carried out by MND association visitors, outpatient and community therapists. The plwMND is seen by an occupational therapist and link worker. To ensure the occupation is based on the person's interests, the Modified Interest Checklist is used. The occupational therapist supports with analysis of the activities and identification of potential barriers and enablers. The link worker provides knowledge of local activities/organisations as well as practical support with issues such as benefits. Quality of life measures are administered to the plwMND and their family carer pre and post intervention. Interviews will be carried out post intervention with plwMND and their family carer, the referrers, link workers and community providers.

Results: Starting in February, two plwMND have utilised the service so far. Both have recently finished working and expressed concern that they had no structure or purpose. They have chosen varied activities including reading and history groups, art classes, bird watching, and accessible exercise.

Conclusion: Currently, we are at the beginning of this implementation project. Findings will have important implications on how a social prescribing service can be provided to plwMND, and if successful, how this service can be rolled out wider across the region and nationally.

Biography

I qualified as an occupational therapist in 2004 having completed a Psychology degree prior to this. Having worked predominantly in neurosciences for the past 11 years in a variety of settings, I completed an MRes at Edge Hill University in 2018 and was a finalist at the North West Coast Research and Innovation Awards 2018 in the category 'Research Student of the Year'. I hold a split post at The Walton Centre as Motor Neurone Disease (MND) Psychological Well-being and Social Support Advisor and as the trust's Making Every Contact Count Lead. I was awarded a 12 month CLAHRC NWC internship in August 2018, as part of which I am conducting a pilot implementation project aimed at improving the well-being of people living with MND, which has led to partnerships with social prescribing services.

Plenary

Stimulation and Reward; understanding the neurophysiology of motor learning

Charlotte Stagg

Nuffied Department of Clinical Neurosciences, University of Oxford

How we learn new motor skills, such as learning to play the piano or play tennis, is a question of fundamental importance to everyday life. It also has direct relevance to how we might re-learn to move our hands after a brain injury such as a stroke. However, motor plasticity occurs across multiple spatial and temporal scales; from the synapse to the network and from effects lasting seconds to those lasting months or even years, making understanding these processes complex.

Here, I will discuss recent studies from my group studying the physiological basis of motor plasticity in vivo, in particular how changes across a wide range of spatial scales may interact to support functional improvements. To this end we have combined advanced neuroimaging, including MR Imaging, MR Spectroscopy and Magnetoencephalography, with non-invasive brain stimulation.

Taken together, these studies provide convergent evidence that changes in local and network-level inhibitory processing is a key component of motor learning. I will discuss how interventions such as reward, punishment and non-invasive brain stimulation may optimise motor learning in both healthy and clinical populations, and how inter-individual differences may prove important for predicting response to potential interventions post-stroke.

Biography

Dr Charlotte (Charlie) Stagg is Professor of Human Neurophysiology and Head of the Physiological Neuroimaging Group at the Wellcome Centre for Integrative Neuroimaging (WIN), University of Oxford, UK. She has held a Sir Henry Dale Fellowship, funded by the Wellcome Trust and the Royal Society, since 2014.

Her inter-disciplinary group uses multi-modal neuroimaging and non-invasive brain stimulation approaches to understand the physiological processes underlying motor plasticity, both in the context of learning new motor skills and regaining function after a stroke. Her work has two overarching themes: to understand the mechanisms underpinning motor learning, and to develop non-invasive brain stimulation as a potential therapeutic intervention for rehabilitation.

https://www.ndcn.ox.ac.uk/research/physiological-neuroimaging-group

twitter: @cjstagg

S3.1

Neural underpinning of visual body representation

Valentina Cazzato [1]

1. Liverpool John Moores University

Visual representation of the body is a key aspect of self-body image. Its importance in our social life is proved by the unreasonable time and effort we put on taking care of our physical appearance and body shape, including use of cosmetic plastic surgery, as well as by the severe mental disorders associated to its alteration, including Eating Disorders (EDs) and Body Dysmorphic Disorders (BDD). Crucially, body shape is also an important cue to form impressions of other people based on basic perceptual processing and explicit negative attitudes and beliefs towards obese individuals seem to modulate the activity of perceptual areas, such the Extrastriate Body Area (EBA). With these regards, evidence suggests the EBA plays a critical role in body (mis)perception and weight-bias towards obese individuals. Temporary inhibition of visual area selectively impairs the aesthetic preference of specific bodily cues (i.e., shape and implied motion), thus suggesting a crucial role of EBA in aesthetic appreciation of human bodies. Crucially, functional or structural alterations of this area may contribute to development of disturbances in perceptual and affective components of body image in women with EDs. In series of non-invasive brain stimulation studies (using TMS and tDCS), we will demonstrate that recognition of one's own and others' body crucially depends on the functional integrity of the lateral-occipital cortex. In particular, we aim at providing causative evidence that activity in the EBA actively contributes to 'person perception' based on several bodily cues, thus supporting the notion that interactions between neural systems important for 'social perception and cognition' may upregulate or downregulate the response in body-selective cortex.

Biography

I carried out my Ph.D., titled 'Reflexive Social Attention modulated by Social Cues: evidence from functional magnetic resonance imaging (fMRI) studies' at 'Sapienza' University of Rome (Italy), which I completed in December 2010. Following this I worked as a Postdoctoral Researcher at University of Udine (Italy) on a project titled 'Neurofunctional Alterations of body representation in Eating Disorder patients' (2011-2014). After a a period as Lecturer in Psychology at University of Bradford, I have recently joined the School of Natural Sciences and Psychology as Lecturer/Senior Lecturer in Psychology.

My research interests span a broad range of topics, focusing on the psychological and neural basis of: corporeal knowledge in both healthy populations and in patients suffering from Eating Disorders and Obesity; aesthetic appreciation of human bodies; action simulation, shared attention and social communication, investigated by means of neurophysiological techniques (TMS and tDCS) and fMRI.

Glucoregulation and episodic memory: Investigating the underlying neural mechanisms

Nicola Jones

Liverpool Hope University

The detrimental effects of less efficient glucoregulation on episodic memory in older adults have been well established. The findings of these previous studies have generated considerable interest, particularly given the increasing prevalence of type 2 diabetes in our ageing population. The research presented here sought to investigate the neurocognitive mechanisms underpinning memory impairments in those with relatively poor glucoregulation using event-related potentials (ERPs). Behavioural results revealed that healthy older adults with poor glucoregulation experienced impairments in both face recognition and verbal episodic memory. Subsequent ERP studies indicated that deficits in verbal memory were due to impairments in memory encoding ability as opposed to retrieval; face recognition deficits were a result of detriments in structural encoding and attention to faces. Evidence from these studies suggest that careful consideration of appropriate glucoregulation measurements is needed in future research.

Biography

I completed my undergraduate degree in Applied Psychology at Durham University and was awarded a departmental scholarship to study for an MSc in Cognitive Neuroscience at the University of York. My PhD in Psychology (supervised by Dr. Michael Smith and Dr. Leigh Riby at Northumbria University) was entitled 'Glucoregulation, Memory and the Ageing Brain: Exploring the Mechanisms'. My current research interests include learning, memory and attention, and how these processes are represented behaviourally and at a neural level in both typical and atypical populations. I am particularly interested in face perception and recognition, investigating their neural mechanisms using event-related potentials (ERPs) and functional magnetic resonance imaging (fMRI). This drove my PhD research, investigating the effects of glucoregulation (blood sugar regulation) on memory and face recognition in older adults. I am also interested in exploring the effects of glucoregulation on memory and face recognition across the lifespan, from children to older adults in both longitudinal and cross-sectional research. This is in part due to my previous work as a research assistant at Newcastle University investigating working memory and attention in typical children and those with Williams syndrome, contributing to an interest in investigating cognitive mechanisms across the lifespan.

S3.3

Individual differences in the behavioural and physiological responses to affective touch

Connor Haggarty [1], Ralph Pawling[1], David Moore[1], Francis McGlone[1,2], Susannah Walker[1]

1. Liverpool John Moores University
2. University of Liverpool

Touch matters: Across the lifespan, while positive social tactile interactions enhance well-being, a lack of positive affiliative relationships is damaging to both physical and mental health. However, to date, little attention has been paid to the mechanism by which touch mediates it positive effects. C-tactile afferents (CTs) are a type of unmyelinated low threshold mechanoreceptor found in the hairy skin of humans and other mammals. They respond optimally to a gentle, skin temperature stimulus moving at between 1-10cm/sec, touch which is reliably rated as pleasant. Such functional characteristics have led to proposal that the CT system has a direct, evolutionary conserved, role in signalling socially relevant, affective touch. Here we explore this putative social function by exploring the relationship between trait sociability and responses to CT targeted touch. The Autism Quotient (AQ) is a widely used self-report measure of autistic or social traits (Baron-Cohen et al, 2008). In a series of studies we found that trait sociabiity (as measured by the AQ) is negatively associated with behavioural (hedonic ratings), implicit affective (facial EMG) and cortical (ERP) responses to affective touch. Taken together, these data provide evidence that stable personality traits are associated with differential sensitivity to socially relevant tactile stimulation.

Biography

Connor completed his PhD 12 months ago in Cognitive Neuroscience at LJMU. His research focused on the effect of trait sociability on responses to affective touch. His first publication is currently under review at European Journal of Neuroscience. Currently he is lecturing in Psychology at LJMU Connor and other members of SomAffect are currently working on a grant application to research social affect in individuals with Autism Spectrum Disorders.

S3.4

Core Outcome Set for Cauda Equina Syndrome: International Delphi survey and Consensus Meeting

Nisharan Srikandarajah [1], Simon Clark[2], Martin Wilby[1], Paula Williamson[1, 2], Tony Marson

1. The Walton Centre NHS Foundation Trust
2. University of Liverpool

Background: A core outcome set (COS) is the minimum set of outcomes that should be researched in any future research study within a specific disease area. Through a published systematic literature review we have shown there are significant differences in the reporting of the outcomes for Cauda Equina Syndrome (CES). We intended to develop a COS for patients with CES to be used for future research studies, officially registered on the COMET database.

Methods: Outcomes were combined from the systematic literature review and from the semi-structured qualitative interviews with CES patients. These were grouped into a shortened list for rating through two rounds of an international Delphi survey. An international consensus meeting would discuss the “no consensus” outcomes and decide the final core outcome set. Ethical approval for the study was granted.

Results: 997 verbatim outcome terms from the systematic literature review and patient interviews were reduced by the study team to 37 outcomes for rating in the Delphi survey. The Delphi had 172 participants (104 patients, 68 healthcare professionals) complete two rounds of the Delphi. The results were discussed at an international consensus meeting attended by 34 key stakeholders (16 patients and 18 healthcare professionals). 16 outcomes were decided for inclusion in the core outcome set.

Conclusion: The core outcome set has been decided through a transparent international consensus process involving healthcare professionals and patients as key stakeholders. These are recommended to be used in future CES studies as the minimum set of outcomes to be collected.

Biography

I am a neurosurgical registrar in Liverpool. I have completed a PhD at the University of Liverpool in Cauda Equina Syndrome and Core Outcome Set methodology with funding awarded from the Royal College of Surgeons. My medical degree is from UCL and early surgical training in St Georges and Frimley Park Hospital before coming to Liverpool for neurosurgical training.