



**Interested in Biological Psychiatry and Psychopharmacology and/or Brain Imaging?
If so, you may be interested in this PhD project offered in 2008 (with a PhD scholarship)**

Physiological and Neurochemical Mechanisms of Executive Control

Response inhibition and error processing are crucial aspects of executive control that allow behaviour to be guided in a goal-directed and adaptive fashion. Response inhibition refers to the ability to inhibit behaviour when a change in the environment dictates that it is no longer appropriate. Error processing, on the other hand, refers to those evaluative processes associated with the detection of performance failures and the subsequent correction of behaviour. Detecting errors and engaging in behavioural correction is critical to our ability to act flexibly in complex and changing environments. Recent research also suggests that an inability to be aware of one's errors might contribute to the self-monitoring deficits observed in clinical conditions, such as ADHD and schizophrenia. There are a number of cognitive probes for distinct aspects or processes of executive control, including *inhibition*, *error correction* and *error awareness*. Importantly, each of these cognitive processes is associated with a distinct *neural signature* that can be measured using event-related potentials (ERPs). In humans, response inhibition is often measured using variants of the classic *Go/No-go* or *stop-signal* paradigms. In these paradigms, an established, or *pre-potent*, "Go" response must be inhibited upon the presentation of a "No-Go" stimulus. Electrophysiological studies indicate that the ERP signatures of response inhibition is an N2/P3 (No-Go) waveform that occurs between 200-400ms after the presentation of a No-Go stimulus. Error correction and error awareness can also be examined using variants of the Go/No Go tasks and the ERP signatures of error-related processing are an early negative component, termed the error-negativity (or **ERN**) (pre-conscious error related response), and a later positive component, termed the **Pe** (related to error awareness and conscious response). Pharmacological studies suggest that response inhibition can be modulated by the dopaminergic and noradrenergic systems (i.e. drugs that increase dopamine or noradrenaline improve response inhibition). Error detection and error awareness have also been shown to be differently modulated by dopaminergic and serotonergic systems with increases in dopamine, enhancing and increases in serotonin, inhibiting error detection. The role of these neurochemical systems on error awareness are yet to be examined. Furthermore, the neurochemical bases of response inhibition and error processing have not been elucidated using ERPs in humans.

Aims

The project will use ERPs to examine how enhancement of monoamines (*dopamine/noradrenaline/serotonin*) using selective transporter reuptake inhibitors (*methylphenidate, atomoxetine, citalopram*) modulates the neural time-course of response inhibition (N2/P3), error detection (ERN) and error awareness (Pe).

Supervisors:

1. Assoc. Professor Pradeep J. Nathan, Monash University and Cambridge University
2. Dr. Mark Bellgrove, University of Queensland
3. Professor Rodney Croft, Brain Sciences Institute, Swinburne University of Technology

Scholarship Options

1. For any student that obtains an APA or MUPS, a supplementary scholarship of \$5,000 per year will be awarded for 3 years (total scholarship around \$25,000 per year)
2. For any student who has been unsuccessful in obtaining an APA or MUPS scholarship and who have received an H1 or H2A (in Honours), a Departmental (SPPPM) Scholarship of \$15,000 per year for 3 years will be awarded (following an interview).

For more information contact:

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