28th Annual Meeting of the Australasian Society for Psychophysiology

Deakin University, Waterfront Campus

1 Gheringahp St, Geelong, 3220

Welcome from Wei-Peng Teo and Helen Macpherson

Conference Co-chairs

It is our great pleasure to welcome all of you on behalf of the Australasian Society for Psychophysiology to the 28th Annual Meeting of the Australasian Society for Psychophysiology (ASP2018) to be held 19–20 November, Deakin University, Geelong Waterfront Campus, Victoria.

Located in the heart of the City of Geelong, and surround by the glorious waterfront views of the Corio Bay, ASP2018 brings together likeminded clinicians and scientists to discuss the relationships between the brain and behaviour. This year's themes of ASP2018 include:

- Electrophysiology and neuroimaging: *shedding light on the human brain*
- Non-invasive brain stimulation: *probing neuroplasticity*
- Clinical cognitive neurosciences: *mental health, ageing and disease*
- Basic neurophysiology: *What simple science can teach us.*

We would particularly encourage postgraduate students and early-career researchers to inter-mingle and exchange ideas. We hope that ASP2018 will provide everyone a platform to showcase and discuss their research, and with that, gain a better understand of the many areas of research that contribute to the field of psychophysiology.

We look forwards to meeting you at ASP2018 down in Geelong.

Dr Wei-Peng Teo and Dr Helen Macpherson

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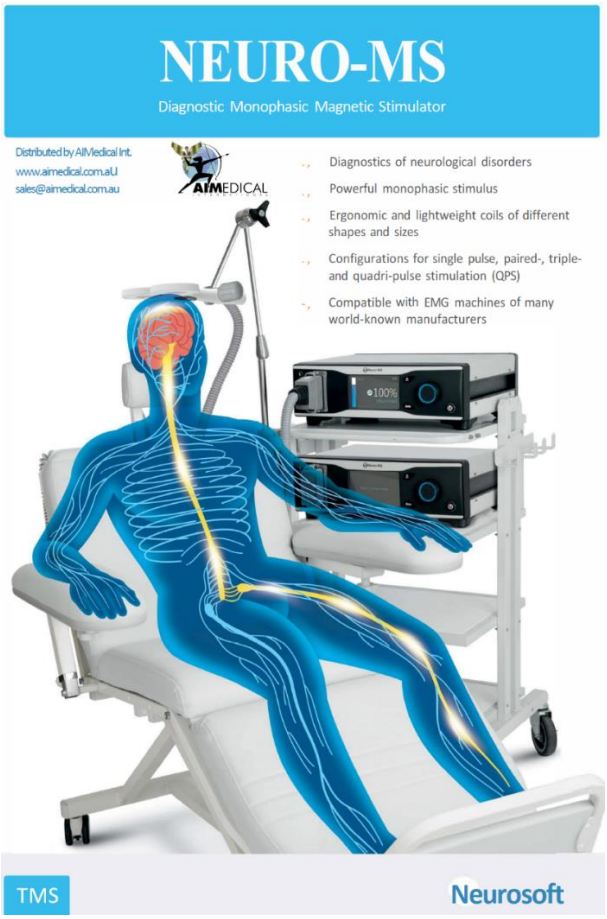

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Our Keynote Speakers

Alex Fornito completed his Clinical Masters (Neuropsychology) and PhD in 2007 in the Departments of Psychiatry and Psychology at The University of Melbourne before undertaking post-doctoral training in the Department of Psychiatry at the University of Cambridge, UK, under the auspices of an NHMRC Training Fellowship. He is currently a Viertel Foundation Fellow, Professor, and co-Director of the Brain and Mental Health Research Hub within the Monash Institute of Cognitive and Clinical Neurosciences.

Alex[1]s research concentrates on developing new imaging techniques for mapping human brain connectivity and applying these methods to shed light on brain function in health and disease. A major emphasis of his work focuses on understanding foundational principles of brain organisation and their genetic basis; characterising brain connectivity disturbances in psychiatric disorders such as schizophrenia; and mapping how brain networks dynamically reconfigure in response to changing task demands.

Tom Johnstone followed a BSc in Physics and PGDip in Cognitive Science at the University of Western Australia, with a PhD based at the University of Geneva, where he investigated the physiological mechanisms underlying emotion-affected speech. He then pursued postdoctoral research training in cognitive neuroscience of emotion and psychopathology at the University of WisconsinMadison under Richard Davidson and Ned Kalin.

Johnstone's ongoing research combines methods in functional and structural MRI, EEG and peripheral psychophysiology to probe the neural circuitry of emotion regulation in healthy individuals as well as those with mood and anxiety disorders, those at elevated risk for such disorders, and those with socioemotional processing deficits such as autism.

In his most recent research, Johnstone is applying simultaneously measured EEG and fMRI to model prefrontal and limbic modulation of early visual processing of socially relevant and emotional stimuli in autism.

Sharon Naismith is a Clinical Neuropsychologist, National Health and Medical Research Council (NHMRC) Dementia Leadership Fellow and holds the Leonard P Ullman Chair at the University of Sydney. She also heads the Healthy Brain Ageing Program at the Brain and Mind Centre, a one-of-its-kind early intervention clinic for dementia.

Her work focuses on modifiable risk factors for dementia and clinical interventions for early cognitive decline including cognitive training, depression, sleep, dietary, e-health and pharmacological interventions. She is currently Chief Investigator on competitive grants totalling ~$11 million including two NHMRC Centres of Research Excellence. She has co-authored more than 230 papers since 2001, and her work has been cited more than 7500 times.

She currently leads the team of a large program investigating the nature of sleep-wake disturbance in neurodegenerative disease.

The Program:

Day 1: Monday 19 November 2019

8am	**Registration Opens**	Gallery
9.00 – 9.15am	**Welcome Address: Conference Co-chairs, WP Teo and H Macpherson**	D3.211
9.15 – 10.15am	**Keynote 1 :Alex Fornito** ***From the genome to connectome and back again: understanding genetic influences on large-scale brain networks***	D3.211
10.15 – 10.45am	**Morning tea**	Gallery
	Session 1 – Oral presentations Chair: Melissa Hayden	
10.45am	Exploiting the magnifying-glass effect: new insight into Go ERP/PCA components. **Jack Fogarty**	D3.211
11.00am	Activity in the right frontal cortex is dependent on inhibitory-demand: a functional near infrared spectroscopy study. **Jason He**	
11.15am	The relationship between 1H-MRS neurometabolites and spatial working memory in age associated memory impairment. **Carlee Cleeland**	
11.30am	Network localization of cervical dystonia based on causal brain lesions. **Daniel Corp**	
11.45am	Cardiovascular function predicts cerebral microstructural integrity in older adults with 'age-associated memory impairment' (AAMI). **Jeff Reddan**	
12pm – 1pm	**Lunch**	Gallery
12.40	**Gold Sponsor workshop: Symbiotic Devices - fNIRS demonstration**	D3.211
1.00pm – 1.50pm	**Keynote 2: Tom Johnstone** ***The cognitive regulation of emotion: what exactly is being regulated?***	D3.211
	Session 2 - Oral presentations Chair: Christopher Latella	
2pm	Acute exercise induced muscle pain differentially modulates intracortical facilitation but not inhibition compared to fatigue. **Christopher Latella**	D3.211
2.15pm	How Chronic Pain Affects Cognitive Control: In an Endometriosis Population. **Katherine Joannou**	
2.30pm	The role of intended movement velocity in corticomotor activation, power and performance. **Michael Reese**	
2.45pm	The effects of stress induction of behavioural and ERP measures of human attentional networks. **Caleb Stone**	

3.00pm -4.30pm	**Session 3 - Poster session : Afternoon tea and drinks** **Diana Karamacoska:** Applying Principal Components Analysis to Assess Resting State EEG Relations to Go/NoGo Performance **Michael Do:** Inter-regional priming of M1: preliminary insights from TMS-EEG **Sapphire Love:** Resting State Electroencephalographic (EEG) Correlates of Chronic Pain in an Endometriosis Population **Mrudhula Komanduri:** Understanding the role of gut microbiota in cognition in healthy older population **Adele Cave:** Eyes-Closed Resting State EEG of Older Adults with Mild Cognitive Impairment Versus Healthy Controls **Inga Griskova-Bulanova:** Auditory steady-state responses and the complex information processing	Western Beach Room
4.30pm	**Day 1 Close**	
6.30pm	Bus depart Waterfront campus for conference dinner	Bus stop, Brougham St
7pm	**Conference dinner**	White Rabbit Brewery
10pm	Bus returns to Waterfront campus	

Day 2: Tuesday 20 November 2019

8.00am	**Registration Opens**	Gallery
9.00am	**Welcome to Day 2**	D3.211
	Session 4 – Oral presentations. Chair: Ashlee Hendy	
9.15am	Who's looking at responsible gambling messages? An eye-tracking study on wagering advertisements. **Lisa Lole**	D3.211
9.30am	Breaking up classroom sitting with cognitively challenging active breaks to improve children's cognition. **Emiliano Mazzoli**	
9.45am	Relationships between peripheral serotonin and the symptoms of Major Depressive Disorder. **Jessica Mills**	
10.00am	Neurobiological underpinnings of social and emotional functioning in children with comorbid ADHD+ASD. **Kate Stephens**	
10.15am	Weight gain in Major Depressive Disorder: Linking appetite and eating behaviours to hunger and satiety hormones. **Jessica Mills**	
10.30am	Default Mode Network Functional Connectivity in Mild Cognitive Impairment and Healthy Controls: An EEG and eLORETA Study. **Sarah Saddik**	
10.45am	**Morning Tea**	Gallery
11.10 -12.00pm	**Keynote 3: Sharon Naismith: *Healthy brain ageing for dementia prevention: a research trajectory***	D3.211
12.00 – 1.45pm	**Lunch and AGM: 12.45 – 1.45pm in D2.205**	Gallery
	Session 5 – Oral presentations. Chair: David White	D3.211
1.45pm	Cerebral Blood Flow and Vascular Predictors of Cognitive Decline in Patients with MCI and SCI: A Feasibility Study. **Danielle Shipton**	
2.00pm	Relational memory performance in older adults with subjective cognitive decline and their relationship with hippocampal volume. **David White**	
2.15pm	The effects of single-session theta-burst stimulation on short-term working memory & cerebral hemodynamics in Parkinson's Disease. **Catherine Offer**	
2.30pm	Theta Amplitude During Immediate and Delayed Word List Recognition in Mild Cognitive Impairment. **David Varjabedian**	
2.45pm	Pregnancy and Executive Functioning Changes: A longitudinal ERP case series study. **Sasha Davies**	
3.00 - 3.15pm	**Afternoon tea**	Gallery
3.15 – 3.30pm	**Awards and Formal conference close**	D3.211
3.45 – 5.30pm	**Workshops**	

Book of Abstracts

Cave, Adele E.

Eyes-Closed Resting State EEG of Older Adults with Mild Cognitive Impairment Versus Healthy Controls

Cave, Adele E. - Author; Saddik, Sarah - Co-Author; Fogarty, Jack S. - Co-Author; Al-Dabbas, Mahmoud A. - Co-Author; Fagan, Naomi L. - Co-Author; Karamacoska, Diana - Co-Author; Steiner, Genevieve Z. - Co-Author

Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Poster submission

Abstract

Aims: Mild Cognitive Impairment (MCI) is a noticeable decline in cognition, without evidence of significant impairment in activities of daily living or functioning. MCI is associated with an increased risk of further cognitive decline, in particular, Alzheimer's disease, the most common form of dementia. The spectrum of cognitive decline (healthy ageing to dementia) is under researched, particularly with regards to neurocognitive functioning, at rest. This study aims to characterise the differences in Eyes-Closed (EC) resting state EEG spectral activity between healthy older adults and those diagnosed with MCI. Method: Participants were 20 older adults with MCI (12 females, mean age = 68.39, range = 60.52-79.32 years; education 15.85 years), and 14 healthy age and education matched participants (10 females, mean age = 68.38, range = 60.84-77.61 years; education 15.62 years). Two minutes of EC resting EEG was recorded from 60 scalp sites, and EOG-corrected data were divided into 2-second sequential epochs and Discrete Fourier Transformed. EEG band amplitudes (Delta, Theta, Alpha-1, Alpha-2, Beta-1, Beta-2) were compared between groups. Results: Between the groups, main effects for all six bands approached significance. Topographically, a frontal Delta enhancement was lower in the hemispheres for MCI cf. healthy controls. In Theta, a fronto-parieto-occipital enhancement was reduced for MCI cf. healthy controls. This was most noticeable in the midline for the MCI group. Centrally, Beta-1 was reduced in the hemispheres for the MCI group cf. healthy controls. Conclusions: Group by topography interactions were evident for Delta, Theta and Beta-1. Previous research has shown significant reductions in peak frequencies in older adults with MCI and Alzheimer's disease. Despite this, the present study did not produce strong main effects across the bands. This is possibly due to arbitrarily defining band amplitudes. Future research should utilise fPCA as a more accurate method of defining band amplitudes.

References

1. NICM Health Research Institute, Western Sydney University, Penrith NSW 2751, Australia 2. School of Social Sciences and Psychology, Western Sydney University, Penrith NSW 2751, Australia 3. Brain & Behaviour Research Institute and School of Psychology, University of Wollongong, Wollongong NSW 2522, Australia

Cleeland, Carlee

The relationship between 1H-MRS neurometabolites and spatial working memory in age associated memory impairment

Cleeland, Carlee - Author

Submission Group

Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup

Oral submission

Abstract

Magnetic resonance spectroscopy (MRS) enables the non-invasive investigation of neurometabolites in vivo. N acetyl aspartate (NAA), a highly concentrated neurometabolite, has been proposed as a key indicator for neuronal integrity and implicated in age related cognitive decline (Ross & Sachdev, 2004; de Graaf, 2007). NAA changes have been closely linked to Alzheimer's disease and mild cognitive impairment (Kantarci et al., 2007); however, there is a paucity of research examining NAA and other neurometabolites in age associated memory impairment (AAMI). This study aimed to investigate age-related changes in NAA and other neurometabolites in AAMI and to investigate the relationship between neurometabolites and spatial working memory (SWM) performance, an early indicator of age-associated cognitive decline. The current study recruited 54 AAMI participants (57.4% males, 42.6% female, age range: 55-74 years). Neurometabolites were assessed using proton MRS (1H-MRS) in the posterior cingulate cortex (PCC). The results showed NAA ($r = -0.31$, $p = 0.03$) and Glx ($r = -0.33$, $p = 0.02$) concentrations were reduced with age in AAMI. Additionally, there was a significant relationship between NAA concentration and SWM performance when controlling for age, gender, education and body mass index (BMI). Pooled glutamate and glutamine (termed Glx) had a positive trend for an association with SWM performance when controlling for age, gender, education and BMI. The associations between NAA, Glx and SWM performance suggest that age-related neurometabolite changes may influence SWM processing in individuals with non-clinical age-associated cognitive decline.

References

Kantarci, K., Weigand, S., Peterson, R., Boeve, B., Knopman D., Gunter, J…. Jack Jr, C. (2007). Longitudinal 1H MRS changes in mild cognitive impairments and Alzheimer's disease. Neurobiology of Aging, 28, 1330-1339. Ross, A., & Sachdev, P. (2004). Magnetic resonance spectroscopy in cognitive research. Brain Research Reviews, 44, 82-102. De Graff, R. (2007). In vivo NMR Spectroscopy Principles and Techniques. Chichester, UK: Wiley.

Corp, Daniel

Network localization of cervical dystonia based on causal brain lesions

Corp, Daniel - Author; Joutsa, Juho - Co-Author; Fox, Michael - Co-Author
Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Oral submission

Abstract

Introduction and Aims Cervical dystonia (CD) is a neurological disorder characterised by involuntary contractions of neck muscles. Brain regions underlying CD have yet to be identified (Prudente et al., 2014). Here, we employed a recently validated technique termed 'lesion network mapping' (LNM) (Boes et al., 2015) to identify brain regions commonly connected to lesions causing CD. Methods First, lesions causing CD were traced onto a standard brain and used as seed regions within a normative dataset of 1000 resting-state fMRI scans. Individual lesion network maps were then overlaid to reveal voxels functionally connected to all lesion locations. Finally, we tested whether identified brain regions were also abnormal in a dataset of patients with idiopathic CD, without brain lesions (N=39, versus controls: N=37). Results Lesions causing CD were connected to the globus pallidus, midbrain, cerebellum, and somatosensory cortex. However, only the cerebellum and the somatosensory cortex were specifically connected to CD lesions, compared to connectivity of lesions causing other neurological symptoms. These two regions also showed abnormal connectivity in patients with idiopathic CD, with the magnitude of the abnormality correlating with patients' symptom scores. Discussion All lesions causing CD were both positively connected to the cerebellum and negatively connected to the somatosensory cortex. This suggests that these two regions are key nodes in a distributed network responsible for processing head and neck sensorimotor information. Conclusion Our findings suggest that the cerebellum and somatosensory cortex are abnormal in patients with idiopathic and acquired CD. These two brain regions represent testable therapeutic targets for brain stimulation interventions.

References

Prudente C, Hess E, Jinnah H. Dystonia as a network disorder: what is the role of the cerebellum? Neuroscience 2014;260:23-35. Boes AD, Prasad S, Liu H, Liu Q, Pascual-Leone A, Caviness VS, Jr., Fox MD. Network localization of neurological symptoms from focal brain lesions. Brain 2015;138:3061-3075.

Davies, Sasha

Pregnancy and Executive Functioning Changes: A longitudinal ERP case series study

Davies, Sasha - Author
Submission Group

Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup

Oral submission

Abstract

Many women report subjective changes in cognitive functioning during pregnancy (Brett & Baxendale, 2001; Brindle et al., 1991), with one meta-analysis recently validating these changes in memory, attention, and executive functioning through objective, standardised measures (Davies et al., 2018). However, it remains unknown whether pregnancy demonstrates a causal relationship with declines in these cognitive domains. It is also unknown whether pregnancy-related cognitive changes observed at the behavioural level are underpinned by physiological differences at the psychophysiological level. Aim: The current study aims to investigate whether pregnancy is causally associated with declines in women's executive functioning at both the behavioural and psychophysiological levels. Method: The current study used EEG in a longitudinal case-series design to track women from pre-conception through to the third trimester of pregnancy. Six participants aged between 27-40 years old completed four testing sessions (Pre-conception, Trimester 1, Trimester 2, and Trimester 3) in a laboratory setting. Testing sessions include three computerised tasks completed while using EEG to measure changes in event-related potentials, and five behavioural cognitive tasks completed without EEG. Results: Results for this study are currently undergoing analysis. Preliminary results are expected to be available at the time of the ASP conference. Conclusion: Given this is the first known study to apply EEG to investigate the effects of pregnancy-related cognitive decline in women from the pre-conception stage through to the final gestational trimester, it is expected that the results of this study will provide novel insights into the potential modulation of executive functioning in pregnant women. These may have implications for the broader knowledge base on the impact of pregnancy of human cognitive performance, as well as practical implications for the delivery of care for pregnant women in the healthcare setting.

References

Brett, M., & Baxendale, S. (2001). Motherhood and memory: a review. Psychoneuroendocrinology, 26, 339-362. Brindle, P.M, Brown, M.W,, Brown, J., et al. (1991). Objective and subjective memory impairment in pregnancy. Psychol Med, 21, 647-653. Davies, S. J., Lum, J. A. G., Skouteris, H., Byrne, L. K., & Hayden, M. J. (2018). Cognitive impairment during pregnancy: A meta-analysis. The Medical Journal of Australia, 208 (1). Henry, J.D, & Rendell, P.G. (2007). A review of the impact of pregnancy on memory function. J Clin Exp Neuropsychology, 29, 793-803.

Do, Michael

Inter-regional priming of M1: preliminary insights from TMS-EEG

Do, Michael - Author
Submission Group Non-invasive brain stimulation: probing neuroplasticity

Submission Subgroup Poster submission

Abstract

Priming protocols involving repeated application of non-invasive brain stimulation can induce homeostatic and non-homeostatic metaplastic-like changes in corticospinal excitability. These effects are commonly quantified as changes in motor evoked potentials (MEP) measured distally in peripheral muscles (e.g. the first dorsal interosseous; FDI). Another approach which can measure neuroplastic changes proximally at the scalp involves administering transcranial magnetic stimulation (TMS) during concurrent electroencephalography (EEG) recording. EEG responses elicited with TMS are referred to as TMS-evoked potentials (TEPs) which comprise several highly reproducible components including the P30, N45, P60, N100 and P200. We used TEPs elicited from the left-M1 to index and compare cortical responses to standard continuous theta burst stimulation (cTBS) applied over M1 to an inter-regional priming protocol. In protocol 1, sham cTBS was administered to the left-dorsolateral prefrontal cortex (DLPFC), then active cTBS over the ipsilateral FDI “hot spot” (sham-M1). In protocol 2, active cTBS was applied over the left-DLPFC, then ipsilateral M1 (DLPFC-M1). cTBS trains were separated by 10 mins with TEPs taken before, in-between, and after each round. TMS applied over the left shoulder was included to control for sensory contamination. Ten right-handed participants (M = 21.90; SD = 5.62) attended 2 sessions separated by at least 1 week. Preliminary results indicate sham-M1 and DLPFC-M1 differentially modulates TEPs over and above shoulder stimulation. Sham-M1 stimulation reduces the P30, whereas DLPFC-M1 stimulation potentiates the P60. Both Sham-M1 and DLPFC-M1 attenuate the N100 response with greater reductions observed in the latter. Although shoulder stimulation evoked similar TEPs to scalp stimulation, responses following peripheral stimulation were largely unchanged across all stimulation protocols and time points. TMS-EEG can be used to measure regionally specific, cortical responses to standard and priming cTBS. Inclusion of an active control condition can assist in isolating the effects specific to the target paradigm.

References

Goldsworthy, M. R., Pitcher, J. B., & Ridding, M. C. (2012). The application of spaced theta burst protocols induces long- lasting neuroplastic changes in the human motor cortex. European Journal of Neuroscience, 35(1), 125-134. Hamada, M., Hanajima, R., Terao, Y., Okabe, S., Nakatani-Enomoto, S., Furubayashi, T., ... & Ugawa, Y. (2009). Primary motor cortical metaplasticity induced by priming over the supplementary motor area. The Journal of physiology, 587(20), 4845-4862. Pötter-Nerger, M., Fischer, S., Mastroeni, C., Groppa, S., Deuschl, G., Volkmann, J., ... & Siebner, H. R. (2009). Inducing homeostatic-like plasticity in human motor cortex through converging corticocortical inputs. Journal of neurophysiology, 102(6), 3180-3190. Rogasch, N. C., Sullivan, C., Thomson, R. H., Rose, N. S., Bailey, N. W., Fitzgerald, P. B., ... & Hernandez-Pavon, J. C. (2017). Analysing concurrent transcranial magnetic stimulation and electroencephalographic data: a review and introduction to the open-source TESA software. Neuroimage, 147, 934-951.

Fogarty, Jack

Exploiting the magnifying-glass effect: new insight into Go ERP/PCA components

Fogarty, Jack - Author; Barry, Robert - Co-Author; Steiner, Genevieve - Co-Author
Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Oral submission

Abstract

Introduction: When event-related potentials (ERPs) are averaged, ERP components that are time-locked to the event are enhanced, while irrelevant signal data are attenuated. This study used that ERP magnifying-glass effect, and behaviour, to clarify the functionality of Go ERP components linked to an auditory equiprobable Go/NoGo task; a two-choice task that requires a motor response to Go, but not to NoGo tones. Method: ERP data from 126 healthy young adults (Mage = 20.3, SD = 2.8 years) in successful Go trials were averaged within-subjects in relation to Go stimulus-onset, and reaction time (RT). These ERP datasets were subjected to separate temporal principal components analyses (PCAs) to identify the Go stimulus-locked and response-locked ERP components in the equiprobable task. Repeated measures MANOVAs were used to assess the magnifying-glass effect on components that were identified in both conditions; larger amplitudes in one condition indicated optimal event synchronisation. Component amplitudes were then related to performance outcomes, including mean RT, RT variability, and error rates. Results: Six components were extracted from both the Go stimulus- and response-locked data, involving three unique components, and three common components that matched across conditions: P3b, and two slow-wave components (SW1, SW2). P3b, SW1, and SW2 were enhanced in the response-locked output, demonstrating that Go RT was their optimal reference event. Lower RT variability, and shorter RTs were linked to larger response-locked P3b and SW1 amplitudes, respectively. Conclusions: These outcomes increase our understanding of PCA-derived components in the equiprobable task, and indicate that P3b and SW1 represent distinct cognitive functions associated with the Go response; possibly response-monitoring, and the evaluation of reafferent information. SW2 is also response-related, but not linked to performance. These findings continue the development of a Go/NoGo processing schema by clarifying the functionality of several Go ERP components, and highlight the utility of the magnifying-glass effect.

References

N/A

Griskova-Bulanova, Inga

Auditory steady-state responses and the complex information processing

Griskova-Bulanova, Inga - Author
Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Poster submission

Abstract

Introduction An auditory steady-state response (ASSR) is a neurophysiological measure of the brain response to periodic auditory stimulation (1). 40Hz ASSRs are mostly used, but the individual resonant frequency of ASSRs is ranging between 35 to 55Hz (2). Although ASSRs were proposed to serve as biomarker of schizophrenia (3), little is known about their relationship to cognitive functions, particularly complex information processing. Aim We aimed to explore the association between ASSRs to 40Hz and to individual resonant gamma frequency and the complex information processing speed. Methods ASSRs were recorded to classical 40Hz click stimulation and to 35-55Hz chirp stimulation in a sample of 33 healthy volunteers on the separate runs. Participants completed nine PEBL (The Psychology Experiment Building Language) computer administered tasks (4) to estimate their complex information processing. EEG data was recorded with 64 channels and ASSRs were analyzed from 9 fronto-central channels. Phase-locking index (PLI, corresponding to the phase consistency over epochs) was calculated after the wavelet transform for 1) 40Hz and 2) for individual resonant gamma frequency in response to chirp stimulation. Spearman's correlation coefficients were calculated between PLI values at 40 Hz, at individual resonant frequency and indices of complex information processing. Results PLI values in response to both 40Hz stimulation and in response to chirp stimulation at individual resonant frequency (39-45Hz range) negatively correlated to the Tower of London task scores - mean move times (40Hz PLI: r=-0.39, p=0.03; chirp PLI: r=-0.56, p=0.001). Conclusion The degree of inter-trial synchronization in response to periodic auditory stimulation may be related to the speed of complex information processing, specifically to the planning speed as reflected by the Tower of London task. The stronger relationship is observed for the responses to the individual resonant frequencies than for the responses to classical 40Hz stimulation.

References

1) T.W. Picton, M.S. John, A. Dimitrijevic, D. Purcell, Human auditory steady-state responses, Int. J. Audiol. 42 (2003) 177–219 2) T. Zaehle, D. Lenz, F.W. Ohl, C.S. Herrmann, Resonance phenomena in the human auditory cortex: individual resonance frequencies of the cerebral cortex determine electrophysiological responses, Exp. Brain Res. 203 (2010) 629–635 3) H. Thuné, M. Recasens, P.J. Uhlhaas, The 40-Hz auditory steady-state response in patients with schizophrenia: a meta-analysis, JAMA Psychiatry 73 (2016) 1145–1153 4) S. T Mueller & B. J. Piper, The Psychology Experiment Building Language (PEBL) and PEBL Test Battery, J. Neurosci. Methods, 222 (2014) 250-259

He, Jason

Activity in the right frontal cortex is dependent on inhibitory-demand: a functional near infrared spectroscopy study

He, Jason - Author

Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Oral submission

Abstract

Introduction. The Go/No-go task has often been used in combination with popular neuroimaging methods to identify changes in brain activity related to inhibitory-control. While studies have been conducted using functional near-infrared spectroscopy (fNIRS) to identify such changes in brain activity during task performance, limitations in the task designs used in previous studies make it difficult to determine whether the changes identified were indeed related to inhibition. Aim. Our aim was to examine whether the increased activity in the rPFC seen in earlier investigations using fNIRS and the Go/No-go task was indeed related to the increased inhibitory demand of the Go/No-go task. Methods. 31 healthy, right-handed adults completed three separate blockwise conditions of the Go/No-go task (Oddball, Equiprobable and Difficult). Inhibitory demand across the conditions was manipulated by increasing the ratio of Go to No-go trials within the Go/No-go blocks. fNIRS was used to assess changes in concentration of △O2Hb and △HHb within the rPFC during task performance. Results. Go-trial RTs decreased as Go-trial frequency increased, $F(2,48) = 46.68$, $p < .001$, partial $\eta 2 = .660$. No-go trial accuracy decreased as inhibitory demand increased, $F(1.51, 36.23) = 35.64$, $p < .001$, partial $\eta 2 = .598$. △O2Hb in the rPFC increased as a function of inhibitory demand, $F(1.68, 40.27) = 4.21$, $p = .028$, partial $\eta 2 = .149$. Similarly, △HHb significantly decreased as inhibitory demand increased, $F(1.33, 31.89) = 4.02$, $p = .044$, partial $\eta 2 = .144$. Discussion. Comparison of the behavioral outcomes across task conditions confirmed that we had successfully manipulated inhibitory-demand. Analysis of △O2Hb and △HHB found that as inhibitory demand increased, as did activity in the rPFC. This pattern of effect is in support of the idea that changes in the rPFC identified in earlier studies using fNIRS were indeed related to the inhibitory demand of the Go/No-go task.

References

N/A

Joannou, Katherine

How Chronic Pain Affects Cognitive Control: In an Endometriosis Population

Joannou, Katherine - Author; Barry, Robert - Co-Author; Love, Sapphire - Co-Author; Armour, Mike - Co-Author; De Blasio, Frances - Co-Author; Fogarty, Jack - Co-Author; Cave, Adele - Co-Author; Steiner, Genevieve - Co-Author

Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Oral submission

Abstract

The neural correlates of cognitive control for those with chronic pain are under-researched; even more so in those with endometriosis associated chronic pelvic pain (CPP). It has been suggested that individuals with chronic pain have impaired cognitive control, possibly due to neuroplastic changes in overlapping neuronal networks. This study compared behavioural and event-related potential (ERP) indices of cognitive control between healthy controls and those with CPP. Twenty females experiencing endometriosis-associated CPP (Mage = 28.54, SD = 5.17) and 20 healthy aged- and gender-matched controls (Mage = 28.45, SD = 5.17) completed an AX-type continuous performance test (AX-CPT) which required a button press when an X was presented, but only if it was preceded by an A. ERP data from successful cued target (AX) and non-target (AY) trials were quantified using separate temporal principal components analyses (t-PCAs) for each group (healthy control, CPP) and condition (AX, AY). ERP components were assessed for temporal and topographical congruence between the groups. P2, P3b, and Slow Wave (SW) corresponded between groups in the AX condition, while early P3a, late P3a, and SW corresponded between groups in the AY condition. There were no significant behavioural differences between groups in response time, omission errors, or commission errors. P3 amplitudes were significantly reduced in the chronic pain group compared to healthy controls in both the AX and AY conditions, while P3 latency and SW amplitude did not differ significantly between the groups. Decreases in P3 amplitude may be indicative of attentional and/or response inhibition differences. These results indicate that endometriosis-associated CPP is associated with P3 amplitude differences, which may reflect possible endometriosis-related CPP changes in brain neuroplasticity that likely impact attentional and/or response inhibition processes. Keywords: Cognitive control, Chronic pelvic pain, P3, AX-type continuous performance test, Temporal principal components analyses

References

None

Karamacoska, Diana

Applying Principal Components Analysis to Assess Resting State EEG Relations to Go/NoGo Performance

Karamacoska, Diana - Author
Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Poster submission

Abstract

Aims: The brain's prestimulus EEG state activity is a fundamental determinant of ERP and behavioural responses. An individual's pretask resting state activity has also been found to affect performance in two-choice tasks. Across these studies, however, EEG has been assessed using predefined frequency ranges. Considered a more data-driven approach to decomposing electrophysiological data, principal components analysis (PCA) was applied here to examine resting state EEG relations to performance. Method: EEG was recorded from 20 young adults at rest with eyes-closed (EC) and eyes-open (EO), and then during an auditory Go/NoGo task. PCAs were conducted separately on each condition of the EEG and ERP data. The following EEG components were extracted from each state: delta-1, delta/theta, and three alpha and two beta components. Six ERP components were identified in Go/NoGo responses (N1-1, PN, P2, N2, P3, and SW). Correlations assessed the ERP component relations to behavioural outcomes, and multiple regression was used to identify the resting state EEG predictors of task-related measures. Results: Mean response time (RT) correlated positively with the Go P2 and negatively with P3b amplitude. Regressions found that larger EC delta-1 amplitude predicted faster RTs, and greater alpha-3 amplitude predicted enhanced P3b positivity. Conclusion: These results reflect the immediate P2 and P3b involvement in decision-making, and the EC delta-1 and alpha-3 activity underpinning response control efforts. These findings offer novel insights into how pretask EEG state activity can affect task performance.

References

NA

Komanduri, Mrudhula

Understanding the role of gut microbiota in cognition in healthy older population

Komanduri, Mrudhula - Author; Stough, Con - Author; Gondalia, Shakuntla - Author
Submission Group Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup Poster submission

Abstract

Background: Increased oxidative stress and inflammation are hallmarks of the ageing process and have recently been associated with poorer cognitive performance in older participants. Therefore understanding mechanisms by which we can change oxidative stress and inflammation are important scientific targets. Gut bacteria have been identified as one mechanism influencing mitochondrial function, the production of Reactive Oxygen Series and the development of innate and adaptive immune system processes in the host. The mechanisms by which the gut bacteria influence the brain is complex. Several potential mechanisms for Gut-Brain communication have been proposed. These mechanisms include the Vagus nerve, the hypothalamic-pituitary-adrenal axis (HPA), the enteric nervous system (ENS) or immune responses. Despite these hypotheses there have not been many empirical studies that have shown relationships between gut bacteria and cognitive processes in healthy older participants. Method: The present study examines the relationship between gut bacteria and cognition in a healthy older population and forms part of an existing large scale RCT on cognition (The Australian Research Council Longevity Intervention - ARCLI). This study has been designed to understand the biological processes that underpin cognition in the elderly. Along with the demographic, haematological, mood, cardiovascular, oxidative stress, inflammatory markers, a wide range of cognitive processes, and Faecal samples are collected to assess the role of gut bacteria. The present study will examine the relationship between the presence of gut bacteria and cognition in healthy older participants as well as several potential mechanism of action by studying oxidative stress and inflammation. Discussion: Aging is associated with decline in some cognitive processes. Specifically, episodic memory, working memory and recognition memory decline upon aging. Understanding the potential mechanisms and pathways by which gut microbiota may influence cognitive aging is important. This knowledge may help in developing prebiotic and probiotic targets and therapeutics for cognitive decline.

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Latella, Christopher

Acute exercise induced muscle pain differentially modulates intracortical facilitation but not inhibition compared to fatigue.

Latella, Christopher - Author; Van der Groen, Onno - Co-Author; Ruas, Cassio - Co-Author; Taylor, Janet - Co-Author

Submission Group

Basic neurophysiology: What simple science can teach us

Submission Subgroup

Oral submission

Abstract

Introduction: Muscle pain has been shown to acutely increase (1) and chronically decrease (2,3) intracortical inhibition. However, the effect of exercise-induced muscle pain on intracortical networks is not well understood. Aim: To investigate the effect of group III/IV muscle afferent firing on intracortical excitability and inhibition following fatiguing exercise. Methods: 16 participants (11M, 5F) completed a time-equated maximal isometric index-finger abduction task until force decreased by approximately 40%. On one day, post-exercise blood flow occlusion of the hand maintained group III/IV afferent firing whereas recovery was allowed on the other day (control). Pain was assessed using a 0-10 scale. Single- and paired-pulse transcranial magnetic stimulation (TMS) assessed motor evoked potentials (MEP), intracortical facilitation (ICF), and inhibition at 2 and 3 ms (SICI2, SICI3, respectively), in the exercised first dorsal interosseous (FDI) and non-exercised abductor digiti minimi (ADM) muscle(s). SICI was individualized to elicit ~50% maximal inhibition and the MEP in FDI was controlled to maintain a 1 mV response. Maximal M-waves (MMAX) were also elicited pre- and post-exercise. Results: Pain was greater during the occlusion condition (3.8±1.7 versus 1.4±0.8, $p<0.001$). SICI2 decreased (conditioned MEP increased) post-exercise from 50.5% to 65.1%, and 51.4% to 62.9% for the FDI ($P=0.021$) and ADM ($P=0.025$) respectively, but was not different between conditions. ICF decreased post-exercise for control in FDI (-28.0%, $p=0.006$), but was unchanged for both conditions in ADM ($P=0.524$). No differences were observed for SICI3 between conditions and across time in the FDI ($P=0.767$) and ADM ($P=0.204$). Conclusion: Changes in inhibition appear to be modulated by fatigue rather than muscle pain. However, afferent feedback appears to attenuate the reduction in facilitation observed with fatigue only. Therefore, group III/IV afferent firing is unlikely to be responsible for the reduction in inhibition following intense exercise, however the factors modulating facilitatory networks remain less clear.

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Lole, Lisa

Who's looking at responsible gambling messages? An eye-tracking study on wagering advertisements

Lole, Lisa - Author; Russell, Alex - Co-Author; Li, En - Co-Author; Greer, Nancy - Co-Author; Thorne, Hannah - Co-Author; Hing, Nerilee - Co-Author

Submission Group

Basic neurophysiology: What simple science can teach us

Submission Subgroup

Oral submission

Abstract

Aim: The effectiveness of responsible gambling messages to impact the behaviours of gamblers has long been questioned and debated; however, to date, the extent to which these individuals attend to such messages, especially when they are presented amongst other highly-appealing stimuli, has not been systematically examined. The current study sought to address this deficit in the literature. Methods: Participants were 58 members of the general public; nine were classified as problem gamblers, 18 as moderate risk gamblers, 10 as low risk gamblers, and 11 were non-gambler controls. They viewed a series of 12 ecologically-valid advertisements in a laboratory setting, while an eye-tracker recorded their eye activity. The number of fixations on the inducement information contained within each of the wagering advertising messages was examined, and compared to the number of fixations made on the responsible gambling messages and terms and conditions information, therein. Results: Although the responsible gambling messages were generally presented for a longer period of time than the wagering inducement information, the former was more likely to be smaller, placed at the bottom of the screen, and static in nature. A series of related-samples t-tests revealed that the mean number of fixations on the wagering inducement information was significantly greater than the mean number of fixations on the responsible gambling messages, and the terms and conditions information, combined (all comparisons were significant at $p < .001$). Conclusions: As expected, the results of the current study showed that responsible gambling messages, are paid little attention, when compared to other wagering advertising content. This finding has the potential to guide future research, in terms of strategies to reduce the negative impacts of such advertisements that are prolific in popular media. It may also be used by government and industry to inform consumer protection and harm minimisation strategies.

References

n/a

Love, Sapphire

Resting State Electroencephalographic (EEG) Correlates of Chronic Pain in an Endometriosis Population

Love, Sapphire - Author; Barry, Robert J. - Co-Author; Joannou, Katherine A. - Co-Author; Armour, Mike J. - Co-Author; De Blasio, Frances M. - Co-Author; Fogarty, Jack S. - Co-Author; Cave, Adele E. - Co-Author; Steiner, Genevieve Z. - Co-Author

Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Poster submission

Abstract

Advances in neuroimaging have identified the role of maladaptive neuroplasticity in chronic pain. Although there are similarities in resting state EEG across chronic pain conditions, there are also distinct condition-dependent differences. Little is known of the neurological correlates of chronic pain associated with endometriosis. This relationship is important to explore as endometriosis disease severity does not correlate with pain severity. The aim of the present study was to identify resting state EEG differences between women with endometriosis-associated chronic pain and healthy controls. Participants included 20 women with chronic pelvic pain associated with endometriosis (age range 21–41 years) and 20 sex and individually age-matched healthy control volunteers. All participants completed a 4-week pain diary and were tested on days 4–11 of their menstrual cycle (or any day, if on hormonal contraception) to control for hormonal effects on resting state EEG. Two-minutes of eyes-open, two-minutes of eyes-closed, and two minutes of eyes-open resting data were recorded using a 62-channel EEG cap. Frequency principal components analysis (f-PCA), a novel data-driven approach, was utilised to decompose the EEG data into natural frequency components. These components were labelled in terms of their presence in traditional EEG bands. Matched components were screened for topographical correlation and spectral congruence. Within groups, matched alpha components displayed the expected reduction in amplitude with the opening of the eyes. Between groups, delta amplitude was significantly reduced in the endometriosis group during eyes-open and was negatively correlated with pain severity, indicating that lower delta amplitude is associated with greater pain. The endometriosis group also displayed significantly greater amplitude in a delta-theta component in the eyes-open condition. This delta-theta component correlated significantly with both pain severity and duration. These findings suggest that maladaptive neuroplasticity may be associated with the experience of pain in an endometriosis population.

References

None

Mazzoli, Emiliano

Breaking up classroom sitting with cognitively challenging active breaks to improve children's cognition

Mazzoli, Emiliano - Author; Salmon, Jo - Co-Author; Teo, Wei-Peng - Co-Author; Pesce, Caterina - Co-Author; He, Jason - Co-Author; Ben-Soussan, Tal Dotan - Co-Author; Barnett, Lisa - Co-Author

Submission Group

Basic neurophysiology: What simple science can teach us

Submission Subgroup

Oral submission

Abstract

Background: Classroom-based active breaks (AB) reduce children's school sitting time and promote physical activity. Such breaks may boost children's cognitive functions. Physical activity enhances cognition (i.e., executive functions), which may be due to the intrinsic cognitive demand of the physical task. We investigated whether cognitively challenging AB could reduce sitting and improve cognitive functions in primary school children. Method: Classrooms from two schools were randomly allocated to the cognitively challenging AB (intervention) or the simple AB (active control). Another school continued with normal school practice (passive control). Teachers implemented AB twice a day for five-six weeks. In total, 145 children aged 7 years participated. Measures at baseline and post-trial included: class time sitting/stepping (activPAL™ monitors), executive functions (n = 132, Go/No-go task – inhibition), and brain activity (n = 62, functional near-infrared spectroscopy). A linear regression, adjusting for age and sex, investigated effect of study condition on sitting/stepping time change. Then four regression models were conducted: 1) inhibition as outcome, change in sitting as predictor, 2) inhibition as outcome, change in stepping time as predictor, 3) brain activity as outcome, change in sitting as predictor, 4) brain activity as outcome, change in stepping as predictor. Each model included study condition and the interaction with sitting/stepping as predictors; age and sex as effect modifiers. Results: Both AB significantly reduced sitting, intervention also increased stepping. The interaction between study condition (intervention) and sitting predicted inhibition (B*=-.457, p=0.002). We found an interaction between condition (active control) and sitting (B*=.531, p=0.02) on brain activity. Stepping did not predict inhibition or brain activity. Conclusions: AB can help teachers support children's physical health and cognition. Results support hypotheses that the cognitively challenging active tasks improved inhibition, however brain activity changed through simple active tasks. Further research is required to clarify the role of tasks' cognitive demand.

References

n/a

Mills, Jessica

Relationships between peripheral serotonin and the symptoms of Major Depressive Disorder

Mills, Jessica - Author; Larkin, Theresa - Co-Author; Deng, Chao - Co-Author; Thomas, Susan - Co-Author
Submission Group Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup Oral submission

Abstract

Aims: The 'monoamine hypothesis' suggests that Major Depressive Disorder (MDD) is caused by deficient serotonin and other monoamines in the central nervous system, however response rates to antidepressant treatments suggest that this hypothesis only partially explains MDD, with the role of serotonin in MDD yet to be conclusively determined. The vast majority of serotonin is synthesised peripherally and is a central element in bi-directional communication in the gut-brain axis, which is closely tied to emotions. While central serotonin is hypothesised to play a major role in mood and cognition, relationships between peripheral serotonin and MDD symptoms are not yet clear. This study investigates the relationships between peripheral serotonin and key symptoms of MDD. Methods: Plasma serotonin levels and psychometrics were compared between 60 unmedicated participants meeting the DSM-5 diagnostic criteria for MDD and 60 healthy controls. Depressive symptoms were assessed using Beck's Depression Inventory (BDI-II). Psychological distress was examined using the Depression, Anxiety and Stress Scale (DASS-21), and negative cognitions using the Automatic Thoughts Questionnaire (ATQ). Results: Depressed participants had higher peripheral serotonin levels than controls, but did not differ significantly by sex. Peripheral serotonin levels correlated positively, albeit relatively weakly, with depressed mood, anxiety, negative thinking and symptom severity. Conclusions: The current study identifies novel links between peripheral serotonin and depressive symptoms. Peripheral serotonin levels were elevated in MDD compared to controls, implicating higher, rather than lower, peripheral serotonin in MDD. Despite being relatively weak, the positive associations between serotonin and psychological distress, negative thinking and depressive symptom severity suggest a potential role for peripheral serotonin in these symptoms. However, it is not yet clear how central and peripheral serotonin interact. Future longitudinal research investigating peripheral serotonin levels in relation to depressive symptoms is warranted.

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Weight gain in Major Depressive Disorder: Linking appetite and eating behaviours to hunger and satiety hormones

Mills, Jessica - Author; Larkin, Theresa - Co-Author; Deng, Chao - Co-Author; Thomas, Susan - Co-Author

Submission Group

Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup

Oral submission

Abstract

Purpose: Individuals with Major Depressive Disorder (MDD) are at increased risk of weight gain, potentially through altered eating behaviours and hormonal dysregulation. Emotional eating and excessive consumption of highly palatable foods, recently conceptualised as 'food addiction', may act as coping mechanisms for low mood in MDD. Dysregulation of the hunger and satiety hormones ghrelin and leptin may relate to these behaviours, however there is a lack of research. This study extends on our previous pilot investigation by examining eating behaviours in a new cohort, in relation to both ghrelin and leptin. Method: Plasma ghrelin and leptin levels normalised to waist circumference, biometrics and psychopathology were compared between participants meeting the DSM-5 diagnostic criteria for MDD (n = 60) and healthy controls (n = 60). Eating behaviours were examined using the Dutch Eating Behaviours Questionnaire (DEBQ) and Yale Food Addiction Scale (YFAS). Results: Disordered eating and food addiction symptoms were higher in MDD than controls, and in females than males. Nineteen (15.8%; 17 MDD, 15 female) met the Yale criteria for food addiction. Leptin levels were higher in females than males, but not different by diagnosis; ghrelin levels did not differ by diagnosis or sex. Leptin positively correlated with disordered eating and subscales of the YFAS; ghrelin negatively correlated with aspects of disordered eating. Conclusion: The results provide further evidence for disordered eating in MDD. Leptin levels were higher in MDD than controls, in females compared to males, and correlated positively with disordered eating and food addiction measures; suggesting that comfort eating is associated with hormones in MDD, particularly in females. The direction of associations indicates the possibility of leptin and ghrelin resistance, related to disordered eating in MDD. Additional research oriented on further understanding these factors, which may contribute to weight gain and chronic health conditions in MDD, is warranted.

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Offer, Catherine

The effects of single-session theta-burst stimulation on short-term working memory & cerebral hemodynamics in Parkinson's Disease.

Offer, Catherine - Author

Submission Group

Non-invasive brain stimulation: probing neuroplasticity

Submission Subgroup

Oral submission

Abstract

Introduction Patients with Parkinson's disease (PD) often present with cognitive impairments in particular working memory (WM). Non-invasive brain stimulation techniques have the ability to modulate neuronal plasticity to improve cognitive functioning. Theta-burst stimulation (TBS) can be applied either continuously (cTBS) having an inhibitory effect, or intermittently (iTBS) to elicit a facilatatory effect. TBS has shown promise in improving WM in healthy older adults, making it a potential treatment for WM difficulties seen in PD. Aim To compare the effects of a single-session of cTBS or iTBS to the left dorsolateral prefrontal cortex (dlPFC) on cerebral hemodynamic response and short-term WM in PD. Method Fifteen participants with moderate PD symptoms (mean age 66 8.5yr, 13 male) received iTBS, cTBS or sham TBS to the left dlPFC in a randomized cross-over design, separated by 7 days between sessions. Computerized 1- and 2-back tasks was used to measure short-term WM and functional near-infrared spectroscopy (fNIRS) was used to measure changes in oxyhemoglobin (O2Hb) in the left dlPFC. Results The results show between conditions iTBS significantly decreased reaction time (p=0.038) and increased accuracy score (p=0.026) in the 1-back task compared to cTBS and sham TBS. The 2-back task produced similar results following iTBS (decreased reaction time, p=0.019; increased accuracy score, p=0.030) compared to cTBS and sham TBS. No significant differences in reaction time or accuracy score was recorded in the 1- and 2-back tasks following cTBS or sham TBS. Increase in O2Hb in the left dlPFC was recorded during the 1- and 2-back tasks following iTBS compared to cTBS and sham TBS. However, no significant change in O2Hb in the left dlPFC was recorded following cTBS or sham TBS. Conclusion A single-session of iTBS applied to the left dlPFC improves short-term WM and increases hemodynamic response during task performance in patients with PD.

References

Offer C1, Hendy AM1, He J2, Enticott PE2, Teo W-P1,3 1. Institute of Physical Activity and Nutrition (IPAN), School of Exercise & Nutrition Science, Deakin University, Geelong Australia 2. Cognitive Neuroscience Unit (CNU), School of Psychology, Deakin University, Geelong Australia 3. Physical Education and Sports Science Academic Group, National Institute of Education, Nanyang Technological University, Singapore

Reddan, Jeff

Cardiovascular function predicts cerebral microstructural integrity in older adults with 'age-associated memory impairment' (AAMI)

Reddan, Jeff - Author; White, David - Co-Author; Kurani, Ajay - Co-Author; Pipingas, Andrew - Co-Author; Macpherson, Helen - Co-Author; Rowsell, Renee - Co-Author; Parish, Todd - Co-Author; Scholey, Andrew - Co-Author

Submission Group

Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup

Oral submission

Abstract

Reduced brain structural integrity is apparent during the normal ageing process (Fjell & Walhovd, 2010). However, there appears to be greater magnitude of deterioration in cohorts with elevated risk of dementia, such as Mild Cognitive Impairment (MCI) and Age-Associated Memory Impairment (AAMI). Poorer cardiovascular (CV) function (as reflected by elevated blood pressures), have been found to predict reduced brain microstructural integrity in older adults (Salat et al., 2012). To date most studies into this relationship have examined brachial blood pressures rather than central (aortic) blood pressures. Moreover, there have been no studies linking CV function and brain structural integrity in adults with AAMI. The aim of this study was to examine the relationship between white matter microstructural integrity (determined using diffusion MRI) and measures of central CV function (determined using a sphygmoCor XCEL device) in 64 older adults with AAMI aged 56 to 75 years. CV measures included central systolic and diastolic blood pressure (cSBP & cDBP), and also central mean arterial blood pressure and central pulse pressure (cMABP & cPP). Multiple linear regression analysis revealed that increased cSBP significantly predicted reduced microstructural integrity within the fornix. There were also trends towards higher cDBP, cMABP and cPP predicting reduced fornix microstructural integrity. Further analyses also revealed that cSBP is a better predictor of fornix microstructural integrity than brachial SBP. These results indicate that aortic blood pressure may be a significant factor predicting brain microstructural integrity in older adults with AAMI. Future research should examine whether modification of CV function may benefit, or maintain brain structure in older adults, particularly in vulnerable groups such as those with AAMI.

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Rheese, Michael

The role of intended movement velocity in corticomotor activation, power and performance.

Rheese, Michael - Author; Tober, Jacob - Co-Author; Leung, Hans - Co-Author; Andrushko, Justin - Co-Author; Drinkwater, Eric - Co-Author; Hendy, Ashlee - Co-Author

Submission Group

Non-invasive brain stimulation: probing neuroplasticity

Submission Subgroup

Oral submission

Abstract

Background: Intended movement velocity is a verbal-cueing principle used commonly in practical settings by strength and conditioning coaches to optimise muscular strength and power (1), however very little research has been conducted to support its use. While it is often stated that neural adaptations underpin training adaptations in response to different cueing techniques, objective measures of neuroplastic change have not previously been studied. Aim: To investigate the effect of intended movement velocity on the neuromotor adaptation and performance of the knee extensors. Methods: Subjects were randomly assigned to perform either high intended movement velocity (HIMV) training (cued to move rapidly) or a traditional training (cued to move in a controlled manner) for 3 weeks. Actual movement velocity was controlled by isokinetic dynamometer, and matched. Neurophysiological analysis of the quadriceps via electrical nerve stimulation and transcranial magnetic stimulation was conducted pre and post training. Performance outcomes were assessed using an isokinetic dynamometer, force plate and leg extension. Results: Preliminary results (n = 11) show that both groups increased isometric force output. There was a 96.7%% increase in corticospinal excitability for the HIMV group ($p<.001$), whilst traditional group increased by 5.6% ($p=.307$). Isokinetic torque improvements at low speeds were similar for both groups (23.8% vs 26.6%). The HIMV increased force output at high speeds by 25.0% ($p=.015$), while the traditional group increased by 4.7% ($p=.798$), even though both groups trained at low speed. Conclusion: These initial results show that training with HIMV can improve cortical excitability and force output at high movement velocities to a greater extent than traditional resistance training, despite actual movement speed being matched.

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Saddik, Sarah

Default Mode Network Functional Connectivity in Mild Cognitive Impairment and Healthy Controls: An EEG and eLORETA Study

Saddik, Sarah - Author; Fogarty, Jack S. - Co-Author; Al Dabbas, Mahmoud A. - Co-Author; Andrews-Marney, Elana R. - Co-Author; Fagan, Naomi L. - Co-Author; Hattom, Lena C. - Co-Author; Steiner, Dr Genevieve - Co-Author

Submission Group

Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup

Oral submission

Abstract

Mild Cognitive Impairment (MCI) is the stage between healthy ageing and dementia. The Default Mode Network (DMN) is a large scale cortical network of brain regions that functionally interact, and are highly active during times of rest and less active during activity. DMN functional connectivity is reduced in people with Alzheimer's disease, yet minimal research has explored this in MCI. The aim of this study was to assess DMN functional connectivity during resting-state EEG in people with MCI compared to healthy age, gender, and education-matched controls (HC). Two minutes of eyes closed resting state EEG data was recorded from 33 MCI participants and 14 HCs. Data were post-processed and lagged phase synchronisation was calculated for DMN regions of interest (posterior cingulate cortex, left and right hippocampal formations, left and right medial temporal lobes, ventromedial prefrontal cortex, left and right posterior inferior parietal lobe and anterior cingulate cortex) for six EEG bands using eLORETA. People with MCI showed significantly greater lagged phase synchrony than the HC group between most DMN cortical regions in Delta, Theta, Alpha-2, Beta-1, and Beta-2 bands. However, no significant lagged phase synchronisation was found in both MCI and HC groups in the Alpha-1 band. Further, greater lagged phase synchrony was shown in the HC group compared to MCI group between the right hippocampal formation and left posterior parietal lobe in the Alpha-2 band. The results of the study unexpectedly indicated greater connectivity in MCIs across several major components of the DMN. However, there were two DMN regions (right hippocampal formation and left posterior parietal lobe) that were disrupted in HCs, which may highlight cortical areas associated with MCI and increase risk of dementia. Future work should aim to replicate these findings longitudinally to determine whether disruptions in DMN functional connectivity results in greater dementia risk.

References

No references for this abstract submission.

Shipton, Danielle G.

Cerebral Blood Flow and Vascular Predictors of Cognitive Decline in Patients with MCI and SCI: A Feasibility Study

Shipton, Danielle G. - Author; Steiner, Genevieve E. - Co-Author; Rispen, Lauren - Co-Author; Cave, Adele E. - Co-Author; Al-Dabbas, Mahmoud - Co-Author; Andrews-Marney, Elana A. - Co-Author; Fagan, Naomi L. - Co-Author; Fogarty, Jack S. - Co-Author; Hattom, Lena C. - Co-Author
Submission Group Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup Oral submission

Abstract

Dementia is a neurodegenerative syndrome characterised by cognitive decline, and an impaired ability to perform day-to-day activities. Mild cognitive impairment (MCI) is characterised by the slight but noticeable objective decline in cognitive abilities, and is considered the prodromal stage of dementia. Subjective cognitive impairment (SCI) is identified as cognitive concerns expressed by individuals who do not show objective cognitive decline, and is thought to represent preclinical dementia. Both SCI and MCI increase the risk of dementia. Subclinical carotid artery atherosclerosis (CAA) (a vascular risk factor), increased arterial blood pressure, and cerebral blood flow (CBF) variations are predictors of cognitive decline. Few studies have investigated these vascular abnormalities in individuals with SCI. This study examined carotid intima-media thickness (cIMT) and blood flow velocity (BFV) in SCI, MCI and healthy controls (HC) to identify pathophysiological abnormalities that may accelerate the onset of dementia. Forty-five participants underwent Common Carotid Artery Doppler Ultrasonography examination (left/right cIMT: MCI=28, SCI=5, HC=12, Females=27); left Doppler-flow velocity: MCI=11, SCI=3, HC=8, Females=11); atherosclerosis determined as cIMT≥1.00mm. Doppler flow velocity was recorded during two counter-balanced conditions: rest (seated) and during a sustained attention and working memory task (Luminosity® Chalk Board Challenge). Right maximum cIMT was examined, and 50% MCI (M=1.15mm, p=.030), 60% SCI (M=0.94mm), and 50% HC (M = 0.96mm) had atherosclerosis (cIMT ≥ 1.00mm). Left maximum cIMT was examined, and 50% MCI (M=1.03mm, p >.05), 0% SCI, and 42% HC (M=0.99mm) had atherosclerosis. No difference between resting state and task conditions for BFV was identified. However, BFV was higher in MCI and SCI groups, and lower in HCs. Our findings demonstrate that increased cIMT (indicating atherosclerosis) is greater in individuals with MCI than HCs, suggesting CAA and increased BFV may be vascular predictors of cognitive decline. Future studies should employ larger sample sizes to investigate this association with SCI.

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Stephens, Kate

Neurobiological underpinnings of social and emotional functioning in children with comorbid ADHD+ASD

Stephens, Kate - Author
Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Oral submission

Abstract

Background: Children with ADHD and clinically significant levels of ASD symptoms (ADHD+ASD) have been shown to have substantially impaired functioning, over and above having ADHD alone, in particular social and emotional functioning (1). Abnormalities in white matter tracts have been implicated in both ADHD and ASD (2), however, research has not yet explored whether there is an association between measures of social and emotional functioning and limbic system tract properties in children with ADHD+ASD. Aims: This study aimed to examine whether measures of social and emotional functioning were associated with limbic tract properties in children with ADHD and ADHD+ASD. Methods: This study used baseline diffusion MRI data from a longitudinal study of children with ADHD (N=84) and non-ADHD controls (N=80) (3). ADHD status was confirmed using the Diagnostic Interview Schedule for Children version 4 (DISC), while the severity of ASD symptoms was evaluated using the Social Communication Questionnaire (SCQ) and emotional and peer difficulties were measured using the Strengths and Difficulties Questionnaire (SDQ). Clinically elevated ASD symptoms was defined as an SCQ score of 11 and over. Results: Preliminary analyses demonstrated a statistically significant difference between the control, ADHD and ADHD+ASD groups on emotional and peer problems measures ($p<0.001$). An association between emotional problems and mean fractional anisotropy (FA) in the bilateral cingulum was found to be statistically significant for the ADHD+ASD group ($p<.01$). Conclusion Consistent with previous research, children with ADHD+ASD were shown to have greater emotional and peer relationship difficulties than children with ADHD alone. The findings of cingulum anomalies supports previous research, which has linked ASD severity to abnormalities of the cingulum. A longitudinal analysis will be conducted to determine whether there are changes in social and emotional functioning over time, and whether this is reflected in changes of mean FA in the limbic tracts across groups.

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Stone, Caleb

The effects of stress induction of behavioural and ERP measures of human attentional networks

Stone, Caleb - Author; Ney, Luke - Co-Author; Felmingham, Kim - Co-Author; Bruno, Raimondo - Co-Author; Matthews, Allison - Co-Author

Submission Group

Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup

Oral submission

Abstract

While ultimately serving to increase the chance of survival, activation of the acute stress response has been shown to differentially affect aspects of cognitive functioning such as attention. According to Arnsten (2009), stress switches attentional regulation from top-down goal-directed processing to bottom-up stimulus-driven processing, thereby facilitating detection of salient threat-related cues in the environment. In the current study, we aimed to capture the differential effect of acute stress on attention by examining behavioural and electrophysiological measures of the Attention Network Test (ANT) (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Using a mixed experimental design, 37 healthy female participants completed the ANT before and after the Maastricht Acute Stress Test (MAST) or a non-stressful MAST-placebo (Smeets et al., 2012). To assess the effectiveness of the MAST, Subjective Units of Distress Scale (SUDS) scores and salivary cortisol measurements were collected at baseline, five, 30, and 45 minutes after the MAST/MAST-placebo, with the second ANT occurring between the five and 30-minute mark. Analysis of SUDS scores indicated that the stress condition experienced significantly more distress than controls at five and 30 minutes following the MAST/MAST placebo, but not at baseline or 45 minutes following the MAST/MAST placebo. Salivary cortisol measurements further confirmed successful stress induction, with stressed participants recording significantly higher cortisol levels at 30- and 45-minutes post MAST/MAST placebo. There were no significant condition effects for reaction time, accuracy, or for amplitude of the P3 ERP component. However, there was a trend towards reduced N1 amplitude in the right hemisphere following the MAST. These results suggest that neural indices of bottom-up stimulus processing are differentially impacted by acute stress induction, while behavioural performance remains unaffected.

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Varjabedian, David

Theta Amplitude During Immediate and Delayed Word List Recognition in Mild Cognitive Impairment

Varjabedian, David - Author; Karamacoska, Diana - Co-Author; Al Dabbas, Mahmoud A. - Co-Author; Andrews-Marney, Elana R. - Co-Author; Fagan, Naomi L. - Co-Author; Fogarty, Jack S. - Co-Author; Hattom, Lena C. - Co-Author; Steiner, Genevieve Z. - Co-Author
Submission Group Electrophysiology and neuroimaging: shedding light on the human brain

Submission Subgroup Oral submission

Abstract

EEG theta band (4.0-7.5 Hz) activity plays a crucial role in memory (encoding and retrieval) and attentional processing. Theta amplitudes are also reduced in people with Alzheimer's disease, where episodic memory impairment is a hallmark clinical symptom. Mild cognitive impairment (MCI) is thought to represent early stage Alzheimer's disease, however, minimal research has investigated theta amplitude during memory encoding and retrieval in MCI; that was the aim of this study. Thirty-one people with MCI and 9 healthy age, gender, and education-matched controls (HC) (N = 40) had continuous EEG recorded from 62 electrodes during a word list task involving three conditions: 1) encoding, 2) immediate recognition, and 3) delayed recognition (30 minutes post-encoding). EOG-corrected EEG data were transformed to the frequency domain via discrete Fourier transformation (DFT), and theta activity (4.0-7.5 Hz) was extracted for each participant and each trial for each condition. Mean error-rates for immediate and delayed recognition did not differ between groups. The MCI group demonstrated significantly lower theta amplitude compared to HC during encoding ($p = .008$), and the immediate recognition phase, for correctly recognised targets ($p = .049$), and incorrectly recognised targets ($p = .022$). Theta amplitude at encoding was positively correlated with theta amplitude for correctly recognised targets in the immediate recognition phase for MCI ($p < .001$) and HC ($p = .019$). The difference between the MCI and HC groups in theta amplitude was apparent during encoding and immediate recognition, however, the target word error-rate during immediate and delayed recognition did not differ between groups. Counter to expectations, higher theta amplitude at encoding did not improve the likelihood of target word recognition for immediate and delayed phases between groups. These findings suggest that MCI participants experience neurological changes reflected in theta amplitude before significant behavioural changes in episodic memory task performance manifest.

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White, David

Relational memory performance in older adults with subjective cognitive decline and their relationship with hippocampal volume

White, David - Author; King, Rebecca - Co-Author; Larsen, Ryan - Co-Author; Minihane, Anne-Marie - Co-Author; Cohen, Neal - Co-Author; Scholey, Andrew - Co-Author
Submission Group Clinical cognitive neurosciences: mental health, ageing and disease

Submission Subgroup Oral submission

Abstract

Relational memory, the binding of elements in events or scenes, is linked to the integrity of the medial temporal lobe. Performance on relational memory tasks is compromised in patients with medial temporal lobe damage (1) and, in older adults, is associated with the extent of subjective memory concerns (2). The present study investigated age-related differences in relational memory performance in older adults (N=70) with subjective cognitive decline (Mean = 65 ± 6.7 years; 45 female) and the association with structural (volumetric) and functional (blood flow) MRI measures of medial temporal lobe integrity. Relational memory was assessed using a spatial reconstruction task which requires learning the location of a set of items in two-dimensional space. Older age was associated with poorer relational memory performance, with a similar pattern to those recently observed in patients with hippocampal damage (3). Specifically, increasing age was associated with a decrease in correct pairing of items with location ($r=-.437$, $p<.001$), but an increased number of (incorrect) items placed in a studied location ($r=.384$, $p=.001$). As expected increasing age was associated with a reduction in hippocampal volumes both overall (left hippocampus, $r=-.529$, $p<.001$; right hippocampus: $r=-.527$, $p<.001$), and across subdivisions of the long axis of the hippocampus (head/body/tail). However the association between volume of the posterior hippocampus and performance measures remained significant when controlling for age. The structure-function relationships held for relational accuracy (item-location accuracy: left: $r=.314$, $p.013$; right: $r=.375$, $p=.003$) and incorrect item-correct location relational errors (left:$-.281$, $p=.027$; right: $-.344$, $p=.006$). Hippocampal blood flow, as assessed by arterial spin labelling, was not significantly associated with age, relational memory performance or hippocampal volumes. These findings further elaborate the specific relational memory impairments associated with aging and their association with volumetric measures of hippocampal integrity, adding to evidence of a functional differentiation along the longitudinal hippocampal axis.

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