



## Thesis Project Form

**Title (tentative):** Investigation of the functional organization of in vitro neural networks

**Thesis advisor(s):** Chiappalone Michela, Sergio Martinoia (DIBRIS), Jordi Soriano (UBarcelona)

**E-mail:** michela.chiappalone@unige.it

**Address:** Via Opera Pia 13, 16145 Genova

**Phone:**

### Description

#### Motivation and application domain

Neuroscience aims at understanding how the nervous system organizes itself and operates, specifically regarding the brain. This scope could be pursued through a wealth of techniques and one of those is in vitro neural network in which cell assemblies are grown in highly controlled environment to monitor their spontaneous activity both during development as well as under the effect of drug impact or their resilience to focal lesions.

#### General objectives and main activities

The student will first learn how to model the behavior of neuronal networks using computational tools that includes the dynamic description of a neuron in terms of the Izhikevich model and the topological description of the network connectivity in terms of graph theory. Then, the student will carry out numerical simulations of networks that mimic the structure and behavior of living neuronal cultures recorded in the laboratory of Dr. Soriano. These cultures are grown in a variety of schemes, in which neuronal positioning and connectivity is guided to suit specific functions. The overall goal of the project will be to design in silico network that reproduce the experimental behavior, understand the emergence of collective behavior, and make predictions of experimental data.

#### Training Objectives (technical/analytical tools, experimental methodologies)

Investigation of neural dynamics: in-vitro experiments with calcium imaging technique and computational modeling.

**Place(s) where the thesis work will be carried out:** University of Barcelona (Spain)

### Additional information

**Pre-requisite abilities/skills:** MATLAB programming skills, signal processing, statistics, attitude to computational work

**Maximum number of students:** 1

**Financial support/scholarship:** Erasmus grant