Hamilton Institute
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Department of Biology, NUIM

In Vivo Voltammetry: Real-Time Analysis of Neuronal Signalling, Drug Actions, and Behaviour

Dr. John P. Lowry,
Conway Institute, UCD

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Abstract

The importance of chemical signalling between cells in the functioning of neural networks is highlighted empirically by the use of drugs in the treatment of neurological disorders, such as Parkinson's disease, schizophrenia and depression, as well as by mind-altering substances of abuse, all of which have specific chemical actions on brain neurons. Most of our understanding of neuronal chemical signalling pathways has been achieved through studies of isolated nerve cells and tissues *in vitro*.

However, an intrinsic feature of CNS function is the interconnectivity over many scales of structure:- between nerve and glial cells to form tissues or 'brain regions' (cortex, cerebellum, etc.); between the different tissues to form the CNS; between the CNS, the senses for environmental feedback, and the musculature for behavioural expression; and between the CNS and the blood supply (blood-brain barrier) for structural and energy nutrition. Many of these levels of coupling are lost in *in-vitro*-preparations. The more recent technologies developed for neurochemical studies in the living brain include spectroscopy, such as NMR, sampling techniques, such as cerebral microdialysis, and *in-situ*- techniques, such as In Vivo Voltammetry (IVV). These different approaches to neurochemical analysis *in vivo* have their respective advantages and limitations.

For example, NMR is non-invasive but lacks the spatial resolution offered by implanted microdialysis or electrochemical probes. Of these two invasive techniques, IVV offers superior spatial (~10 μm *vs.* ~100 μm) and temporal (milliseconds *vs.* minutes) resolutions, and a major advantage of long-term stability (continuous monitoring *in vivo* over several weeks). IVV detects signalling substances released from nerve cells into the ECF, using amperometric electrodes and voltammetric techniques. By implanting a microvoltammetric electrode (biosensor) in a specific brain region, applying a suitable potential profile and recording the resulting faradaic current, changes in the concentration of a variety of substances in the ECF can be monitored with sub-second time resolution over extended periods in behaving animals. This allows investigations of the functions and roles of specific neurochemicals in neuronal signalling, drug actions, and well-defined behaviours.

Venue: Seminar Room, Hamilton Institute, Rye Hall, NUI Maynooth

Time: 1.00 - 2.00pm (followed by tea/coffee)

Travel directions are available at www.hamilton.ie

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