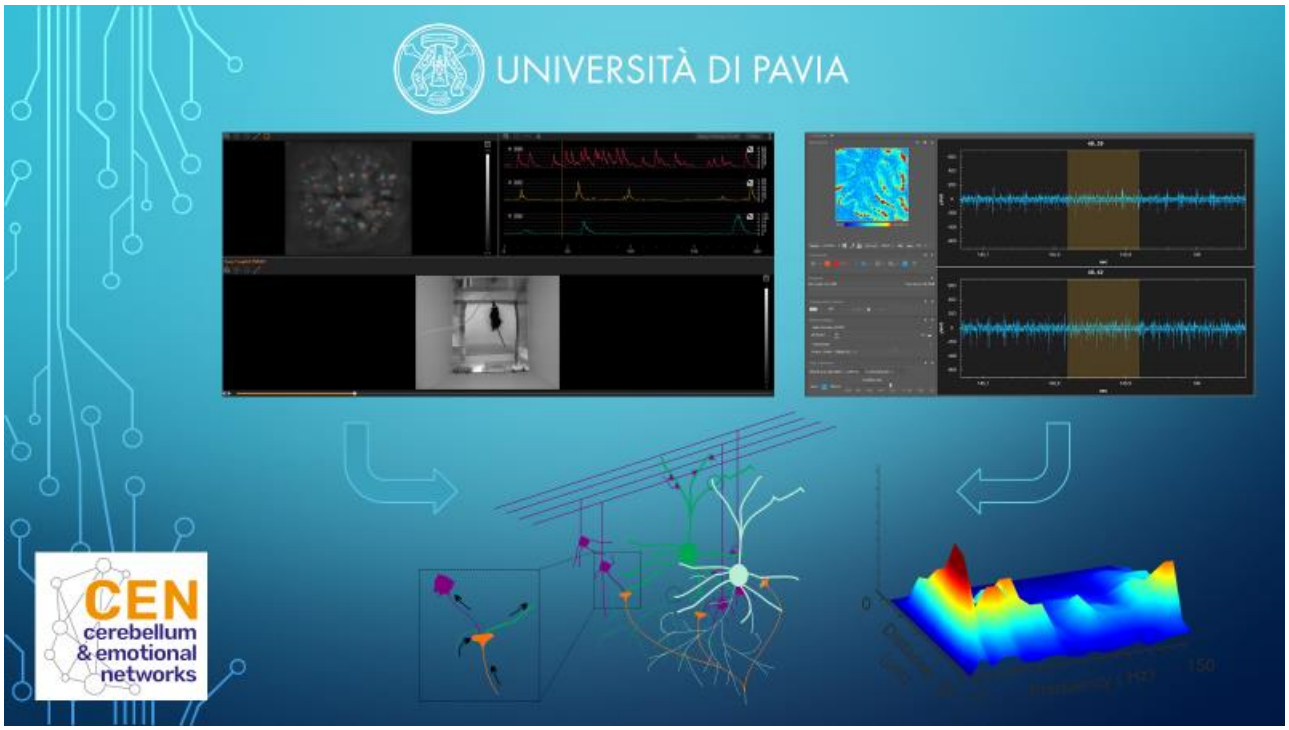
Cerebellum and Emotional Networks (CEN)

Marie Skłodowska-Curie Innovative Training Network

*** 3 POSITIONS AVAILABLE ***



CEN is a Marie Skłodowska-Curie Innovative Training Network funded by the European Research Council to explore the brain circuits that underlie emotional behavior. CEN offers an early research contract to the student, who will be enrolled in the PhD in Biomedical Sciences of the University of Pavia. The position is open for non-Italian residents according to EU rules.

Contacts and information:

https://dangelo.unipv.it/available-positions/

http://drsbm.unipv.it/international-phd-positions/

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POSITION 1 - **Cerebellar neuronal activity during emotional control.** This project will determine the extent of cerebellar activation during emotional behavior and the contribution of different modules to encoding prediction error. The latest in vivo calcium imaging technology (miniscope - INSCOPIX) will be used to monitor neuronal population activity in different cerebellar cortical modules during the acquisition and extinction of emotional behavior in freely moving mice. The tasks will be designed in order track cerebellar activity in relation to error prediction. The result of the experiments will then be the basis for brain simulations in the neurocomputational group of our research unit. The project is based on close interactions within the CEN network. We are planning secondments of the PhD student for training at INSCOPIX and at the University Hospital Wurzburg (by Prof. Philip Tovote) to collaborate in latest miniscope calcium imaging techniques in behaving animals.

POSITION 2 - Signal processing in cerebellar modules involved in emotional, cognitive and motor control loops. This project will provide new insights into neuronal activity within cerebellar modules and how the signal processing varies between different lobules. This project will determine how signal processing differs between different parts of the same cerebellar module, in particular between vermal lobules IV-V, VI-VII, VIII, and IX-X. High density multielectrode arrays (HD-MEA – 3-Brain) will be used to characterize spontaneous activity from Purkinje cells, Golgi cells and molecular layer interneurons within each lobule, as well as responses to electrical stimulation of mossy fibre bundles. Advanced techniques for LFP modelling (Diwakar et al, 2011; Casali et al., 2019) will be used to extract information about the spatio-temporal organization of the underlying neuronal circuit activity. The HD-MEA work will be complemented by patch-clamp recordings to provide evidence of the cellular mechanisms unveiled by HD-MEA. We are planning collaborations of the PhD student with 3-Brain and the University of Bristol (Prof. Richard Apps/Charlotte Lawrenson) for training in combined optogenetic and electrophysiological approaches to understand cerebellar modules.

POSITION 3 - Computational modelling and simulation of the cerebellar circuits involved in emotional control. This project will address the concept of a generalized cerebellar algorithm to determine potential differences in the computation performed in different vermal lobules. Moreover, it will address the role of cerebellum in fear conditioning learning task. An advanced integration of the data obtained in this ITN with literature will be achieved by computational and robotic modeling. In the framework of the Human Brain Project, of which this host institution is part, a cerebellar model is developed that includes detailed microcircuit connectivity and neuronal properties (Casali et al., 2019; Geminiani et al., 2018, 2019a, 2019b). This background will be taken as the starting point of this project, where the modules corresponding to the cerebellar vermis in relation to emotional control will be investigated. The model will be adapted and extended in order to account for the data obtained by the other participants to the CEN project (e.g. for MEA and INSCOPIX recordings and for cerebellar structural and functional connectivity) and will be exploited to simulate the data obtained on fear conditioning learning tasks. Collaborations planned with the University of Edinburgh (Prof. Thomas Watson / Peter Kind) for modelling of rodent data.