THE UNIVERSITY OF MELBOURNE ADVANCED RESEARCH WORKSHOPS IN NEUROSCIENCE

A series of advanced, hands-on workshops for PhD students will be available during 2017. These workshops will offer students the opportunity to develop skills in key areas that they, with the support of their supervisor, 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 four confirmed workshop programs offered in 2017. These are detailed within this document.

WORKSHOP	WORKSHOP LEADER	PROPOSED DATES
Magnetic Resonance Imaging	**Professor Roger Ordidge**	**Early September to mid-October*** 3x 1hr lecture per week for 6 weeks (18hrs contact time)
Fundamentals of Ion Channel Function in the Brain: Intracellular and Extracellular Recordings	**Professor Ian Forster**	**Tentatively 10 – 15 July** 5 consecutive full days with breaks (~35 hrs. contact time)
Introduction to Bioinformatics resources for Neuroscientists	**Dr Victoria Perreau**	**Thursdays weekly @ 10.00 - 12.00pm from June - August** (9 x 2hrs contact time = 18hrs)
Neural Computational Modelling	**Dr Levin Kuhlman**	**After 11 September 2017** Approx. 20 hrs contact time (TBC)

*(*) Exact dates may be subject to change. Applicants will be advised by email.*

There is no cost to attend the workshop programs.

Other opportunities/workshop topics

Other opportunities on different workshop topics are currently under discussion and students will be advised when confirmed, including the possibility of workshops on the following:

- Regenerative Medicine
- Human Genetics
- Microscopy (including confocal)

Application Process

The timeline for the application process is as follows:

Applications Open:	Thursday 4 May, 2017
Applications Close:	Friday 19 May, 2017
Successful Applicants Notified:	Friday 26 May, 2017

Students must be from the University of Melbourne or the Florey Institute of Neuroscience and Mental Health. 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 TBC.
Please send your EOI and CV to the following email address: research-mni@unimelb.edu.au
For any enquiries, please email: vikki.marshall@unimelb.edu.au

Melbourne Neuroscience Institute

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

You may wish to subscribe to the Melbourne Neuroscience Institute's monthly newsletter:
http://neuroscience.unimelb.edu.au/engagement/newsletter

1. 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: September to mid-October. Three 1hr lectures per week for 6 weeks (18hrs. contact time)

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

Professor Roger Ordidge

2. 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 multi-electrode 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.

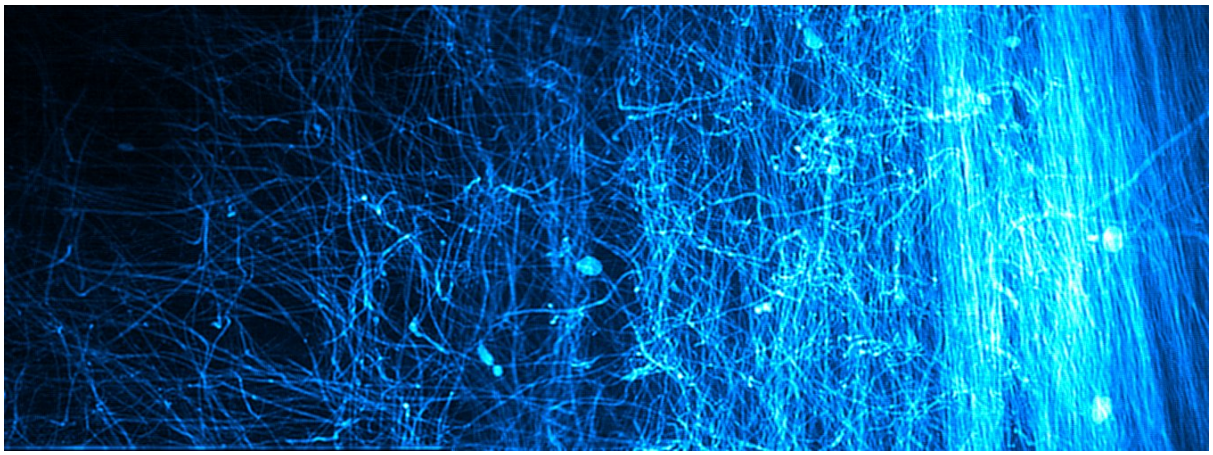
Workshop format:
36 hours total

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

Course preparation
It is recommend that participants access/read/browse/digest the following material beforehand:

Medical Physiology, Boron W and Boulpaep E, 3rd Edition (2010). Chapters 6, 7. This is available as an e-book via the Clinicalkey link: https://www-clinicalkey-com-au.ezp.lib.unimelb.edu.au/#!/

Proposed timeframe: One full week in the first half of July 2017, approx. 7hr days with breaks



3. 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:


Dr Victoria Perreau

- **Introduction (including data types and intro to NGS)**
- **Genome Browsers**
  - UCSC genome browser, Integrated Genomics Viewer (IGV)
- **The Allen Brain Atlas**
  - Developing mouse brain, Celltax, BrainSpan
- **Analysis of complex traits, phenotypes and eQTL analysis**
  - Mouse Phenome Database, GeneNetwork, GTEX.
- **Finding and analysing public experiments** in:
  - Gene Expression Omnibus, Immunological Genome, Array Express and SRA.
- **Genomics (Andrew Fox)**
  - SNPs, genotyping and disease; dbSNP, OMIM, NHGRI GWAS Catalog, **DisGeNET,** GTEX
- **Proteins (Noel Faux)**
  - Protein sequence alignment, domains and motifs; SMART, PFAM, Motifscan
- **Protein Interaction and co-regulation networks**; Intact, Genemania, Gemma, IMP and Cytoscape
- **Student presentations**
  - Students are encouraged to invite their colleagues and supervisors to these talks.

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:
18 hours total required 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. Total 38 hours commitment.

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

Proposed timeframe:
Thursdays 10.00 -12.00pm in June-August

Prerequisites:
A good understanding of molecular biology, including gene structure, transcription and translation is essential. Students must bring their own lap top computer to workshops.

Places are competitive with a maximum of 9 students in the workshop. Preferred applicants will be those who articulate a relevant biological question in their application that may be approached using bioinformatics tools. This is because the student's own research interests will be used as examples in tutorials and students will be expected to present their own analyses to the group at the conclusion of the workshop.

4. Neural Computational Modelling

This workshop aims to introduce students to the mathematical approaches and computational tools used in computational modelling of neurons and neural systems. Students will use learn to use the simulation packages "Neuron" and "Nengo" while at the same time learning how to program with 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: 24 hours total contact

- Comprised of intermingled lectures and tutorials during 4 x 8 hour days (includes 2 hours of breaks per day; 2 days for biophysical modelling with Neuron, 2 days for cognitive modelling with Nengo).

Proposed timeframe:
2 days (9.00am-5.00pm) in the week starting September 11 and 2 days in the week starting September 18 (days negotiable with class).

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