SiNAPSA Neuroscience Conference 2011

Central European FENS Featured Regional Meeting

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Plenary lectures and special talks

Principles and mechanisms of neuronal migration: Relevance for human brain disorders

CME

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The identity, synaptic relationship and, ultimately, function of neurons is defined by their position. It is particularly evident in the cerebral cortex where neurons acquire their proper areal, laminar and columnar position during development by active migration from multiple sites of origin and involve complex molecular events and cell-cell interactions. Specific genes and variety of morphoregulatory and signaling molecules cooperate in orchestrating various components of neuronal migration. We found that the rate of neuronal migration can be disturbed by manipulation of selected gens or exposure of embryo to various physical, chemical, and biological agents. Consequences of disruption or even slowing down of neuronal migration can range from gross heterotopias to subtle abnormalities of neuronal positions that eventually affect the pattern of synaptic circuits and may ultimately cause variety of neuropsychiatric disorders.

Neural plasticity: liberating the brain from its genetic constraints

CME

Colin Blakemore

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Development of complex neural circuits depends on general rules, specified by genetic instructions, with adaptive mechanisms to fine-tune connectivity. Such flexibililty, essential for development, might have underpinned evolutionary changes in complex brains. In addition, synaptic plasticity enables neurons to change the strength of their connections in response to the pattern of activity passing through them, helping individuals to match perceptual, cognitive and motor skills to the nature of the world around them. Neuronal plasticity, although genetically determined, enabled humans to escape from the informational limits in the blueprint of their genes and propelled them into a different mode of evolution

On the relationship between emotion and cognition

CME

Luiz Pessoa

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The current view of brain organization supports the notion that there is a considerable degree of functional specialization and that many regions can be conceptualized as either 'affective' or 'cognitive'. Popular examples are the amygdala in the domain of emotion and the lateral prefrontal cortex in the case of cognition. This prevalent view is problematic for a number of reasons. It will be argued that complex cognitive–emotional behaviors have their basis in networks of brain areas, none of which should be conceptualized as specifically affective or cognitive. Central to cognitive–emotional interactions are brain areas with a high degree of connectivity called hubs (e.g., amygdala), which are critical for regulating the flow and integration of information between regions. To illustrate cognitive-emotional processing, I will discuss a series of studies that have investigated interactions between emotion and perception (including studies showing that emotional perception is not automatic) and, more recently, between emotion and executive function.

Classifying clinical images: a new aid to dementia diagnosis with implications for treatment strategies

CME

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The application of modern computerized automated techniques for analyzing structural and functional brain images have led to real advances in the application of advanced neuroimaging to clinical practice in ways undreamed of only a short time ago. One major advance is the development of image classification techniques that puts diagnosis of the individual at the centre of the enterprise. This approach is currently based on machine learning techniques, some of the best results being obtained with support vector machines (SVM). There is a lot of activity in this area at present and new methods of analysis and results are constantly being reported. MR scanner manufacturers are becoming interested in translating these encouraging results into potential products.

Thus, neuroimaging techniques, in addition to their traditional diagnostic role are currently expanding understanding of the structural and functional changes that occur in dementia. Further research may allow identification of early pathological signs of AD, before clinical symptoms are evident, providing the opportunity to test preventative therapies.

The lecture will review imaging in Alzheimer's disease and other neurodegenerative diseases and attempt to project into the future how the field will develop. Additionally obstacles to such developments will be highlighted and approaches to validating image classification as a diagnostic tool and a means of monitoring treatment discussed.

Untangling the role of protein aggregation in neurodegenerative diseases

CME

Maria Grazia Spillantini

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Parkinson's disease (PD) is the most common movement disorder. Clinically is characterized by rigidity, resting tremore and bradikinesia which are associated with degeneration of neurones in the substantia nigra and other brain regions. Although the movement disorder is the main feature of (PD), non motor symptoms such as depression, disturbed sleep and intestinal problems can precede the motor dysfunction. Neuropathologically PD is characterized by the presence of intracellular filamentous protein aggregates known as Lewy bodies and Lewy neurites in neurones of the substantia nigra and other brain regions. Indeed Braak et al. have shown that Lewy bodies are present very early in in the gut of PD patients and concluded that the pathology progresses from the gut to the brain through neuronal networks. Genetic mutations and multiplications of the alpha-synuclein gene have been found to be the cause of familial forms of PD and alpha-synuclein has been also shown to be the major componenet of the Lewy bodies. These two findings clearly associate alpha-synuclein to the pathogenesis of the PD but the contributions of Lewy bodies to neurodegeneration and the mechanism leading to their formation remain unclear. We have produced a transgenic mouse models that expresses truncated human alpha-synuclein under the control of the tyrosine hydroxilase promoter in dopaminergic neurons. In these mice, both in the presence or absence of endogenous alpha-synuclein, truncated alpha-synuclein aggregates into granular and filamentous material and this aggregation is associated with progressive reduction in dopamine release, dopamine loss and appearance of motor impairment. The reduction of dopamine release is associated with alpha-synuclein aggregates at the presynaptic terminal and redistribution of the SNARE complex involved in neurotransmitter release. In this mouse model we find some accumulation of alpha-synuclein also in the gut. These mice represent a good model where to investigate the mechanisms associated to alpha-synuclein aggregation.

Wired for sex: the neurobiology of Drosophila courtship behaviour

CME

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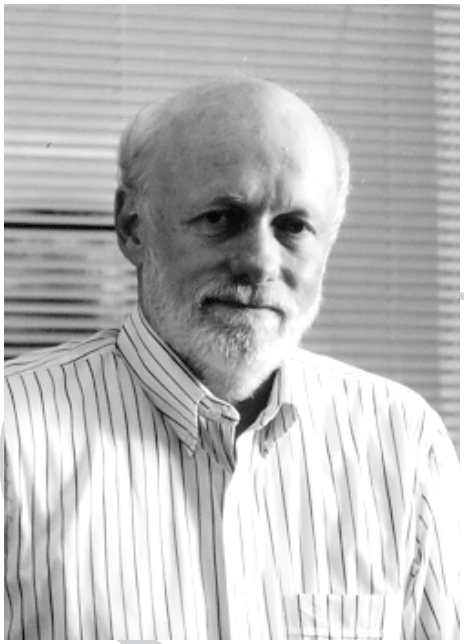
How are innate behavioural repertoires pre-programmed into the nervous system? And how does trial-and-error learning allow each individual to fine tune this innate template to adapt to the conditions of the local environment? The courtship behaviour of Drosophila melanogaster males is an ideal model system to address these questions at the level of single cells and genetically-defined neural circuits. I will present our current understanding of the neural circuity that generates male courtship behaviour. This analysis has revealed how sexual dimorphisms sculpted into these circuits by the fruitless gene shape the distinct behaviours of males and females. Elements of this circuit mediate dopamine-dependent learning in the adult fly, so that his courtship activity is preferentially directed at receptive virgin females. These studies are beginning to reveal the cellular and circuit mechanisms underlying innate and learned behaviours in this model system.



Andrej O. Župančič Memorial lecture

The α,β-Hydrolase Fold: Offering Adhesion and Catalysis within the Synapse

CME

Palmer Taylor

Department of Pharmacology, Skaggs School of Pharmacy & Pharmaceutical Sciences, University of California, San Diego, USA

Janez Faganel Memorial lecture

What causes weakness in myasthenia gravis?

CME

Donald B. Sanders

Duke University Medical Center, Durham, USA

EJN Best Publication Award talk

A common molecular basis for membrane docking and functional priming of synaptic vesicles

CME

Lea Siksou

Friedrich Miescher Institute for Biomedical Research, Basel, Switzerland