

Experiment Protocol

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1 Overview

This is an experiment protocol to induce learning on a high-definition multielectrode array (HD-MEA) produced by *Imec*, and to define the changes in the network activity following the learning. The learning protocol is based on the paper by *Shahaf and Marom, 2002*. We will replicate their work on a **HD-MEA** which allows recording from many neurons with a very high resolution. The **HD-MEA** will allow us to extend on the work done *Shahaf and Marom, 2002*, by giving us access to the activity and connectivity of the entire network of cultured neurons. We aim to define the neuronal network in fine details and estimate the changes induced on the network by learning. We aim to shed light on mechanisms that underline such learning, providing insights on how neuronal networks learn.

2 Protocol

- Baseline Recording
- Stimulation Recording
- baseline post stimulation
- Learning Protocol
- Post Learning Baseline
- Post Learning Stimulation
- Post stimulation baseline

3 Protocol Details

3.1 Baseline Recording

The **baseline recording** is the first step in the experiment protocol. We evaluate the baseline activity of the neuronal network before any stimulation or learning is applied. We will repeat this step at different stages of the experiment to compare the activity after manipulations. We will record 30 minutes of activity from all the available 16 wells to evaluate the activity of the entire network. We need to create based on the `baseline.yaml` file a baseline recording protocol in the `sparrow` app that will include the following parameters:

- Create a new configuration file
- 4 configuration maps encompassing all the 16 wells
- Create a recording configuration
- Create a batch recording element
- Set reference electrode
- Create the mux maps
- Create the batch sweep with all `cfgmaps`
- Create a time line with a timeline delay of 30 minutes
- Save locally the configuration file

This settings will repeat at the different stages of the experiment to evaluate the activity of the network. The settings can be reactivated and recalled to the sparrow app. The baseline recording should be loaded to the sparrow app:

- Load the configuration file
- activate the chip
- load settings to the chip
- start the recording
- stop the recording
- deactivate the chip
- move the recording to the storage device

3.2 Stimulation Recording

3.3 Baseline Post Stimulation

3.4 Learning Protocol

3.5 Post Learning Baseline

3.6 Post Learning Stimulation

3.7 Post Stimulation Baseline

4 How to run the experiment