

Australian Advanced Neuroscience Research Initiative (AANRI) Program 2005

Weeks 1 & 2

Sunday 3 April

Student welcome / housekeeping announcements

Safety induction – Kevin Townsend, Manager of Moreton Bay Research Station

TOPIC 1: NEURAL INTEGRATION & EXCITABILITY

Monday 4 April

Theme: Biophysics & Methods

Lecture 1 (9 – 10:30 am) – Alan Finkel

Aims of the course

Basic membrane biology and circuit analysis

Lecture 2 (11 am – 12:30 pm) – Greg Stuart

Principles of electrophysiological recording; fields, sharps, patch clamp

Lab (1:30 pm – late)

Each student chooses a lab partner. Cover the following topics:

1. Preparing electrodes and solutions
2. Patch clamp amplifier with model cell and oscilloscope
3. The rig – microscope, grounding, perfusion
4. Data acquisition principles and software

Tuesday 5 April

Theme: Passive properties

Lecture 3 (9 – 10:30 am) – Steve Redman

Passive cable theory

Space clamp and voltage clamp distortion

Lecture/Tutorial 4 (11 am – 12:30 pm) – Steve Redman / Demonstrators

NeuroSim simulation program

Lab (1:30 pm – late)

Subset of students watch/cut cortical/hippocampal slices, rest familiarize with rig

Look at slices, adjust optics

Practise moving electrode, measuring resistance

Get a seal; measure passive properties

Wednesday 6 April	Theme: V-gated channels & APs
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Lecture 5 (9 – 10:30 am) – Joe Lynch

Introduction to ion channel diversity
Voltage-gated Na, K and Ca channels

Lecture 6 (11 am – 12:30 pm) – John Bekkers

The Hodgkin-Huxley action potential

Lab (1:30 pm – late)

Different students cut slices, rest familiarize with rig
Whole-cell in cortex. Current clamp recordings of APs, f-I plots etc

Thursday 7 April	Theme: Channel structure-function
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Lecture 7 (9 – 10:30 am) – Meyer Jackson

Mechanisms of channel gating

Lecture 8 (11 am – 12:30 pm) – Peter Schofield

Molecular approaches to channel structure/function

Lab (1:30 pm – late)

Whole-cell VC in cortex or cerebellar granule cells; try VC with outside-out patches

Friday 8 April	Theme: Modulation of excitability
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Lecture 9 (9 – 10:30 am) – Alistair Sim

Principles of modulation, phosphorylation, second messengers, G-proteins, etc.

Lecture 10 (11 am – 12:30 pm) – Pankaj Sah

Ca-activated K channels; modulation of APs

Lab (1:30 pm – late)

IC in cortex or hippocampus
Modulation of AP firing; blocking different K conductances

TOPIC 2: SYNAPTIC TRANSMISSION**Saturday 9 April****Theme: Fundamentals of synaptic transmission****Lecture 13 (9 – 10:30 am) – Bruce Walmsley**

Physiology of synaptic transmission; quantal analysis

Lecture 14 (11 am – 12:30 pm) – Meyer Jackson

Cell & molecular biology of transmitter release

Lab (1:30 pm – late)

Record EPSCs and minis in hippocampus; quantal properties of EPSCs

Sunday 10 April

Day off

Monday 11 April**Theme: Ligand-gated ion channels****Lecture 15 (9 – 10:30 am) – Christian Stricker**

Excitatory and inhibitory synaptic transmission

Lecture 16 (11 am – 12:30 pm) – John Clements

Receptor and neurotransmitter dynamics

Lab (1:30 pm – late)

Pharmacology of EPSCs and IPSCs; IV plots

Tuesday 12 April**Theme: Short-term plasticity & modulation****Lecture 17 (9 – 10:30 am) – Shaul Hestrin**

Short-term plasticity

Lecture 18 (11 am – 12:30 pm) – Mark Bellingham

Presynaptic modulation

Lab (1:30 pm – late)

Short-term synaptic dynamics of EPSCs; presynaptic modulators

Wednesday 13 April**Theme: Synaptic integration & networks****Lecture 21 (9 – 10:30 am) – Michael Häusser**

Synaptic integration

Lecture 22 (11 am – 12:30 pm) – Shaul Hestrin

Networks

Lab (1:30 pm – late)

Dendritic recordings / pair recordings

Thursday 14 April**Theme: Long-term plasticity****Lecture 19 (9 – 10:30 am) – Johanna Montgomery**

LTP, LTD

Lecture 20 (11 am – 12:30 pm) – Cliff Abraham

Learning & memory

Lab (1:30 pm – late)

Hippocampal LTP in fields / whole cell

Friday 15 April**Theme: Computational neuroscience****Lecture 11 (9 – 10:30 am) – Michael Häusser**

Computational neuroscience

Lecture/Tutorial 12 (11 am – 12:30 pm) – Anna Cowan / Michael Häusser

Introduction to the simulation program NEURON

Lab (1:30 pm – late)

Lab project

Saturday 16 April**Theme: Other systems****Lecture 23 (9 – 10:30 am) – Ian Gibbins**

A taste of autonomic neurophysiology

Lecture 24 (11 am – 12:30 pm) – Paul Martin

Visual neuroscience

Lab talks (1:30 pm – 3:30 pm)

10 minute student presentations on lab project

Sunday 17 April

Day off

TOPIC 3: DEVELOPMENTAL PLASTICITY & REPAIR

One week organised by James Vickers.

Lectures on development, damage and repair, etc.

Labs on histochemistry, fluorescence imaging, etc.