Project 1.11. Activity of distinct neuronal populations of the prefrontal cortex in the development and maintenance of social bonds

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Background:
Impairments of social interactions are a key feature of many neurodevelopmental dysfunctions such as autism spectrum disorders (ASD) and social anxiety disorders (SAD). Additionally, current health reports highlight alarming rise in frequency of ASD, including a number of patients suffering from social deficits. Understanding brain mechanisms underlying social behavior, specifically the neurobiology of voluntary social bonds, seems crucial for our ability to address those aggravating health issues.

Although much is known about the neuroanatomy of social behavior, the functional neurobiology of social bonding is still poorly understood. However, it has become increasingly clear that cortical regions, specifically prefrontal cortex, play a critical role in encoding and execution of social interactions. In the following project we propose to investigate how main classes of neurons, composing the circuits of the prefrontal cortex, encode information relevant to bonding with others.

Aim:
In the first step, the project aims to develop automated methods to measure the development of voluntary social ties between individuals housed in the Eco-HAB system as in large groups, resembling cohorts formed under natural conditions. Further, the PhD candidate will study the neurobiological components that accompany dynamic changes in social bonds, namely the neuronal activity of various classes of cells (excitatory neurons and major classes of inhibitory cells expressing parvalbumin, somatostatin and vasoactive intestinal peptide) in the prefrontal cortex, using two-photon microscopy in behaving animals. In the next step, PhD candidate will manipulate the activity of selected types of neurons by wireless optogenetics / chemogenetics in behaving animals to regulate social instructions in real time.