

Date of submission:
Project title:

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SINAPSE PhD Project Proposal Template for PhDs starting in 2009

SINAPSE Centre (i.e. primary university to which this studentship will be attached*):

University of Dundee

First supervisor: contact details

Name: Dr Douglas Potter
Department: School of Psychology
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Co- supervisors: contact details

Name: Dr Cyril Pernet
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Name: Dr Guillaume Rousselet
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Speciality of first supervisor:

Cognitive Electrophysiology

Speciality of the co- supervisor:

Cognitive neuroimaging (EEG, fMRI)

PROJECT

Title:

Spatial and temporal imaging of attention reorienting mechanisms

Planned start date (month/year):

Sept 2009

Likely background of suitable student (eg. Neuroscience, MR Physics, Chemistry, Psychology) and essential skills required prior to starting this PhD:

Likely background: Candidates from neuro-informatics or cognitive sciences with computational experience.
Essential skills: Good mathematical or statistical skills. Ability to program in Matlab.
Additional skills: A background in Cognitive Neuroscience or Psychology

Summary of proposed project (approximately 200 words):

Background: Fox et al. (Fox et al., 2005) hypothesize that a dorsal 'goal-driven' attention network controls environmentally directed processes (perception and action) and a 'default network' controls internally directed processes (memory and introspection). Within this model it is hypothesised that a ventral 'stimulus-driven' network facilitates reorientation in goal-driven attention as well as between internally and externally directed processing modes. We have demonstrated abnormal patterns of brain activity in both the goal-driven and stimulus-driven networks in individuals with a history of mild concussion (Potter et al., 2001) and in patients diagnosed with schizophrenia (Potter et al., 2008). These abnormalities may result from reduced effectiveness of frontal control caused by diffuse neurotransmitter imbalances (Rolls et al., 2008). The planned research will extend our previous work by providing a better understanding of the role of the stimulus-driven system in switching between goal-driven and default processing modes.

Aims:

To better characterise the function of the stimulus-driven system by determining the effects of task load and distractor contingency on the temporal relationships between the components of the stimulus-driven system.

To better characterise the function of the stimulus-driven system by inducing more explicit switching and maintenance of processing modes.

Method: Combine fMRI and EEG to visualise selective activation or suppression of posterior and anterior components of the 'stimulus-driven' control system while participants perform a number decision paradigm in which the temporal and spatial relationship of goal relevant and distractor stimuli are systematically manipulated.

Outcome: The development of optimised, inexpensive (EEG), measures of cognitive control for use in the assessment of pharmacological efficacy in patients diagnosed with schizophrenia, depression and mild cognitive impairment.

Key references (up to five):

References

- Fox MD, Snyder AZ, Vincent JL, Corbetta M, Van Essen DC, Raichle ME (2005) The human brain is intrinsically organized into dynamic, anticorrelated functional networks. *PNAS* 102:9673-9678.
- Potter DD, Bassett MRA, Jory SH, Barrett K (2001) Changes in event-related potentials in a three-stimulus auditory oddball task after mild head injury. *Neuropsychologia* 39:1464-1472.
- Potter DD, Schloerscheidt A, Back D, Nerad L, Day R, Tatler B, Hurko O (2008) Development of Translational Biomarkers of Attention Function. In: *TMRC 2nd Annual Scottish Translational Medicine Research Conference*. Glasgow.
- Rolls ET, Loh M, Deco G, Winterer G (2008) Computational models of schizophrenia and dopamine modulation in the prefrontal cortex. *Nature Reviews Neuroscience* 9:696-709.
- Rousselet GA, Pernet CR, Bennett PJ, Sekuler AB (2008 (In Press)) Parametric study of EEG sensitivity to phase noise during face processing. *BMC Neuroscience* 9:98.

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In what way does this PhD proposal meet the SINAPSE criteria as described in the call for proposals? (100 words)

This project will involve collaboration between the Universities of Dundee (Potter), Edinburgh (Pernet), Glasgow (Rousselet) and NHS Tayside (Lerski). We will employ novel parametric experimental designs combined with general linear analyses of single trial EEG to optimise signal extraction (Rousselet et al., 2008 (In Press)). When combined with fMRI this will provide much improved information on the spatio-temporal dynamics of attention control. This research will contribute to an existing Scottish Translational Medicine Research Collaboration program which has the aim of developing new biomarkers of cognitive function in Schizophrenia as well as other disorders such as depression and mild cognitive impairment.

Please state the name of the local SINAPSE Centre Lead with whom you have discussed this project (Leads are listed on the Call for Proposals, applications submitted without prior discussion will not be considered.):

Dr Richard Lerski