Title (tentative): Development of an experimental platform for heterogeneous neuronal networks coupled to High-density Micro-Electrode Arrays

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Description

Motivation and application domain
Brain is made up of different regions characterized by different neuronal types. Such heterogeneity contributes to generate peculiar dynamics at the network level. Goal of this project is to create at in vitro level, heterogeneous networks generating complex and realistic electrophysiological patterns by using the new high-density Micro-Electrode Array (HD-MEA) devices containing 4096 microelectrodes.

General objectives and main activities
The main scientific question of this thesis project is: how much cortical dynamics are driven by other brain districts? The project will contain the following steps: 1. Designing of PDMS mask to interface to HDMEAs for creating interconnected neuronal networks; 2. Characterization of the so originated network dynamics In terms of spiking and bursting statistics; 3. Analyze the avalanche distribution as a function of number of assemblies and kind of neuronal populations.

Training Objectives (technical/analytical tools, experimental methodologies)
The activities of the thesis will require the use of an innovative experimental set-up which allows to simultaneously record the electrophysiological activity from more than 4000 microelectrodes. In addition, in order to interconnect different neuronal populations, the master student will develop and realize PDMS mask to clusterize such networks.

Place(s) where the thesis work will be carried out: NBT Lab, Via Opera Pia 13, floor -1

Additional information

Pre-requisite abilities/skills: Neuroengineering and Computational Neuroscience
Curriculum: Bioengineering
Maximum number of students: 2
Financial support/scholarship: none