NEUROKIT

Extracellular Electrophysiology Acquisition 0522

23-27 May 2022

Course overview

Any data we collect has been shaped by the system we used to record it. Understanding the tools involved in data acquisition gives you the confidence to make informed experimental design choices, and the freedom to combine and try new approaches while building your dream setup.

In this course, we will develop your understanding of **electrophysiology data acquisition**. In terms of hardware, you will learn how acquisition systems can **amplify** tiny signals and **filter** out noise. You'll test this understanding by building your own system to measure muscle and heart signals. In software, you will encounter **synchronisation** considerations, as we add incoming datastreams and build an increasingly complex experimental design.

Don't be discouraged if you secretly panic at the mention of capacitance, this course starts from the very basics. Advanced students can make the final project as challenging as they like.

Designed by Open Ephys and Open Ephys Production Site, this course will have an open-source flavour and encourage you to try new ideas, share your insights, and connect with the open-source community.

Learning Outcome

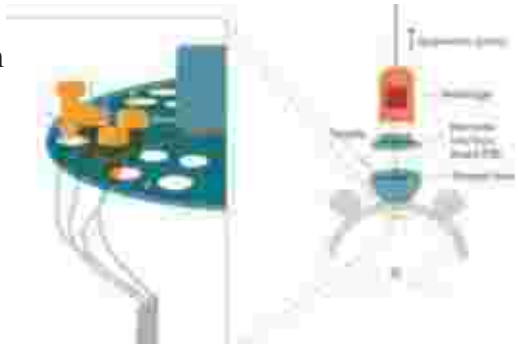
By the end of the course, you will:

- be familiar with the electronic building blocks of acquisition systems
- be able to model and build circuits to amplify and filter incoming signals
- be able to use the Bonsai programming language to stream data and run closed-loop experiments with multiple datastreams

Program Schedule

Day 1 – Introduction

- What are we trying to measure?
  Electrical signals in the brain and ways to record them.
- How can we collect these signals without changing them
  Considerations when building an acquisition system.
- Using a simulator to visualise electrical circuits
  online and make predictions about real-world circuits.
- Using the breadboard and components in your kit
  to test your understanding of electronics concepts.



Day 2 – Impedance

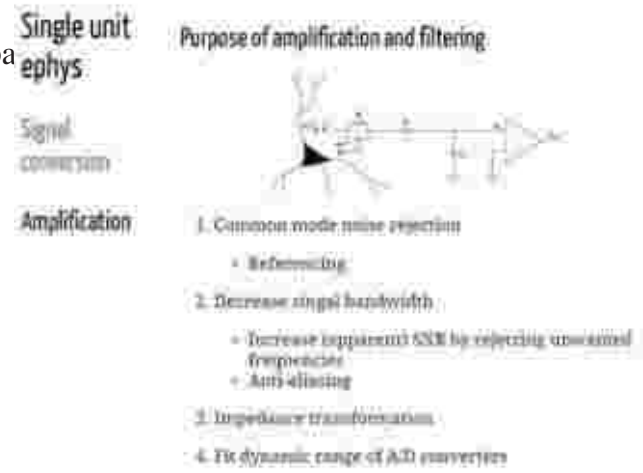
- Using microcontrollers to acquire physiological data.
- What is impedance? Understanding how we protect

our signals while measuring them.

- Understanding the function and limitations of operational amplifiers.

Day 3 – Data Acquisition

- Understanding Instrumentation Amplifiers.
- Simulating, building and testing low & high-pa
- Visualise your own EMG/ECG data using the Bonsai programming language.



Day 4 – Synchronizing Datastreams

- Expanding on Bonsai – controlling cameras, receiving other datastreams.
- Understanding closed-loop experiments,

Day 5 – Project and Open-Source Neuroscience

- Open Ephys – open-source hardware & software development.
- An overview of open-source community projects.
- Student project presentation.
  timestamp considerations, and synchronising datastreams.
- Designing student projects and group feedback on plan.

The course will be held from 14:00 to 18:00 GMT.