THE UNIVERSITY OF MELBOURNE ADVANCED RESEARCH WORKSHOPS IN NEUROSCIENCE

A series of advanced, hands-on workshops for PhD students will be available during 2016. These workshops will offer students the opportunity to develop skills in key areas that they identify to be directly related to their research project. Each program has been designed by the Workshop Leader to provide a comprehensive, small group experience.

Program

There are 5 confirmed workshop programs offered in 2016. These are detailed within this document.

WORKSHOP	WORKSHOP LEADER
Magnetic Resonance Imaging	Professor Roger Ordidge
Human Pluripotent Stem Cells in Neuroscience Research	Professor Martin Pera
Fundamentals of Ion Channel Function in the Brain: Intracellular and Extracellular Recordings	Professor Ian Forster
Introduction to Bioinformatics resources for Neuroscientists	Dr Victoria Perreau
Neural Computational Modelling	Dr Levin Kuhlman

There is no cost to attend the workshop programs.
Other workshop topics are under discussion and students will be advised when confirmed, including the possibility of a workshop on the Synchroton at Monash University".

Application Process

The timeline for the application process is as follows:

Applications Open:	Friday 11 March 2016
Applications Close:	Friday 22 April 2016
Successful Applicants Notified:	Friday 20 May 2016

Students must be from the University of Melbourne or the Florey Institute of Neuroscience and Mental Health. Very limited places are offered for each workshop program. Expressions of Interest are to be submitted on the form provided, together with your CV, by COB Friday 22 April 2016.
Please send your EOI and CV to the following email address: research-mni@unimelb.edu.au
For any enquiries, please email: research-mni@unimelb.edu.au

Melbourne Neuroscience Institute

For further information about the Melbourne Neuroscience Institute, please visit our website: www.neuroscience.unimelb.edu.au

Magnetic Resonance Imaging

The aim of this workshop program is to educate students in the principles of MRI, the design of the MRI scanners and use of contrast to distinguish between abnormal and normal tissue. The focus will be on imaging the brain. A scanner will be used to explore MRI contrast differences between various liquid samples.

It is envisaged that this course will provide a solid foundation in MRI for current PhD students involved with MRI research.

Presenters: Professor Roger Ordidge, Dr Jon Cleary

Workshop format: 18 hours total

Topics to be covered in a series of one-hour lectures (3 per week) will include:

- Classical description of Nuclear Magnetic Resonance
- Excitation of the MR signal by resonance
- Spin relaxation behaviour: T1 and T2 Spectroscopy
- MR signal detection and processing
- MR image formation
- MRI hardware
- Spin-echoes, gradient-echoes and production of image contrast
- Understanding MR sequences using K-space
- Echo-Planar Imaging, artefacts, and MR safety
- Fast imaging using FLASH, contrast agents
- Flow and angiography
- Diffusion- and perfusion-weighted imaging and functional MRI.

Two one-hour tutorials covering multiple choice questions discussed as a group.

Hands-on demonstration of MRI measurements.

Proposed timeframe: October – December 2016, over 6 weeks, up to 3 hours per week.

Prerequisites: VCE qualification in secondary maths, physics or chemistry (or all).

Professor Roger Ordidge

Human Pluripotent Stem Cells in Neuroscience Research

The aim of this workshop program is to familiarise participants with the application of human pluripotent stem cells to problems in neuroscience, including the study of brain development, functional genomics, and disease modelling.

Presenters: Professor Martin Pera and Dr Anna Michalska.

Professor Martin Pera

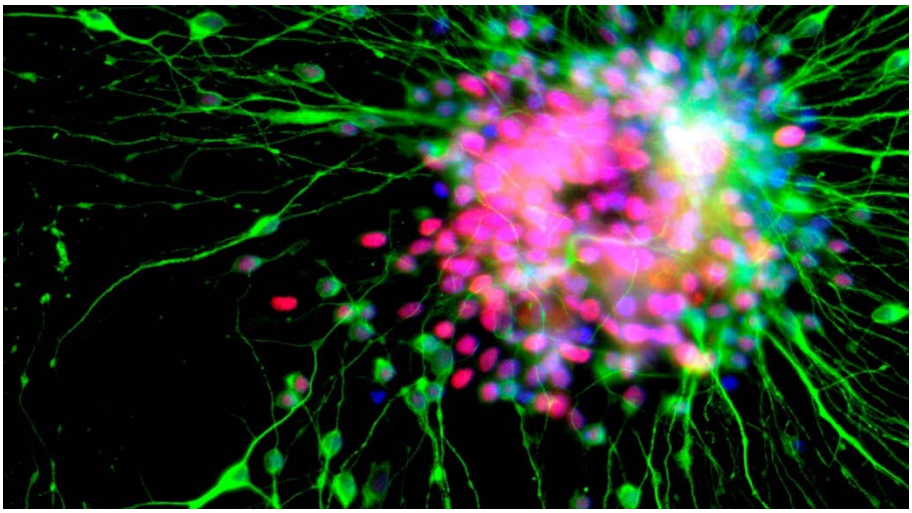
Workshop format: 28 hours total

- 6 x 1 hour tutorials
- 2 x 1 hour literature review
- 4 x 5 hour workshops including:
    - Pluripotent stem cell propagation, maintenance and characterisation
    - Stem cell genetic manipulation and differentiation
    - Functional investigation of differentiated cells.

Pre-Reading will be provided to students.

Proposed timeframe: October – November 2016

Prerequisites: Tissue culture experience



Fundamentals of Ion Channel Function in the Brain: Intracellular and Extracellular Recordings

This program will introduce students to theory, methods and approaches for the expression and analysis of ion channels using two electrode voltage clamp and extracellular fields using multielectrode arrays. This program will cover:

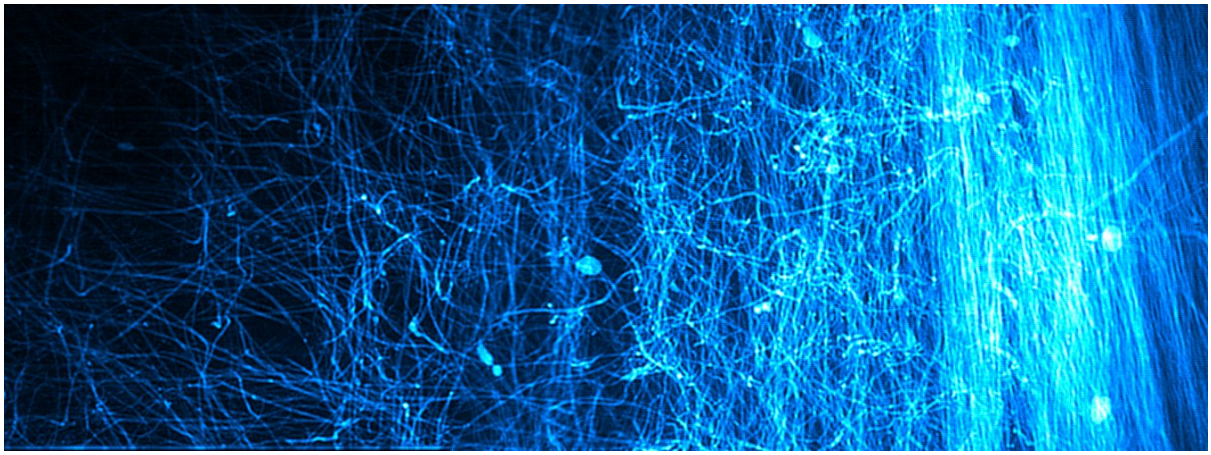
- Theoretical lectures on diffusion, reversal potentials, single channels, selectivity, current-voltage, conductance-voltage, resting membrane potential, action potentials, microscopic and macroscopic current, gating and kinetics, potentials in a volume conductor, action potential propagation, and source of extracellular currents.
- Fundamentals of signal processing and analysis
- Practical 1. Whole cell electrophysiology using two electrode voltage clamp recording in Xenopus oocytes
- Practical 2. Analysis of cultured neuronal networks using multi-electrode arrays

Presenters: Professor Ian Forster, Professor Steven Petrou and A/Prof Chris Reid.

Workshop format: 36 hours total

- 3 x 6 hour theoretical workshops
- 2 x 8 hour practical sessions

Proposed timeframe: 11 – 15 July 2016



Introduction to Bioinformatics resources for Neuroscientists

Bioinformatics is a diverse and fast growing field and this course will provide an intensive introduction to selected analysis methods and data types commonly used in bioinformatics, with a particular focus on applications for bench researchers in the Neurosciences. The course is aimed at researchers with no programming skills who wish to know more about how to utilize online tools to support their own research objectives.

Each week a different topic will be covered in a 2 hour tutorial and a selection of tools and databases discussed or demonstrated. It will not be possible to cover all databases and tools in depth and students are therefore expected to continue the exploration of the tools in their own time to advance their own research aims. The topics proposed are listed below, however the tools demonstrated may change at the request of the group or due to developments in the field:

- SNPs, genotyping and disease; dbSNP, OMIM, NHGRI GWAS Catalog, **DisGeNET**
- Protein sequence alignment, domains and motifs; SMART, PFAM, Motifscan
- Using the Allen brain atlases and other large expression datasets such as GTEX.
- Finding and analysing public experiments in Gene Expression Omnibus and Array Express.
- Analysis of complex traits, phenotypes and eQTL analysis; Mouse Phenome Database, GeneNetwork, GTEX.
- Protein Interaction and co-regulation networks; Intact, Genemania, Gemma, and Cytoscape

Dr Victoria Perreau

The course is structured to include defined tutorials using example data. However, students will also be supported at an individual level to apply these tools to their own research questions. All students will be expected to present their own analysis using one or more of the tools discussed in the final week of the course.

Presenters: Dr Victoria Perreau, Bioinformatics core manager and Dr Noel Faux and Dr Andrew Fox

Workshop format: 38 hours total

- 18 hours total contact time in 9 weekly 2 hour small group workshops (8 tutorial sessions and 1 presentation session).

- Additional 20 hours (minimum) outside workshop hours commitment, for completing workshop activities, individual research projects and preparing presentations for the final week of the course.

All software used in the workshop is freely available and instructions for downloading and installing will be provided where necessary.

Proposed timeframe: August-September

Prerequisites: A good understanding of molecular biology, including gene structure, transcription and translation is essential.

Applicants who articulate a biological question in their application, relevant to their research area, that they think might be approached from a bioinformatics stand point will be preferred. This is because the student's own research interests will be used as examples in tutorials wherever possible and students will be expected to present their own analyses to the group at the conclusion of the workshop.

Familiarity with using genome browsers and the types of data displayed in genome browsers is required as it will not be covered by the course. Tutorials for genome browsers are available on line:

UCSC genome browser: http://www.openhelix.com/ucsc

Ensembl genome browser: http://www.ensembl.org/info/website/tutorials/index.html

Neural Computational Modelling

This workshop aims to introduce students to the approaches and tools used in computational modelling of neurons and neural systems. Students will use packages such as Neuron, Nengo and Brian, as well as write their own code in MATLAB and/or Python. Approaches used to model individual neurons will include rate-based and integrate-and-fire models through to Hodgkin-Huxley models. Applications to different aspects of neuroscience will be examined including modelling of the effects of different channels and morphologies on a neuron's behaviour, and interactions of neurons in networks. The use of spiking neurons to perform computation will also be explored.

Presenters: Dr Levin Kuhlmann assisted by other computational neuroscientists.

Workshop format: 22 hours total

- Comprised of 7 x 1 hour lectures and 5 x 3 hour computer workshops.

Proposed timeframe: September to October, over 5 weeks, with 4-5 hours per week.

Prerequisites: First year university maths would be helpful but not necessary. Have your own laptop to run code and applications.