UCL Centre for Developmental Cognitive Neuroscience

SEMINAR SERIES

Previous seminars:

Wednesday 14th December 2011 @ 4:30pm

Anna Simmonds

Computational , Cognitive & Clinical Neuroimaging Laboratory and MRC Clinical Sciences Centre, Imperial College London

"Motor-sensory learning of foreign speech"

Levinsky Room, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

Articulatory movements necessary for producing native speech are highly over-learned and automatic. In contrast, those necessary for non-native phonemes are unfamiliar and require greater engagement of sensorimotor neural feedback systems. I am particularly interested in the function of the temporo-parietal junction (TPJ) - planum temporale (posterior auditory association cortex in the supratemporal plane) and parietal operculum (the location of somatosensory association cortex) – during native and non-native speech production. The motivation for this research has been to study bilingualism as a motor learning skill, in contrast to the many studies of bilingualism in terms of linguistic competence. Although my studies are on normal participants, my results have the potential to translate to studies on impaired speech production that can accompany vascular and neurodegenerative diseases.

Biosketch

Anna Simmonds is in the final year of her PhD, supervised by Professor Richard Wise and Dr Robert Leech, at Imperial College London. Her research uses functional magnetic resonance imaging to investigate feedforward (motor) and feedback (auditory and somatosensory) systems for foreign language speech production. Her background is in language teaching and a particular focus of her PhD research is how these feedforward and feedback systems are modulated by proficiency levels. Her most recent study manipulates proficiency by training monolingual subjects in the production of non-native speech sounds, with scanning pre- and post-training.

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9th November 2011 @ 4.30pm

Dr Jess Nithianantharajah

Research Associate, Wellcome Trust Sanger Institute, University of Cambridge

"Dissecting the Molecular Basis of Cognition"

The Levinsky Room, Philip Ullmann Wing, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

The vertebrate cognitive repertoire comprises forms of learning, attention and executive functions and how this set of important behaviors evolved is poorly understood. Gene duplication and diversification in postsynaptic proteins is a potential mechanism driving the evolution of vertebrate cognition. I will present recent work on a family of key postsynaptic proteins, Discs large (Dlg), a scaffold protein encoded by a single invertebrate gene and four vertebrate paralogs. We probed the cognitive repertoire using a recently developed computerized touchscreen test battery in mice carrying deletions in each Dlg gene and find that each gene diversified to play specific roles in distinct cognitive processes. Using analogous touchscreen tests in humans with Dlg2 mutations, which has been linked to Schizophrenia, we find a high degree of similarity between mouse and human in the cognitive processes Dlg2 selectively impacts on suggesting the derived role of Dlg2 in human cognition arose prior to primate brain evolution. These studies suggest duplication and diversification of Dlg proteins expanded higher cognitive functions at the cost of conferring genetic susceptibility to mental illness.

Biosketch

Dr. Nithianantharajah is a Postdoctoral Research Associate working with Prof Seth Grant in the Genes to Cognition program at the Wellcome Trust Sanger Institute, Cambridge. Her research interests include understanding the molecular and neural basis of specific cognitive capacities, particularly, the involvement of postsynaptic proteins in cognitive function and dysfunction in brain disorders. She completed her PhD at the University of Melbourne examining synaptic plasticity following experience and learning and then worked with Dr Anthony Hannan at the Howard Florey Institute, University of Melbourne, Australia investigating the effects of environmental enrichment and gene-environment interactions mediating synaptic and behavioural plasticity associated with cognitive dysfunction in Huntington's disease.

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20th October 2011 @ 4.30 pm

Professor Margot Taylor

Director of Functional Neuroimaging, Diagnostic Imaging, The Hospital for Sick Children, Toronto, & Professor of Medical Imaging, University of Toronto

"Functional and structural neuroimaging of cognitive development: Children born very preterm and children with ASD"

Levinsky Room, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

I will present an overview of a number of our neuroimaging studies that address differences in brain structure and function between typically developing children, children born very preterm (<32 weeks gestational age) and children with ASD. We use structural MRI measures (cortical thickness and DTI) and functional measures using fMRI and magnetoencephalography (MEG) in school-aged children. The cognitive tasks employed target frontal lobe functions, and include emotional face processing and memory tasks.

Biosketch

Dr. Taylor is a senior scientist at the Hospital for Sick Children and a professor in the departments of Paediatrics, Medical Imaging and Psychology at the University of Toronto. Her research focus is on the use of fMRI, MRI and MEG to understand the neural bases of cognitive development, assessing functional brain correlates of high-level cognitive skills, particularly frontal lobe functions (set-shifting, emotional processes, inhibition and working memory), using protocols adapted for children. A major focus has been on children with autism and children born very preterm, with the aim of understanding the brain functions that underlie the atypical frontal lobe abilities in these children and adolescents. Her group has also optimized a complex series of multimodal neuroimaging protocols for very preterm infants (born at <32 weeks gestational age), studied at birth and followed longitudinally.

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12th October 2011 @ 4.30 pm

Professor Narinder Kapur

Consultant Neuropsychologist & Honorary Professor of Neuropsychology, University of Southampton

"Memory Aids in Memory Rehabilitation"

Seminar Room PUW4, Philip Ullmann Wing, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

This will be a clinically-oriented talk that reviews the role of memory aids in memory rehabilitation. I will describe how memory aids may be useful in addressing particular memory symptoms in neurological patients. I will briefly consider some of the evidence for the effectiveness of memory aids. I will present some recent research we have carried out on a novel memory photographic aid, SenseCam, originally developed by Microsoft. I will present a video clip showing a patient describing his experience of being treated in our Memory Aids Clinic in Cambridge.

Biosketch

Narinder Kapur currently holds the position of Visiting Professor of Neuropsychology at University College London, and Consultant Neuropsychologist at Clementine Churchill Hospital, Harrow, London.

He is past President and a founder member of the British Neuropsychological Society. His main areas of research are in the area of human memory disorder. He is currently involved in projects relating to the pure amnesic syndrome after hippocampal lesions, and Transient Epileptic Amnesia. He has a major interest in paradoxical phenomena relating to the human brain, which is the subject of his most recently published book The Paradoxical Brain, Cambridge University Press. He has an interest in how memory aids may benefit neurological patients, having set up the first Memory Aids Clinic in the country while in Cambridge, and he is currently co-supervising a PhD in this area.

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14th September 2011 @ 4.30 pm

Dr Iroise Dumontheil

Postdoctoral Research Fellow, UCL Institute of Cognitive Neuroscience

"Development of executive functions: behaviour, neuroimaging and genetics"

The Levinsky Room, Philip Ullmann Wing, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

Large scale longitudinal studies of brain structural development have demonstrated prolonged and region-specific trajectories of grey and white matter development, with significant changes occurring during adolescence and until early adulthood. However, it is still unclear how these structural changes relate to functional and behavioural changes during childhood and adolescence, and little is known of individual differences in brain and cognitive function during typical development. In this talk I will present work combining genetics, behavioural, and both structural and functional MRI measures to study the development of executive functions during late childhood and adolescence. The findings show that although concomitant, functional decreases in brain activity in the prefrontal cortex do not necessarily reflect decreases in grey matter volumes; that neuroimaging data may be more sensitive to individual differences associated with genetic polymorphisms or academic performance than behaviour alone; and that the effect of genetic polymorphisms are not necessarily static during development.

Biosketch

Iroise Dumontheil is a Postdoctoral Research Fellow at the Institute of Cognitive Neuroscience, University College London. Following her PhD completed in between UCL and University Paris VI, she was a postdoctoral fellow at the MRC-Cognition and Brain Sciences Unit in Cambridge, at UCL, and most recently at the Karolinska Institutet in Stockholm. She has run a series of research studies on the typical development of social cognition and cognitive control during adolescence, using a combination of methods including functional and structural neuroimaging, behavioural assessments, and genetics.

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3th July 2011 @ 4.30 pm

Dr. Tom Mrsic-Flogel

Wellcome Trust Research Career Development Fellow, UCL Department of Neuroscience, Physiology & Pharmacology

"Mapping synaptic connectivity between functionally characterised neurons in the neocortex"

The Levinsky Room, Philip Ullmann Wing, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

Neuronal connectivity is fundamental to information processing in the brain. Understanding the mechanisms of sensory processing, therefore, requires uncovering how connection patterns between neurons relate to their function. This has not been attempted with existing approaches, because neuronal functionality has to be assessed in the intact brain (electrode recordings, two-photon calcium imaging), while synaptic connectivity mapping is only feasible in brain slices (paired whole-cell recordings). To provide a solution to this problem, we have combined three powerful techniques that enable us first to visualise and characterise response properties of hundreds of neurons in the cortex with two-photon calcium imaging, then to identify the same neurons in slices of the same tissue using custom 3D image registration algorithms, and finally assay synaptic connections between a subset of these neurons with multiple whole-cell recordings. Applying this approach to mouse visual cortex, we found that connection probability was related to the similarity of visually driven neuronal activity. Neurons with the same preference for oriented stimuli connected at twice the rate of neurons with orthogonal orientation preferences. Neurons responding similarly to naturalistic stimuli formed connections at very high rates, while those with uncorrelated responses were rarely connected. Bidirectional synaptic connections were found more frequently between neuronal pairs with strongly correlated visual responses. Our results reveal a high degree of functional specificity of synaptic connections in local cortical circuits, and point to the existence of fine-scale subnetworks dedicated to processing related sensory information.

Biosketch

Thomas Mrsic-Flogel has a degree in Biology from University of Oxford, and a Ph.D. in auditory processing from Physiology Department, Oxford, supervised by Andrew King. His postdoctoral work on high-resolution in vivo imaging of neuronal circuit plasticity in visual cortex was carried out at the Max Planck Institute of Neurobiology in Munich with Tobias Bonhoeffer and Mark Huebener. He was awarded the Wellcome Trust Career Development Fellowship in 2007 and a Senior Research Fellowship in 2011 at the Department of Neuroscience, Physiology and Pharmacology, University College London.

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8th June 2011 @ 4:30pm

Dr Jennifer Bizley

Dorothy Hodgkin Research Fellow, UCL Ear Institute

"Listening to the Auditory Cortex: Neural Measures of Pitch Perception"

Room B, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

We are able to recognize and understand speech across many different speakers, voice pitches and listening conditions. However, the acoustic waveform of a sound (e.g. for example the vowel "ae") will vary considerably depending on the individual speaker. Moreover, the ear itself will filter the sound in a location-dependent fashion, and the "ae" may be embedded in a cacophony of other, background sounds in our often cluttered acoustic environments. Because we can perceive the pitch, timbre and spatial location of a sound source independently, it seems natural to suppose that cortical processing of sounds

might separate out these attributes. However, recordings made in primary and secondary cortical areas of the ferret suggest that neural encoding of pitch, timbre and location is highly interdependent. Moreover, sensitivity to these sound percepts was distributed throughout the cortical fields examined. To investigate whether these distributed responses might underlie pitch perception, we compared the performance of ferrets trained in a pitch discrimination task to the pitch discrimination abilities of auditory cortical neurons. To achieve a more robust decoding of the neural responses, we developed a population neurometric analysis, with which we decoded the activity of ensembles of simultaneously recorded units. We found several parameters of the ensemble response to be informative; both spike count vectors and relative response latency vectors encoded stimulus pitch just as effectively.

Biosketch

Jennifer Bizley is a neuroscientist based at the Ear Institute, University College London, where she holds a Royal Society Dorothy Hodgkin Research Fellowship and a UCL Excellence Bridging Award. She studied Natural Sciences at University of Cambridge and completed her D.Phil. as a student at the University of Oxford. After her doctorate she worked as a Post-Doctoral Scientist and Research Fellow within the Department of Physiology, Anatomy and Genetics in Oxford. In 2009 Jennifer was awarded a L'Oreal-UNESCO For Women in Science Fellowship which funded a period of research at Boston University and the Martinos Center for Biomedical Imaging, Harvard.

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Wednesday 11th May 2011 @ 4:30pm

Professor Yonata Levy
Psychology Department and Hadassah-Hebrew University Medical School, Jerusalem.

"Delay IS deviance' Insights from language development in Williams syndrome and in Down syndrome"

Room C, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

The relevance of congenital brain disorders to our understanding of normal cognition rests on the assumption that the basic properties of the cognitive network are preserved even in the face of brain alterations. Such robustness can be a consequence of functional plasticity as well as the outcome of constraints imposed by the computational properties of the problem-space. In the case of language, these are spelt out in theories of Universal Grammar. I shall report of a three year naturalistic follow-up of the development of basic grammar in nine children with Williams syndrome (WS), ages 46.8m – 74.1m, and nine children with Down syndrome (DS), ages 54.7m – 87.7m. Developmental trajectories of grammatical variables, as well as profile analyses showed similar trajectories in the participant groups and in typically-developing controls, with one possible exception seen in the expressive language of the DS group, yet not in the WS group. Similarity breaks down however, when time is considered one of the variables, as onset

and pace were drastically different among the groups. The controversy between the neuro-constructivist approach (Karmiloff-Smith, 1998; Thomas and Karmiloff-Smith, 2003) and the "normalcy" approach to cognitive development will be discussed in the light of these results. I shall examine the familiar dichotomy between delay and deviance, arguing that a distinction between the two is ill-conceived, given the centrality of developmental timing in genetic transcription and the network properties of brain functioning.

Karmiloff-Smith, A. (1998). Development itself is the key to understanding developmental disorders. *Trends in Cognitive Sciences, 2(10), Oct,* 389-398.

Thomas, M. S. C.& Karmiloff-Smith, A. (2003). Modeling language acquisition in atypical phenotypes. *Psychological Review, 110(4)*, 647-682.

Biosketch

Yonata Levy is a linguist and a developmental neuropsychologist. Her research focuses on cognitive processes in children with congenital syndromes (i.e. autism, Williams syndrome, Down, Fragile X). Her research focuses on language, reading and facial emotions. Recently she was part of the group at the Whol Institute for Brain Imaging who studied white matter pathways in non-verbal autistic children. Prof. Levy established the first neuropsychology program in Israel and was the head of this program for 7 years. In 2006-2010 she served as the Provost of the International School at the Hebrew University. Prof Levy is a visitor at the Developmental Cognitive Neuroscience Unit from March-June 2011.

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Wednesday 13th April 2011 @ 4:30pm

Dr Kate Baker

Specialty Registrar in Clinical Genetics, Addenbrookes NHS Trust, Cambridge

"Neuroimaging Phenotypes in Genetic Disorders: Examples and New Challenges"

Room B, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

With the advent of whole-genome diagnostic approaches, the proportion of neurodevelopmental disorders remaining genetically unexplained is set to decline rapidly. Once a causal diagnosis has been established, cognitive neuroscience has much to offer in meeting new scientific and clinical challenges. This talk will illustrate how quantitative MRI has been used to elucidate neuroanatomical phenotypes underlying cognitive and psychiatric features in two different genetic disorders (Bardet-Biedl syndrome and 22q11 deletion syndrome). Future partnerships between medical genetics and cognitive neuroscience are necessary, to aid diagnostic interpretation of genomic variants and to reveal potential targets for mechanism-based therapeutic intervention.

Biosketch

Dr Kate Baker MRCPCH PhD graduated from the UCL MBPhD programme in 2005. Following foundation training at UCH, she undertook paediatric specialty training in East London, alongside an NIHR Academic Clinical Fellowship in Paediatric Neuroscience and Mental Health at UCL-ICH. She has recently been appointed NIHR Clinical Lecturer in Medical Genetics at the University of Cambridge, and aims to continue integrating research with clinical practice at the interface between genetics and developmental neuroscience.

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Wednesday 16th March 2011 @ 4:30pm

Dr John Wattam-Bell
UCL Division of Psychology & Language Science

'Developmental reorganisation of cortical visual processing in infancy'

Room C, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

It is widely accepted that the cortex processes visual information in hierarchically-organised parallel pathways. One major division is between the dorsal cortical stream, which includes several motion-sensitive areas and contributes to visual control of actions, and the ventral steam, consisting of form-sensitive areas involved in object and face recognition. This talk will describe research in the Visual Development Unit on the typical and atypical development of form and motion sensitivity, which has revealed that these pathways have distinct developmental trajectories, and undergo significant reorganisation between infancy and adulthood. Changes in cortical visual networks that might account for this developmental reorganisation will be discussed, including the possible roles of emerging feedback cortical connections, and of direct thalamic inputs to extrastriate areas that bypass primary visual cortex.

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23rd February 2011 @ 4:30pm

Professor Robin Morris
King's College Institute of Psychiatry

"White Matter Integrity, Cognition and the Ageing Brain"

Room B, UCL Institute of Child Health, 30 Guilford Street, London, WC1N 1EH

Abstract

In the past age related change in cognition has been seen as an inevitable consequence of the aging process. However, considerable variability in decline occurs and this leads to the notion that there might be multiple neurobiological factors affecting individual change. One of these factors is the amount of white matter degeneration, in turn affected by small vessel disease. The talk outlines recent research concerning the characteristic neuropsychological changes associated with small vessel disease including use of diffusion tensor imaging to explore regional white matter tract integrity in relation to cognitive function. This research includes studies of patients with neurological small vessel disease and normal aging.

Biosketch

Robin Morris has a degree in Physiology and Psychology from Oxford University and a Ph.D. on working memory in Alzheimer's disease at the MRC Applied Psychology Unit, Cambridge, supervised by Alan Baddeley. His postdoctoral work was in the University of Cambridge with Trevor Robbins and in the University of Toronto with Fergus Craik. He was appointed lecturer at the Institute of psychiatry in 1989 and Professor of Neuropsychology in 2001. His main interests are in the neuropsychology of memory and executive functioning. He has conducted research on a range of patients with neuropsychological disorder, including those with focal brain damage, schizophrenia, and Alzheimer's disease. He is a consultant clinical neuropsychologist at King's College Hospital, where he is head of the Clinical Neuropsychology Department. He has published about 180 peer reviewed papers and 40 book chapters. He co-edited with Professor James Becker the book 'Cognitive Neuropsychology of Alzheimer's Disease' published by Oxford University Press. He was Program Chair for the International Neuropsychological Meeting in Dublin, 2005. He has been on the Governing Board of the International Neuropsychological Society and on the committee of the British Psychological Society Division of Neuropsychology. He is associate editor for Cortex and the Journal of Neuropsychology.

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Wednesday 19th January 2011 @ 4:30pm

Dr Michael Thomas
Reader in Cognitive Neuropsychology, Birkbeck College

'A computational model of regression in autism: Does regression happen in all cases of autism?'

4th Floor Seminar Room, Wellcome Trust Centre for Neuroimaging, 12 Queen Square

Abstract

Loss of previously established behaviours in early childhood constitutes a markedly atypical developmental trajectory, found almost uniquely in autism, and its cause is unknown (Baird et al., 2008). I will describe an artificial neural network model of developmental regression, which explores the hypothesis that regression is caused by over-aggressive synaptic pruning and identifies the mechanisms involved. I use a population modelling technique, in which neurocomputational parameters and the learning environment varies across a large number of simulated individuals. Regression was generated by the atypical setting of a single pruning-related parameter. Simulations demonstrated a probabilistic relationship between the atypical pruning parameter and the presence of regression, as well as variability in the onset, severity, behavioural specificity and recovery from regression. If behavioural regression indexes an underlying anomaly that characterises the broader phenotype of autism, I show how the model would account for several additional findings: shared gene variants between autism and language impairment (Vernes et al., 2008), larger brain size in autism but only in early development (Redcay & Courchesne, 2005), as well as the possibility of quasi-autism, caused by extreme environmental deprivation (Rutter et al., 1999). Based on this hypothesis, I make a novel prediction that the earliest developmental symptoms in the emergence of autism should be sensory and motor rather than social, and review preliminary support for this prediction.

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Wednesday 8th December 2010 @ 4:30pm

Professor Cathy Price
Wellcome Department of Imaging Neuroscience, University College London

"Language in the absence of most of the left hemisphere: A comparison of childhood hemispherectomy and stroke"

The Levinsky Seminar Room, ground floor, UCL Institute of Child Health, 30 Guilford Street, WC1N 1EH

Abstract

In my talk, I will consider the contribution of the right hemisphere to single word comprehension and production. I will start by showing the word processing abilities of three young right handed adults (aged 18, 21 and 29) who had left hemispherectomies in the first 10 years of their lives. Their reading abilities were in the dyslexic range but they all had accurate auditory word comprehension, object naming and verbal fluency. This contrasts to the severe loss of single word comprehension and production abilities observed in the early years after large left hemisphere strokes. However, when time since "left hemisphere loss" is controlled (i.e. 10-20 years) auditory word comprehension and repetition are comparable in those with adult stroke or childhood hemispherectomy. This suggests that the right hemisphere can eventually learn to support auditory word processing, even in adulthood. I will then discuss why reading is so difficult without the left hemisphere. Four pieces of evidence suggest that efficient reading requires the right hemisphere as well as the left hemisphere: (1) Patients with right (or left) hemisphere damage have inefficient visual word processing, even 10-20 years after stroke; (2) Healthy controls are slower and less accurate making phonological judgments when TMS is applied over right or left hemisphere frontal and parietal sites; (3) Healthy skilled adult readers have more bilateral temporal and parietal grey matter than illiterate adults; (4) In healthy skilled readers, functional connectivity between the left and right angular gyri is greater during reading than object naming. Together this evidence showing that both hemispheres are needed for efficient reading may explain why learning to read has been so difficult in our 3 adults who had their left hemisphere removed in childhood.

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Wednesday 24th November 2010 @ 4.30pm TO BE RE-ARRANGED

Professor Faraneh Vargha-Khadem
Director of the UCL Centre for Developmental Cognitive Neuroscience

"Dissociations in cognitive memory associated with early hippocampal injury resulting from hypoxia-ischaemia"

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Wednesday 20th October 2010 @ 4:30pm

Dr Jon Clayden

Lecturer in Neuroimaging & Biophysics, Imaging and Biophysics Unit, UCL Institute of Child Health

"Common factors and gender differences in normal white matter tract development"

Room B, 2nd floor, Wellcome Trust building, UCL Institute of Child Health, 30 Guilford Street, WC1N 1EH

Abstract

It is by now well accepted that structural change to both the grey and white matter of the developing brain continues well beyond birth, with processes such as axonal myelination proceeding right up to the onset of adulthood. Diffusion MRI studies have demonstrated that microstructural changes in white matter can be observed with increasing age. It has also been reported, however, that the diffusion characteristics of different white matter tracts tend to be linked.

Here I will describe a study using diffusion and structural MRI, and principal components analysis, to identify common factors and gender differences in the developmental trajectories of different tracts over the age range of 8-16 years, with respect to diffusivity and diffusion anisotropy. I will also discuss the general benefits of this kind of approach to tract-based analysis.

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Wednesday 15th September 2010 @ 4:30pm

Dr Luc Berthouze

Senior Lecturer, Centre for Computational Neuroscience and Robotics, University of Sussex, and Honorary Senior Lecturer, Developmental Cognitive Neuroscience Unit, UCL Institute of Child Health

"Long-range temporal correlations of oscillation amplitude in EEG during development"

Room C, 2nd floor, Wellcome Trust building, UCL Institute of Child Health, 30 Guilford Street, WC1N 1EH